DOMINION OF CANADA

REPORT OF THE DEPARTMENT

OF

MINES AND RESOURCES

FOR THE

FISCAL YEAR ENDED MARCH 31, 1948

OTTAWA
EDMOND CLOUTIER, C.M.G., B.A., L.Ph.,
KING'S PRINTER AND CONTROLLER OF STATIONERY
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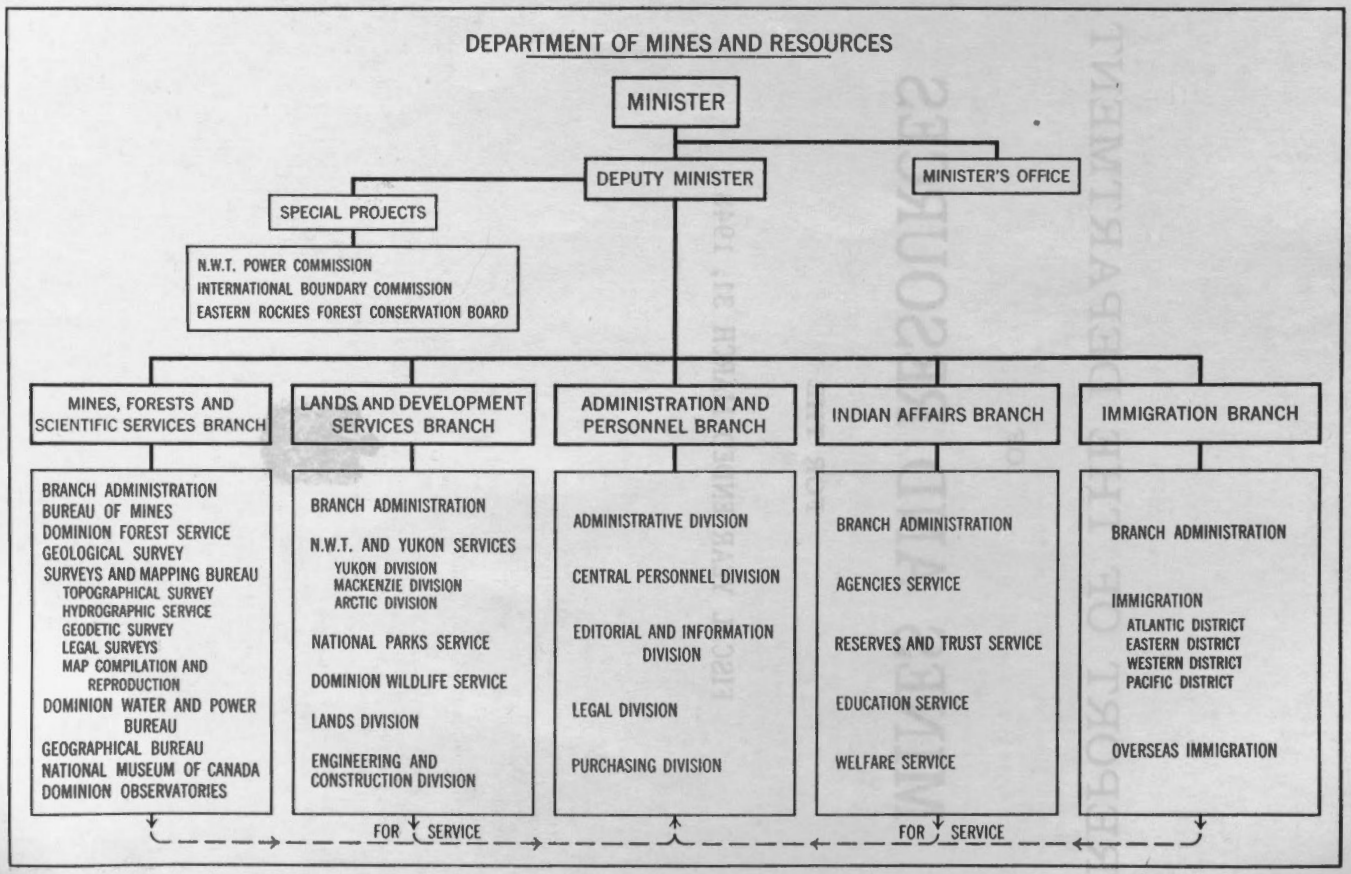

Organization Chart, Department of Mines and Resources.

CONTENTS

24724—1½

CONTENTS—*Concluded*

To His Excellency Field Marshal the Right Honourable Viscount Alexander of Tunis, K.G., G.C.B., G.C.M.G., C.S.I., D.S.O., M.C., Governor General and Commander-in-Chief of Canada.

MAY IT PLEASE YOUR EXCELLENCY:

The undersigned has the honour to lay before Your Excellency the Annual Report of the Department of Mines and Resources for the fiscal year ended March 31, 1948.

Respectfully submitted,

JAMES A. MACKINNON,
Minister of Mines and Resources.

The Honourable James A. MacKinnon,
Minister of Mines and Resources,
Ottawa.

SIR:

I have the honour to submit the Twelfth Annual Report of the Department of Mines and Resources, covering the fiscal year which ended on the 31st of March, 1948.

Your obedient servant,

H. L. KEENLEYSIDE,
Deputy Minister.

REPORT OF THE DEPARTMENT OF MINES AND RESOURCES FOR THE FISCAL YEAR ENDED MARCH 31, 1948

INTRODUCTION

During the year under review a major re-organization was effected in the Department when, under authority of Order in Council P.C. 37/4433 of November 1, 1947, the Mines and Geology, the Lands, Parks and Forests, and the Surveys and Engineering Branches were abolished; and the Mines, Forests, and Scientific Services Branch and the Lands and Development Services Branch were established in their place.

This re-organization brought together in the Mines, Forests, and Scientific Services Branch all the basic research activities and all the survey and mapping responsibilities of the Department. All the national development and the engineering and construction activities of the Department are now centralized in the Lands and Development Services Branch.

This re-alignment of activities enabled the Director of the former Surveys and Engineering Branch to become associated directly with the Deputy Minister's Office as Director of Special Projects. In addition to supervising certain major construction projects, he represents the Department on a number of boards or commissions, including the Eastern Rockies Forest Conservation Board, the International Boundary Commission, and the Northwest Territories Power Commission.

The research and administrative work of the Department was carried on during the year with notable results. The high degree of co-operation received from industry was a matter of great satisfaction. The Department's activities with respect to the surveying, development, and full utilization of the mineral, forest, and water-power resources of the Dominion were in keeping with the greatly increased contribution which these resources are making to the national economy. Assistance and guidance was provided to industry in all phases of mineral discovery, development, and use, in the conservation and full utilization of forests and forest products, and with respect to water-power development by conducting research work and field investigations and by supplying reports, maps and charts.

Field work included surveys and investigations by 90 field parties and aerial reconnaissance over a large area of the Arctic. A wide range of investigations were conducted, aimed at aiding industry in overcoming technological and economic problems.

Studies were continued on the nation-wide problem of managing Canada's forests so as to ensure a sustained yield. Forest fire research showed that, although forest fire losses last year were the lowest in two decades, campers and smokers were responsible for more than one-third of the outbreaks.

New hydro-electric installations completed during the year resulted in a 1·7 per cent increase in the total, and the great increase in planning of new developments resulted in heavy demands for essential data.

Surveying and mapping operations were carried out on a greatly increased scale and production and distribution of maps and charts was higher than in the previous year.

Established mining companies in the Northwest and Yukon Territories made steady progress and prospectors devoted their attention chiefly to the discovery of new sources of base metals. Towards the end of the year a concession was granted for a thorough investigation of lead-zinc deposits in a 500-square mile area at Pine Point.

Good progress was made in the construction of the Snare River power development and the Grimshaw-Great Slave Lake Highway.

Measures were taken for the further improvement of educational facilities and medical services in the Territories. Owing to the heavy losses suffered by wildlife from fire and over-shooting, it was necessary to restrict hunting and trapping in many areas.

The number of visitors to the National Parks was the largest in years, and the system was extended by the addition of a suitable area set aside by the Government of New Brunswick for national park purposes. Plans were laid during the year for substantial development and improvement of parks roads and other facilities.

The Department's efforts to give full effect to the Government's policy with respect to immigration resulted in an increase of 18·2 per cent in the number of immigrants as compared with 1946-47. The improvement in travel conditions facilitated the movement of new citizens to Canada. Every effort was made to meet the Government's commitments with respect to Displaced Persons, and, in co-operation with representatives of the Netherlands Government, a movement of agriculturists from the flooded areas of that country was begun. A substantial number of Canadians returned from the United States. Notwithstanding a shortage of shipping space, special attention was given to the movement of immigrants from the British Isles. Good progress has been made in the re-establishment of immigration facilities in Europe.

Indians engaged in agricultural pursuits in most parts of Canada had a successful year. Pacific Coast Indians extended their fishing operations, and hunting and trapping activities generally brought satisfactory returns. There was a slight stiffening in competition for employment in industry, but for the most part, employment was maintained at a high level. The improvement of educational, health and general living conditions was continued.

The following tables give a summary of revenues and expenditures for the fiscal year:—

SUMMARY OF REVENUES AND EXPENDITURES FOR THE FISCAL YEAR 1947-48

—	Revenue	Expenditures		
		Ordinary	Special including Demobilisation and Reconversion	Total Expenditures
	$ c.	$ c.	$ c.	$ c.
Administrative Offices		260,117 79	4,691 26	
Special Projects	9,916 61	2,553,999 61		
	9,916 61	2,814,117 40	4,691 26	
				2,818,808 66
Mines, Forests and Scientific Services Branch—				
Branch Administration	34,702 89[1]	40,829 68		
Bureau of Mines	26,175 57	707,376 79	517,522 95	
Geological Survey	6,257 34	686,672 72		
Surveys and Mapping Bureau	56,913 25	2,060,921 19	990,884 86	
Dominion Forest Service	19,130 77	961,674 69		
Water and Power Bureau	158,512 16[2]	570,691 15	48,966 25	
National Museum of Canada		93,925 36		
Dominion Observatories	114 11	199,307 21	35,974 92	
	301,806 09	5,321,398 79	1,593,348 98	
				6,914,747 77

SUMMARY OF REVENUES AND EXPENDITURES FOR THE FISCAL YEAR 1947-48

	Revenue	Expenditures		
		Ordinary	Special including Demobilization and Reconversion	Total Expenditures
	$ c.	$ c.	$ c.	$ c.
Lands and Development Services Branch—				
Branch Administration		25,703 79		
Northwest Territories and Yukon Services	638,507 97[3]	2,879,046 07		
Lands Division	131,707 66[4]	138,102 34	3,727 38	
National Parks Service	491,708 61	2,472,369 65		
Dominion Wildlife Service	1,269 94	67,890 81		
Engineering and Construction Division	139 10	109,715 82	133,628 37	
	1,263,333 28	5,692,828 48	137,355 75	
				5,830,184 23
Indian Affairs Branch—				
Branch Administration		87,303 36		
Indian Agencies—Administration	33,192 35	1,409,596 71		
Reserves and Trusts—Administration	11,558 75	90,218 20	190,112 56	
Welfare of Indians	9,659 68	1,662,620 90		
Indian Education	2,565 26	3,614,804 04		
Miscellaneous Statutory Items (Annuities and Pensions)	68 55	307,268 82		
Other Items		10,826 99		
Miscellaneous Revenue—not including revenue accruing to Indian Band Funds	11,428 72			
	68,473 31	7,182,639 02	190,112 56	
				7,372,751 58
Immigration Branch—				
Administration of the Immigration Act and the Chinese Immigration Act		312,513 78		
Field and Inspectional Service—Canada		2,074,868 57		
Field and Inspectional Service—Abroad		277,563 36		
Miscellaneous Statutory Items		1,474 00		
Demobilization and Reconversion—Miscellaneous			76,977 75	
Miscellaneous Revenue	199,836 50			
	199,836 50	2,666,419 71	76,977 75	
				2,743,397 46
Totals for Department	1,843,365 79	23,677,403 40	2,002,486 30	25,679,889 70

NOTES—

[1] Includes $28,293.48 received from Abasand Oils Ltd., under agreement of sale of Crown Assets, and $6,291.41 repayment of loans, plus interest, from War Appropriations.

[2] Includes a refund of $95,958.49 previous years' expenditure from the Province of Manitoba with respect to the transfer of water power developments to the Province under the terms of the Manitoba Natural Resources Act, 1930.

[3] Amounts received from profits on sale of liquor and for liquor fines in the Northwest Territories are not included but are deposited to the Trust Account—Liquor Profits—N.W.T. The credit balance in that account at the close of the fiscal year was $444,129.98.

[4] Includes $62,571.50 to offset similar amount reported as expenditure and covering amounts written off during year from outstanding advances for Seed Grain and Relief.

SPECIAL PROJECTS—DIRECTOR, J. M. WARDLE

This report covers those projects of a special nature which were made the responsibility of the Director when the re-organization of the technical Branches of the Department was made effective on November 1, 1947. Included are certain major construction projects, the International Boundary Commission, and work related to the Eastern Rockies Forest Conservation Board established under authority of Act of Parliament. The Director of Special Projects is a Dominion member of this Board.

Special Projects falls under two headings, namely, that work primarily of a construction nature which may involve joint action by the Dominion and the Provinces, and that of a special engineering or scientific nature. In the first category fall the road construction projects; in the second the International Boundary Commission and the operations of the Eastern Rockies Forest Conservation Board.

HIGHWAYS

GRIMSHAW-GREAT SLAVE LAKE HIGHWAY

The main project under construction in the fiscal year under review was the Grimshaw-Great Slave Lake Highway. This road is being built to give an all-weather road connection between Grimshaw on the Edmonton, Dunvegan and B.C. Railway, and Hay River in the Northwest Territories on the south shore of Great Slave Lake. The total length of this road will be 385 miles, and its completion will permit all-year transportation by truck from railhead to Great Slave Lake. The lake will be crossed in the summer season by boats and barges, and in the winter season by tractor trains over the ice. The increased transportation facilities afforded by this road will accelerate the development of mineral areas in the Great Slave Lake district.

The Grimshaw-Great Slave Lake Highway comprises two main sections: that through the Province of Alberta, and the section through the Northwest Territories. The Provincial Section, which is being constructed as a joint project, is 304 miles long, of which 69½ miles were built prior to the initiation of the major project. Up to the end of the fiscal year 1947-48, the Dominion contribution was two-thirds of actual construction costs, the maximum Dominion expenditure being set under agreement at $1,375,000.

The Northwest Territories section extending from the Alberta boundary to Hay River is 81 miles long, and is being built entirely by the Dominion.

Provincial Section.—Work operations for the 1947-48 season were continued until November, 1947, at which time the total work undertaken on a joint basis was as follows:—

Clearing and grubbing	234·0 miles
Rough grading for approximately	191·1 "
Fine grading for approximately	148·6 "
Gravel surfacing	104·6 "
Culverts were installed for	185·0 "

Steel bridges were constructed as follows: one 175-foot span over Meikle River, one 80-foot span over Kemp Creek, one 80-foot span over Keg Creek.

Necessary timber bridges were installed to Mile 188·6.

Dominion Section.—Construction operations from the northern boundary of Alberta to Hay River in the Northwest Territories, a distance of some 81 miles, was continued under contract by the Bond Construction Company Limited of Edmonton, Alberta. Grading operations closed down in the autumn of 1947 for the winter, at which time the following items of work had been completed:—

Clearing and grubbing	80·9	miles
Rough grading for approximately	49·6	"
Fine grading for approximately	43·5	"
Gravel surfacing for approximately	40·0	"
Culverts installed for	50·0	"
Bridges, timber built	2	

Both sections of the road will be completed early in the autumn of 1948.

The total Dominion expenditure on the Alberta section to March 31, 1948, is $1,342,715.61, and the Dominion expenditure on the Northwest Territories section to that date is $940,850.22.

SNOW LAKE MINING ROAD

In order to facilitate development of a mineral area in the Snow Lake district north of Wekusko in Manitoba, the Dominion entered into an agreement in 1946 with the Province whereby it would contribute one-half the estimated cost of construction of a mining road from Wekusko on the Hudson Bay Railway to Snow Lake, a distance of some 35·5 miles. The estimated cost as supplied by the Province was $500,000, and the Dominion's share was limited to $250,000.

As it was found impossible to award the work to any contractor at a reasonable sum, construction has largely been carried on by day labour under the immediate direction of the Public Works Department of the Province of Manitoba. Good progress has been made. Grading operations were carried on during the 1947 season until December of that year. During the winter months clearing was undertaken and native timber taken out for bridge and culvert construction.

The following is a summary of the status of this project as at March 31, 1948:—

Clearing (100 feet wide) and grubbing	35·5	miles
Grading, 20-foot top, equivalent of	33	"
Gravelling, equivalent of	31	"
Timber bridges built	5	
Native timber cut for structures	190,000	ft.b.m.

This project will be completed in the summer of 1948.

The Dominion contribution to this project up to March 31, 1948, was $207,349.83.

Engineering services necessary for the construction of both the Grimshaw-Great Slave Lake Highway and the Snow Lake Mining Road have been supplied by the Engineering and Construction Division, Lands and Development Services Branch of the Department.

VICTORIA-PATRICIA BAY AIRPORT ROAD

In 1947 representations were made by the Province of British Columbia that improved highway facilities were very necessary between the Patricia Bay Airport and the City of Victoria, B.C., a distance of some 17 miles. The existing road between the city and the airport was one of the main roads serving the Saanich District, with very heavy local traffic. It was inadequate to carry as well the higher speed traffic to the airport. Owing to congestion on the existing road, it took longer to travel between the airport and Victoria than to fly from Vancouver across the Gulf to the airport.

An arrangement consequently was made between the Dominion and the Province whereby a detailed survey would be made in 1947-48 of an improved or new road between Victoria and the airport. Each Government would pay one-half the cost of the survey, the Dominion's share being limited to $4,000. After some field reconnaissance, actual survey work was begun in March, 1948,

by the Public Works Department of the Province, and will be completed during the summer of that year. After plans, specifications and estimates of cost are available, consideration will be given to the basis on which construction might be undertaken.

Snare River Storage and Power Project

This is a major power project begun under the Surveys and Engineering Branch, and was designated as a Special Project at the time of the departmental re-organization in the autumn of 1947. It consists of the construction of a hydro-electric plant on the Snare River, at the outlet of Big Spruce Lake, some 95 miles northwest of Yellowknife, Northwest Territories. The plant will develop 8,000 horsepower, and will supply power to mines, the Town of Yellowknife, and other consumers in the district.

Its construction and eventual operation under the Dominion Government is a new type of activity. Outside of national park areas, it will be the first hydro-electric plant of any size to be constructed and operated in the public interest under the auspices of the Dominion Government.

Construction included the generating plant and a 95-mile transmission line from the site of the plant to the vicinity of Yellowknife, Northwest Territories. Construction is being undertaken by contract, with the Giant Yellowknife Gold Mines Limited handling and supervising the construction of the transmission line. When completed the plant will be operated by a Northwest Territories Power Commission. A Bill to authorize the establishment of such a Commission to operate the plant on a self-sustaining basis is under preparation at the present time.

The hydro-electric development consists essentially of an earth-fill dam, about 800 feet in length with a maximum height of 73 feet, spanning the Snare River at a point where it is divided into two channels by a rocky island. A main tunnel, 16·5 feet by 16·5 feet in section and about 136 feet in length through the island, will supply water to the main turbine, while a smaller tunnel 4 feet by 6 feet in section will supply a small turbine-driven exciter. Intake works at the upstream end of the tunnels containing trash racks and steel gates will control the flow. The power-house, located immediately at the foot of the dam, will house a turbine of 8,360 horsepower, under a head of 56 feet, driving a 7,000-kva. generator, and a small 200-horsepower turbine for standby station service. Four 2,500-kva. transformers situated adjacent to the powerhouse will raise the voltage to 115,000 volts for transmission to Yellowknife. In addition to the main dam, two small containing dams will be required to complete the closure of the head pond. A storage area of some 30 square miles, including Big Spruce and Kwejinne Lakes, will be created as the river will be backed up for 28 miles.

Preliminary construction operations were undertaken in the summer and autumn of 1946. These operations included completion of the two tunnels, stripping of the main dam foundation and borrow pits, some rock excavation in the powerhouse foundation, the building of camps to house the construction force and the freighting of supplies and equipment to the project during the winter months of 1946-47. Active construction was resumed in April, 1947, and was continued until low temperatures brought operations to a close in November. During this period, despite delays occasioned by wet weather, substantial progress was made on the main dam. Seventy-two per cent of the clay core, 46 per cent of the sand and gravel embarkment material and 17 per cent of the rock facing was placed. In all about 45 per cent of the dam was completed on the basis of total quantities. The concrete head-gate structure was completed and the head-gates installed, excavation for the power-house foundation was finished and

concrete was poured to an elevation about the draft-tube section. A start was made on the construction of the staff house and cottages for the permanent operating staff. Preliminary work was done also at the sites of the two supplementary dams.

During the winter of 1947-48 the principal activity was the freighting of power-station equipment and construction equipment and supplies to Snare River over winter roads from Grimshaw, Alberta, and from various places on the north shore of Great Slave Lake. Approximately 1,650 tons were delivered at the project of which 260 tons were transported by air. All items of power-house equipment arrived safely, including the main and auxiliary turbines, generator, switchgear, transformers, penstocks, power-house steel, travelling crane and other accessories. With this program of freighting completed in March, 1948, preliminary construction operations were resumed on the power station and on the construction of the supplementary dams. The construction schedule, as planned, provides for completion of the development and the initial delivery of power by November, 1948.

Construction of the transmission line by Giant Yellowknife Gold Mines proceeded favourably during the year, with the expectation that it will be completed by July, 1948. Negotiations took place between the Department and Consolidated Mining and Smelting Company of Canada, Limited, with a view to effecting an agreement for the interconnection of the Snare transmission system with that of the Company, at a point adjacent to the stepdown sub-station at the Yellowknife end of the Snare line.

Satisfactory progress was made throughout the whole year and on March 31, 1948, all operations were on schedule. The total expenditure up to that date, including Dominion payments for the construction of the transmission line, was $2,454,135.40.

Engineering and technical service since the inception of this project has been supplied by the staff of the Dominion Water and Power Bureau, Mines, Forests and Scientific Services Branch of the Department.

Eastern Rockies Forest Conservation Board

This Board was established in the autumn of 1947 under the authority of the Eastern Rocky Mountain Forest Conservation Act, passed by the House of Commons in July, 1947, and ratified on behalf of Alberta by its Legislature in March, 1948.

Under the Act and appended Agreement, an area of some 8,585 square miles on the eastern slope of the Rocky Mountains in Alberta becomes the responsibility of the board for all matters related to forest protection and development. This includes the construction and maintenance of roads and other projects and facilities required to conserve the forests of the area and maintain the greatest possible flow of water in the Saskatchewan River and its tributaries.

The waters on which the Prairie Provinces of Alberta, Saskatchewan, and Manitoba depend for power, irrigation, and domestic purposes, take their rise in the eastern slope of the Rockies and are a most important factor in the agricultural economy of these Provinces. Consequently it was desirable and in the national interest that special steps be taken towards the conservation and orderly development of the eastern slope areas which form the sources of the streams and rivers flowing easterly.

The Dominion Act is administered by the Minister of Mines and Resources, and the Minister of Lands and Mines of Alberta represents that Province in the Legislative field.

As the work of the Board for the fiscal year ended on March 31, 1948, has been covered in its own Report, only a summary of its operations will be given here.

The three members of the Board are as follows: Howard Kennedy, C.B.E., M.C., B.Sc., Chairman of the Board; J. M. Wardle, C.B.E., B.Sc., Dominion member of the Board; and H. G. Jensen, LL.B., Alberta member of the Board.

The main work of the Board in the past fiscal year was that related to planning and organization. Regular meetings were held monthly, beginning in October, 1947. In addition, special meetings were held from time to time.

Among matters requiring the Board's attention were improved fire protection, insect pest control, the establishment of forest headquarters, and the planning of main roads, secondary roads, and trails which would give the required access to the conservation area. The latter comprises essentially the original Clearwater, Bow, and Crowsnest Forest Reserves.

The agency for forest protection and silvicultural work is the Alberta Forest Service, the personnel of which work under the general direction of the Board. The Province of Alberta has the right to undertake the development and construction work required by the Board under certain terms and conditions laid down by the Act and the Agreement. The latter provide for a capital expenditure of not more than $6,300,000 over the first six years of the Agreement, these funds being provided by the Dominion, and a yearly maintenance sum of not more than $300,000 provided by the Dominion and the Province in the respective proportions of seven-twelfths and five-twelfths. The Board could not function completely until the Dominion-Provincial Agreement was ratified by the Province of Alberta, and when this was done late in March, 1948, the Board was formally established in all respects as from April 1.

During the fiscal year ended March 31, 1948, the expenses of the Board were met through funds especially provided in the 1947-48 estimates of the Department of Mines and Resources. Of the amount of $60,000 provided, an expenditure of $48,304.51 was made.

International Boundary Commission

The boundary line between Canada and the United States is divided into six sections. Each section is defined by its own treaties and each is the subject of a separate report and set of boundary maps. In every section, the boundary line as defined in the first treaties was found to be too indefinite or inaccurate to be marked on the ground and each treaty had to be amended by subsequent treaties or conventions. This was due partly to the ambiguous wording of the treaties and partly to the lack of accurate knowledge of the topography of the country through which the boundary line was to run.

Starting from the east, the first section is from the "Source of the St. Croix River to the Atlantic Ocean", as defined in the Treaty of 1783. In this section, the location of the source of the St. Croix River, the identity of the river itself, the course of the boundary line through the islands of Passamaquoddy Bay and the termination of the boundary line in Grand Manan Channel, were all more clearly defined in the later treaties of 1794, 1798, 1817, 1842, 1892, 1908, and 1925.

The boundary line through the second section from the "Source of the St. Croix River to the St. Lawrence River" was also first defined in the Treaty of 1783. It was later more clearly defined in the Webster-Ashburton Treaty of 1842 and the Treaty of 1908.

The third section is a water boundary throughout and extends through the St. Lawrence River and the Great Lakes from the 45th Parallel to the mouth of the Pigeon River on the westerly shore of Lake Superior. This section of

the boundary was loosely defined in the Treaty of 1783. It was later found necessary to define more clearly the line through the middle of the lakes and rivers, particularly where islands complicated the situation. This was done in the Treaty of Ghent 1814, the Webster-Ashburton Treaty of 1842 and the Treaty of 1908.

The fourth section is from the "Northwesternmost Point of the Lake of the Woods to Lake Superior". Mitchell's map of 1755, on which the Treaty of 1783 was based, showed the Lake of the Woods draining into Lake Superior through Long Lake, later found to be non-existent. After the location of the northwesternmost point of the Lake of the Woods had been determined and the Pigeon River agreed upon instead of Long Lake, the line was more clearly defined by the treaties of 1842 and 1908.

The fifth section is from the "Gulf of Georgia to the northwesternmost point of the Lake of the Woods". The boundary here was defined as the 49th Parallel as far west as the summit of the Rocky Mountains by the Convention of 1818. Later, the Oregon Treaty of 1846 continued the 49th Parallel as the boundary line westward to the middle of the channel which separates the continent from Vancouver Island. The 49th Parallel was further modified by the Treaty of 1925.

The boundary line through the last section from the 49th Parallel to the Pacific Ocean was also defined in the Oregon Treaty as following the middle of the channel which separates the continent from Vancouver Island, through "Fuca's Straits" to the Pacific Ocean. It was not until 1872, after an arbitration and award by the German Emperor that the identity of this channel and the course of the boundary line through the islands was agreed upon.

The Commissioners, Mr. Ulinski for the United States and Mr. Ogilvie for Canada, met in conference at Ottawa, June 10 to 12, and discussed plans for an inspection of the boundary on the Pacific Coast. They left for Vancouver about the middle of July and on the way inspected the work of the United States party at Warroad, Minnesota.

From Vancouver they investigated the boundary situation at Point Roberts, called at the Land Office in Bellingham to get information on land holdings and assessments, and interviewed local residents on the Point. A full joint report on their investigations was made by the Commissioners to their respective Governments.

Later the Commissioners inspected the work of the Canadian party in Haro and Juan de Fuca Straits. The Fisheries Department kindly put one of its patrol boats at the disposal of the Commissioners and from Victoria they inspected the reference monuments at Beechy Head and Sheringham Point. Crossing to the southerly shore of the Strait, they inspected the monuments on Pillar Point and Tongue Point. They returned to Sidney, where they remained overnight and the following day inspected the reference monuments among the islands as far north as East Point on Saturna Island.

Article 4 of the boundary treaty of 1925 provides that "the Commissioners appointed under the provisions of the Treaty of 1908 shall continue to carry out the provisions of this Article and, upon the death, resignation, or other disability of either of them, the Party on whose side the vacancy occurs, shall appoint an Expert Geographer or Surveyor as Commissioner, who shall have the same powers and duties in respect to carrying out the provisions of this Article, as are conferred by this Article upon the Commissioner appointed under the provisions of the said Treaty of 1908".

After holding the office of International Boundary Commissioner for Canada for over sixteen years, Noel J. Ogilvie retired on November 15, 1947. While he was Commissioner, he had collaborated with three United States Commis-

sioners; Mr. Van Wagenen, Mr. Riggs and Mr. Ulinski. Following Mr. Ogilvie's retirement, J. M. Wardle, C.B.E., Director of Special Projects for the Department of Mines and Resources, was appointed International Boundary Commissioner.

MAINTENANCE OF THE BOUNDARY

A party from the United States section of the Commission was assigned to the Ontario-Minnesota and Manitoba-Dakota boundary to reclear the vista, inspect and repair the boundary monuments and bridge tablets, and recover and occupy the triangulation stations. Mr. Prinsep was the Canadian representative with this party and was engaged chiefly in recovering old triangulation stations which had been established by the Canadian Department of Public Works in 1913. These triangulation stations were along the Rainy River and were marked by iron posts driven flush with the ground surface. The marks had become covered with earth or overgrown by brush, making them very difficult to find.

To facilitate their recovery, experiments were tried with a portable mine detector, borrowed from the Department of National Defence. The area to be searched was narrowed down by means of a rough intersection and under favourable conditions the detector was found to be very useful. In a number of cases it saved considerable time in finding the marks. The disadvantages of the detector are that the coil has to be swung over the area in long sweeps a few inches above the ground, which is difficult to do in underbrush. Further, the coil shows no discrimination, but registers impartially the proximity of old wire, tin cans or any other metal scrap which may come within its field.

The party worked westward along the 49th Parallel as far as the Pembina Hills, on the Meridian Line from the 49th to the Northwest Angle; and eastward along the Rainy River as far as Rainy Lake.

A party from the Canadian Section of the Commission in charge of Mr. Chisholm was assigned to the water boundary through Haro and Juan de Fuca Straits on the Pacific Coast. This party was to inspect and repair the reference monuments. This part of the boundary line is a series of straight-line courses and the positions of the turning points are controlled by reference monuments and lighthouses along the shores. The boundary runs from the 49th Parallel in the middle of the Gulf of Georgia in a southerly direction through the islands and Haro Strait, then westerly through Juan de Fuca Strait to the Pacific Ocean.

A small boat from Shoal Harbour near Sidney was chartered and operated by the owner, who also provided a dinghy for landing on the beaches. Two men were engaged for the work of repairing the monuments and clearing brush from in front of them, so they would be plainly visible from the water.

The following lighthouses and reference marks were inspected:

East Point Lighthouse on Saturna Island
Patos Lighthouse on Patos Island
Turn Point on Stuart Island
Fairfax Point on Moresby Island
Kelp Reefs Beacon on Kelp Reefs
Andrews Bay on San Juan Island
Pile Point on San Juan Island
Discovery Lighthouse on Discovery Island
Iceberg Point on Lopez Island
New Dungeness Lighthouse on the Mainland
Fisgard Lighthouse on Fisgard Island
Race Rocks Lighthouse on Race Rocks
Beechy Head on Vancouver Island
Sheringham Point on Vancouver Island
Pillar Point on the Mainland

Tatoosh Lighthouse and Bonilla Point Reference Mark were not inspected as the boat was too small to venture to the west end of Juan de Fuca Strait. At Tongue Point and Angeles Point it was too rough to land and inspect the reference marks.

Connections had been made between all these reference marks and lighthouses, and the first order triangulation in the area, by the United States Coast and Geodetic Survey in 1942. The geographic positions of the reference marks and turning points were readjusted on the 1927 Geodetic Datum during the winter and the new values are listed in Mr. Chisholm's report.

A second Canadian party in charge of Mr. Mussell continued maintenance work on the British Columbia-Alaska section of the boundary along the Chilkat River and its tributaries, northwest of Skagway. The boundary between British Columbia and Alaska, following as it does the summits of the snow and glacier-covered mountains parallel to the coast, is very difficult of access. The best routes of approach have been found to be up the rivers, which cross the line on their way to salt water. The navigation of these Alaskan rivers is not easy and can be successfully done only by experienced boatmen.

This year the party worked along the Kelsall River, which is not navigable, and it was found necessary to clear out a pack trail for about 14 miles to get men and supplies up to the line. The country traversed was very difficult; through swamps and sloughs along the lower part of the river and over broken rocky ground along the upper part. Two bridges had to be built to cross and recross the river when it became impassable on one side.

Two mules were used to do the heavy packing and were found to be very useful. On account of the rough character of the country and the difficulty of getting men to stay with the party, less work was accomplished than had been planned. Beyond getting the trail finished as far as the boundary area, very little work could be done on the line itself. Provision has been made for completing this work in 1948.

MISCELLANEOUS

In November the District Engineer's Office of the Department of Public Works at Westminster made another inspection of the off-shore range mark on the west side of Point Roberts. He reported no further change in the settlement of the foundation since it had been inspected a year previously.

During the year many requests were received for reports, maps, and other information regarding the boundary. The material supplied included the following:

A set of the maps and two copies of the report on the Ontario-Minnesota section of the boundary to the Surveyor General of Ontario.

Forty of the maps of the same section to the Ontario Department of Lands and Forests at Port Arthur.

Special plan of the St. Zacharie-Rockwood highway boundary crossing, and scenery data respecting the boundary monuments for use in connection with the erection of a new Customs Office there.

Maps of the Chiputneticook Lakes on the Maine-New Brunswick boundary for the use of the Customs Collector at Forest City, N.B.

EXPENDITURE

The Vote provided in the 1947-48 Estimates for the International Boundary Commission (Canadian Section) was $38,564, and the expenditure for the fiscal year was $35,835.76.

MINES, FORESTS, AND SCIENTIFIC SERVICES BRANCH

W. B. TIMM, DIRECTOR

All the basic research activities of the Department were brought under one administrative head on November 1, 1947. The Forest Service, which was a main unit of the former Lands, Parks and Forests Branch, was brought into the Mines, Forests, and Scientific Services Branch with retention of its Bureau status. The Topographical Survey and part of the Map Compilation and Reproduction Divisions of the former Mines and Geology Branch, and the Hydrographic Survey, Geodetic Survey, and Legal Survey Divisions of the former Surveys and Engineering Branch are now the Surveys and Mapping Bureau of the Mines, Forests, and Scientific Services Branch. The Dominion Observatories and Dominion Water and Power Bureau are now Bureaux of the Branch, having been transferred from the former Surveys and Engineering Branch with retention of their Bureau status. The status of the Geological Survey was raised from that of a Division in the former Mines and Geology Branch to a Bureau in the present Branch. The status of the Bureau of Mines and that of the National Museum of Canada were not affected by the re-organization. The Geographical Bureau was established on June 5, 1947, by the Cabinet in recognition of the important contribution that can be made by geographers in government and academic spheres.

The eight Bureaux of the Branch are headed by the following officers:

Geological Survey of Canada— G. S. Hume, Chief.
Bureau of Mines — C. S. Parsons, Chief.
National Museum of Canada — F. J. Alcock, Chief Curator.
Dominion Forest Service — D. A. Macdonald, Dominion Forester.
Surveys and Mapping Bureau — F. H. Peters, Chief.
Water and Power Bureau — Victor Meek, Controller and Chief Engineer.
Dominion Observatories — C. S. Beals, Dominion Astronomer.
Geographical Bureau — Trevor Lloyd.

This consolidation of the scientific services of the Department was effected with little disruption of any of the main activities of the Branch. However, limitations in available space have prevented the bringing together of units whose staffs are engaged in closely related work.

With this rearrangement of the Department's activities, the Branch has a broad and varied field of endeavour. Through the work of its Geological Survey and Bureau of Mines it plays an integral role in the development of Canada's mineral resources. Its Forest Service plays a corresponding role in advancing scientific knowledge of all factors relating to the economics, growth, and use of Canadian timber, and in compiling a national forest inventory. The surveys and maps upon which the investigation and development of the country's natural resources are based are made by the Branch.

Ships on Canadian coastal and inland waters rely for their safety on nautical charts and other standard hydrographic aids to navigation furnished by the Branch. Knowledge of the natural history of Canada is enhanced by the scientific and educational activities of the National Museum. Geographical

data on Canada and on foreign areas of importance to Canada are collected and made readily available for use of all branches of the Dominion Government. Astronomical and geophysical research conducted by the Branch combine fundamental studies of the laws of nature with more immediately practical activities such as the determinations of time, and the application of astronomical and geophysical observations to such diverse problems as navigation, economic geology, and building construction in seismic areas. Acquisition, analysis, and publication of stream flow data covering the whole Dominion is a responsibility of the Branch. These basic data are used in connection with power development, storage, irrigation, drainage, flood control, domestic water supply, and various international water problems. Rounding out its activities are such functions as making and recording legal surveys, and producing and distributing aeronautical charts and electoral district maps.

Forestry and mining, the two primary industries served by the Branch, attained record outputs in 1947. Mineral production was valued at approximately $624,000,000, a gain of $121,000,000 over the previous year. Metal production was valued at $393,000,000 in 1947, and non-metallic mineral production at $231,000,000. Lumber output was an estimated 5,346,000 M. board feet, and newsprint was approximately 4,447,000 tons.

The chief contributing factor in the record value of mineral production was the general price rise for practically all principal mine products, especially the non-ferrous base metals. Price rises were largely responsible in establishing new output value records for copper, zinc, lead, iron ore, coal, natural gas, asbestos, gypsum, peat moss, silica, sodium sulphate, barite, clay products, and lime.

The price increases reflect a continually increasing demand for products of the mines. Consumption of these products in Canada and elsewhere has been rising at unparalleled rates, paced in Canada by an industrial growth that shows promise of continuing well into the future. Reflecting this growth, Canadian consumption of copper rose from approximately 54,000 tons in 1938 to approximately 110,000 tons in 1947. In the same periods, the domestic consumption of crude petroleum and coal increased approximately 200 per cent and 60 per cent respectively. The marked expansion in the chemical industries during and since the war has required the use of greatly increased tonnages of several of the industrial minerals.

Even with this greater domestic consumption of mine products, Canada in 1947 exported metals and minerals in the raw or only partly manufactured state valued at $345,305,000. The corresponding value for 1946 was $273,852,000. Shipments to the United States in 1947 were valued at $157,454,000 an important factor in view of the need for American dollars. Chief metals and minerals shipped abroad in 1947 in order of their value were nickel, aluminum (made in Canada from imported ore) copper, asbestos, lead, zinc, precious metals, iron ore, coal, and gypsum.

Developments in the mineral industry in 1947 kept pace with improvements in production and exports. Perhaps the foremost of these developments from the viewpoint of public interest and economic importance was the discovery of crude oil in the Leduc field near Edmonton. By the end of the fiscal year this field was producing oil at the rate of 5,600 barrels of oil daily and production was increasing rapidly. In fact there appeared to be every likelihood that output from this and other fields in Alberta and Saskatchewan would soon be sufficient to meet all requirements of the Prairie Provinces for crude oil. At present a large part of these requirements are imported from the United States.

Exploration for oil in the West was seldom more active than in 1947 and there was every prospect of much greater activity in 1948. The significance

of such activity is evident from the fact that Canada in 1947 imported close to 69,000,000 barrels of crude oil, an increase of more than 60 per cent over 1940. Of these imports, about 39,000,000 barrels came from the United States and most of the remainder from Venezuela. In view of the increasing demand for oil in the United States it seems likely that Eastern Canada will continue to draw more heavily upon the latter source or on Near East oil if this should become available in large quantities when the Trans-Arabian pipelines are completed.

Removal of the domestic ceiling prices on copper, lead, and zinc in June, 1947, and the consequent price rises stimulated the search for new sources of base metals. This, coupled with the improvement of labour conditions, enabled operators of properties nearing production to speed up construction work on mining and milling plants. Some of these plants, designed to handle upwards of 2,000 tons of ore daily, will likely be in production by the end of 1948. No major discoveries were made in the search for base metals, but considerable knowledge was gained by exploration companies and syndicates of the possibilities of outlying areas that had hitherto received little attention.

Gold production showed no marked improvement over the previous year and the industry continued in a depressed state, the result mainly of rising costs, labour shortages, and the fixed price of gold. Anxious to assist the industry over the present emergency because of the important position it holds in the Canadian economy and its significance in promoting the discovery of other metals, the Government, near the close of 1947, introduced a Bill, cited as "The Emergency Gold Mining Assistance Act". It was designed to encourage a greater output of gold by assisting the producers in meeting the higher costs of production. The proposed legislation is intended more particularly to maintain the marginal mines in operation, and thus to enable them to support their dependent communities. By the close of the fiscal year the Bill was well advanced toward Royal Assent. Officers of the Branch devoted much of their time to preparing basic material required in drafting this legislation.

Shipments of iron ore from the two operating mines, both in Ontario, amounted to 1,919,366 short tons, a new record. Of this amount less than one-fifth was used in Canadian furnaces and the remainder was exported to the United States. By the end of 1947, drilling of the iron ore field in the Labrador-Quebec boundary region had proved about half the 300,000,000 tons of high-grade ore required to warrant railway construction. An important development in 1947 was the discovery of bodies of manganiferous hematite containing 6 to 10 per cent manganese and low in silica like the rest of the hematite.

The production records set by several of the industrial minerals and the gains over 1946 recorded by most of the others reflect the increasing demands for these minerals brought about by Canada's industrial expansion. Available information indicates that the industrial minerals industry is expanding more rapidly at present than is any other phase of Canadian industry. Capital expenditures on plant construction and on equipment for mining and processing industrial minerals were much higher in 1947 than in 1946, and still greater expenditures for these purposes are anticipated in 1948. These new plants and plant extensions will serve two main purposes. Their production will help bridge the present wide gap between supply and demand, and the modern facilities that will be available will better enable the companies concerned to raise the quality of the products to the higher standards now required by the chemical, metallurgical, and construction industries.

The Branch, through the work of its Geological Survey and the Bureau of Mines, continued to provide valuable guidance and assistance to all phases of mineral development throughout the Dominion. The 57 parties assigned to field

work by the Geological Survey gave particular attention to gold, base metals, and to structures in which oil or gas might occur. Field work also included a reconnaissance survey by aircraft over a large area of the Arctic region. To enhance its services to mine operators, exploration companies, and prospectors in the Northwest Territories, the Survey established a branch office at Yellowknife, with a resident geologist in charge. To keep abreast of modern techniques in mineral development, it established a geophysical section with facilities for research and field experiment with specialized equipment, including the airborne magnetometer. In co-operation with the National Research Council, the Survey made several experimental flights to determine the practical application of the magnetometer to geological problems and to prospecting. It is planned to extend this field of endeavour considerably in 1948.

The Bureau of Mines had a wide range of investigations under way, designed chiefly to aid industry in overcoming technological and economic problems, and to further mineral development in general. In research on the treatment of refractory gold ores, methods were devised to overcome some of the difficulties arising from the presence of deleterious minerals. Such ores are being found more frequently in Canada, and their treatment poses difficult problems requiring much further research.

Tests and other work done for the ceramic industries was of great assistance in aiding them to cope with the unprecedented demand for their products. A laboratory was established for fundamental research on ceramic problems. Recognizing their increasing importance in the Canadian economy, the Bureau gave a greater share of its attention to the industrial minerals, directing its investigations in general toward the beneficiation of low grade materials and the use of substitute materials. Research resulted in the commercial development of a floor tile bonded with magnesium oxysulphate cement, and of a flooring composition based on magnesium oxychloride cement produced from the high grade magnesia obtained from the brucitic limestone deposit near Wakefield, Quebec.

In a survey of Canadian coal mining methods initiated during the year, the Bureau will pay particular attention to the effect of altered mining methods, and more especially of increased mechanization, on the sizing and quality of coals produced. In the field of combustion engineering, further efforts were made to improve the national position in regard to domestic fuels by investigating the possibilities of a new type of heater developed by Bituminous Coal Research, Incorporated. The purpose of this investigation is to encourage the greater use of Canadian bituminous coals.

Investigational and fundamental research was continued by the Bureau in ferrous and non-ferrous alloy constitution, production, and fabrication methods. Canadian foundries were assisted in re-organizing their melting operations as a means of overcoming the shortage of suitable pig iron and quality scrap. Good progress was made in the joint screw thread research program set up to establish an international standard thread form. Preliminary investigations were under way to develop comparatively cheap processes for manufacturing the extremely light metal lithium and the corrosion-resistant metal titanium.

The demand for forest products, both for domestic use and for export, was exceptionally strong in 1947. To assure adequate supplies for domestic needs, export controls were continued on such items as lumber, poles, veneers, plywoods, pulpwood, doors, and millwork. The control of prices was discontinued in September, however, resulting in a quick stabilization of prices at levels consistent with the increased costs of production.

Losses from forest fires in 1947 were the lowest in 20 years and merchantable timber losses were substantially below normal. Yet the toll from fires was not light considering that the area burned was 613,000 acres. Despite the many appeals and warnings by Dominion and provincial authorities and by various associations, it must be recorded that campers and smokers were responsible for more than one-third of the forest fires in 1947. Losses from insects and disease continued at a high rate. As an indication of the extent of these losses, it may be noted that the average annual loss for the ten-year period 1936-45 was 500,000,000 cubic feet of usable wood. The average fire loss for the same period was 353,547,000 cubic feet.

A great problem confronting Dominion and provincial authorities and the forest industry is management of Canada's forest domain in order to ensure a sustained yield. The Branch, through its Forest Service, operates five forest experiment stations with an area of 227 square miles. At these stations the underlying principles governing the growth of forests are sought, and practical methods of management are tested. Certain problems are studied on a nation-wide basis directed from Headquarters; many others are of regional interest and are supervised from District Forest Offices. The purpose is to keep all forest lands in continuous production and to obtain the highest possible volume of high-quality wood in a short period of time at a reasonable cost. To this end, studies are made to determine the extent to which logged and burned areas are regenerating, and to develop silvicultural methods of cutting which will assure better results than those now attained. Investigations in tree breeding seek the selection and development of superior strains from artificial propagation. Other studies aim to speed up the growth rate of trees by thinning.

Preliminary results from regeneration surveys begun in 1946 indicate that the regeneration of conifers following logging is usually satisfactory under most conditions in Eastern Canada. However, a variation in regeneration from east to west across Canada was noted, apparently the result of differences in climate and topography rather than in logging methods. Most important of the forest management projects is that known as the Green River Forest Management in New Brunswick, where the Branch co-operates with the Province, the Canadian Pulp and Paper Association, and the Dominion Department of Agriculture in managing a 400-square mile tract of forest on a sustained yield basis. In 1947, an additional 5,000-acre research block was laid out and other areas were marked for selected cutting.

The high level of activity in the wood-producing and wood-using industries resulted in greatly increased demands on the services of the Forest Products Laboratory at Ottawa and of the Laboratory at Vancouver. Since the war, the Laboratory at Ottawa has experienced increasing demands for assistance in connection with housing, the rehabilitation of public utilities, and in launching new types of manufacture based on war-time experience. Much attention was given during the year to improving sawmilling practices and to closer integration of sawmills and pulp-mills in order to avoid undue waste. The rapid expansion of the plywood industry introduced many problems in laminating veneers and in using new synthetic resins. Keeping pace with the demand for greater service, the facilities of the Vancouver Laboratory were expanded. It now operates as a regional research unit for Western Canada.

The use of air photographs in surveying the forests of Canada has assumed special importance in the Branch's forest research programs. An opportunity to combine research with practice has arisen in forest mapping of federally administered lands and in cases where mapping is done in co-operation with the provinces. In the past year detailed forest maps were prepared for 1,097 square miles in federally administered lands. Plans were made for mapping approxi-

mately 9,000 square miles on the eastern slopes of the Rocky Mountains, where a special area has been set aside to ensure protection of the forests and thus maintain a steady flow in the Saskatchewan River.

Emphasis was placed on further advances in using the forestry tri-camera method of photography. This method was developed to establish a type of air photography that will meet the special needs of the forester for maximum forest detail at minimum cost.

The desire to bring the National Museum to the position it should occupy among scientific and cultural institutions was brought closer to fruition. A number of additions were made to the staff, field work was increased, educational work was extended, and the rotunda, exhibition, and communication halls were redecorated. Ethnological investigations on the North Pacific Coast resulted in the collection of many interesting specimens, and in obtaining a wealth of information on the folklore and artcraft of the Haidas. A field study was made of grazing conditions in the Mackenzie Delta Reindeer Reserve, and a botanical survey was made of the east shore of James and Hudson Bays from Fort George to Great Whale River.

Records maintained by the Water and Power Bureau show that in 1947 new hydraulic installations totalled 178,800 h.p., bringing the installed capacity of all plants in Canada to 10,491,000 h.p. Central electric stations comprise more than 90 per cent of this capacity. Estimates by the Bureau of the water power resources of Canada give 40,124,000 h.p. at ordinary six-months flow, which would allow for a commercial installation of about 52,000,000 h.p. On the basis of ordinary minimum flow the estimate is 25,723,000 h.p. The urgency of several special investigations and new demands for information arising from a marked increase in the planning of new power developments continued to strain the facilities of the Bureau. Projects requiring special attention included a reconnaissance water-power survey of the upper Snare River, Northwest Territories, to determine the possibilities of developing power to serve the Indin and Courageous Lakes areas where metal discoveries are being explored. Investigations on behalf of the International Columbia River Engineering Board for the International Joint Commission were continued. These investigations are conducted in the interests of domestic water supply and sanitation, navigation, water power, flood control, irrigation, reclamation of wet lands, and other such beneficial purposes.

The Surveys and Mapping Bureau had 32 topographical parties in the field making original surveys for ground and air mapping for use in developing mineral, agricultural, and other natural resources. Expansion of staff to handle the large commitments for topographical work was seriously delayed by lack of adequate office space and difficulty in obtaining suitable field officers. The Bureau made substantial progress in re-charting a number of important Canadian harbours and coastal areas. The addition of a small, well-equipped hydrographic vessel gave considerable impetus to hydrographic operations off the Pacific Coast. A specially designed hydrographic launch facilitated the charting of Great Slave Lake. Triangulation operations by the Bureau progressed favourably toward providing control in the potentially important mineral area in western Quebec and at intervals along the contemplated boundary between Quebec and Labrador. Other operations to provide immediate or future control for mapping and surveys in Ontario, Alberta, and Yukon, were extended. The Bureau made legal surveys of airfields at Norman Wells, Fort Simpson, and Fort Resolution in the Northwest Territories, and the legal survey of the Alaska Highway was completed to the Yukon-Alaska boundary. Field work was completed on the survey of the most northerly 170 miles of the Ontario-Manitoba boundary between Echoing River and Hudson Bay.

A seismic survey of the Canadian Shield was started by the Dominion Observatories with the setting up of control stations at various centres in Ontario and Quebec.

In co-operation with the R.C.A.F., major efforts were made by the Observatories to extend the network of magnetic stations in the Arctic, specifically to more accurately locate the North Magnetic Pole. Observations indicate that the Pole is located in the northern part of Prince of Wales Island, having moved north and west approximately 200 miles from the point located by Ross in 1831. Networks for gravity and magnetic observations were established in southern New Brunswick to fill in gaps in previous work, and to investigate further the relation between geophysical results and the geology, as revealed by recent studies. Similar networks were established in the mining areas of northern Ontario and western Quebec.

The Geographical Bureau started to function in October, 1947, and concentrated most of its efforts on compiling data on Northern Canada. A senior officer of the Bureau made a northern reconnaissance flight in mid-winter in which he visited Churchill, Baker Lake, and settlements in Mackenzie Valley as far north as the Arctic Coast. Details were worked out and staff was selected for eight field parties to work in Northern Canada during the summer of 1948.

Administration of the unit responsible for producing secret naval equipment for the Naval Services was transferred from the Director's Office to the Bureau of Mines. This activity was curtailed to a large extent by delays in completing the building in which it is to be housed.

BUREAU OF MINES

The functions of the Bureau of Mines implement a major portion of the interest of the Federal Government in Canadian mineral development. It is the agency of Government primarily concerned with the technological problems of the mineral industry. Its tests and research work on radioactive ores and its investigation of the metallurgical problems encountered at Chalk River brings the Bureau into close association with atomic energy development in Canada. It also investigates the entire field of mineral economics, and administers the Explosives Act.

Canada's great industrial expansion and the role the Dominion plays in supplying a large share of the rising world demand for mine products makes the maintenance of a strong mineral economy imperative. For reasons of defence, also, the mineral economy must be kept strong. Canada's capacity to do so depends largely upon the practical application of research-acquired knowledge to the treatment of all types of ores found in Canada, to the fabrication of metals, and to the uses of all mine products. As the central agency for this type of work the Bureau is charged with a heavy responsibility.

Thus, Canada's mineral supply is high among the considerations of the Bureau and received much attention during the year. Canada's position, although strong in most of the principal metals and minerals, is unfavourable in several others. Some of these deficiencies eventually may be remedied by new finds, by developing marginal and low-grade deposits, by improving present techniques of operation and treatment, and by developing substitute materials.

One of the greatest needs of the country is an adequate domestic supply of oil. Canada imports about 90 per cent of her oil requirements, and these imports increased from 34,244,600 barrels in 1938 to 68,446,700 barrels in 1947. The conversion of bitumen, coal, and other raw materials to liquid fuels is the most promising method of eventually solving this problem. To this end, the Bureau has already done considerable experimental work on a laboratory scale. To

obtain further data on possible yields from these raw materials, it took steps during the year toward installing hydrogenation apparatus for work on synthetic fuels at pressures up to 20,000 pounds per square inch. Data obtained from use of this equipment will also guide the design of such commercial units as industry may eventually establish. The technical and economic problems involved in commercial production will provide a basis for research well in advance of large-scale development.

Canada also imports approximately two-thirds of her coal requirements. This is necessitated mainly by the geographical distribution of deposits in relation to the principal markets. By constant investigation of technological problems, the Bureau, in co-operation with industry, has done much toward expanding the use of Canadian coals. Much remains to be done. The Bureau undertook, during the year, a comprehensive survey of Canadian coal mining methods with the overall objective of acquiring knowledge useful to industry in lowering costs and increasing production.

Other important minerals in short supply are manganese, vanadium, chromium, cryolite used in the production of aluminium, tin, quartz crystals having the required physical properties, and certain fertilizer minerals. Continuous investigation of the problems bearing upon these deficiencies is maintained by the Bureau.

Industrial minerals are becoming increasingly important to the Canadian economy. Great quantities of these minerals are used in Canada's expanding chemical and construction industries. Larger quantities will be required as this expansion gains momentum. Recognizing this, the Bureau gave increased attention to these minerals. Its investigations are directed, in general, toward the beneficiation of low-grade materials to bring them up to the rigid specifications now required; the development of industrial processes to use the more abundant lower grade materials; the use of substitute minerals; and development of synthetic products from basic raw materials in ample supply. In all cases a great deal of research is required and as there is always a period of unsettlement involved in any major change of processing, it is imperative that this research proceed while industry is still assured of its normal supplies of raw materials from either domestic or foreign sources.

The Bureau's work greatly assisted the Canadian ceramics industry in coping with an unprecedented demand for its products. The operations are seldom large enough for the companies to maintain the staff and equipment necessary for scientific investigation of their raw materials and products.

In the physical metallurgy field, Canadian manufacturers of metal products used the Bureau's services to advantage in solving vital technical and economic problems. Shortages of materials created numerous problems for the Bureau. Canadian ferrous foundries, for example, faced serious operating difficulties, particularly in the grey iron foundries, because of the shortage of suitable pig iron and quality scrap. The Bureau assisted greatly in modifying the melting procedures that enable the foundries to produce good sound casting.

Studies of the behaviour of new magnesium alloys when specific additions of certain other metals were made to magnesium led to the development of a promising new magnesium casting alloy containing six per cent zinc and one per cent zirconium.

A long-term research project in conjunction with the National Research Council made considerable headway in developing new and superior alloys capable of withstanding extremely high temperatures. This work may lead to more efficient and more powerful gas turbine jet engines.

Preliminary tests were under way to develop comparatively cheap processes for manufacturing the extremely light metal, lithium, and the corrosion-resistant metal, titanium.

The work on radioactive ores, begun in 1945 as an advisory service to the Crown-owned Eldorado mine at Great Bear Lake, was originally handled by a staff of two scientists. It has since expanded so rapidly that 30 scientists and technicians are now employed, and a further enlargement of staff may soon be necessary. Expanding activities necessitated establishment of the Radioactivity Section in 1946, with a highly qualified scientist in charge.

At first most of the work was on Eldorado ores. More recently, however, prospecting for radioactive ores has increased greatly, and much of the test work, particularly on ore concentration, has been on samples sent in by prospectors from various parts of the Dominion.

The work of the Section is divided into three groups: Ore Dressing and Extractive Metallurgy, Radiation, and Chemical Laboratory. The Ore Dressing group is chiefly concerned with improving the recovery of radioactive ores. Improved methods developed in the Bureau are proving successful in practice. The Radiation group has been giving particular attention to the problem of accurate analysis of the radioactivity of ores and ore products by chemical and physical methods. Reliable methods have been worked out which are now in use. The Chemical group makes chemical analyses of test products and field samples.

The Section maintains contact with similar research groups in Great Britain, the United States, and South Africa, through exchange of confidential reports and information and by personal visits. It supplies standard samples of uranium to a selected list of outside laboratories.

In administering the Explosives Act, much emphasis was placed on safety measures in handling explosives in hope of reducing the frequency of accidents to children. As one step in this direction, a ban was placed on the retail sale of sky rockets by removing them from the list of fireworks classed as "shop goods". Benefits arising from this prohibition were reported from several centres. Studying the fire and explosion hazard in handling and storing ammonium nitrate fertilizer, the Bureau acquired sufficient data to indicate that only extremely large masses can lead to propagation of detonation. Railways, harbour boards, and all those responsible for transport matters have an interest in this investigation, especially in view of the great increase in sales of the commodity since the war. The investigation, a co-operative effort with the National Research Council, is endeavouring to determine the mechanism of conditions favourable to explosion, and much remains to be done.

The systematic stock-taking of Canada's mineral resources, begun by the Bureau shortly after the war, was continued. Canada's industrial growth and increasing importance in international affairs in which questions of mineral supply often come to the forefront, emphasize the need for such an inventory. Its value will become increasingly apparent as world shortages of the principal metals and minerals occur. The inventory was used extensively by the Bureau during the year in supplying information of strategic importance to the Defence Research Board and the Defence Services.

Special Mineral Projects

Yukon Coal Company Agreement.—Increased mining activities in Yukon gave rise to the problem of supplying the mining properties with fuel. Exhaustion of readily accessible supplies of wood for fuel and the increasing cost of this fuel greatly hampered development of Yukon's mineral resources. Operators indicated that they were prepared to develop a deposit of coal acquired at Tantalus Butte, near Carmacks, and produce coal for the general benefit of Yukon, if the Government would loan funds to equip and bring the mine into production. Examination of the deposit by a geologist of the Department and by a consulting engineer retained for the purpose, indicated that good quality coal

should be available for long-term requirements of Yukon and could be mined at reasonable cost. It was recognized that considerable expenditure would be entailed in getting the mine into production, and that a slowly developing coal market would not ensure an immediately profitable operation. Accordingly the Department entered into an agreement July 10, 1947, with the Yukon Coal Company, Limited, to advance the Company funds not in excess of $300,000 to develop and operate a colliery or collieries and market coal. The funds are repayable by a royalty on production. Administration of the agreement was assigned to the Branch, and at the close of the fiscal year advances totalled $81,569.49. Substantial progress was made in opening the mine and preparing it for shipments of coal during the 1948 navigation season.

The mine is on the Lewes River, a branch of Yukon River, and economical water transportation is expected into the Whitehorse, Dawson, and Mayo markets. Expansion of transportation facilities beyond the present fleet of steamboats and barges will likely be needed to handle the coal and the large shipments of lead-silver concentrates being brought out from the Mayo area.

Agreement with Abasand Oils, Limited.—This agreement was entered into during the war because of the urgent need of obtaining domestic supplies of petroleum. War appropriation funds were used to remodel and enlarge the Company's bituminous sand plant three miles from Fort McMurray, Alberta, and to operate it as a test plant to tackle the various problems requiring solution for utilization of the bituminous sand as a source of petroleum product. The plant for separating bitumen from the sand was destroyed by fire in June, 1945. Under an agreement of sale dated November 1, 1946, the remaining facilities, including the oil refinery, were handed over to the Company, but it has not proceeded with development of the bituminous sand because of large quantities of well petroleum becoming available from Alberta fields. Moreover, exploratory drilling indicated that the Horse River Reserve, the area leased from the Dominion Government on which the plant is located, has insufficient reserves for large-scale operation. Also, if further development is undertaken it is likely to be in an area of adequate reserves some distance north of Fort McMurray. For these reasons the Company has been salvaging the plant and other facilities before serious deterioration sets in. Under the agreement of sale, the Dominion Government receives the proceeds from rentals of equipment and from sales.

Exploration of Deposits of Bituminous Sands.—Extensive war-time drilling by the Branch in the bituminous sand area north of Fort McMurray outlined a 4½-square mile area of bituminous sand estimated to contain close to a billion barrels of bitumen, the overburden being relatively thin. The bitumen content in each ton of sand is also more favourable for economic development than in the other area explored. The reserves are large enough to produce 20,000 barrels per day for more than 100 years. However, much research and test work is necessary to determine suitable extraction and refining methods. There is also the question as to when economic mining of the sands for their heavy low-grade oil content will become feasible.

In the meantime, the records of the drilling program were turned over to the Mineral Resources Division, which was preparing the results of the drilling for publication.

Fluorspar Agreements.—These wartime agreements with mining operators were for the production of fluorspar from the Madoc, Ontario, area. Repayment of the loan to H. C. Miller was completed during the year. The only loan now outstanding is that of Fluoroc Mines, Limited, successor to Trent Mining Syndicate, Limited, made in 1943 for an amount of less than $10,000. During

the fiscal year the Company shipped fluorspar from the Johnston property in Huntingdon township, Hastings county, and a small amount is payable to the Government from the proceeds.

Former Wartime Oils, Limited.—During the war, the Government advanced funds through Wartime Oils, Limited, for the drilling of 22 wells in the Turner Valley area, Alberta, 21 of which became producers. The owners repay the Government out of the proceeds of production, as required by the terms of the agreements. At the end of the fiscal year the balance of loans unpaid was $1,204,382.17. On April 1, 1948, the Department of Reconstruction and Supply turned over to the Branch the administration of collections.

MINERAL RESOURCES DIVISION

The Division provides information on all matters pertaining to mineral resources and their economic development and use. It also investigates problems of a technical and economic nature related to the development of Canada's mineral resources. One of its basic functions is the assembling, correlating, tabulating, recording, and indexing of new mineral data and related data. These data are received from many sources, and are added to the large mineral information pool accumulated over many years.

The tremendous drain on so many of the country's ore reserves during the war emphasized the importance of taking stock of available mineral resources. Such stock-taking required, first of all, the consolidation of all information available in Government reports and files. Much of the required information was in existence, but it was widely scattered through innumerable publications and reports. The primary move in establishing a mineral resources inventory was the setting up of a mineral occurrences index. This will be the base for assessing the mineral potential of the country, including ore reserves and possibilities of economic development.

During the year a large proportion of the significant mineral occurrences in Canada was indexed. All provincial mines departments were visited, and arrangements were made to exchange information on new mineral discoveries and the development of mines and properties currently being investigated. A number of engineers visited the Division to make use of information provided in the index of occurrences. In addition, a number of inquiries were dealt with by correspondence.

An extensive collection of maps from the Public Projects Branch, Department of Reconstruction and Supply, was transferred to the Bureau of Mines. These, with all the maps of the Mineral Resources Division, were placed under the Mineral Inventory Section. The collection includes all Dominion and Provincial topographical and geological maps, and provides an indispensable adjunct to the mineral index.

Practical use of this accumulation of mineral data is made in preparing special reports for distribution to the industry and in preparing articles for publication. It is used in making studies and investigations for the Government and in replying to numerous inquiries. These inquiries reflect a continued active interest in mining development, particularly in the fields of industrial minerals and metals. There were approximately 2,600 inquiries made by letter, 400 more than in the preceding year. Prospectors, mining and allied industrial operators, and others interested in Canada's mineral resources, called personally for information pertaining to mining development, mining taxes, and markets for minerals and mineral products.

The Chief of the Division acted as technical adviser to the Canadian representation on the Combined Tin Committee, which allocates the short world supply of tin. He attended seven meetings of the Committee at Washington, at which Canada's tin allocations were determined. Several officers served upon various inter-departmental committees, formed to consider and advise upon national and international problems in which minerals and mineral products were involved.

The Division is divided into an Industrial Minerals Section and an Economics Section, apart from the Mineral Resources Inventory and the Records. The Library of the Bureau of Mines is also attached to the Division.

Industrial Minerals Section

Industrial minerals, which include the non-metallic minerals, sands, clays, and rocks, are among the essential raw materials of modern industry. They came into prominence with the growth of the chemical industry, in which they find their widest application. Their importance in the industrial field is steadily increasing as the chemical and metallurgical industries become even more closely integrated with other basic industries such as agriculture and construction. Without cheap and abundant supplies of these minerals modern industry could not function normally. Investigations into the occurrence and technology of industrial minerals, coupled with laboratory research into their beneficiation and development, with the primary object of assisting industry in general, is the function of the Industrial Minerals Section. Officers of the Section are widely consulted in Canada and from abroad on matters pertaining to the occurrence and utilization of these minerals.

Information is gained on industrial minerals by detailed examination of occurrences, by studies of methods of production and utilization, by laboratory research, by correspondence, and by studies of current literature. This information is made available to industry by correspondence, interview, and formal report.

Because many industrial minerals have a wide variety of uses, some of which are constantly changing, the scope of activities of the Section is very broad. With the staff available, it is impossible to cover adequately all phases of the work in any one year. Thus, special attention is given to the more urgent problems. In 1947, emphasis was placed on the production of fertilizer minerals, and on minerals and products used in the construction and chemical industries.

Production of sufficient food to supply a rapidly increasing world population is a problem of the utmost importance. Agricultural authorities warn that with the continued exhaustion of food-producing soils, the continuing food shortage is the greatest single threat to society. The annual replacement of minerals removed by cropping, grazing, and erosion, is one of the chief means of increasing food production. In order to bring information on Canadian resources of fertilizer minerals up to date, field studies were made of the resources and production of agricultural limestone, brucite, magnesia, phosphate, nitrates, sulphur, and potash. All available information on the recent discoveries of potash in Western Canada was compiled and presented in a paper read before The Canadian Institute of Mining and Metallurgy at its annual meeting in Vancouver, April, 1948. Studies were also made of new developments in manufacturing fertilizers from raw materials available in Canada. Small scale laboratory experiments were conducted to determine the suitability of domestic raw materials for these new products.

Work on construction materials included:

1. A field survey of the supply of sand, gravel, crushed rock, rock wool, lime, gypsum, cement, and building stone in Eastern Canada.

2. A study of the production of roofing granules from Canadian slate and rhyolite.

3. Initial experiments in the production of light-weight aggregate from slags and shales.

4. Research on rock wool, with attention being concentrated on utilizing new raw materials such as diopside and syenite. Technical assistance was also given to a number of producing plants. In 1947 the production of rock wool in Canada was valued at approximately $5,000,000.

5. The continuation of work begun in 1946 on a study of magnesium oxychloride and magnesium oxysulphate cements made from Canadian raw materials. Small areas of magnesium oxychloride cement floor were laid in two industrial plants and the effects of heavy plant traffic were observed. Research on oxychloride formulae was carried on in the laboratory to obtain material for a report. A floor tile made of wood waste bonded with magnesium oxysulphate cement was developed in the Bureau's laboratories in co-operation with industry. This tile is being manufactured commercially.

6. Research on the beneficiation of impure gypsum from British Columbia was successfully undertaken.

The basic work of obtaining data on the industrial waters of Canada was continued. Thirty-one key stations for sampling the Ottawa River watershed were set up and monthly samples were obtained, as well as samples at low water and high water. Most of these samples were analysed and a compilation of the results is under way. A mobile laboratory was used for tests that had to be made as soon as the samples were collected. In March, 1948, twenty-five similar stations were set up in southern and western Ontario, and sampling was discontinued at the stations in the Ottawa watershed. Information is also being obtained on the industrial uses of water, on the amounts used, and on treatment methods employed by various industries.

Field work was undertaken on anhydrite, silica, clay, marl, marble, calcite, feldspar, mica, fluorspar, nepheline, syenite, brucite, magnesite, graphite, lithium minerals, talc, corundum, cobalt, and molybdenite. This work included visits to industrial plants engaged in producing and processing the various minerals. Special attention was paid to corundum, for which a good demand is materializing. It is hoped that if certain processing difficulties can be overcome, production will again be resumed from Canadian deposits. Extensive laboratory tests were made in co-operation with industry on bulk samples of corundum ore from the Bancroft-Craigmont area, Ontario, with satisfactory results. A valuable by-product in the form of a material suitable for glass-making is obtained from the ore by the method of treatment employed in the laboratory.

Laboratory work was undertaken on talc, lime, calcite, diopside, tremolite, diatomite, clay, marble, and limestone. Much of this work was research on the beneficiation of low-grade material so that it could meet industrial specifications when high-grade deposits become exhausted. The possibility of improving existing methods of processing and utilizing certain industrial minerals was studied and work was undertaken at the request of provincial government organizations on many samples submitted by them.

A large proportion of office time was taken up with correspondence and consultation with the representatives of industry and scientific organizations, in connection with the occurrence and technology of the minerals in which they

specialize. Services were also rendered in examining and advising on numerous samples of industrial minerals submitted for identification and estimating their economic worth.

The following technical papers were prepared for publication:

Prospectors' Guide for Uranium and Thorium Minerals in Canada.

Potash Discoveries in Western Canada.

Industrial Minerals in the National Economy.

Canadian Water Supplies for Industrial Use.

Annual reviews of developments in connection with 38 Canadian minerals and mineral products were prepared for inclusion in "The Canadian Mineral Industry in 1946".

Economic Section

This Section is concerned with all economic questions pertaining to the development, use, and conservation of Canada's mineral resources, particularly the metallic mineral resources. Its mineral investigation and information service is used freely by mining and related industries, by Government departments, and by others interested in the economic aspects of the Canadian mineral development.

Gold mining is the one depressed major division of Canada's mining industry. It failed, by reason of rising costs, labour shortages, and the fixed price of gold, to make any real progress in post-war rehabilitation. Because of the special significance of the gold-mining industry in promoting northern development, the Government was increasingly concerned with assisting the industry over the present emergency. The Economic Section devoted much time and attention to studying the situation. These studies included a field examination of many of the gold mines of Central Canada, and the preparation of data for the Government.

Bill 7 (The Emergency Gold Mining Assistance Act), to provide assistance in meeting increasing costs of producing gold, was recommended to Parliament in the latter part of the year. Following this, considerable attention was given to preparing basic material for drafting the regulations necessary to administer the assistance effectively.

Studies were made of possible markets for the coal in Yukon Territory in connection with a proposal to re-open with Government assistance, the coal mine at Tantalus Butte; of the possibility of producing metallic titanium from the ilmenite deposits of Quebec; of the economic possibilities of producing electric-furnace pig iron in Canada; of mining methods employed in Canadian gold mines and of the probable economic future of several Canadian mining camps.

Annual mineral reviews were prepared for 1946, summarizing noteworthy developments for each mineral. Other engineers of the Bureau assisted in this work. These reviews were made available for distribution in mimeographed form. Substantial progress was made in preparing similar reviews for 1947, and in preparing the manuscript for the fifth edition of the report, "The Mineral Industries of Canada". The latter is designed to present a concise and comprehensive statement of the resources, development, and utilization of each Canadian mineral of economic interest. Each successive annual review will bring up to date the data on any given mineral.

Much attention was given to mining taxation problems. This involved preparing comments and opinions on behalf of the Department on referrals to it from the Department of National Revenue on matters related to administering

special tax concessions to mine operators. The three-year income tax exemption granted to corporations operating new mines was the most notable of these referrals. Fifteen applications for such exemption were referred to the Section. In addition, submissions were prepared in co-operation with the Chief Geologist of the Department for the Minister's information in dealing with nine applications from oil companies for the 50 per cent tax deduction incentive, provided under Section 8 (10) Income War Tax Act, for drilling approved deep test oil wells. A revision of the Summary Review of Dominion Tax and Other Legislation Affecting Canadian Mining Enterprises was completed with the co-operation of the Department of National Revenue. It was made available in mimeographed form. The head of the Section served as Departmental representative on the Business Classification Committee, Excess Profits Tax Act.

Prospectors' identification cards were again issued with the assistance of the provincial Departments of Mines but the need of the prospector for the card ended during the summer with the ending of food rationing. This project, begun in 1943 to assist the prospector to continue active prospecting in the face of wartime food rationing and labour controls, was closed. Only 580 cards were issued, as compared with 1,117 in the preceding year.

Library

The number of acquisitions to the library was approximately 8,000, chiefly through purchase of new books and periodicals required for new fields of work being undertaken by technical members of the Bureau. Much of the work of the library had to be curtailed, however, because of the shortage of staff. This applied particularly to reference work, indexing, circulation of periodicals, and binding. An effort was made to keep the catalogueing of material up-to-date, with the result that about 200 more cards were added to the catalogue than in the previous year.

The following acquisitions were recorded:

Books and pamphlets ordered	323
Bureau of Mines reports added	53
Canadian Government documents	1,286
British, U.S., and Foreign Government documents	1,698
Scientific societies	1,140
Periodicals	3,372
Books and pamphlets by gift	175
Total	8,047
Periodicals and annuals subscribed for	243
Number of volumes bound	78
Recorded loans	5,198
Cards added to the catalogue	961

MINERAL DRESSING AND METALLURGY DIVISION

Mineral Dressing and Extractive Metallurgy Section

The efforts of mine operators, particularly operators of gold mines, to combat rising production costs by making every possible improvement in their millflow sheets, contributed largely to the 35 per cent increase over the previous year in the number of investigations handled by the Section. Eighteen of the 48 completed investigations were on gold ores. It was more imperative than ever before for this industry to watch production costs closely, and ore treatment is a major item in these costs. By using the results of the test work, the producing gold mines generally were able to report higher recoveries and lower processing costs. Other companies bringing new gold properties into production, or with properties nearing production, were afforded guidance in the design of their flow sheets through large scale tests on their ores.

Long-needed research on the treatment of refractory gold ores was undertaken. Such ores are occurring more frequently and their treatment poses a difficult problem. This type of work had been held largely in abeyance because of the pressure of more urgent work and the difficulty, until recently, of obtaining properly qualified scientists. Refractory gold ores from properties in the Northwest Territories and in the Red Lake area of Ontario received chief attention. These ores contain lead, arsenic, and antimony minerals that have a deleterious effect when standard milling methods are used. Research has identified several of these minerals and their effect on cyaniding and in roasting prior to cyaniding. Methods were devised to overcome some of the difficulties.

Nineteen of the investigations completed were of base metal ores, of which some were of prospects seeming to have mine-making possibilities; some were of properties with large ore bodies where the companies concerned are engaged in erecting milling plants so that full advantage may be taken of present metal prices and the ever-increasing demand for metals; and others were of properties that were closed when prices were below present levels. All this test work reflects a great upswing of activity in base metal areas throughout Canada. Much of it concerns complex ores, which, in some cases, require the development of new techniques for their treatment.

Some of the companies used the facilities of the Bureau to carry out their own research. One of these companies proved the technical feasibility of electric furnace smelting of lead concentrate to produce lead. These experiments showed that slags can be obtained from the electric furnace that have a lower lead content than is the rule in lead blast furnace practice. However, this test work was for a particular case. The electric furnace smelting of lead is not likely, in the near future,to replace standard blast furnace practice, except in scattered cases where the economic factors are favourable.

The production of titanium dioxide from Quebec ilmenite ores was the goal of another company conducting its test work in the Bureau. There has been a world shortage of titanium and its compounds for metallurgical and pigment use, but to date there has been little development of Canadian deposits. The largest potential Canadian source, now receiving active attention, is the recently discovered Allard Lake deposits on the Gulf of St. Lawrence in Quebec. One of these deposits, discovered in 1946, is of unusually large dimensions.

The shortage of scrap iron and the high prevailing price has turned attention to the economic feasibility of using sponge iron as a substitute for high purity scrap. A committee of the Ontario Research Commission, on which the Bureau is represented, has been studying the problem. Beneficiation tests were made by the Bureau on a carlot sample of lower grade ore from the Steep Rock iron deposits in western Ontario. Much further work will be required before definite conclusions can be reached.

Spodumene, base raw material of lithium and alloys, and of many lithium salts, was prominent in the work on industrial minerals, which accounted for 10 of the completed investigations. Spodumene and other lithium-bearing minerals occur in Manitoba and other sections of Canada, but the deposits have been developed to only a limited extent. New important uses for lithium and its compounds, developed during the war, are now in general use in industry. With the widening markets in mind, the Manitoba Government requested full investigation of a carload shipment of spodumene from the Cat Lake area. Though the project was not far advanced by the end of the year, it seemed apparent that no great difficulty would be experienced in obtaining a fairly high-grade concentrate with an economical recovery.

In most cases, test work on industrial minerals was for companies planning to bring new deposits into production or seeking information on the suitability of products for present or new uses.

Spectrographic Laboratory

The spectrographic laboratory continued to render special services for the Bureau of Mines Laboratories, the National Research Council, the Royal Canadian Mounted Police, and non-governmental organizations. These laboratories were called upon to carry out a large number of quantitative determinations, many of which involved development work.

Improvements were made in spectral excitation apparatus, and in techniques to increase the range of application and accuracy of the spectrographic methods. As an example, work was begun on replacing the photography of spectral lines with electronic photo-multiplier direct reading techniques. This method speeds up spectrographic analysis of materials, particularly in the field of impurity trace analysis. This latter analysis has grown in importance in proportion to the increased demand for high purity metals.

In this manner, the spectrographic equipment has provided analyses of a wide variety of samples, with speed, reliability, and economy. There were 1,593 samples analyzed, 678 quantitatively, and 915 qualitatively. This work represents 5,506 photographic spectral recordings from which 62,170 element percentage compositions were determined.

Ceramic Section

This Section is a centre for industrial and fundamental research for industries in Canada producing and using ceramic materials. There was an unprecedented demand for ceramic materials, particularly those used in the construction industries, such as brick, tile, sewerpipe, sanitary ware, and glass. There is an equally strong demand for refractory materials for metallurgical furnace linings, boiler linings, and cement kilns, and for ceramic whitewares such as floor and wall tile, electrical porcelains, and tableware. To cope with these demands, the ceramic industries must keep fully abreast of scientific achievements in operating their plants and in maintaining the quality of products at the highest possible standard. The main function of the Ceramic Section of the Bureau of Mines is to provide this scientific service.

The laboratory is equipped with the necessary mills, clay-working equipment, kilns, and physical testing equipment for preparing, firing, and examining ceramic industrial products. The equipment also provides for preparing and testing refractory materials of all kinds. Raw materials or manufactured products are submitted to the laboratory by the public or by industrial firms for testing and evaluation. Most of the ceramic industries in Canada operate on a small scale, and it is not practical for them to maintain the staff and equipment for the scientific investigation of their products. Thus, the Bureau of Mines provides a much needed centre of assistance for industrial groups.

A program of fundamental research on ceramic problems also seemed advisable, and a laboratory was established during the fiscal year for research on high temperature phase equilibrium systems as applied to ceramic problems. This approach, which in itself is a branch of physical chemistry, deals with the underlying reactions that take place when common earth oxides react together at high temperature. It gives insight into the complex reactions that occur in firing a ceramic body. During the year, work was carried on in a system involving four common oxides, namely, lime, magnesia, alumina, and silica. The purpose was to study the reactions involved in high lime magnesia clinker of the type produced in Canada, and, specifically, to determine the effect of alumina on such compositions. This information will assist manufacturers by indicating the range of favourable and unfavourable alumina contents, and by indicating the effect of natural spinels, such as aluminous chromites, on refractory clinkers. The type of chromite that can be used in chrome-magnesite

mixtures, and the amount of coal ash that can be tolerated in firing refractory clinkers in a rotary kiln, (and other matters of interest to refractory manufacturers) can be inferred from the results of this study. Some of the compositions may also be of interest to manufacturers of rock wool.

A similar method of attack is planned on other ceramic problems as the need arises. Fundamental research of this kind produces rigorously correct data from the scientific point of view and is valuable for application to specific problems.

Provincial Governments, clay plant operators, and individuals interested in clay deposits sent in 174 clay samples for commercial evaluation by physical and firing tests. Of these, 104 were from British Columbia, 14 from Alberta, 5 each from Saskatchewan and Manitoba, 10 from Ontario, 11 from Quebec, 8 from New Brunswick, 12 from Nova Scotia, and 5 from Prince Edward Island. The Department of Mines, British Columbia, submitted a large number of samples from the Fraser River, near St. George, indicating a revival of interest in the kaolin deposits of the district. These clays are a white-firing refractory type which should be of interest to western whiteware manufacturers. A short manual of instructions for sampling was issued and is available for distribution. This publication is Memorandum Series No. 95 "The Sampling and Examination of Clay and Shale Deposits".

Testing was done for manufacturers and Government organizations interested in purchasing refractories for large installations. For example, an Ontario manufacturer of locomotive boiler arch tile was advised as to the causes of slag attack on the tile; special refractory shapes were made and fired for use in an experimental salt furnace in Western Canada; and tests were made on a plastic refractory material and a bonding fireclay mortar for use in a boiler generating power at a large dry dock in Quebec.

Research and development work on brucite magnesia refractory brick, an unique Canadian product, for use in high temperature metallurgical furnaces, is described in the following reports issued by the Bureau:—

47–1 *The Effect of Grain-size Variation on the Properties of Refractory Brick Made from Brucite Magnesia.*

47–2 *The Effect of Lime-Silica Ratio on the Properties of Brucite Magnesia Brick.*

These reports of laboratory investigations point out the best combination of particle sizes and the most suitable composition for the bonding phase to give the maximum refractoriness. This information is of value to producers and users of brucite in extending and improving its industrial utilization.

Microscopic examinations and identifications of 75 samples of ceramic and other non-metallic minerals were made for industry, including such materials as serpentine waste rock, granite building stones, clays, nepheline syenite, silica, gypsum, mica, and refractories.

Much of the work of the Section was of direct and immediate aid to industry. As a result, for instance, of additions indicated by laboratory tests a brick manufacturer in Ontario was able to commercially produce buff-firing brick from a red-firing clay. Tests for improving the pottery body and glaze used by a small plant in Quebec led to the development of a product of increased commercial application. Extensive tests on the use of slag aggregate conducted for a company in Nova Scotia gave valuable assistance in the problems of utilizing a waste product.

An officer of the Section visited 34 ceramic plants in northwestern Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia, examined four clay deposits, and sent samples to Ottawa for laboratory tests. He gave technical assistance and advice to many operators.

Physical Metallurgy Research Laboratories

The research and development facilities of these Laboratories enable manufacturers of Canadian metal products to solve their technical and economic problems. Investigation and fundamental research was pursued in ferrous and non-ferrous alloy constitution, production, and fabrication methods. The urgency of this work required wider utilization of existing facilities, the design and construction of special equipment, and the installation and calibration of new apparatus. Hence the Laboratories possess an increasingly wide range of modern equipment functioning at a high level of efficiency.

Metal production is gradually losing its role as an art and is becoming more and more of a science. In this respect, encouraging progress was noted in the Bureau's continued extensive study of the casting and foundry techniques of ferrous and non-ferrous alloys. Whenever possible, standard procedures were established only after detailed research of melting, refining, and casting problems. This is especially evident in the work done in co-operation with the magnesium industry. The behaviour of new magnesium alloys was observed when specific additions of barium, beryllium, cadmium, calcium, cerium, copper, lithium, zinc, and zirconium were made to the parent metal magnesium. The result was the birth and development in the Bureau's Laboratories of a promising new magnesium casting alloy containing six per cent zinc and one per cent zirconium.

The full working capacity of the foundry section can be visualized from the fact that more than 100 requests for advice and assistance from the foundry industry in Canada were answered in 1947. In addition, wide distribution was made of prepared information memoranda which assessed methods of using various substitutes for normally used grades of pig iron and coke.

The chief concern of Canadian iron and steel foundries was to obtain sufficient pig iron, scrap, and metallurgical coke. Buying pressure forced prices up sharply, particularly in the scrap industry where there has been a shortage of supply since the war. Many foundries were assisted in re-organizing their melting operations to use scrap where pig iron was scarce, and to use grades of pig iron not normally used by iron foundries. There was an increase in the number of requests for technical aid in overcoming problems brought about by metallurgical coke and scrap iron of poor quality. In some cases, the trouble was traced to the presence of small quantities of such unusual impurities as aluminium and tin, which had entered the cast iron in poor quality scrap.

Among the problems presented to the Bureau by the steel casting industry were those of melting, gating, risering, and heat treating carbon and alloy steels. An extensive study to evaluate the performance of various exothermic compounds resulted in more efficient feeding and less riser or return metal, thus increasing the overall capacity of the foundry.

The cleaning phase in a steel foundry is one of the most expensive operations in the production process. With this in mind, a research program was conducted for the Steel Castings Institute of Canada, on the serious problem of metal penetration of steel core sands.

Most foundry sands used in Canada are imported, and the Bureau co-operated in developing sources of Canadian sands by examining several promising submitted samples to determine their suitability for foundry use.

Assistance was given Canadian foundries in improving their methods of sand conditioning. This study has helped to eliminate such casting defects as hot casting cracks, blows, scabs, buckles, and rat-tails, thus improving casting quality and promoting greater efficiency. In the case of rat-tails, corrective measures were worked out which have provided a method for overcoming this

defect. Close co-operation on this subject was maintained by membership in the American Foundrymen's Association Committee on the Physical Properties of Iron Foundry Moulding Materials at Elevated Temperatures.

An improved disposable (wax) pattern casting machine was designed, built, and put into operation. This machine was patented by the Bureau. Improved pattern pre-coating methods and materials were developed.

In the non-ferrous field, the casting of alloys and foundry techniques received special attention. As an example, to aid small foundries, the refining of aircraft scrap was studied. Another project was initiated to investigate the effect of the centrifugal casting technique on the properties of aluminium and magnesium alloys in particular. This work is being studied in co-operation with The American Foundrymen's Association.

Industry's wide interest in powder metallurgy resulted in several investigations on the sintering and compacting of metal powders. The powder metallurgy technique offers, in many cases, great economy in producing small machine parts.

In co-operation with the American Society for Testing Materials, a study was begun of the effects of temperatures, speeds, and pressures on the soundness and mechanical properties of pressure die castings.

The development of new and improved alloys for use at elevated temperatures received considerable research attention, specifically in the Canadian gas turbine industry. As a preliminary aid, an advisory committee was set up within the Bureau of Mines to survey and assess data on the properties of aluminium and magnesium alloys at elevated temperatures. This survey helped in planning research on the development of new alloys more suitable for temperatures commonly found in service.

In one of the major projects, a suitable magnesium alloy is being developed for components of the gas turbine jet engine, where only moderately elevated temperatures are experienced and a saving of weight is sought. In another, considerable success was achieved in developing new and superior alloys capable of withstanding extremely high temperatures which may lead to more efficient and more powerful gas turbine jet engines. An experimental alloy with promise of industrial practicability was produced. This long-term research project is carried on in conjunction with the National Research Council, acting through the Associate Committee on High Temperature Metals.

Incidentally, considerable data was collected for the Canadian aircraft industry, when existing and recently-developed light alloys were compared with respect to strength and hardness at temperature experienced in service. The critical high-temperature materials used in building the first successful all-Canadian gas turbine jet engine were tested in the Bureau's physical metallurgy laboratory before assembly in the engine.

Numerous "post mortem" metallurgical investigations were performed on metal failures. In an attempt to overcome some of the more common physical metallurgical property deficiencies, an extensive research project was started. For example, the behaviour of metals under repeated dynamic loads was studied to acquire more knowledge of the physical changes associated with fatigue, the factor which is responsible for most of the failures in moving parts. A better understanding of the progress of fatigue would lead to greater efficiency in industrial design and more economical utilization of existing materials. The magnetic properties of the alloy are measured and their relationship to the flow of the metal and changing internal structure are determined. Reports on the progress made were prepared.

The effect of shot peening, a widely used method of increasing the fatigue strength of components, on various selected steels of various surface finishes was investigated. The service life of mining drill rods was greatly improved by shot peening after heat treatment.

Many short term investigations were undertaken involving endurance tests on suspension springs, turbine blades, and aircraft cable, and the stress analysis of piano plates, compressed air reservoirs, and high temperature retorts.

This work has required the services of experienced and competent personnel possessing the ability to manipulate experimental apparatus to the best advantage. Much of the special equipment required is designed and constructed within the Bureau. Examples are: improvements in the design of the X-ray spectrometer to increase its usefulness in diffraction analysis of alloy constitution; calibration of fatigue testing machines; and experimental extrusion operations in the metal forming laboratory. The extrusion press was in successful operation for several months producing aluminium and magnesium shapes, and brass rods and tubes. Improvements in welding technique were made which have been of benefit to the Armed Services in fabricating higher strength aluminum.

Work in the Chemical Metallurgy Laboratory was devoted largely to research in methods of combating corrosion of the more commonly used metals, and to developing new methods of producing certain rare metals, particularly those whose minerals occur in Canada. Research was conducted on: methods of combating the corrosion of domestic hot water tanks and steel marine piling by determining the most suitable magnesium-zinc-aluminium alloys for the cathodic protection of steel; methods of evaluating the corrosive properties of antifreeze materials for motor cars; methods of protecting certain types of aluminum parts from corrosion under marine conditions; the most satisfactory material for inhibiting the corrosion of magnesium alloys; and methods of producing corrosion-resistant power cables for use along the sea-coast.

Much time was given to designing and installing equipment for producing certain rare metals. Preliminary experiments were under way to develop cheap processes for manufacturing the extremely light metal lithium and the corrosion-resistant metal titanium. A prominent part was taken in the following activities: the National Research Council's Associate Committee on Corrosion Research and Prevention, the purpose of which is to further research work in Canada in the field of corrosion prevention; the Corrosion Sub-Committee of the Atomic Energy Project of the National Research Council; the Royal Canadian Navy Committee on Corrosion and Fouling, which aims to improve the resistance of metal naval equipment to marine corrosion; and the Sub-Committee on Specifications for Fire-Fighting Equipment of the Canadian Government Purchasing Standards Committee, which will specify corrosion-resistant materials for such equipment.

Numerous representatives of other countries visited and exchanged correspondence with the Laboratories, thus fostering international good-will. An example of this is the report that good progress was made in the joint screw thread research program set up to establish an international standard thread form, the desirability of which was emphasized in the recent war in servicing Allied equipment. This is a joint project in collaboration with the National Physical Laboratory, England; the National Bureau of Standards of the United States of America; and the National Research Council of Canada. The steels selected were prepared, heat treated, and examined mechanically and metallurgically. Quantities of each material were sent to a manufacturer

in the United States for machining the agreed thread forms by standard commercial methods. The initial calibration and cross checking of the Bureau's fatigue testing machine was completed in preparation for the next phase of the work.

Members of the staff continued to serve as consultants on matters of a metallurgical nature arising at the Chalk River plant of the National Research Council. Co-operative research carried on under the Atomic Energy Control Board included investigations of special construction materials required to withstand severe service conditions.

FUELS DIVISION

Problems of fuel supply in relation to demand were well to the forefront during the fiscal year, placing added importance on the activities of the Division. Its survey of coal mining methods in Canada undertaken during the year; its combustion engineering and pressurized combustion investigations; and its attention to the problems of producing synthetic liquid fuels all were directed toward the long range goal of improving the overall fuel economy of the country by promoting, through research, the wider, and more efficient use of Canadian fuels.

Survey of Coal Mining Methods

Efficient mining methods are important in lowering costs, obtaining increased productivity, and conserving the country's coal resources. Methods of underground mining and strip mining should be investigated. The survey will cover both underground and strip mining methods, and particular attention will be given to increased mechanization on the sizing and quality of coals produced. Problems associated with the underground gasification of coal, which would have its greatest application in steeply-dipping, narrow coal seams that might otherwise be left unmined because of the difficulty and cost of removing the coal will be studied.

The Division studied the flame-proof testing of electric machines used in coal mines as a first step toward the eventual adoption of a country-wide flame-proof standard designed to minimize explosion hazards.

A mining engineer with considerable experience in coal mining operations in England is in charge of the survey.

Combustion Engineering Investigations

The coal industry has been endeavouring to introduce small mechanically-operated stokers for house heating. The satisfactory operation of such units requires a supply of suitable fuel of uniform quality.

The Division entered into a co-operative agreement with the Stoker Institute of Canada and Bituminous Coal Research, Incorporated to conduct field and laboratory work on Canadian and imported coals used in stokers. In February, 1948, 7 coals and 23 operating stoker installations were studied in the Toronto area and 5 Nova Scotia coals were included for evaluation purposes. This was a continuation of an investigation of 65 coals and 30 operating stoker installations in the Montreal, Toronto, Hamilton, and Windsor areas. Several progress reports on this work were made and arrangements were made for further laboratory evaluation work on many of these coals.

A further effort to improve the domestic fuels position was made by investigating the B.C.R.-2C Smokeless Heater, developed by Bituminous Coal Research, Incorporated. This new type of heater is designed to burn bituminous coals without objectionable smoke. The purpose was to encourage the use of bitu-

minous Canadian coals in those areas in which this type of coal was available by supplying impartial information concerning the operation of these heaters with various fuels. Several Canadian coals were tested by the Division in one of these heaters.

Pressurized Combustion

During the previous fiscal year the Division in co-operation with the Locomotive Development Committee of Bituminous Coal Research, Incorporated, began a study of the combustion of pulverized coal under pressure. The ultimate objective is to develop a coal-fired gas-turbine railway locomotive. Such a locomotive would require only one-third to one-quarter the amount of fuel required for an ordinary coal-fired locomotive; it would require no water; and it would develop more power in cold weather than in hot weather. Such a locomotive would be especially valuable to Canadian railway companies.

Other organizations co-operating in the work are Johns Hopkins University, Battelle Memorial Institute, Institute of Gas Technology, American Locomotive Company, and Northrop-Hendy Company. Each organization is developing some particular part of the locomotive or solving some specific problem. The Division of Fuels is studying the combustion of pulverized coal under a pressure of about five atmospheres. It is hoped that this work will shed light on the mechanism of combustion, and especially on the variation of combustion performance with different coals.

Preliminary tests show that the experimental furnace can be operated under predetermined conditions, but numerous technical difficulties must be overcome before uniform tests of long duration can be made in order to determine comparative measurements of efficiency. Laboratories in the United States associated with the project were visited, and analyses and grindability measurements were made as a service to the other laboratories co-operating in the project. Studies were made of theoretical aspects of combustion of pulverized fuel and these will be continued and increased in scope.

Synthetic Liquid Fuels

Although Canada must still import about 90 per cent of its crude oil, there are available large deposits of coal and other materials which can be converted to liquid products if the necessary manufacturing processes can be developed to the point of being economically profitable. The Division has already studied and experimented with the hydrogenation of Canadian coal and Alberta bitumen. It has also kept in close touch with similar work that has been done in other countries, particularly Germany, Great Britain, and the United States. It is the belief of the Division that much larger yields of valuable products can be obtained by hydrogenation at higher pressures than have been previously used on this Continent. High pressure equipment for laboratory scale experimental work at a pressure of 20,000 pounds per square inch was contracted for. The design work was well advanced at the end of the fiscal year. In the meantime, the Division experimented with some of the materials which would be used in the process, and determined a number of factors essential for the design work.

Visits were made to the coal hydrogenation demonstration plant and the oil shale mining and process plant of the United States Office of Synthetic Liquid Fuels.

Some years ago, the Fuels Division in collaboration with the Geological Survey began a study of the physical and chemical characteristics of Canadian coals. The objectives were to discover (*a*) the most suitable manner in which the seams should be developed; (*b*) the most satisfactory present use to which

the coal might be put; (*c*) the best manner of preparing it for the market; (*d*) the adaptability of Canadian coal to entirely new uses in the future as, for instance, for hydrogenation into synthetic liquid fuels.

To date, comparative fundamental data has been obtained concerning practically every coal mining area in Canada, and this has served to demonstrate most clearly the necessity of expanding the original plan so as to include more exhaustive tests and a more comprehensive number of samples. Characteristics of the different petrographic constituents of coal from the same seam were studied, so that greater flexibility might be effected in the products from one and the same seam. Small and fine coal from the mines, now largely of low quality and increasingly difficult to market are being studied as raw material for briquetting with or without prior, or subsequent, carbonization. All the coals are being examined as to the possibility of washing them to lower their ash and sulphur content. The chemical and physical survey has indicated the location of certain unmineable coal seams and some of these should be selected for experimentation in underground gasification.

The samples examined during the year included coking bituminous coals from the Sydney area, Nova Scotia; the Minto area, New Brunswick; the Bulkley Valley and Comox areas in British Columbia; non-coking sub-bituminous coal from the Drumheller area, Alberta; coal from the Highwood area, Alberta; and lignites from Saskatchewan. A number of detailed reports dealing with the physical and chemical survey were issued.

Washing of Coal Fines

A Driessen cyclone unit, a unique fine coal washer developed by the Dutch State Mines, was set up in the Fuel Research Laboratories and investigations were carried out with different types of media, wetting agents, and flotation reagents. The use of this equipment as a means of preparing ultra-clean coal for electrode carbon was investigated. A report was issued concerning the beneficiation of slack coal from the Inverness Coal Field, Nova Scotia, with the object of preparing a suitable stoker coal.

Natural Gas and Petroleum

Ever on guard to detect the presence of helium in commercial quantities the Division each year collects samples from various fields for analysis, with particular attention to fields in Alberta where large quantities of natural gas have been discovered in recent years. The Division collected about 30 samples from the natural gas fields, mainly of Alberta, and analysed most of them to show hydrocarbons, helium, and other gases.

Precise analyses of petroleum oils produced in Canada, particularly for certain of the lower grade oils, are important for determining the special treatment required to obtain marketable products. To obtain distillation results comparable to those experienced in a refinery, and to expedite investigational work on the products, the Division set up a true-boiling-point still of five gallon capacity and made several runs from a large sample of oil from the Lloydminster Field.

Changes in automotive design necessitate that accurate technical data be available regarding the knock-rating, volatility, vapour pressure, sulphur, and gum content of all brands of gasoline sold throughout Canada. This data is also valuable in drawing up and revising gasoline specifications for Government purposes, and as a guide to petroleum refining and hydrogenation investigations. More than 60 samples representing 21 brands of gasoline from the principal Canadian cities were analysed. A report prepared for limited distribution compares the data obtained with results of previous years.

Peat and Peat Moss

The need of organic matter for soil improvement creates a problem that is becoming increasingly acute. A deficiency in soil humus, which already exists in certain sections, cannot be allowed to continue if agriculture is to prosper.

The Division, in cooperation with the Federal Department of Agriculture, undertook an investigation designed to demonstrate the value of humified peat for soil improvement purposes and to encourage the use of such peat by farmers and horticulturists. A joint bulletin was prepared entitled, "The Agricultural Uses of Peat Materials".

The Division also continued its survey of Canada's resources of peat moss with special attention to deposits and operating plants in Nova Scotia and Quebec.

General

The Division's work is closely linked with that of the Dominion Coal Board. For the information of the Board a report was prepared by the Chief of the Division on the research facilities of the Division and its activities in relation to the functions of the Board. Copies of this report were also distributed to the larger coal mining companies by the Canadian Coal Operators Association.

The "Analysis Directory of Canadian Coals," previously issued for limited distribution, was revised, and will be published in mimeographed form. The analysis data include the more important physical properties and the chemical analyses of different sizes of coals as prepared for the market at Canadian collieries.

Senior technical officers were prominent in the activities of the Coal Division of the Canadian Institute of Mining and Metallurgy, and of the Coal Committee of the Research Foundation of Nova Scotia. The Division was also represented actively at Committee meetings of the National Research Council (Petroleum Committee, and Canadian Government Purchasing Standards Committee); Committee D-5 on Coal and Coke of the American Society for Testing Materials; and, the Royal Commission on Coal. Field and laboratory work was conducted on smoke abatement, utilization of sawdust and wood waste for fuel, and consulting service was rendered to public institutions, industrial firms, and private individuals seeking advice on fuel heating and allied problems. Six addresses on various subjects were delivered at meetings of trade associations in Niagara Falls, Toronto, Hull, Ottawa, and Montreal. A number of reports on the above subjects were prepared for distribution.

EXPLOSIVES DIVISION

Only two minor amendments were necessary to regulations made under the Explosives Act, 1946.

Registered premises for the sale of explosives (which replace what was formerly known as Unlicensed Premises) are popular with retail dealers whose sales of explosives are small and intermittent. By means of the certificate, which the Division issues, a close contact is maintained with all vendors. The inspection of their premises ensures compliance with the Regulations, and, through these vendors, appropriate warnings can be circulated to casual users of explosives.

There was a noticeable increase in the frequency of accidents to children. The Division issued a warning to farmers, whose children were the chief sufferers, from improper or careless storage of blasting caps. A pamphlet prepared particularly for British Columbia received wide circulation among farmers through the agency of the Farmer's Institute.

Assistance was given to War Assets Corporation in the destruction of obsolete and surplus explosives, and in the inspection of buildings formerly owned by the Corporation and later sold for factory or other use.

There was a great demand for toy pistol caps. Four new factories were built and brought into production and a former factory was re-opened. Plans and sites for these were checked by the Division and the plants were inspected when they went into operation. The operator of one of these new factories was convicted of illegal manufacture of toy pistol caps. The factory went bankrupt and operations were discontinued.

As a result of two fatal accidents in 1946, a ban was placed on the retail sale of sky rockets by removing them from the list of fireworks classed as "shop goods." The benefits arising from this prohibition were reported from some centres. The fire department of one large city reported the lowest number of fire alarms on record during a 24th of May celebration.

The manufacture of commercial explosives increased greatly, and the number of licences for magazines also increased. More than 1,000 licensed magazines and registered premises were in operation.

The public response to educational work undertaken by the Division through the use of pamphlets, memoranda, motion pictures, and correspondence was gratifying.

Explosives Testing and Research Laboratories

The testing and analyses of explosives, required in the administration of the Explosives Act, are carried out in the Explosives Testing and Research Laboratories, Montreal Road. These Laboratories are staffed and maintained jointly by the Department of Mines and Resources and the National Research Council under an agreement of June 30, 1942.

During the fiscal year, 415 samples were submitted for chemical and physical examination, by or on behalf of manufacturers or representative agencies, the National Research Council, the Post Office Department, the Royal Canadian Mounted Police, and the Inspection Service of the Explosives Division. The samples are classified as follows:

Commercial dynamites	25 samples
Pyrotechnics (including fireworks, toy caps, warning smokes and flares, railway fusees and track torpedoes)	347 samples
R.C.M.P. (exhibits for examination as crime detection evidence)	24 samples
General	19 samples

The investigation of hazards in the storage and shipment of nitraprills (ammonium nitrate fertilizer) continued to receive major attention. Work on this material is being carried out for an Advisory Conference on Ammonium Nitrate Fertilizer, set up in 1946, and composed of representatives of the manufacturers, transport and harbour authorities, and the National Research Council. A technical sub-committee was formed September, 1947. The Explosives Testing and Research Laboratories have been concerned with obtaining data by laboratory and field trials, using such methods as were thought to offer some possibility of throwing light on the character and performance of this substance. An interim report was issued in 1947, and a second report in February, 1948. The latter contains numerous tabulations and results significant to the transport problem.

Following the shipping accidents at Texas City, Texas, and at Brest, France, similar, but much larger investigation groups were organized in the United States and Great Britain. There has been some exchange of data with these groups.

In the United States, the chief work was undertaken by the Inter-Agency Committee, comprising representatives of several Government and ordnance departments. In several of the agency's large scale tests, samples of ammonium nitrate fertilizers confined in large ordnance shells and exposed to external heating, exploded violently. However, in a large scale burning test at the A. P. Hill Proving Grounds in Virginia, at which an officer of the Division was an observer, there was no indication of detonation or explosion.

Recent work in the Explosives Testing and Research Laboratories has been directed toward exploring the effect on nitrate detonation of gases, known to occur with thermal decomposition of ammonium nitrate:

1. By firing ammonium nitrate fertilizers in a medium of these gases only;
2. By heating ammonium nitrate fertilizers in a medium of the same gases.

It may be noted that, through the years, most of the workers on nitraprills material were employed by the manufacturers of explosives and were therefore interested in its "positive" tendencies. In the last report, an attempt was made, by tabulating the results of previous work and by analyzing the factors influencing detonation, to emphasize any "negative" tendencies appearing in detonation trials with this material.

Studies to date apparently suggest that, with regard to shipping methods and accompanying hazards, only extremely large masses can provide sufficient self-confinement to assure propagation of detonation, whether initiated accidentally or by thermal decomposition accompanied by a gas explosion.

Following a disastrous collision in Western Canada in 1946, the Canadian National Railways requested the National Research Council to develop an improved signalling device and the project was turned over to the Laboratories. Consultations with manufacturers and technical experts resulted in many trials involving changes in formulae of torpedoes and track fusees, and development of mechanical devices. An improved torpedo made by a Canadian manufacturer resulted from these trials. The results obtained were communicated to the United States Bureau of Explosives, New York, which is doing further work along these lines.

At the request of Canadian Industries, Limited for a suitable container in which to transport detonators by railway express, a safe box was designed but was considered too elaborate for manufacture in remote areas. A second box, made from material readily available anywhere, received the approval of the Board of Transport Commissioners, February 18, 1948.

Members of the laboratory staff attended meetings and conferences in Canada and the United States dealing with problems and developments related to explosives.

Factories

Eighteen factories and storage depots were licensed under the Explosives Act, which is an increase of one over the previous fiscal year. Some of the plants and storage depots for military explosives were closed.

Magazines and Registered Premises

Three hundred and seventy-seven permanent and 563 temporary magazine licences were in force at the end of the fiscal year, an increase of 46 over the previous year. Registered Premises licences increased from 27 to 49.

Inspections

	Factories	Magazines	Registered Premises	Unlicensed Premises
Explosives Division Inspectors.....	30	584	32	710
Royal Canadian Mounted Police.....	..	333	7	6,982

Importation Permits

During the year, 600 permits and 20 special permits were issued, covering such items as fireworks, nitrocotton for use in the manufacture of lacquers, propellent powders used in the manufacture of ammunition, and nitroglycerine for blowing oil wells.

Accidents

There were two fatal accidents in factories, both of which occurred in the manufacture of fireworks and toy pistol caps. On May 13, a two-year-old child was fatally burned in a flash fire in the basement of a house where toy caps were being manufactured illegally. A thorough investigation was made by deputy inspectors of the Royal Canadian Mounted Police. Prosecution was not considered advisable on compassionate grounds.

On July 30, the wife of the proprietor of a small licensed fireworks factory was fatally injured in an explosion. Following an investigation, changes in procedure to prevent a recurrence of such an accident were recommended.

Efforts were made to find and correct the causes of several unusual incidents and minor explosions involving slight injuries to personnel of explosives factories.

Reports were received of 133 accidents in the use and handling of explosives, resulting in 30 deaths and 150 injuries. Most of these occurred in mining, logging, construction, and farming industries, but almost one-third were the result of children playing with detonators, fireworks, and other explosives.

Circulars, illustrating and describing blasting caps, and warning of the dangers in handling and playing with them, were distributed through farm organizations and the Youth and Police Program of the Royal Canadian Mounted Police. Prints of a film "Blasting Caps" were shown throughout the country. It is proposed to intensify this campaign in an effort to reduce the number of accidents to children.

The Division is indebted to provincial Departments of Mines, the Workmen's Compensation Board, the Department of Labour, Ottawa, and several interested individuals, for reports and newspaper clippings on explosives accidents.

	Accidents	Killed	Injured
Mines and quarries	56	16	62
Elsewhere in industry	42	13	43
Playing with detonators	14	..	19
Playing with other explosives	17	1	22
Miscellaneous	4	..	4
Total	133	30	150

Prosecutions

Seven cases were prosecuted under the Explosives Act. One firm was fined $20 and costs for illegal manufacture of toy caps, and five construction companies and two individuals were fined up to $50 and costs for illegal or improper storage of explosives.

Under the Criminal Code of Canada, 22 persons were charged with theft or illegal use of explosives. Fines up to $500, and sentences up to five years were imposed.

Three men were fined under the Ontario Mining Act for carelessness in the use of explosives.

Destruction

The Division is responsible for the destruction or disposal of commercial explosives abandoned, found improperly stored, or condemned in approved storage by reason of deterioration. Commercial explosives destroyed totalled

75,782 pounds of dynamite, 16,104 detonators, 5,750 feet of safety fuse, 225 pounds of black blasting powder, and 50 boxes of rejected fireworks. A quantity of toy pistol caps and raw materials used in the manufacture of such caps was also destroyed.

PUBLICATIONS

Following is a list of publications of the Bureau of Mines issued during the fiscal year:

English Publications

816 *Physical Properties of Canadian Building Brick*, by J. G. Phillips. (Combined English-French.)

819 *Industrial Waters of Canada.*

820 *The Canadian Mineral Industry in 1945.*

Prospectors' Guide for Uranium and Thorium Minerals in Canada.

List No. 1-2. *Milling Plants in Canada, Part I. Metallic Ores.*

List No. 4-1. *Coal Mines in Canada, 1947.*

Memorandum Series No. 92. *The Beneficiation of Drumheller Subbituminous Coals by Briquetting using various kinds of Binders*, by E. Swartzman.

Memorandum Series No. 94. *Gasoline Surveys for Five Winters 1941-1942 through 1945-1946*, by P. V. Rosewarne, M. McD. Chantler and P. B. Seely.

Memorandum Series No. 95. *The Sampling and Examination of Clay and Shale Deposits*, by A. T. Prince.

Memorandum Series No. 97. *Physical and Chemical Survey of Coals from Canadian Collieries Drumheller Coalfield Alberta*, by E. Swartzman and J. H. Nicolls.

Memorandum Series No. 98. *Gasoline Survey for Summer, 1947*, by H. McD Chantler, P. B. Seely and F. E. Goodspeed.

Consolidation of Explosives Act and Regulations, 1946.

Separates of *Explosives Act and Regulations, 1946.*

French Translations

821 *Peat Moss Deposits in Canada*, by H. A. Leverin.

823 *The Physical Properties of Canadian Structural Tile*, by J. G. Phillips and G. A. Kirkendale.

Consolidation of Explosives Act and Regulations, 1946.

Separates of *Explosives Act and Regulations, 1946.*

DOMINION FOREST SERVICE

The year was marked by a number of changes and events of significance to the Service. D. Roy Cameron, after 37 years of service, the last 11 years of which he served as Dominion Forester, retired November 1, to accept an appointment as Chief of the Forestry and Forest Products Division of the United Nations Food and Agriculture Organization, with headquarters at Geneva, Switzerland. His duties were taken over by D. A. Macdonald, who was elected a member of the Standing Advisory Committee of the Forestry and Forest Products Division of UNFAO.

The Vancouver Forest Products Laboratory was re-organized and the staff and laboratory enlarged. This organization began functioning on a regional basis to serve the West Coast wood-using industries. Under a new arrangement effected during the year, the Vancouver and Ottawa Laboratories and the Pulp and Paper Research Institute of Canada, located in Montreal, now function as separate organizations and report directly to the Dominion Forester. To co-ordinate the work of these three establishments, a Forest Products Research Committee was set up, comprising representatives of each Laboratory, with the Dominion Forester as chairman. This body meets quarterly, and held its initial meeting in February, 1948.

An event of interest to the Forest Service was the fifth British Empire Forestry Conference, convened in the United Kingdom during June and July, 1947. Material was assembled and published by the Dominion Forest Service, dealing with forestry activities and developments in Canada since the previous conference, held in South Africa in 1935. Included in the Forest Service submission was a comprehensive report entitled "Canada's Forests and the War". The Forest Service also arranged with the provinces for the preparation, collection, and distribution of provincial submissions, and for the selection and attendance at the Conference of provincial forest service and forest industry representatives. The Canadian delegates were headed by the Dominion Forester. Valuable discussions of papers and problems affecting forestry were carried on and resolutions were adopted to provide closer collaboration in the development, and utilization of forests, and the distribution of forest products through the Commonwealth of Nations. The published results and findings of the Conference are expected to be available August, 1948.

There was continued co-operation with the forest industries on problems involving development of forest management. An outstanding example of this is the interest taken by pulp and paper companies in the regeneration survey which has been in progress for the past two years. A number of companies are preparing to undertake similar surveys in their own limits. Their surveys will be based on methods employed by the Dominion Forest Service, which organization has been requested to supervise the work of their field parties. The data so obtained will be available to the Service for compilation and analysis. Such an arrangement results in a financial saving to the Department, and augments the picture of growth conditions throughout Canada. Above all, it indicates the value of the work which the Dominion Forest Service is performing for industry.

The Woodlands Section of the Pulp and Paper Association held its anuual summer meeting at the Petawawa Forest Experiment Station July 16-18. Field trips were organized to permit more than 400 representatives of industry, universities, and provincial forest services to observe the results of forest research and investigations conducted at this Station over the past 30 years. Demonstrations of logging and fire-protection equipment were given by manufacturers, including a display of helicopter performance.

The demand from provincial forest services, and from industry, for extension of research in fire protection, forest aerial photography, and silviculture is greater than can be handled because of difficulty in obtaining qualified technical personnel.

Close co-operation is maintained with the Federal Department of Agriculture, which has established forest entomological and pathological laboratories and staff on the Service's forest experiment stations.

On January 1, 1948, the Forest Insect Control Board was transferred from the Department of Reconstruction and Supply to this Department. This Board, set up by Order in Council in September, 1945, is comprised of forestry representatives of the Dominion, the provinces, and the forest industries. It has done excellent work in procuring funds and in providing plans and advice for forest entomological activities. Although primarily established to combat the spruce budworm epidemic, it has expanded into the broad field of forest insects. This Board also has done excellent work in increasing the interest and support of the provinces.

FOREST ECONOMICS DIVISION

The demand for forest products during 1947 continued to exceed supply. Production reached a new peak, with a record lumber output estimated at 5,346,000,000 ft. b.m., and a record newsprint production of approximately 4,447,000 tons. Production in 1948 is expected to maintain, if not exceed, these levels.

In order to ensure adequate supplies for domestic housing and industrial requirements, export controls were continued on such items as lumber, poles, railway ties, veneers and plywoods, pulpwood, doors, flooring, and millwork. The control of prices was discontinued in September. Prices increased, but quickly stabilized at levels consistent with increased production costs.

The following table gives the average rate of utilization and destruction of merchantable timber during the ten-year period 1936-45. In compiling these statistics, converting factors are used which give cubic volumes of merchantable wood only, excluding stumps and tops.

ANNUAL FOREST DEPLETION
1936-45

Products Utilized	Thousands of Cubic Feet of Usable Wood	Percentage of Depletion
Logs and Bolts	930,338	28·2
Pulpwood	705,095	21·4
Fuelwood	717,104	21·7
Other Products	90,688	2·8
Wastage		
By forest fires	353,547	10·7
By insects and disease	500,000	15·2
Total Depletion	3,296,771	100·0

Replacement of this depletion requires an average annual growth rate of almost 12 cubic feet of merchantable wood per acre over the 278 million acres of accessible productive forests of Canada. This rate does not seem excessive, but it must be noted that the abnormal demand for forest products during the past eight years resulted in severe overcutting in the more accessible forested areas.

An indication of the relative value of the principal forest industries in 1945 is given by the following table:—

FOREST INDUSTRIES

Summary of Principal Statistics, 1945

	Employees No.	Salaries and Wages $	Net Value of Products $	Gross Value of Products $
Woods operations	121,860 (1)	209,000,000	267,000,000	334,324,901
Lumber industry	44,040	54,017,500	103,153,766	231,108,030
Pulp and paper industry	39,996	80,462,644	180,401,885	398,804,515
Wood-using industries	50,949	68,276,967	109,396,119	229,737,695
Paper-using industries (2)	20,823	29,164,530	60,719,265	138,055,346
Total	277,668	440,921,641	720,671,035	1,332,030,487

(1) Man-year basis (300 working days). (2) Excluding printing trades.

The gross value of products contains a duplication of values, because the products of one branch of industry may be used as the raw material for another. The net value is an indication of the contribution made by the forest industries to the national output of wealth, and represents six per cent of the gross national production, which for 1945 was estimated at $11,614,000,000. The net value of products of the forest industries in 1945 was 7·7 per cent greater than in 1944 and 114·0 per cent greater than in 1939.

The Division published the third edition of the Statistical Record of the Forests and Forest Industries, 1947. In co-operation with the Dominion Bureau of Statistics and the Export Trade Branch of the Department of Trade and Commerce, it prepared quarterly and annual reports on Canada's forest resources as required by international organizations.

The forestry section of an annual progress report dealing with agriculture, fisheries, forestry, and nutrition in Canada was prepared for submission to the Food and Agriculture Organization of the United Nations. Quarterly reports on the production and exports of forest products were also compiled for the Economic Commission for Europe.

FOREST AIR SURVEY DIVISION

The Division is concerned with detailed study of forest stands as they appear in air photographs. Research is conducted in special methods of forest survey based on the use of air photographs. These photographs are also used in the forest mapping of federally administered lands, and of provincial territory in cases where the forests are investigated in co-operation with the provinces.

Emphasis is placed on further advances in the use of the forestry tri-camera method of photography. This method has been developed to establish a type of air photography which will meet the special needs of the forester for maximum forest detail at minimum cost.

Forestry tri-camera photography was carried out over 1,000 square miles. The areas covered were the Green River Management area, where control of the spruce budworm and other projects were being initiated; the Aubinadong area where tests will be made of the application of the photographic survey technique to the detailed quantitative estimating of pine saw-timber; and on five Indian reserves and two forest experiment stations. Photographs were supplied to the Dominion Forest Service for areas of special forestry interest of 33,000 square miles.

In view of the increased demand for detailed quantitative estimating, the training of new men was an important factor in the work. Only two members remain of the pre-war Forest Air Survey staff.

The preparation of photolithographed map sheets was continued, and general forest inventory maps were prepared for an area of 4,100 square miles. In the Duck Mountain area, Manitoba, 356 square miles were covered in the form of provisional forest maps, with a view to elaboration by field work and subsequent use as the basis for photolithographed forest map sheets.

In the case of federally administered lands and special projects on provincial lands, more detail is usually required than in the case of general forest inventory. Detailed forest maps were prepared for 1,097 square miles. The areas covered were in Riding Mountain National Park, Moberley Lake Indian Reserve, lands near the shore of Great Slave Lake, Northwest Territories, and the Upper Mitchinamekus Test Project. In the latter area, detailed estimates of pulpwood were made by air methods for comparison with a forest survey carried out on the ground. Forestry tri-camera photographs were used effectively in many of these special maps.

Plans were made to forest map about 9,000 square miles on the eastern slopes of the Rocky Mountains.

Various advances were made in developing instruments and equipment. The monoscope was adapted for use in transferring detail from the low angle or steep oblique photographs which are the main feature of the forestry tri-camera method. A "Height-Crown Scale" was prepared by sub-dividing the spacings of the tree-height grid into 10 graduations to permit more accurate measurement of tree images in oblique photographs. Special markings were placed on this scale to facilitate the measurement of crown widths. A "Pole Scale", developed to measure tree images or tree shadows in air photographs, consists of a series of vertical lines of graduated heights on a transparent base. The scale is moved along the image to be measured until one of the lines coincides with it. The scale makes possible direct comparison of a vertical dimension with a vertical line. Additional equipment incorporated on the photoelectric planimeter makes possible a substantial saving of time in planimetering forest areas. The instrument is used chiefly to measure individual map sub-divisions rather than to determine aggregate acreages for a whole map sheet. The "Nash Scale" was devised and constructed to measure crown widths in the field, as required for air photographic estimates. It is based on the use of an adjustable graduated bar which the operator views in proper alignment with the tree's crown.

Field trips in Quebec, Ontario, and Manitoba provided basic data required in the air photographic technique of estimating quantities of pulpwood and saw-timber.

Provincial forest services and the forest industry are interested in the recently developed air survey technique and some of their foresters visited Ottawa to obtain information on Dominion Forest Service developments.

An article entitled, "An Instrument to Measure Forest Crown Cover" was published. It describes the instrument known as "The Moosehorn", and explains its use in measuring the per cent of crown cover, an essential factor in the adopted system of forest classification. A leaflet was issued dealing with the above-described "Pole Scale", and an article was published on "Some Volume Tables for Use in Air Survey".

SILVICULTURAL RESEARCH DIVISION

The Division is concerned with the aspects of forest research which will assist in the management of Canadian forests on a sustained yield basis, and with developing methods of silviculture suitable for the various forest types in each forest section. The fields of activity covered are:— forest botany, forest ecology, silviculture, forest mensuration, and forest management. Certain problems are studied on a nation-wide basis and directed from headquarters; others are of regional interest and are supervised from the District Forest Offices.

The work of the Division was limited by the lack of qualified technical personnel, particularly in the field of ecology. In all cases re-measurements and routine compilations of existing projects were maintained, but it was not possible to have all of the data analysed and reported on.

A complete revision of the publication "Native Trees of Canada" was undertaken. The new edition will shortly be available for distribution.

Regeneration surveys to determine the condition of cut-over and burned-over lands across Canada were continued. Four field parties were at work in the Maritimes, Quebec, Ontario, and the Prairie Provinces. The surveys were begun in 1946 at the request of the pulp and paper industry which, with the provinces, is co-operating on this large project. Field work will be completed in 1948. Preliminary results indicate that regeneration of conifers is usually satisfactory under most conditions in Eastern Canada, excepting areas burned after logging. Proceeding westward, there appears to be a gradual decrease in coniferous reproduction until, in the Prairie Provinces, reproduction is unsatisfactory. In Alberta, the rate of regeneration on cut-over lands is not usually adequate to ensure a new stand comparable in quality to that cut. The variation in regeneration from east to west is apparently the result of differences in climate and topography rather than in logging methods. Preliminary reports on most of the areas sampled by the survey will not be available for general distribution until all the field work is completed.

Detailed investigation of the effect of site and cutting method upon regeneration was either expanded or initiated on permanent experimental areas to supplement the fact-finding surveys mentioned above. In Manitoba, a study was made to compare the effect on regeneration of two harvest cutting methods in mixed spruce stands cut 10 years ago. The shelterwood system was moderately successful, but the seedtree method was unsatisfactory. A report was prepared for publication. In Alberta and Manitoba, preliminary results of detailed investigations to study the effect upon regeneration of scarifying the forest floor indicate that in some cases the matted debris and humus has an inhibitory effect upon the establishment of reproduction. Sample plots established in black spruce swamps cut-over 10 years ago by various cutting methods were re-measured at the Petawawa Forest Experiment Station. Adequate regeneration was found in most cases but competition from shrubs and inferior tree species, which will influence the future development of the stand, varied considerably with site and cutting method.

Work was undertaken to improve techniques for recording and studying the development of regeneration.

A publication entitled "Tree Breeding in Canada", summarized the work and results of plantation forestry.

At all experiment stations, long-term projects concerned with intermediate and harvest cutting methods were re-measured. Preliminary reports were prepared on the growth of lodgepole pine in Alberta and red and white pine in Ontario, under varying conditions of density, site, and age.

Several observation areas, established in cut-over lands on the limits of pulp and paper companies or in conjunction with the provinces, were re-measured. Research notes are being prepared to indicate the effect of the cutting method on the growth and development of the new stand. A new observation area was established in Quebec to study conditions on an area cut over two years ago by mechanical and conventional logging methods.

The stand-density method of preparing yield tables to predict the future yield and composition of forest areas was further developed and a research note was issued illustrating the use of the method for mixedwood stands. A number of pulp and paper companies are co-operating on this project by establishing permanent sample plots on their limits. Several United States forest experiment stations are also investigating the method.

"Form-Class Volume Tables", first issued in 1930, was completely revised. These tables are used as standards by provincial governments and private companies when making volumetric estimates. As a supplement to the volume tables, methods of evaluating form-class without cutting down trees were studied. The results of the investigation will be issued concurrently with the volume tables.

Two statistical studies of sampling methods by line-plots were made, and published as Research Notes.

The program of establishing a grid of permanent line-plots on each of the Experiment Stations was continued. The plots provide data on growth, yield, and depletion. In 1947, 18-inch aluminum pickets were successfully used as permanent corner posts for the plots.

The most important project in forest management is the Green River Forest Management project in New Brunswick. The Dominion Forest Service co-operates with the province, the Canadian Pulp and Paper Association, the Dominion Department of Agriculture, and a pulp and paper company in managing a 400-square-mile tract of forest on a sustained yield basis, with the silvicultural treatment designed to reduce losses from the spruce budworm. In 1947 an additional 5,000-acre research block, on which detailed studies of growth and forest conditions were made, was laid out and a report prepared. Other areas were marked for selective cutting. Reports on marking costs and on losses from windfall were prepared for publication.

The ten-year management plans for each of the Forest Experiment Stations are in the process of revision or preparation. Experimental cutting under timber sale or permit was made on all stations.

In the Maritimes, co-operation with the Dominion Department of Agriculture was continued on demonstration woodlots. Trees were marked for removal on each of the woodlots to make up an amount equivalent to the annual cut for each woodlot, according to prescriptions of the working plans prepared several years ago.

PUBLICATIONS ISSUED

Research Notes

82 *Empirical Stand Density Yield (Part 2)*—G. A. Mulloy.
83 *One-Fifth Acre vs. One-Tenth Acre Plots in Sampling Immature Stands*—A. Bickerstaff.
84 *Sampling Efficiency of Line Plot Survey*—A. Bickerstaff.

Bulletins Prepared for British Empire Forestry Conference:

Forest Ecology in Canada—G. A. Mulloy.
Forest Tree Breeding in Canada—J. L. Farrar.

FOREST PROTECTION DIVISION

There were almost 900,000 square miles of forest under organized forest-fire protection in Canada during the 1947 fire season. This is approximately 70 per cent of the forested area of the country.

The combined expenditure of all Canadian forest agencies for forest-fire protection in the 1946 season is estimated at more than $7,000,000. This estimate includes such items as salaries and wages of permanent employees, purchase and maintenance of equipment and improvements, and fire-prevention expenditures.

Fire Losses

Except in the Maritime Provinces, the fire season of 1947 was unusually favourable. There were 5,017 fires reported excluding Yukon and Northwest Territories. The area burned, 613,007 acres, was the smallest in 20 years. Merchantable timber losses were substantially below normal, and the estimated damage was only 55 per cent of the average for the period 1937-46. (See Table I.)

Forest-fire losses in New Brunswick during 1947 were higher than average, and in Nova Scotia the damage was much greater than that of the exceptionally severe season of 1944. The almost unprecedented drought of the late summer and autumn was responsible for most of the fires in the Maritimes. In the other provinces, and in Dominion Lands within provincial boundaries, both the area burned and the resulting damage were considerably less than the previous ten-year average. (See Tables III and IV.)

In Yukon and Northwest Territories a much more favourable fire season was experienced in 1947 than in 1946, except for the large amount of young growth destroyed. Forest-fire statistics were not recorded in these Territories prior to 1946.

Causes of Fires

The number of forest fires in Canada and the percentages attributed to various causes are shown in Table II. Campers and smokers were responsible for more than one-third of all forest fires in 1947. The proportion of settlers' fires was considerably reduced in comparison with the average for 1937-46. The percentage of fires attributed to railways remained substantially higher than in the years immediately preceding the Second World War, although somewhat lower than the war-time peak. The number of lightning fires was a little greater than normal, the increase occurring mainly in Manitoba, Ontario, and Quebec.

Legal Proceedings

The number of prosecutions and convictions under the forest fire laws (Table IV) was greater in 1947 than in either of the two preceding years. As in 1946, one life was lost as a result of a forest fire. This occurred in Nova Scotia.

Forest Fire Research

Progress was made in studying forest inflammability and in measuring forest-fire danger in several regions of Canada. Intensive investigations were again carried out at the Kananaskis Forest Experiment Station. Although weather conditions during the past two fire seasons were not favourable to such work, valuable data were obtained on the occurrence and distribution of weather inversions in the Banff and Kananaskis area, and on the effect of these inversions on forest-fire hazard. Other projects at Kananaskis included an investigation of moisture content changes in slow-drying fuels such as peat and large windfalls, the determination of seasonal effects of vegetation on forest fire danger, and studies of apparatus suitable for weather records under forest conditions, and fire-hazard indicators.

At the Petawawa Forest Experiment Station, fire-danger research was limited to certain fuel moisture studies, and to investigating chemicals which might serve as simple indicators of forest inflammability. At the Acadia Forest Experiment Station data were abstracted from reports supplied by the New Brunswick

Forest Service, on approximately 2,000 forest fires which have occurred in New Brunswick during the past nine years. These are being analysed to determine the characteristics of fire occurrence and behaviour in that Province, and to improve the system of fire danger measurement now in use.

Checking and analysis of weather and fire danger records from the National Parks and Forest Experiment Stations was continued.

A Forest-Fire Research Note was issued dealing with the effect of altitude, length of hose, and other factors on the performance of forest-fire pumping units. Tests were made on all such pumps at Forest Experiment Stations and several National Parks. Short publications were prepared on: the use of certain chemicals for suppressing surface fires in the spring; coated-lens binoculars for use at forest lookouts; and army type smoke generators as forest-fire detection aids. Studies of chemicals for retarding the growth of vegetation on fire-guards were continued.

A series of Forest-Fire Protection Notes was published in loose-leaf form. These were distributed to fire control officers of the Dominion Forest Service, the National Parks Service, and the Bureau of Northwest Territories and Yukon Affairs.

TABLE I

Forest-fire losses in Canada, 1947, compared with 10-year average, 1937-46

Item		Provinces(*)		Yukon and Northwest Territories Year 1947
		Annual Average 1937-46	Year 1947	
Fires under 10 acres	No.	3,845	3,893	35
Fires 10 acres and over	"	1,663	1,124	13
Total number of fires		5,508	5,017	48
Area burned—				
Merchantable timber	acres	472,426	105,098	3,884
Young growth	"	605,179	98,591	30,343
Cut-over lands	"	340,175	93,747	4
Non-forested lands	"	810,596	315,571	3,880
Total area burned	"	2,228,376	613,007	38,111
Merchantable timber burned—				
Saw-timber	M. ft. b.m.	582,016	38,107	5,104
Small material	cords	2,135,263	359,982	24,597
Estimated values destroyed—				
Merchantable timber	$	2,178,827	565,560	168,572
Young growth	$	809,173	289,407	775,770
Cut-over lands	$	297,451	97,389	14
Other property burned	$	607,897	1,180,630	30,600
Total damage	$	3,893,348	2,132,986	974,956
Actual cost of fire-fighting	$	883,942	1,170,859	8,749
Total damage and fire-fighting cost	$	4,777,290	3,303,845	983,705
Area under protection	sq. miles	.....	788,000	111,000

TABLE II

Forest fires in Canada, 1947, by causes, compared with 10-year average, 1937-46

Cause	Provinces(*)				Yukon and Northwest Territories Year 1947	
	Annual Average 1937-46		Year 1947			
	No.	%	No.	%	No.	%
Camp-fires	949	17	746	15	22	46
Smokers	995	18	1,164	23	4	8
Settlers	769	14	405	8	.....	.....
Railways	419	8	596	12	7	15
Lightning	968	17	1,022	20	10	21
Industrial operations	171	3	234	5	2	4
Incendiary	258	5	118	3	.....	.....
Public works	49	1	57	1	.....	.....
Miscellaneous known	482	9	414	8	2	4
Unknown	448	8	261	5	1	2
Totals	5,508	100	5,017	100	48	100

(*) Includes Dominion Lands within provincial boundaries.

TABLE III

Statistics of forest fires by regions, 1947

(Averages given are those for 10-year period 1937–46)

		British Columbia		Alberta		Saskatchewan		Manitoba		Ontario		Quebec	
		Average	1947	Average	1947	Average	1947	Average	1947	Average	1947	Average	1947
Fires—													
Total number		1,702	1,332	352	122	229	96	357	162	1,167	1,393	1,627	1,111
Caused by lightning	%	35	25	3	4	5	8	7	38	18	29	7	16
Area burned—													
Merchantable timber	acres	40,808	2,071	168,981	5,103	56,567	9,029	35,640	10,494	69,207	47,644	85,559	16,849
Young growth	"	57,336	6,125	212,451	14,916	216,584	6,408	34,269	20,380	31,349	6,882	19,629	10,004
Cut-over lands	"	96,904	13,318	19,254	13,145	17,286	726	4,069	788	33,256	15,795	144,530	35,647
Non-forested lands	"	135,836	121,251	289,819	46,894	183,985	16,555	124,474	41,848	30,283	13,711	20,333	34,419
Total area burned	"	330,884	142,765	690,505	80,058	474,422	32,718	198,472	73,510	164,095	84,032	270,051	96,919
Damage	$	782,428	323,488	969,247	37,344	177,133	12,866	139,408	134,758	543,162	216,922	960,016	467,738
Cost of fire-fighting	$	261,677	161,486	85,018	20,412	66,551	27,362	28,784	22,625	171,193	423,168	197,000	234,943
Total damage and fire-fighting cost	$	1,044,105	484,974	1,054,265	57,756	243,684	40,228	168,192	157,383	714,355	640,090	1,157,016	702,681

TABLE III—*Continued*

—		New Brunswick		Nova Scotia		Dominion Lands							
						National Parks		Indian Lands		For. Expt. Stations		Yukon	North-west Territories
		Average	1947	Average	1947	Average	1947	Average	1947	Average	1947	1947	1947
Fires—													
Total number		234	300	269	444	58	18	58	35	5	4	21	27
Caused by lightning	%	7	8	1	1	14	28	9	3	0	0	5	33
Area burned—													
Merchantable timber	acres	4,594	7,247	1,435	4,290	5,898	2,330	3,666	41	71	.....	654	3,230
Young growth	"	4,494	17,061	4,889	16,645	18,683	160	4,993	10	502	.....	340	30,003
Cut-over lands	"	18,173	7,519	1,762	6,773	4,297	.....	572	30	52	6	3	1
Non-forested lands	"	3,122	20,145	4,802	17,221	9,322	2,006	8,482	1,521	138	.....	678	3,202
Total area burned	"	30,383	51,972	12,888	44,929	38,200	4,496	17,713	1,602	763	6	1,675	36,436
Damage	$	226,192	231,351	29,769	701,000	49,559	6,150	13,672	1,369	2,762	.....	32,495	942,461
Cost of fire-fighting	$	35,944	139,993	19,816	116,641	11,946	22,018	5,626	2,082	387	129	470	8,279
Total damage and fire-fighting cost	$	262,136	371,344	49,585	817,641	61,505	28,168	19,298	3,451	3,149	129	32,965	950,740

TABLE IV

Fire season 1947—Comparative statement by regions

Region	Increase or Decrease in Relation to Average for Period 1937–46			Proceedings under Fire Laws		Deaths
	Number of Fires	Area Burned, Acres	Fire-fighting Cost Plus Damage	Prosecutions	Convictions	
			$			
British Columbia	− 370	− 188,119	− 559,131	27	23	0
Alberta	− 230	− 610,447	− 996,509	12	12	0
Saskatchewan	− 133	− 441,704	− 203,456	26	26	0
Manitoba	− 195	− 124,962	− 10,809	0	0	0
Ontario	+ 226	− 80,063	− 74,265	24	23	0
Quebec	+ 34	− 173,132	− 454,335	8	7	0
New Brunswick	+ 66	+ 21,589	+ 109,208	56	55	0
Nova Scotia	+ 175	+ 32,041	+ 768,056	48	47	1
Yukon				0	0	0
N.W. Territories				5	4	0
Other Dominion Lands	− 64	− 50,572	− 52,204	0	0	0
Canada	− 491	−1,615,369	−1,473,445	206	197	1

FOREST PRODUCTS LABORATORY
OTTAWA

The work of the Laboratory continued to be closely associated with the problems of the wood-producing and wood-using industries. The high level of activity resulted in heavy demands on its services. This was indicated by the demand for special investigations, technical information, and requests for publications issued by the Laboratory. Fourteen thousand nine hundred and forty-six publications were distributed in response to these requests.

The lack of adequate accommodation handicapped the initiation and implementation of certain phases of the work. However, an active program of research was conducted. Members of the staff were active on committees of a number of national and international organizations, such as the Canadian Standards Association, the Technical and Woodlands Sections of the Canadian Pulp and Paper Association, the Ontario Research Commission, the American Society of Testing Materials, the American Wood Preservers' Association, and the United Nations Food and Agricultural Organization. The Laboratory also participated in the work of the newly organized Forest Products Research Society of the United States.

Representatives of the Forest Products Laboratories of the British Commonwealth met during the British Empire Forestry Conference in the United Kingdom in 1947, and steps were taken to promote greater collaboration in forest products research. Following this, preliminary arrangements were made for a conference in Ottawa, during the summer of 1948, of representatives of the Timber Mechanics Divisions of British Commonwealth and United States Laboratories.

A laminated wood arch was constructed for the Department of Trade and Commerce for use in the Canadian exhibit at the Building Trades Exhibition, Manchester. The Laboratory also co-operated in the preparation of the booklet, "Canadian Export Timbers", for use at this Exhibition and by Canadian Trade Commissioners overseas. A six-day course in forest products was given to a group of Assistant Trade Commissioners who were completing a period of training prior to being posted overseas.

Division of Timber Mechanics

The collection of data on the mechanical and physical properties of Canadian species was continued. Two species, eastern hemlock and rock elm, were investigated.

The effect of specimen size upon strength was studied by comparing the results of tests in compression on specimens 1″ x 1″ x 2″ with those obtained from 2″ x 2″ x 8″ specimens. The study was undertaken to determine the value of data from smaller specimens, because standard test specimens cannot always be cut from the material available.

A glued, laminated arch of 47-foot span and 25-foot rise was designed, built, and proof-loaded. The arch, made of white spruce boards glued together with casein glue, was tested by loading with eight large boxes of sand suspended by rods in such a manner as to simulate a distributed load. All winter it carried a load of 48,600 lbs., made up of a dead load of 7,400 lbs., a live load of 20,400 lbs., and an overload of 20,800 lbs.

Assistance was given a telephone company in determining the effect upon strength of such defects as brown stain and cat faces in poles.

Attention continued to be focused on the proposed increase in safe allowable working stresses for structural timbers. A considerable amount of analytical work was done on available test data to determine the validity of the increases proposed.

Tests on glued, laminated beams which had been subjected to ageing and weathering for three years indicate the unsuitability of certain types of glue for exterior use.

The possibility of a shortage of large-size railway tie timber led to an investigation of the feasibility of laminating small timbers to make ties. A number of experimental laminated ties were prepared, which will be installed in track to obtain details of performance under operating conditions, and a record of service life.

Preliminary work was done to determine the strength and safe load values applicable to a new type of steel anchor used in timber framing. This anchor is made in three patterns and is designed to facilitate the framing of houses and other light timber structures.

Assistance was given to a number of manufacturers in improving the packaging of their products. This service included re-design of containers to produce a more economical and efficient pack. The packing of Army stores was examined from time to time at the request of the Department of National Defence, and check tests were made on a number of containers used.

Many branches of the wood-using industries requested technical assistance in the application of adhesives, veneer, and plywood. Many of these problems involved considerable experimental work.

The remarkable growth during the year in the use of radio-frequency dielectric heating by the wood-using industries was reflected in the number of requests for technical assistance. Equipment has been installed by a number of furniture companies and many resulting problems have necessitated fundamental research by the Laboratory in the application of this new technique. Improved methods of bonding curved plywood, a component of increasingly wide application in many different fields, were also investigated. Dielectric heating was applied to the gluing of the smaller elements used in manufacturing laminated railroad ties with satisfactory results. A similar study was made of edge-gluing lumber to make lumber cores suitable for veneering in the manu-

facture of furniture and for the production of laminboards. Fundamental studies of the dielectric properties of woods and glue were carried out. The work was confined to yellow birch but will be expanded to embrace all Canadian species of commercial importance.

Drying wood by applying high-frequency currents can be done quickly and efficiently on small pieces of wood, but when the same technique is applied to larger timbers it is unsuccessful, because the wood checks severely and is rendered unserviceable. It was found, however, that if the method is modified by maintaining an ambient atmosphere of high humidity around the timber the ill effects are considerably lessened. Since this technique gave promising results, it is proposed to continue the experiments.

Division of Wood Preservation

A weatherproof and fire-retardant coating for exterior use on plywood and shingles was developed and tested. Such a coating, to be practical, must possess the properties of permanence, cheapness, and ease of application, and must also impart a definite degree of fire-resistance to shingles subjected to standard flame and brand tests for roofing materials.

Comparative laboratory and service tests were started to determine the relative value as a wood preservative of creosote distilled from lignite tar produced in Saskatchewan, and standard creosote. Creosote may not always be available for use as a wood preservative and intensive studies were made of other preservatives such as zinc-meta-arsenite, copper naphthenate, pentachlorophenol, and copper sulphate.

The development of accelerated methods for testing wood preservatives was continued. These tests are required to supplement service tests on full-size timber products, which require from 20 to 30 years.

Investigation of the ground-line treatment of eastern white cedar pole stubs, begun in 1940, was completed. When the investigation began, there were approximately 10,000,000 untreated wood poles in line in Canada. It was not possible to treat these poles when installed, and the desire to postpone costly replacements centred attention on the need for definite information regarding the relative merits of some comparatively cheap and easily applied ground-line treatments. The results of the tests made by the Laboratory on seven ground-line treatments and one butt treatment indicated that all treatments were effective in inhibiting decay at the ground-line for a period of six years, with the exception that in one treatment there was a small amount of decay at the junction of the heartwood and sapwood. The treatment that combined creosote and salt penetration appeared to be the most effective.

Division of Wood Chemistry

Barks from black spruce, white spruce, balsam fir, eastern hemlock, and Douglas fir were analysed by the usual methods applied to wood. The content of reducing and fermentable sugars derivable from the bark was also studied. Important points noted were the presence in the barks of large amounts of extractives, the low yields of pulp obtained by alkaline cooking, the presence of "lignin" fractions resistant to solubilization with alkaline solutions, and the low content of sugars fermentable with baker's yeast. The latter fact possibly indicates the presence of only small quantities of cellulosic material in the barks.

Fibreboards of the insulation and hard-pressed types were prepared from eastern cedar and western red cedar barks, and from combinations of these barks with either sulphite pulp screenings or groundwood pulp screenings. There are indications that a board of the insulation type, of acceptable tensile strength,

can be prepared from eastern cedar bark. Western red cedar bark alone produces a board of very low tensile strength. The strength of such a board is, however, increased considerably by the addition of ten per cent of sulphite pulp screenings to the stock. The incorporation of groundwood pulp screenings did not produce as great an improvement in strength.

Hard-pressed boards prepared from eastern cedar bark are considerably higher in modulus of rupture and tensile strength than boards prepared from Western red cedar bark. However, such boards fall considerably below the present requirements specified for commercial boards of this type.

In the use of wood sugar solutions for the production of ethyl alcohol, one of the conditions desired for distillation is a high concentrate of alcohol in the fermented liquid. It was considered that such a condition might be achieved by using, prior to distillation, the fermented liquid from one run to prepare acid solution for the hydrolysis of wood for a second run. However, before this was tried it was necessary to make certain that alcohol in the liquid is not chemically transformed during the hydrolysis of wood by the Scholler process. Experiments were undertaken which indicated that, under the experimental conditions used, no appreciable change in the alcohol occurred.

Experimental work was initiated on the preparation from wood hydrolyzate of pure, crystalline glucose by more effective methods than are presently available. Limited success was obtained by using lead acetate as a means of precipitating and removing some of the impurities present.

The chemical changes resulting from the electrolysis of lignin solutions were investigated. In order to understand the chemical reactions taking place at the electrodes, the gases evolved during electrolysis were analysed. The cathode gas consisted almost entirely of hydrogen, whereas that from the anode consisted of 82 per cent oxygen, 6 per cent carbon dioxide, 8 per cent carbon monoxide and 4 per cent undetermined gas. Deposits formed at the cathode during electrolysis of sulphite waste liquor contained carbonates of calcium and magnesium. Sulphites are also present in the deposits, since sulphur dioxide (7·18 per cent) is set free by the addition of mineral acids. As the methoxyl content of the cathode deposit was found to be 4·7 per cent, as against 7·8 per cent methoxyl in the dry residue of the untreated waste liquor, the presence of considerable amounts of lignin was indicated. Changes in the pH of the anolytes from 4·9 to 0·65 during electrolysis indicate the formation of considerable amounts of organic acids. Attempts were made to extract compounds formed during electrolysis in sufficient quantities for analysis and identification.

Analyses of electrolysis of solutions of soda lignin showed that some demethoxylation took place during electrolysis. Benzene extractions of catholytes and anolytes were carried out, but in attempts to vacuum distil the extracted substance, decomposition took place under the conditions used.

At the request of the Topographical Survey Division of the Department, the possibility was investigated of improving the properties of certain cardboards used for making templets.

Division of Timber Pathology

Surveys were made during the summer and winter at mills manufacturing birch veneer and lumber to study methods of handling and storing logs in the woods and at the mills. Sapwood of untreated logs stored on land showed advanced decay to a distance of 1 to 3½ feet from the end with incipient decay running at times the length of the log. Information received indicated that the loss was almost $2,000,000 for a total cut in 1946-47 of 250,000,000 ft. b.m.

Samples of rots observed were collected, and wood-rot fungi isolated from them were under study. Tests were conducted to determine the efficiency of certain end-coatings in protecting the logs from fungoid attack.

Fifty-eight fungi obtained from spore traps set in lumber seasoning yards were grown on blocks of red pine sapwood in culture jars to test their ability to stain the wood. Thirty-seven caused heavy stain, 13 slight to moderate stain, and 8 insignificant or no stain.

Two series of cultures of fungi isolated from green jack pine were completed; one run in quadruplicate on agar plates, the other on blocks of jack pine. In both series the fungi were paired. The fungi showed a wide variety of reactions on one another and great diversity in the colour changes induced in the wood. The reactions of three fungi, commonly associated with *Fomes pini* in red-stained jack pine, on secondary wood-rot fungi, which attack jack pine railway ties in service, were studied.

The identification of fungi responsible for rots in different species of wood was continued. Fungi isolated from rock elm, beech, white birch, and yellow birch were identified as *Hydnum erinaceum*, which causes white heartwood rot; *Armillaria mellea, Collybia velutipes*, and a haploid mycelium of *Pholiota adiposa* were isolated from rock elm; *Hydnum septentrionale* was obtained from birch; *Lenzites trabea, Stereum purpureum* and *Polyporus hirsutus* were obtained from poplar, and others were under study.

Soil was found to be a satisfactory medium in which to obtain rapid decay of wood blocks in culture, but the blocks may be so stained by the soil that the true colours of the rots do not appear. Vermiculite was tested as a substitute for soil in the hope that the rots produced may be more characteristic. Blocks of white pine buried in soil, and in vermiculite, and inoculated with four fungi, were examined after six months incubation at 78° to 80° F. The wood was only slightly discoloured by vermiculite, but was badly stained by soil. Loss in weight due to decay was 62 per cent to 71 per cent in soil and 5 per cent to 35 per cent in vermiculite. This was probably caused by the higher moisture content retained by the wood in soil. The four fungi were about equally active on the blocks in soil, but showed very considerable variation in their attack on blocks in vermiculite. The effect of an extract of vermiculite on the growth of two of the fungi was tested in plate culture. The spread of the fungi over the plates was not checked, but reduced vitality was evidenced by a thinning of the mats.

Logs from five rock elm trees were cut into test material and seasoned, in connection with investigating the relative resistance to decay of white and rock elm. Preparation of blocks for decay-resistance tests was begun.

A study was made of brown stain and decay in sapwood of red pine poles which had been stored under conditions provocative of fungoid attack.

Division of Lumber Seasoning

Experimental kiln runs were made in connection with revising drying schedules for Eastern Canadian species of lumber. Because of the danger of damaging large quantities of lumber, the drying conditions tested have been comparatively mild. This restriction will be necessary until equipment on order for a new small experimental drying chamber is in operation.

Technical assistance was given to industry, and several firms in Nova Scotia and Quebec were visited. At the request of the Quebec Department of Agriculture certain firms manufacturing egg cases and butter boxes were assisted in improving the seasoning of their wood.

An investigation was made of the preparation of willow logs for manufacturing artificial limbs. During the air-seasoning of these logs, which takes from four to five years previous to manufacture, many split and have to be discarded. Willow logs were obtained for sawing and drying at the Laboratory in an attempt to obtain lumber without splits which may be laminated into blanks and subsequently manufactured into artificial limbs.

Approximately 400 replies were received from a questionnaire seeking information on the kiln-drying problems of selected lumber mills and secondary wood-working industries in Eastern Canada. The object of this questionnaire was to determine the main seasoning problems of those plants operating dry kilns.

Plans were made to conduct a lumber seasoning course in April, 1948, to extend the knowledge of kiln operation and seasoning practices. Lumber manufacturing firms were invited to send representatives. The response was so great that it was necessary to arrange two more courses.

Division of Timber Physics

Large scale co-operative experiments on the chemical treatment of standing trees were carried out during the summer of 1947 on the woods operations of a paper company in northern Ontario. The tests were made to determine the effects of various chemical treatments, when applied during different months of the year, on the ease of peeling and on the shipping weight of pulpwood. About 3,800 jack pine, black spruce, balsam fir, aspen poplar, balsam poplar, and white birch trees of pulpwood size were treated with different chemicals in June, July, August, and September. Sample cuttings were made at intervals, beginning one month after treatment and continuing until mid-October. A further series of cuttings from these 1947 treatments will be made during the summer of 1948.

The season in which the chemicals were applied was found to be a factor in their effectiveness in improving peeling. Material treated in June and July gave more satisfactory results than that treated in August, and chemicals applied in September did not improve the peeling in any way. Weight reduction occurred only in the softwoods, with the maximum reduction in those treated early in the season. Loss in weight per cubic foot was greatest in top logs, increasing progressively from butt level upwards. In trees treated in June and July, top logs of jack pine showed a reduction in weight up to 22 pounds per cubic foot when felled from two to four months following treatment.

The effect of chemical treatment of cedar, to be peeled for use as posts and small poles, was investigated near Maberley, Ont. Material treated in July and August and felled in the late summer and autumn, peeled easily, and was about 15 per cent lighter in weight than untreated material cut and peeled at the same time.

A study was also made of the reduction in weight of logs of untreated trees that had been felled and allowed to retain their branches for various periods, so that drying would occur during the warm weather by evaporation through the foliage. The results indicate that more drying is obtainable in a short period of one or two months by this method than occurs when chemically-treated trees are left standing through the summer. This weight reduction occurred in broad-leaf and coniferous species, but there was no improvement in peeling.

Division of Wood Utilization

Sawmill utilization studies were resumed. They are designed to determine the amount of material suitable for economic use that is wasted, and the relative efficiency of present equipment and combinations of equipment. They investigate various sawing practices and the effect of log diameter on production time and yield of lumber.

The studies were conducted at 25 mills in Ontario and Quebec, cutting mainly spruce, jack pine, balsam fir, and white pine. The mills had sawing capacities ranging from 700 ft. b.m. to 25,000 ft. b.m. per day. This range in size necessitated classification of the mills according to the type of production equipment used. The classification follows:

A.—Circular head-saw, trim-saws.
B.—Circular head-saw, edger, trim-saws.
C.—Band head-saw, edger, trim-saws.
D.—Twin circular head-saw, re-saw, edger, trim-saws.
E.—Circular head-saw, re-saw, edger, trim-saws.
F.—Band head-saw, re-saw, edger, trim-saws.
G.—Compound mills (two or three manufacturing sides).

In the twelve type B mills studied, results indicate lumber recoveries ranging from 44 per cent to 56 per cent of the volume of the log. The average lumber recovery in this type of mill was 49 per cent. Approximately one-third of the sawdust produced in these mills is used for fuel and one-third of the slabs, edgings, and trim-ends are used for mill fuel or sold as firewood. Only one of the type B mills studied was operating a lath machine. Sufficient coverage was not given to the other types to be representative and additional mills in these types will be included in the program for 1948.

FOREST PRODUCTS LABORATORY, VANCOUVER

This Laboratory provides service to western Canadian lumber producing and wood-using industries, and provides information on new and improved methods for utilizing western woods. It is located on the campus of the University of British Columbia and works in co-operation with the University.

Keeping pace with the demand for greater service, the facilities of the Laboratory have been expanded. The re-organization of the Forest Products Laboratories of Canada resulted in decentralization of the work already in progress or to be undertaken. The Vancouver Laboratory now operates as a regional research unit for western Canada, and the program of work is carried out under four major divisions.

There was a marked increase over 1946 in the manufacture of lumber in western Canada, with coast sawmills showing an increase of about twenty per cent. There were indications, however, of a return to more competitive market conditions, and there was growing interest on the part of representatives of industry in all types of research work, with special emphasis on utilization.

Division of Timber Mechanics

Determination of the physical and mechanical properties of western Canadian lumber species was continued. Small, standard specimens free from defects were used. Tests of mountain hemlock in the air-dry condition were advanced materially. Testing in green condition was begun on a shipment of second-growth Douglas fir logs from the Fraser River Valley, and on a shipment of western birch logs from Quesnel, B.C.

Service was provided to industry relative to standard testing of adhesives of various kinds. Many technical inquiries were answered concerning glues and their application to fabrications of various types. Studies were undertaken in order to supply industry with data on the strength and water-resistance of various glues, to conduct acceptance tests, within specifications, of plywood and other glued construction, and to determine the underlying causes of failure in gluing operations. Frequent tests were made to determine the shear strength of various glues when applied to hard maple clips one inch wide and one inch overlap, and to maple blocks having a shear area of 4 square inches. Both are standard for testing and for acceptance within the relevant specification.

A fundamental investigation was continued of the comparative specific gravities and mechanical strength properties of material from the north, east, south, and west sides of western species. All listings and computations for this study, covering a number of species, were completed, and a report will be published.

Few data were available regarding the taper of Douglas fir and western red cedar poles and piling. Accordingly, measurements were made, in various pole yards, of Douglas fir poles 25 to 45 feet in length, Classes 1 to 7, and of piles 50 feet long, Classes A and B. Western red cedar poles, Classes 1 to 7, length 25 to 45 feet, were also measured. Additional measurements will be made as poles and piling become available in local yards.

The belief in some sections of the timber industry that specifications with respect to factors of safety for structural timber design are too rigid, brought renewed attention to the matter of working stresses for structural timbers. Test results of current allowable stresses are being analysed by both the Canadian and the United States Forest Products Laboratories. Test data originating at the Vancouver Laboratory were requested by the United States Forest Products Laboratory at Madison, for inclusion in an overall analysis of test results for structural timbers.

There was a continuous demand from manufacturers and consumers for testing of mechanical and physical properties of particular wood samples. Custom testing of materials other than wood was also done at the laboratory, because suitable equipment was not available locally. The cost was defrayed by the firms concerned.

The Timber Mechanics Laboratory was used for two and one-half days a week for instruction and demonstration to engineering students of the University of British Columbia in testing materials of construction. Approximately 450 students attended regular sessions, resulting in a much greater use of laboratory facilities by undergraduates than in former years.

Division of Utilization and Seasoning

The results of a sawmill waste survey conducted during the summer of 1946 were completed, and reports were sent to the mills concerned. This survey indicated that although the proportion of log not converted into lumber still remained high, utilization of this so-called "sawmill waste" had improved since the last survey was made in 1930.

Considerable information was assembled on the manufacture of wood flour from sawmill waste. Samples of flour from various local species were sent on request to the Trade Representative, Department of Trade and Industry, London, England.

Preliminary tests were made on the burning qualities of western red cedar wood briquettes, manufactured from shingle mill waste. This is the first major step toward utilizing this material.

A survey was conducted on utilizing shingle "tow" for use in plant nurseries. The quantity used, however, was so small in comparison with the amount produced that it was not considered of great economic importance from a utilization standpoint.

A study was initiated to determine the weight and solid wood volume of a cord of sawmill waste. This material is being sold as pulpwood for conversion into pulp chips.

The compilation of information on the effect of log size and grade on the quality and quantity of lumber produced from Douglas fir logs was completed.

Logging waste and methods of salvage were studied. Two of the three salvage operations studied involved re-logging cut-over lands to recover merchantable material. In the third, all merchantable material was removed in the initial operation. Results of one operation indicate that approximately two-thirds of the waste left after the initial logging can be recovered by re-logging, using light modified equipment. Matched kiln-dried and air-dried furniture stock was studied to determine the comparative rate of moisture absorption under storage conditions. Results indicate that kiln-dried material does not absorb moisture as readily as air-dried stock.

Test runs were made in the experimental kiln to develop a schedule for black cottonwood lumber green from the saw.

Two kiln courses for lumbermen were conducted, with an enrolment of thirty-three. Lectures were prepared and distributed to candidates.

A survey of kiln-drying facilities in the southern coast region of British Columbia was begun. Numerous Vancouver Island mills were visited in connection with this project. The prevention of warping in hickory strips used in manufacturing laminated skis was investigated. It was found that these strips remain fairly stable when subjected to a pressure of 5 pounds per square inch and a temperature of 250° F. for four to six minutes.

A charge of 4-inch by 6-inch western hemlock pipe stock was dried in the experimental kiln to determine whether it is feasible to kiln-dry large-size material prior to preservative treatment. The results indicate that if a proper schedule is used and sufficient time allowed, very little de-grade occurs.

Division of Wood Preservation and Timber Pathology

A number of preliminary tests were made to obtain information on temperatures which prevail at various points in a commercial retort while wood is undergoing treatment with a preservative. A special pressurized recording thermometer was designed and manufactured locally for this purpose. Readings indicate variations of temperature which might affect treatment adversely.

Progress was made in providing and equipping a laboratory for studying wood preservation problems of a regional nature, and plans were initiated on several projects.

Collaboration with the Ottawa Laboratory in recording the service life of treated and untreated timber products was continued. Studies were made of the relative durability of commercial species of western Canadian woods, when used in conditions favouring decay, and when subjected to attack by insects and marine borers.

Numerous wood samples submitted by various industrial firms and wood users were identified.

A reference collection of pathological material was maintained for the study of wood-inhabiting fungi and stains which attack forest products. The collection, in the form of cultures on malt agar, numbered 160 at the end of the year, and will be extended as opportunity is afforded. Some permanent mounts of the mycelia of wood-destroying fungi were maintained to serve as a means of diagnosing decay and for demonstration purposes.

Experiments were made to discover a practical colour test for differentiating between sapwood and heartwood in western hemlock. A large number of chemical reagents were tried, one of which appeared to be a successful indicator on western hemlock and a number of other woods. The work will be extended to investigate the possible effect of seasonal influences on the efficacy of promising indicators.

Division of Wood Chemistry

The most recent addition to services offered the wood-using industry of western Canada was the proposed work in wood chemistry. A survey was begun of the possibilities and problems of chemical utilization applicable to that region. A chemistry laboratory was set up and basic equipment was installed. It was proposed to add specialized equipment with the initiation of specific projects. A number of problems are in need of early attention and these were carefully considered, with a view to beginning work as soon as possible.

General

There was a considerable revival of interest in the use of the laboratory facilities as a bureau of technical information in connection with the properties and uses of wood.

Research workers visited industrial establishments regularly and men in the industry visited the laboratory for discussions of technical problems. Such association was extended also in committee work and through attendance by laboratory officers at the various scientific meetings of forestry, logging, lumbering, and research groups.

Co-operation between the Vancouver Laboratory and other regional research institutions which were carrying out work in associated fields resulted in collaboration on various projects of mutual interest with such organizations as the Dominion Science Service, the British Columbia Forest Service, various departments of the Faculty of Applied Science at the University of British Columbia and the British Columbia Research Council.

List of Laboratory Publications

News Letter, Forest Products Laboratory, Vancouver. (Seven issues distributed.)

The Effect of Kiln-drying upon the Strength of Western Hemlock.

A Review of the Work in Progress and the Results Obtained at the Vancouver Forest Products Laboratories. (Prepared for the British Empire Forestry Conference.)

Summary of Information on the Change in Moisture Content of Seasoned Lumber in Storage and in Transit (Revised).

The Air Seasoning of Lumber in the Southern Coast Region of British Columbia (Revised).

Moisture Content of Lumber—Its Determination and Effect on Weight.

Course of Lectures on Lumber Seasoning Practice in British Columbia—Prepared for Classes in Lumber Seasoning.

Lectures Prepared for University Students in Applied Science.

Forest Products Research in British Columbia. (March issue of *Industrial Canada.*)

Program of Work, 1948-49.

List of Publications Available. (Revised March 1948.)

PULP AND PAPER RESEARCH INSTITUTE OF CANADA

The Forest Products Laboratory, Montreal, is a part of the Pulp and Paper Research Institute of Canada. The latter is supported jointly by the Dominion Government, the Canadian Pulp and Paper Association, and McGill University. The work of the Institute is under the supervision of a General Director, who is responsible to a Joint Administrative Committee consisting of representatives of the three constituent bodies.

Fundamental Research Studies

Great headway has been made in the past few decades in chemical and physical use tests for cellulose and cellulose derivatives. Nevertheless, these tests may fail to explain why two pulps, apparently similar in all measurable properties, sometimes give papers of different quality; why they acetylate, xanthate, or nitrate with unequal ease; or why they yield derivatives varying in solubility, clarity, and filterability. These apparent anomalies suggest that present specifications for pulps fail to take account of all the important and variable qualities of cellulose. One of these undetermined variables might be that pre-treatments, such as wetting and re-drying, alter the "accessibility" or "re-activity" of the pulp during subsequent physical or chemical processing. If so, derivatives differing perhaps only slightly in overall chemical composition, but perhaps markedly in physical properties, would be expected. Even if the overall chemical composition remains constant, unknown but possibly wide variations are possible in the way in which nitrate, xanthate, ester, or ether groups are distributed among the remaining primary and secondary alcohol groups in technical cellulose derivatives. This variable may influence the viscosity, gelation, and solubility of the products in various liquids. Research in the cellulose field is chiefly concerned with such problems.

Two of the researches on carbohydrate oxidations attempt to provide more precise information on what happens chemically when cellulose and starch are oxidized, and the third explores the possibility of turning electrolytic oxidation to good use in the disposal of the carbohydrates in wood wastes. Electrolytic oxidation was chosen because Canada has much electric power, and because chemical control over the oxidation might be secured by an appropriate choice of the electrolytic cell.

Although the bleaching of pulps involves bleaching or removal of non-carbohydrate phenolic constituents of a complex and unknown nature, surprisingly little information is available concerning the action of bleaching agents upon simpler phenolic substances. Three researches in progress are filling this gap in knowledge, and constitute a prelude to future studies of the action of halogen-containing oxidants on lignin itself.

Because it is clear that present methods of isolation yield products not fully characteristic of lignin as it exists in wood, attempts have been made to find new methods free from this objection. Researches on lignin include one new method that appears to isolate almost all the lignin in a pulpable condition, another that isolates a small and apparently homogeneous fraction, and a third that attempts, by oxidative degradation, to determine the chemical difference between most types of isolated lignin and lignin as part of the wood structure. It is clear that more information along these lines will help to explain the chemistry of commercial sulphite cooking.

The enormous quantities of bark produced by the lumber and pulp industries are at present almost entirely waste, and any information leading to their economic use is desirable. Research on bark aims at identifying and estimating all the constituents of spruce bark that can be isolated as pure chemical individuals.

Applied Research Studies

Attempts to prepare a film which would duplicate the action of the ink film in printing were successful. Pressure-smoothness curves relating to newsprint obtained with the use of such a film resemble similar curves obtained by printing samples at various pressures and then estimating the per cent contact by means of reflectance measurements on the prints.

Investigation of methods of analyzing sulphite waste liquor reached a stage where it appeared desirable to discontinue laboratory work and to publish a report on what had been done. The purpose of this work was to find procedures which would convey useful quantitative information about the various sulphonic acids which exist in the liquor. A condensed report was published, containing new procedures developed at the Institute, older methods which were checked and modified in some particulars, and some analyses extracted from recent literature.

The study of the alkaline pulping of wood was continued. An investigation of black spruce was completed, and work was begun on balsam and Douglas fir. The equipment in use was renovated.

The investigation of longitudinal grinding was concluded, using eastern spruce. Such grinding appears to offer no real advantages over transverse grinding with regard to pulp quality, energy requirement, and production, and has the disadvantage of producing a great deal of coarse material unsuited for paper manufacture. Such material however, would be of value in manufacturing insulating board.

The basic problem of measuring the specific external surface area of cellulose fibre suspensions as a means of studying drainage and inter-fibre bonding in paper-making has made it possible to improve experimental techniques and to simplify interpretation of the data. The compressibility of concentrated pulp suspensions, the sedimentation of fibre suspensions, and the increase in surface area of fibres by beating were studied.

A long-term study of the phenomenon of fibre flocculation was undertaken. The first phase concerns the development of a quantitative and objective method of assessing the flocculating tendency of pulp suspensions. Two methods were investigated. One measures the statistical fluctuations in the optical transmission coefficient of suspenisons subject to reproducible flow conditions. The other measures the apparent viscosity and degree of thixotropy* at various rates of shear. In addition a relation was sought between the electrokinetic properties of fibres and their flocculating tendency, because it is known that the stability of colloidal suspensions depends greatly upon the distribution of electrical charges at the solid-liquid interface.

Work dealing with instruments used in pulp and paper testing was started. The first problem dealt with burst testers, with particular emphasis on the Mullen tester, which is widely used in industry. The conditions necessary to give reproducible performance and to analyze the mechanism of bursting were being determined. Study of the action of the pressure gauges used with this tester has shown that they are subject to several kinds of error.

A method was devised of estimating by dye absorption the fraction of unbleached sulphite pulp in mixture with ground wood pulp.

An instrument, based on photo-electric principles, for providing an assessment of dirt spots in paper, was developed. It requires improvement before being submitted to the industry as a routine testing instrument.

A method of checking freeness testers by means of reference samples of pulp was being developed and shows promise of success. Samples were tested by a number of mills. In the study, definite relations were found between the freeness of a pulp and the properties of the water in the pulp.

A long-term project was begun in co-operation with several companies, to find means of improving the regeneration of desirable forest species. Information was obtained whereby recommendations can be made regarding three species.

*The property, shown by certain gels, of liquefying on being shaken and of re-forming on standing.

Further study was given to the design and construction of logging camps.

Several improvements were made as a result of further experiments in studying the gravity transportation of pulpwood by means of a suspended wire.

A study was made of various pulpwood holding areas, and improvements were suggested to the companies regarding sites and designs of necessary structural components.

Lectures on the Industry

With the co-operation of the Canadian Pulp and Paper Association and McGill University, the Institute organized a course of nine lectures for engineering students attending the McGill winter term. These lectures, given by a specialist in each subject, described the operations of the pulp and paper industry and were intended to arouse interest in the opportunities in the industry for engineers. The course was well attended.

GEOLOGICAL SURVEY OF CANADA

The Geological Survey of Canada became a separate Bureau during the year and is responsible for the geological mapping of Canada, office studies and field investigations of the geological factors affecting mineral development, co-operation with Government agencies and the public in developing natural resources, and maintenance of complementary services in mineralogy, geophysics, fuels, borings, ground water, and palæontology.

Early in the year G. S. Hume was appointed Chief of the Bureau of Geology and Topography and, later, of the Geological Survey of Canada. Dr. Hume entered the Government service in 1920, and in the intervening years was engaged principally in the study of the petroleum and natural gas resources of Canada. He brings to his new task unusual competence and experience.

In 1947 the Geological Survey of Canada celebrated the 105th year of its existence in late December when the Geological Society of America held its annual meeting in Ottawa. This occasion also marked the 60th anniversary of the Society and was its first meeting in Canada since 1930. Members of the Society and of its six affiliates, as well as members of the newly formed Geological Association of Canada, attended in large numbers. The registered attendance was 908, of whom many were outstanding scientists from the United States. Eight technical papers were presented by members of the staff of the Geological Survey of Canada.

The Survey maintained its progressive position in the field of geology. In collaboration with the National Research Council, experimental flights were made to determine the practical application of the airborne magnetometer to geological problems and prospecting. With regard to atomic energy, special attention was given to organizing the facilities of the Survey to investigate radioactive ores in Canada.

Detailed studies of coal were continued, and information was collected for computing the natural gas resources of Western Canada. Field studies were continued in areas favourable to occurrences of oil and gas, and an enlarged program of geological mapping was carried on throughout the provinces and in Yukon and Northwest Territories. Fifty-seven field parties were at work, 16 more than in 1946. Ten of the parties were in the Northwest Territories, four in Yukon, eleven in British Columbia, eight in Alberta, three in Saskatchewan, four in Manitoba, six in Ontario, six in Quebec, one in New Brunswick, two in Nova Scotia, and two on general work in two or more provinces.

Increased interest in mining was reflected in increased demands for mineral specimens and identification of samples. A total of 6,500 samples from prospectors, students, and others were identified. In addition, numerous applicants

submitted samples and received information personally. More than 67,500 specimens were distributed to meet requests. These included 826 sets of prospectors' mineral samples and 874 sets of prospectors' rock specimens.

Eighty-two maps were published including 33 standard geological maps, three mineral maps, and one physiographic map. One memoir, one Economic Geology Series report, two geological Bulletins, and 25 Papers were issued. More than 132,300 maps and reports were distributed, of which 1,100 were French.

GEOLOGICAL DIVISION

A Geophysical Section was established, and facilities were arranged for research and field experiment with specialized equipment including, particularly, the airborne magnetometer. Field and office work was expanded in line with recent national interest in the search for, and research in, radioactive and other strategic mineral deposits. Special attention was given to the compilation of map and statistical data on Canada's coal reserves, and to an assessment of the vast reservoirs of natural gas in the western provinces. The Annual Meetings of the Canadian Institute of Mining and Metallurgy in January, and of the Geological Society of America in December, both held in Ottawa, required active participation by the geological staff.

Much of the field work was again devoted to mapping-in areas of economic interest, including potential sources of gold, strategic minerals, base metals, oil, and natural gas. Further investigations were made of coalfields in Eastern and Western Canada, and of Pleistocene geology and ground-water supply in parts of Ontario and the Prairie Provinces. Standard geological mapping, on scales of either 1 or 4 miles to an inch, was conducted in 31 areas in various parts of Canada. Detail mapping was continued in the Yellowknife greenstone belt at Yellowknife, Northwest Territories, and in Beauchastel and Dasserat townships of western Quebec. Similar mapping was begun in Ossian township of eastern Ontario. Subsurface stratigraphic studies were made in the oil and gas fields of Alberta and western Saskatchewan. Other stratigraphic investigations, supplemented by palæontological collections, were conducted in Alberta and British Columbia. Assistance was given when possible to industrial and engineering projects. Field work included a reconnaissance survey by aircraft over a large area of the Arctic regions, and an inspection of the iron ore deposits of Ontario, Quebec, and Labrador.

M. E. Wilson prepared a memoir on southern Rouyn and southeast Beauchastel townships, Quebec, after several years of field work. He also edited the Special Jubilee Volume of the Canadian Institute of Mining and Metallurgy on the Structural Geology of Canadian Ore Deposits. After more than 40 years of continuous and distinguished service as a geologist he retired on superannuation.

In Ottawa, efforts were continued to assist visiting oil geologists employed in Canada by providing them with temporary office accommodation and placing at their disposal the records and facilities of the Palæontological and Ground Water and Borings Sections. To a more limited extent these services were also made available to visiting scientists from this or other countries, particularly during the annual meeting of the Geological Society of America, in late December.

A branch office of the Geological Survey was established at Yellowknife, Northwest Territories, and M. Feniak was appointed Resident Geologist. A. F. Buckham. who has had charge of field work in the coal-mining areas of Vancouver Island since 1943, returned to Ottawa to complete his reports and maps of these areas.

In June, G. W. H. Norman was granted two years' leave of absence from the Geological Survey to undertake consulting work for a mining company in Arizona. It was expected that this experience in mineralized Precambrian rocks, not unlike those of northern Quebec, but in an unglaciated terrain, would be of great value to him in subsequent field studies for the Survey in Canada. In the early autumn, C. H. Stockwell was also granted leave of absence to lecture at McGill University. The leave was granted at the urgent request of the Department of Geology of the University.

Field Work

GENERAL

G. S. Hume continued field studies and supervisory work in the oil and gas fields of Western Canada, and maintained close touch with industrial developments there. He also visited topographical and geological parties in various parts of the Dominion.

J. S. Stewart continued to act as supervisory petroleum engineer for the Northwest Territories Administration. He visited Norman Wells and prepared a complete report on operations and conditions there. He also visited Hay River, where exploratory diamond drill-hole tests for a favourable oil structure were being made by the Frobisher Exploration Company. Later in the field season he inspected the Leduc oil field southwest of Edmonton, and collected information on the completed wells. He supervised investigation of groundwater conditions and glacial geology in Alberta and Manitoba.

NORTHWEST TERRITORIES

C. S. Lord examined the principal mines and prospects in western Northwest Territories, with a view to revising his previous memoir, now nearly out of print, on the mineral industry of that region.

M. Feniak completed geological mapping of the McAlpine Channel area, (longitude 117° 30′ to 118°, latitude 66° 15′ to 66° 30′) Great Bear Lake. The project was designed in part to facilitate the search for uranium deposits.

W. H. Parsons completed geological mapping of the Camsell River area (longitude 116° to 118°, latitude 65° to 66°), Great Bear Lake region, begun the previous year by C. S. Lord. The project was designed in part to facilitate the search for uranium deposits.

R. E. Folinsbee completed geological mapping of the Lac de Gras area (longitude 110° to 112°, latitude 64° to 65°), begun the previous year. The area lies northeast of Yellowknife.

Y. O. Fortier made flights with the Dominion Observatory's magnetic survey party in the Arctic Islands and adjoining mainland region. Continuous observations were made of bedrock geology, topographic forms, Pleistocene glaciation, present ice conditions, land emergence, and cartography. Fossil collections were obtained from two localities in the Arctic Islands, and many pictures were taken. Specimens of living plants were collected for the National Museum and notes were taken on any signs of human or animal life.

J. F. Henderson continued detailed geological mapping of the Yellowknife Bay greenstone belt, begun the previous field season. This work is on a scale of 1 inch to 500 feet, and will eventually include a strip some 25 miles long, of which the southernmost 9 miles has been mapped. Important gold deposits, including those of Giant Yellowknife Gold Mines, have been found in this belt, and development and exploratory work is in progress. The detailed mapping will assist in interpreting the many complex structural features, and in discovering ore deposits within the belt.

L. P. Tremblay completed geological mapping of the Chalco Lake area (longitude 115° to 115° 30′, latitude 64° 15′ to 64° 30′), begun the previous year by M. S. Stanton. Mr. Tremblay also completed geological mapping of the adjoining Ranji Lake area (longitude 115° to 115° 30′, latitude 64° to 64° 15′). Numerous gold discoveries have been made, and the areas are being actively explored by prospectors and mining companies.

YUKON

H. S. Bostock continued geological mapping of the McQuesten area (longitude 136° to 138°, latitude 63° to 64°), begun the previous year. The area has important placer possibilities and is a potential source of lode gold and strategic minerals.

E. D. Kindle continued geological mapping of the Dezadeash area (longitude 136° to 138°, latitude 60° to 61°), begun the previous year. The area borders the St. Elias Mountains and the great complex of coast intrusions. It contains placer deposits on which work is being done, and is a region where geological conditions favour the occurrence of mineral deposits.

J. R. Johnston, under supervision of W. E. Cockfield, continued geological mapping in the Whitehorse area (longitude 134° to 136°, latitude 60° to 61°). This work was begun the previous year by W. E. Cockfield and J. C. Fyles. Work was discontinued early in the field season when Mr. Johnston became ill. The area comprises one of the best known and more accessible parts of Yukon. Significant mineral discoveries have been made there, and important production has been achieved. These discoveries have included gold-silver quartz veins, antimony-silver veins, silver-lead veins, and contact metamorphic copper deposits.

B. R. MacKay, accompanied by W. J. Dick, mining engineer, Edmonton, examined the Tantalus, Tantalus Butte, and Five Fingers coalfields on Lewes River near Carmacks. This was a preliminary to re-opening the coal mine at Tantalus Butte, closed since 1938. Private interests, assisted by the Government, will operate the mine.

BRITISH COLUMBIA

E. F. Roots continued geological mapping of the Aiken Lake area (longitude 125° to 126°, latitude 56° to 57°), begun in 1945 by J. E. Armstrong and continued in 1946 by E. F. Roots. The area possesses many gold-bearing and base metal prospects and occurrences of strategic and industrial minerals. Exploratory work has been done on some of the properties, and several discoveries were made by prospectors in 1947.

S. Duffell began geological mapping of the Whitesail Lake area (longitude 126° to 128°, latitude 53° to 54°), which occupies part of the eastern flank of the Coast Mountains, and contains mineral deposits. The area is underlain by formations of the Hazelton group, intruded by granitic masses of more than one age. The mapping is expected to provide information relative to the age of the intrusions responsible for mineralization, and on the mineral deposits themselves. It should also lead to a more definite conception of the age and sequence of the formations of the widespread Hazelton group.

A. G. Jones completed geological mapping of the Salmon Arm area (longitude 119° to 120°, latitude 50° to 51°), begun in 1945 and continued in 1946 by H. M. A. Rice. The area contains gold and base metal prospects, gypsum deposits at Falkland, and occurrences of industrial minerals.

J. W. Hoadley began geological mapping of the Zeballos area (longitude 126° 30′ to 127°, latitude 49° 45′ to 50°), Vancouver Island. The Zeballos gold-mining camp is in this area and the work is expected to provide useful information on the source and character of the mineral deposits.

K. C. McTaggart was engaged in surveying and mapping the geology of the South Torrent and Wardner dam-sites on Kootenay River for the Dominion Water and Power Bureau. The work is part of an international project concerning the Columbia River drainage system.

A. F. Buckham completed present field investigations of the coalfields of southeastern Vancouver Island. His detailed studies, conducted continuously over a period of several years, have led to revised conceptions of the structure of the region. This should be of practical value in developing and mining the coal deposits.

H. W. Little began geological mapping of the Ymir area (longitude 117° to 117° 15′, latitude 49° 15′ to 49° 30′). The Ymir camp became widely known for its gold properties in the early years of the century. It experienced renewed activity from 1934 to 1943, when some of the larger mines produced base metals as well as gold and silver. Properties undergoing development and making shipments were examined.

V. J. Okulitch investigated the stratigraphy of Late Precambrian and early Palæozoic formations in the Salmon Arm and Pend-d'Oreille River areas, in an initial effort to define the base of the Palæozoic system in this part of the Canadian Cordilleran region.

W. E. Cockfield assisted the Dominion Water and Power Bureau in investigating the Columbia River drainage system, visited several mining properties in the Province, and examined several limestone deposits with the object of finding a cheap source of this rock for agricultural purposes in the lower Fraser Valley.

E. B. Owen, in co-operation with the Dominion Water and Power Bureau of the Department, made field and laboratory studies of conditions at the Gibralter and Torrent dam-sites on Kootenay River, British Columbia. He returned to Ottawa in early November, and was replaced by E. Hall, also of the Geological Survey.

BRITISH COLUMBIA AND ALBERTA

L. D. Burling collected fossils from Cambrian formations within a triangular area outlined by Cranbrook on the southwest, Golden on the northwest, and Banff on the northeast. Among the collections were some from ten hitherto inadequately represented formations, and the study of the material should go far toward completing a standard Cambrian section for the Canadian Cordillera.

ALBERTA

A. H. Lang and E. J. W. Irish completed geological mapping of the Pierre Grey Lakes area (longitude 113° 45′ to 114°, latitude 53° 45′ to 54°). The area includes the southeasterly extension of what may be an important oil structure and source of deposits of Lower Cretaceous and Paleocene coal.

E. J. W. Irish completed geological mapping of the Moon Creek area (longitude 118° 15′ to 118° 30′, latitude 53° 30′ to 53° 45′), begun the previous year. The area lies along the western flank of the Foothills belt in which oil structures are being tested and important coalfields have been developed.

R. J. W. Douglas completed geological mapping of the Gap area (longitude 114° 15′ to 114° 30′, latitude 49° 45′ to 50°) begun the previous year, and began geological mapping of the Mount Head area (longitude 114° 30′ to 114° 45′, latitude 50° 15′ to 50° 30′). The Gap area includes potential oil structures and the Mount Head area contains important coal measures.

E. P. Williams began geological mapping of the Cardston area (longitude 113° 15′ to 113° 30′, latitude 49° to 49° 15′). The area lies within the eastern part of the southern Foothills belt where structures favourable to the accumula-

tion of oil and natural gas may occur. Coal seams of economic importance have been reported from the St. Mary River and Belly River formations, which occupy much of the area.

A. M. Stalker continued investigating ground-water supplies and Pleistocene geology in the vicinity of Red Deer, in south-central Alberta.

W. A. Bell spent two months in southern Alberta gathering palaeontological data that might assist in establishing the Cretaceous-Tertiary boundary in that region. The results of this study will be incorporated in an illustrated report on the flora of the late Cretaceous and Paleocene formations of Alberta.

J. S. Wonfor continued studying subsurface formations and 55 core samples from wells in southern Alberta. In Montana, he examined type sections of outcropping formations, to assist in subsurface correlations north of the International Boundary.

C. M. Sternberg continued collecting dinosaur remains and plant fossils from the upper Edmonton beds along Red Deer Valley near Ardley. The principal purpose of this work is to assist in fixing the position of the Upper Cretaceous-Paleocene contact.

ALBERTA AND SASKATCHEWAN

R. T. D. Wickenden studied drill cores and other well samples from the Lloydminster field in order to interpret the subsurface stratigraphy and its relation to the occurrence of petroleum and natural gas. On the Athabaska River below Athabaska, he studied exposed sections of formations that lie 1,000 to 1,800 feet below the surface in the Lloydminster area.

SASKATCHEWAN

A. M. Christie began geological mapping of the Martin Lake area (longitude 108° 15′, to 108° 30′, latitude 59° 30′ to 59° 45′), north of Lake Athabaska. The area is in a region of geological complexity, and one in which gold deposits and occurrences of uranium minerals have been found.

G. E. P. Eastwood began geological mapping of the Snake Rapids area (longitude 102° 30′ to 102° 45′, latitude 54° 30′ to 54° 45′), on the western continuation of the Flin Flon mineral belt.

MANITOBA

J. M. Harrison completed most of the geological mapping of the Kississing area (longitude 100° to 102°, latitude 55° to 56°), which contains many gold and base metal prospects and includes the Sherritt-Gordon mine.

D. S. Robertson began geological mapping in the Nokomis Lake area (longitude 100° 45′ to 101°, latitude 55° to 55° 15′). Several sulphide deposits exist and gold was discovered in the area in 1947.

M. J. Frarey continued geological mapping of the Crowduck Bay area (longitude 99° 30′ to 99° 45′, latitude 54° 40′ to 55°), begun the previous year. The area lies east of the Herb Lake-Snow Lake gold region. It includes one gold property, lithium (spodumene) deposits, and several scattered showings of gold, copper, lead, and nickel minerals.

J. A. Elson continued investigating ground-water conditions and Pleistocene geology in the extreme southwestern part of the Province. These investigations, begun the previous year, have covered about 72 townships.

ONTARIO

J. B. Currie began detailed geological mapping of Ossian township, west of the Quebec boundary on the Rouyn-Larder Lake mineral belt. Exposures are mainly of Keewatin volcanic rocks, in which several gold prospects have been explored. Encouraging gold assays have been reported from samples taken in the vicinity of Labyrinth Lake.

J. F. Caley continued systematic geological mapping of the Palæozoic sedimentary formations east of Lake Simcoe. The stratigraphic sequence established will assist correlation of strata containing oil or gas throughout the Province. Dr. Caley also brought up-to-date the records of recent drilling in southwestern Ontario.

R. E. Deane studied and mapped the Pleistocene deposits of the adjoining Brechin and Beaverton areas (longitude 79° to 79° 15′, latitude 44° 15′ to 44° 45′). His party also collected data on all water wells as a basis for studying the ground-water resources of these areas.

T. L. Tanton made detailed geological examinations of rocks in the vicinity of the iron ore deposits at Steeprock Lake, and collected fossil plants from sediments believed to be of Cretaceous age. At Silver Harbour, he discovered a mineral identified as danburite, in a vein in diabase. It is the first occurrence of this mineral on record in Canada. He inspected Silver Mountain mine, where old workings have been reopened to provide material for mill tests on the possible recovery of fluorspar and other minerals from veins formerly mined for their silver content.

H. V. Ellsworth studied pegmatite occurrences in the Parry Sound district, including Geiger counter surveys, and also re-examined the Lansdowne township quartz-crystal deposit in Leeds county.

J. R. Marshall spent three weeks in the Parry Sound district and in Lansdowne township, Leeds county, collecting rock and mineral material for eventual distribution to the public.

QUEBEC

T. L. Tanton made a geological examination of an area adjacent to Heney Lake in Hincks and Northfield townships, where exploration for iron ore is being carried on by trenching, diamond drilling, and geophysical prospecting. He also examined large bodies of ilmenite in anorthosite at Lac Tio, north of Havre St. Pierre, on the north shore of the St. Lawrence. The airborne magnetometer was of great value in delimiting the orebodies. He inspected extensive deposits of hematite in Labrador and Quebec, which are being explored as potential iron ore deposits by Labrador Mining and Exploration Company, Limited, and Hollinger North Shore, Limited.

C. H. Stockwell continued detailed geological mapping in western Beauchastel and Dasserat townships, in an area lying between the Quebec gold and base metal belt on the east and the Kirkland Lake-Larder Lake gold belt on the west. It is expected that the work will assist in further exploration of the intervening territory.

A. S. MacLaren completed geological mapping of the Senneterre area (longitude 77° to 77° 30′, latitude 48° to 48° 30′), where much detailed and 1-mile mapping had been done in previous years. The southern part of this area includes the numerous gold properties along, or north of, the Cadillac belt within Dubuisson, Bourlamaque, and Louvicourt townships. There are also numerous deposits of gold and base metal ores and strategic minerals in other parts of the area.

K. R. Dawson and M. Tiphane completed geological mapping of the adjoining Shamus, Lac Marrias, Lac Sabourin, and Lac Marmette areas (longitude 77° to 78°, latitude 47° 45′ to 48°). These areas lie just south of the Cadillac gold belt, and extend eastward into the Grenville geological sub-province of the Canadian Shield. A few gold prospects have been staked, and work has been done on a nickeliferous deposit in the Lac Marrias area.

H. C. Cooke continued systematic geological mapping and investigations in the Eastern Townships begun in 1943. The areas were Scotstown (longitude 71° to 71° 30′, latitude 45° 30′ to 45° 45′), Dudswell (longitude 71° 30′ to 72°, latitude

45° 30′ to 45° 45′), Sherbrooke (longitude 71° 30′ to 72°, latitude 45° 15′ to 45° 30′), and the east half of Richmond (longitude 72° to 72° 30′, latitude 45° 30′ to 45° 45′). These areas comprise part of a belt of intensely folded and faulted Palæozoic rocks bordering the gently folded strata of the St. Lawrence lowland to the west. The belt includes valuable asbestos and chromite deposits, and copper deposits that were mined as recently as 1937. Another season's field work should complete requirements for a comprehensive report on this region.

NEW BRUNSWICK

G. S. MacKenzie continued systematic geological mapping in the Bay of Fundy region. He completed geological mapping of the Welsford area (longitude 66° to 66° 30′, latitude 45° 15′ to 45° 30′), which contains occurrences of copper and zinc minerals, and of graphite, limestone, and building stone.

NOVA SCOTIA

L. J. Weeks continued systematic geological mapping begun in 1944, within an area of six map-sheets in Cape Breton Island. The area lies between longitudes 59° 45′ and 60° 45′ and latitudes 45° 30′ and 46°, and centres in the Sterling lead-zinc mine. Work is almost completed in four of these map-areas, and preliminary geological maps, with descriptive notes, are being issued until such time as final editions and a memoir can be prepared.

H. L. Cameron completed geological mapping of the adjoining Margaree and Cheticamp areas (longitude 61° to 61° 15′, latitude 46° 15′ to 46° 45′), Cape Breton Island. The areas contain the St. Rose-Chimney Corner coalfield and deposits of industrial minerals and construction materials.

Office Work

Special reports and maps based on field examinations were prepared for limited distribution to various Departments. These reports dealt with occurrences of, and investigations for, pitchblende or other radioactive minerals; with specific mining properties or mining areas, and with assistance in engineering projects.

More than 800 exposures were made on 80 plates or films, and nine reports were issued on samples of rock and mineral specimens received for spectroscopic analyses. Five additions were made to the current collection of standard reference samples. Other work included assembling field kits for testing well waters, and examining and reporting on three lake-bottom samples from Great Slave Lake.

The mineral files of the Geological Survey now include all known geological information on more than 10,000 mines, prospects, and mineral occurrences in Canada. They also include unpublished data collected by members of the staff. They are useful to geologists in preparing for field work and in meeting requests for information on specific mines or mining areas.

The Paper series of mimeographed reports and preliminary blue-line maps continue to provide advance information on the results of field investigations. There was one report on the air photographs recently assembled by A. H. Lang, H. S. Bostock, and Y. O. Fortier of the field staff. Two others, illustrated by fossil plates, dealt with the Triassic system of formations in Western Canada. Ten reports and 21 maps were prepared for publication in this series, of which 14 maps were accompanied by descriptive notes.

The series of mimeographed water-supply papers provides information on ground-water conditions and Pleistocene geology in different parts of Canada. Each report is accompanied by a map in duplicate of the area covered, one part showing the geology and the other the locations and types of wells with

relation to the topography. Twenty-six of these reports and maps were prepared for publication. Eleven were of areas which embrace 16 townships each in Saskatchewan; 10 were of rural municipalities in Alberta and five were of townships in southern Ontario.

Among the publications forwarded for printing was a geological map of British Columbia on a scale of 1 inch to 20 miles; a map showing the physiographic divisions of the Canadian Cordillera north of the 55th parallel on a scale of 1 inch to 40 miles; and the Smithers-Fort St. James map, British Columbia, the first of a series of 8-mile compilation geological maps, based on the National Topographic series, which eventually will cover all of Canada. Other maps and reports prepared for publication included six memoirs, two Geological Survey bulletins, and 13 final editions of maps.

Palæontological Section

Reports were made on 33 fossil collections of which 20 were submitted by the Geological Survey, nine by oil companies, and four by the Department of Mines, British Columbia. Three additional reports were prepared through voluntary contributions by L. S. Russell, University of Toronto, Alice E. Wilson, Ottawa, and W. G. Sinclair, University of Western Ontario.

W. A. Bell reported on Mesozoic and Tertiary plant collections from Dezadeash area, Yukon; from Coal Creek and Fraser River areas, British Columbia; from Mount Head, Ardley, Moon Creek, and Pierre Greys Lakes areas; and from other localities in the foothills of Alberta. He also reported on invertebrate collections from Aiken Lake and Ymir areas, British Columbia; from southern New Brunswick; and from southern Cape Breton Island, Nova Scotia.

F. H. McLearn reported on Mesozoic invertebrate collections from Dezadeash area, Yukon; from Fraser River, Bridge River, Fernie, McConnell Creek, Whitesail Lake, Tetsa Valley, Moberly Lake, Sikanni Chief River, Daniels Creek, and Halfway and Prophet Rivers areas, British Columbia; from Cardston, Gap, Mount Head, Athabaska River, Moon Creek, and Pierre Greys Lakes areas, Alberta; and from drill cores from southern Alberta.

L. D. Burling reported on Cambrian fossil collections from southern British Columbia and from southern Cape Breton Island, Nova Scotia. He continued preparation of an illustrated index to published Cambrian fossils, and of reference collections representative of typical Cambrian fauna of the Cordilleran region.

C. M. Sternberg was engaged in preparatory work on dinosaur specimens from Alberta.

J. L. Usher was engaged during the summer in a study of Upper Cretaceous fossil collections from the Comox and Nanaimo coalfields, British Columbia.

B. J. Botte was engaged in preparatory work on invertebrate fossils, and compiling the locality catalogue of fossil collections.

Donations of fossil collections are acknowledged from Imperial Oil, Limited; Socony-Vacuum Oil Company; Shell Oil Company; Phillips Petroleum Company; and the British Columbia Department of Mines.

Mineralogical Section

Approximately 6,500 specimens of rocks and minerals were received and the results of their examination were embodied in 550 issued reports. Considerable attention was given to the extension and organization of the radioactive mineral program of the Geological Survey. This includes preparing an inventory of uranium and thorium resources, and accumulating radioactive data for rock formations throughout Canada. Testing of ores and mill products

of Canadian mines by Geiger counter and spectroscopic methods was in progress, and plans for more detailed and extensive work on ores and rocks were formulated. Detailed mineralogical research on ores of known occurrences was also continued. With the easing of governmental restrictions in prospecting for radioactive materials, it is expected that these testing facilities will need to be considerably increased.

During the year 1,867 collections, containing 67,522 specimens of rocks and minerals, were distributed. This is 242 collections and 10,617 specimens more than were contributed the previous year. There were unfilled requisitions for more than 15,000 specimens. The collections distributed comprised 826 sets of prospector's minerals, 874 sets of prospector's rocks, 73 miscellaneous collections, and 77 sets of strategic minerals. These were distributed as follows: British Columbia and Northwest Territories, 395; Alberta, 330; Saskatchewan, 107; Manitoba, 141; Ontario, 409; Quebec, 487; Maritime Provinces, 45; and foreign countries, 32.

Ground Water and Borings Section

The work includes the collection, organization, and filing of records dealing with the occurrence of oil, gas, and ground water from all parts of Canada. Samples of rock cuttings from wells drilled for oil, gas, and ground water are prepared for examination. There are 1,114,858 samples available for study, of which 77,316 were prepared during the year.

The number of drill samples received was: Northwest Territories, 1,439 samples from 8 wells; British Columbia, 138 samples from 2 wells; Alberta, 47,336 samples from 130 wells; Manitoba, 518 samples from 2 wells; Ontario 25,260 samples from 234 wells; Quebec, 1,119 samples from 8 wells; and Nova Scotia, 200 samples from 6 wells. Cores were received from the Northwest Territories, Manitoba, and Nova Scotia.

Samples from the Northwest Territories were mainly from the Frobisher Exploration Company's Hay River tests. Those from British Columbia came from water wells on Vancouver Island. Most of the Alberta samples were from wells drilled within known oil and gas fields, notably Leduc and Turner Valley, although some came from exploratory wells in unproven territory. The most important of these latter were the Roxana 4-K, Gulf Pincher Creek, and Muskeg wells in the Foothills regions. The Manitoba samples came mainly from the Langford Oil Syndicate well near Neepawa. Most of the Ontario samples were from areas in which oil and gas had been found. Those from Quebec were from wells in Gaspé county, and the Nova Scotia samples were from the Sun Oil Company's Sunoco 1-A well in Cumberland county.

Acknowledgments are due to the following persons and organizations through whose co-operation the samples were received: the Frobisher Exploration Company for cores and samples from Northwest Territories; the Petroleum and Natural Gas Conservation Board of Calgary, for all samples received from Alberta; the Manitoba Department of Mines and Natural Resources, for the Langford well samples; R. B. Harkness, Natural Gas Commissioner for Ontario, Toronto, for samples from Ontario; Paul Payette, for samples from Gaspé county, Quebec; and the Sun Oil Company for samples from its well in Cumberland county, Nova Scotia.

Acknowledgment is made to officials of the Petroleum and Natural Gas Conservation Board, who supplied periodical drilling reports, interim reports, electrologs, and maps dealing with drilling in Alberta; to F. H. Edmunds of the University of Saskatchewan for logs of wells, test holes, and shot holes in Saskatchewan; to the Department of Resources and Industrial Development, Saskatchewan, for monthly provincial drilling reports; to G. M. Furnival,

Director of Mines for Manitoba, for information on wells in Manitoba; to I. W. Jones of the Quebec Department of Mines, and to Paul Payette, for logs and other information on wells in Quebec; to T. H. Clark of McGill University, for maps and reports on subsurface conditions in the St. Lawrence Lowland; and to officials of many oil companies for much useful information.

Samples were examined from, and stratigraphic logs were compiled of, deep wells in Gaspé county, Quebec, and in Nova Scotia; several older wells in south-central Saskatchewan; the Gulf Pincher Creek well in southern Alberta; and recent wells in the Leduc field, Alberta, from which structure contour maps of the D_1, D_2, and D_3 zones were prepared. The Palæozoic section of the St. Lawrence Lowland was studied in the field, involving subsequent correlation and revision of logs.

Numerous inquiries on ground-water conditions were received from many parts of Canada. Records of water wells in Saskatchewan are kept by the Provincial Government, but several hundred logs of water wells were received from F. H. Edmunds, under whose supervision samples from these wells were examined. In Alberta, the Petroleum and Natural Gas Conservation Board forwarded copies of records of water wells being drilled in that Province. Officers of the Geological Survey publish analyses of water samples from areas in which ground-water investigations are made. Acknowledgments for water samples received are due to J. H. Rainsford, Royal Oak, British Columbia; O. V. Kennedy, Bridgetown, Nova Scotia; and the International Water Supply Company of Montreal.

Coal Section

The 1946 report of the Royal Commission on Coal led to preparation of memoranda, maps, and statistical data; field investigations; and participation in several committee meetings and conferences by the Section.

The following manuscript maps were prepared: an atlas of individual maps of the twelve workable coal seams of the Sydney coalfield, Nova Scotia, on a scale of 1 inch to 3 miles; detailed maps of each seam of the Sydney coalfield, on a scale of 1 inch to 1 mile, to serve as bases for subsequent stratigraphic investigations and microscopic studies of the coal; an atlas of sixteen maps of the coal seams of the Thorburn, Albion, and Westville areas of the Pictou coalfield, Nova Scotia, on a scale of 1 inch to 2,000 feet; an atlas of seven maps of the coal deposits of the Springhill-Joggins coalfields, on a scale of 1 inch to 1 mile; a compilation of much detailed information on the Minto coalfield of New Brunswick, as supplied by the Provincial Geologist; and an atlas of fifty geological maps covering each of fifty coal areas in Alberta, on a scale of 1 inch to 4 miles. This last atlas will be accompanied by a tabulated list of the coal occurrences, giving the essential data used in calculating coal reserves. Other work included a map of the Coalfields, Potential Coal Areas, and Coal Occurrences of Canada, on a scale of 1 inch to 230 miles, and a geological map of southern Saskatchewan, on a scale of 1 inch to 12 miles, showing some 2,000 coal occurrences.

B. R. MacKay, Chief of the Section, visited the Coalspur, Mountain Park, Cascade, Highwood, and Crowsnest coal areas of the Foothills belt and the Fernie coalfield of British Columbia, and assisted coal companies in various geological problems arising from their prospecting and mining operations. He attended two meetings of the Nova Scotia Research Foundation Committee at Halifax; held two conferences with officials of the Dominion Steel and Coal Corporation at Sydney, Nova Scotia; two conferences with the Provincial Geologist, at Fredericton, New Brunswick; attended a meeting on coal research at Chicago; and visited the Illinois Geological Survey at Urbana to confer on problems of microscopic coal research.

Geophysical Section

On a grant from the National Research Council, ground magnetometer surveys of sixteen quarter-townships in northern Quebec were compiled for publication on a scale of 1 inch to 1,000 feet.

In collaboration with the National Research Council, an airborne magnetometer acquired from the United States Navy was installed in an Anson aircraft, and test surveys were made from the National Research Council's Flight Research Section at Arnprior, Ontario. This survey covered about 3,000 square miles of the area between latitudes 44° 45′ and 45° 30′ and longitudes 75° 30′ and 76° 30′. The complete data for the western half of this area were plotted on a scale of 1 inch to ½ mile. Plotting of the eastern half was begun.

Twenty-five Geiger-Mueller counters acquired from the National Research Council were overhauled and tested, and a new, light-weight model weighing 4 pounds was designed. Six of these counters will be made for field tests.

British Columbia Office

The British Columbia office works in co-operation with an adjoining branch office of the British Columbia Department of Mines. It maintains a complete library of all Geological Survey publications, textbooks, and current periodicals on geology and mining. It distributes Departmental geological maps and reports dealing with British Columbia and Yukon. Visitors seeking information numbered 4,381, and many inquiries were handled by mail and telephone. Altogether, 3,200 reports and 3,350 separate maps were issued in response to requests from the public. Determinations were also made of several rock and mineral specimens.

DRAUGHTING AND REPRODUCING DIVISION

Maps Published

Publication Number	Title	Remarks
	Canada	
900A	Canada Mining Areas; scale, 1 inch to 125 miles.....	For separate distribution.
	Coalfields, Potential Coal Areas and Coal Occurrences of Canada (English and French editions); scale, 1 inch to 230 miles.....	For Canada Year Book and separate distribution.
	Canada, Type of Farming Areas, 1941.....	For Department of Agriculture.
	Yukon	
	Dezadeash; scale, 1 inch to 4 miles.....	Preliminary Geological Map. Paper 47-15A.
	Yukon and British Columbia	
922A	Physiographic Subdivisions of the Canadian Cordillera, north of 55th parallel; scale, 1 inch to 40 miles.....	Physiography for Memoir by H.S. Bostock and separate distribution.
	Northwest Territories	
467A	Fort Smith Sheet, District of Mackenzie (reprint); scale, 1 inch to 4 miles.....	Topography. For separate distribution.
675A	Indin Lake, District of Mackenzie (reprint); scale, 1 inch to 4 miles.....	Topography. For separate distribution.

Maps Published—Continued

Publication Number	Title	Remarks
935A	Chalco Lake, District of Mackenzie; scale, 1 inch to 1 mile	Topography. For separate distribution.
936A	Ranji Lake, District of Mackenzie; scale, 1 inch to 1 mile	Topography. For separate distribution.
937A	Prelude Lake, District of Mackenzie; scale, 1 inch to 1 mile	Topography. For separate distribution.
	Chalco Lake; scale, 1 inch to ½ mile	Preliminary geological map. Paper 47-18A.
	Ross Lake; scale, 1 inch to ½ mile	Preliminary geological map. Paper 47-16A.
	BRITISH COLUMBIA	
886A	Nicola, Kamloops and Yale Districts; scale, 1 inch to 4 miles	Geology. For Memoir by W.E. Cockfield and separate distribution.
887A	Nicola, Kamloops and Yale Districts; scale, 1 inch to 4 miles	Minerals. For Memoir by W.E. Cockfield and separate distribution.
888A	Princeton, Yale, Kamloops, Similkameen and Osoyoos Districts; scale, 1 inch to 4 miles	Geology. For Memoir 243 by H.M.A. Rice and separate distribution.
889A	Princeton, Yale, Kamloops, Similkameen and Osoyoos Districts; scale, 1 inch to 4 miles	Minerals. For Memoir 243 by H.M.A. Rice and separate distribution.
907A	Fort St. James; scale, 1 inch to 6 miles	Geology. For Memoir by J. E. Armstrong and separate distribution.
909A	Tofino; scale, 1 inch to 1 mile	Topography. For separate distribution.
912A	Effingham; scale, 1 inch to 1 mile	Topography. For separate distribution.
914A	Alberni; scale, 1 inch to 1 mile	Topography. For separate distribution.
915A	Buttle Lake; scale, 1 inch to 1 mile	Topography. For separate distribution.
916A	Cape Scott; scale, 1 inch to 1 mile	Topography. For separate distribution.
917A	Shushartie; scale, 1 inch to 1 mile	Topography. For separate distribution.
918A	Quatsino; scale, 1 inch to 1 mile	Topography. For separate distribution.
919A	Port McNeill; scale, 1 inch to 1 mile	Topography. For separate distribution.
938A	Bennett; scale, 1 inch to 4 miles	Topography. For separate distribution.
	Ashcroft (second edition); scale, 1 inch to 2 miles	Preliminary geological map. Paper 47-10.

Maps Published—Continued

Publication Number	Title	Remarks
	Carp Lake (Bedrock) Carp Lake (Surface deposits)	Preliminary geological maps. Paper 47-13 A, B.
	Nanaimo Coalfield; scale, 1 inch to 1 mile	Preliminary geological map. Paper 47-22.
	ALBERTA	
894A	Southesk, West of Fifth Meridian; scale, 1 inch to 1 mile	Topography. For separate distribution.
899A	Gregg Lake, West of Fifth Meridian; scale, 1 inch to 1 mile	Geology. For separate distribution.
904A	Athabaska Falls, West of Fifth Meridian; scale, 1 inch to 1 mile	Topography. For separate distribution.
905A	Brûlé, West of Fifth Meridian; scale, 1 inch to 1 mile	Geology. For Memoir 244, by A.H. Lang, and separate distribution.
923A	Donald Flats, West of Sixth Meridian; scale, 1 inch to 1 mile	Topography. For separate distribution.
924A	Medicine Lake, West of Fifth Meridian; scale, 1 inch to 1 mile	Topography. For separate distribution.
945A	Two Lakes, West of Sixth Meridian; scale, 1 inch to 1 mile	Topography. For separate distribution.
	Moberly Creek; scale, 1 inch to ½ mile	Preliminary geological map. Paper 47-11.
	Langford Creek; scale, 1 inch to ½ mile	Preliminary geological map. Paper 47-19.
	Gap; scale, 1 inch to ½ mile	Preliminary geological map. Paper 47-23.
	SASKATCHEWAN	
895A	Geological map of Saskatchewan; scale, 1 inch to 20 miles	Geology. For separate distribution.
	MANITOBA	
906A	Tramping Lake, West of Principal Meridian; scale, 1 inch to 1 mile	Topography. For separate distribution.
921A	Buzz Lake, West of Principal Meridian; scale, 1 inch to 1 mile	Topography. For separate distribution.
930A	Nor-Acme Mine Area; scale, 1 inch to 1,000 feet	Geology. For Memoir by J. M. Harrison, and separate distribution.
	ONTARIO	
589A	Capreol, Sudbury District (reprint); scale, 1 inch to 2 miles	Topography. For separate distribution.
	Sutton and Barrie; scale, 1 inch to 1 mile (approx.)	Preliminary geological maps. Paper 47-21A, B.

Maps Published—Continued

Publication Number	Title	Remarks
	QUEBEC	
908A	Dudswell; scale, 1 inch to 1 mile	Geology. For separate distribution.
925A	St. Patrick Lake; scale, 1 inch to 1 mile	Topography. For separate distribution.
928A	Barraute; scale, 1 inch to 1 mile	Topography. For separate distribution.
939A	Lac Dumoine; scale, 1 inch to 1 mile	Topography. For separate distribution.
947A	Lac Brûlé; scale, 1 inch to 1 mile	Topography. For separate distribution.
	Vauquelin (in 4 sheets); scale, 1 inch to 1,000 feet	Preliminary geological maps. Paper 47-6A, B, C, D.
	Pershing (in 4 sheets); scale, 1 inch to 1,000 feet	Preliminary geological maps. Paper 47-7A, B, C, D.
	Lacorne; scale, 1 inch to ½ mile	Preliminary geological map. Paper 47-8.
	Barraute; scale, 1 inch to ½ mile	Preliminary geological map. Paper 47-9.
	Vauquelin, Pershing and Haig townships; scale, 1 inch to 1 mile	Preliminary geological map. Paper 47-12.
	Dubuisson, Boulamaque and Louvicourt; scale, 1 inch to 1 mile	Preliminary geological map. Paper 47-20.
	Shamus; scale, 1 inch to 1 mile	Preliminary geological map. Paper 47-27.
	Lac Sabourin; scale, 1 inch to 1 mile	Preliminary geological map. Paper 48-2.
	NEW BRUNSWICK	
269A	Moncton Sheet (reprint); scale, 1 inch to 1 mile	Topography. For separate distribution.
402A	Petitcodiac, East half (reprint); scale, 1 inch to 1 mile	Topography. For separate distribution.
403A	Petitcodiac, West half (reprint); scale, 1 inch to 1 mile	Topography. For separate distribution.
920A	Minto, scale, 1 inch to 1 mile	Topography. For separate distribution.
926A	Campobello; scale, 1 inch to 1 mile	Topography. For separate distribution.
927A	Grand Manan; scale, 1 inch to 1 mile	Topography. For separate distribution.
	NOVA SCOTIA	
241A	Digby Sheet (reprint); scale, 1 inch to 1 mile	Topography. For separate distribution.
253A	Bridgetown Sheet (reprint); scale, 1 inch to 1 mile	Topography. For separate distribution.
893A	Kennetcook; scale, 1 inch to 1 mile	Topography. For separate distribution.

Maps Published—Concluded

Publication Number	Title	Remarks
897A	Shubenacadie; scale, 1 inch to 1 mile	Topography. For separate distribution.
	Mira—Framboise; scale, 1 inch to 1 mile	Preliminary geological map. Paper 47-17.
	FOR REPORT OF NORTH PACIFIC PLANNING PROJECT	
	(a) Index Map.	
	(b) Geology; scale, 1 inch to 80 miles.	
	(c) Physiography; scale, 1 inch to 80 miles.	
	(d) Forestry; scale, 1 inch to 80 miles.	
	(e) Agriculture; scale, 1 inch to 80 miles.	
	(f) Water Power; scale, 1 inch to 80 miles.	
	(g) Transportation; scale, 1 inch to 80 miles.	
33	(h) Meteorology (graph).	
	(i) Trade (chart).	
	MISCELLANEOUS	
	(a) Coal occurrences in Northwest Territories. (b) Coalfields and Potential Coal Areas of Yukon	For Report by B.R. MacKay.
	Upper Triassic of Pardonet Hill, Peace River Foothills, British Columbia (Half-tone plates of fossils and Figure)	Palæontology. To accompany Paper 47-14.
Figure 2	Geology of the Codroy Area, Newfoundland	To illustrate Bulletin 10 by W.A. Bell.
Figure 3	Geology of part of the southeast coast of St. Georges Bay, Newfoundland	To illustrate Bulletin 10 by W.A. Bell.
	Triassic Nathorsites fauna of northeastern British Columbia (Half-tone plates of fossils and Figures)	Palæontology. To accompany Paper 47-24.

At the end of the fiscal year seven geological maps, including one of British Columbia and one of the Maritime Provinces, were about to be published. Ten topographical maps were with the Geographical Section, Department of National Defence, for printing. A geological map of Yukon, seven standard geological maps, and fifty geological coal areas of Alberta were being compiled. Thirteen standard topographical maps were in progress. One hundred and forty-four sections of the Bituminous Sands of Northern Alberta were in progress for publication in the report.

Thirteen preliminary maps for the Ground Water Resources Section were drawn for publication. One hundred and eighty-nine maps and scientific figures were drawn for reproduction by zinc-cut process for illustrating memoirs, reports, articles, and papers. One hundred and thirty-three of these were to complete illustrations for the Canadian Institute of Mining and Metallurgy symposium "Structural Controls of Canadian Ore Deposits". Other draughting and miscellaneous projects necessary for staff, mineral development, and public use, amounted to more than 1,200 separate items.

Library

Good progress was made in resuming exchanges interrupted during the war. Valuable material reached the library, although much work remains to be done before all exchanges are re-established. Progress was made in catalogueing maps accumulated during the war. The acute shortage of space in the library was partly overcome by building a floor over the centre stacks and erecting shelves thereon.

Literature was acquired by gift and purchase. Included were 11 volumes from the Royal Danish Academy of Science; 26 volumes from the Norwegian Academy of Science; a set of The Queensland Flora in 7 volumes, presented by the Government of Queensland; 10 volumes from the Norwegian Geological Survey; 23 volumes of the Quarterly Journal of the Geological Society of London, presented by the Library of Parliament; 18 volumes from the Royal Museum of Natural History of Belgium; 13 volumes from the Institut d'Egypte; 8 volumes of the Internationales Archiv fur Ethnographie and 6 volumes of l'*Oiseau* et la revue francaise d'ornithologie. Bergens Museum and the Service de la Carte Geologique de France made extensive contributions, and valuable material was received from the Geological Society of America.

Acquisitions to the library were:

Books acquired by purchase	183
Books (complete unbound Volumes by purchase)	151
Books by transfer, exchange, and gift	942
Canadian Government documents—individual issues (by gift and exchange)	2,287
British and Foreign Government documents—individual issues (by gift and exchange)	2,696
Canadian periodicals, individual issues	1,424
British and Foreign periodicals, individual issues	2,096
Scientific societies' bulletins, proceedings and transactions—individual issues (by gift and exchange)	4,813
	14,592

Other data:

Recorded loans of books, pamphlets, periodicals	14,291
Inter-library and occasional loans	1,747
Books borrowed from other libraries	301
Maps and charts added to the library	935
Maps and charts borrowed from the library	443
Lantern slides borrowed	615
Lantern slides added to the library	214
Photographs loaned (exclusive of albums)	2,813
Volumes bound	401
Volumes accessioned	1,411
Cards added to general catalogue	12,377
Cards added to map catalogue	787
Cards added to slide catalogue	482
Letters and cards received	1,752
Letters and cards sent	2,367

Photographic Section

The expanding activities of Geological Survey were reflected in the increased production of this Section. The photographic needs of the National Museum of Canada continued to be met.

Details of the work done are as follows:

Bromide enlargements, sizes—3 x 4 to 32 x 40	6,982
Contact prints, sizes—1½ x 2½ to 36 x 48	17,510
Van Dyke prints, sizes—5 x 7 to 35 x 47	1,383
Negatives retouched	540
Dry plate negatives made	987
Kodalith negatives made	635
Van Dyke negatives made	136
Exposures developed—(Field work)	7,100
Linen negatives made—24 x 30 to 38 x 47	12
Linen prints made	12
Aero mapping prints	48
Celluloid scales—5 x 7 to 30 x 40	151
Autoradiographs	59
Lantern slides	573
Maps and photographs dry mounted	2,658
Grid positives on glass	154
Microphoto negatives made	21

Blueprint, Photostat, and Lapidary Services

The output was:

Blueprint—247,151 sq. ft.—33,049 prints
Océ prints—41,345 sq. ft.—4,789 prints
Photostats—14,414 sheets
Lapidary—Thin sections, 1,873
Cut and polished sections, 33

PUBLICATIONS

Following is a list of publications issued during the fiscal year.

English Publications

Report No.

A Century in the History of the Geological Survey of Canada, by F. J. Alcock.

Economic Geology Series No. 1. *Geology and Economic Minerals of Canada.* (Third edition.)

G.S. Bulletin No. 9. *Trilobita of the Ottawa Formation of the Ottawa-St. Lawrence Lowland*, by Alice E. Wilson.

G.S. Bulletin No. 10. *Early Carboniferous Strata of St. Georges Bay Area, Newfoundland*, by W. A. Bell.

2479 Memoir 244. *Brûlé and Entrance Map-areas, Alberta*, by A. H. Lang.

Reprints of sections in *Report of Royal Commission on Coal pertaining to Coal Reserves in Canada* being Chapter I, Appendix A.

Catalogue of Geological Survey Publications.

*47- 1 *The Upper Part of the Edmonton Formation of Red Deer Valley, Alta.*, by C. M. Sternberg.

*47- 2 *Exploration for Pétroleum, Northwest Territories, 1946*, by J. S. Stewart.

* Indicates a mimeographed report.

English Publications—Continued

Report No.	
*47- 3	*Haig Abitibi Country, Quebec,* by G. W. H. Norman and K. R. Dawson. (Maps only.)
*47- 4	*Camsell River, Northwest Territories,* by C. S. Lord. (Map only.)
*47- 5	*Lac de Gras, N.W.T.,* by R. E. Folinsbee. (Map only.)
*47- 6	*Vauquelin, Abitibi Country, Quebec,* by G. W. H. Norman and H. C. Norman. (Maps only.)
*47- 7	*Pershing, Abitibi County, Quebec,* by G. W. H. Norman and M. Tiphane. (Maps only.)
*47- 8	*Lacorne Map-area, Abitibi County, Quebec,* by L. P. Tremblay. (Report and map.) (Second edition.)
*47- 9	*Barraute, Abitibi County, Quebec,* by L. P. Tremblay. (Map only.)
*47-10	*Ashcroft, B.C.,* by S. Duffell and K. C. McTaggart. (Map and descriptive notes.)
*47-11	*Moberly Creek Map-area, Alberta,* by A. H. Lang. (Report and map.)
*47-12	*Vauquelin, Pershing, and Haig Townships, Abitibi County, Quebec,* by G. W. H. Norman. (Report and map.)
*47-13	*Carp Lake, B.C.,* by J. E. Armstrong, H. W. Tipper, and J. W. Hoadley. (Maps only.)
*47-14	*Upper Triassic Faunas of Pardonet Hill, Peace River Foothills, B.C.,* by F. H. McLearn.
*47-15	*Dezadeash Map-area, Yukon,* by E. D. Kindle. (Report and map.)
*47-16	*Ross Lake, N.W.T.,* by Y. O. Fortier. (Map and descriptive notes.)
*47-17	*Mira-Framboise Cape Breton and Richmond Counties, Nova Scotia,* by L. J. Weeks. (Map only.)
*47-18	*Chalco Lake Map-area, N.W.T.,* by M. S. Stanton. (Report and map.)
*47-19	*Langford Creek, Alberta,* by R. J. W. Douglas. (Map only.)
*47-21	*Pleistocene Deposits and Beaches of Sutton and Barrie Map-area, York and Simcoe Counties, Ont.,* by R. E. Deane. (Maps only.)
*47-22	*Nanaimo Coalfield British Columbia,* by A. F. Buckham. (Map only.)
*47-23	*Gap, Alberta,* by R. J. W. Douglas. (Map only.)
*47-24	*The Triassic Nathorstites Faund in Northeastern B.C.,* by F. H. McLearn.
*47-25	*Moon Creek Map-area, Alberta,* by E. J. W. Irish. (Report and map.)
*47-26	*Interim Catalogue of the Geological Survey Collections of outstanding air photographs,* by A. H. Lang, H. S. Bostock, and Y. O. Fortier.
*47-27	*Shamus, Abitibi and Pontiac Counties, Quebec,* by M. Tiphane. (Map only.)
*48- 2	*Lac Sabourin, Témiscamingue and Abitibi Counties, Quebec,* by K. R. Dawson. (Map only.)

* Indicates a mimeographed report.

SURVEYS AND MAPPING BUREAU

The Surveys and Mapping Bureau was formed during the re-organization of the Department in November, 1947. It was created to co-ordinate the work of the various surveying and mapping units to prevent overlapping of effort and to make full use of the small number of trained men available.

The new Bureau has five divisions, each with its own functions. Collectively, they do the surveying, mapping, and charting for the development of the natural resources of the country, and for administrative purposes. Difficulty in recruiting qualified personnel has handicapped efforts to meet the increased demand for this work.

The Geodetic Survey Division does the work of the former Geodetic Service of the Surveys and Engineering Branch. It provides a national system of levelling and precise triangulation surveys for use as geodetic control by Federal and Provincial departments and private agencies. It provides a control for international and interprovincial boundaries, and data concerning horizontal and vertical movements of the earth's crust.

The Canadian Hydrographic Service, formerly the Hydrographic Service of the Hydrographic and Map Service under the Surveys and Engineering Branch, produces and distributes all Canadian aids to navigation. It makes surveys, and compiles and distributes navigation charts, volumes of "Pilots and Sailing Directions" covering coastal and inland waters, standard tidal publications, and "Water Level Bulletins" for the St. Lawrence-Great Lakes Waterways.

The Legal Surveys, a division of the former Hydrographic and Map Service, is responsible for all legal surveys of Dominion Lands required by the Federal Government. It compiles, from trimetrogon photographs to the map manuscript stage, the information for air charting; prepares information for the Dominion electoral maps; and distributes a wide variety of maps and air charts.

The Topographical Survey, formerly a division of the Bureau of Geology and Topography, is responsible for original mapping at scales of one inch to four miles or greater. It plots maps to the manuscript stage from information secured by field surveys and from air photographs. The National Air Photographic Library is a section of the Topographical Survey, and the staff of the Geographic Board is under its administration.

The Map Compilation and Reproduction Division draughts, reproduces, and prints maps and air charts originating in the Topographical and Legal Surveys Divisions, and photographs and prints hydrographic charts.

TOPOGRAPHICAL SURVEY

The Topographical Survey prepares ground and air maps from its original surveys, and compiles base maps for use in developing natural resources. The Topographical Mapping Section is responsible for field surveys and computations pertaining to field work. The Air Survey Section plots information from aerial photographs into map form, and conducts research in, and development of, photogrammetrical methods. The Map Editing Section is responsible for editing and finishing map manuscripts and drawing projections.

The National Air Photograph Library became, in November, 1947, a part of the Topographical Survey.

The expansion of staff was seriously delayed by lack of adequate office space and difficulty in obtaining suitable field officers.

Topographical Mapping Section

The work of this Section comprises control surveys for aerial photographic maps, topographical mapping, and computation of geographical positions from the field surveys. Thirty-two parties were engaged in field surveys in the areas specified:

FIELD WORK—1947

Officer in Charge	Sheet Name	Sheet Number	Latitude and Longitude	Scale of Publication
	Nova Scotia			
D. A. MacKay.....	Margaree.....	11 K/6	46° 15′– 46° 30′ 61° 00′– 61° 31′	1 in. to 1 mi.
	*St. Ann's.....	11 K/7	46° 15′– 46° 30′ 60° 30′– 61° 00′	1 in. to 1 mi.
R. T. Gahda.....	Antigonish.....	11 F/12	45° 30′– 45° 45′ 61° 30′– 62° 00′	1 in. to 1 mi.
P. J. Dunsworth....	Gaspereau Lake.....	21 A/15	44° 45′– 45° 00′ 64° 30′– 65° 00′	1 in. to 1 mi.
	*Windsor.....	21 A/16	44° 45′– 45° 00′ 64° 00′– 64° 30′	1 in. to 1 mi.
A. B. Grant.....	Lockeport.....	20 P/11	43° 30′– 43° 45′ 65° 00′– 65° 30′	1 in. to 1 mi.
	Pubnico.....	20 P/12	43° 30′– 43° 45′ 65° 30′– 66° 00′	1 in. to 1 mi.
	Tusket.....	20 P/13	43° 45′– 44° 00′ 65° 30′– 66° 00′	1 in. to 1 mi.
	Shelburne.....	20 P/14	43° 45′– 44° 00′ 65° 00′– 65° 30′	1 in. to 1 mi.
	Port Mouton.....	20 P/15	43° 45′– 44° 00′ 64° 30′– 65° 00′	1 in. to 1 mi.
	New Brunswick			
[1]J. A. Macdonald...	Minto.....	21 J/1	46° 00′– 46° 15′ 66° 00′– 66° 30′	1 in. to 1 mi.
	*Chipman.....	21 I/4	46° 00′– 46° 15′ 65° 30′– 66° 00′	1 in. to 1 mi.
	Kouchibouguac.....	21 I/14	46° 45′– 47° 00′ 65° 00′– 65° 30′	1 in. to 1 mi.
	Rogersville.....	21 I/11	46° 30′– 46° 45′ 65° 00′– 65° 30′	1 in. to 1 mi.
	Blackville.....	21 I/12, E.½	46° 30′– 46° 45′ 65° 30′– 65° 45′	1 in. to 1 mi.
	Lake Stream.....	21 I/5	46° 15′– 46° 30′ 65° 30′– 66° 30′	1 in. to 1 mi.
	Harcourt.....	21 I/6	46° 15′– 46° 30′ 65° 00′– 65° 30′	1 in. to 1 mi.
	Salisbury.....	21 I/3	46° 00′– 46° 15′ 65° 00′– 65° 30′	1 in. to 1 mi.
Rheo McDonald..	Big Bald Mtn.....	21 O/1	47° 00′– 47° 15′ 66° 00′– 66° 30′	1 in. to 1 mi.
	California Lake.....	21 O/8	47° 15′– 47° 30′ 66° 00′– 66° 30′	1 in. to 1 mi.

FIELD WORK—*Continued*

Officer in Charge	Sheet Name	Sheet Number	Latitude and Longitude	Scale of Publication
	Doaktown	21 J/9	46° 30′– 46° 45′ / 66° 00′– 66° 30′	1 in. to 1 mi.
	Hayesville	21 J/10	46° 30′– 46° 45′ / 66° 30′– 67° 00′	1 in. to 1 mi.
	Tuadook Lake	21 J/15,E½	46° 45′– 47° 00′ / 66° 30′– 66° 45′	1 in. to 1 mi.
	McKendrick Brook	21 J/16	46° 45′– 47° 00′ / 66° 00′– 66° 30′	1 in. to 1 mi.
W. G. Landles	Gounamitz River	21 O/12	47° 30′– 47° 45′ / 67° 30′– 68° 00′	1 in. to 1 mi.
	McDougall Brook	21 O/13	47° 45′– 48° 00′ / 67° 30′– 68° 00′	1 in. to 1 mi.
	Grandmaison	21 N/9	47° 30′– 47° 45′ / 68° 00′– 68° 30′	1 in. to 1 mi.
	Wild Goose Lake	21 N/16	47° 45′– 48° 00′ / 68° 00′– 68° 30′	1 in. to 1 mi.
	Baker Lake	21 N/7	47° 15′– 47° 30′ / 68° 30′– 69° 00′	1 in. to 1 mi.
	Quebec			
[2]H. N. Spence	Dyke Lake	Triangulation		
J. F. MacLean	Oak Bay	22 B/2	48° 00′– 48° 15′ / 66° 30′– 67° 00′	1 in. to 1 mi.
	Jerome Brook	22 B/7	48° 15′– 48° 30′ / 66° 30′– 67° 00′	1 in. to 1 mi.
	Skimenac River	22 B/8	48° 15′– 48° 30′ / 66° 00′– 66° 30′	1 in. to 1 mi.
	Big Berry Mtns	22 B/9	48° 30′– 48° 45′ / 66° 00′– 66° 30′	1 in. to 1 mi.
	Boutet	22 B/10	48° 30′– 48° 45′ / 66° 30′– 67° 00′	1 in. to 1 mi.
	Mt. Logan	22 B/15	48° 45′– 49° 00′ / 66° 30′– 67° 00′	1 in. to 1 mi.
	Mt. Albert	22 B/16	48° 45′– 49° 00′ / 66° 00′– 66° 30′	1 in. to 1 mi.
	St. Ann des Monts	22 G/1	49° 00′– 49° 15′ / 66° 00′– 66° 30′	1 in. to 1 mi.
	Cap Chat	22 G/2	49° 00′– 49° 15′ / 66° 30′– 67° 00′	1 in. to 1 mi.
H. D. Worden	Chambord	32 A/8	48° 15′– 48° 30′ / 72° 00′– 72° 30′	1 in. to 1 mi.
	Roberval	32 A/9	48° 30′– 48° 45′ / 72° 00′– 72° 30′	1 in. to 1 mi.
	Dolbeau	32 A/16	48° 45′– 49° 00′ / 72° 00′– 72° 30′	1 in. to 1 mi.
S. G. Gamble	Pascalis detail	32 C/3, 4 (parts)		1 in. to 1,000 ft.

FIELD WORK—*Continued*

Officer in Charge	Sheet Name	Sheet Number	Latitude and Longitude	Scale of Publication
	Ontario			
H. R. Grant	Province Bay	41 G/9	45° 30′– 45° 45′ / 82° 00′– 82° 30′	1 in. to 1 mi.
	Meldrum Bay	41 G/14	45° 45′– 46° 00′ / 83° 00′– 83° 30′	1 in. to 1 mi.
	Silver Water	41 G/15	45° 45′– 46° 00′ / 82° 30′– 83° 00′	1 in. to 1 mi.
	Kegawong	41 G/16	45° 45′– 46° 00′ / 82° 00′– 82° 30′	1 in. to 1 mi.
	Manitowaning	41 H/12	45° 30′– 45° 45′ / 81° 30′– 82° 00′	1 in. to 1 mi.
	Little Current	41 H/13	45° 45′– 46° 00′ / 81° 30′– 82° 00′	1 in. to 1 mi.
	Manitoba			
F. P. DuVernet	Grand View	62 N/2	51° 00′– 51° 15′ / 100° 30′–101° 00′	1 in. to 1 mi.
	Roblin	62 N/3	51° 00′– 51° 15′ / 101° 00′–101° 30′	1 in. to 1 mi.
	Angling Lakes	62 N/6	51° 15′– 51° 30′ / 101° 00′–101° 30′	1 in. to 1 mi.
	Baldy	62 N/7	51° 15′– 51° 30′ / 100° 30′–101° 00′	1 in. to 1 mi.
	Singush	62 N/10	51° 30′– 51° 45′ / 100° 30′–101° 00′	1 in. to 1 mi.
	Childs Lake	62 N/11	51° 30′– 51° 45′ / 101° 00′–101° 30′	1 in. to 1 mi.
	Durban	62 N/14	51° 45′– 52° 00′ / 101° 00′–101° 30′	1 in. to 1 mi.
	Pine River	62 N/15	51° 45′– 52° 00′ / 100° 30′–101° 00′	1 in. to 1 mi.
	St. Laurent	62 I/5	50° 15′– 50° 30′ / 97° 30′– 98° 00′	1 in. to 1 mi.
	Tevlon	62 I/6	50° 15′– 50° 30′ / 97° 00′– 97° 30′	1 in. to 1 mi.
	Red River Delta	62 I/7	50° 15′– 50° 30′ / 96° 30′– 97° 00′	1 in. to 1 mi.
	Lac du Bonnet	62 I/8	50° 15′– 50° 30′ / 96° 00′– 96° 30′	1 in. to 1 mi.
G. M. Donohoe	Duck Bay	63 C/1	52° 00′– 52° 15′ / 100° 00′–100° 30′	1 in. to 1 mi.
	Renwer	63 C/2	52° 00′– 52° 15′ / 100° 30′–101° 00′	1 in. to 1 mi.
	Lenswood	63 C/7	52° 15′– 52° 30′ / 100° 30′–101° 00′	1 in. to 1 mi.
	Camping Islands	63 C/8	52° 15′– 52° 30′ / 100° 00′–100° 30′	1 in. to 1 mi.

FIELD WORK—*Continued*

Officer in Charge	Sheet Name	Sheet Number	Latitude and Longitude	Scale of Publication
	Saskatchewan			
C. M. Duncan.....	Denare Beach.....	63 L/9	54° 30′– 54° 45′ 102° 30′–103° 00′	1 in. to 1 mi.
	Hanson Lake.....	63 L/10	54° 30′– 54° 45′ 102° 00′–102° 30′	1 in. to 1 mi.
	Birch Portage.....	63 L/15	54° 45′– 55° 00′ 102° 30′–103° 00′	1 in. to 1 mi.
	Annabel Lake.....	63 L/16	54° 45′– 55° 00′ 102° 00′–102° 30′	1 in. to 1 mi.
	Cumberland House.....	63 E/N.E. (N½)	53° 45′– 54° 00′ 102° 00′–103° 00′	1 in. to 2 mi.
A. E. Schneller....	Stanley.....	73 P/7	55° 15′– 55° 30′ 104° 30′–105° 00′	1 in. to 1 mi.
	Nistowiak Lake.....	73 P/8	55° 15′– 55° 30′ 104° 00′–104° 30′	1 in. to 1 mi.
	Guncote Lake.....	73 P/9	55° 30′– 55° 45′ 104° 00′–104° 30′	1 in. to 1 mi.
	Otter Lake.....	73 P/10	55° 30′– 55° 45′ 104° 30′–105° 00′	1 in. to 1 mi.
J. R. Barnes.....	Pierceland.....	73 K/5	54° 15′– 54° 30′ 109° 30′–110° 00′	1 in. to 1 mi.
	Goodsoil.....	73 K/6	54° 15′– 54° 30′ 109° 00′–109° 30′	1 in. to 1 mi.
	Dorintosh.....	73 K/7	54° 15′– 54° 30′ 108° 30′–109° 00′	1 in. to 1 mi.
	Island Hill.....	73 K/8	54° 15′– 54° 30′ 108° 00′–108° 30′	1 in. to 1 im.
	Waterhen Lake.....	73 K/9	54° 30′– 54° 45′ 108° 00′–108° 30′	1 in. to 1 mi.
	Flotten Lake.....	73 K/10	54° 30′– 54° 45′ 108° 30′–109° 00′	1 in. to 1 mi.
	Muskeg Lake.....	73 K/11	54° 30′– 54° 45′ 109° 00′–109° 30′	1 in. to 1 mi.
	Cold River.....	73 K/12	54° 30′– 54° 45′ 109° 30′–110° 00′	1 in. to 1 mi.
	Primrose Lake.....	73 K/13	54° 45′– 55° 00′ 109° 30′–110° 00′	1 in. to 1 mi.
	Windy Lake.....	73 K/14	54° 45′– 55° 00′ 109° 00′–109° 30′	1 in. to 1 mi.
	Barnette Ridge.....	73 K/15	54° 45′– 55° 00′ 108° 30′–109° 00′	1 in. to 1 mi.
	Keeley Lake.....	73 K/16	54° 45′– 55° 00′ 108° 00′–108° 30′	1 in. to 1 mi.
	Alberta			
M. E. Nidd.....	Kvass Flats.....	83 E/14 W½	53° 45′– 54° 00′ 119° 15′–119° 30′	1 in. to 1 mi.
	Daniels Flats.....	83 L/3 E½	54° 00′– 54° 15′ 119° 00′–119° 15′	1 in. to 1 mi.

FIELD WORK—*Concluded*

Officer in Charge	Sheet Name	Sheet Number	Latitude and Longitude	Scale of Publication
	Copton Creek	83 L/3 W½	54° 00′– 54° 15′ / 119° 15′–119° 30′	1 in. to 1 mi.
G. M. Armstrong	Cherry Point	84 D/S.W.	56° 00′– 56° 30′ / 119° 00′–120° 00′	1 in. to 2 mi.
	Hines Creek	84 D/S.E.	56° 00′– 56° 30′ / 118° 00′–119° 00′	1 in. to 2 mi.
	Blueberry Mtn	83 M/N.W.	55° 30′– 56° 00′ / 119° 00′–120° 00′	1 in. to 2 mi.
	Beaverlodge	83 M/S.W.	55° 00′– 55° 30′ / 119° 00′–120° 00′	1 in. to 2 mi.
	British Columbia			
H. A. S. West[3], Capt. B. F. Engler[3]	*Whitesail Lake	93 E	53° 00′– 54° 00′ / 126° 00′–128° 00′	1 in. to 4 mi.
D. A. MacLean	Dawson Creek	93 P/N.E.	55° 30′– 56° 00′ / 120° 00′–121° 00′	1 in. to 2 mi.
	Moberly Lake	93 P/N.W.	55° 30′– 56° 00′ / 121° 00′–122° 00′	1 in. to 2 mi.
	Fort St. John	94 A/S.E.	56° 00′– 56° 30′ / 120° 00′–121° 00′	1 in. to 2 mi.
	Hudson Hope	94 A/S.W.	56° 00′– 56° 30′ / 121° 00′–122° 00′	1 in. to 2 mi.
	Blueberry River	94 A/N.W.	56° 30′– 57° 00′ / 121° 00′–122° 00′	1 in. to 2 mi.
	Rose Prairie	94 A/N.E.	56° 30′– 57° 00′ / 120° 00′–121° 00′	1 in. to 2 mi.
B. L. Anderson[3], R. F. Brooks	Jennings River	104 O	59° 00′– 60° 00′ / 130° 00′–132° 00′	1 in. to 4 mi.
	Yukon			
A. M. Floyd[3], C. E. Hoganson	Wolf Lake	105 B	60° 00′– 61° 00′ / 130° 00′–132° 00′	1 in. to 4 mi.
B. M. Monaghan[3], R. J. Brehler	Teslin Lake	105 C	60° 00′– 61° 00′ / 132° 00′–134° 00′	1 in. to 4 mi.
W. H. Miller	Tantalus detail	115 I/1 (part)		1 in. to 800 ft.
A. C. Tuttle[3], P. A. Monaghan[3]	Glenlyon	105 L	62° 00′– 63° 00′ / 134° 00′–136° 00′	1 in. to 4 mi.
	Northwest Territories			
Eric Fry	Port Radium	86 L/1, 86 K/4	66° 00′– 66° 15′ / 117° 30′–118° 05′	1 in. to 1 mi.
	MacAlpine Channel	86 K/5	66° 15′– 66° 30′ / 117° 30′–118° 05′	1 in. to 1 mi.

* Field work not completed.
[1] In charge of contour parties in Nova Scotia and New Brunswick.
[2] Visited control parties in Nova Scotia and New Brunswick.
[3] On loan from Army Survey Establishment for part of season.

Computations were completed for all control traverse executed by the field staff. This includes computation of geographical co-ordinates of permanent marks established in the field. Also, geographical co-ordinates were computed for control of aerial pictures in many areas where the township system is available, and basic control positions were supplied for the field parties.

Air Survey Section

Location and extent of compilations completed are:

I COMPILATION FROM TRIMETROGON PHOTOGRAPHY

Sheet No.	Publication Scale	Approximate Area in Square Miles
Manitoba:		
64 B	1 in. to 4 mi.	5,300

II COMPILATION FROM VERTICAL PHOTOGRAPHY

Sheet No.	Publication Scale	Approximate Area in Square Miles
Northwest Territories:		
85 I/6	1 in. to 1 mi.	280
85 I/7	1 in. to 1 mi.	280
86 K/4	1 in. to 1 mi.	245
86 K/5	1 in. to 1 mi.	240
		1,045
British Columbia:		
93 P/N.W. (Part of S.½)	1 in. to 2 mi.	240
Alberta:		
83 M/N.E	1 in. to 2 mi.	1,350
83 M/N.W. (S.½)	1 in. to 2 mi.	675
83 M/S.E. (S.½)	1 in. to 2 mi.	685
83 M/S.W	1 in. to 2 mi.	1,365
83 N/N.E. (N.½)	1 in. to 2 mi.	670
83 N/N.W	1 in. to 2 mi.	1,350
83 N/S.E. (S.½)	1 in. to 2 mi.	685
83 N/S W	1 in. to 2 mi.	1,365
84 C/S.W	1 in. to 2 mi.	1,335
84 D/S.E	1 in. to 2 mi.	1,335
84 D/S.W	1 in. to 2 mi.	1,335
		12,150
Saskatchewan:		
63 D/N.E	1 in. to 2 mi.	1,450
63 D/N.W. (S.W. and N.E.¼'s)	1 in. to 2 mi.	725
63 E/N.E	1 in. to 2 mi.	1,420
63 E/S.E	1 in. to 2 mi.	1,435
63 E/N.W	1 in. to 2 mi.	1,420
63 E/S.W. (E.½)	1 in. to 2 mi.	715
		7,165
Manitoba:		
62 N/3	1 in. to 1 mi.	375
Ontario:		
31 D/12	1 in. to 1 mi.	430
31 D/13 (Portion in Simcoe county only)	1 in. to 1 mi.	35
31 D/14 (Portion in Simcoe county only)	1 in. to 1 mi.	135
41 A/16 (Portion in Simcoe county only)	1 in. to 1 mi.	35
31 L/1	1 in. to 1 mi.	415
31 L/2	1 in. to 1 mi.	415
		1,465

AIR SURVEY SECTION—*Continued*

II. COMPILATION FROM VERTICAL PHOTOGRAPHY—*Continued*

Sheet No.	Publication Scale	Approximate Area in Square Miles
Ontario—Quebec:		
31 L/7	1 in. to 1 mi.	415
31 L/8	1 in. to 1 mi.	415
		830
Quebec:		
31 K/11	1 in. to 1 mi.	410
31 K/12-E½	1 in. to 1 mi.	205
31 K/13-E½	1 in. to 1 mi.	205
31 K/14	1 in. to 1 mi.	410
31 K/6 (Revision of northerly 5 miles)	1 in. to 1 mi.	120
32 D/6	1 in. to 1 mi.	400
32 D/8	1 in. to 1 mi.	400
		2,150
New Brunswick:		
21 G/9	1 in. to 1 mi.	420
21 G/10	1 in. to 1 mi.	420
21 G/11	1 in. to 1 mi.	420
21 G/12	1 in. to 1 mi.	420
21 G/13	1 in. to 1 mi.	415
21 H/13	1 in. to 1 mi.	415
21 I/15	1 in. to 1 mi.	410
21 J/12	1 in. to 1 mi.	410
21 J/13	1 in. to 1 mi.	410
21 O/10	1 in. to 1 mi.	405
21 O/11	1 in. to 1 mi.	405
21 O/15	1 in. to 1 mi.	400
21 P/2	1 in. to 1 mi.	405
21 P/3	1 in. to 1 mi.	405
21 P/6	1 in. to 1 mi.	405
21 P/7	1 in. to 1 mi.	405
21 P/11	1 in. to 1 mi.	405
21 P/13	1 in. to 1 mi.	400
21 J/4	1 in. to 1 mi.	415
21 O/9	1 in. to 1 mi.	405
21 P/5	1 in. to 1 mi.	405
21 I/10	1 in. to 1 mi.	410
		9,010
Nova Scotia:		
21 A/1	1 in. to 1 mi.	430
21 A/2	1 in. to 1 mi.	430
21 A/4	1 in. to 1 mi.	430
21 A/7	1 in. to 1 mi.	425
21 A/8	1 in. to 1 mi.	425
21 A/9	1 in. to 1 mi.	425
21 A/10	1 in. to 1 mi.	425
21 A/11	1 in. to 1 mi.	425
21 A/15	1 in. to 1 mi.	425
21 A/16	1 in. to 1 mi.	425
21 B/1	1 in. to 1 mi.	430
21 B/8	1 in. to 1 mi.	425
11 E/9	1 in. to 1 mi.	420
11 F/5	1 in. to 1 mi.	420
11 F/12	1 in. to 1 mi.	420
11 F/14	1 in. to 1 mi.	415
11 F/15	1 in. to 1 mi.	415
11 K/2	1 in. to 1 mi.	415
11 K/3	1 in. to 1 mi	415
11 K/6	1 in. to 1 mi.	415
11 K/7	1 in. to 1 mi.	415
21 A/5	1 in. to 1 mi.	425
21 A/6	1 in. to 1 mi.	425
		9,720

AIR SURVEY SECTION—*Concluded*

Sheet No.	Publication Scale	Approximate Area in Square Miles
DETAIL SHEETS		
Yukon:		
Part of 115 I/1 (Tantalus)	1 in. to 800 ft. (contoured)	16
Northwest Territories:		
Part of 85 J/8 (3 sheets)	1 in. to 800 ft.	83
Quebec:		
Parts of 32 C/3, C/4 S.W ¼ of Pascalis Tp	1 in. to 1,000 ft.	25
		124

Flight maps were prepared for R.C.A.F. air photographic operations covering areas in Yukon, Northwest Territories, British Columbia, Alberta, Saskatchewan, Manitoba, Quebec, and Labrador. These operations were requested by the Department.

An extensive test was carried out to determine the accuracy of the slotted templet method of assembly for large areas with a minimum of ground control. The test covered 2,800 square miles in the Saddle Lake area in Saskatchewan. A detailed report of the results was prepared.

Tests were made to determine the stability of film base and photoprint materials, and measurements were made of the accuracy of multiplex table surfaces.

Approximately 5,000 plans and 1,000 manuscript compilations were indexed and stored for ready reference.

An auxiliary air photographic library was set up to handle all the work copies of air photography used for compilation. This involved collecting, docketing, and storing more than 850,000 prints, which are now the responsibility of this library.

Fifty-five members were taken on the staff and trained in compilation from air photography. Nine men resigned and six were transferred to other divisions or branches of the service.

MAP EDITING SECTION

The Section forwarded the following 37 map sheets, comprising 83 map manuscripts, for publication.

	Planimetric	Contoured	Total
Northwest Territories	5	..	5
Yukon	..	1	1
British Columbia	..	2	2
Alberta	7	4	11
Saskatchewan	7	..	7
Manitoba	1	..	1
Ontario	1	..	1
Quebec	6	..	6
New Brunswick	3	..	3
	30	7	37

The Section prepares advance prints, which are issued for all areas completed, and makes the results of surveys available for development purposes as early as possible. Advance information prints were prepared for:

Nova Scotia	20
New Brunswick	16
Quebec	8
Ontario	7
Manitoba	5
Saskatchewan	28
Alberta	47
British Columbia	2
Yukon	2
Northwest Territories	10
	145
Map Manuscripts Inked	43

The Section developed a new, time-saving method of mounting manuscript paper on metal sheets.

Metal-mounted sheets prepared	177
Map projections drawn	146

Numerous special drawings and index maps were also prepared.

The preparation of geographic names for maps was transferred on March 31, 1948, to the Draughting and Reproducing Division.

Geographic Board of Canada

At monthly meetings of the Board, names for 70 maps and 29 charts were adopted, and many new names and name changes were considered. The Chief of the newly formed Geographical Bureau, Department of Mines and Resources, was included in the Board membership.

Six Provincial members attended the February, 1948 meeting of the Board, at which several items of particular interest to the provinces were discussed. A special meeting of the Executive Committee was held March 18 to discuss matters of common interest with the Director of the United States Board on Geographic Names. Many inquiries from Government and public sources were dealt with. Considerable work was done in preparing publication of place name reports.

The present membership of the Board is: Chairman, F. H. Peters; executive committee, F. H. Peters, K. G. Chipman, and C. H. Smith; members, R. J. Fraser, Norman Fee, Ludovic Germain, A. McFarlane (acting), J. G. Wright, Trevor Lloyd; provincial members: W. G. H. Firth, British Columbia, H. P. Brownlee, Alberta, A. I. Bereskin, Saskatchewan, H. E. Beresford, Manitoba, F. W. Beatty, Ontario, J. G. B. Pugh, New Brunswick, A. E. Cameron, Nova Scotia, The Honourable J. Walter Jones, Prince Edward Island; secretary, L. B. Skinner. (The Province of Quebec has an independent Board which co-operates with the Geographic Board of Canada on matters pertaining to that province.)

National Air Photographic Library

Prints of 113,911 new aerial negatives were added to the Library collection. Of these 32,136 were prints of trimetrogon negatives covering approximately 230,000 square miles in Quebec, Ontario, Manitoba, and the Northwest Territories. The remainder were prints of vertical negatives covering approximately 140,000 square miles in Quebec, Ontario, Manitoba, Saskatchewan, Alberta, British Columbia, and the Northwest Territories. Prints of approximately 1,605,000 aerial negatives covering more than 1,800,000 square miles are on file in the Library.

Aerial photographs are especially useful in the study and development of Canada's natural resources. The National Air Photographic Library is organized to assist applicants, either personally or by correspondence, in the use of aerial photographs. Index maps of areas photographed and other related information are supplied on request. Facilities for stereoscopic study of the photographs and expert assistance in their interpretation are provided.

During the year, 1,250 requisitions for purchase of 191,000 prints of aerial negatives were prepared and forwarded to the Photographic Establishment of the Royal Canadian Air Force. These prints were for companies and organizations engaged in developing Canada's natural resources. Representatives of Federal and Provincial services and of commercial organizations were assisted in selecting and interpreting aerial photographs of areas in which they were interested. This assistance included examining and selecting large numbers of aerial photographs of areas in Quebec and the Northwest Territories for mining companies engaged in development work; of timbered areas in the different provinces for pulp and paper companies; and of areas in Ontario, Alberta, British Columbia, and the Northwest Territories for oil companies engaged in exploratory work.

CANADIAN HYDROGRAPHIC SERVICE

The merging of the Hydrographic Service into the newly-formed Surveys and Mapping Bureau has unified charting and mapping services and increased the efficiency of administrative and surveying activities. For the conduct of specialized sea, land, or air surveys the hydrographic, land-survey, and mapping services retain their identities. The work of the Hydrographic Service includes detailed charting of the Atlantic, Arctic, and Pacific marginal seas and the inland navigable waters of Canada.

A regional Hydrographic Office at Victoria supervises charting and tidal operations and distributes hydrographic publications for the Pacific Coast. Maintenance of two hydrographic establishments permits close contact with mercantile and naval authorities, and with requirements of shipping on both coasts.

The safeguarding of shipping in Canadian waters requires that vessels should have available the best in nautical charts. The function of the Canadian Hydrographic Service is to provide such standard hydrographic aids-to-navigation for civil and naval purposes. Specific activities of the Service include producing navigation charts and volumes of Pilots and Sailing Directions for coastal and inland waters; investigating and distributing tidal data covering Canadian oceanic and estuarial waters; and recording and analysing fluctuations of the water-surface elevations of the Great Lakes-St. Lawrence waterway and of the Mackenzie River system.

Hydrographic work, by reducing navigational hazards, helps to keep marine insurance rates low. This is an important economy to Canada, the third largest exporting nation.

Most of these navigational hazards occur on the continental shelf which protrudes from the coast. The vastness of the submerged continental extension may be visualized from the following approximate areas, given in square nautical miles: the Atlantic seaboard (Nova Scotia to the entrance of Hudson Strait), 325,000; Hudson Bay and Strait, 300,000; the Canadian Arctic, 440,000; the Pacific seaboard, 30,000.

Charting this sea-frontier requires the most modern technical equipment. In the past 20 years hydrographic instruments and sounding devices ensuring greater accuracy and economy have been adopted. Air-photography is used for delineating the coastline, and echo-sounding for depth-finding. Other advanced marine surveying methods are being investigated and it is expected that electronic devices will further facilitate the processes of oceanic charting.

The increasing use of ship-borne radar has raised the question whether or not present charts are as fully developed as they should be for their most effective use in connection with this electronic aid. The great increase in ship-displacement, draught, and speed also calls for revision of many hydrographic safeguards. Extensive new charting and chart compilations are required. Administrative activities during the year were directed toward acquiring, converting, and equipping suitable floating equipment. By the addition of a new hydrographic vessel considerable impetus was given to operations off the Pacific Coast. A specially designed hydrographic launch facilitated the charting of Great Slave Lake. At Hydrographic headquarters, production of new editions of standard navigation charts increased. However, the margin between chart-demand and chart-production has widened.

The nautical chart needs of the rapidly growing waterborne tourist trade are supplied by the Service. In addition to standard navigation charts for commercial shipping, there are available special large-scale charts of popular water-areas on the Pacific Coast, Great Lakes, Lake of the Woods, and the Ottawa, Richelieu, Saguenay and St. John (New Brunswick) Rivers. At the opening of the 1947 season of navigation two map-charts of the Rideau Lakes system from Kingston to Ottawa were issued. Similar charts of the Trent River Valley system between Lake Ontario and Georgian Bay are needed.

During the year, navigation problems requiring considerable nautical research were referred to the Service. Inquiries dealt with such subjects as dangers to navigation; available depths in channels and anchorages; recommended ship-routes and distances between ports; harbour facilities; oceanic, estuarial and river currents; descriptions of the Canadian continental shelf; ice-data; water-surface temperatures on comparative North Atlantic lanes; and authorized nomenclature of seaboard features. Much information was supplied on tidal phenomena and also as to rises and falls of the water-surface elevations and navigable lakes and rivers. To provide a ready-reference service to the sea-going public, a well-kept repository of nautical information is maintained. Much of the material is world-wide in scope and consists of hydrographic publications issued by numerous countries.

The Department of Transport furnished particulars as to buoy, light, and radio installations. The Department of Public Works supplied valuable information in regard to dredging and wharf construction. Reciprocating, the Hydrographic Service conducted special hydrographic surveys and supplied various Departments with copies of hydrographic aids-to-navigation. Precise water-level data were prepared for Government and private interests connected with shipping and power developments on the Great Lakes-St. Lawrence system.

The Tidal and Current Division of the Hydrographic Service continued to supply official information on tides in coastal and estuarial waters to the seafaring trade. The work covers tidal phenomena on the Atlantic and Pacific seaboards, and Hudson Bay and Strait. These data, in the form of tide-tables and other publications, consist of predictions for the times and heights of tides and the time of turn of tidal streams. Strengths and directions of tidal currents as they affect navigation are dealt with in special reports and atlases. In accordance with international agreement, tidal information is made available to foreign Hydrographic offices.

Pilots and Sailing Directions.—Though the chart is the primary guide to navigation, there is a large amount of important navigational information better suited for publication in the standard volumes of "Pilots and Sailing Directions". These nautical books cover districts of the Atlantic and Pacific seaboards, Gulf of St. Lawrence and St. Lawrence River, the Great Lakes, the Mackenzie River system, and Hudson Bay and Strait. Supplements are produced, and revised

editions of main volumes are issued when sufficient new information has accumulated. New editions of the following publications were prepared for publication: "Great Lakes Pilot, Vol. 1, Quebec Harbour to Montreal Harbour"; "Great Lakes Pilot, Vol. 1, Lake Ontario, Lake Erie and Lake St. Clair", "Great Lakes Pilot, Vol. 2, Lake Huron and Georgian Bay".

In addition hydrographic information of urgent importance to shipping is intermittently promulgated by official Canadian Notices to Mariners. Masters of vessels and shipping and engineering interests are supplied with special data by correspondence or personal interviews. International exchange of official charts and nautical publications, and submission of chart place-names to the Geographic Board of Canada are administered by the Section.

Reports of the Divisions comprising the Hydrographic Service follow.

Hydrography

The ocean area charted by the Canadian Hydrographic Service is defined approximately by the limits of the continental shelf. The submarine topography of the Atlantic seaboard is typified by great fishing banks separated by deep ravines. For navigation purposes, the steep outer edge of the submerged shelf, when accurately charted, provides an excellent "line of position" which can be intersected by a radio or other bearing. Shoreward areas, more subject to the action of the elements, undergo extensive physical changes. Localities, once safe for navigation, become encumbered by dangerous shoals and banks. Channels, gouged out by river and tidal currents, may provide new passages for navigation. Continual vigilance is required in order to maintain accurate hydrographic charts.

Charting operations in exposed offshore waters are conducted from specially constructed hydrographic vessels. For sounding inshore waters the ships carry motor-boats fitted with echo-sounders. Accessible parts of the seaboard, and inland navigable waters such as the St. Lawrence River and Great Slave Lake, are charted by motor-cruisers, a type of small craft which has been highly developed to meet Canadian hydrographic requirements.

During the year eight survey units worked in widely separated localities. On the Atlantic Coast was the hydrographic vessel *Acadia;* on the Pacific, the *Wm. J. Stewart* and a small vessel, the *Parry*. Shore-based units were established on Great Slave Lake, the Atlantic Coast, and in the river and gulf of St. Lawrence. As far as possible, all charting projects were undertaken in accordance with the established long-term program of progressive charting.

Concise reports of the year's work of each charting unit follow.

Atlantic Coast and Inland Waters

Gulf of St. Lawrence.—During the fitting out period of the *Acadia* at Pictou, the hydrographic staff of the vessel, from June 12 to July 6, made surveys in the area between Merigomish and Caribou Harbours. The principal operation of the ship was charting Northumberland Strait from Cape George to Pictou, including Merigomish Harbour. The existing chart of this latter area was based on a survey made in 1842, and a new chart was needed for general coastwise traffic.

In August, a large-scale survey was made of channels and wharves at Summerside to determine the maximum draught capacity of that harbour. Several surveys were made of anchorage and wharf areas along the coast, the entrance to the ferry wharf at Caribou, and the approaches to Pictou harbour. The ship returned to Pictou on November 5 and survey work terminated for the season two days later.

As a result of this work it will be possible to publish two new charts, "Merigomish Harbour" and "Cape George to Pictou". The latter will complete a series of coast charts extending from Cape George to beyond Summerside Harbour.

Summary of Season's Work

Ship sounding	634	linear nautical miles
Boat sounding	967	" " "
Coastlining	102	" " "
Shoals examined	16	

Northumberland Strait.—During the last week of May this unit, with the hydrographic launch *Henry Hudson*, examined an area in Richibucto Harbour reported to be an obstruction to shipping. The charting of Boughton River and Cardigan Bay, P.E.I., were resumed. Almost a century has elapsed since these areas were surveyed by the British Admiralty. Individual charts of each of the above harbours will be issued.

Summary of Season's Work

Boat sounding	643	linear nautical miles
Coastlining (from air photographs)	100	" " "
Shoals examined	24	

Great Bras D'Or, N.S., and Murray Harbour, P.E.I.—A small field party, in the hydrographic launch *Anderson* and another small boat, completed charting a number of inshore areas and examinations in the western portion of Great Bras D'Or. On completion of this work the party moved to Murray Harbour, P.E.I., for detailed charting of the harbour and its approaches. Two charts will be published: "Great Bras D'Or (Western Portion)" and "Murray Harbour, P.E.I.".

Summary of Season's Work

Boat sounding	366	linear nautical miles
Coastlining	18	" " "
Shoals examined	17	

Atlantic Coast.—This unit, equipped with the sounding launch, *Dawson*, recharted Yarmouth Harbour. The previous hydrographic survey of this area on which the existing chart is based was made by this Service more than 25 years ago. Since then, natural changes in submarine topography have developed and extensive dredging for channel improvement has been carried out.

When the Yarmouth survey was completed, sounding in the approaches to Halifax Harbour was undertaken. This operation was halted on September 15 when the *Dawson* was destroyed by fire. Fortunately there were no casualties, but from that date until October 30 hydrographic work was restricted to station-building and triangulation in Bedford Basin, establishment of permanent triangulation markers on the Halifax waterfront area, and detailed sounding of the Ocean Terminals.

As a result of the season's operations, special large-scale plans of Yarmouth Harbour were supplied to the Department of Public Works and a complete chart of the area will be issued when dredging operations are completed. Considerable progress was made on the Halifax Harbour recharting program.

Summary of Season's Work

Boat sounding	212	linear nautical miles
Coastlining	26	" " "
Shoals examined	6	

St. Lawrence River.—This unit, equipped with a small echo-sounding launch, continued recharting the St. Lawrence River. The Cap St. Michel-Longue Pointe section was completed during the season. For chart purposes, river-current velocities and directions were determined by the float-vane method. The harbour at Valleyfield, Quebec, was charted, and a detailed investigation was made of river currents in the vicinity of Pine Tree Point

above Morrisburg in connection with a shipping disaster. As a result of the season's work, a large addition will be made to a new chart of the St. Lawrence River and a large-scale chart of Valleyfield Harbour will be made available for navigation.

Summary of Season's Work

Boat sounding	315	linear nautical miles
Coastlining	34	" " "
Shoals examined	54	

Great Slave Lake.—Hydrographic operations were undertaken for the benefit of water-borne transportation on the Mackenzie River-Great Slave Lake route. A 32-mile stretch on the western side of the lake from Slave Point northward was charted. The locality has three harbours of refuge about which little was previously known. Danger of striking uncharted reefs prevented use of the shelters. A new, specially-designed hydrographic cruiser, *Rae*, helped the survey launch to expedite the work. The latter charted the shallower inshore waters and the *Rae* sounded the deeper areas offshore.

The work proved that deep water exists both in the harbour approaches and in the protected inside areas. A number of shoals exist, but these dangers can be avoided by installing aids-to-navigation. Three new navigation charts will be published and large additions will be made to the existing general chart of the southern part of Great Slave Lake. With the aid of these charts, shipping, which formerly waited at the entrance of Mackenzie River for favourable weather before crossing the open lake, will be able to proceed with the assurance that good anchorage exists near their route. This is of particular importance to tugs and barges carrying oil to Norman on the Mackenzie River to Yellowknife on Great Slave Lake. It is anticipated that the harbours will also be much used by commercial fishermen of this northern lake.

A small area in Great Bear River at the outlet of Great Bear Lake was sounded to determine whether a navigable channel led from deep water of the lake to a wharf about one mile down the river. Investigation disclosed that the required depths could be obtained by removing boulder obstructions.

Fitting-out operations began at Waterways May 30. The *Rae* reached Yellowknife June 27; active charting continued from July 5 to September 21.

Summary of Season's Work

Boat sounding	1,178	linear nautical miles
Coastlining (not including photographed areas)	15	" " "
Shoals examined	18	

PACIFIC COAST DISTRICT

From a hydrographic viewpoint, outstanding characteristics of the coastal waters of British Columbia are the innumerable fiord-like inlets, the abrupt submarine topography, and the extreme narrowness of the continental shelf off Queen Charlotte and Vancouver Islands. In places the seaward slopes of the island mountain ranges continue, almost unbroken, to the depths of the ocean floor. The sea bordering the mainland is studded with small islands and, in places, it bristles with pinnacle rocks. Great care in charting is required and a wire-sweep is needed to locate projecting rocks which otherwise might escape detection.

During 1947 two hydrographic ships, the *Wm. J. Stewart* and a new and smaller vessel, the *Parry*, were in operation. Some of the most important and most shoal-infested areas on the coast were surveyed. The number of shoals discovered and charted has seldom been exceeded in one season. The marine-labour turnover, though somewhat improved, deterred the work considerably.

The *Wm. J. Stewart* cleared from Victoria April 17. Until April 23 detailed sounding was made of the approach to Esquimalt Harbour, of which a large-scale chart is required by the Navy. Surveys in harbours and inlets on

the west coast of Vancouver Island were then conducted. The detailed hydrographic survey of Queen Charlotte Sound and Smith Sound, extending from Ripple Passage to Virgin Rocks and into Smith Sound, was accomplished between May 1 and August 31. September was spent charting in Otter Passage and off the Sound end of Banks Island. In the latter part of the season, hydrographic surveys were conducted in Homfray and Sutil Channels, and examinations were made at various places including Vancouver Harbour and Fraser River.

The ship was decommissioned at Victoria October 28.

Summary of Season's Work

Ship sounding	1,051	linear nautical miles
Boat sounding	2,818	" " "
Coastlining	322	" " "
Shoals examined	1,433	

The *Parry*, an 84-foot, diesel-motored, reconverted, R.C.N. patrol vessel acquired in 1946 is excellent for charting northern inlets and inside passages. The ship sailed from Victoria May 12 and until October 17 surveyed in the following localities: Finlayson Channel, Tolmie Channel, Meyers Passage, Alexander Inlet, Jackson Passage, Nowish Inlet, Oscar Passage, Mathieson Channel.

On October 26 the vessel was decommissioned at Victoria.

Summary of Season's Work

Ship sounding	94	linear nautical miles
Boat sounding	506	" " "
Coastlining	194	" " "
Shoals examined	96	

Tides and Currents

The Tidal and Current Division investigated and analysed tides and tidal action, and compiled the resultant data for public use. The information is published as official tide-prediction tables, special tidal-current charts, and comprehensive tidal reference data on the standard navigation charts. Supplementary information is continually studied and tabulated.

Editions of 1948 Tide Tables were prepared and considerable progress was made on the 1949 issues. The Tide Tables are sold through the Department of Public Printing and Stationery. Postmasters, customs officers in seaport towns, maritime newspapers, libraries, and tourist bureaus are supplied free with single copies. The Department of Fisheries distributes many copies to the fishing trade.

Two complete editions of the Tide Tables are produced. One for the Atlantic Coast and one for the Pacific Coast are published for shipping interests generally. Six abridged pocket editions serve local needs; and four cover the east coast and two the west coast. The publications are classified as follows:

Atlantic Coast Tide Tables.—"Tide Tables for the Atlantic Coast of Canada", complete edition, including "Tide Tables for St. John's, Nfld". There are also four abridged editions entitled "Quebec and Father Point", "Charlottetown and Strait of Canso", "Halifax and Sydney", and "Saint John and Bay of Fundy". Tide tables for Nelson, Manitoba, are supplied in mimeograph form.

Pacific Coast Tide Tables.—"Tide Tables for the Pacific Coast of Canada", complete edition. There are also abridged editions entitled "Vancouver and Point Atkinson" and "Prince Rupert and Northern British Columbia". Efforts are made to improve the tide tables each year. The 1949 tables for the Pacific Coast will include complete current tables for First Narrows and Slack Water for Deception Pass in United States waters.

Publications on current and tidal streams to assist navigation are: "Tables for Direction and Velocity of Currents in the Bay of Fundy and its Approaches"; "The Currents in the Gulf of St. Lawrence"; "The Currents in the St. Lawrence Estuary, St. Anne des Monts to Father Point"; and "Atlas of Current Charts for Hourly Stage of the Tide, Orleans Island to Father Point".

Other publications not bearing definitely on navigation are: "Tide Tables and Datum Planes, Atlantic Coast"; "Tide Tables and Datum Planes, Pacific Coast"; "Tides at the Head of the Bay of Fundy"; and "Tides and Tidal Streams".

The principal tidal stations operated are:

Atlantic Coast.—Quebec, Father Point, and Harrington, P.Q.; Charlottetown, P.E.I.; Saint John, N.B.; Halifax, N.S.; and Churchill, Man. A station at Chicoutimi is maintained during the open season of navigation.

Pacific Coast.—Vancouver, Point Atkinson, Victoria, Comox, Alert Bay, Seymour Narrows, Clayoquot, and Prince Rupert.

Special Investigations of Tides and Tidal Streams.—A survey of currents was conducted at First Narrows Bridge, Vancouver. At Second Narrows an electrical current recorder was installed to record the times of slack water. It is anticipated that complete current tables for this critical part of the channel will be available for the 1949 tide tables.

Information Service.—Specialized tidal data, including tables for the arrival time of the bore on the Petitcodiac River at Moncton, were furnished to navigation interests, engineers, coast industries, municipalities, and Government Departments.

Precise Water Levels

This Division systematically records precise water-level data pertaining to Federal waterways. The work is an integral part of Hydrographic Service activities in charting the St. Lawrence-Great Lakes Waterway and the Great Slave Lake-Mackenzie River system. Special studies to provide authoritative reports respecting phenomena connected with lake and river elevations are made. Tabulated graphs and bulletins are supplied. This information is the basis of regulatory measures for maintaining adequate water-levels for navigation, water power, and municipal purposes.

Gauging stations were maintained at 48 locations on the Great Lakes, and the St. Lawrence and Ottawa Rivers. Recordings were made over 525 months. Approximately 65,000 water-surface elevations were tabulated. Twelve monthly, five annual, six general data, and five graphic bulletins were issued. The Canadian Press Association was furnished with a synopsis of each monthly bulletin for publication in the marine section of newspapers. Investigations of lake and river levels were made during the year.

Chart Construction and Reproduction

This Division is responsible for producing navigation charts from field-sheet stage to completed chart. It also marks changes affecting navigation on all chart stocks on hand at Ottawa. Severe limitations were imposed on chart production by lack of staff and only by the most careful and selective planning was it possible to keep abreast of even the most urgent work. The backlog of charts waiting attention at the close of the year was greater than ever.

The increased output of standard navigation charts is accounted for partly by the adoption of more efficient cartographic methods, and partly by better organization. Because of heavier demands of the Navy and Merchant Marine, adequate chart production cannot be maintained unless sufficient trained cartographers are obtained.

Sixty-three navigational publications were printed. Fifty-two were charts published in colour; nine charts were printed in black and white, and two index maps were printed for catalogues and "Pilots and Sailing Directions".

A list of nautical charts published during the year may be obtained on application to the Chief Hydrographer, Canadian Hydrographic Service, No. 8 Temporary Building, Ottawa, Canada.

Distribution of Nautical Publications

The demand for hydrographic charts was great. Chart sales were more than three times the highest prewar figure. Stocks of standard charts for distribution were well maintained, though printing difficulties kept several out of print for short periods.

The following table shows the yearly distribution of charts since 1938: 1938, 17,999; 1939, 19,850; 1940, 33,136; 1941, 47,699; 1942, 50,968; 1943, 83,936; 1944, 106,042; 1945, 101,633; 1946, 50,126; 1947, 59,043.

During the six years of war the output of all charts rose rapidly. In comparing the war-year figures, however, with peace-time years, it is important to recognize that the former include large shipments of special war-plotting charts in addition to standard navigation charts. The latter constitute almost 100 per cent of peace-time demands.

Hydrographic publications distributed during the year were: Catalogue of Charts, Sailing Directions and Tidal Information with Index Maps, 1,430; Navigational Charts, 59,043; Pilots and Sailing Directions, 1,518; Supplements to Pilots, 284; Tide Tables, 48,439; Water Level Bulletins and Graphs, exclusive of those distributed through Notices to Mariners, 11,535.

Many Canadian charts are reproduced in quantity by other Hydrographic offices for the use of their own vessels. The world circulation of Canadian charts is, therefore, greatly in excess of the above figures.

List of Nautical Charts Issued 1947-48

Number	Title	Province	Scale (Inches to Nautical Mile)	Remarks
1210	Bersimis R. To Bic I.	Quebec	0·8	New Edition.
1215	Pointe des Monts to Father Point	Quebec	0·5	Reprint.
1216	Anticosti I. to Cape Magdalen	Quebec	0·4	New Edition.
1302	Longue Pointe to Varennes	Quebec	6·0	New Edition.
1321	Quebec Harbour	Quebec	5·5	New Edition.
1325	Richelieu River (R. St. Lawrence to Beloeil Bridge)	Quebec	2·5	New Edition.
1326	Richelieu River. (Chambly Basin to Lake Champlain)	Quebec	2·5	New Edition.
1338	Head of Lake St. Peter to Lavaltrie Sorel Harbour	Quebec Quebec	2·0 6·0	New.
1340	Montreal Harbour	Quebec	6·0	Reprint.
1443	Brockville Narrows	Ontario	7·25	Reprint.
1453	Lancaster Bar to Cornwall	Ontario	2·4	Reprint.
1458	Rockport to Howe Island	Ontario	2·2	Reprint.
1459	Kingston Harbour Lakes Route	Ontario	6·0	Reprint.

LIST OF NAUTICAL CHARTS ISSUED 1947-48—*Continued*

Number	Title	Province	Scale (Inches to Nautical Mile)	Remarks
1575	Rideau Lakes Route (Kingston to Narrows Lock)...	Ontario	2·0	New.
1576	Rideau Lakes Route (Narrows Lock to Ottawa).....	Ontario	2·0	New.
2042	Welland Canal.....	Ontario	6·0	New Edition.
2060	Main Duck I. to Scotch Bonnet I.....	Ontario	0·9	New Edition.
2063	Toronto to Niagara River.....	Ontario	1·0	New Edition.
2174	Lake Erie, Eastern portion.....	Ontario	0·9	New Edition.
	Port Colborne.....	Ontario	6·0	
2211	Plans of Harbours, Georgian Bay, Midland Harbour.	Ontario	12·0	New Edition.
	Tiffin.....	Ontario	12·0	
	Port McNicol and Victoria Harbour.....	Ontario	6·0	
2272	Goderich Harbour.....	Ontario	14·9	Reprint.
2281	Collingwood and approaches.....	Ontario	2·0	Reprint.
	Collingwood Harbour.....	Ontario	6·0	
2282	Cape Rich to Cabot Head.....	Ontario	0·8	Reprint.
	Lionhead Harbour.....	Ontario	5·7	
	MacGregor Harbour.....	Ontario	6·2	
	Owen Sound.....	Ontario	3·0	
2285	McCoy Islands to Collins Inlet.....	Ontario	0·8	New Edition.
	Pte. au Baril Harbour.....	Ontario	5·2	
	Alexander Inlet.....	Ontario	7·1	
	French River.....	Ontario	3·0	
2311	Thunder Cape to Pigeon River.....	Ontario	1·0	New.
3416	Esquimalt Harbour.....	B. C.	11·0	New Edition.
3430	Fraser R., Steveston to Tilbury I.....	B. C.	6·0	New.
3449	Race Rocks to Turn Point.....	B. C.	1·0	New Edition.
3577	Sand Heads to Ballenas I.....	B. C.	0·9	Reprint.
3579	Sand Heads to Cape Mudge.....	B. C.	0·5	New.
3584	Baronet Pass, and Clio Channel.....	B. C.	2·6	Reprint.
3591	Cape Lazo to Discovery Island.....	B. C.	1·0	Reprint.
3627	Barkley Sound and Approaches.....	B. C.	1·0	New Edition.
3642	Sooke Harbour.....	B. C.	6·0	New Edition.
3645	Nootka Sound.....	B. C.	0·9	New Edition.
3652	Swiftsure Bank to Esteban Point.....	B. C.	0·5	New Edition.
3667	Kyuquot Sound to Klaskish Inlet.....	B. C.	1·0	New Edition.
3682	Kyuquot Sound.....	B. C.	2·0	New Edition.
3683	Checleset Bay.....	B. C.	2·0	New Edition.
3710	Plans in Laredo and Milbanke Sound.....	B. C.		
	Higgins Passage.....		4·0	New.
	Meyers Passage.....		2·0	
	Meyers Narrows.....		6·0	
	Weeteeam Bay.....		6·0	
	Clifford Bay.....		4·0	
	Channels East of Milbanke Sound.....		4·0	
3737	Laredo Channel, including Laredo and Surf Inlets....	B. C.	0·9	New Edition.
3772	Sainty Pt. to Baker Inlet.....	B. C.	2·0	New.

List of Nautical Charts Issued 1947-48—*Concluded*

Number	Title	Province	Scale (Inches to Nautical Mile)	Remarks
3774	Plans in vicinity of Prince Rupert	B. C.		New Edition.
	Baker Inlet		6·0	
	Entrance to Portland Inlet		2·0	
	Nass Bay		6·0	
3778	Rivers Inlet	B. C.	1·0	New Edition.
	Nelson Narrows		2·0	
3805	Masset Sound and Inlet	B. C.	1·0	Reprint.
3811	Harbours in Queen Charlotte Is.	B. C.		New Edition.
	Thurston Bay		4·0	
	Pacofi		6·0	
	Port Louis and Otard Bay		4·0	
	Rockfish Harbour		4·0	
4322	Yarmouth Harbour	N. S.	6·0	New Edition.
	Yarmouth Inner Harbour		12·0	
4363	Cape Smoky to St. Paul Island	N. S.	1·0	Reprint.
4379	Liverpool Harbour	N. S.	8·7	New Edition.
4405	Pictou Island to Tryon Shoal	N. S.	1·0	New.
	Victoria Harbour		3·0	
	Victoria Wharf		15·0	
4411	Direction Finding Chart. (Strait of Belle Isle to Cape Sable)	N. S.		New Edition.
5406	Cape Tatman to Port Nelson	Manitoba	0·6	Reprint.
5407	Anchorages in Hudson Strait	Quebec		New Edition.
	Button Islands	and N.W.T.	0·5	
	Port Burwell		2·0	
	Sugluk Inlet		0·6	
5412	Erik Cove to Nuvuk Harbour	Quebec		
	Digges Island	and N.W.T.	1·03	Reprint.
	Erik Cove		2·7	
	Digges Harbour		5·5	
	Port de Laperriere		5·5	
	Nuvuk Harbour		1·8	
6201	Lake of the Woods	Ontario	0·52	Reprint.
	Approaches to Kenora		0·85	
6240	Red River to Berens River	Manitoba	0·3	New Edition.
	Channel into Dauphin River		0·55	
6269	Wanipigow River	Manitoba	6·0	Reprint.
	Mouth of Wanipigow River		15·2	
6369	Yellowknife Bay	N.W.T.	2·3	Reprint.
	Yellowknife		12·0	
6371	Plans of Harbours, Great Slave L.	N.W.T.		New.
	Dawson Bay		10·0	
	Ile du Mort		10·0	
	Presqu'ile Cove		10·0	
	Sulphur Cove		10·0	
	Breynat River		10·0	
	Buffalo River		12·0	
	Hay River		12·0	
6379	Beaver Lake to Fort Providence	N.W.T.	4·5	New.
6380	Pte. Demaris to Providence	N.W.T.	1·0	New.
	Index Map XII—St. Lawrence River.			
	Index Map XIV—St. Lawrence River.			

GEODETIC SURVEY OF CANADA

The Geodetic Survey continued basic operations to provide horizontal and vertical control for surveys and mapping in widely scattered areas throughout Canada. Demands for information from Government and private sources concerning the geographical position and elevation of stations established by the Geodetic Survey makes it imperative to examine and adjust each season's field work as early as possible so that preliminary or final values may be available. Final loop-closure adjustments are published as soon as possible after completion of the field work.

In providing horizontal control of sufficient accuracy and density for mapping the increasingly important Far North, the previous available control has been considerably augmented. Triangulation operations have also progressed favourably toward providing control in the potentially important mineral districts in northern Quebec and at intervals along the contemplated boundary between Quebec and Labrador. Other triangulation operations for providing immediate or future control for mapping and surveys in Ontario, Alberta, and Yukon are being extended as rapidly as possible. For vertical control, precise levelling operations were made under the able direction of R. H. Montgomery until his death in October, 1947, while on an annual inspection.

Preliminary progress was made in determining the feasibility of utilizing new electronic devices which may lead to a more rapid extension of geodetic control into outlying areas.

Triangulation

The policy of extending triangulation networks to control the systematic mapping and development of Northern Canada was continued in the Moisie River and Natashquan River areas in Quebec, the Alaska Highway area in Yukon and in northern British Columbia, the Sault Ste. Marie area in Ontario, and the Edmonton-Jasper area in Alberta. Work of a minor nature to check on a secondary network of the Topographical Survey was undertaken in the area south of Calgary. One officer was again seconded to the Commission of Government of Newfoundland to assist in training personnel and developing that country's Geodetic Survey.

The five main areas mentioned above may be divided into two groups, namely, those in which the objectives are immediate and specific, and those in which they provide a basis for future triangulation control into undeveloped areas. In the first group are those networks which were inaugurated in recent years and have been extended northerly from the primary network along the Gulf of St. Lawrence. They follow the courses of the Moisie and Natashquan Rivers and provide control for a possible survey of the Quebec-Labrador boundary, and for other surveys in and adjacent to the important mineral areas of the central Ungava peninsula. The Alaska Highway triangulation is also in this group since its function is to provide control for mapping along the British Columbia-Yukon boundary and the area adjacent to the Alaska Highway. In the second group are the operations in Alberta between Edmonton and Jasper, and the Sault Ste. Marie area in Ontario.

Both of these networks are links in comprehensive schemes embracing large areas, and from which future extensions into many parts of British Columbia, Ontario, and the Prairie Provinces will be provided.

Operations were successfully concluded in the Natashquan River and Edmonton-Jasper areas. In the former, the network was extended 125 miles north of the Gulf of St. Lawrence to a point near the 52nd parallel of latitude. In the latter, a 265-mile network, begun in 1945 and connecting the British

Columbia and prairie networks, was completed. This closed a gap in a 1,600-mile loop which had its inception in 1910 on the line Discovery-Iceberg of the United States Coast and Geodetic Survey, south of Vancouver. The completion of this loop provides an opportunity to compute and permanently fix in position a large number of triangulation stations on the 1927 North American Datum. It also establishes a basis for extending geodetic control into neglected areas of British Columbia and Alberta.

GULF OF ST. LAWRENCE

J. W. Menzies had charge of all geodetic triangulation operations in the Gulf area. Supervising and supplying the work parties on the Natashquan and Moisie watersheds necessitated establishment of a base headquarters for the Natashquan work at Havre St. Pierre, and for the Moisie operations at Rapide Lake about seven miles north of Seven Islands. Local facilities at these places were utilized during the early part of the season to transport personnel and supplies by plane. Communication between the various sub-parties and with headquarters was maintained by portable radio transceivers in co-operation with radio facilities of Canadian Pacific Airlines and the Department of Transport at the aforementioned bases. Operations in both areas were considerably hampered by the late spring break-up.

On the Natashquan, planes were used to establish caches of food and equipment at strategic points. In August, W. H. Stilwell was flown in from Havre St. Pierre with a Laplace azimuth and the necessary equipment for measuring a baseline at the north extremity of the work. Nine new stations were selected, 11 were prepared for observing, observations were completed at 12 stations, a base line was cleared and posted, and assistance was rendered in measuring the base.

In the Moisie area the early part of the season was devoted to observing one station and re-observing two stations in the south part of the net. The parties were then flown into Caopacho Lake when it opened June 20. Reconnaissance was completed to the north outlet of Ashuanipi Lake, and observing to the lower portion of the same lake. Eleven new stations were selected, 14 were prepared for observing, and the observing was completed at 12 stations.

YUKON

This work, under the supervision of F. P. Steers, was begun in 1945 as an extension of the U.S. Coast and Geodetic Survey triangulation from Whitehorse east, roughly following the Alaska Highway. By the end of the 1946 season this network had been extended to the British Columbia-Yukon boundary south of Teslin village. During 1947, an additional 60 miles was completed in an easterly direction to approximately longitude 131° 30′.

During the 32 days of clear weather, 14 stations were selected, 17 were prepared for observers, and observing was completed at 13 stations. In addition, a base line five and one-half miles long was selected and prepared for measurement, and connections were made at two stations by spirit levelling to precise level bench marks to provide control for the trigonometric levelling in the area.

ONTARIO

Work in the area west of Sudbury was in charge of J. H. Kihl. Good progress was made by all parties in extending this network, which is urgently required to provide control for the aerial-photographic mapping program contemplated by the Provincial Government in the area adjacent to and north of Lake Superior. Fifteen new stations were selected, 17 were prepared for observing, and observing was completed at 19 stations.

ALBERTA

Operations in Alberta were in charge of J. M. Riddell and continued the network started at Edmonton in 1945. The work began near Edson and aimed at joining the British Columbia network. This involved the preparation and occupation of 16 stations, seven of which were on difficult peaks of the Rocky Mountains in Jasper National Park. By August 7 connection with the British Columbia network was made. The party was then reorganized to undertake work in the area south of Calgary and to re-observe a number of stations of the Edmonton-Jasper network. In all, four new stations were selected, 21 were prepared, and observing was completed at 21 stations. In addition, six stations were re-occupied and ties were made to a number of section and quarter-section corners of the Dominion Lands system of survey, and to two reference marks established for the use and convenience of local surveyors. A tie was also made to the precise level bench mark at Jasper for the control of trigonometric levelling.

NEWFOUNDLAND

W. M. Dennis was again seconded to the Commission of Government of Newfoundland to assist in training personnel and developing a triangulation network in Newfoundland to extend the system recently established by this Survey.

TRIANGULATION ADJUSTMENTS

The preliminary adjustments of two primary nets, extending from Edmonton to Jasper, and from Edmonton to Prince Albert district, were completed. The computations of the Canada-Alaska Highway net, and the net extending from Manitoulin Island to north of Lake Superior were advanced to include all stations at which the field observations had been completed by autumn of 1947. The adjustment of the Natashquan River and the Moisie River second-order nets was near completion.

At the request of the Surveyor-General of British Columbia, a tertiary triangulation scheme projected by the Topographical Survey between Kamloops and Lillooet in British Columbia was adjusted between fixed primary triangulation stations of the Geodetic Survey of Canada.

The adjustment and computation of trigonometric elevations of the stations of the St. Augustin River net, the Natashquan River net, and the Edmonton-Jasper net were completed. Preliminary work was done on determining trigonometric elevations of stations in the Yukon net and the Manitoulin Island-Lake Superior net.

As a preliminary step toward the final loop closure adjustment of the geodetic triangulation in British Columbia and the Prairie Provinces, check computations were made of the mathematical reductions of the following bases:—Kitscotty, Calgary, Edmonton, and Niton, Alberta; Lucerne, Smithers, and Prince George, British Columbia; Kinistino, Saskatchewan; Cheeseman Lake, Quebec.

British Columbia-Alberta Triangulation Loop Closure.—The completion of the 1947 field operations was marked by the junction on the common line, Fitzwilliam-Colonel, near Jasper, Alta., of two long arcs of triangulation. From the preliminary adjustment of the Edmonton-Jasper net, the co-ordinates of the westerly terminal station, Fitzwilliam, were known. These values are based on computation through the series of nets extending from the International Boundary south of Calgary, north to the Edmonton area, and thence west to Jasper. Different values of the same co-ordinates had previously been determined by computation through a second chain of triangulation, based on the U.S. Coast and Geodetic Survey network, which extends from Vancouver northeast through Williams Lake to the Jasper area.

The two values of latitude and longitude of Fitzwilliam, derived from computations over the alternative routes, are:

Route	*Latitude*	*Longitude*
Calgary-Edmonton	52° 49′ 49·712″	118° 27′ 20·448″
Vancouver-Williams Lake	52° 49′ 50·002″	118° 27′ 20·177″
Difference	0·290″	0·271″

The closure of 0·290″ in latitude and 0·271″ in longitude corresponds to 29 and 16·6 feet, respectively, in the meridian and prime vertical planes, or a hypotenuse distance of 33·3 feet. As the total axial length of the series of nets comprised in the loop is 1,646 miles, the ratio of discrepancy in closure to axial length is 1/261,000, indicating a high standard of precision in carrying out the angular measurement work. It also reflects the corrective effect of adequate length and Laplace azimuth controls.

Lists of descriptions and geographic positions of triangulation stations in Alberta and northern Saskatchewan were compiled for the U.S. Army Mapping Service. For the same organization, survey ties from geodetic stations to section corners of the Dominion Land Survey System were computed.

Geodetic Astronomy and Isostasy

Field measurements were made in Nova Scotia, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, and in the Districts of Keewatin, Franklin, and Mackenzie. Two Laplace stations were observed; 37 astronomic positions for control of small-scale aeronautical maps were established, and astronomic latitude, longitude, and azimuth were determined for four Loran station locations, for two meteor observatories, and for two lighthouses. Two precise base lines were measured, the invar base-line tapes were standardized from the Standard Nickel Bar No. 10239 at the beginning, middle, and end of the field season; and a magnetic observation program was carried out for the Dominion Observatory at each of the 37 astronomic control positions. Two daily reports containing data on clouds, wind, temperature, barometer, visibility, and local weather were radioed to the Edmonton meteorological station by each of the six astronomic position parties.

LAPLACE DETERMINATION

At Laplace stations, measurements are made to determine the relation between the astronomic and the geodetic values of longitude, azimuth, and latitude. This relation is used to control the direction of the triangulation. One such station at the east end of the Niton base in Alberta was completed by W. H. Stilwell in June, and the astronomic azimuth of the East Base to West Base line was determined. A second Laplace station at Cheeseman Lake in Quebec, near the north end of the Natashquan River triangulation net, was completed by the same observer in August, and the astronomic azimuth of the North Base to Owl line was determined.

LATITUDE AND LONGITUDE

Eight field parties established astronomic control points for aeronautical maps. This operation is a combination of astronomic observations, aerial photography, and ground measurements by a field party comprising an observer and an assistant. Six of these parties, under the supervision of B. J. Woodruff, carried out control location in Mackenzie District, between Great Bear Lake and the Arctic Coast. During July almost continuous daylight greatly restricted the time during which star observations could be made, and transportation was

impeded by ice-filled lakes. During August, because of bad weather, only a partial coverage of this area with 19 control points was possible. Observations to obtain meteorological and magnetic data were also made at these stations.

The astronomic locations for two Loran stations in Mackenzie District, one in Franklin District, and one in Saskatchewan were determined for the R.C.A.F. and the positions of two meteor observatories in Alberta were obtained for the Dominion Observatory. Transportation for the Mackenzie parties was furnished by the R.C.A.F. photo-survey squadrons, which supplied two Canso and four Norseman aircraft.

Astronomic control location was also carried out in those parts of northern Ontario, Manitoba, and Keewatin adjacent to James Bay. Two parties, under the supervision of T. H. Manning, established eight island and ten mainland points. Magnetic data were obtained by both parties and identification photography was accomplished by the R.C.A.F.

BASE LINES

At Niton, Alberta, G. F. Dalton completed an eleven-kilometre base. At the northern end of the Natashquan River triangulation net in Quebec, W. H. Stilwell measured a three-kilometre base.

MISCELLANEOUS

Many requests for technical information about Northern Canada were answered. Compilation of star programs (calculation and tabulations of altitude, azimuth and time for the location of stars to be observed) for northern latitudes was carried forward. The progressively shorter summer nights, as the work extends northward, necessitates a method of obtaining astronomic positions during daylight. The experienced astronomer can select a method to suit the immediate conditions, whereas the new graduate requires one simple and generally applicable method. Suggested methods are being tested. The R.C.A.F. is investigating means of overcoming transportation problems caused by far northern ice movements.

LEVELLING

During the regular season, three double unit parties and one single unit party were in the field. They ran 1,085 miles of precise levels, including 167 miles of re-levelling in British Columbia.

QUEBEC

The precise levelling was in charge of D. McMillan. The Department of Public Works level lines Nos. XIX, XVIII, and XXXII along the northwest shore of the St. Lawrence River from Cornwall, Ontario, to Quebec City were re-levelled to improve the accuracy of the levelling, restore bench marks destroyed since the original levelling, and replace unreliable bench marks. In 1946, a similar revision was made on the southeast shore of the St. Lawrence River. In 1947, the two precise lines were connected across the river at Lachine-Caughnawaga, Montreal-Longueuil, and at Quebec bridge. These connections form three precise level circuits astride the St. Lawrence River between Cornwall and the City of Quebec. In the course of this 270 miles of levelling, 70 new bench marks were established, including fundamental bench marks at Ste. Anne de Bellevue and Trois Rivieres. The additional bench marks were placed with the requirements of the St. Lawrence Ship Channel improvements and of the Hydrographic Survey in mind. Of the 271 bench marks of the original levelling of 1928, 48 had been destroyed, three had to be removed, and four had been rendered inaccessible.

On completing the St. Lawrence River work, the party moved to the Parc National des Laurentides district to complete the line from Hebertville to Quebec

City. This line had been discontinued north of Stoneham in 1939. Its completion closes two circuits north and northwest of Quebec City, and provides vertical control for developments in the Laurentides Park area.

Less than 8 per cent of the season's work consisted of re-levelling, despite the fact that most of the work followed along No. 2 highway, a narrow and heavily travelled road.

NORTHERN BRITISH COLUMBIA AND YUKON

A party in charge of George S. Raley carried out levelling operations in northern British Columbia and Yukon. The line to Beatton River airport in northern British Columbia was extended 38 miles to the airport. The party then levelled 72 miles north from the Alaska Highway to the Aishihik airport. In the vicinity of Snag, it re-levelled 44 miles of work on the Alaska Highway, previously levelled in 1943 by the U.S. Coast and Geodetic Survey. Additional bench marks were placed in that section. From this part of the Highway, a branch line was run 15 miles into Snag airport, Yukon. The party then moved about 205 miles southeast on the Alaska Highway to the junction of the Haines Road, and completed 61 miles of levelling along Haines Road to the vicinity of Dalton Pass. This party levelled 222 miles and placed 87 bench marks.

PEACE RIVER AREAS OF ALBERTA AND BRITISH COLUMBIA

This party, in charge of L. O. R. Dozois, did precise levelling in the Peace River areas of Alberta and British Columbia. The work was performed under the new double unit system, whereby two observers, each with separate personnel, do levelling from a common camp location. A total of 381 miles of new levelling was completed and 172 bench marks were established. Lines were run from High Prairie to Grande Prairie, Alta, 111 miles; Charlie Lake to Hudson Hope, B.C., and beyond to Peace River Coal Mines, 64 miles; Pouce Coupé, B.C., to Spirit River, Alta., 68 miles; and from Grimshaw north on highway No. 35, Grimshaw road, as far as Metis Colony, 138 miles.

BRITISH COLUMBIA

A single unit party in charge of E. W. Berry re-levelled the line from Bull River to Golden, a distance of 167 miles along the railway. This work was undertaken at the request of the Water and Power Bureau and was necessitated by the high percentage of destruction of bench marks which had occurred since the original levelling in 1915. A branch line of six and one-half miles was run to the East Kootenay Power plant on the Bull River and another of nine miles, from Elko to Waldo. This party levelled 182½ miles and placed 57 bench marks.

SUPERVISION AND INSPECTION

R. H. Montgomery, Chief of the Levelling Division, visited the parties in Alberta, British Columbia, and Yukon, and, with G. Bird, inspected 1,299 bench marks in Alberta and Saskatchewan.

Detailed Statement of Precise Levelling Run in 1947

	Miles		B.M.'s
QUEBEC			
Cornwall, Ontario, to Quebec	271·0		70
Stoneham Portal to Quebec	31·0		15
		302·0	
ALBERTA			
High Prairie to Grande Prairie	111·3		47
Pouce Coupé, B.C., to Spirit River, Alta.	67·8		27
Grimshaw Road	138·2		62
		317·3	

BRITISH COLUMBIA			
Bull River to Golden (Re-levelling).....	166·9		47
Branch to Power House (Bull River)....	6·6		4
Branch to Elko-Waldo	8·9		6
Charlie Lake to Hudson Hope.....	64·0		36
Beatton River Road	38·0		15
		284·4	
YUKON TERRITORY			
Aishihik Branch	72·5		30
Snag	15·1		6
*Alaska Highway (M.1159 to 1193)	34·4		12
*Alaska Highway (M.1011 to 1021)	10·0		3
Haines Road	49·7		21
		181·7	
	1,085·4		401
Less re-levelling Bull River to Golden....	166·9		..
New Levelling 1947	918·5		401

*Re-levelling of original work by U.S. Coast and Geodetic Survey between Whitehorse and Big Delta.

Summary

Precise Levelling	Miles	B.M.'s
Prior to 1947.....	29,386	10,593
1947	918	401
	30,304	10,994
Secondary		
Prior to 1947.....	11,929	4,218
1947	Nil	Nil
Public Works		
Prior to 1947	4,858	
Less re-levelling to Precise Standards 1947.....	271	
	4,587	

Levelling mileage in the Canadian Net distributed by provinces at the end of the fiscal year 1947-48 was:

	Precise	Secondary	Pub. Works	Total
Prince Edward Island	284	..	..	284
Nova Scotia	779	..	309	1,088
New Brunswick	1,106	..	403	1,509
Quebec	3,970	1,288	1,750	7,008
Ontario	7,069	1,324	2,012	10,405
Manitoba	2,963	368	113	3,444
Saskatchewan	4,113	5,098	..	9,211
Alberta	3,608	3,799	..	7,407
British Columbia	5,419	52	..	5,471
Yukon	883	..	..	883
Minnesota, U.S.A.	89	..	..	89
Vermont, U.S.A.	6	..	..	6
New York, U.S.A.	15	..	..	15
	30,304	11,929	4,587	46,820

In the course of the season's work, approximately 271 miles of Public Works levelling in Quebec was transferred to the precise levelling column.

Supplementary Information

Chief of Party	Mileage	B.M.'s
McMillan	302	85
Berry (single party)	182	57
Dozois	381	172
Raley	220	87
	1,085	401

Mileage by Provinces

Quebec	302
Alberta	317
British Columbia	284
Yukon	182
	1,085

LEGAL SURVEYS DIVISION

This Division makes and records legal surveys under direction of the Surveyor General; produces aeronautical charts and electoral district maps; and distributes maps, aeronautical charts, publications, and official plans. As noted under the Map Compilation and Reproduction Division section of this Report, the work of the two Divisions was combined by the Departmental reorganization. In reporting their separate activities, duplication of accounts of the year's work has been reduced to a minimum.

Field Work

Northwest Territories.—Four field parties were engaged on legal surveys, two of them on control or governing surveys, and two on miscellaneous lot and right of way surveys. The system of control surveys forming the framework for such subdivision surveys as may be required in the Northwest Territories was extended. This control survey, which follows township outlines, was begun in 1944 and was extended 132 miles during 1947 from the northeast corner of township 150, range 24 west of the sixth meridian, to the northeast corner of township 164, range 5 west of the seventh meridian. The field party examined discrepancies in the 1946 survey, and carried levels along the portion of the line surveyed in 1946.

Legal surveys were made of the airfields at Norman Wells, Fort Simpson, and Fort Resolution. Lots were surveyed at Rat River and Hay River Settlements, and miscellaneous surveys were carried out at Fort Smith Settlement. At Yellowknife Settlement, a retracement survey was made of the highway through Block 11, and a transmitter station site, a radio range site, and a right of way for a power transmission line to Yellowknife airfield were surveyed. Returns were received covering the survey of 267 mineral claims.

Yukon.—The legal survey of the Alaska Highway was completed to the Yukon-Alaska boundary. This survey serves the dual purpose of providing a control survey in Yukon and of delimiting the boundaries of the right of way of the highway. The survey was begun in 1944 and during 1947 it was extended 102 miles from a point about 25 miles northwest of Burwash landing to the Alaska-Yukon boundary.

The boundaries of Aishihik and Snag airfields were surveyed. Within Snag airfield, lots 5, 6 and 7, group 804, were subdivided as an extension of the town of Whitehorse.

Surveys were made of lot 1, group 901, in the vicinity of mile post 118 of the Alaska Highway, and of lots 2, 3 and 4, group 951.

At Kysawa Lake, lots 7 and 8, group 803, were subdivided into lots for summer cottage sites.

At Watson Lake, two parcels of land were surveyed as lots 2 and 3, group 757.

At Marsh Lakes, lots 265 and 266, group 804, were surveyed.

A waterfront subdivision was laid out near mile post 889 of the Alaska Highway.

One hundred and eighty acres of land were selected and surveyed as an Indian reserve, to compensate the Indians for a similar area taken from Teslin reserve for the airfield and settlement there.

Forty-eight mineral claims were surveyed in the Nansen creek area.

A surveyor investigated local problems and requirements relative to mineral claim surveys in Yukon. He collected information for a detailed report on current conditions and survey requirements.

British Columbia.—Both limits of the right of way of the Alaska Highway were surveyed and monumented through Liard River Indian Reserve No. 3, comprising provincial lots 5461 and 5463 at Lower Post. A short connecting road was surveyed from the Alaska Highway to Liard River in the same vicinity. A subdivision survey of a portion of Hazelton Indian reserve as an addition to the town of Hazelton was begun.

On the Columbia River Basin project, it was planned to operate four major survey parties but a shortage of qualified personnel and inadequate transport facilities reduced the number to three. One of these operated in Similkameen River Valley, and two in the East Kootenay area. Field work was completed on 23 map sheets. The work is for the Canadian Section of the International Engineering Board inquiring into the utilization of the Columbia River waters.

Yukon-British Columbia Boundary Survey.—Under the direction of the British Columbia-Yukon Boundary Commission, 36·5 miles of the 60th parallel of north latitude in the vicinity of Swift River were finally determined and monumented, and preliminary surveys were completed over an additional 36 miles. This work is in the territory adjacent to the Alaska Highway. The British Columbia-Yukon-Northwest Territories Boundary Commission is composed of the Surveyor General of Dominion Lands and the Surveyor General of British Columbia.

Alberta.—A number of villa lots were laid out at Lake Edith in Jasper Park as an addition to the existing subdivision. A survey was made of a 14-acre parcel of land in section 35 Tp. 25-12-5. Lots 22 and 23, block A, in the town of Banff were subdivided into building lots.

Manitoba.—A retracement survey was made of the boundaries of Riding Mountain Forest Experimental Station in Riding Mountain Forest Reserve.

Ontario-Manitoba Boundary Survey.—The survey of the most northerly 170 miles of the Ontario-Manitoba boundary between Echoing River and Hudson Bay was resumed under the direction of the Ontario-Manitoba Boundary Commission after a lapse of 10 years. Field work was completed. The portion of the boundary, of which 170 miles is a part, is a right line between two fixed points 282 miles apart. The survey of the 282 miles, 114 of which was done in 1937, is a trial survey of the actual boundary.

Ontario.—All corners of the lots laid out in the subdivision survey of Snake Island (part of Georgina Islands Indian Reserve) in Lake Simcoe in 1946 were monumented.

A survey was made of a 40-acre parcel of land in Rideau Canal Ordnance reserve at Brewers' Mills for leasing purposes.

The survey of Indian holdings in Manitoulin Island Indian Reserve, begun in 1945, was continued, and a number of farm lots were laid out as planned.

A right of way was surveyed for a road through West Bay Indian Reserve in the township of Billings, and a traverse survey was made of a part of Church Street in the township of Tehkummah. A right of way for highway purposes was surveyed through a portion of Saugeen Indian Reserve with a view to future subdivision of this portion.

Quebec.—A survey was made of a portion of Lauzon Ordnance reserve at Levis. Lot 1194 in Victoria Street Ordnance reserve at Sorel was subdivided into five building lots and later cadastered. The dividing line between lots 1219-12 and 1219-13 was established by survey.

The dividing line between lots 130 and 131 in the Ordnance reserve at Coteau-du-Lac was established by survey. A cadastral subdivision of lot 130 into four building lots was carried out.

One party completed field revision of the Parent-Three Rivers eight-miles-to-one-inch aeronautical chart. It obtained information for revising 6 two-miles-to-one-inch maps in the National Topographic series.

New Brunswick.—A survey was made of the boundaries of Kingsclear Indian Reserve in the vicinity of Fredericton.

Nova Scotia.—A parcel of land was surveyed as an addition to Fort Beauséjour National Historic Park.

General.—Legal surveys on Indian reserves, Ordnance lands, and National Parks were made in British Columbia, Alberta, Manitoba, Ontario, Quebec, New Brunswick, and Nova Scotia.

Air Photogrammetry

This section was engaged mainly in plotting the planimetry from trimetrogon air photographs. This material will be assembled into aeronautical charts for publication at eight miles to one inch, and will also form the World Aeronautical Chart of the International Civil Aviation Organization on a scale of 1:1,000,000.

The rate of output in square miles shows a marked increase, reflecting the results of increased staff experience and improved methods.

Fiscal Year	*Total Output*	*Increase Over Previous Year*
1945-46.....	134,198 sq. mi.	
1946-47.....	177,339 sq. mi.	33 per cent
1947-48.....	250,583 sq. mi.	40·7 per cent

The output per person per month was more than 1,000 square miles.

The planimetry plotted is summarized in the following table:

16-Mile National Topographic Series No.	Area Plotted Square Miles
32	20,463
42	58,922
43	63,720
53	14,259
54	10,346
55	29,823
64	25,250
75	22,600
Special strip map for the Ontario-Manitoba boundary survey	3,900
Revision of part of Tawatina 3-mile sectional sheet	1,300
Total	250,583

Nine operational maps were compiled for trimetrogon air photography covering 1,187,164 square miles. They included the remainder of the mainland and Baffin Island, but not certain gaps in areas already photographed.

Thirteen operational maps for vertical air photography were prepared.

A map was made from vertical air photographs of Sable Island, at the request of the Hydrographic Survey.

Two maps of Indian reserves were made from vertical air photographs for use in surveying their boundaries.

A rigidly controlled air photo mosaic at a scale of 200 feet to one inch was made of the town of Smiths Falls, Ontario, to be used by Central Mortgage and Housing Corporation in town planning.

Plotting was almost completed for 28,395 trimetrogon air photographs, covering 291,000 square miles.

The following improvements were made in operations:

A logarithmic spiral and logarithmic arc were made for use in scale factoring the resected points of paper templets.

A table was computed to read off depression angles of wing photographs as given by the negative at the instant of exposure.

Tables based on 27,000 computations were made for determining new focal lengths and depression angles to compensate for print distortion.

A special templet was reproduced on glass to evaluate the movement of pass points caused by paper distortion.

Methods were set out for solving the following photogrammetric problems:

To find unknown focal lengths.

To find the depression angle of an oblique photograph in level country from three suitably disposed control points.

To find the plumb point of a near vertical from three control points and their elevation.

To find the isoaxes proper of a trimetrogon set when the focal lengths differ from each other.

Computations and drawings were in progress for reading off the oblique tip of a wing photograph when its horizon is fogged out at the photo margin.

Aeronautical Charts

Aeronautical charts are being compiled by the combined staffs of the Legal Surveys and the Compilation and Reproduction Divisions.

The Duluth-Houghton 8-mile standard sheet No. 51 N.E., was started to complete coverage of the new T.C.A. air route to Western Canada. Four standard and twelve preliminary charts were revised.

Seventy-nine air information plates for the 8-mile aeronautical charts were revised. An index to aeronautical charts is issued bi-monthly to users.

Work was started on 22 sheets of the World Aeronautical Chart I.C.A.O., 1:1,000,000, of which 16 were compiled. The series gives world coverage and is drawn to specifications laid down by the International Civil Aviation Organization. Canada is responsible for 65 sheets covering or touching on Canada.

A revised edition of the World Aeronautical Planning Chart showing airways and air routes in Canada was issued at a scale of 1:5,000,000.

Increased activity in R.C.A.F. training made it necessary to revise and reprint six charts in the North American Plotting Series.

Other Activities

The Division supervises production and sale of the Canada Air Pilot, issued by the Department of Transport. The Pilot consists of two volumes covering all of Canada and Newfoundland, and overlaps into the United States and Alaska. Amendments are issued every two weeks to each volume, and 1,199 copies of the Eastern Volume, 868 of the Western Volume, and 21,039 individual pages were distributed.

Encouraging results were obtained in experiments to obtain ground profiles from an aeroplane in level flight with the aid of radar and sensitive pressure altimeters. It is now believed that the radar altimeter is sufficiently developed to undertake practical operations in obtaining level data to control the drawing of contours on aeronautical charts. A small project is planned for 1948. The National Research Council and the R.C.A.F. are co-operating in this work.

Numerous air line distances were supplied to the Post Office Department, the Canadian Broadcasting Corporation, and the Air Transport Board. Short distances are measured directly on the aeronautical charts. Longer distances are calculated. Air line distances supplied by the Surveyor General are accepted as official for air mail contracts.

By the Representation Act, 1947, the Surveyor General is responsible for preparing the 273 electoral district maps required under the Act. By the end of the fiscal year, 157 maps were printed, and 69 were compiled.

The 1933 issue of electoral district maps was in blue-print form. The current issue is lithographed in two colours, the base map in black, and the boundaries of the districts in a transparent red. This process is cheaper and produces a more satisfactory map.

The descriptions of the 146 electoral districts involved in boundary changes were written in co-operation with the Chief Electoral Officer's staff before inclusion in the Act.

Current astronomical field tables were prepared for use on surveys throughout Canada. The tables for corrections to chained distances for slope and temperature were enlarged, rearranged, and reprinted, and the "Manual for Control Surveys" was reprinted.

Survey Records and Distribution

This Section registers and records all survey notes and plans affecting Dominion lands and distributes topographical and geographical maps, aeronautical charts, publications, and official plans.

During the year, 33,426 letters and requests for maps and aeronautical charts, and 831 technical requests concerning survey records were dealt with.

The following were distributed:

National Topographic Series maps	92,248
National Topographical Series maps published by the Army Survey Establishment, R.C.E.	44,631
Aeronautical and plotting charts	102,254
Sectional maps	11,514
Old Chief Geographer's Series	7,358
Miscellaneous maps	153,735
Forestry maps	351
Electoral District maps	9,354
Official plans	10,035
Publications	3,722
Total	435,202

This was an increase of 86,429 over the previous fiscal year. Approximately 64 per cent were distributed free of charge to federal and provincial administrative offices and to educational institutions.

Board of Examiners for Dominion Land Surveyors

This Board held two meetings. The first was a special meeting from May 2 to May 19, inclusive, during which examinations were held in Ottawa and Edmonton. The second, from February 9 to March 29, was the regular annual

meeting in accordance with Section 9 of the Dominion Land Surveys Act. During this meeting, examinations were held at Ottawa, Winnipeg, Saskatoon, Edmonton, Vancouver, and Victoria.

Fifty-eight of the 64 candidates wrote preliminary examinations and 16 were successful; five wrote the final, and one was successful; and one wrote the examinations for Dominion topographical surveyors.

Two commissions were issued to candidates who had passed the final examination and had furnished oaths of office and allegiance and bond for $1,000 as required by Section 25 of the Dominion Land Surveys Act. Five certificates of preliminary examination were issued to successful candidates who had complied with the requirements of the Act.

R. H. Montgomery, a member of the Board of Examiners, died in an automobile accident on October 6, 1947, while on duty in Saskatchewan. F. H. Peters was appointed Chief of the Surveys and Mapping Bureau, and relinquished the Chairmanship of the Board which he had held since 1924. J. L. Rannie, Dominion Geodesist, became a member of the Board, and B. W. Waugh, Surveyor General, became Chairman.

Office Work

Instructions for field surveys were prepared. Plans and field notes relative to field surveys were examined. Descriptions, reports, plans, and sketches relating to surveys affecting the 2,200 Indian reserves in Canada were continued.

Two hundred and seventy-five descriptions for insertion in legal transfers were prepared, 96 new plans were drawn, and 159 plans, including 31 plans of mineral claim surveys, were examined and approved. There were 4,092 blueprints and photostat copies from plans or field notes requisitioned and sent out. Additional information was added to 817 plans and maps, and 1,771 letters or memoranda relating to surveys were prepared for the Surveyor General's signature.

Instructions were issued to four Dominion Land Surveyors in private practice for surveying 151 mineral claims in the Northwest Territories and Yukon.

Five map sheets were prepared for the R.C.M.P. showing the location, name, and number of all Indian reserves in Canada. A preliminary print of the new edition of the Manual of Instructions for the survey of Dominion Lands was examined.

MAP COMPILATION AND REPRODUCTION DIVISION

In the reorganization of the Department, the Map Compilation and Reproduction Division was formed from parts of the former Hydrographic and Map Service and the draughting office of the former Bureau of Geology and Topography.

Some editions of the large scale Canadian maps issued the previous fiscal year were depleted by American tourist needs. Maps for such purposes frequently require extensive revision, but the shortage of staff and facilities limited revisions to important changes.

The 64-mile map of Canada published by the Division late in the fiscal year was widely approved. Drawn on a Lambert conformal projection, the map measures 42 inches by 58½ inches and may be obtained with or without rods. The main highways, air routes, and railways are shown.

In the National Topographic Series, the bases of five standard 8-mile sheets were revised or corrected and one new sheet was compiled. Revisions of 12 preliminary sheets, four 4-mile sheets and five 2-mile sheets were prepared.

A revised edition of the Edmonton sectional sheet was issued to meet the demand arising from development of the Leduc oil field. Limited corrections were made on eight other sheets of this series.

Revisions and corrections were made to the 100-mile map of Canada showing natural resources, a diagrammatic map of Alberta showing municipal district boundaries, the Waterton Lakes National Park and the Prince Albert National Park maps, and the 35-mile map of Alberta. Such small scale maps are in great demand for administrative purposes by Dominion and Provincial departments as base maps for showing a wide variety of projects.

At the request of the Department of National Defence, the co-ordinates were calculated for the projections of four azimuthal equidistant charts of the world, centred at strategic points across Canada. Co-ordinates were also calculated for a number of charts on the transverse Mercator projection for the Hydrographic Service and other Divisions.

Field tables were computed for determining azimuth from observations on Polaris between latitudes 60° and 66°. Tables giving chainage corrections for slope and temperature were enlarged and revised. Research was undertaken into the structural relationship between the Lambert Conformal and the Transverse Mercator projections.

Regulations require that all names shown on maps published by the Government be approved by the Geographical Board of Canada. For the Bureau, this entailed preparing lists categorized to facilitate Board rulings.

Name lists were prepared for the Columbia River Basin Series and the 1:1,000,000 World Aeronautical Charts.

Draughting Section

Finished drawings were made of eight standard aeronautical charts, including the new Duluth-Haughton sheet.

Approximately 90 drawings were made for magenta overprints showing aeronautical information. In the reorganization of the Department this work was taken over by the Legal Surveys Division. Seven 4-mile, two 2-mile, and one 1-mile sheets of the National Topographic sheets were drawn, or the drawings revised.

Transverse Mercator projections were drawn for seven latitude bands for the 1:1,000,000 world aeronautical charts in hand, and six maps of the series were drawn to ICAO specifications.

Twenty projections were drawn for maps of the Columbia River project and ten of these maps were drawn.

Two hundred and forty-seven drawings were made for the Electoral maps.

The work in the photo-mechanical plant was:

Wet plate negatives	1,987
Photo-lithographic plates	1,061
Photographic prints	6,757
Vandyke prints	4,246
Vandyke printing (sq. ft.)	3,303
Blue-printing (sq. ft.)	211,507
Photostat work (sheets)	14,667

The old blue-printing machine was replaced by a faster machine capable of taking 54-inch paper. A new photostat machine was installed.

The Division regrets to record the death of Herbert Murray who had been the Chief of the Photo-Mechanical Section. He had just completed a mission for the Department to Washington and Philadelphia.

Four hundred and twenty-four maps, including 157 new Electoral map sheets were published.

Details of the printing are:

	Maps	Total Copies
New maps printed	186	366,150
Maps reproduced	3	1,045
Maps revised	34	134,950
Maps reprinted	92	274,610
Hydrographic charts	70	66,890
Miscellaneous	39	13,985
		857,630

The Division co-operates with all Survey organizations of the Dominion and Provincial Governments and with private engineering and development companies in exchanging mapping information. An essential part of its equipment is its collection of maps, plans, and other data which is a reservoir of recorded information.

List of New or Revised Maps Printed by the Map Compilation and Reproduction Division During the Fiscal Year 1947-48.

(1) Aeronautical Charts, National Topographic Series

Location	Number	Name	Scale	Latitude	Longitude	Remarks
Labrador	13 SW.	Northwest River	8 mi.	52° 00′ to 54° 00′	60° 00′ to 64° 00′	Preliminary, Revision
Quebec	23 SE.	Ashuanipi	8 mi.	52° 00′ to 54° 00′	64° 00′ to 68° 00′	Preliminary, Revision
Quebec	23 NE.	Dyke Lake	8 mi.	54° 00′ to 56° 00′	64° 00′ to 68° 00′	Preliminary, Revision
Quebec	34 NW.	Port Harrison	8 mi.	58° 00′ to 60° 00′	76° 00′ to 82° 00′	Preliminary, Revision
Quebec	35 SW.	Cape Smith	8 mi.	60° 00′ to 62° 00′	76° 00′ to 81° 00′	Preliminary, Revision
Ontario	40 NE.	Windsor-Toronto	8 mi.	42° 00′ to 44° 00′	79° 00′ to 83° 00′	Standard, Revision
Manitoba	54 NW.	Churchill	8 mi.	58° 00′ to 60° 00′	92° 00′ to 96° 00′	Preliminary, Revision
Alberta-Saskatchewan	73 NW.	Lac la Biche-Peter Pond	8 mi.	54° 00′ to 56° 00′	108° 00′ to 112° 00′	Standard, Revision
British Columbia	104 NE.	Dease Lake	8 mi.	58° 00′ to 60° 00′	128° 00′ to 132° 00′	Preliminary, Revision
British Columbia	104 NW.	Juneau-Atlin	8 mi.	58° 00′ to 60° 00′	132° 00′ to 136° 00′	Preliminary, Revision
Northwest Territories	55 SW.	Eskimo Point	8 mi.	60° 00′ to 62° 00′	92° 00′ to 96° 00′	Preliminary, Revision
Northwest Territories	36 SE. & SW.	Fox Peninsula	8 mi.	64° 00′ to 66° 00′	72° 00′ to 80° 00′	Preliminary, Revision
Northwest Territories	105 SE.	Wolf Lake-Watson Lake	8 mi.	60° 00′ to 62° 00′	128° 00′ to 132° 00′	Preliminary, Revision

(2) Other National Topographic Series

Quebec	31K/SE.	Gracefield	2 mi.	46° 00′ to 46° 30′	76° 00′ to 77° 00′	Revision
Quebec	31J/SE.	Ste. Agathe	2 mi.	46° 00′ to 46° 30′	74° 00′ to 75° 00′	Revision
Quebec	32C/SW.	Senneterre	2 mi.	48° 00′ to 48° 30′	77° 00′ to 78° 00′	Revision
Quebec	31I/10	Shawinigan	1 mi.	46° 30′ to 46° 45′	72° 30′ to 73° 00′	Revision
Ontario	31D/NW.	Orillia	2 mi.	44° 30′ to 45° 00′	79° 00′ to 80° 00′	Revision

Ontario	52 F	Dryden	4 mi.	49° 00′ to 50° 00′	92° 00′ to 94° 00′	Revision
Ontario	52 G	Ignace	4 mi.	49° 00′ to 50° 00′	90° 00′ to 92° 00′	Revision
Ontario	52 P	Miminiska	4 mi.	51° 00′ to 52° 00′	88° 00′ to 90° 00′	Revision
Manitoba	64 C	Granville	4 mi.	56° 00′ to 57° 00′	100° 00′ to 102° 00′	Revision
Saskatchewan	64 D	Reindeer Lake South	4 mi.	56° 00′ to 57° 00′	102° 00′ to 104° 00′	Revision

(3) Sectional Maps

Manitoba	172	Fairford	3 mi.	51° 06′ to 51° 48′	98° 00′ to 100° 10′	Revision
Alberta	315	Edmonton	3 mi.	53° 11′ to 53° 54′	112° 02′ to 114° 00′	Revision
Alberta	66	Medicine Hat	3 mi.	49° 40′ to 50° 24′	110° 00′ to 112° 04′	Revision

(4) Aeronautical Plotting Charts (North American)

54½/116	Athabaska	1:1,000,000 at 56°	54° 30′ to 60° 00′	101° 00′ to 116° 00′	Limited Revision
54½/130	Fort St. John	1:1,000,000 at 56°	54° 30′ to 60° 00′	115° 00′ to 130° 00′	Limited Revision
41/88	Great Lakes	1:1,000,000 at 56°	41° 00′ to 48° 30′	73° 00′ to 88° 00′	Limited Revision
41/74	Nova Scotia	1:1,000,000 at 56°	41° 00′ to 48° 30′	59° 00′ to 74° 00′	Limited Revision
48/116	Regina	1:1,000,000 at 56°	48° 00′ to 55° 00′	101° 00′ to 116° 00′	Limited Revision
48/102	Winnipeg	1:1,000,000 at 56°	48° 00′ to 55° 00′	87° 00′ to 102° 00′	Limited Revision

(5) Special Aeronautical Plotting Charts for the Royal Canadian Navy

British Columbia	X	Cape Disappointment	1:1,000,000 at 56°	44° 00′ to 48° 00′	121° 00′ to 127° 00′	New
British Columbia	XI	Cape Cook	1:1,000,000 at 56°	47° 00′ to 51° 00′	124° 00′ to 130° 00′	New
British Columbia	XII	Cape Flattery	1:1,000,000 at 56°	47° 00′ to 51° 00′	120° 00′ to 126° 00′	New
British Columbia	XIII	Cape Scott	1:1,000,000 at 56°	49° 00′ to 53° 00′	127° 00′ to 133° 00′	New
British Columbia	XIV	Cape Caution	1:1,000,000 at 56°	49° 30′ to 53° 30′	124° 30′ to 130° 00′	New
British Columbia	XV	Cape St. James	1:1,000,000 at 56°	50° 30′ to 54° 30′	129° 30′ to 136° 00′	New
British Columbia	XVI	Cape Chacon	1:1,000,000 at 56°	52° 00′ to 56° 00′	127° 30′ to 134° 00′	New
British Columbia	XVII	Cape Bartolome	1:1,000,000 at 56°	53° 30′ to 57° 00′	130° 30′ to 137° 00′	New

(6) Miscellaneous Maps

Location	Number	Name	Scale	Latitude	Longitude	Remarks
		Canada	64 mi.	40° to 75°	55° to 141°	New
Ottawa		Experimental Farm	400 ft. to 1 in.			Revision
Alberta		Jasper Park South	3 mi.	52° 07′ to 53° 00′	116° 45′ to 118° 30′	Revision
		Northern Canada (Western part)	35 mi.	60° 00′ to 76° 00′	90° 00′ to 141° 00′	New
Alberta and Northwest Territories		Wood Buffalo Park	8 mi.	59° 05′ to 60° 40′	111° 00′ to 115° 30′	New
Canada		World Aeronautical Planning Chart	1:5,000,000			New
Eastern Canada		11 forestry maps	1 mi.			New
		6 other miscellaneous maps	Varied			New

(7) Electoral Maps

		Ontario	54			New
		Quebec	51			New
		Manitoba	17			New
		British Columbia	14			New
		Saskatchewan	21			New

DOMINION WATER AND POWER BUREAU

The chief function of the Bureau is the acquisition, analysis, and publication of stream-flow data covering the whole Dominion. These basic data are used in connection with power development, storage, irrigation, drainage, flood control, domestic water supply, and various international water problems. These hydrometric investigations are in accordance with the terms of co-operative agreements with the various provinces. To facilitate field operations, district offices are maintained in Vancouver, Calgary, Winnipeg, Ottawa, Montreal, and Halifax, with sub-offices at Kamloops, Nelson, Keewatin, North Bay, and Niagara Falls. These offices are also entrusted with important administration and engineering matters, and construction projects on behalf of other Federal agencies. Engineers of the Bureau serve on numerous International Boards concerned with waterway problems.

The Bureau's activities are largely co-ordinated with those of both public and private organizations interested in the use of water resources. Stream-flow data and assistance in hydraulic problems are furnished to organizations which reciprocate by supplying the Bureau with gauge records. Close co-operation is maintained with Dominion, provincial, and municipal authorities with respect to power and water-supply problems. The Bureau works with the Water Resources Branch of the United States Geological Survey in operating international gauging stations and exchanging flow data with respect to international streams.

The urgency of several special investigations and new demands for information arising from a marked increase in planning new power developments strained the resources of the Bureau. This was enhanced by difficulty in recruiting additional engineering and technical employees. Investigations requiring special attention included Columbia River surveys, the Snare River Power Project, and a power survey in the Northwest Territories. During 1947, 178,800 horse-power of new capacity was brought into operation; plants with a capacity of about 1,000,000 horse-power were under construction; and other sites under planning or investigation total an additional 1,000,000 horse-power.

DOMINION HYDROMETRIC SERVICE

During the fiscal year the work was expanded in British Columbia, Alberta, Saskatchewan, Ontario, and Quebec. More than 1,000 stream gauging stations were maintained, many of them continuously, and approximately 3,300 stream discharge measurements were made.

In British Columbia, additional recording gauges and metering stations were established on the principal tributaries of the Kootenay and Columbia Rivers in connection with the international Columbia River studies. In Alberta, storage and power studies on the upper Bow River involved establishing new stations, and a special study was made of ice conditions near Calgary. The current meter rating station was operated from May to October and more than 90 meters were calibrated and repaired. In Ontario, 12 new stations were established, two for power purposes and ten for flood control studies. In Quebec, the outflow of storage reservoirs were rated and special gauges were operated on the Richelieu and Magog Rivers for international purposes. Hydrometric operations were extended on rivers north of the Gulf of St. Lawrence because of new interest in the water powers of this area.

Run-off Conditions in Canada

For Canada as a whole, the run-off for the year was well above normal, although there were severe seasonal shortages of water in some areas. On the Pacific Coast and on Vancouver Island, monthly stream-flow was below normal

except for October, while in the interior of British Columbia the flow generally was well above average. Sproat River, in the coastal region, had a flow of 83 per cent of the long-term mean, and for the upper Kootenay River the flow was 118 per cent. New maximum and minimum flows were recorded on the Skeena River in northern British Columbia. In the Arctic and western Hudson Bay drainage, typical stations showed a range in yearly run-off from 215 per cent of the long-term mean for the Red River at Emerson, Manitoba, to 91 per cent for the English River at Sioux Lookout in northwestern Ontario. In the St. Lawrence and southern Hudson Bay drainage, the range was from 165 per cent for the Saugeen River at Port Elgin in southwestern Ontario, to 108 per cent for the Harricana River in northern Quebec. In the Atlantic drainage there were extreme variations from high water to drought conditions, but the mean yearly stream-flow on typical rivers did not vary greatly from average. The flow of the Lepreau River in southern New Brunswick was 82 per cent of the long-term mean, and that of the St. John River at Pokiok in northern New Brunswick was 105 per cent.

Snow and Glacier Surveys

To aid in predicting the amount of spring run-off available from accumulated snow in important drainage areas, annual snow surveys are made on selected typical courses in these areas at the same time each year, and the water content of the snow cover is determined. The survey of St. Mary River, Alberta, in co-operation with the United States Geological Survey, is made in Glacier National Park, Montana, in early May. The 1947 result showed 138 per cent of the average for 26 years. In the Bow River basin near Lake Louise, at the end of March, 1948, the snow water content was 150 per cent of the 11-year average. In the Winnipeg River watershed, the surveys are conducted early in March co-operatively with the United States Corps of Engineers and the Hydro-Electric Power Commission of Ontario. The 1948 results showed snow slightly in excess of the 20-year average. Six surveys were conducted on watersheds of rivers in the northern sector of central Ontario. The average for the 1947-48 surveys showed the amount of accumulated snow to be about equal to the mean of previous years of record.

The glacier observations, begun in 1945 in connection with studies of the water resources of the mountainous regions, were continued. Five glaciers were under study in British Columbia and six in Alberta. Further recession of the tongues of all glaciers was noted, the average retreat for the two-year period being at the rate of 88·6 feet per year. An article describing the glacier observations by the Bureau was prepared for delivery at the conference of the International Union of Geodesy and Geophysics at Oslo in August, 1948.

Regulation of Lake of the Woods and Lac Seul

The regulation of Lake of the Woods was continued under the authority of the Lake of the Woods Control Board. The annual run-off of the watershed was well above normal and reached flood proportions in June. The lake level rose from 1,059·61 feet on April 1, 1947, to a peak of 1,062·08 feet on June 17. Water was wasted at varying rates during the periods April 1 to May 21, and June 5 to July 23. From June 13 to July 10 all dam gates were fully open and the discharge from the lake was at the maximum rate. Wasting of lesser proportions was allowed during the periods August 15 to September 2, October 7 to November 1, December 23 to January 5, and February 20 to March 31, 1948. The elevation of the lake on March 31, 1948, was 1,059·73 feet. During the period June 6 to September 7, the level of the lake was above 1,061·0 feet, thus its regulation was subject to the approval of the International Lake of the Woods Control Board.

The regulation of Lac Seul, under the supervision of the Lake of the Woods Control Board, was carried out by the Hydro-Electric Power Commission of Ontario. The run-off for the watershed was slightly below normal for the year, with low flow conditions during the last six months. The lake level, which was at 1,167·31 feet on April 1, 1947, rose to a peak of 1,171·58 feet by September 11 and was drawn down to 1,166·85 feet by March 31, 1948. Water was spilled up to the maximum rate of 10,600 second-feet during the period June 12 to July 24 to hold the lake within storage limits. Water was also released during the period September 10 to February 21 at rates varying up to 4,700 second-feet to supplement the flow of the Winnipeg River in Manitoba and to provide storage capacity for the spring run-off period.

The Water-Power Resources of Canada

From the records of the Bureau's hydrometric investigations and from data accumulated from other sources, periodic revisions are made of the water-power resources of Canada. The current estimate shows resources of 40,124,000 h.p. at ordinary six-months flow, which would allow for a commercial installation of about 52,000,000 h.p. On the basis of ordinary minimum flow, the estimate is 25,723,000 h.p. During 1947, new hydraulic installations totalled 178,800 h.p., bringing the installed capacity of all water-power plants in Canada to 10,491,000 h.p. Central electric stations comprise more than 90 per cent of this capacity. Hydro-electric energy produced by hydraulic central stations in Canada comprises more than 97½ per cent of all electricity produced for sale. The 1947 production of 43,893 million kilowatt hours exceeded the 1946 output by eight per cent. The current water-power situation was discussed in the Bureau's annual bulletin, "Water Power Resources of Canada", issued March 15, 1948.

Water Resources Monthly Review

The Bureau co-operates with the United States Geological Survey in issuing monthly summaries of general stream-flow conditions in Canada and the United States. The monthly flow records of selected rivers are computed immediately at the month's end at each of the district offices across Canada, and these flow data are transmitted by airmail to Washington where they are combined with those for the United States. The information in bulletin form is made available promptly to the general public. It is of value in all matters connected with run-off. Semi-annual and annual summaries are also issued.

SPECIAL INVESTIGATIONS

Snare River Power Project

The Bureau continued to supply engineering advice and services in connection with the construction, by the Crown, of an 8,000 horse-power hydro-electric development on the Snare River, Northwest Territories. Early in the year these services were provided through the Surveys and Engineering Branch and later by the Special Projects Branch. Progress made is described in the section devoted to the Special Projects Branch.

Northwest Territories Water-Power Survey

A reconnaissance water-power survey of the upper Snare and Lockhart Rivers was made to determine the possibilities of developing power to serve the Indin and Courageous Lakes areas where metal discoveries are being explored. There are two sites a short distance below Indin Lake with an estimated combined capacity of 11,000 h.p. but favourable sites to serve the Courageous Lake area are lacking.

Columbia River Surveys

Considerable progress was made in the investigations on behalf of the International Columbia River Engineering Board for the International Joint Commission. Co-operation with Dominion, Provincial, and United States agencies was extended. Extensive ground water and hydrometric data were obtained and new stations established. Reconnaissance and damsite surveys resulted in the production of river map sheets and plans. Field operations included aerial photography, precise levelling, bathymetric surveying, topographic mapping, geological studies, soil surveys, and damsite drilling. Further auxiliary studies related to development of the water resources of the basin were made.

WATER POWER ADMINISTRATION

Reference was made in the Annual Report for 1946-47 to the agreement between the Governments of Canada and Alberta, confirmed by concurrent legislation, under the terms of which final water power licences were issued to Calgary Power, Limited, for the Horseshoe Falls and Kananaskis Falls developments. The final licence was issued to this company for the Ghost Power undertaking on the Bow River above Calgary. As required by the water-power regulations, the capital cost of each development as of December 31, 1944, was fixed and agreed upon. These developments are now administered by the Province. Under the terms of the Ghost River licence the Indians of the Stony Band received $53,506.77. They had previously received $62,100 as rental for the period 1930-1946 inclusive. Also, approximately $100,000 accrued rental became payable to the Province. The Indians receive approximately $20,000 annually from these three developments.

A final licence was issued for the Lake Minnewanka-Cascade River development. The channel at the Ghost River diversion was excavated and sealed and the shores of Lake Minnewanka and two tributary lakes were cleared of timber killed by flooding. Usable storage was 171,086 acre-feet on October 31, 1947, the highest so far recorded, and the power output for 1947 was 54,335,400 kwh., approximately 10 per cent less than in 1946.

The plant of The Consolidated Mining and Smelting Company of Canada, Limited, on Yellowknife River, Northwest Territories, produced 24,560,500 kwh. as compared to 21,025,000 kwh. in 1946.

As required by the Statutory Orders and Regulations Order, 1947, revisions were made to the Dominion Water Power regulations originally established in 1921. These revisions, mainly textual, were necessitated by the abolition of the Department of the Interior and the establishment of the Department of Mines and Resources. The revised regulations were established by P.C. 4683 of November 19, 1947. The special regulations established in 1906 with respect to new water power grants in Yukon are replaced by the general water power regulations, because modern means of communication have rendered special regulations unnecessary. A Bill to amend the Dominion Water Power Act, R.S.C. 1927 (Chapter 210), was introduced in the Senate February 4, 1948, received third reading on February 10, and, by March 31, was awaiting introduction in the House of Commons. The Bill establishes, beyond question, the authority of the Minister, with the approval of the Governor in Council, to develop water powers on lands of the Dominion in the right of the Crown.

INTERNATIONAL WATERWAY PROBLEMS

International Boards of Control with which the Bureau is actively concerned, and which functioned during the year, were those relating to the Columbia River, Kootenay Lake, Osoyoos Lake, St. Mary and Milk Rivers,

Souris River, Rainy Lake, Lake of the Woods, Prairie Portage, Lake Superior, Niagara, Massena, Lake Champlain, and St. Croix River. Engineering investigations and studies were also made on behalf of other Boards and Engineering Committees under the jurisdiction of the International Joint Commission.

Columbia River.—Under the chairmanship of the Controller, and with funds and personnel provided by the Bureau, the Canadian Section of the International Columbia River Engineering Board continued to study further uses of the water resources of the Columbia River basin in Canada. The investigations are conducted in the interests of domestic water supply and sanitation, navigation, water power, flood control, irrigation, reclamation of wet lands, and conservation of fish and wildlife.

Osoyoos Lake.—Under the direction of the International Osoyoos Lake Board of Control, of which a Bureau engineer is a member, improvements were made at the outlet of Osoyoos Lake to increase the discharge capacity during freshet stages of the Okanagan River, and thus minimize flooding.

St. Mary and Milk Rivers.—Extensive studies were continued in the St. Mary and Milk Rivers basins to determine the natural flow at the International Boundary. In this vicinity, investigations also were carried out in reference to the use of the waters of Sage Creek, and Bureau engineers testified at the hearing by the International Joint Commission in Havre, Montana, in November.

Souris, Red, and Roseau Rivers.—The Bureau contributed to international investigations and studies involving the Souris, Red, and Roseau River systems. In January, 1948, the problem of the division of the waters of international river systems in the vicinity of the Boundary from the Milk River basin on the west, to, and including, the Red River basin on the east, was referred to the International Joint Commission. Bureau officials have been co-operating in the preparation for this investigation, which will involve additional hydrometric and engineering assistance.

Rainy Lake.—The International Rainy Lake Board of Control, on which an engineer of the Bureau serves, held two meetings and submitted a report to the International Joint Commission on the regulation of Rainy and Namakan Lakes.

Niagara River.—Special attention was given to hydraulic problems arising from the construction of the submerged weir in the Niagara River above the Horseshoe Falls. This weir was built under international agreement. Studies of the Niagara River slopes and river discharge also were continued.

TECHNICAL ASSISTANCE TO FEDERAL AGENCIES

The western district offices of the Bureau are entrusted with important administration and engineering matters, and construction projects on behalf of other Federal agencies.

Indian Affairs Branch.—The Vancouver office administered all water rights on Indian reserve lands in British Columbia, and applied for the required licences from the Provincial Government. Satisfactory conferences were held with the provincial Comptroller of Water Rights on matters affecting Indian interests. Direct assistance was given in planning and carrying out many engineering works relating to Indian reserves. This involved an expenditure of over $43,000 during the year.

Lands and Development Services Branch.—In British Columbia and Yukon, engineering work on 34 projects costing more than $49,000 was done on Indian reserves. Detailed reports were prepared covering a number of other projects

which will involve large expenditures. Engineers of the Winnipeg office made inspections, surveys, and reports covering buildings, water supply, and other projects on 13 reserves in Ontario, Manitoba, and Saskatchewan.

Other Agencies.—Assistance was given the Public Works Department in the major hydraulic problem involved in developing and maintaining permanent ship channels in the Fraser River. Co-operative programs with the Pacific Biological Station, Fisheries Research Board of Canada, and with the International Pacific Salmon Fisheries Commission were expanded to meet new hydrometric demands.

GEOGRAPHICAL BUREAU

The important contribution that can be made by professional geographers in government and academic spheres was recognized by the establishment of a Geographical Bureau in Canada by the Cabinet on June 5, 1947. The early organization of the new Bureau was undertaken by Dr. Diamond Jenness while he was on loan from the National Museum of Canada, and recruiting of a staff began in August. The Chief of Bureau was appointed early in October and the search for qualified geographers to fill several positions already established was at once intensified. Because the first university department of geography in Canada was not opened until 1935, no senior geographers have yet been trained wholly in this country. The Bureau, therefore, recruited some of its staff elsewhere. Geographers now employed at the Bureau received their training in universities in Canada, the United States, the United Kingdom, France, and Poland, although all are Canadian citizens.

The Bureau had been in operation for six months at the end of the fiscal year. Much of the energy of its small staff was devoted to securing space, furniture, publications, and research materials. In spite of difficulty in finding highly qualified geographers, and the numerous problems that face any new organization, research work was carried on according to plan. The Bureau is believed to be the first governmental attempt to set up a central organization for carrying on geographical research. Such a plan clearly conserves the efforts of the few Canadian geographers, and prevents duplication of effort in different Government departments.

Broadly, the functions of the Bureau are to collect, organize, and make readily available for the use of all branches of the Government, geographical data about Canada and foreign areas of importance to Canada. The Bureau concentrated on compiling data on Northern Canada, while not neglecting to build up facilities required for wider research. Numerous special reports were prepared for other Government departments. Files containing topographical and other data on northern Canada, and classified by areas, were started. The summarization of the work of many hundreds of northern travellers provides swift access to geographical information needed for aviation, administration, and navigation. The files contain details of all northern settlements and will in time, it is hoped, form a record of all the important geographical facts known about the Canadian north. Travellers, traders, missionaries, and all those whose work has taken them into the far north, co-operated with those compiling this information.

Field Work.—Field work was limited by winter conditions. However, one important northern reconnaissance flight was made in mid-winter by J. L. Jenness, geographer. To supplement the information available in Ottawa he visited Churchill, Baker Lake, and settlements in the Mackenzie valley as far north as the Arctic Coast. In addition to information gathered directly, the Bureau benefited by making excellent contacts with long-term northern residents, thus securing accurate information based on personal experiences.

Details were worked out and staffs selected for eight field parties to work in Northern Canada during the summer of 1948. Because of the small permanent staff many of the geographers will be recruited from universities. One important purpose of the field parties is to provide training in field methods for younger geographers who in later years will be qualified to head similar parties. This arrangement will also enable young Canadian geographers to secure in this country the field experience needed to obtain higher academic degrees, which in the past have often been sought elsewhere, with a consequent loss of promising young scientists.

Research

The Bureau initiated original research on the Arctic Islands and the neighbouring mainland. In this work much use was made of modern aerial photographs and of the older reports prepared by early explorers. Some assistance was given to those responsible for locating sites for far northern weather stations and other new scientific establishments. In this work the Bureau's primary aim is to assist in the selection of places which will be satisfactory for as many purposes as possible, so that the great cost of opening, operating, and maintaining such places can be reduced and shared by as many Government agencies as possible.

Map Intelligence, Inquiries

The Bureau provided up-to-date map information on Canada and foreign areas for the Department of External Affairs, the National Film Board, the Department of National Defence, the Department of Agriculture, and other official agencies in addition to numerous private inquirers.

Although the Bureau was in operation for only a few months there were many requests for information from different parts of Canada and from foreign countries. Geographers carrying on research on Canadian subjects used the Bureau as a clearing house for the information they needed. Foreign inquiries increased rapidly as the Bureau's work became widely known. Almost invariably such foreign contacts lead to valuable additions to the map and reference library. Canadian and foreign geographers have begun to use the Bureau as a headquarters when in Ottawa.

Map and Photographic Collections

A central collection of Canadian and foreign maps needed for the Bureau's own research was started. A complete set of all Canadian map sheets from federal and provincial sources is being collected, and foreign maps were obtained by exchange and purchase. It is hoped that within a few years Canada will have in the Geographical Bureau a well-catalogued series of maps adequate for the needs of all Government departments. The classification being used is the same as for that of the library. A map curator and assistants are being trained because of the lack of fully qualified persons in Canada.

A classified collection of photographs of terrain and other geographical features is being compiled. All photographs made by the Bureau's field workers are incorporated in the collection.

Scientific and Other Meetings

The Bureau was represented by its Chief at the meetings of the Association of American Geographers and the American Society of Professional Geographers, held at the University of Virginia, Charlottesville, in December. Following these meetings, he inspected United States Government agencies at Washington, and made arrangements for the exchange of geographical publications.

R. T. Gajda and J. L. Jenness attended meetings of the Geological Society of America held in Ottawa in December, 1947.

There were many requests for the Bureau's staff to address meetings and conferences and it was only possible to accept some of them. The Bureau Chief addressed the following meetings:

Annual Meeting of the Canadian Geographical Society

Easter Conference of the Ontario Educational Association (at which five addresses were given)

Ottawa Teachers' Association

Geographical Society of Montreal

Personal contacts were made with geographers in all eastern Canadian universities and with persons engaged in geographical work in the Ontario and Quebec Provincial Governments.

No meetings outside North America were attended, although plans were completed for a strong Canadian delegation to attend the International Geographical Union Congress at Lisbon. The preparation of a map exhibit was begun. It will be the first occasion in which the Canadian Government will have taken a full part in the work of the Union.

Library

A geographical library is essential for satisfactory research in the Bureau. Immediately on its establishment a staff was set to work checking the contents of all Ottawa libraries to estimate the existing coverage of books, pamphlets, atlases, and periodicals in the fields of science likely to be touched on. Following this a nucleus of a library was set up, avoiding duplication with other libraries whenever possible. A highly qualified librarian was appointed. Because of the need for conserving space and funds, use is made of a microfilm projector.

An important collection of foreign geographical periodicals not available elsewhere in Canada is being built up. All books, pamphlets, and reports are classified under a specially designed geographical system adapted from the Boggs and Lewis system used in the United States.

NATIONAL MUSEUM OF CANADA

The desire of the Government to bring the National Museum to the position it should occupy among scientific and cultural institutions was, to a considerable extent, brought to fruition during the fiscal year. This desire, long held, was virtually impossible of fulfilment during the war years, although steps towards doing so had been taken in the immediate pre-war period. Recent visitors to the Museum from similar institutions have been impressed with the enhanced activities and greatly improved interior appearance.

During the year, a number of additions were made to the staff, field work was increased, and educational work expanded. The rotunda and exhibition and communication halls were redecorated, the lighting was improved, three exhibition halls on the second floor which were closed to the public throughout the war and during 1945 and 1946 were re-opened, new seats were placed in the gallery of the lecture hall and much-needed new projection equipment was installed. The Biological Division and the National Herbarium were moved to newly decorated quarters on the fourth floor, and progress was made on new exhibits, particularly the beaver habit group. A large totem pole, acquired during the summer in British Columbia, was placed on the west side of the main archway of the rotunda where it forms a balanced counterpart to the fine totem pole on the east side of the arch.

The great need of the Museum now is for more space for exhibits, storage, and research. Large collections are stored in several other buildings in Ottawa where they are available neither for the public to see nor for the specialist to study. There are also many phases of the natural history of Canada concerning which the Museum should have comprehensive exhibits, but which now are either wholly unrepresented or illustrated in an almost negligible manner. When more exhibition space is made available in the building by using for that purpose the rooms now occupied by the offices, the Museum will be in a position to take a great forward step in becoming an institution that will be a credit to Canada.

Most of the foregoing changes were made by June, and the thousands of visitors who came to Ottawa for the Marian Congress saw the Museum in its improved condition. The number of visitors for the year was more than 207,200. In December the Geological Society of America and a number of affiliated societies held their annual meetings in Ottawa. On the evening of December 29 a social function, attended by more than 900, was held at the National Museum and National Gallery. The principal item on the program was the presidential address by Dean A. I. Levorsen of Stanford University. In February, 1948, Their Excellencies, the Governor General and the Viscountess Alexander of Tunis, were in attendance to hear an address by Brigadier P. H. Hansen of London, England, on "Britain in Ceremonial".

Field work, reduced to a minimum during the war, was enlarged. The main fields of investigation were in zoology, botany, and anthropology, and research was carried out by officers of the Museum staff and by a number of university professors and graduate students engaged for the summer months. Educational work, one of the most widely known of the Museum's activities, proved again, by the attendance at lectures and by the increased demand for services afforded, to be a valuable channel of information to the general public, school groups, and educators.

One of the greatest assets of the Museum is the international renown enjoyed by various senior members of the staff as authorities in their respective fields. Through the medium of their field studies, published reports, papers and books, and addresses at learned societies, they have enhanced the reputation of the Museum, and accordingly the policy has been to allow them every reasonable scope in their endeavours.

The Museum lost the services of A. L. Rand who had been acting Chief of the Mammalogy and Ornithology Sections, and who left to join the staff of the Field Museum in Chicago.

The Curator of the Museum and the Secretary of the Museum Lecture Committee attended the meetings of the American Association of Museums at Quebec City in May. Later, the Curator took part in organizing a Canadian Museums Association, of which he became Secretary-Treasurer. The new organization will promote the work and welfare of Museums throughout Canada.

ANTHROPOLOGICAL DIVISION

C. Marius Barbeau, assisted by Arthur Price, made ethnological investigations on the North Pacific Coast. On the Queen Charlotte Islands he investigated the history of argillite carvings of the Haidas in order to complete, in the near future, a museum monograph on the subject. He recorded information on the lives of the Haida carvers and draughtsmen, and visited a number of ancient, deserted villages and photographed the remaining totem poles and structures. In the region around Prince Rupert he continued linguistic studies of the Tsimsyan Indians, made song records, and gathered myths and tales. This work was greatly facilitated by William Beynon, assistant and interpreter.

Among the Kwakiutls of Fort Rupert and Alert Bay, Dr. Barbeau studied the origin and late development of Tlingit totem poles, recorded myths, and studied the recent infusion of Kanaka blood among them. He also studied the plastic arts of the North Pacific Coast in the museums and private collections in Vancouver, Victoria, Seattle, Alberni, Alert Bay, Fort Rupert, Skidegate, Massett, and Prince Rupert.

Arthur Price made a large number of drawings in colour and in black and white, of native carvings. Some were finished and others will be completed and developed at a later date. He also took 1,200 photographs in addition to the 900 taken by Dr. Barbeau. William Beynon filled several notebooks with Tsimsyan narratives and repeated on the phonograph a number of native texts. These are now available for study at the Museum. Specimens collected by the field party included: the 45-foot Kwarsuh totem pole of the Wolf and Grizzly Bear, from Angyadae on the Lower Nass, which now stands in the rotunda of the National Museum; a collection of North Pacific specimens, and another collection of Eskimo specimens, both of these gathered by the late Walter C. Waters in Alaska and elsewhere; Carrier, Gitksan, and Kwakiutl specimens obtained at Hazelton and Hagwelget on the Upper Skeena and the Bulkley Rivers, and at Alert Bay. Fine carvings were obtained at Alert Bay and Fort Rupert, and negotiations were begun for an important collection of ancient and valuable specimens at Prince Rupert.

The Department of External Affairs appointed Dr. Barbeau a Canadian delegate to the UNESCO meeting at Mexico City, from November 4 to December 5. He also represented the Department at the meeting of the International Council of Museums which acted in an advisory capacity to UNESCO. In the 1947 re-organization and enlargement of the Wildlife Conservation Board he was again appointed chairman, and the advisory activities of the Board to the Government were resumed in the winter of 1947-48.

The following publications by Dr. Barbeau appeared during the year: *Come a Singing,* Canadian folk songs (National Museum Bulletin 107), *Grandmere raconte,* Longmans, Green and Co., Toronto; *Troix beaux canards* (collab. in "Archives de Folklore", Quebec); *Four Indian Tales* (collab. in "A Book of Canadian Stories", The Ryerson Press, Toronto); *Arbre des Reves* (Collection Humanitas, Editions Lumen, Montreal); and *Cornelius Krieghoff* (Canadian Art Series, The Ryerson Press, Toronto). Manuscripts accepted for publication include: *Le Reve de Kamalmouk,* and *Tresor des Anciens Jesuites* (at Editions Fides, Montreal); and *Tsimsyan Songs* (at the American Ethnological Society). A second mimeographed edition of *Anthropologie ou geographie humaine de l'Amérique du Nord* was issued for students by Université Laval, Quebec. A lengthy manuscript entitled *French Folklore* was prepared for the "Dictionary of Folklore, Mythology, and Legend," soon to be published by Funk, Wagnall Company, New York. The previous collaboration in the *Archives de Folklore* (Laval University, Quebec) was continued, and more articles will appear in the third number of this folklore periodical. Work progressed on an all-inclusive monograph on *Totem Poles.* A large manuscript on Iroquois names, by Charles Cook, in the course of preparation for several years in consultation with the Anthropological Division, was completed.

The Division employed a number of non-staff workers to collect folklore data in the Provinces of Quebec and Nova Scotia. The following areas were covered: Professor Luc Lacourciere and Abbe Felix Antoine Savard, both of Laval University, in Charlevoix County; Mlle Madeleine Doyon, of the same university, in Beauce County; Madame Juliette Caron-Dupont, the Magdalen Islands; M. Francois Brassard in the Lake St. John region; Brother Marcellin Andre in a number of localities in Quebec; and Miss Helen Creighton in Nova Scotia.

BIOLOGICAL DIVISION

A party headed by W. E. Godfrey conducted field work at Lake Mistassini and Lake Albanel, in the southern interior of the Labrador peninsula. Though the coasts of the Labrador peninsula have frequently been visited by ornithologists, little is known of the vast interior. The expedition brought back comprehensive notes, habitat photographs, and 701 specimens. The latter included 593 birds, 93 mammals, and 11 amphibians and reptiles, all from areas heretofore unrepresented in museum collections. Coloured motion pictures depicting phases of the summer life of the Montagnais-Nascopie Indians were obtained.

Field Work

A. E. Porsild visited the Mackenzie Delta Reindeer Grazing Reserve to study grazing conditions and the progress in the reindeer experiment. Travelling from Hay River by canoe, he made frequent stops along the Mackenzie River for botanical collecting and for studying biotic problems connected with the natural afforestation following destruction of the original forest by fire. He collected 350 plants along the Mackenzie, including several rare species heretofore known only from single collections made by early travellers in the Mackenzie District. Air transportation was provided for the survey of the Reindeer reserve which made possible visits to usually inaccessible places. Later, Mr. Porsild travelled from Edmonton, Alberta, to Fairbanks, Alaska, to accompany a U.S.A.A.F. "Polaris" non-stop flight from Fairbanks across the Arctic Archipelago to northwest Ellesmere Island. Arrangements for his participation in this flight were made by the Defence Research Board, Ottawa.

A party headed by W. K. W. Baldwin conducted a botanical survey of the east shore of James and Hudson Bays, from Ft. George to Great Whale River. With this party travelled botanists Dr. I. Hustich and Dr. R. Tuomikoski, both of the Botanical Institute of the University of Helsingfors, Finland, and Dr. E. H. Kranck, Professor of Geology in the University of Neuchatel, Switzerland.

The party obtained large collections of plants and valuable information on the floristics and ecology of the region.

Office Work

A. E. Porsild spent considerable time preparing his manuscript of Yukon Flora, of which the taxonomic part was completed last year. At the invitation of the Swedish National Museum at Stockholm he undertook preparation of a monographic treatment of the genus *Antennaria* in northwestern North America, which will be published in Hulten's Flora of Alaska and Yukon. The typescript, which comprised 61 pages, was completed and submitted in December. Simultaneously, he prepared a similar but less detailed treatment of the genus for his Yukon Flora.

After returning from the Mackenzie Delta, Mr. Porsild prepared a detailed 15,000 word report on the reindeer experiment.

A beaver group showing six beavers and their work in a representation of their natural habitat was completed; a selection of colourful Canadian birds was put on display; and miniature bear and Indian groups were made for loan purposes. Material was loaned for exhibition at the Sportsmen's Show in Ottawa. Reproductions of two bear skulls were made for exchange. A list of amphibians and reptiles that may occur in Riding Mountain National Park was prepared for the National Parks Bureau. Hair from various kinds of mammals was supplied to the Royal Canadian Mounted Police for technical analysis and

comparative records. A series of marine fishes was loaned for examination to Henry Hildebrand, McGill University. One hundred and eighty-eight birds and mammals were supplied from the School Loan Collection for use in nature study classes.

R. M. Anderson revised Bulletin No. 69, "Methods of Collecting and Preserving Vertebrate Animals", for re-publication.

Substantial progress was made in research on the taxonomy, distribution, and ecological relations of the birds of Canada. The study collection was increased by 1,555 bird specimens, and on March 31, 1948, the catalogued bird collection totalled 32,540.

A. L. Rand completed a comprehensive report on the birds of southern Alberta, and a manuscript on the mammals of Canada. He made progress on a distributional list of Canadian birds and submitted for publication several articles and reviews.

W. Earl Godfrey continued research on the birds of Canada, with special attention to certain species, the distribution and taxonomy of which have not heretofore been well understood. He made detailed studies of long-eared owls, swamp sparrows, olive-backed thrushes, water-thrushes, and brown-headed chickadees. The results of the studies completed were prepared for publication. He completed and submitted for publication a comprehensive report on the birds of the Lake St. John region, Quebec. Another report on the birds of Lake Mistassini and Lake Albanel, Quebec, was nearing completion.

He began to bring up-to-date the bibliographical files and species range maps, one of the most comprehensive and valuable compilations of bird distributional information in North America. He completed the 1942 literature, involving abstraction of data for over 1,000 cards, and plotted the distributional data on species range maps. He selected the material for, and supervised similar work on the 1943 bird literature, a work near completion. He examined the bird and mammal literature published during the fiscal year 1947-48, and selected suitable titles for carding.

The ornithology study collection continued to serve as the basis of bird research in the National Museum. Material contained in the collection was borrowed for research purposes by the Carnegie Museum, Pittsburgh, Pa.; the Museum of Comparative Zoology, Cambridge, Mass.; the University of Michigan, Ann Arbor, Mich.; the Universitetets Zoologiske Museum, Copenhagen, Denmark; the Museum of Vertebrate Zoology, Berkeley, Calfornia; and the Chicago Natural History Museum, Chicago, Ill. Several ornithologists from Canada and the United States visited the Museum to do research on the bird collection.

Numerous gifts of birds, some mammals, and a few amphibians and reptiles were received, and two collections of birds from the Hudson and James Bays region, totalling 744 specimens, were purchased.

H. J. Scoggan made final revisions to his 653-page manuscript "Flora of Gaspé", which was submitted for publication in December. He and W. K. W. Baldwin spent considerable time naming the collection of vascular plants obtained in 1947 by the James Bay field party, and did preliminary research on a series of popular ecological pamphlets planned for publication by the Museum. At the invitation of the Director of Protestant Education, Quebec, he joined a committee organized to draw up a new syllabus for High School Biology.

During the year, 76 visitors from Canada and abroad consulted the herbarium for varying periods. Dr. Morten P. Porsild, of Copenhagen, formerly Director of the Danish Arctic Station in Greenland, spent about four weeks in the Herbarium.

During the year, 2,239 herbarium specimens were received by exchange, 3,263 by donation, and approximately 10,500 from field work by members of the National Herbarium staff. Loans were made of 801 specimens, and 203

specimens were borrowed from other botanical institutions. There were 6,707 duplicate specimens distributed to other herbaria in Canada and abroad in continuation of exchanges. There were 7,854 specimens mounted and inserted in the Herbarium, bringing the total of numbered specimens in the National collection to 189,120.

Among the notable accessions received by donation are the private collections of Dr. H. J. Scoggan consisting of 2,001 beautifully mounted and prepared specimens of plants of the Gaspé peninsula, and a set of 581 plants of southern Yukon collected by Dr. Morten P. Porsild of Copenhagen.

EDUCATIONAL WORK

The Educational Section continued its varied program of service to the general public, school classes from Ottawa and outside localities, and to special groups. It is through this channel that the results of conservation and research are interpreted through the medium of correspondence, publications, loans of visual aids, and through participation in the various activities of the Museum at Ottawa. The increase in attendance, especially by school groups, following the re-opening of the exhibition halls, closed during the war years, and the increasing demand for the services mentioned, demonstrates the interest of educators and others in co-operating with the Museum. Normal school students resumed their annual survey of the Museum as an aid to their studies.

Visitors to the exhibition halls numbered 160,000, including scientists, teachers, students, and the general public. Special museum educational activities were attended by 47,200 persons. The scientific staff arranged educational exhibits for organized study groups, the largest of which had an attendance of 6,400. The total attendance was 207,200.

National Museum Lectures

The Museum lectures had a total attendance of 20,500. The program for the 1947-48 season was:

Adult Lectures—

Mexico, by H. L. Keenleyside, M.A., Ph.D., LL.D., F.R.H.S., Deputy Minister of Mines and Resources, Ottawa.

Through the Northwest Passage, by Corporal F. S. Farrar, Royal Canadian Mounted Police, Ottawa.

Moscow Anniversary, 1147-1947, by J. E. Stanley Lewis, O.B.E., LL.D., Mayor of Ottawa.

The Canadian Arctic in Colour, by A. L. Washburn, Ph.D., Director, The Arctic Institute of North America, Montreal.

Aircraft, Yesterday, Today and Tomorrow, by J. J. Green, Ph.D., Chief Research Aeronautical Engineer, Air Transport Board, Ottawa.

The World is Rich, by G. S. H. Barton, C.M.G., D.Sc.A., Deputy Minister, Department of Agriculture, Ottawa.

St. Ignace, an Old Huronian Town, by William Sherwood Fox, Ph.D., LL.D., F.R.S.C., ex-pres., University of Western Ontario, London, Ont.

Canadian Mines and Metals, by J. M. Humphrey, Travelogue-Lecturer, Vancouver, B.C.

Motion Picture Program: School for Danger, and Letter from Paris.

Life in the Mistassini Country, by W. E. Godfrey, Zoologist, National Museum of Canada, Ottawa.

The Belgian Congo in Colour, by D. M. Hodgson, Montreal, Que.

Motion Picture Program: New Zealand, South Africa, Australia and England.

Burma Background, by G. S. Jury, M.B.E., M.A., Ph.D., McMaster University, Hamilton, Ontario.

Two special lectures were given. On February 13 Brigadier P. H. Hansen, V.C., D.S.O., M.C., gave an outstanding illustrated lecture, "Britain in Ceremonial", and on March 31, H. R. Lillie, M.B., Ch.B., B.Sc., A.M.I.C.E., who had been with one of the British whaling fleets, used his splendid collection of lantern slides to illustrate an address "To the Antarctic on a Whaler."

Children's Lectures—

Motion Picture Program: Mexico and South America.
Through the Northwest Passage, by Corporal F. S. Farrar, Royal Canadian Mounted Police, Ottawa.
Indians of the Plains, by Douglas Leechman, Ph.D., National Museum of Canada, Ottawa.
Two Motion Picture Programs: Natural History films.
Let's Play, by Doris Plewes, Ph.D., Department of National Health, Ottawa.
On Safari in Northern Rhodesia, by C. S. Lord, Ph.D., Geological Survey, Ottawa.
Exploring around Lake Mistassini, by W. E. Godfrey, National Museum of Canada, Ottawa.
A Live Program, arranged by Wayne Robinson, Provincial Department of Lands and Forests, Ottawa, assisted by W. E. Steele and Royal Baker, Kemptville, Ont., R. Hewans, Percy and Samuel Headlam, George Boyce, and Guy D. Martin, Ottawa.
A Drop of Water and its Cousins, by Alice E. Wilson, Ph.D., Ottawa.
A Motion Picture, Alice in Wonderland, introduced by Mabel Godwin, National Museum of Canada, Ottawa.
A Motion Picture, Beyond Bengal.

The assistance of the Boy Scouts, Sea Scouts, and Commissionaires on Saturday morning in looking after the large number of children who come to the Museum is greatly appreciated by the Lecture Committee.

Particular acknowledgment is made of the co-operation of the local press in reporting the various lectures, and of the Ottawa Public Library in selecting and providing lists of books related to the subjects of the lectures for supplementary reading.

Lecture Hall

The Lecture Hall was made available for scientific and related meetings at which lectures were given, and 155 reservations were made. There was an attendance of 47,200 at these meetings, and approximately 388,150 feet of film and 2,250 lantern slides were shown. The Hall seats 598, and has equipment for showing 35mm. and 16mm. films, and standard and kodachrome lantern slides.

Photographs

Photographs to illustrate scientific publications, textbooks, and magazine and newspaper articles were selected from the large photographic collection taken by officers of the National Museum and the Geological Survey. Requests for these photographs were received from England, the United States, European countries, and Canada.

Publications

An increasing number of educational institutions found Museum publications of value, and encouraged students and others to make full use of this material. Distribution of Museum publications was in excess of 25,000 copies.

Visual Aids

A great deal of Museum material on anthropology, biology, and other phases of the natural history of Canada went to teachers, students, and other persons in all parts of Canada. Motion pictures and lantern slides were seen by 58,316 persons. This material is loaned free of charge to educational institutions in Canada except for cost of transportation one way. Natural history specimens were loaned under similar conditions.

PUBLICATIONS

English Publication

Bulletin 107. *Come a Singing*, by Marius Barbeau, Arthur Lismer and Arthur Bourinot.

DOMINION OBSERVATORIES

The Dominion Observatories at Ottawa and Victoria, B.C., perform the dual functions of promoting knowledge of fundamental science and of providing such essential national services as depend upon precise astronomical observations and upon studies of the earth's crust and atmosphere. The scientific activities of the Observatory at Ottawa include the study of precise star positions and their use in maintaining the time service of Canada; the study of the earth's magnetic field, with special reference to navigation and economic geology; the study of gravity and its relations to the composition of the earth's crust; the study of the nature and effects of earthquakes, and their utilization in studying the earth's crustal structure; and the investigation of the earth's upper atmosphere by the agency of meteors. The Dominion Astrophysical Observatory at Victoria studies various aspects of astrophysics, including the temperature and other physical characteristics of the stars, the motions of the stars, the character of interstellar material, and undertakes investigations associated with the production and radiation of stellar energy.

DOMINION OBSERVATORY, OTTAWA

The activities of the Observatory are organized into five divisions—Positional Astronomy, Stellar Physics, Seismology, Terrestrial Magnetism, and Gravity. Its scientific work is discussed under these headings.

Positional Astronomy.—A major function of this division is to maintain the Time Service of Canada. Astronomical observations for the correction of standard clocks were made on 187 nights, 2,254 separate star transits being observed. The transits were made with a three-inch broken-type Cooke transit, and the star positions used were from the F K 3 Catalogue now employed by all major observatories. Final clock corrections were interpolated from a smoothed curve of the corrections of all the primary Observatory clocks. These consist of a Shortt Free-Pendulum, two Rieflers, and a quartz crystal clock, and provide time sufficiently accurate for most present purposes. However the increasing need of scientific institutions for more accurate subdivision of time units makes an additional crystal clock highly desirable.

Considerable attention was devoted to distributing accurate time signals to all parts of Canada. The radio broadcasting station CHU formerly located in the Observatory building was operated at Greenbank Road, 12 miles west of Ottawa, by arrangement with the Department of Transport. The broadcast frequencies are 3,330, 7,335, and 14,670 kc. and the power of the station was increased by a factor of seven to 350 watts. Seconds time signals suitably coded for identification are continuously broadcast 24 hours a day over this station. Reports from Canadian surveyors and signals stations indicate clear reception as far away as the Pacific Coast and the delta of the Mackenzie in Canada, and numerous letters from other countries indicate that use is being made of the signals over large areas of the United States and even in some parts of South America.

In addition to the continuous broadcasts, time signals are relayed through the Department of National Defence to the Halifax Station CFH, where they are broadcast twice daily for shipping in the western Atlantic. Similar signals are relayed to the Department of Transport Station VAP at Churchill where daily five-minute broadcasts are made for sea and air navigators in the Hudson Bay area.

Other outlets may be enumerated as follows: the daily broadcast at 1 p.m. E.S.T. over the C.B.C. network; continuous wire service to the C.B.C. network, the two major railway companies, and the National Research Council; a five-minute daily broadcast over the Department of Transport station VAA at 11,990 kc., beamed to signals stations in the Northwest Territories; and special signals for survey parties from June to October from 7 p.m. to 5 a.m. E.S.T. over VAA.

Foreign time signals were received daily from WWV and NSS (U.S. Bureau of Standards) and a few from GBR Rugby, England. Reception times of these signals and the final values of the observed clock corrections are published bi-monthly and exchanged with other observatories.

The 750 electrically-driven clocks in Ottawa Government buildings, many of them automatically synchronized from the Observatory, were maintained. Observatory clocks, watches, and other timing mechanisms were kept in repair, and many time pieces for other Government offices were overhauled.

A series of multivibrator units controlled by the 1,000-cycle crystal clock were constructed to provide a 60-cycle power supply. This operated satisfactorily and it was fitted with a 60-cycle Bodine motor to take the place of the weight drive on the printing chronograph.

A gear train for converting mean to sidereal time was constructed and fitted with a synchronous motor drive and electrical contacts. This will be incorporated in the time service, mainly to compare the rates of the Observatory's own clocks with those of other observatories.

Meridian Circle observations were made on 66 nights, during which 2,130 observations were obtained and 130 sets of instrumental constants were taken.

A stand-by power plant of 20,000 watts was purchased and will be installed in such a manner as to take over automatically and maintain the time service units in case of failure of the city power.

Stellar Physics.—Major work was concerned with a study of the upper atmosphere by the methods of meteoric astronomy; with various aspects of the study of stellar spectra; with observations of eruptions on the surface of the sun; and with investigations of the motions of interstellar material.

Progress was made with plans for the international program of meteor photography for studying the upper atmosphere. This project is sponsored in Canada jointly by the Royal Canadian Air Force and the Department of Mines and Resources, in co-operation with the Harvard Observatory and the Massachusetts Institute of Technology. Suitable camera sites for the Canadian stations were selected at Meanook and Newbrook, Alberta, and the necessary land was purchased. Detailed plans for the two meteor observatory buildings were completed and items of necessary equipment were purchased. There will be some delay in beginning observations because of difficulty in finding adequate optical glass for the lenses of the main meteor cameras. These cameras will be faster than any at present in existence and are being designed and constructed in the United States.

An important advance in the observational technique of meteor study was made by combining radar observations with the photographic and visual work carried out previously. In August, 1947, a co-operative program of meteor study was initiated by the Dominion Observatory and the National Research Council.

Successful observations were carried out in August and December, 1947, during which time 24,000 radar meteor records, 1,700 visual meteor plots, and 45 meteor photographs were secured. Preliminary results were published in "Nature", and more detailed papers are under preparation, indicating that this observational method gives promise of being a powerful tool in the study of the structure of the ionosphere and the physical nature of meteors.

In continuing a study of the wave lengths and line intensities of the interesting emission line star H.D. 190073, 219 stellar wave lengths were measured with probable identifications of all but 14 lines. In this study, use was made of low and high dispersion spectrograms obtained at Victoria. The intensities of all lines were measured and a series of representative line profiles were studied from the point of view of interpreting the emission features. Interesting results of the study of profiles from high dispersion plates include the discovery that the lines of FeI and FeII are composite, consisting of absorption superimposed upon emission.

A series of 692 stellar spectrograms measured for the velocity of interstellar sodium and calcium yielded the interstellar velocity for 110 stars.

Preliminary tests were conducted in connection with a projected new porgram of measurement of stellar temperatures.

A theoretical investigation was made into the forces responsible for ejecting atoms from the surfaces of stars, and the photoelectric temperatures of 52 stars of P Cygni stars were studied.

Seismology.—Eight hundred and forty seven earthquakes were recorded at stations of the Canadian network. All major shocks were reported to the press and to Science Service at Washington, D.C. Registration of local shocks was reported monthly to Weston for inclusion in the Bulletin of the Northeastern Seismological Association.

The long period seismograph installations for recording distant earthquakes were in continuous operation at Victoria, Saskatoon, Ottawa, Seven Falls, and Halifax. In addition, short-period instruments were operated at Ottawa, Shawinigan Falls, and Seven Falls.

A seismic survey of the Precambrian Shield was started early in June, 1947. A control station was established at Kirkland Lake, Ontario, equipped with a vertical component Sprengnether seismograph. A second station was set up at Dane about five miles from the control station. At the close of field operations, stations were set up at Temiskaming and Ville Marie in Quebec, and both were supplied with three component Sprengnether seismographs. These stations, together with the Ottawa and Quebec stations, form a network for the registration of rockbursts in the Lake Shore gold mine in Kirkland Lake. The energy release from the rockbursts will be used in establishing a set of travel times as a basis of the survey.

All Canadian registrations were regularly reported in a monthly bulletin. Reports on the records obtained at the two Quebec stations were distributed monthly to the offices of the co-operating agencies. The Bibliography of Seismology was continued in a semi-annual publication.

Terrestrial Magnetism.—In co-operation with the R.C.A.F., a major effort was made to extend the network of magnetic stations in the Arctic in an attempt to locate the North Magnetic Pole more accurately. Ten stations were established in the area between latitude 62·5 and 73·7 degrees and longitudes 92·5 and 114·5 degrees, several of them being quite close to the estimated position of the magnetic pole. Nine stations were established in the region of the Eastern Arctic between latitudes 72·7 and 80 degrees and longitudes 73·9 and 100·7 degrees. Transportation was provided by a United States Navy icebreaker.

Observations in these two areas, combined with those made during Arctic expeditions of 1945 and 1946, indicate that the North Magnetic Pole is located in the northern part of Prince of Wales Island, approximately 200 miles northwest of the point located by Ross in 1831.

Seventeen magnetic observations were made in the areas between latitudes 42 and 48 degrees and longitudes 69 and 83 degrees. In Northern Canada, 405 declination observations from 73 localities were received from the Geodetic Service.

Considerable attention was given to developing field instruments better suited to specific investigation than the Division's standard types of magnetic instruments. Two Gurley transits with circular compasses were modified so that horizontal intensity as well as declination could be measured. These were required for rapid reconnaissance work in investigating magnetic anomalies. A universal electrical induction type magnetometer for absolute measurements, designed and constructed at the Observatory, performed satisfactorily when rigidly tested in the environs of the North Magnetic Pole. It was later equipped to act as either an absolute instrument or a continuous recording variometer.

A temporary magnetic observatory was established at Baker Lake, Northwest Territories, and plans were advanced to establish an observatory at Resolute Bay, Cornwallis Island.

Photostats of all Agincourt magnetograms were made available to the National Research Council and to six geophysical prospecting companies. Tabulations of K-indices for each month for Agincourt and Meanook were sent to the Carnegie Institution and the Bureau of Standards, Washington, and to an aerial prospecting company in Canada.

Gravity.—With the aid of new types of gravity meters, which greatly increase speed and accuracy, a considerable extension was made of the network of Canadian gravity stations. More than 1,600 gravity stations were established in a region extending from the Maritime Provinces to the Rocky Mountains. At most of the stations occupied, vertical magnetic force as well as gravity was measured.

Two field parties were engaged in combined gravity and magnetic observations. One of these operated with a Mott Smith gravimeter and an Askania vertical magnetometer. This party, in charge of A. H. Miller, took observations across Canada between Amherst, Nova Scotia, and Jasper, Alberta.

It established networks in southern New Brunswick to fill in gaps in the previous work, and to investigate further the relation between geophysical results and geology as revealed by recent study and investigation. Networks were also established in the mining areas of northern Ontario and western Quebec. At North Battleford, Saskatchewan, this party took north-south observations for a distance of 60 miles through Hamelin, where a large deflection of the vertical had been observed by the Geodetic Survey. Its traverse west across the Prairies followed route 4 in Manitoba between Portage la Prairie and Russell, and route 14 from there on into Saskatchewan through Yorkton to Saskatoon. It then followed route 5 through North Battleford to Lloydminster; and went from there by routes 16 and 15 through Vermilion, Vegreville, and Fort Saskatchewan, to Edmonton, Edson, and Jasper. Return was made from Edmonton through Leduc to Wetaskiwin, and thence by route 13 through Camrose, Hardisty, and Provost, to Macklin in Saskatchewan; and from there by route 14 through Unity, Wilkie, and Biggar, to Saskatoon. The traverse continued by routes 11, 33, and 47 through Regina and Stoughton to Estevan, and followed closely along the International Boundary through Gainsborough by route 18 in Saskatchewan, and by route 24 to Melita in Manitoba; and thence through Deloraine, Crystal City, and Morden, by route 3 to Winnipeg. More than one thousand determinations were made with the Mott Smith gravimeter.

A second party, in charge of M. J. S. Innes, observed 670 stations with a gravimeter hired from the North American Geophysical Company of Houston, Texas. Two hundred and thirteen of these stations were established in north-western Ontario, northern Manitoba, and Saskatchewan between latitudes 50 and 58 degrees north and longitudes 92 and 108 degrees west, covering an area of 185,000 square miles within the Canadian Shield. Traverses were also made along the railways between Cochrane and James Bay in Ontario, and between The Pas and Churchill in Manitoba.

Observations were taken with a vertical magnetometer at all gravity stations established by the two parties, except the two rail traverses in Ontario and Manitoba, and approximately 400 stations in New Brunswick, where a considerable part of the area had been covered previously with the magnetometer. Absolute determination of horizontal magnetic intensity, declination, and dip was made at 16 base stations established by the airborne survey in the Canadian Shield.

A test of the applicability of the gravity and magnetic methods to the location and delineation of mineral deposits was also made apparently with favourable results. This was done by establishing 220 stations with a gravimeter and vertical magnetometer over the East Sullivan sulphide ore body at Val d'Or, Quebec.

One of the most remarkable magnetic anomalies encountered in many years was that observed in the vertical magnetic intensity along Highway 4 between Gladstone, Neepawa, and Minnedosa, a distance of 40 miles. The largest anomaly, about 6 miles east of Neepawa, was estimated to exceed 10,000 gammas and could not be accurately determined with the magnetometer, as it exceeded the normal range of the instrument employing the largest auxiliary magnet. Gravity anomalies along the profile, although not so marked, indicate a correlation with the magnetic results, suggesting that the cause of the anomaly is heavy magnetic rock.

General

The Dominion Observatory was represented at meetings of the Royal Society of Canada, the American Association for the Advancement of Science, the American Astronomical Society, and at a meeting of the Directors of the Seismological Society of America in San Francisco.

Scientific papers on a wide range of topics were published and several scientific lectures were given.

Alterations to the machine shop, doubling its size, and modernizing of the interior, were nearing completion. Substantial additions were made to equipment of the machine shop and carpenter shop.

All the lower rooms and some in the first floor of the Observatory residence were renovated and a temporary garage was built by the Department of Public Works. A number of rooms in the Observatory building were also redecorated. General plans for completing renovations to these buildings were drawn up.

DOMINION ASTROPHYSICAL OBSERVATORY, VICTORIA, B.C.

Astrophysical Researches

The Carbon Stars (R- and N-types).—In studies of the spectra of these stars, several important advances were made. The first concerns the main and isotopic molecular bands of the Swan system of carbon and the result is of importance in certain aspects of nuclear physics and may lead to more definite knowledge concerning stellar structure. The bands were measured in the spectra

of 21 R stars and the ratio of abundance $\frac{C12}{C13}$ was derived. This ratio is 50 in three objects, thus approaching the terrestrial value, but in twelve other stars a fairly uniform ratio of about 3 is found.

The second research leads to a determination of the excitation temperatures of three R-type stars from band absorption of C_2, CH, and CN. The final results are in good agreement with colorimetric data.

A third development is the photographing of the spectra of N-type stars to the shortward size of λ4,200. New unidentified bands were found, possibly indicating the existence of polyatomic molecules in stellar atmospheres.

Solar Type Stars.—The study of line intensities was continued with the highest possible dispersion. Many faint features were measured in the spectrum of αPersei, indicating the existence of spectra not previously associated with F stars. Interesting deviations from other solar curves of growth were found in a study of the lines of vanadium in the solar spectrum, made in collaboration with Dr. R. B. King of the Mount Wilson Observatory.

A study of the spectrum of εAurigae, a supergiant star, shows very broad lines. A study of this effect was made. Diluted radiation effects may explain certain anomalies in the behaviour of normal metastable lines of neutral iron.

Further valuable knowledge on the structure of stellar atmospheres and the transfer of radiation through them was acquired in the detailed study of line intensities.

Rotational Velocities of B-type Stars.—In a study of the spectral line shapes in stars of the Pleiades Cluster, the rotational velocities of the B-type stars were measured and those of other types were estimated. The distribution of velocities was analysed statistically, showing that a random distribution is probable.

Line Intensities in O-type Stars.—The results of a completed study of measured line-intensities in a selected list of O stars show certain new features of the variation of line intensity with temperature. Spectral-Class criteria are found and luminosity effects are very small. A temperature scale for the absorption-line O stars is derived, calling for a downward revision of the previously accepted values.

Spectrophotometric Gradients.—Derivation of gradients for a number of Wolf-Rayet, O, and B stars was completed. Interstellar reddening was so irregular that individual gradients could not be derived. Mean colour temperatures were calculated and the relationships of gradients to colour excess and interstellar absorption were studied.

Galactic Star Clusters.—Preliminary results of a study of spectral types in galactic star clusters indicate important revisions in spectral type over those previously accepted on the basis of quite low-dispersion spectrograms. In particular, it seems that the number of known O-type stars will be increased substantially.

Line Intensities in B Class Spectra.—Continuation of measuring line intensities in the spectra of class B produced an improved basis for classifying B-type spectra. It gives promise of providing a reliable method of determining absolute magnitudes from spectroscopic measures. A test of the method was made upon members of the Pleiades cluster with satisfactory results.

Radial Velocity Work

Approximately 600 spectrograms were measured for radial velocity. These were largely observations of spectroscopic binaries and spectra suitable for determining effective wave-lengths. Some spectra on the extensive B-type

program were also measured. Two significant developments in radial-velocity work were nearing completion, namely, the projection Comparator discussed above, and the derivation of revised wave-lengths for spectra of classes A_0 to K_3 with high, moderate, and low dispersion. It is anticipated that, as a result, radial velocity measurements will receive a great impetus in the coming years.

The wave-length revision attempts to place all radial velocities upon a common dynamic basis so that systematic differences will be eliminated between different dispersions and over various spectral types. Extended and detailed studies utilizing measurements made upon several hundred spectrograms were completed, and new tabular forms were computed. The solar-type spectra with low dispersion were revised.

Double Stars

In the research on spectroscopic binaries less emphasis was placed upon purely orbital studies. Six new systems exhibiting two spectra were discovered. H.D. No. 47732, 47755, 193611, 215835 were found to be massive early-type binary systems and H.D. 171978 to be a double-line binary of type A3. The star H.D. 223924 was found to be a binary with two spectra. Orbital studies were made upon the above and were continued for other binaries, especially certain eclipsing systems. The final results for a B-type system discovered at Victoria, H.D. 218066, were published. Intensive observations of the important eclipsing system εAurigae were instituted.

The program to determine $\triangle$m for spectroscopic systems showing two spectra was continued, and observations were completed. Final results of the analysis of the spectrograms are expected to be issued during 1948-49.

Observatory Telescope

Use of the telescope was devoted exclusively to stellar spectroscopy. High dispersion work continued to be largely in the field of detailed line-intensity studies in solar-type stars. Most of the telescope time was devoted to several extensive programs for which relatively low dispersion is used. These are: (*a*) the B-type stars, north of declination 20 and between magnitudes 7·5 and 9·0; (*b*) the R- and N-type stars; (*c*) stars in the North Galactic Polar Cap; (*d*) certain interesting binary systems.

A special weather forecast for the Observatory, supplied daily by the Meteorological Service, was introduced. This is frequently of assistance in planning the employment of the telescope during the ensuing night.

Seismology

Seismological observations were continued regularly and records were forwarded for analysis. Thirty earthquakes were recorded.

General

Dr. F. J. Neubauer of the Lick Observatory visited the Observatory for a month and joined in a study and discussion of the problems of classifying the B-type spectra. Valuable progress was made toward future fundamental work in the realm of galactic studies.

More than 29,000 persons visited the Observatory, which was open to the public every Saturday evening for two hours for demonstration of equipment and observing with the telescope. Special addresses were given to several of the organized groups of visitors. Astronomical items of popular interest were furnished to the public and press from time to time.

Extensive improvements to the grounds were undertaken by the Department of Public Works. A dense growth of broom and underbrush, long a fire-hazard, was removed. Footpaths for the convenience of the public were being

improved. Exterior lighting about the dome, office, and residences was being repaired and improved. The antiquated lighting fixtures in the Dome were replaced with modern illumination.

Stout protective screens were installed outside the glass doors located on the observing floor level to remove the dangerous hazard of unprotected openings.

A camera that can remain in position throughout the night without interfering with the spectrographic work was designed and constructed in the workshop for use at the Cassegrainian focus. It enables the use of the great focal length (108 ft.) of the combination to obtain large-scale photographs of double-stars, small star groups, and planets.

A new projection-measuring machine was designed and built. The novel features represent a substantial advance in the efficiency of radial-velocity measurements. The design of a new spectrograph was worked out and working drawings were made and blue-printed. The need for the instrument is evident in view of the advance of astronomical techniques and the shifting emphasis in observational requirements.

LANDS AND DEVELOPMENT SERVICES BRANCH

R. A. GIBSON, DIRECTOR

This Branch deals with business arising from the local government of the Northwest Territories and Yukon, and administers the land, mineral, timber, and related resources of these territories, which comprise an area of more than 1,500,000 square miles. It administers the National Parks of Canada, attends to Dominion interests in the conservation of wildlife, marks historic sites of national importance and assists in the encouragement of tourist travel. It plans and arranges for the construction of public buildings, highways, and other facilities required in the Northwest Territories and the Yukon, in the National Parks, and for the Indian Affairs Branch of the Department. It maintains a bureau for the administration of Dominion lands, ordnance lands, and public lands.

The Branch is organized as follows:—

(1) The Northwest Territories and Yukon Services which consist of three units:
   (*a*) Yukon Administration;
   (*b*) Administration of the Mackenzie District of the Northwest Territories;
   (*c*) Arctic Administration.
(2) National Parks Service.
(3) Dominion Wildlife Service.
(4) Land Administration.
(5) Engineering and Construction Division.

The established mining industries in the Northwest Territories and the Yukon showed steady progress during the year but prospecting for gold in the Northwest Territories has fallen off. More attention was devoted to prospecting for base metals. A significant development was the granting of a reservation of 500 square miles near Pine Point on the south shore of Great Slave Lake, Northwest Territories, in order that the Consolidated Mining and Smelting Company of Canada, Limited, and Ventures, Limited, might undertake intensive exploration involving considerable outlay. The search for radio-active ores was continued.

It is expected that electric power from the Snare River development will become available in the Yellowknife field during the autumn of 1948.

The Giant Yellowknife Gold Mines will start production at Yellowknife in 1948, and the rapid development of this property is assured. Negus Mines, Limited has brought in valuable ore at depth. This has greatly improved the prospects of this and adjacent properties.

Substantial improvements have been made in and around Yellowknife townsite. There is a splendid Public School and a Red Cross Hospital. There are good roads and the water and sewer installation is nearing completion. The building of homes and business places is progressing as materials become available. The Northern Transportation Company has sufficient carrying capacity to handle all water-borne freight that is being offered.

Interest is growing rapidly in the diversified mineral resources of the Yukon Territory. The revival of silver-lead enterprises in the Mayo district by the United Keno Hill Mines, Limited, has encouraged interest in the possibility of mineral resources other than gold.

It was necessary to restrict hunting and trapping in the Northwest Territories and Yukon because the supply of game and fur-bearing animals was barely adequate to meet the economic needs of the native population. In fact, in some instances it was necessary to assist the natives until these resources recover from the effects of forest fires and other adverse influences. Other conservation measures have been adopted, and substantial progress was made in the organization of forest and game protection services.

Considerable attention was given to the improvement of educational facilities in the Northwest Territories, particularly in the Mackenzie District. Model day school buildings are planned for 1948 at the Hay River, Taltson River, Fort Smith, and Fort Norman settlements. These buildings will serve as community centres as well. The educational program now includes the distribution of films on a regular monthly circuit, and educational broadcasts to schools of the Mackenzie District. Film projectors and radio receiving sets have been provided for school use. A proposed salary schedule for teachers in Government positions has been recommended. The intention is to recruit highly qualified teachers who also will serve as welfare officers.

Transportation facilities are being improved steadily. It is expected that the Grimshaw-Great Slave Lake all-weather road will be completed in 1948. The Alaska Highway has opened up considerable territory. With the lifting of travel restrictions on the Alaska Highway, provisions were made for an influx of tourists to the Yukon Territory by this route. Further road building in the Yukon is planned.

Scientists have been active in the Northwest Territories and in the Yukon, studying the health and welfare of the people, and the mineral, forest, and wildlife resources. Extensive mapping has been carried on and scientific stations are being established in the Arctic regions.

Many interesting and encouraging developments have featured the administration of National Parks in Canada during the past year. A new link has been added to this great chain of national playgrounds by the gift from the Province of New Brunswick of an area of about eighty square miles in Albert County, which is of outstanding interest from a scenic and recreational standpoint. Plans are being made for the substantial development of this area during the next fiscal year.

With increased appropriations, it has been possible for the National Parks Service to overcome some of the arrears of maintenance that accumulated during the war years. Plans are well advanced for the improvement of main highways in the parks, for the provision of additional camp-grounds, and for other facilities needed to supplement the available accommodation, especially for those of low income. Additional recreational facilities are being provided.

Travel to National Parks exceeded that of any previous year. Private enterprises operated mainly by returned soldier concessionaires, have made considerable progress in providing comfortable accommodation for tourists. This accommodation is available at reasonable rates.

Late summer rains in the mountain parks, while protecting forests from fire, caused considerable discomfort at the camp-grounds and made the maintenance of gravel roads difficult.

There have been some adjustments in the size of National Parks, but in each case the change is considered to be beneficial.

A great deal of interest is being shown in the National Historic Parks. In all matters relating to National Historic Parks and National Historic Sites, the administration has been advised by the Historic Sites and Monuments Board of Canada.

The establishment of the Dominion Wildlife Service has emphasized the growing importance of the conservation and management of Canada's wildlife resources. This Division carries on the administration of the Migratory Birds Convention Act and the Northwest Territories Game and Fur Regulations. It advises the Northwest Territories administration and the National Parks administration on wildlife problems. It co-operates with other agencies, Dominion and Provincial, interested in these problems.

Scientific research is carried on over a wide field and a yearly Dominion Wildlife Conference is held at Ottawa to exchange ideas. An important undertaking now being organized is the caribou survey, in which project the provinces will provide some assistance.

The management and disposal of Ordnance, Admiralty and Public lands; the registration of all lands of the Crown; the adjustment of seed grain, fodder, and relief indebtedness in certain provinces, were the principal functions of the Land Registry. The newly created Lands Division assumes these responsibilities and in addition deals with the administration of the land, timber, and mineral resources of the Northwest Territories and the Yukon.

Substantial progress has been made with the revision and consolidation of all regulations administered by the Branch.

The Engineering and Construction Division is responsible for the greatly increased program of construction that has been planned and for making arrangements to engage contractors. Difficulty has been experienced in recruiting trained engineers and architects. Consequently it has been necessary to retain the services of a number of professional men in private practice so that work may be done under proper supervision. Work is being carried on in the National Parks, in the Northwest Territories and the Yukon, and for the Indian Affairs Branch.

There have been a great many changes in personnel in the Branch during the past year. The best wishes of the administration go to those who have retired after many years of faithful service. A hearty welcome is extended to the new men who have been recruited to share the burden of administration. Many are showing considerable promise.

NORTHWEST TERRITORIES AND YUKON SERVICES

NORTHWEST TERRITORIES

The Northwest Territories comprise that part of the mainland of Canada lying north of the Provinces of Manitoba, Saskatchewan, Alberta, and British Columbia and east of Yukon Territory, the islands in Hudson and James Bays and in Hudson Strait, including Ungava Bay, and the vast Arctic Archipelago. The estimated total of land and fresh water areas of the Northwest Territories is 1,304,903 square miles. According to the 1941 census, the population of the Territories was 12,028, including 2,284 whites, 4,334 Indians, 5,404 Eskimos, and 6 others, chiefly Asiatics. An estimate of the population made in 1947 placed the total at 15,514, including 5,527 whites, 4,334 Indians, 5,651 Eskimos, and 2 Asiatics. The increase in white population is accounted for by renewed mining activity in Mackenzie District.

The Commissioner of the Northwest Territories in Council has power to make ordinances for the government of the Northwest Territories relating to subjects designated by the Governor in Council, under the authority of the Northwest Territories Act. The seat of Government is in Ottawa.

Council

Commissioner	Hugh L. Keenleyside
Deputy Commissioner	Roy A. Gibson
Members of Council:	Stuart T. Wood
	Robert A. Hoey
	John G. McNiven
	Louis de la C. Audette
	Harold B. Godwin
Secretary	James G. Wright

Work of Council

Ten regular and seventeen special sessions of Council were held during the year. Assent was given to the following ordinances and amendments: Local Administrative District Ordinance; Territorial Liquor Ordinance; Legal Profession Ordinance; Ordinance to Prevent Pollution of Running Streams; Miner's Lien Ordinance; an Ordinance to repeal the Benevolence Society Ordinance; an Ordinance to repeal the Succession Duties Ordinance; Vital Statistics Ordinance; Sanitary Control Amendment Ordinance; Motion Picture Ordinance; and Lord's Day Ordinance. In addition, a number of obsolete Ordinances were repealed.

During the year, matters of policy were discussed in connection with the Eastern Arctic Patrol; Eskimo relief in the Eastern Arctic; scientific work by the Department of Fisheries in the Arctic; postal service; legal control; workmen's compensation; development of northern agriculture; education; Northwest Game Act and Regulations; radio reception in the Northwest Territories; forest fire protection; old age pensions for the Northwest Territories; creation of a Northwest Territories Power Commission; motion picture of Yellowknife; various recreation projects at Yellowknife; oil transportation costs; air passenger rates in Northwest Territories; caribou survey; labour conditions; the Yellowknife Hospital; the reindeer project; taxation; co-operatives and credit unions in the Northwest Territories; Family Allowances; assistance to various organizations interested in northern development and resources generally.

Dr. H. L. Keenleyside attended his first meeting of Council in his capacity as Commissioner of the Northwest Territories on April 15, 1947.

Hospitals

Thirteen hospitals were operated in the Northwest Territories during the year, 9 by missions of the Roman Catholic Church and the Church of England in Canada, 2 by mining companies at Yellowknife and Port Radium, and one by private enterprise at Norman Wells. A new modern hospital was opened at Yellowknife by the Canadian Red Cross Society.

The mission hospitals are situated at Fort Smith, Fort Resolution, Hay River (sick bay), Fort Simpson, Aklavik (two), Rae, Chesterfield, and Pangnirtung. The Northwest Territories Administration paid the mission hospitals $4.50 per diem for the care of indigent whites and half-breeds who were admitted on the recommendation of the resident medical officer. The aged and infirm are cared for in industrial homes operated in conjunction with the mission hospitals at Aklavik, Chesterfield, and Pangnirtung. These inmates were also admitted on the recommendation of the Government medical officer, and the missions received $400 per annum for their care and maintenance.

During the year, $24,952.50 was expended for the care of destitute patients in the hospitals, representing 6,901 days of treatment. The industrial homes accommodated an average of 22 patients at a cost of $7,996.94.

Indigent patients from the Northwest Territories in provincial institutions were treated 7,191 days at a cost of $18,441.91. Of this, 2,923 days treatment were given to tuberculosis patients in the Charles Camsell Indian Hospital, Edmonton, Alberta, and 2,700 days treatment were given to insane persons in the Provincial Mental Hospital, Ponoka, Alberta.

The Department of National Health and Welfare is responsible for the hospitalization of Indians and Eskimos.

Schools

Residential and day schools in the Northwest Territories are operated by the Church of England and the Roman Catholic Missions. The residential schools are located at Fort Resolution, Fort Providence, and Aklavik (two), and the mission day schools are located in the principal settlements. Owing to the nomadic tendency of the natives, some of the day schools in the outlying areas are operated only when the natives are in the vicinity. During the year, 369 pupils attended the residential schools and 564 pupils attended the day schools. The public schools operated at Fort Smith and Yellowknife were attended by 205 pupils.

Grants totalling $55,928.94 were paid for the maintenance of indigent children in the residential schools. Adequate quantities of school supplies and equipment were provided.

The Northwest Territories Administration is responsible for the welfare of all Eskimos, and arrangements have been made for the maintenance of a number of destitute children in the residential schools at Fort George, Quebec, and Moose Factory, Ontario. School supplies were also furnished to a number of mission schools operated within Eskimo territory of the Province of Quebec. The above figures do not include accounts paid by the Indian Affairs Branch for the maintenance of Indian children.

There is no phase of the work of the Lands and Development Services Branch in which a healthier growth can be noticed than in education. In December, 1947, a modern 8-room public school building was completed at Yellowknife to serve the interest and activities of this vigorous, growing community. In addition, a new Territorial Day School was built at Port Brabant for the residents of that area. It is planned to erect several new day schools in the near future.

The Northwest Territories Administration has established scholarship awards and tuition grants for the assistance of worthy students residing in the Territories. Manual training equipment and supplies have been provided to the residential schools to assist them in initiating manual training instruction.

Shipments of films are being made on a monthly basis to seven settlements in the Mackenzie District. A new service, introduced in 1947, was the re-broadcast over radio station CHAK at Aklavik of the school broadcast program specially prepared by the Canadian Broadcasting Corporation for audiences of school children across Canada. Correspondence courses are available free of charge to all children residing in the Northwest Territories. Plans are under way for the establishment of Government positions and the provision of superannuation benefits for all teachers employed in day schools.

All schools operated in the Northwest Territories are inspected periodically by J. W. McKinnon, Inspector of Schools, for the purpose of raising instructional standards.

Administration

The Lands and Development Services Branch is responsible for the administration of the various acts, ordinances, and regulations pertaining to the Northwest Territories. To facilitate departmental administration, there is a Chief of

the Arctic Division and a Chief of the Mackenzie Division. A District Agent is stationed at Fort Smith, N.W.T., and this officer also serves as Superintendent of Wood Buffalo Park. The District Agent is also Agent of Dominion Lands, Crown Timber Agent, Mining Recorder, Stipendiary Magistrate and Marriage Commissioner. The Sheriff of the Northwest Territories is also located at Fort Smith. The Mining Recorder, Agent of Dominion Lands, and Crown Timber Agent for the Yellowknife District, which includes what was formerly known as the Great Bear Lake Mining District, is situated at Yellowknife. The Mining Recorder for unorganized districts is located at Ottawa, and sub-mining recorders are also located at Ottawa, Edmonton, Fort Simpson, Fort Norman, Aklavik, Coppermine, and Port Radium.

Medical Officers

Under the provisions of Order in Council (P.C. 6495) of October 12, 1945, the control and supervision of that part of the Public Service administering the medical care and hospitalization of the native population, Indians and Eskimos, together with the staff employed, equipment, and other physical assets used in connection therewith, were transferred from the Department of Mines and Resources to the Department of National Health and Welfare, effective November 1, 1945.

Although the medical staff of the Department of Mines and Resources was absorbed by the Department of National Health and Welfare, the Government medical officers in the Territories continue to represent the Department of Mines and Resources in the administration of public health and other related ordinances, and also in connection with the health of all residents of the Territories other than Indians and Eskimos. All doctors have been appointed coroners and medical health officers under provisions of the Public Health Ordinance. Some of the doctors patrol outlying areas, and all make use of the Northwest Territories radio system in prescribing for those who are unable to obtain treatment at the medical centre.

Law and Order

Law and order in the Territories is maintained by the Royal Canadian Mounted Police. Detachments are stationed at the more important settlements and extensive patrols are made to outlying areas. To facilitate the administration of justice, four Stipendiary Magistrates and several Justices of the Peace have been appointed.

Eastern Arctic Patrol

The annual Eastern Arctic Patrol sailed in the R.M.S. *Nascopie* from Montreal July 5, and after calling at Lake Harbour, Sugluk, and Wolstenholme, the ship was wrecked on a submerged reef, 6 miles off Cape Dorset Harbour, July 21. Passengers and crew were put ashore at Cape Dorset where they were picked up one week later by the Department of Transport icebreaker *N. B. McLean* and carried to Churchill.

All mail and most of the important records were salvaged, but all Government freight on board as well as most of the personal effects of the passengers were lost. In this connection, special mention must be made of the work of Inspector A. W. Parsons, Royal Canadian Mounted Police; R. Hadden, Post Office Department, and Alexander Stevenson, Department of Mines and Resources, in salvaging mail and valuable records from the wrecked vessel under difficult and dangerous conditions.

Essential supplies lost in the wreck of the *Nascopie* were re-ordered promptly and shipped to Montreal and Churchill. Arrangements were then made for the far northern section of the patrol to be completed by the *North Pioneer*, a vessel

of about 1,400 tons chartered by the Hudson's Bay Company. The resumed patrol sailed from Montreal on the *North Pioneer* on August 16, carrying supplies to River Clyde, Dundas Harbour, Arctic Bay, and Pangnirtung and returned to Montreal on September 26. Owing to limited passenger accommodation, the only Government officials on board were Alexander Stevenson of the Northwest Territories Administration, in charge of the patrol, and Dr. H. W. Lewis, Department of National Health and Welfare.

The situation at all points of call was found to be generally good. It was a fair year for foxes and the supply of native food generally was satisfactory. The health of the natives was good in all regions, with no epidemics and most cases of death due to old age. The statistics of births and deaths show great improvement over the previous year.

The patrol investigated the administration of Family Allowances and Eskimo relief, mail and postal functions and matters of general administration. In the limited time available, it was impossible to complete the coverage of posts in as thorough a manner as in previous years, but contact was maintained, and, following the return of the patrol to Montreal in September, plans were immediately initiated for the 1948 Eastern Arctic Patrol to be made by chartered vessels pending completion of the new Government ship which is expected to be available for service in 1950.

Within Hudson Bay, where the shipping situation was further aggravated by the loss of the small Hudson's Bay Company schooner *Neophyte* near Fort Severn, the schooner M.S. *Blackmore,* chartered by the Hudson's Bay Company, carried supplies from Montreal to Ungava Bay, re-loaded at Churchill, and made trips to Chesterfield, Baker Lake, and Southampton Island. The Company also chartered another schooner, M.S. *Earle Trader,* operating out of Churchill, which called at Port Harrison, Cape Smith, Wolstenholme, and Sugluk. Points on the west coast of Hudson Bay were serviced by the small Hudson's Bay Company schooner *Fort Severn.*

The Roman Catholic Missions were not greatly affected by the sinking of the *Nascopie* as the bulk of their freight was carried on their new ship, the *Regina Polaris,* which carried supplies to all mission posts in Hudson Strait and Bay, and reached Igloolik which had not been served by ships for several years.

Liquor Permits

The territorial liquor stores at Yellowknife and Fort Smith were continued in operation, with the Saskatchewan Liquor Board as agent for the Northwest Territories Administration. A cocktail lounge was opened in the Ingraham Hotel, Yellowknife, and provision was made for the issue of banquet liquor permits and permits to sell liquor in service messes and canteens. The fee for individual permits was reduced from $2.00 to $1.00. The gross business at the Yellowknife store increased about 6 per cent over the previous year and business at the Fort Smith store declined slightly.

Net profits from the operation of the liquor stores amounted to $196,370.57 as compared to $206,227.77 in 1946-47. Profits from the Yellowknife store were $154,736.70 and from the Fort Smith store $41,633.87. Profits from liquor sales and permit fees in the Mackenzie District together with $2,425 derived from fines under the Territorial Liquor Ordinance and $277 from liquor permit fees paid to Ottawa were placed in the special liquor account for territorial purposes. It is the plan of the Administration to utilize funds from this account for public welfare and other general improvement measures.

During the fiscal year, 4,358 Class "A" annual permits and 6 Class "E" banquet permits were issued in the Northwest Territories. Four Class "B" permits covering sacramental wine and 54 Class "C" permits authorizing the importation of limited quantities of spirits, wine, and beer were issued at Ottawa.

Sales at the territorial liquor stores were about 9,559 gallons of spirits, 1,851 gallons of wine, 6,085 gallons of ale and stout, and 88,856 gallons of beer. Importation permits covered 118 gallons of spirits, 296 gallons of wine and 108 barrels of beer.

Commercial Fishing

During 1947 summer fishing was again conducted commercially in the northern portion of Great Slave Lake, with the catch limit for whitefish and lake trout set at a total of 2,500,000 pounds. Catch actually taken amounted to nearly 2,187,000 pounds, round weight, or slightly more than 1,943,000 pounds, dressed weight, but in each case the totals included some comparatively small quantities of inconnu. In terms of round weight, and dropping the odd figures, the trout landings amounted to 1,359,000 pounds and the catch of whitefish to 779,000. The great bulk of the catch went to market in two forms—frozen dressed (669,000 pounds) and frozen fillets (464,000 pounds). The quantities shipped in the fresh dressed form totalled slightly more than 270,000 pounds.

Sixty-one fishermen took part in the summer operations and used, all told, 55,000 yards of gill-net. One of the interesting features of the summer operations was the development of shipments by air. More than a quarter million pounds of fresh trout were flown from Great Slave Lake to railhead at Waterways, Alberta, a flight of about 450 miles. The remainder of the season's catch was frozen and taken by refrigerator barge to railhead by way of the Slave and Athabaska Rivers.

Commercial fishing for pickerel or pike-perch (*Stizostedion vitreum*) was tried out during the summer at Kakisa Lake, where a catch limit of 200,000 pounds has been established under the fisheries regulations. Transportation and equipment difficulties, however, compelled abandonment of the undertaking.

During the 1947-48 winter fishing season at Great Slave Lake approximately 1,281,000 pounds of whitefish and lake trout were taken. Slightly less than 137,000 pounds of inconnu were also landed. The first nets were set on December 5 and fishing continued until the latter part of March. The season's end was set originally for March 15, but a ten-day extension was granted. There were operations by four companies.

In general, fishing was considered good during the season. Most of the fish were taken about 12 or 15 miles off the mouth of Hay River. Shipments to market consisted of nearly 902,000 pounds of whitefish, 169,300 pounds of trout and 100,150 pounds of inconnu. Half-tracks, dog teams and, while weather permitted, some trucks were used in moving the catch. One operator made effective use of two snowmobiles. For a short time use was also made of an aeroplane.

Tests of Kakisa Lake were made during the winter by two different operators. Neither met with much success, but, as a matter of fact, the tests covered only brief periods. The tests were not extended but produced only small catches.

Research

The program of scientific investigation carried on in 1947 at Great Slave Lake by the Fisheries Research Board of Canada, which operates under the control of the Minister of Fisheries, included two main projects. Study of the commercial fish population was continued by Dr. W. A. Kennedy, who had begun this investigation in 1946. Problems relating to temperature, plankton and bottom fauna, which had emerged in the course of the basic survey completed in 1946, were also under investigation in 1947. Five student assistants were employed in the program which was under the supervision of Dr. D. S. Rawson and Dr. Kennedy.

Detailed temperature records revealed more complex conditions of temperature stratification than had been suspected previously. A special study was made of the extent of distribution and mixing of water from the Slave delta. Annual inflow of the Slave River amounts to about one-hundredth of the volume of the main lake and has, therefore, great influence on temperature, transparency and life in the lake.

Plankton studies showed an average standing crop similar to that of 1946. Early and late periods of diatom abundance were pronounced. The occurrence of numerous capepods at all depths down to 2,000 feet was investigated at Christie Bay. Bottom organisms were studied chiefly in the deep water areas. The average population in depths of 1,000 to 2,000 feet has been determined as 336 per square yard with the amphipods *Pontoporeia* making up 55 per cent.

Analysis of the results of fish sampling carried on in 1944-45-46 showed the three dominant species to be the ciscoes, which feed on plankton, the common whitefish, a bottom feeder, and the lake trout, a piscivore. Five other species in a secondary group provided some competition for the first three. Four other species are very restricted in numbers.

Forest and Wildlife Conservation

Except during the month of July, fire-hazards were much less in 1947 than in 1946, and close supervision by the Forest and Wildlife Organization prevented most fires from doing extensive damage. Twenty-seven fires were reported. The area burned over was estimated at 36,436 acres, as compared to 1,452,487 acres burned over in 1946. The most serious fire occurred in the vicinity of Beaulieu Yellowknife Mines in Yellowknife district. This fire was estimated to have burned over 25,600 acres, and destroyed a considerable amount of mine timber. It is seldom possible to establish the cause of fires in this area, but failure to extinguish camp-fires and smudges was suggested as the probable cause of 16, and lightning as the probable cause of 9 of the outbreaks in 1947. The estimated value of merchantable timber burned was $167,260, as compared to $223,497 in 1946.

The protection service established in the Mackenzie District in 1945-46 was again strengthened in 1947-48. A park warden was assigned to the Yellowknife warden district, and during the fire-hazard season a patrolman operated from a base at Ford Liard. The standard park warden's cabin at Aklavik was completed by the Department of Public Works. Additional cabins are planned for Fort Liard and Fort Good Hope, and the appointment of wardens at these points will increase the Mackenzie District warden staff to 7.

The patrol boat M.B. *Caribou* was in service on the Slave and Mackenzie Rivers, and during the spring and summer of 1947 five additional patrol boats were placed in commission. These are M.B. *Beaver* and M.B. *Moose*, approximately 15 tons, each, M.B. *Spruce*, approximately 5 tons, and M.B. *Aspen* and M.B. *Pine* approximately 1½ tons each. They were used in fire patrols on the Peace, Slave, and Mackenzie Rivers, on Great Slave Lake, and in the transportation of personnel and supplies. Total operating hours for all boats were 2,008 and total mileage was 12,113. An additional 15-ton boat, M.B. *Buffalo*, is scheduled for delivery in 1948.

One Fox Moth airplane was chartered and placed at the disposal of Fort Smith headquarters for fire suppression work and administrative purposes. It was used in reconnaissance and in the rapid delivery of crews and equipment. Additional equipment, including more than 30,000 feet of hose, was purchased and placed at strategic locations under the care of the wardens or R.C.M.P. At Fort McPherson, Arctic Red River, Fort Good Hope, Fort Providence, and Rae, frame warehouses 20 feet by 40 feet were constructed for the safe storage of equipment when not in use.

It is now thoroughly established that forest fires are largely to blame for the decline in wildlife in many districts and the resultant impoverishment of the native population. Education in fire prevention was consequently accelerated. New and improved signs and posters were prepared and widely distributed. An effort was made by the wardens to get in touch with mining and lumbering companies to see that all necessary fire precautions were observed. As many as possible of the trappers and hunters were canvassed and the need brought home to them of carefully extinguishing their camp-fires. The representatives of the missions and schools in the Northwest Territories were approached and their co-operation in giving publicity to forest and wildlife conservation activities was obtained. A number of prizes were awarded to school children for essay contests on fire prevention subjects. A motion picture projector unit was purchased and films secured which stress the conservation of game and forests.

Fur Production

The take of muskrat pelts declined sharply. The yield in 1947 was 336,662 as compared to 448,912 in 1946. This was due in part to unfavourable conditions during the trapping season in the Mackenzie Delta. An increase is anticipated in 1948. A sharp reduction also took place in the number of beaver pelts obtained, and lynx and mink continued to decline. Receipts of white fox pelts were more than doubled from 20,854 in 1946 to 57,750 in 1947. The take of ermine showed a notable increase.

Reports of an increase in the marten population made it possible to declare an open season on this animal, and it may now be taken under a limited permit. A survey is under way, the results of which will permit the proper management of this fur bearer in the future. The area in which beaver may be taken under limited permit was increased in size by the addition of a large tract of country south and east of the Liard River, from which reports were received of sufficient numbers of beaver to justify trapping. As beaver are still scarce around Great Slave Lake and southward, a year-round closed season is in force in that region.

A biological survey of the Mackenzie River Delta was carried out during the summer of 1947 by Dr. Ian McT. Cowan of the University of British Columbia with two purposes in view:—(*a*) the initiation of a long term field research on Arctic mammals, particularly fur-bearing and game mammals and (*b*) an intensive study of the management and sociological aspects of the fur industry in the Delta. The year was also marked by the appointment of resident mammalogists at Fort Smith and Aklavik. The researches of these scientists may be expected to provide data for regulating fur production and conserving wildlife on a sound basis.

Registration of Trapping Areas

The collection of preliminary information for a proposed system of registering trapping areas in the Northwest Territories was begun by the Royal Canadian Mounted Police in 1945-46 in those parts of the Mackenzie District which lie outside the native game preserves. Upon the establishment of the Forest and Wildlife Organization this work was continued and extended under the direction of headquarters at Fort Smith by the wardens in their respective districts and also by the warden staff of Wood Buffalo Park.

Meetings were held and trappers interviewed. Master maps were prepared showing the location and extent of the area utilized by each individual trapper. This work is well advanced in all districts, and information regarding the Aklavik and Simpson warden districts is complete. Two hundred and twenty-six areas in the Aklavik district and 118 areas in the Simpson district have been determined and mapped. The areas vary in size from one square mile to many hundreds of square miles, depending on the needs of the trapper and the kind of fur to be trapped.

The institution of such a system is intended to prevent the depletion of game by overtrapping. Each trapper will have exclusive rights in his territory, and it will be in his own interest to husband its resources. In the long run this should be very beneficial to the economy of the fur country and the conservation of wildlife. Provision is being made for allocating extensive trapping grounds for the exclusive use of natives who desire to have the areas registered for the benefit of the group as a whole and to share the fur harvest in common.

Wood Buffalo Park

Forest fire damage was comparatively light in the park in 1947. The most serious fire was at Lynx Lake, southwest of Government Hay Camp which burned off 1,400 acres of young forest-cover.

The road-building program made good progress under direction of Forest Engineer, J. S. Prescott, who was appointed in January, 1947. Work on the road between Fort Fitzgerald and Government Hay Camp was facilitated by the purchase of a D-4 caterpillar tractor and bull-dozer, and by arrangement with the Department of Transport and others for the hauling of gravel. Grading was completed on 13·2 miles and partially completed on 17 miles. A considerable amount of work was also done on the Fort Smith-Hay River Road, including the erection of a pile bridge 182 feet long over the Salt River. Construction of a new road from Government Hay Camp to Pine Lake was begun.

Four wardens' cabins, started in 1946, were completed in 1947, and preparation was made for building a standard warden's cabin at 27th Base Line in the southeast corner of the Park in 1948.

Continued observation of the buffalo herd from the ground and the air shows it to be in a thriving condition. It is now estimated at between 9,000 and 10,000 head. Sixty-six buffalo, mostly aged bulls, were slaughtered and 63 carcasses distributed for consumption by indigent natives. An innovation was the shipment of a barge-load of meat to the hospitals at Fort Providence and Fort Simpson, where fresh meat was urgently needed.

Production of all classes of fur declined somewhat except in the case of ermine, which showed a slight increase. Muskrat populations are reported to be increasing because of favourable water conditions, and beaver are becoming more plentiful in some sections. A trapping-area plot of the Park has been completed and it is believed that registration of individual and group areas will be an inducement to Treaty Indians and half-breeds who are permitted to hunt and trap in the Park to husband the wildlife resources.

Northwest Game Regulations

The Northwest Game Regulations were amended by 3 Orders in Council during the fiscal year.

(1) Order in Council P.C. 2567 dated July 3, 1947:—
   (*a*) Forbidding the serving of game meat at places where a charge is made for meals.
   (*b*) Forbidding the sale of moose meat.
   (*c*) Allowing the taking or killing of not more than 5 caribou by a Canadian citizen who is the head of a family or by an employee of the Dominion Government.
   (*d*) Allowing an employee of the Dominion Government to take game necessary to supply him with fresh meat while on patrol in winter.

(2) Order in Council P.C. 4285 dated October 24, 1947:—
   (*a*) An open season for marten from the 1st day of November to the 1st day of March.
   (*b*) Not more than 5 marten may be taken under permit during the open season.

(3) Order in Council P.C. 506 dated February 12, 1948:—

(*a*) Native hunters permitted to take male caribou during March, but only as food for themselves and their families.

(*b*) The area in which beaver may be taken under permit enlarged to include a large tract south and east of the Liard River.

Fur Export Ordinance

Fur Export Tax schedule was amended by reducing the tax on each white fox pelt from $1.50 to 75 cents, effective January 1, 1948.

General

Seven fur farms were licensed to operate in the Northwest Territories during the fiscal year.

Comparative figures of the number of big game animals and birds taken during the licence years ended June 30, 1946 and 1947 follow:

	Year ended June 30 1947[2]	1946[1]
Big Game		
Caribou	10,710	28,854
Deer	10	7
Moose	416	597
Sheep	8	13
Goat	....	2
Game Birds		
Ducks	10,489	10,853
Geese	301	819
Grouse	625	446
Partridge	2,359	548
Prairie Chicken	762	1,624
Ptarmigan	3,956	7,783

Licences, Permits, and Revenue.—Comparative statement of licences and permits issued and revenue derived under the Northwest Game Act .

	Licences Year ended June 30 1948[2]	1947[1]
Hunting and trapping—		
Resident	348	465
Game Bird	145	49
Trading and Trafficking—		
Resident	96	105
Non-resident	6	5
Non-resident, non-British	1	1

	Permits Year ended June 30 1948[2]	1947[1]
To establish trading post in N.W.T.	9	11
To take animals for propagation purposes	2	1
To take migratory birds	2	15
To take scientific specimens	11	8
To take (10) beaver	226	493
To take (5) caribou	37	..
To take (5) marten	992	..
To Indians to hunt and trap in Wood Buffalo Park	214	260

[1]These figures may differ slightly from those recorded in the Annual Report for 1946-47 because of additional returns received after that report was printed.

[2]Subject to revision as additional returns are received.

Revenue under Northwest Game Act for fiscal years ended March 31, 1947 and 1948 is shown hereunder:—

	Fiscal year 1947-48	1946-47
Hunting licences	$ 860.00	$ 900.00
Trading licences	1,845.00	1,580.00
Bird licences	402.00	102.00
Fur farm licences	21.00	13.00
Trading post permits	9.00	7.00
Caribou hunting permits	55.00	...
Sale of furs	4,212.88	6,893.80
Fur Export Tax	141,423.38	90,894.44
Fines and forfeitures	164.79	3.00
Sale of buffalo hides	1,320.00	795.00
Total	$ 150,313.05	$ 101,188.24

Infractions of Game Laws.—There were 18 prosecutions for infraction of the game laws and convictions were secured in all cases.

Reindeer

Reindeer herding as a native industry is being developed in Northern Canada by the Dominion Government through the Northwest Territories Administration. The enterprise began with the delivery in 1935 of a herd of 2,370 reindeer from Alaska to a reserve on the east side of the Mackenzie Delta. There is now a main herd on the reserve and a subsidiary herd about 200 miles eastward near the mouth of Anderson River. The field organization consists of about 25 employees for supervision, labouring and herding with necessary buildings, corrals, boats, equipment, and supplies. Wireless communication is used to a considerable extent. Transportation is effected by boats, tractor, dog teams and deer teams, and the occasional use of aircraft. The herders are mostly Eskimos, assisted by three Laplanders.

At the roundup of the herds in July, 1947, there were 4,251 head in the main herd and 2,027 in the Anderson River herd. Two hundred and fifty surplus deer were slaughtered for meat and the usual donation of 100 carcasses was made to the mission hospitals and residential schools at Aklavik. The revenue from the sale of reindeer products during the fiscal year was $3,306.60. Three hundred skins were shipped to the Eastern Arctic.

Investigations of the condition of the range and the best methods of developing the reindeer industry were conducted during the year. A new superintendent of the Reindeer Range Station was appointed, and efforts were continued to interest young natives in reindeer training, to improve the technique of herd management, and to develop a suitable procedure for handling, storing, and marketing surplus reindeer products.

Yellowknife Administrative District

The Local Trustee Board of Yellowknife now has nine members, five elected locally, and four (including the Chairman) appointed by the Commissioner of the Northwest Territories. During the fiscal year the Board held 36 meetings and passed several by-laws, including those covering such matters as the rate of taxation, town planning, regulation of traffic and health, and sanitation within the District.

Public Improvements

The Department of Public Works, with funds supplied by this Department, constructed a number of buildings in the Mackenzie District. Some of these were begun in 1946, but, because of shortage of materials and efficient labour, they were not completed until this year.

At Yellowknife Settlement, two 4-room apartment buildings for staff purposes, an Administration building, a new liquor vendor building, Royal Canadian Mounted Police barracks, and a garage were completed. Construction work undertaken at Fort Smith included completion of three residences and an Administration building. A fourth residence, single men's quarters, guard-room, and married officers' quarters for the Royal Canadian Mounted Police were begun. These buildings are to be completed in 1948. Game wardens' residences begun in 1946 at Fort Resolution, Fort Simpson, Fort Norman, and Aklavik were finished and made ready for occupation in 1947.

Surveys and investigations were made in 1946 for the installation of modern pure water and sewage systems in the new section of Yellowknife Settlement. Excavation of trenches in the permanently frozen subsoil, and the construction of a pump-house were begun in 1947, and the progress made indicates that these systems will be in operation some time in the summer of 1948. The water system will have a continuous flow of heated water to prevent it from freezing.

During the year construction was carried forward on the Snare River Power Project. This power plant, situated on the Snare River about 90 miles northwest of Yellowknife, is designed to provide 8,000 horse-power under 56-foot head. An engineer of the Dominion Water and Power Bureau has been maintained on the project to inspect and report on the progress of the work. By the late autumn of 1947, the dam was about half completed, the head-gate structure was finished and the head-gates installed; excavation for the power-house was completed and concrete poured for the sub-structure; a start had also been made on constructing permanent housing for the operating staff. During the winter months, the principal activity was the successful freighting of equipment, materials, and supplies by tractor trains over the ice of Great Slave Lake and winter roads, to the site. Good progress was made on the transmission line being constructed by Giant Yellowknife Gold Mines. It is anticipated that delivery of power will begin during the next fiscal year.

As a means of assisting tonnage measurements and registry of ships in the Northwest Territories, a matter made difficult by the distances between the owners and the Registrars of Shipping and Measuring Surveyors of Shipping, arrangements have been made by the Department of Transport whereby Royal Canadian Mounted Police constables in the detachments at Aklavik, Fort Norman, Fort Simpson, Fort Smith, and Yellowknife will discharge these duties. Ports of registry and registrars of shipping are now located as follows: R.C.M.P. Detachment, Aklavik, N.W.T., and Customs House, Edmonton, Alberta. It is expected that these arrangements will greatly facilitate shipping operations in N.W.T. waters.

The Department of Transport continued the maintenance of aids to navigation along parts of the Mackenzie River waterway, including buoys, on Great Slave River, Great Slave Lake, Mackenzie River and Great Bear River. In 1947, three additional lights were established on Great Bear Lake, and in 1948 it is proposed to establish a further light in these waters. The harbours of refuge on the north side of Great Slave Lake were investigated and it is proposed to establish a lighted buoy in Windy Bay. The aids presently maintained are as follows:

Great Slave Lake; 14 lights, 5 pairs of range lights, and 4 lighted buoys.
Great Bear Lake; 6 lights, 1 pair of range lights.

In addition to the above, unlighted buoys and markers suitable to available depths are maintained.

At the close of the fiscal year, 31 meteorological stations were maintained in the Northwest Territories. These include a new station at Indin Lake, north of Yellowknife, and two new stations in the Arctic Archipelago, one at Eureka on Slidre Fiord, Ellesmere Island, and a second at Resolute Bay, Cornwallis Island. Co-operation continues with the Hudson's Bay Company, in recording

meteorological information, and radio communications from stations in the Northwest Territories were maintained in co-operation with the radio division of the Department of Transport, the Royal Canadian Corps of Signals, Government Telegraph Service, and the Meteorological Teletype Circuit.

Scientific Surveys

During the year, the Bureau of Mines undertook intensive studies relating to the treatment of gold ores from properties in the Yellowknife area. In an endeavour to locate a suitable source of road material for use on the Fort Smith-Fitzgerald road an officer of the Bureau investigated several deposits within reasonable access of the road. In reference to operations at the Eldorado mine, the Bureau gave attention to development work on equipment for concentrating the ores, and engineers and physicists are sent to the property periodically to assist in milling operations.

The Geological Survey of Canada had six parties in the field during the year. One of these completed reconnaissance mapping of the Camsell River area, and another party completed mapping of the Lac de Gras area. Other mapping operations were carried out near Indin Lake and in the McAlpine Channel area north of Eldorado. A detailed study of the complex Yellowknife Gold Belt was continued from 1946, and embraced the Con-Rycon and Negus properties. In addition to these projects, three officers were engaged in special operations, including a survey of all outstanding mines and prospects. One investigator travelled with the Royal Canadian Air Force aircraft engaged in North Magnetic Pole investigations, and obtained data from the wide area of the northern mainland and Arctic Islands which should materially assist in planning future geological explorations. Recent developments connected with the exploration for and production of petroleum in the Great Slave Lake and Norman Wells areas were also investigated. A resident geologist established his quarters and office at Yellowknife late in the year.

During the year, the Surveys and Mapping Bureau parties made astronomic fixes in the areas adjacent to the mouth of the Mackenzie River, Great Slave Lake, and Cambridge Bay, to provide control for aeronautic charts of the Northwest Territories. Other parties were engaged in township outline surveys designed to provide the framework for such subdivisions as may ultimately be required. Canadian Hydrographic Survey parties carried out charting operations for the benefit of water-borne transportation on the Mackenzie River-Great Slave Lake route. The season's work was expedited by a new, specially designed hydrographic cruiser, the *Rae*. As a result of these operations, three new charts will be published and large additions will be made to assist general charting of the southern part of Great Slave Lake. In addition to the regular season's charting, a small area was sounded in Great Bear River, at the outlet of Great Bear Lake, to determine whether a navigable 6-foot channel leads from the deep water of the lake to a wharf about one mile down the river.

A Magnetic Observatory for the study of magnetic disturbances was established at Baker Lake, N.W.T., for the purpose of charting diurnal and annual magnetic variations. The Dominion Water and Power Bureau continued and expanded its stream measurement program, and the investigation of water power in the Northwest Territories. During the open water season of 1947, a special survey was made of the Upper Snare and Lockhart Rivers to determine the possibility of developing power to serve the Indin Lake and Courageous Lake mining areas.

Agriculture

A meeting of the Interdepartmental Committee on northern agriculture was held December 9, 1947, and the work carried out by the Experimental Farms Service in the Northwest Territories during the previous summer season was

reviewed in detail. The centre for this work is the experimental station at Beaverlodge, Alberta. It is planned that in February of each year the officer in charge of the Fort Simpson and Yellowknife sub-stations will spend some time at Beaverlodge reviewing the work of each sub-station with the Superintendent of the Beaverlodge Station, and in making plans for future operations. The strategic position of the good agricultural district around Fort Vermilion is important. Although Fort Vermilion is outside the Northwest Territories, the eventual completion of the Grimshaw-Hay River road will give it ready access to the Mackenzie River for the disposal of agricultural produce.

The town of Yellowknife is now reaching such proportions that the residents are interested in ornamental gardening. In this connection, it has been arranged that an experimental farms officer will visit the townsite in the spring to give advice on ornamental plantings to local residents, and to show films designed to inspire interest in vegetables and small fruits.

Dr. A. Leahey of the Dominion Experimental Farm, Ottawa, visited the sub-stations at Yellowknife and Fort Simpson in July, 1947, and his investigations indicated that agriculture at Yellowknife will probably be confined to garden crops, particularly of the leafy kind, and poultry. A large number of experiments were started at the Fort Simpson station during the year, but the results of the first year's operations do not warrant a comprehensive estimate of the potentialities of this area. Investigations at Hay River have revealed the existence of good soil, and it is felt that there may be considerable agricultural activity there in the future.

Geographic and Economic Research

Studies dealing with the geography, natural resources, and people of the Northwest Territories were continued by the Bureau's geographer during the late spring and early summer of 1947. Later in the season, Dr. J. L. Robinson, representing the Northwest Territories Administration, accompanied the Geodetic Survey party on flights to determine the location of the North Magnetic Pole, and his report on the physical geography of the western Arctic has provided the Administration with useful background material. In addition, a comprehensive article on Canada's Western Arctic was prepared by Dr. Robinson for publication in the *Canadian Geographical Journal*.

The co-ordination of geographical information relating to the Northwest Territories and the Yukon has now been assumed by the Geographical Bureau of the Department, which was established by Cabinet decision June 5, 1947. Northwest Territories and Yukon Services are co-operating with the Geographical Bureau in exchanges of useful information, and in this connection the data compiled by Dr. J. L. Robinson during the several years of his employment with the Northwest Territories Administration will constitute a valuable source of material.

Publicity and Information

Numerous requests for information about the Northwest Territories and the Yukon were met by distributing pamphlets, folders, and maps, and by correspondence. During the year it was necessary to run off several reprint editions of the booklet *The Northwest Territories; Administration, Resources and Development*. A new publication with illustrations, *Yukon Territory: History, Administration, Resources and Development*, was issued for general distribution. To meet the demand for information concerning public use of the Alaska Highway, the multilithed circular issued the previous year was revised and reprinted for issue. Articles of an informative and statistical nature were prepared for publication in various mining journals, encyclopedias, and other books and periodicals.

YUKON TERRITORY

Yukon Territory has an area of 207,076 square miles. It is bounded on the south by British Columbia and Alaska, on the west by Alaska (longitude 141 degrees west), on the north by the Arctic Ocean, and on the east by the Northwest Territories. Most of the Yukon's present population is found in the northern or Dawson District, the southern or Whitehorse District, and the Upper Stewart River or Mayo District. According to the 1941 census, the population of Yukon Territory was 4,914. This figure has been increased by new developments, including a revival of the mining industry. The most recent estimate places the population of the Territory at 7,512, comprising 5,927 whites and 1,585 Indians.

The Yukon was created a separate territory in June, 1898. Provision is made for a local government composed of a chief executive, called the Controller, and an elective Legislative Council of three members, with a three-year tenure of office. The Controller administers Government measures and works under instructions from the Governor in Council or the Minister of Mines and Resources. The Controller in Council has power to make ordinances dealing with the imposition of local taxes, sale of liquor, preservation of game, establishment of territorial offices, maintenance of prisons and municipal institutions, issue of licences, incorporation of companies, solemnization of marriages, property and civil rights, administration of justice, and generally all matters of a local and private nature in the Territory. The seat of government is at Dawson, Y.T.

Territorial Council

The Yukon Territorial Council, elected by acclamation for a three-year term in 1947, is composed as follows: Dawson District, John R. Fraser, Dawson; Mayo District, Ernest J. Corp, Keno Hill; and Whitehorse District, R. Gordon Lee, Whitehorse. The Controller of Yukon Territory is J. E. Gibben, K.C., Dawson.

Work of Council

The Yukon Council met on July 2, and was prorogued on July 17, 1947. The following Ordinances were amended: Fur Export Tax, Sale of Beer, Forest Fires, Workmen's Compensation, Gasoline Tax, Succession Duty, Income Tax, Motion Picture, Insane Persons, Assessment, Legal Profession, and Public Service Ordinances. New Ordinances were passed respecting the profession of dentistry; to regulate the speed and operation of motor vehicles on highways; respecting Yukon game; requiring registration of guests at auto camps and hotels situated in unorganized territory; respecting hotel, boarding-house and lodging-house keepers; to provide for the regulation of motor carriers; to exempt the Mayo light plant from payment of licence fee; respecting second-hand dealers; to provide for the regulation of hours of closing of restaurants; and for granting of supply.

Administration

The Lands and Development Services Branch of the Department at Ottawa is responsible for the transaction of business arising from the general administration of the Territory under the Yukon Act and ordinances passed by the Territorial Council; for the disposal of lands under the Dominion Lands Act; for administering the Yukon Placer and Quartz Mining Act; and for collecting revenue.

Revenue and Expenditures

The revenue collected under Territorial Government Ordinances during the year amounted to $145,277.83. The amount transferred from the liquor account was $250,000. The sum of $130,382.88 was transferred from the Yukon

Post-War Work Fund. Expenditures from the Yukon Consolidated Revenue Fund amounted to $585,148.84. A grant of $170,000 was made by the Dominion Government for the Yukon Council.

Forest Protection

Forest fire protection in Yukon Territory has been confined generally to areas accessible from the Alaska Highway and the connecting road system in the southern part of the Territory. The present aim is to extend the system in conjunction with road construction.

During the year, numerous inspections and patrols were made along the Alaska Highway, Haines Cut-off, and Canol, and access roads in Yukon Territory. Suppressive action was taken on some 21 fires which burned approximately 1,675 acres, this being considerably below the area burned the previous season. Arrangements were continued with the Royal Canadian Air Force, the Canadian Army, and land and air transportation companies operating in Yukon Territory whereby they would report immediately any fires observed.

The Officer in Charge continued to assist the Crown Timber and Lands Agent at Whitehorse in administering timber and public lands in southern Yukon. He also served as liaison officer for the Department in arrangements relating to obtaining certain United States Army surplus buildings, equipment, and materials required by the various branches of the Department. Field work relating to restoring private property leased during construction of the Alaska Highway was continued, and a number of leases were terminated.

The Alaska Highway

The maintenance of the Alaska Highway, and access roads to airports along the Northwest Staging Route and flight strips bordering the highway, was under the jurisdiction of the Department of National Defence (Canadian Army).

Airports along the Northwest Staging Route continued to be maintained by the Royal Canadian Air Force, and flight strips bordering the highway were serviced by the Royal Canadian Engineers. The Northwest Communication System, comprising the telephone and telegraph system paralleling the highway, was turned over to the Department of Transport at the beginning of the year. It provides facilities for public long distance telephone and commercial telegraph services at a number of repeater stations along the Alaska Highway. In addition, this system ties in with other Department of Transport facilities at Fort St. John, Beatton River, Fort Nelson, Smith River, Watson Lake, Teslin, Whitehorse, Aishihik, and Snag.

During the year travel restrictions were removed, and permit to travel on the Alaska Highway was no longer required. However, restrictions on travel were made from time to time by the highway maintenance authorities because of flood conditions or damage to bridges. Law and order along the highway was maintained by the Royal Canadian Mounted Police.

Bus services were operated regularly from Dawson Creek to Whitehorse and return by the British Yukon Navigation Company, of Whitehorse, Y.T., and similar services were provided from Whitehorse to Fairbanks and return by the British Yukon Navigation Company, and the O'Harra Bus Company, of Fairbanks, Alaska. Facilities for the maintenance and repair of motor vehicles were slightly improved. A weekly trucking service was maintained over the highway by the British Yukon Navigation Company and by a number of private trucking companies.

The Haines Cut-off Road connecting Haines, Alaska, with the Alaska Highway at a point approximately 95 miles west of Whitehorse, Y.T. was open for traffic during the summer months only.

The Canol Project

The Canol pipeline from Norman Wells, Northwest Territories, to Whitehorse, Yukon Territory, was sold by the United States Government in October, 1947. The oil refinery at Whitehorse was also disposed of. The petroleum-distributing pipelines from Skagway to Whitehorse and from Whitehorse to Fairbanks, which were constructed as part of the Canol Project and which had been placed in an inoperative condition by the United States Government, have been reactivated following agreement entered into between the Government of the United States of America and the White Pass and Yukon Route and its subsidiaries.

Roads, Bridges, and Public Works

Expenditures for roads, bridges, and public works from Territorial revenue amounted to $210,610.08. The roads maintained by the Territory are, generally speaking, in excellent condition.

Air fields at Dawson and Mayo were maintained in good condition throughout the year. There were few days when these fields were not in excellent shape.

Agriculture

J. W. Abbott, in charge of the Federal Experimental Station on the Alaska Highway, west of Whitehorse, visited most settled parts of the Territory during the year. He conducted field tests and garden trials with a view to improving agriculture conditions in the areas concerned.

In the northern part of the Territory the season was normal, and garden products, with the exception of potatoes, were up to the usual standard.

Fur and Game

Collections made under the Fur Export Tax Ordinance reached $9,296.22, an increase of $374.93 over the previous year. Black fox, silver fox, white fox, lynx, wolverine, and squirrel all showed increases. Bounty payments for wolves and coyotes total $10,950, a decrease of $180 from the previous year.

Public Welfare

The health of the white population in the Territory was uniformly good throughout the year with a comparatively low incidence of communicable diseases. A tuberculosis X-ray survey was completed in the southern part of the Territory during the late autumn, and arrangements were made to continue this survey in 1948. The incidence of venereal disease continued to diminish.

Registrations under the Vital Statistics Ordinance during the year were: births, 341; marriages, 61; and deaths, 75.

The Government hospital at Whitehorse and St. Mary's Hospital at Dawson continued to function efficiently. The Territorial Hospital at Mayo was reopened and functioned throughout the year under administrative supervision with the assistance of a Local Advisory Board. The following grants were made: Whitehorse General Hospital, $37,000; St. Mary's Hospital, $45,000; Mayo General Hospital, $25,203.40. The number of hospital days of patients for the year were: St. Mary's Hospital, 18,295 for 675 patients; Whitehorse General Hospital, 13,559 for 918 patients; Mayo General Hospital, 1,481 for 186 patients.

Relief was extended to aged people who were destitute and unemployable. The sum of $59,770.16 was expended for relief and $5,697.94 was paid to St. Mary's Hospital, Dawson, for the care of all indigent half-breed and white children. These children attended Dawson Public School.

Education

Eight schools were maintained in the Territory during the year, including two at Dawson and one each at Whitehorse, Mayo, Carcross, Brook's Brook, Destruction Bay, and Swift River. In addition, a separate school is maintained at Whitehorse, and is inspected by the Superintendent of Schools for the Yukon Territory. The number of teachers employed was 22. The number of pupils enrolled was 507, and this figure includes enrolment at the separate school at Whitehorse. The amount expended on education was $104,705.15.

Law and Order

Law and order has been well maintained throughout the Territory by the Royal Canadian Mounted Police.

Scientific Surveys

Scientific surveys in various fields were undertaken or continued by officers of the Department during the year. A marked increase in the recovery of silver and lead will result from flotation and cyanidation tests by the Bureau of Mines on ore and old tailings from the Keno Hill property in the Mayo area. The increasing mining activity in the Yukon has given rise to the problem of supplying the mining properties with fuel. This led to arrangements to bring the Tantalus Butte coal mine, near Carmacks, into production. Activities on this property were begun during the summer of 1947, the Dominion having loaned the Yukon Coal Company funds, not exceeding $300,000, for this purpose. With the assistance of a departmental coal geologist, the driving of a new slope adit was begun. The development program continued throughout the winter and the coal which will be available as a result of these operations is apparently ample to meet Yukon's requirements for many years.

Geological, geodetic, and topographical survey parties were active in different parts of the Territory. Legal survey parties completed the survey of the Alaska Highway and established the boundaries of Aishihik and Snag airfields; surveyed an extension to Whitehorse townsite; selected and surveyed an Indian reserve, and carried out various other surveys designed to assist in the development and administration of the Territory. In addition a surveyor investigated on the ground the problems and requirements relative to mineral claim surveys, with a view to facilitating development and administration of the territorial mineral resources.

NATIONAL PARKS SERVICE

The National Parks system of Canada was expanded further during the year. The Province of New Brunswick provided title to an area of almost 80 square miles, fronting on the Bay of Fundy and extending back about 9 miles between the Goose and Upper Salmon (Alma) Rivers. The National Parks system now comprises twenty-six units and covers an area of more than 29,000 square miles. These parks are administered by the National Parks Service in Ottawa under the authority and provisions of the National Parks Act. The Act also covers the National Historic Parks, places set aside to commemorate historic events or to preserve national sites and monuments. In addition to the administrative staff at Ottawa, a resident superintendent is located in each of the principal parks. In the interest of better administration, National Parks Regulations were revised and consolidated during the year.

Two National Park areas in Alberta, Buffalo and Nemiskam, having served the purpose for which they were established, were abolished, and the lands returned to the Province. Adjustments in the boundaries of some of the other

parks were made. The principal changes were reductions in the areas of Prince Albert Park in Saskatchewan and Waterton Lakes Park in Alberta in order to facilitate administration; and an increase of approximately one-third in the size of Elk Island Park. Minor adjustments, all of them increases in area, were made to some of the national historic parks, including an addition to Fort Beauséjour Park donated by a public-spirited citizen of New Brunswick.

Travel to the Parks

During the year the total attendance at National Parks exceeded all previous records when 1,243,822 visitors were recorded. The number of visitors to each park, and comparative figures for the previous year, will be found in the following table:

National Parks

	1947-48	1946-47
Banff	326,573	246,397
Cape Breton Highlands	27,507	23,896
Elk Island	45,615	39,976
Georgian Bay Islands	4,778	6,591
Glacier	839	461
Jasper	71,957	29,191
Kootenay	77,805	64,530
Mount Revelstoke	11,053	8,542
Point Pelee	109,354	87,150
Prince Albert	34,371	31,474
Prince Edward Island	67,508	50,281
Riding Mountain	184,778	161,237
St. Lawrence Islands	14,299	15,824
Waterton Lakes	147,177	126,337
Yoho	31,085	23,015
Sub-Total	1,154,699	914,902

National Historic Parks

Fort Anne	11,980	8,754
Fort Beauséjour	16,397	12,023
Fort Chambly	26,703	22,546
Fort Lennox	1,303	1,223
Fortress of Louisbourg	4,858	4,238
Fort Malden	14,065	17,335
Fort Wellington	5,800	5,699
Port Royal Habitation	8,017	6,025
Sub-Total	89,123	77,843
GRAND TOTAL	1,243,822	992,745

Direct Revenue

The net revenue of the National Parks Services of Canada for the fiscal year amounted to $491,708.61, as compared with $422,219.91 for the preceding year, an increase of $69,488.70.

CONSERVATION SERVICES

Conservation plays an important part in the administration of National Parks since all park areas are natural wildlife sanctuaries. Because most of the parks are well wooded a great deal of emphasis is placed upon the protection of park forest from fire and insect pests.

Forest Protection

Although only 18 forest fires were reported during the year, the total area burned over was the largest since 1943. This situation was the result of abnormal fire-hazard conditions and large fires in Cape Breton Highlands Park.

This region accounted for 96 per cent of the total area burned in all National Parks. This was a complete reversal of the situation that has prevailed during the last ten years and may be attributed to the cumulative effect of subnormal precipitation which had been gradually building up to an extreme hazard condition in this district for a number of years.

An analysis of the causes shows that smokers and lightning were each responsible for 27·8 per cent, railways for 16·7 per cent, incendiary for 5·5 per cent, and camp fires and unknown causes for 11·1 per cent each. Classified according to size, 56 per cent of the fires were less than one-quarter of an acre, 22 per cent were one-quarter to 10 acres, 11 per cent were 10 to 500 acres, and 11 per cent were over 500 acres. The absence of settlers' fires, usually a major cause, was largely due to the favourable conditions which prevailed in Riding Mountain Park.

Fire Losses in National Parks

Park	Number of Fires		Area Burned Acres		Cost of Suppression	
	1946	1947	1946	1947	1946	1947
					$ cts.	$ cts.
Banff	19	6	2	4½	396 05	248 73
Jasper	7	3	248	Spot	2,137 46	8 02
Glacier	1	1	2½	Spot	206 30	32 00
Kootenay	3	0	161	0	440 58	0 00
Yoho	9	0	1½	0	304 18	0 00
Mount Revelstoke	0	0	0	0	0 00	0 00
Waterton Lakes	4	3	Spot	Spot	4 30	33 28
Elk Island	1	0	1,120	0	408 11	0 00
Prince Albert	2	2	177	161½	53 13	559 67
Riding Mountain	1	0	65	0	5 34	0 00
St. Lawrence Islands	0	0	0	0	0 00	0 00
Point Pelee	1	0	Spot	0	0 00	0 00
Georgian Bay	0	0	0	0	0 00	0 00
Cape Breton	0	3	0	4,330	0 00	21,136 77
Prince Edward Island	1	0	Spot	0	0 90	0 00
Totals	49	18	1,777	4,496	3,956 35	22,018 47

One new fire lookout, the Aylmer, was completed in Banff Park. This is a 30-foot steel tower on Mount Aylmer, which permits observation of part of the eastern end and all of the western end of Lake Minnewanka, and the Cascade Valley as far west as Banff. In addition, work has been done on the Geraldine Lookout in Jasper Park, which, it is hoped, will be completed during 1948. The total number of primary lookouts in the mountain Parks is now thirteen.

New equipment purchased during the year included twelve portable gasoline pumps, and 23,000 feet of 1½-inch line hose as well as many small accessories such as siamese couplings, nozzles, metal tool boxes, and canvas relay tanks. More than half of this equipment was purchased for fighting the large fires in Cape Breton Highlands Park.

Fire Weather Stations

All fire weather stations in Banff, Jasper, Yoho, Waterton Lakes, Prince Albert, and Riding Mountain Parks were in operation from the middle of May until about the end of September, depending on local conditions. No new fire weather stations were established during the year. During the fire season the western parks received daily weather forecasts from the Meteorological Service, Department of Transport.

Although weather conditions were generally favourable in the western parks, periods of extreme hazard prevailed intermittently from May to August. In Prince Albert Park, during June, the fire danger index rose to "extreme" on several occasions. In the eastern parks, periods of extreme danger were experienced in August, resulting in the severe fires which occurred in Cape Breton Highlands Park.

Insect Control

Control of forest insects during the past year was limited to experiments aimed at controlling the mountain-pine bark beetle (*Dendroctonus monticolae*) by the use of chemicals, and a survey of an infestation of the false hemlock looper (*Nepytea canosaria*) which is attacking Douglas fir in the vicinity of Radium Hot Springs in Kootenay Park.

The experiments to control bark beetles were carried out in Yoho Park to determine the practicability, effectiveness, and cost of this method of control. Although field work was completed during the summer of 1947, the analysis of information obtained is as yet incomplete.

Disposal of Timber Under Annual Cutting Budget

Under control of a forest working plan, cutting of saw-timber, fuelwood and other forest products for the use of local settlers was continued in Riding Mountain Park. During the year, 2,021 permits were issued for 3,588,650 feet board measure of saw-timber, 15,643 cords of fuelwood, 76,112 posts and 10,307 trees. The number of permits issued was approximately the same as last year, and 20 per cent of the cut consisted of wind-thrown timber. With a few minor exceptions, regulations controlling the cutting of timber in National Parks were well observed.

MAINTENANCE AND IMPROVEMENTS

A program of development and improvement, held in abeyance during war years, was resumed in many of the parks. This program included road and trail improvements, extension of camp-ground areas, construction of wardens' cabins, fire lookout towers, bridges, and provision of townsite services. The Service was enabled to overcome, to some extent, arrears of maintenance, and to obtain some replacements for worn out and obsolete equipment. All park facilities, such as highways, roads, trails, bridges, culverts, telephone lines, and buildings owned by the National Parks Service, were maintained in efficient operation.

Roads and Bridges

The work under this heading consists of the construction and maintenance of highways, roads, and bridges.

In Banff Park, work began on the revision of the Banff-Windermere Highway, starting at Eisenhower Junction. Considerable resurfacing was done on the Trans-Canada Highway from Lake Louise Station to the boundary of Yoho Park. Resurfacing operations were also carried out on the Moraine Lake Road. Other work included construction of 1½ miles of fire road into the Flint's Park area.

In Jasper Park the road and parking space at Athabaska Glacier were improved and a new bridge was constructed across the canyon at Sunwapta Falls.

In Kootenay Park, the Sinclair Canyon bridge was repaired and a new concrete bridge was erected at Mile 27 on the Banff-Windermere Highway.

In Prince Albert and Riding Mountain Parks a number of bridges were repaired and culverts replaced.

In Cape Breton Highlands Park two new bridges were completed, one at Mile 12 on the Cabot Trail and one on the road up Roper's Brook intervale. Extensive repairs were made to the North Mountain Bridges, and a number of culverts installed.

Trails

In Banff Park, 1½ miles of fire trail were constructed in Johnson's Canyon. In Jasper Park the Whirlpool fire trail was completed to Moab Lake, the 11-mile Devona fire trail was graded, and the Snake Indian fire trail was completed to Strawberry Creek. In addition, the Marmot ski trail was opened up as far as Mile 2·5.

Communication System

The following table indicates the existing mileage of roads, trails, and telephone lines within the National Parks as of March 31, 1948:

Roads

National Parks	Motor	Secondary	Fire	Trails	Telephone Lines
	Miles	Miles	Miles	Miles	Miles
Banff	182·9	3·2	103·0	727·5	288·15
Cape Breton Highlands	50·8	1·6	.....	21·0	.....
Elk Island	16·0	.....	.....	30·0	16·0
Glacier	.....	.....	17·5	95·5	3·5
Jasper	144·0	18·5	58·0	582·5	423·7
Kootenay	61·1	.....	9·5	156·0	60·0
Mount Revelstoke	18·0	.....	.....	82·5	10·75
Point Pelee	7·5	4·0	.....	.....	.....
Prince Albert	68·0	48·0	.....	298·25	129·0
Prince Edward Island	7·0	4·0	.....	.....	.....
Riding Mountain	51·6	52·9	.....	113·0	227·5
Waterton Lakes	47·8	13·5	.....	146·40	65·0
Yoho	45·0	6·5	24·5	204·0	72·5
Total	699·7	152·2	212·5	2,456·65	1,296·10

Buildings

Building activity showed a marked increase notwithstanding the shortages of materials and labour. In Banff townsite 102 building permits were issued covering new construction, including alterations and improvements, with an estimated value of more than $711,000. Outside the townsite, building construction to the value of approximately $39,000 was authorized. The principal structures included replacement of the Cascade Hotel, a new Hudson's Bay Company store, and the Banff Clinic building. A chalet to accommodate students of the Banff Summer School of Fine Arts was completed, and construction of a second chalet started. Building activity undertaken by the Parks Administration at Banff included removal of 37 buildings from the former Seebe Internment Camp. Eighteen of these buildings were utilized in the emergency housing project at the Tunnel Mountain camp-ground. The remainder were turned over to the various park services.

In Jasper townsite, 29 building permits were issued to private enterprise. The administration made a start on a new recreation centre and swimming pool and a new incinerator, and work, either underway or completed, included a residence and utility building at the fish hatchery and an information bureau on the Banff-Jasper Highway near the boundary between Jasper and Banff Parks.

In Waterton Lakes Park, new construction included two staff residences, a warden's cabin, a stable, and two campsite kitchens.

In Kootenay Park, the work of providing temporary bath-house facilities, made necessary by the destruction of the bath-house by fire, was begun.

At Elk Island Park, an equipment and storage building was completed, and the golf club-house and the garage at the North Gate were enlarged.

In Prince Albert, 21 building permits totalling $31,275 were issued, and the Parks Administration constructed a frame building to be used as a doctor's residence and medical centre, and 4 cabins for the warden service.

At Riding Mountain Park, a medical centre and R.C.M.P. barracks were erected by the National Parks Service, and an outdoor roller skating rink, 4 cottages and 2 bungalow cabin units were constructed by private enterprise. Good progress was made on the construction of a boys' camp at the west end of Clear Lake, also by private enterprise.

In Georgian Bay Islands Park, the Queen Elizabeth Sea Cadets, the Y.M.C.A., the Lions Club, and the Calvary Baptist Church all added to their camp facilities. The administration built a new wharf, repaired others, and enlarged the caretakers' cabin.

At St. Lawrence Islands Park, wharves at Beau Rivage Island and Gordon Island were reconstructed.

In Cape Breton Highlands Park, the Provincial Government of Nova Scotia completed construction of an eight-room cabin at Keltic Lodge and added a second staff dormitory and an extension to the laundry. The Parks Administration erected a new staff quarters building, and new aerial masts to improve radio-phone communications. At Prince Edward Island Park, progress was made in the construction of a staff residence at Dalvay, and a warden's cottage at Cavendish. The residence of the park superintendent was remodelled to provide accommodation for the administrative office, which was removed from Dalvay House.

Townsites

The National Parks Service is responsible for providing normal municipal facilities in the townsites, including street and sidewalk maintenance, water supply and sewage disposal, garbage collection, fire prevention, public health services, and control of building design. These municipal services are operated on a repayment basis. Regular townsite services were maintained, and water systems operated at Banff, Jasper, Kootenay, Waterton Lakes, Prince Albert, and Riding Mountain Parks. Electric power facilities in Jasper Park were extended by the erection of new transmission lines from Jasper townsites to Lake Edith and the Fish Hatchery. The provision of electric power at Waterton Lakes Park by the Calgary Power Company and at Riding Mountain Park by the Manitoba Power Commission was begun during the year.

Tourist Accommodation and Camp-Grounds

Tourist accommodation, particularly the bungalow cabin type, was considerably expanded by private enterprise. Many new cabins were added within and adjacent to park areas. Arrangements were made to lease a group of Government-owned cabins in Banff Park to returned veteran concessionaires already operating tourist accommodation for visitors. Agreements were made to provide for the erection of two bungalow camps in 1948 by private enterprise in the vicinity of Cape Breton Highlands Park. A new summer hotel and five new bungalow camps were put in operation just outside the boundary of Prince Edward Island Park. Concessionaires, some of them war veterans, opened up many new catering establishments in the National Parks in Western Canada. Forty new buildings were added to existing bungalow camps and other concessions in Banff Park. Twenty new cabins were added to bungalow camps in Jasper Park and twenty-six to auto camps in Waterton Lakes Park. The main camp-ground in Prince Albert was extended, and construction of a new camp-ground at Two-Jack Lake in Banff Park was begun.

Recreational Features

The National Parks serve as centres of outdoor life and recreation for both summer and winter sports. Hundreds of miles of smooth roads and thousands of miles of well kept trails provide access to all parts of the parks where the vacationist may enjoy the natural beauty of the scenery and the abundant wildlife resulting from sanctuary conditions.

Favourite summer sports include hiking, riding, mountain climbing, boating, canoeing, swimming, fishing, tennis, and golf. Many of the parks possess golf courses, some of which are equal to the finest on the continent, as well as tennis courts. Work on bowling greens was completed in Riding Mountain Park and begun in Cape Breton Highlands and Prince Edward Island Parks.

Winter sports, including skiing, skating, and curling, are popular in several of the parks. Banff Park in particular has developed into an outstanding resort for winter sports and is the centre of a vast territory where skiing lasts from December until April.

Special Events

Events of interest in the National Parks during the year included ski meets, tennis and golf tournaments, curling bonspiels, trail riding, trail hiking and mountaineering expeditions, regattas, ball games, winter carnivals, and Indian Days. In addition, more than 50 organizations from Canada and the United States held their meetings and conventions in the parks. The popularity of the National Parks for gatherings of this nature is increasing annually.

Their Excellencies the Governor General of Canada and Viscountess Alexander of Tunis with their family spent most of August in Cape Breton Highlands Park. This park was also the locale for the meeting of the Provincial Ministers of Mines during the first week in September. Earlier in the summer a memorial plaque was unveiled at the Lone Shieling picnic grounds on the Cabot Trail by Mrs. Flora McLeod, a Highland Chieftain from Dunvegan, Scotland. Premier Angus L. Macdonald of Nova Scotia took part in the ceremony. Two cairns, erected by International Rotary to commemorate the cordial relations which have long existed between Canada and the United States, were unveiled in the presence of a large number of citizens from both countries. The cairns are located on the International Boundary between Waterton Lakes Park in Alberta, and Glacier National Park in Montana.

Publicity and Information

The growing interest in the National Parks as vacation areas is reflected not only in the increased number of visitors but also in the heavy demand for printed information, such as booklets and folders. The following publications in the quantities indicated were prepared for distribution during the fiscal year:

Booklets—	
Canada's Mountain Playgrounds	20,000
Sport Fishing in Canada's National Parks	10,000
Folders—	
Point Pelee, Georgian Bay Islands and St. Lawrence Islands National Parks	25,000
Elk Island National Park	35,000
Prince Albert National Park	25,000
Banff National Park	50,000
Jasper National Park	50,000
Waterton Lakes National Park	50,000
Prince Edward Island National Park	25,000
Cape Breton Highlands National Park	25,000
Riding Mountain National Park	25,000
Kootenay, Yoho, Glacier and Mount Revelstoke National Parks	25,000
Miscellaneous—	
Mailing Card	250,000

These publications were made available through provincial and other travel bureaux, transportation agencies in Canada, the United States, and Mexico, and to other countries through the Information Section of the Department of External Affairs.

The preparation of a new folder dealing with National Historic Parks and Sites in the Province of Quebec was begun during the year.

In order to keep pace with the growing public interest in the National Parks, certain changes in the organization and administration of the Publicity Division were effected. As the number of inquiries rapidly increased, it became necessary to expand the use of other agencies to secure a wider dissemination of information, particularly in the United States. To provide adequate material for this purpose, the number and quantity of publications were increased, new motion pictures were produced, and the still photo and kodachrome slide library expanded.

The responsibility for the distribution of National Parks motion picture films was transferred to the National Film Board. The responsibility for exhibition requirements was assumed by the Canadian Government Exhibition Commission. The advantages of National Parks as recreation areas were more widely publicized in the United States by the Canadian Government Travel Bureau. In the departmental reorganization an Editorial and Information Section was established and the Parks Publicity Division was merged with the new Section. Thus, liaison duties with other agencies have expanded and a greater percentage of time has been devoted to co-ordinating these combined efforts in order to furnish Canadians and people of other countries with up-to-date knowledge of the National Parks and National Historic Sites. Conferences and meetings dealing with travel, recreation, health, and wildlife conservation have been numerous.

National Parks motion pictures of recreational and wildlife subjects were exhibited through National Film Board channels to audiences in Canada, the United States, and Australia. There were 2,861 showings and an attendance of approximately 575,312 persons. Four new 16mm. coloured sound films were produced and progress was made in having films used in television broadcasts. Purchases of 2,803 still photographs were made, of which 1,536 were distributed. Nine hundred and twenty-two lantern slides and 686 kodachrome slides were loaned. Eight hundred and thirty-five new kodachrome slides were purchased, duplicates of which are available to the public at cost.

Participation in the Canadian National Exhibition, after a lapse of several years, required the preparation of a new modernized display by the Canadian Government Exhibition Commission. Conservation of wildlife was graphically portrayed, and continuous projection of new National Parks films attracted an estimated 600,000 visitors.

Closer liaison with the Canadian Government Travel Bureau has increased the reference to National Parks in both its advertising program and the exhibits which are provided at Travel Shows in the United States. As a result many more inquiries on National Park subjects have been dealt with.

Addresses on recreational and wildlife study opportunities in the National Parks were delivered to a number of organizations in Canada, and 66 special articles and news releases were distributed to newspapers and magazines. Material for special writers, encyclopedias, and other publications were regularly supplied.

NATIONAL HISTORIC PARKS AND SITES

The National Parks Service is entrusted with the restoration, preservation and administration of National Historic Parks and Sites, and with the commemoration of the public services of outstanding persons in Canadian

history. The Service is advised in this phase of its work by the Historic Sites and Monuments Board of Canada, an honorary body of recognized historians, representing the various provinces of the Dominion.

The personnel of the Board is as follows: Chairman, Dr. J. Clarence Webster, Shediac, New Brunswick; Professor Fred Landon, London, Ontario; Professor D. C. Harvey, Halifax, Nova Scotia; the Honourable E. Fabre-Surveyer, Montreal, Quebec; J. A. Gregory, North Battleford, Saskatchewan; the Reverend Antoine d'Eschambault, St. Boniface, Manitoba; Major G. Lanctot, Dominion Archivist, Ottawa, Ontario; Professor M. H. Long, Edmonton, Alberta; Professor Walter N. Sage, Vancouver, British Columbia; and W. D. Cromarty, National Parks Service, Ottawa, Ontario.

The annual meeting of the Board was held in Ottawa, May 21-23, 1947. A wide variety of matters relating to the historic background of the Dominion were reviewed and a selection made of those considered of sufficient national importance to be dealt with. Of the many sites considered by the Board to date, 348 have been marked or acquired and 210 others recommended for attention at a later date.

National Historic Parks

The following is a summary of maintenance and improvement work carried out in Canada's nine National Historic Parks during the year:

Fort Anne, N.S.

Concrete mountings were made for the cannon on the northwest Curtain, shingle stain was applied to the roof and walls of the band stand, the exterior walls of the museum building were painted, and a water sprinkling system was installed on the lawn of the fort square.

Port Royal, N.S.

Fresh gravel was spread on the floors of the magazine and wine cellar, and ventilators were installed in the latter to offset dampness. New steps were constructed in the stockade, cannon were mounted and painted, and the parchment windows were replaced.

Fortress of Louisbourg, N.S.

Arrangements were made with the Nova Scotia Light, Heat and Power Company for their power line to be extended to the park. A memorial was built over the grave of the Duc d'Anville, whose remains were found some years ago when excavation work was being carried out. Four old fireplaces in the ruins of the hospital were dismantled and rebuilt, and a section of the wall was repointed. The bridge over the moat leading to the burying-ground, the casemates at the Citadel, and the archways near the bake-ovens were repaired and new stone walls constructed on each side of the doorway. Cement bases and carriages were made for some of the cannon, a garage was built, and the entrance road and fences repaired.

Fort Beauséjour, N.B.

A concrete base was constructed at the north end of the museum building to receive the large millstones which have been obtained. New gun carriages were made and the cannon mounted. The pavilion and interior of the library were painted.

Fort Chambly, Que.

Repairs were made to the retaining wall where it had been undermined by high water, and additional fill placed at the points affected. The interior walls of the museum, the main entrance doors, and all picnic benches, tables, and signs were painted.

Fort Lennox, Que.

Permission was granted to the Jeunesse Etudiante Catholique Organization to use a portion of the park property during the summer months as a youth training centre. The inner walls, roof, and fireplace of the Officers' Quarters were repaired and the windows painted. The masonry in the archway and along the stairs leading to the second floor of the Guard House was repaired, the Parade Ground was levelled, and the drains cleaned. A new galvanized roof was placed on the Commissariat Building and painted; the entrance bridge was repaired and the railings painted; the windows in the Men's Barracks and Canteen were repaired, and a new boat house was constructed. Arrangements were made with the Department of Public Works to have the road from the highway to the wharf repaired.

Fort Wellington, Ont.

A new macadam surface was placed on the entrance road and parking area; repairs were made to the earthworks, and a number of new benches made and placed at different points for the convenience of visitors. The buildings were painted, the caponnierre was drained, and the grounds levelled. Road signs were erected by the Provincial Department of Highways to direct tourists to the fort, and permission was granted to the town of Prescott to plant a number of trees along the east side of the park property in memory of the local men who lost their lives in World War II.

Fort Malden, Ont.

Arrangements were made with the Department of Public Works to have repairs made to the retaining wall, and for additional fill to be placed at the back. Temporary repairs were made to the roof of the Old Mess Hall, which was damaged by fire, and a spark guard placed on top of the chimney to prevent recurrences.

Fort Prince of Wales, Man.

The bronze tablets were cleaned and damaged enamelled signs were removed.

National Historic Sites

The following new historic sites were marked by the erection of cut-stone monuments or bronze tablets during the year:

The First Responsible Government in the British Empire

This event has been commemorated by the erection of a bronze tablet in the Assembly Chamber of the Parliament Buildings, Halifax, N.S.

The Lumber Industry, Saint John, N.B.

A cut-stone monument with tablet was erected in Riverview Park to commemorate events connected with the lumber industry.

Bliss Carman, Sir Charles G. D. Roberts, and Francis Joseph Sherman, Fredericton, N.B.

A cut-stone monument with tablet was erected on the campus at the University of New Brunswick to commemorate these outstanding Canadian poets, all of whom were born in or near Fredericton.

Louis Jolliet, Quebec, P.Q.

A cut-stone monument with tablet was erected on Champlain Street in memory of Louis Jolliet, 1645-1700, a native of Quebec, who, with Father Jacques Marquette, discovered and explored the Mississippi River in 1673.

Survey of the Great Lakes, Owen Sound, Ont.

A cut-stone monument with tablet was erected on the grounds of the Public Library to commemorate the Survey of the Great Lakes.

Brigadier-General E. A. Cruickshank, Welland, Ont.

A bronze tablet was affixed to the County Court House to commemorate Brigadier-General E. A. Cruickshank, historian, soldier, and magistrate.

Archibald Byron Macallum, London, Ont.

A bronze tablet was placed in the County Court House to the memory of Archibald Byron Macallum, biologist, chemist and teacher.

The Honourable John Norquay, Winnipeg, Man.

A bronze tablet was placed in the Legislative Buildings to commemorate the Honourable John Norquay, Premier of Manitoba, 1878-87.

Louise Crummy McKinney, Claresholm, Alta.

A bronze tablet was placed on the Post Office to Louise Crummy McKinney, the first woman to become a member of a legislature in the British Empire.

The Oregon Treaty of 1846, Douglas, B.C.

A bronze tablet was attached to the monument erected the previous year on the International Boundary in co-operation with the Washington State Historical Society and the British Columbia Historical Association, to commemorate the signing of the Oregon Treaty of 1846.

Amor de Cosmos, Victoria, B.C.

A bronze tablet was placed in the Parliament Buildings in memory of Amor de Cosmos, a leader in the struggle for Confederation and Responsible Government.

DOMINION WILDLIFE SERVICE

The Dominion Wildlife Service deals with questions of policy and method with respect to conservation and management of those wildlife resources that are under control of the Dominion Government, including fur-bearers, game, and other wild animals and birds, and, by scientific research, obtains the information necessary for such conservation and management. More specifically, the work embraces administration of the Migratory Birds Convention Act and the Northwest Game Act and Fur Export Ordinance, conservation of the game and fur resources and other wild creatures in the Northwest Territories, and the management of wild animals, birds, and fish in the National Parks of Canada. The work also includes dealing with national and international problems relating to wildlife resources as a national asset, co-operation with other agencies having similar interests and problems, and planning and carrying out scientific investigations relating to numbers, food, shelter, migrations, reproduction, diseases, parasites, predators, competitors, and uses of the wild creatures.

In addition to the scientific, administrative, and clerical staff at Ottawa, the service is represented by five Dominion Wildlife Officers, resident in and responsible for their respective districts. These districts are, the Maritime Provinces, Quebec, Ontario, the Prairie Provinces, and British Columbia.

Two mammalogists, W. A. Fuller and W. E. Stevens, were appointed to the staff of the Mackenzie Division of the Northwest Territories and Yukon Services in June, 1947. Both were assigned to duty in Mackenzie District, Mr. Fuller at Fort Smith and Mr. Stevens at Aklavik. They were included in the establishment of the Dominion Wildlife Service when it was formed.

On January 1, 1948, Dr. O. H. Hewitt was transferred from the position of Dominion Wildlife Officer for Ontario to headquarters staff as Wildlife Management Officer in charge of migratory bird research.

The Service is responsible for the establishment and control of Dominion Bird Sanctuaries. In the fiscal year 1947-48, there were 67 sanctuaries, with an area of some 1,360 square miles. A number of these sanctuaries are under the protection of salaried resident caretakers. The Service also receives co-operation from a large number of Honorary Game Wardens in the provinces and territories. These officers assist voluntarily in spreading conservation ideas and in the administration of the Migratory Birds Convention Act. The information on wildlife conditions that they furnish is very valuable.

INVESTIGATIONS

Migratory Birds.—From May to October, 1947, investigations on waterfowl production on the southern coast of James Bay were carried on by two student assistants, John P. Kelsall and Louis Lemieux. Dr. O. H. Hewitt participated in this work in spring and autumn. This survey included studies of the goose populations on the vast feeding grounds in that region, and of the hunting of this bird by resident and non-resident hunters.

The annual survey of breeding woodcock and Wilson's snipe in Ontario, Quebec, and the Maritime Provinces was conducted during April and May.

J. A. Munro and J. Dewey Soper were engaged during the greater part of the summer in an extensive survey of breeding waterfowl in British Columbia and the Prairie Provinces.

In Saskatchewan, during the summer and early autumn, an investigation of the breeding population of greater sandhill cranes and of the economic status of sandhill cranes, with particular reference to crop damage in certain areas, was carried on. The necessary research was done by David A. Munro, student assistant, with the help of Mr. Soper.

J. A. Munro conducted an intensive study of Duck Lake in the Creston district of British Columbia, and of waterfowl frequenting it. This investigation was of particular importance in considering future use of Duck Lake.

In January, 1948, all field personnel of the Dominion Wildlife Service, together with various co-operators, took part in the annual international inventory of wintering waterfowl of North America.

Biological Surveys.—Under a contract with the Department, Dr. I. McT. Cowan, Professor of Zoology, University of British Columbia, assisted by W. E. Stevens, mammalogist, of Aklavik, spent the greater part of the months of June, July, and August, 1947, in carrying out a preliminary study of the biota of the Mackenzie River Delta. His report on these investigations, and his recommendations for the development and proper harvesting of the fur crop of the Mackenzie Delta, were studied by the Advisory Board on Wildlife Protection and reviewed by the Northwest Territories Council.

Field research relating to Arctic mammals, particularly fur-bearing and game mammals, and intensive study of the management and sociological aspects of the fur industry of the Mackenzie Delta are being continued. W. A. Fuller has been engaged upon mammalogical investigations in the southern part of the Mackenzie District and in Wood Buffalo Park. Attention has been focused on muskrats, which are an important source of revenue and of food. A detailed study of the muskrat population of the Embarrass River region within the park was made.

These surveys are the most scientific approach yet made to the study, development, conservation, and utilization of the wildlife resources of this territory. The data obtained and recommendations of the field officers will provide a sound basis for development of a policy to improve wildlife conditions generally and to improve the economic well-being of the aboriginal population dependent upon wildlife for their livelihood.

Parks Wildlife.—Wildlife investigations in the National Parks by the Chief Mammalogist included the following:

Wildlife conditions generally in Banff, Revelstoke, Glacier, and Waterton Lakes National Parks; timber wolf control in Prince Albert National Park; coyotes in Point Pelee National Park; status of elk in Riding Mountain National Park; and status of moose in Elk Island National Park.

The investigation in Riding Mountain National Park revealed that vegetation was heavily damaged by an over-population of elk. Reduction of this population was recommended. Assistance was given in corralling moose in Elk Island National Park for shipment to Cape Breton Highlands National Park. The effects of the grazing of domestic stock on the ranges of certain parks is being studied. The survey of Waterton Lakes National Park included examination of the population and ranges of the large game mammals.

Experiments in the use of mechanical equipment named "coyote getters" for control of timber wolves were conducted.

Caribou.—Implementing a recommendation of the Provincial-Dominion Wildlife Conference of 1947, an investigation into the status, range, and general ecology of barren-ground caribou began in February, 1948. A. W. F. Banfield was in charge of the investigation. As a preliminary to carrying on the actual survey, itineraries for the several field parties were prepared, equipment was provided, and transportation arrangements were completed. The investigation embraces the range, population, food supply, reproduction, migrations, utilization, pathology, and predator relations of the caribou in the region between Hudson Bay and the Mackenzie and Slave Rivers, north to the Arctic Ocean. Aircraft will be used extensively as a means of transportation for the field officers, and the R.C.A.F. is co-operating in this respect whenever practicable.

FISHING AND FISH CULTURE

The limnologist, Dr. V. E. F. Solman, studied fish populations in eleven National Parks during the summer. The information thus secured and the results of the creel census are used as guides for adjustment of policies of fish management and for more efficient utilization of hatchery products.

Of the 9,413 anglers who visited the parks, 5,982 completed and returned creel census cards showing the capture of 28,464 game fish. Since the completion of the cards is voluntary, it is reasonable to assume that a far larger number of fish were actually taken. The creel census report was distributed to 1,583 anglers who had evinced interest in the returns.

A shipment of 339 adult lake trout was made from The Pas to Clear Lake, in Riding Mountain National Park. The fish were released in excellent condition, there being no loss in transit.

Statement of Fry, Fingerlings and Adult Fish Distributed in Park Waters During the Year

—	Rainbow		Eastern Brook		Cutthroat		Lake Trout	Total
	Fingerling	1 to 5 Years Old	Fingerling	1 or 2 Years Old	Fingerling	1 to 5 Years Old	Adults	
Waterton	53,716	30,760	36,680	.....	81,500	.....	.....	202,656
Banff	368,350	7,710	9,300	1,400	80,000	525	.....	467,285
Jasper	42,425	13,747	12,020	2,300	.....	.....	.....	70,492
Yoho	4,000	2,400	.....	.....	.....	.....	.....	6,400
Kootenay	5,000	.....	6,600	.....	10,000	.....	.....	21,600
Riding Mountain	.....	.....	.....	.....	.....	.....	339	339
Total	473,491	54,617	64,600	3,700	171,500	525	339	768,772

A considerable number of the fish distributed were of yearling or larger size. Such fish are subject to less loss than smaller fish.

WILD ANIMALS IN PARKS

In order to eliminate over-populations of elk that were severely damaging park ranges and neighbouring ranches, 87 elk in Waterton Lakes National Park, 253 in Jasper National Park, and 257 in Banff National Park were slaughtered. The meat and hides were transferred to the Indian Affairs Branch for distribution to needy Indians.

Ten buffalo were slaughtered at Elk Island National Park. The meat was placed in storage and the hides were reserved for departmental use.

A decided increase in beaver was reported from Prince Albert National Park. One hundred and one beaver were furnished to the Province of Saskatchewan to be used for restocking provincial areas where the beaver have become depleted. In addition, 14 beaver were transferred to Riding Mountain National Park and released.

Statement of Wild Animals in Fenced Enclosures in National Parks as of March 31, 1948

—	Banff Park Paddock	Elk Island Park	Prince Albert Park Paddock	Riding Mountain Park Paddock	Totals
Buffalo	12	1,227	8	30	1,277
Elk	.....	746	.....	145	891
Moose	.....	427	.....	.....	427
Mule deer	.....	95	.....	.....	95
White-tailed deer	.....	.....	.....	14	14
Total	12	2,495	8	189	2,704

Migratory Birds Convention Act

The Migratory Birds Treaty, signed in Washington, D.C., on August 16, 1916, and made effective in Canada in 1917 by Act of Parliament, was designed for the better protection of the many valuable birds that migrate between Canada and the United States. In this conservation measure the Dominion and the provinces co-operate. Regulations in accordance with the statute are agreed upon before being adopted by Dominion Order in Council.

Responsibility for the police work in connection with the enforcement of the provisions of the Migratory Birds Convention Act and Regulations thereunder was transferred to the Royal Canadian Mounted Police in 1932.

As of March 31, 1948, 67 bird sanctuaries were set aside in Canada under the Migratory Birds Convention Act, with an approximate area of 1,360 square miles. Two of these, Amherst Point Bird Sanctuary in Nova Scotia and Marconi Station Bird Sanctuary in Quebec, were established during the period under review.

Field administration of the Act was continued under the supervision of Dominion Wildlife Officers.

In areas where special protection is required, such as breeding areas for eider ducks and other sea-birds on the north shore of the Gulf of St. Lawrence and haunts of the rare trumpeter swan in British Columbia, special salaried game officers are employed by the Dominion Wildlife Service. The total number of such salaried officers employed in 1947 was twenty-seven.

Honorary Game Officers are appointed without salary to assist in enforcement of the Migratory Birds Convention Act and Regulations and to further the cause of wildlife conservation. In addition, all members of the Royal Canadian Mounted Police and of the New Brunswick Provincial Police, and all Game and Fishery Officers of the Provinces of British Columbia, Manitoba, New Brunswick, Ontario, and Quebec held in 1947 the appointment of Game Officer *ex officio* under the Migratory Birds Convention Act.

The waterfowl situation in Canada during 1947 was unfavourable in many respects. There were again, as during the two previous summers, extensive droughts in eastern Alberta and western Saskatchewan. Even in many areas of the Prairie Provinces where water and food conditions were favourable, there was a scarcity of ducks. A late spring and cold, wet weather adversely affected waterfowl breeding in southern Ontario and Quebec, and a short, stormy summer impaired breeding conditions in the Eastern Arctic. In the Maritime Provinces, where weather conditions were more favourable, there was a waterfowl shortage attributed to increased hunting pressure during the last two years and to reduction of suitable wintering grounds. In British Columbia the goose population was well maintained, but other species of waterfowl showed, on the whole, a decline from the numbers observed in 1946.

Minor changes in seasons and bag limits were made in the Regulations under the Migratory Birds Convention Act. Close co-operation was continued with provincial governments, game conservation societies, and other organizations interested in migratory bird conservation.

Bird Banding.—In order to conserve and manage wild birds by statute and otherwise, a broad and firm foundation of facts about many aspects of bird life is necessary. The only practical and satisfactory way in which much of the required information may be obtained is by means of systematic bird banding. Official bands bear a distinctive number, whereby the birds marked with them may be identified as individuals when they are later recaptured, killed, or found dead. The bands also bear an address to which their recovery is to be reported. In this way not only can some activities in the normal life span of an individual bird be recorded accurately and studied, but a species or group of species may be investigated.

In North America, bird banding is being conducted co-operatively by the Dominion Wildlife Service and the Fish and Wildlife Service of the United States Department of the Interior. Much of the banding work throughout Canada and the United States is done by voluntary co-operators of recognized ornithological ability who, operating under authority of special permits, serve

without remuneration from either Government, furnish their own equipment, and pay for any other incidental expenses. In Canada, the official Canadian bird-banding records are kept as part of the records of the Dominion Wildlife Service.

Bird banding in Canada has been under Dominion Government administration since 1923. As of December 31, 1947, the official Canadian bird-banding records contained 521,587 records of birds that had been banded, and 34,437 records of banded birds that had been recovered.

Current ornithological and conservation literature contains many papers and tabulations of the results of certain bird-banding investigations. These demonstrate clearly the practical usefulness of bird banding as an aid to applied ornithology and the conservation of wild bird life. Many fields of possible bird-banding investigations have yet to be explored fully, and much of the information which has already accumulated has not yet been put to maximum use. At present bird banding is in a state of expansion, particular attention being given to the banding of wild ducks and geese. As bird banding continues to expand and progress, the resulting accumulation of information will increase in usefulness.

Miscellaneous.—During the year, 1,041 permits and licences were issued under the provisions of the migratory bird regulations. Printed material distributed comprised 8,787 copies of the Migratory Birds Convention Act and Regulations, 16,212 Abstracts of the Regulations, 51,105 posters, 14,034 educational pamphlets, 210 Baiting Cards, 1,795 Bird Sanctuary Signs, and 665 Blue Goose brochures.

LANDS DIVISION

The Lands Division now includes the functions of the former Land Registry and, in addition, the administration of Crown-owned land, including timber and mining, throughout the Northwest Territories and Yukon Territory.

The Lands Division administers in provincial territory certain lands remaining under the control of the Dominion, such as Ordnance and Admiralty Lands not required for National Defence purposes, certain Public Lands reserved to Canada under the transfer of natural resources, and unpatented Soldier Settlement Lands on which advances have been made. In addition, the Division administers mineral rights reserved by virtue of Section 57 of the Soldier Settlement Act; maintains a Central Office of Record of Dominion-owned lands; maintains a record of seed grain, fodder, and relief advances made by the Dominion to settlers in the Western Provinces; and, in conjunction with the three Prairie Provinces, considers applications for apportionment or adjustment of advances made jointly by the Dominion and the Provinces; issues letters patent; and is responsible for dealing with land matters arising from the construction of the Alaska Highway.

The functions of this Division in relation to mining, lands and timber in the Northwest Territories and Yukon Territory will be dealt with in the first section of this Report, followed by sections dealing with the more general aspects of the Division's work.

NORTHWEST TERRITORIES

Mining

As in preceding years, the Yellowknife area was the focus of gold mining and prospecting activities in the Northwest Territories. However, some interest was shown in the area immediately west of Hudson Bay and in the Arctic area in the vicinity of Bathurst Inlet.

In the Mackenzie mining district interest was revived in lead-zinc deposits near Pine Point on the south shore of Great Slave Lake, west of the estuary of the Slave River. In March, after careful consideration of the steps necessary to cover adequate development of the area, the Consolidated Mining and Smelting Company of Canada Limited, in association with Ventures Limited and Northern Lead-Zinc Limited, was granted, for three years, the exclusive right to explore and develop in a tract of approximately 500 square miles. This grant was authorized by Order in Council P.C. 1004 dated March 23, 1948. The tract surrounds a group of mineral claims owned by Northern Lead-Zinc Limited.

Work was continued on the Grimshaw-Great Slave Lake road and on the Snare River power development, both of which undertakings are closely connected with the development of the mineral resources of the Northwest Territories.

The location at depth of the continuation of the West Bay Fault on the properties of the Con and Negus mines is felt to have assured these mines of a long productive life and to have confirmed Dr. Neil Campbell's geological theory in connection with the "shift" of the Giant ore body. The manifestation of this ore body on the above mentioned properties is often referred to as the "Campbell Shear Zone".

The general business of the Mining Recorders' Offices decreased in comparison with the preceding year, but work on first class prospects continued. Several of these began underground exploration.

There was also a marked increase in the interest shown in radio-active ores, and it was anticipated that next year would show a revival of prospecting and staking pitchblende deposits, particularly in the Great Bear and Hottah Lake areas.

The revenue derived from fees collected during the fiscal year under the various mining regulations applicable to the Territories was $339,541.79 as compared with $222,908.45 for the previous year. This revenue was derived as follows:

Quartz Mining	
General fees	$ 55,206.55
Leases	3,655.30
Royalties	9,292.38
Miner's Licences and Renewals	50,093.45
Petroleum Natural Gas	
Leases	1,945.13
Royalties and Government share in production of the "Proven Field"	218,584.48*
Petroleum and natural gas permits (Permit No. 207, deposit returned $16,000.00)	500.00
Coal	
Leases	25.00
Permits	5.00
Royalties	12.50
Gravel	
Permits	nil
Quarrying	
Leases	15.00
Dredging	
Leases	207.00
	$339,541.79

The Con-Rycon Mines were still the largest gold producers in the Northwest Territories and milled about 300 tons of ore per day. The outstanding development at these mines was the cross cut on the 2,350-foot level to intersect the Campbell Shear Zone.

* This figure includes an adjustment covering the period from May 1, 1945 to the end of 1947.

The Negus Mine, a close neighbour of the Con-Rycon, and the second largest producer in the Territories milled about 125 tons of ore a day. This Company also was preparing to exploit its share of the "Campbell Shear Zone."

The third mine which produced gold during the year was Thompson-Lundmark. This mine, after being reconditioned, milled ore at the rate of about 100 tons daily.

The Giant Mine spent the year preparing for production. A total of 19,500 tons of ore were stock piled, and it was anticipated that milling at the rate of about 200 tons daily would start in April.

Six companies sank shafts and were working underground with the probability of becoming "mines," and there were at least four other companies which had completed extensive surface exploration and whose next logical move would be shaft-sinking should funds be available.

Mining enterprise in the Territories was handicapped by lack of electrical power, although the latter deficiency would be supplied by completion of the Snare River development.

Value of Mineral Production.—The value of mineral production in the Northwest Territories for the past four years and the value of production since 1938 is indicated by the following figures which have been supplied by the Dominion Bureau of Statistics. The figures for the fiscal year 1947 are preliminary figures and therefore subject to some slight modification.

	1944	1945	1946	1947	Total production to end of 1947
Gold	$ 799,838	$333,218	$ 725,372	$2,378,530	$17,447,521
Silver	5,881	956	4,481	33,387	875,391
Lead	....	....	....	....	490
Copper	1,428	....	....	....	24,102
Tungsten	....	....	....	....	37,674
Crude petroleum	632,587	136,303	287,000	599,080	2,531,184
	$1,439,734	$470,477	$1,016,853	$3,010,997	$20,916,362

During the fiscal year 1,466 miner's licences were sold, 2,301 quartz grants were issued, and 1,933 assignments of mineral claims were recorded. In addition, 23 leases comprising 1,078.74 acres were issued under the Quartz Mining Regulations.

Coal.—Three annual permits were issued under the Domestic Coal Mining Regulations, and one coal lease issued under the Coal Mining Regulations was in good standing.

Petroleum and Natural Gas.—The permit on the Hay River was abandoned after the permittee had expended approximately $30,000 on drilling without striking oil. In several of the "holes" a strong flow of gas containing a large percentage of hydrogen sulphide was encountered. A new permit comprising 64,000 acres was granted in the neighbourhood of Fort Providence.

Six leases comprising 3,279·23 acres and the "Proven Field" comprising 7,939 acres were still in good standing. Production of 272,309 barrels of oil from the "Proven Field" during the year raised total production since April, 1942 to 2,211,772 barrels. Royalties and the Government's share of proceeds from sale of the oil amounted to $144,401.60, making a total revenue of $270,947.36 since the Proven Field Agreement came into force.

Dredging.—There were only two Dredging Leases in the Northwest Territories in good standing. These comprised two five-mile stretches, one on Grizzly Creek and the other on Bennett Creek. Both are tributaries of the South Nahanni River. The combined annual rental of these two leases is $100.

Lands and Timber

Land Sales.—Seventeen settlement lots were sold and patented as follows: Aklavik, 4; Arctic Red River, 1; Taltson River, 1; and Hay River, 11.

Leases and Permits to Occupy (Surface Rights).—There are now in force 762 leases and permits to occupy. Of these, 629 are for land in Yellowknife Settlement and the remainder for land at various points throughout the Northwest Territories. The types of leases and permits are as follows: residential and business purposes, 734; agricultural leases, 15; grazing leases, 3 and fur-farm leases, 10. Leases are authorized by Order in Council and are usually issued for a term of five years with a renewal option for a further like term. Permits to occupy unsurveyed Dominion lands are issued subject to cancellation upon serving a stipulated notice.

Assignments.—During the year, 61 assignments affecting lands were registered in the Department.

Hay Permits.—During the year, 5 hay permits were issued under which 138 tons of hay were cut.

Timber.—One hundred and forty-four timber permits, exclusive of those granted in connection with timber berths were issued, authorizing the cutting of 45,159 linear feet of timber, 54,000 feet board measure of lumber, 407 poles, and 6,605 cords of wood. Of these permits, 32 were issued free of dues to educational, religious, and charitable institutions, to settlers for domestic use, and to Government Departments. Twenty-one timber berth permits were granted during the year and 3,654,513 feet board measure of lumber were manufactured, together with 3,700 linear feet of timber and 3,641 cords of wood. There were two timber seizures.

Revenue.—Revenue derived from lands, timber, grazing, and hay was $42,941.37.

YUKON TERRITORY

Mining

The gold production of the Territory continued to increase. As in past years, this gold was almost all obtained from placer operations in the Dawson District. The new find on the Firth River was also in this District. Prospecting and development under both Placer and Quartz Mining Acts continued active, but not to the same degree as in previous years. The officer commanding the Royal Canadian Mounted Police Detachment at Aklavik, Northwest Territories, was appointed a Sub-Mining Recorder for the convenience of prospectors locating claims on the Firth River and its tributaries. In the Mayo District, development of the Keno Hill silver-lead deposits continued. An increased amount of ore was mined and concentrated, but all work was handicapped by transportation difficulties caused by extremely low water in the Stewart River. Development work was continued in the Nansen-Victoria Creek area of the Whitehorse Mining District. One company had its claims surveyed with the intention of applying for leases, and a coal mining lease, covering 530 acres was granted in the vicinity of Tantalus Butte. There seems to be every possibility that this development will be of economic importance, at least locally.

Gold production for the year was 59,486·86 ounces, an increase of 2,421·38 ounces over the preceding year. This production, valued at $35 an ounce, amounted to $2,082,040.10, an increase of $84,748.30 over the previous year. There were 2,726 grants and renewal grants, and prospecting leases covering 180

miles, issued under the Placer Mining Act. Under the Quartz Mining Act, 1,062 grants were issued and 2,575 grants were renewed. The increase of 236 grants issued and 1,801 grants renewed reflected a well-sustained interest in lode mining.

The revenue collected from mining in the Territory was $79,049.54, made up as follows: quartz mining fees, $19,530.10; quartz mining leases, $1,000; placer mining fees, $33,009.94; placer mining royalty (export tax on gold), $22,315.75; hydraulic mining leases, $2,390; dredging leases, $100; and coal leases and royalties, $703.75.

Gold Royalty.—The amount collected on placer gold up to March 31, 1948, was $5,395,799.51, of which $22,315.75 was collected during the fiscal year.

Dredging Leases.—Four leases issued under the Dredging Regulations were in force until March 8, 1948, when three of them expired. Rentals from this source up to March 31, 1948, amounted to $213,966.27, of which $100 was collected during the fiscal year. No new dredging leases were issued.

Hydraulic Mining Locations.—Four hydraulic mining locations were still held under the old Regulations, which were withdrawn by Order in Council, dated February 2, 1904. These leases comprised sixteen linear miles. Rentals amounting to $225,418 have been collected to date from this source, of which $2,390 was collected during the fiscal year.

Coal Mining Leases.—Five coal mining leases were in good standing, two of which were issued during the fiscal year. The revenue from these leases amounted to $703.75.

Quartz Mining Leases.—One hundred and forty-eight quartz mining leases were in force. Of these, five were new leases and one was a renewal for the second period of 21 years.

Placer Mining

Of the 2,726 placer grants in good standing, 2,541 were in the Dawson Mining District, 127 in the Whitehorse Mining District, and 58 in the Mayo Mining District. Most placer claims are worked by dredging, and the Yukon Consolidated Gold Corporation remains the largest operator in this form of mining. This company had its dredges in operation during the season, and completed 1,220 dredging days, an increase of 184 days over the previous year. Excellent dredging conditions continued until early in December, but the supply of labour remains poor, although improved over the previous year. During 1947 the Yukon Consolidated Gold Corporation dredged 6,692,528 yards of material and produced 37,789·338 ounces of gold. Three other companies employed one dredge each during the season. These companies, together with individual placer miners, produced about one-third of the gold produced in the Territory during the year.

Lode Mining

Dawson Mining District issued 432 mining grants, an increase of five over the previous year. Whitehorse Mining District issued 512 grants and Mayo Mining District issued 118, the latter showing a decrease of 77 from the preceding year. The renewals of quartz mining grants for the three offices were 2,448, 73, and 54. In the Mayo Mining District work was concentrated in the vicinity of Keno Hill. Development on the Vanguard claim in Charity Gulch produced a considerable amount of high-grade ore, the assays of which averaged more than 400 ounces of silver to the ton. The largest operator in this district was United Keno Hill Mines, Limited. This company had 170 men employed as of March 31, 1948, and produced, during the fiscal year, 3,662·28 dry tons of high-grade ore and concentrates with an estimated value of $842,338.95. The

company shipped concentrates to the smelter valued at $343,587.99 and, during the winter months, freighted 254 tons to Minto. In the Whitehorse Mining District a considerable amount of diamond drilling and tunnelling was carried out by Brown-McDade Mines, Limited in the Victoria Creek area. Noranda Mines, Limited, acquired a number of claims in the copper belt and a well-organized program was under way to prove the area. There were 14 incorporated companies operating in this mining district, in addition to numerous individuals. No mine made sufficient profit to be assessed for royalty under the Quartz Mining Act.

Assay Office

At the Assay Office, maintained by the Territorial Government at Keno, 1,080 samples of rock were received from all parts of the Territory and 1,596 assays or quantitative analyses were made. In addition, qualitative analyses and chemical tests were made in connection with identification and classification of various rocks and minerals of which no record was kept. The assays made were: gold and silver, 1,080; lead, 479; copper, 13; zinc, 20; molybdenum, 2; antimony, 1; and iron, 1. The gold, silver, and lead figures showed a considerable increase over the previous year.

Lands and Timber

Lands.—There are now in force ten agricultural leases, three grazing leases, nineteen permits to occupy Dominion Lands, twenty-three waterfront leases, one licence of occupation, two miscellaneous leases, twenty-three homestead entries and one agreement of sale. During the year, one lot was sold and patented. Two hay permits, authorizing a cut of fifteen tons of hay, were issued.

The revenue from lands and Land Titles Office fees was $8,235.57.

In connection with the maintenance of the Alaska Highway in Yukon Territory, there are now in force twelve leases of privately owned lands.

Timber.—The number of timber permits issued during the year was 193, authorizing the cutting of 2,446,470 feet board measure of saw-timber, 2,000 linear feet of timber and 20,837½ cords of wood. Fourteen licensed timber berths were in force. There was one timber seizure. The total revenue from timber was $11,427.68.

ORDNANCE AND ADMIRALTY LANDS

Ordnance and Admiralty Lands are those strategic areas in the Maritime Provinces, Quebec, and Ontario which were acquired by the Crown principally for purposes of national defence. Because they are not being used in this way, they were transferred to this Department for administration. Some of these lands are made to produce revenue by leasing. Others, no longer required by the Crown, are sold. During the year, one parcel of land in New Brunswick, five in Quebec, and three in Ontario, were transferred to this Department. Ninety-one leases were issued during the year, and forty-four parcels of land were sold. Lands were inspected by field officers in the Provinces of New Brunswick, Quebec, Ontario, and British Columbia. Surveys were made of four areas in Quebec. The net revenue from rentals, sales, and assignment fees was $30,562.97. Appraisals of these properties are being made, and it is anticipated that increased revenue will result.

PUBLIC LANDS

Lands originally administered by other government departments for specific purposes and now no longer required, are transferred to this Department for administration or disposal. Six parcels of land, comprising 800 acres in the Provinces of Nova Scotia, Quebec, Ontario, and British Columbia,

were received during the year and two of them were transferred to other Departments. Three areas totalling 20 acres were sold, and seven investigations were carried out. The net revenue from Public Lands was $14,593.44.

SOLDIER SETTLEMENT CHARGED LANDS

There are eighty quarter-sections and parts of quarter-sections of these lands remaining vested in the Dominion, against which charges are registered under the Soldier Settlement Act. They are all in the western provinces and comprise approximately 12,500 acres. Settlers who complete their duties in accordance with the Dominion Lands Act are eligible for Crown grant when their indebtedness to the Soldier Settlement has been liquidated. In cases where the duties are completed but the indebtedness unpaid, the land may be patented in the name of the Director of Soldier Settlement if the settler desires this action to be taken. During the year, four patents were issued in the name of the Director of Soldier Settlement and six patents were issued to the various settlers.

CENTRAL RECORD OF FEDERAL LANDS

This record is found to be of great convenience in answering correspondence regarding the ownership of particular properties, as the information contained in the record enables inquiries to be forwarded to the Department in control of the land. It is being increasingly used by other Government departments, and requests from the public for information about Government lands are directed to this office for attention.

SEED GRAIN, FODDER, AND RELIEF INDEBTEDNESS

The indebtedness referred to under this section represents the accounts still outstanding for advances of seed grain, fodder for animals, and relief made to settlers in the western provinces from 1876 to 1926. The advances are secured by liens given by the individual recipients against their lands and bear interest varying from 5 per cent to 7 per cent. In addition to Federal advances the municipalities of the Provincial Governments of Saskatchewan and Alberta made advances of relief from 1919 to 1922 for which the Federal Government gave a joint guarantee of payment on an equal basis with the province.

By 1927 many properties in Western Canada were encumbered by seed liens and arrears of taxes far in excess of the depreciated value of the land. Collection of the outstanding accounts was at a standstill and the land was vacant. To ameliorate this condition, the Federal Government passed an Act, assented to on April 14, 1927, under which Seed Grain Adjustment Boards were established to investigate, apportion, or reduce the indebtedness of the settlers. During the fiscal year 1947-48, the Seed Grain Adjustment Boards made 416 applications to Council for reductions, and, as a result, 1,796 liens were removed. In addition, 73 advances were paid in full and the liens discharged. These reductions represent a total write-off of $218,962.01, and the cash payments made by the property owners amounted to $72,044.05. The Chief of the Lands Division is a member of the Federal Board and also the federal representative on boards dealing with joint Federal-Provincial liens.

In addition to the settlements made, approximately 1,100 requests were received from the provincial governments and the Western Department Adjustment Boards for settlement of outstanding indebtedness. As a result of land grants being made by the provinces, 43 certificates of indebtedness were issued, registering 168 liens against title and security for advances that had been made on unpatented land.

The following summary shows financial operations for the year ended March 31, 1948:

Debits	Principal	Interest	Total
Balance outstanding March 31, 1947	$2,295,843.85	$3,541,640.54	$5,837,484.39
Accrued interest April 1, 1947 to March 31, 1948		130,848.30	130,848.30
Total debits	$2,295,843.85	$3,672,488.84	$5,968,332.69
Credits			
Net revenue, April 1, 1947, to March 31, 1948	$ 50,120.06	$ 21,923.99	$ 72,044.05
Amount written off as loss by Orders in Council—(Sec. 1, Chap. 51, 17 George V.)	62,571.50	156,390.51	218,962.01
Total credits	$ 112,691.56	$ 178,314.50	$ 291,006.06
Amount outstanding March 31, 1948	$2,183,152.29	$3,494,174.34	$5,677,326.63

SUMMARY

Province of Manitoba

Debits	Principal	Interest	Total
Amount outstanding—March 31, 1947	$ 10,037.11	$ 16,537.91	$ 26,575.02
Accrued interest—April 1, 1947 to March 31, 1948		522.07	522.07
Total debits	$ 10,037.11	$ 17,059.98	$ 27,097.09
Credits			
Net revenue April 1, 1947 to March 31, 1948	$ 337.63	$ 147.09	$ 484.72
Amount written off as loss by Orders in Council	258.20	717.75	975.95
Total credits	$ 595.83	$ 864.84	$ 1,460.67
Amount outstanding—March 31, 1948	$ 9,441.28	$ 16,195.14	$ 25,636.42

SUMMARY

Province of Saskatchewan

Debits	Principal	Interest	Total
Amount outstanding—March 31, 1947	$1,501,405.80	$2,273,748.09	$3,775,153.89
Accrued interest—April 1, 1947 to March 31, 1948		86,600.24	86,600.24
Total debits	$1,501,405.80	$2,360,348.33	$3,861,754.13
Credits			
Net revenue—April 1, 1947 to March 31, 1948	$ 37,940.53	$ 18,941.79	$ 56,882.32
Amount written off as loss by Orders in Council	7,527.06	44,915.53	52,442.59
Total credits	$ 45,467.59	$ 63,857.32	$ 109,324.91
Amount outstanding—March 31, 1948	$1,455,938.21	$2,296,491.01	$3,752,429.22

SUMMARY

Province of Alberta

Debits	Principal	Interest	Total
Amount outstanding—March 31, 1947	$ 784,375.94	$1,251,314.54	$2,035,690.48
Accrued interest—April 1, 1947 to March 31, 1948		43,724.74	43,724.74
Total debits	$ 784,375.94	$1,295,039.28	$2,079,415.22
Credits			
Net revenue—April 1, 1947 to March 31, 1948	$ 11,841.90	$ 2,835.11	$ 14,677.01
Amount written off as loss by Orders in Council	54,786.24	110,757.23	165,543.47
Total credits	$ 66,628.14	$ 113,592.34	$ 180,220.48
Amount outstanding—March 31, 1948	$ 717,747.80	$1,181,446.94	$1,899,194.74

SUMMARY

Province of British Columbia

Amount outstanding—March 31, 1948	$ 25.00	$ 41.25	$ 66.25

LETTERS PATENT

During the fiscal year there were 26 Letters Patent issued, covering a total of 1,586 acres, divided as follows:

	Patents	Acres
Alberta	5	800
Saskatchewan	5	774
Northwest Territories	14	9
Yukon Territory	2	3
	26	1,586

The various kinds of grants are dealt with in the following table:

	[1]Homesteads		[1]Soldier Grants		[2]Special Grants		Sales	
	Patents	Acres	Patents	Acres	Patents	Acres	Patents	Acres
Alberta	3	480	1	160	1	160	—	—
Saskatchewan			1	138	2	476	1	160
Northwest Territories							14	9
Yukon Territory							2	3
Totals	3	480	2	298	4	636	17	172

There were 236 certified copies of Letters Patent issued during the fiscal year, for which the Department received $570.

TIMBER AND GRAZING WITHIN THE PROVINCES

Timber.—In the Province of British Columbia, there are eight Licence Timber Berths comprising an area of 42·85 square miles within the boundaries of National Parks. Licences, in duplicate, were issued for each berth and the revenue was $1,767.89.

On the Dominion Government Coal Block, near Hosmer, B.C. there is one timber permit berth in force.

Timber cutting operations have continued on Ordnance Reserve No. 1 and Naval Reserve A on St. Joseph Island in Lake Huron, Ontario. The revenue was $124.37.

Grazing.—In southern Saskatchewan, annual grazing permits were issued on Dominion Lands, covering a total of 10,240 acres. Sworn returns by the permittees indicate that, for the grazing season of 1947, there were 410 cattle and 109 horses maintained on the lands. The revenue collected, consisting of ground rental, was $205.

ALASKA HIGHWAY LAND ACQUISITION

Right of Way.—In connection with the acquisition of land for the right of way of the Alaska Highway, as of the 31st March, 1947, title for seven parcels of land was still required. Four of these have been completed and the remaining three are with the Department of Justice awaiting Crown grant to the owners who have not yet completed sufficient improvements on their property.

Campsites and Flight Strips.—The Bullen-Prefontaine Estate was expropriated and, when notice was received from the Department of Transport that the land was no longer required, a Notice of Abandonment was filed with the Land Titles Office at Kamloops.

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[1]Under this heading are included lands entered for by returned soldiers affected by loans from the Director of Soldier Settlement of Canada, said loans having been repaid in full. Patents were issued direct to the settlers.

[2]Under this heading are included lands entered for by returned soldiers affected by loans from the Director of Soldier Settlement of Canada, which lands were patented to the said Director at the request of the entrants or pursuant to salvage proceedings under the Soldier Settlement Act.

Water Line to Dawson Creek.—Three easements have yet to be secured, as the owners of the property concerned have not yet received Crown Grant.

Water Line to Fort St. John.—All easements have been secured.

Telephone and Telegraph Easements.—The last two of these easements were secured during this fiscal year and all are now complete.

ENGINEERING AND CONSTRUCTION DIVISION

The Engineering and Construction Service continued to function as a Service under the Surveys and Engineering Branch until November 1, 1947, when by Order in Council P.C. 37/4433 a change was made in the organization of the Department by which this Service was brought back to closer association with the National Parks and the Northwest Territories and Yukon Services and became established as a Division of the Lands and Development Services Branch. This Division also continued its activities as a general engineering and architectural agency of the Department, and undertook engineering and architectural work for other Departments of the Government or acted in an advisory capacity. Its work included the organization and supervision of construction and maintenance operations for the larger projects as well as preparation of plans, specifications, bills of materials, estimates and designs for such activities, and also inspections, reports, technical advice and supervision as required on numerous small projects, for various Government services.

Pursuant to surveys carried out from 1945 to 1947 to obtain information on work required for the improvement and reconstruction of existing highways, water supply and sewage disposal systems, and on highway bridge sites in the National Parks of Canada, contracts were let and investigations and inspections were carried out on various related works. A great deal of preparatory work was done in anticipation of one of the largest construction programs during 1948-49 that has been undertaken in many years.

A staff of architects was engaged in preparing plans, specifications, bills of material and estimates in connection with a program of future development works, as well as for normal departmental requirements.

A description of the more important construction and maintenance projects undertaken by this Division is given hereunder.

HIGHWAYS

Alaska Highway

Two engineers, with headquarters at Whitehorse, Yukon Territory, and Fort Nelson, British Columbia, respectively, continued their work as departmental observers on all phases of maintenance and reconstruction operations on the Alaska Highway. Owing to a change in Government policy, these officers were withdrawn from this project early in 1948.

Snow Lake Mining Road

During 1946 an agreement was entered into with the Province of Manitoba whereby the Dominion contributed on a 50 per cent basis of approved expenditure of the construction by day labour of a mining road to Snow Lake, approximately 40 miles from Wekusko on the Hudson Bay Railway. Construction operations continued until December, 1947 During the winter months timber was taken out for bridge and culvert construction.

Grimshaw-Great Slave Lake Highway

DOMINION SECTION—NORTHWEST TERRITORIES

Construction operations on the Dominion Section of this road viz: from the northern boundary of Alberta to Hay River in the Northwest Territories, a distance of some 81 miles, was continued under contract by the Bond Construction Company Limited of Edmonton, Alberta. Work operations closed down in the autumn of 1947 at which time this project was completed as follows for the major work items: clearing and grubbing, 80·9 miles; rough grading for approximately, 49·6 miles; fine grading for approximately, 43·5 miles; gravel surfacing for approximately 40·0 miles; culverts, 50; bridges, timber, 2.

DOMINION-PROVINCIAL SECTION—ALBERTA

The Province of Alberta under agreement with the Dominion Government continued by contract the construction of that section of the Provincial highway between mileage 69·4 north of Grimshaw, Alberta, and the northern boundary of the Province of Alberta, a distance of approximately 234 miles. Work operations were closed down in November, 1947, at which time the project was completed as follows for the major work items; clearing and grubbing, 234·0 miles; rough grading for approximately 191·1 miles; fine grading for approximately 148·6 miles; gravel surfacing, 104·6 miles; culverts, 185. Steel bridges were constructed as follows: One 175-foot span over Meikle River; one 80-foot span over Kemp Creek; one 80-foot span over Keg Creek. Timber bridges completed to Mile 188·6.

Yukon Territory

A reconnaissance survey was carried out from a point on the Alaska Highway approximately 60 miles west of Whitehorse to Aishihik Airport road, then to Brown McDade mine on Victoria Creek and thence to Carmacks on the Lewes River.

Plans, profiles, and estimates were completed for the construction of a road between Jake's Corner on the Alaska Highway, Yukon Territory, and Atlin Lake, British Columbia, a distance of 58 miles.

MAYO-MINTO ROAD

Instructions were prepared for locating engineer and contractors were requested to submit proposals in connection with the construction of this road in 1948.

Northwest Territories

RECREATION HALL, AKLAVIK

Working drawings and bill of materials were prepared covering the proposed construction of a recreation hall.

POWER-HOUSE, SNARE RIVER

Plans, together with a bill of materials, were prepared in connection with a timber structure to enclose the site of the power-house.

YELLOWKNIFE WATER SUPPLY

Studies were made of certain recommendations relative to proposed equipment and operation methods.

WINTER ROAD, REINDEER DEPOT TO ESKIMO LAKE

Studies were made of a proposed route and an estimate of the cost prepared.

WORK FOR INDIAN AFFAIRS BRANCH

British Columbia

KAMLOOPS AGENCY

Kamloops I.R. No. 1 (Paul Creek System): Repairs to the dam at the outlet of Paul Lake and other irrigation improvements were completed.

Niskonlith I.R. No. 1 and Adams Lake I.R's. Nos. 4 and 4A: Installation of an outlet box and pipe extension with new wooden and metal flumes in the irrigation system. Materials for further flume repairs were purchased and stored on the reserve for early use in the next fiscal year.

Kamloops Residential School: A survey was made relative to the extension of the irrigation system by pumping at this reserve.

Four-classroom Day School, Kamloops: Mechanical drawings together with specifications for this proposed school were prepared.

KOOTENAY AGENCY

Kootenay I.R. No. 9: A survey was made of the existing irrigation works from Phillip's Creek and an alternative route to supply the acreage was investigated.

Kootenay Residential School: A report was prepared covering the removal of St. Joseph's Creek pipeline in connection with water supply for this school. Fire protection equipment was installed.

OKANAGAN AGENCY

Okanagan I.R. No. 9: A conference was held with several parties who had raised objections to the water storage in Shannon Lake.

Osoyoos I.R. No. 1: Work on the rehabilitation of the irrigation system for this reserve was practically completed. Some 2,700 feet of wood-stave pipe was laid and backfilled.

NICOLA AGENCY

Cooks Ferry I.R. No. 9: Considerable repairs were made to Calling Lake dam but owing to local conditions the work could not be completed this year.

Lower Nicola I.R. No. 1: An investigation to improve the water supply system was carried out. Arrangements were made to obtain the necessary water licence to legalize the present and future diversions of the system.

The necessary ditching work in connection with the drainage system on this reserve was completed.

Lower Nicola I.R. No. 4: A draft agreement was prepared in connection with the application made by the Nicola Lake Stock Farmers' Limited of Nicola, British Columbia, to cross this reserve with an irrigation ditch.

Pimainus Dam: An inspection and report was made on the condition of this dam.

LYTTON AGENCY

Lytton I.R. No. 14: An inspection was made of the irrigation system serving this reserve.

Lillooet I.R. No. 1: A survey and report was made and plans prepared relative to the domestic water supply system.

Seabird Island I.R. No. 1: An investigation was made of the site for the proposed Day School.

St. George's School and adjacent Lytton Reserves: An investigation and report was made on a claim made by the Canadian National Railways against the Department as a result of overflow of Botanie joint irrigation ditch.

Working drawings and specifications were prepared covering the work required on the remodelling of the heating, plumbing, and domestic water supply systems. A report was prepared in connection with A.K. water treatment.

Lytton I.R. No. 1: A report was prepared covering the proposed water supply to service this reserve.

WILLIAMS LAKE AGENCY

Redstone I.R. No. 1: An investigation survey and preliminary plans were made relative to irrigation possibilities from several sources.

Clinton I.R. No. 2: The irrigation system from Gabriel and an unnamed creek on this reserve was examined.

Anaham I.R. No. 1: Work on the present domestic water supply was completed under the supervision of the Indian Agent.

Alkali Lake I.R. No. 1: Records of flow of Kirkpatrick Spring Creek were obtained. The weir was repaired and collecting galleries were installed which augmented the available water supply.

Soda Creek I.R. No. 1: An inspection was made of Ross Lake Dam.

Dog Creek I.R. No. 1: An agreement was drawn up between C. R. Place and the Department relative to the construction of a ditch across the reserve to supply water to him and also to the lands on this reserve.

Dog Creek I.R. No. 2: Application for change in location of works and permission to cross over Crown Lands was submitted to the Water Rights Branch relative to the change in location of the irrigation ditch for this reserve made necessary by the agreement with the Diamond S Ranch Company Limited.

COWICHAN AGENCY

Saanich I.R. No. 2: The necessary repairs to the bridge on this reserve were completed. An inspection of the water supply system for two Indians was carried out.

Songhees I.R. No. 1: An inspection and report were made on the completed work carried out by the City of Victoria relative to the installation of a four-inch cast iron water main along Cooper's Road to a fire hydrant. Service connections to individual dwellings along this line and also along Admiral's Road were made.

Cowichan I.R. No. 1: Flood conditions were examined and a report prepared in connection with erosion on this reserve by the Cowichan and Koksilah Rivers.

STIKINE AGENCY

Nanaimo I.R. No. 1: Arrangements were made to carry out an investigation relative to the water and sewer possibilities in connection with this reserve.

Agency Buildings: A report was prepared covering the requirements for an electric light plant to serve this agency.

NASS-SKEENA AGENCY

Dolphin I.R. No. 1: Owing to adverse weather and labour conditions, the work on the Kitkatla Indian Village water supply system was only partially completed during the year.

Greenville I.R. No. 9: Investigations were made and a report prepared on domestic water and hydro-electric supply to serve this reserve.

Kincolith I.R. No. 14: Investigations were made and reports prepared on the possibility of constructing a road to the Village and on the domestic water and hydro-electric supply. An electric lighting plant was installed.

VANCOUVER AGENCY

Squamish I.R. No. 1: A report was prepared on the sewage and water supply system. An inspection was made of roads improved by Indian labour.

Musqueam I.R. No. 2: A new flood box and gate was installed in the dyke. An inspection of the reserve was made relative to a proposal of the City of Vancouver to use flow channels through the reserve.

BABINE AGENCY

Kitsegukla I.R. No. 1: A diversion dam relative to the water supply system was constructed.

Hazelton I.R. No. 1: A survey was made and a report prepared on the Hazelton Village domestic water supply.

Sliammon I.R. No. 1: Two wood-stave tanks together with gate valves, piping and fittings, were purchased in connection with the water supply system.

NEW WESTMINSTER AGENCY

Chilliwack I.R's. Nos. 3, 4, 5, 6 and 7: An investigation was made and a report prepared on the erosion by the Fraser River in the vicinity of these reserves.

Pemberton I.R's. Nos. 1, 2, 3 and 8: The reclamation work carried out under the P.F.R.A. work in connection with the extension of the water supply system for Indian Reserve No. 1 was completed.

Sumas I.R. No. 6: Investigations were made relative to securing a water supply from the Clayburn Brick Company system.

Pemberton Day School: Preliminary plans were prepared to enlarge the day school to a two-room school.

BELLA COOLA AGENCY

Kitasoo I. R. No. 1:—The water supply system serving Klemtu Village was completed. A report was prepared relative to the proposed hydro-electric project for Klemtu Village.

Katit I. R. No. 1:—An investigation was made relative to the proposed domestic water supply system.

Kitimat I. R. No. 2:—An investigation was made and a report prepared of the existing water supply and electric lighting systems.

Bella Bella I. R. No. 1:—An investigation was made and a report prepared relative to repairs to the domestic water supply system. The proposal to move the airport buildings to Bella Bella Village for school purposes was investigated. The dam at Bella Coola Village was repaired and a drainage gate installed.

KWAWKEWLTH AGENCY

Gilford Island I. R. No. 1:—An investigation was made and report prepared on the possibility of installing a domestic water supply system to serve Gwayasdums Village.

Quaee I. R. No. 7:—An investigation was made covering the proposed domestic water supply and hydro power for Kingcome Village.

Campbells River I. R.:—A teacher's residence was completed including the installation of the electric system and water supply.

Turnour Island School and Teacher's Residence:—Progress was made on the erection of these two buildings.

Nimpkish I. R. No. 1:—An investigation was made relative to the water supply to serve the various Indian reserve buildings at Alert Bay. A well was drilled and the water piped to the new day school and teachers' residences.

School and Teachers' Residences:—A four-room day school and two teachers' residences were constructed by contract at Alert Bay.

Agency Storeroom:— A sixty-foot storeroom was completed adjacent to the Agency office at Alert Bay.

Port Hardy Military Camp:—Several buildings at this camp were dismantled and materials transported to Alert Bay Village to be used in connection with Indian Affairs projects.

WEST COAST AGENCY

Four-Classroom School, Alberni:—A new four-classroom school was constructed by contract in the vicinity of the main residential school.

Prepared working drawings and specifications relative to revisions to the domestic hot and cold water systems and boiler equipment to serve the residential school building. The installation of the stoker was completed and a steam pressure test carried out.

Christie Island Residential School:—A gravel road was practically completed from Opitsat dock to the school. A new dock was also constructed.

STUART LAKE AGENCY

Lejac Residential School:—An inspection was carried out and a report prepared relative to the hot water supply and heating system.

ALBERTA

HOBBEMA AGENCY

Sewage Disposal System, Hobbema:—A contract was let covering sewer system installation to serve the agency buildings and Ermineskin Residential School. The system was completed for the agency buildings.

Peigan I. R., Sacred Heart Residential School:—An examination of the water system was carried out and a report prepared including an estimate of the cost.

LESSER SLAVE LAKE AGENCY

Agency Headquarters, High Prairie:—A revised layout was prepared for agency buildings and location of well. The proposed power line to the agency was investigated.

ATHABASKA AGENCY

Power Plant Development, Fort Chipewyan:—A report was prepared together with plans and bill of materials for the power-house and specifications for the lighting plant.

Prefabricated Houses, Chipewyan:—A bill of materials was prepared in connection with basement construction.

BLOOD AGENCY

St. Mary's Residential School, Cardston:—Reports were prepared relative to drainage of the basement floor and revised plans prepared of the basement dining room.

St. Pauls Residential School:—A new pressure tank and water supply system was installed.

EDMONTON AGENCY

Michel and Stoney Plain Reserves:—Inspections were made and reports prepared on the proposed sites for one-room day schools.

SASKATCHEWAN

TOUCHWOOD AGENCY

Gordon's Residential School, Punnichy.—Prepared layout, plan, working drawings and specifications relative to revision of the heating, plumbing and domestic hot and cold water systems serving this school. The work was let by contract and put underway.

ONION LAKE AGENCY

Residential School.—An investigation was made and a report prepared regarding equipment required to supply light and power to serve this school and also for the domestic water supply serving the agency.

CARLTON AGENCY

Grey Residential School, Sturgeon Lake.—An investigation was made and a report prepared relative to equipment required to supply light and power to serve this school.

CROOKED LAKE AGENCY

Four-classroom Day School, Cowessess.—An inspection was made and a report prepared regarding plumbing and heating for proposed new building.

MANITOBA

FISHER RIVER AGENCY

Agency Buildings.—A report was prepared for a new lighting plant and distribution system. Prepared and issued plans for plumbing and drainage systems relative to the clerk's residence.

MANITOBA INSPECTORATE, WINNIPEG

Brandon Residential School.—Plans and specifications were prepared relative to repairs and revisions required to the heating and domestic hot water supply system. A contract was let and the work put underway. A report was prepared on the proposed water supply to serve this school.

Elkhorn Residential School.—Prepared working plans and specifications relative to revisions to be carried out by contract in connection with the heating and domestic hot water system.

MANITOWAPAH AGENCY

Fort Alexander Residential School, Pine Falls.—An investigation was made and a report prepared on suggested system of fire escapes.

Residential School, Sandy Bay.—The proposed installation of a new lighting plant was investigated.

PORTAGE LA PRAIRIE AGENCY

Portage la Prairie Residential School.—Prepared a report relative to structural and heating alterations required for this school.

Camperville Residential School.—An inspection was made and a report prepared relative to repairs required to the heating plant.

GRISWOLD AGENCY

One classroom Day School, Oak River.—A report was prepared relative to mechanical data required for a new school.

ONTARIO

SAULT STE. MARIE AGENCY

Shingwauk Home.—A report was prepared relative to the heating, plumbing and domestic water supply pump repairs and maintenance.

Serpent River and Mississaugi Reserves.—An inspection was made of the sites and reports prepared on proposed one-room day schools.

SIOUX LOOKOUT AGENCY

McIntosh Residential School.—A reconnaissance survey was made of road routes from the school to McIntosh Station and hence to Red Lake Highway.

FORT FRANCES AGENCY

St. Margarets Residential School.—A report and working drawings were prepared relative to the heating, plumbing and domestic water supply. Drawings and specifications were prepared covering repairs to the school. An agreement was drawn up between the Town of Fort Frances and the Department relative to the domestic water supply serving this school.

JAMES BAY AGENCY

Agent's Residence, Moose Factory.—Prepared working drawings for special type of residence.

Combined Office and Warehouse Building.—Prepared working drawings. Investigated and prepared a report on the proposed installation of a lighting plant to serve the agency buildings.

SIX NATIONS AND NEW CREDIT AGENCY

Mohawk Institute.—An inspection of the school and associated buildings was made and a report prepared relative to electrical installations.

MANITOWANING AGENCY

Day School and Teacher's Residence, Wikwemikong.—An investigation was made, working drawings and specifications prepared relative to electrical power required for the lighting plant.

CHRISTIAN ISLAND RESERVE

An inspection of the existing dock and a survey of proposed additional dockage was made.

Agent's Residence.—A report was prepared on the present electrical plant in connection with the proposal to provide automatic electrical control of the water supply system.

A report together with an estimate of the cost was prepared re installation of electric lighting plant and communication system from the Island to the mainland.

QUEBEC

TIMISKAMING AGENCY

Agency Residence and Barn:—A report was prepared on the electric wiring required for these buildings.

Notre Dame du Nord.—Inspected site for day school, staked out site and prepared a report together with topographical plan of the site. Prepared working drawings, specifications and bill of materials relative to installing a hot water system in the Agent's residence.

MANIWAKI AGENCY

Day School.—An inspection was made and a report prepared covering improvements required to the day school.

BERSIMIS AGENCY

R.C.M.P. Quarters.—Investigated electrical power requirements and prepared a report regarding the lighting plant.

ST. REGIS AGENCY

Chenail Two-room Day School.—An inspection was made and a report prepared re site of proposed school. Prepared working drawings relative to plumbing and heating requirements; also prepared a report on water supply.

CAUGHNAWAGA AGENCY

New 12-room Day School and Boiler House.—Drawings and specifications were prepared. Instructions were issued for testing of well water as a possible source of water supply to serve these buildings.

MARITIME PROVINCES

LENNOX ISLAND AGENCY, P.E.I.

An inspection was made relative to the location for new agency development. Tentative building sites were established for proposed buildings and a sketch block plan prepared.

TOBIQUE RESERVE, NEW BRUNSWICK

A survey looking to the possible sources of water supply to serve the population of Tobique Village was made and a plan prepared of the area showing a proposed distribution system.

Agent's Residence, Kingsclear.—An inspection was made and a report prepared on the proposed alterations and additions to this residence.

ESKASONI AGENCY, NOVA SCOTIA

The domestic water supply system, including fire protection to serve this agency was completed.

The construction by contract of a four-room day school and teachers' residence was completed.

SHUBENACADIE AGENCY, NOVA SCOTIA

A domestic water supply system including fire protection to serve the white and Indian population of the Shubenacadie development area was installed.

The construction by contract of a teachers' residence, principal's residence, agent's residence and office and warehouse building, was completed.

Prepared data for renovation of the domestic water supply system serving the residential school. A contract was let relative to repairs to the heating system.

NORTHWEST TERRITORIES

Four-classroom Day School, Hay River.—All plans and specifications in connection with this school were prepared. Construction operations started in the summer of 1947 and it is expected the school will be completed early in 1948.

Principal's Residence with Electrical and Heating Building, Hay River.—Plans, specifications and bills of materials were prepared for the construction of these buildings. Construction operations for the principal's residence were put under way early in 1948.

Standard Two-classroom Day School, Coppermine and Coronation Gulf.—Architectural working drawings and bills of materials were prepared to be used for the Indian Affairs and Northwest Territories Administration.

Lighting Plant, Fort Smith.—A report was prepared in connection with the enlargement of the power plant serving the agency area.

Four-classroom Day School, Fort Smith.—Architectural sketch drawings were prepared.

WORK FOR NATIONAL PARKS SERVICE

BANFF PARK, ALBERTA

Lake Minnewanka Development.—An engineer continued to act as departmental representative in connection with the development of Lake Minnewanka by the Calgary Power Company.

Ski-tow, Mount Norquay.—Checked design and prepared report on structural details.

Banff Townsite Development.—A report was prepared on the proposed remodelling operations relative to buildings on Lots 9 and 10, Block 2.

Banff Water Supply.—Investigations were made into the Banff water supply system relative to the reconstruction of the dam on Forty Mile Creek. Tenders for materials were received and examined. Negotiations were entered into with the Calgary Power Company re construction of a power line from Banff to the dam site.

Fish Hatchery Water Supply.—A temporary water supply was obtained and installed from the Middle Springs and Bow River.

St. Julien Subdivision.—A report was prepared dealing, in general, with a proposed scheme to provide water and sewer services for this subdivision and in particular with the initial stage of the development which would be required in connection with services for the School of Fine Arts.

Veterans' Emergency Housing Project, Tunnel Mountain.—Examined working drawings re changes to buildings and prepared reports on electrical installation and rental costs for equipment in connection with this housing scheme.

Spray River Bridge.—A reinforced concrete arch bridge of 150-foot span was designed for erection over the Spray River near its junction with the Bow River.

Banff-Windermere Highway.—A relocation survey was made of a section of this highway leading southwesterly (Mile 4) from Castle through Banff Park to approximately Mile 12, in the vicinity of Marble Canyon in Kootenay Park.

A contract was awarded for the reconstruction of a section of this highway leading southwesterly from Castle through Banff Park. Construction work was carried on over approximately 4 miles of highway and clearing operations were extended to approximately Mile 7.

JASPER PARK, ALBERTA

Meat Dressing Plant.—A report was prepared covering an inspection of the site and requirements for heating, plumbing, refrigeration, etc.

Information Bureau.—Working and detailed drawings together with specifications were prepared.

Swimming Pool.—Sketch drawings were prepared relative to this project.

Chalet at Columbia Ice-field.—Detailed drawings were prepared for a fireplace and also a report on interior wall treatment.

Isolation Hospital.—Sketches were prepared in connection with the construction of this proposed hospital.

Fish Hatchery.—Working drawings and specifications were prepared for the central steam heating system, to serve the existing hatchery, superintendent's residence and new utility building.

Administration Building.—Prepared a report relative to description of materials required for this building.

Equipment Storage Building.—A report was prepared on the utilization of Quonset Huts as storage buildings for equipment.

Roads.—A study of the soil conditions was made relative to the revision of the Jasper Highway Miles 6·7 to 12·0.

Jasper Water Supply.—A general investigation and study was made to augment the present domestic water supply system of the town of Jasper. An investigation and survey was made for a reservoir site. Working drawings and bills of materials were prepared relative to the construction of a reservoir. Tenders were issued, received and examined in connection with the purchases of materials for the improvement to the water intake and pondage.

Athabaska and Rocky River Bridges.—A contract was awarded to the Dominion Bridge Company Limited relative to the dismantling of the existing wooden spans of the Athabaska and Rocky River bridges in the vicinity of Jasper and the supply and erection of steel spans.

WATERTON LAKES PARK, ALBERTA

Staff Residence.—Working drawings and bills of materials were prepared in connection with a proposed staff residence.

Private Residence Lot 11, Block 45.—Sketch elevations were prepared and suggestions made for an improved plan for the cottage.

Proposed Retail Store Lot 25, Block 2.—Plans of this store were received and examined re general layout and structural requirements.

Waterton River Bridge.—An inspection was made and report prepared on the possibilities of placing this bridge in repair until such time as it can be replaced.

Communications Across Narrows.—Certain detailed investigations were carried out and estimates prepared of the various means of public transportation across the Narrows.

ELK ISLAND PARK, ALBERTA

Meat Dressing Plant.—An inspection was made and a report prepared in connection with the proposed site and requirements for heating, refrigeration, etc. All architectural plans, specifications and tendering documents were prepared. After investigation a report was also prepared on the water supply.

Golf Club House.—Drawings were prepared for revisions to this building.

YOHO PARK, BRITISH COLUMBIA

Field Water and Sewer Systems.—Studies were made of the water and sewer system to augment the present system of the town of Field.

Kicking Horse River Bridge.—An inspection was made and a report prepared on the condition of and maintenance required to this bridge. Plans and estimates for a proposed new steel and concrete bridge were prepared.

KOOTENAY PARK, BRITISH COLUMBIA

Radium Hot Springs Water Supply.—A preliminary report was prepared on the proposed new water supply system for Radium Hot Springs together with plans and profile.

Sinclair Creek Bridge.—A reinforced concrete bridge was constructed across Sinclair Creek at Mile 2·7.

PRINCE ALBERT PARK, SASKATCHEWAN

Spruce River Bridge.—Plans and estimates of cost were prepared.

Project No. 5, Waskesiu Highway.—This project comprises the improvement and preparation for hardsurfacing of Waskesiu Highway, 28·7 miles, including the Spruce River bridge and replacement of other small bridges where necessary. Contractors' bids covering the work were examined and recommendations made.

RIDING MOUNTAIN PARK, MANITOBA

Bunkhouse and Dining Hall.—Drawings and bills of materials were prepared.

R.C.M.P. Detachment Quarters.—Drawings and specifications were prepared.

Bowling Greens Clubhouse, Wasagaming.—Architectural drawings were prepared.

Roads.—An inspection and report were made covering damage by high water and floods to roads in the Park.

Wasagaming Water Supply.—The question of augmenting the present water supply serving Wasagaming Townsite was investigated and a report was prepared together with plans and recommendations.

CAPE BRETON HIGHLANDS PARK, NOVA SCOTIA

Garage, Workshop and Storage Building.—Working drawings and bills of materials were prepared relative to these buildings.

Cabot Trail.—Structural plans, bills of materials and estimates of cost were prepared covering the proposed construction of seven steel girder concrete bridges over Warren Brook, Black Brook, Still Brook, Halfway Brook, Neil Brook, North Aspy River and the west branch of the Aspy River. Also the construction of three timber trestle bridges at Miles 37·1 and 35·8, North Mountain and at Cap Rouge.

Tenders were called for the construction by contract on a cost plus fixed fee basis, of a road between Ingonish and Neil Harbour and a short section near Presqu'Ile as well as two steel girder concrete bridges and two trestles near North Mountain.

Brackley Beach, Prince Edward Island Park

Working drawings and details were prepared for a revised design of a portable bath-house.

Fort Beausejour Historic Park, New Brunswick

Working drawings and specifications were prepared covering the proposed addition to the Museum. Tendering documents were issued to let the work by contract.

Fort Wellington Historic Park, Ontario

The existing Fort entrance, tar penetration macadam road from No. 2 Highway, was scarified and repaved. The same class of road was constructed from the north entrance to join up with the existing road and also extended from the north entrance to the main arched gateway of the Fort.

Fort Lennox Historic Park, Quebec

An inspection was made and a report prepared covering repairs required to the north and south bridges and east and west wharves.

Fort Chambly Historic Park, Quebec

An inspection was made and a report prepared covering the land adjacent to the retaining wall built around the cemetery grounds at the point where an adjoining small stream separates the municipalities of Chambly Basin and Chambly Canton.

St. Joseph's Island Historic Site, Ontario

An inspection was made and a report prepared on the possibilities of the location and construction of an approach road to the Fort site from Concession "A" Highway, St. Joseph's Island.

Battle of Chrysler's Farm Historic Site, Ontario

The work of resetting the three top granite blocks and pointing the monument was carried out.

Stoney Creek Monument

An inspection was made and a report prepared covering the required repairs to this monument.

Fortress of Louisbourg Historic Site, Nova Scotia

A report was prepared together with an estimate of the cost covering the proposed development work to be carried out at this Fortress. A report submitted by the Nova Scotia Power Commission in connection with the proposed extension of the power line to the Fortress was analysed and recommendations made.

MISCELLANEOUS

Surveyed allotment of space to accommodate this Division in the Motor and Norlite buildings. Plans were prepared covering structural alterations, lighting and telephone requirements.

Architectural advice to Immigration Branch regarding new quarters in the Woods building.

Checked and reported on two dams to be built by the Consolidated Mining and Smelting Company at Yellowknife, Northwest Territories.

A cost estimate was prepared for intercommunication system in Observatory building, Ottawa.

Drawings and specifications were prepared for Seismograph Hut at Kirkland Lake.

Geophysical and Meteorological Project at Newbrook and Meanook, Alberta. Prepared architectural, electrical, heating working drawings and bills of materials for this project.

Prepared working drawings and lighting layout relative to office accommodation on the third floor of the Sparks Street Chambers for new occupancy.

An inspection was made and report prepared together with working drawings regarding repairs to the roof and wall of the Forestry Division Storehouse, Petawawa, Ontario.

Working drawings and specifications for plumbing and heating system were prepared for a typical standard building and residence for R.C.M.P. married constables.

Working drawings and bill of materials were prepared for a typical one-room school with teachers' quarters.

Revised working drawings and specifications for a typical two-room day school with teachers' quarters.

Studies were made of aluminum housing possibilities.

Investigated the merits of gypsum and ten-test re construction of standard combined one classroom and one day school with teachers' quarters.

INDIAN AFFAIRS BRANCH

R. A. HOEY, DIRECTOR

There were indications during the year that economic conditions among the Indians were being affected by increased competition in employment and other fields. Unusually severe winter weather, over-hunting, and forest fires in the Northwest Territories have seriously depleted the numbers of game and fur-bearing animals, and conservation measures were deemed essential to help replenish the supply. New game laws, introduced in the Territories have, as a consequence, reduced returns of Indians engaged in hunting and trapping. However, as the Indians become accustomed to adjusting their hunting and trapping activities to registered trap-line systems, beaver and muskrat preserves, and other controlled fur conservation practices, returns will increase and the supply will be more dependable.

Administrative duties at headquarters increased considerably during the past fiscal year and, in order to divide the greater responsibilities more appropriately, the unit formerly known as Welfare and Training Service was separated into a Welfare Division and an Education Division, each under a superintendent.

Field-staff reclassifications were made and the territorial boundaries of some agencies were rearranged in an effort to re-distribute the responsibilities of superintendents of the large Indian agencies where activities had become too great for efficient administration.

Although construction of agency buildings, schools, and homes was actively carried on, the full construction program for the year could not be completed because of the continuing shortage of building materials and, in a few areas, of skilled labour.

Considering the number of Indian enlistments, the current trend of applications received under the re-establishment program for Indian veterans appears to indicate that a peak has been reached in the number of Indians seeking assistance under the Veterans' Land Act. The number of applications and the amount of expenditures approved were lower than in 1946-47. The majority of grants approved were for building materials and for the purchase of live stock and agricultural equipment. The next most important outlay was for commercial fishing equipment, which was applied for chiefly by coastal Indians.

Indians engaged in farming in Western Canada continued to enjoy encouraging returns. Cattle raisers of Alberta and grain and alfalfa growers of certain Manitoba areas did especially well. An increase in canning factory crops helped British Columbia and Ontario farmers to become better established in this type of agriculture. In Saskatchewan, however, adverse weather conditions resulted in decreased crops for many Indians engaged in grain and vegetable growing.

Commercial fishing operations were successfully carried on by coastal Indians, who were able to purchase larger fishing outfits. However, Indians engaged in fresh-water fishing met with an over-stocked market.

Irrigation improvements on reserve lands in British Columbia and Alberta resulted in an increased acreage of fertile land. The exploration and development of mineral resources within several Alberta agencies added considerably to their revenue.

POPULATION

The quinquennial census of the Indian population was taken in 1944. The records of the Branch indicate that there has been a slow but steady increase in the population of approximately 1½ per cent annually.

The following table shows the number of Indians by provinces according to the 1944 census:—

Province	Population
Alberta	12,441
British Columbia	25,515
Manitoba	15,933
New Brunswick	2,047
Northwest Territories	3,816
Nova Scotia	2,364
Ontario	32,421
Prince Edward Island	266
Quebec	15,194
Saskatchewan	14,158
Yukon	1,531
Total Indian population	125,686

A more detailed statement giving statistics of the Indian population under the headings of religion, age, and sex in the various provinces will be found in Table 1 on page 228.

PROGRESS DURING THE YEAR

BRITISH COLUMBIA

The Indians of British Columbia continued to make steady progress, and employment in lumbering, fishing, agriculture, and industry was maintained at a high level. Many areas reported good fur catches at satisfactory prices, but others showed a marked decline in the number of Indians engaged in trapping and in the quantity of fur taken. There was a lower aggregate return from trapping than in the previous year.

The number of Indians accepting year-round employment in lumbering and other industrial pursuits showed an increase over previous years, and there was less absenteeism among Indians so employed. In a number of cases individuals showed a desire to have their families established in the immediate vicinity of permanent employment.

Seasonal employment in fruit-picking in the State of Washington continued to attract many Indian families from the Cowichan, West Coast, New Westminster, Vancouver, Lytton, Okanagan, and Kootenay Indian Agencies. Wages earned in fruit-picking are considered high, but travelling and living cost, apparently leave little to offset the time spent and the loss caused by neglected gardens and subsistence farms on home reserves. An increase was noted in the number of Indian workers accepting seasonal employment in the United States logging industry, which offered higher wages than in previous years.

Through assistance to veterans under the Veterans' Land Act and by numerous boat purchases arranged privately and through commercial fishing companies, the already large fleet of commercial fishing craft owned by Indians has increased during the year. Indian coastal fishermen catch salmon, halibut, dog fish (livers), and herring. Returns in some areas were disappointing, although the catch was generally satisfactory.

Activities among Indian farmers during the year showed a marked increase in acreage planted. With substantial rises in prices for agricultural products, an increased number of families remained on their farms rather than accept outside seasonal employment. Potatoes, small fruits, peas and beans were planted in large quantities, particularly in the New Westminster, Okanagan, Kootenay, and Kamloops Agencies where public markets and canning factories offer attractive

prices. On Indian reserves in the lower Fraser Valley additional land was cleared to encourage increased production, and old orchards were removed to prevent disease from spreading. Orchard planting was continued in the Okanagan Agency, one Indian grower setting out apple trees on ten acres of his farm.

With a view to improving herds, eighteen purebred bulls were distributed in the Williams Lake, Nicola, and Okanagan Agencies. In addition, individual Indians purchased a number of excellent herd sires.

An open autumn season enabled ranchers to pasture their cattle beyond the usual period with a consequent saving in winter fodder. Seven tractors and other necessary farm machinery were purchased under the Veterans' Land Act for Indian veterans in the Kootenay Agency. The new equipment was used to increase the acreage sown.

The amount expended from the B.C. Special Vote for irrigation improvement on reserve lands was $27,693.93. Reconstruction work was continued on the Kamloops, Neskainlith, and Adams Lake Reserves. At Osoyoos Indian Reserve in the Okanagan Agency the rehabilitation of existing irrigation services was substantially advanced, resulting in an excellent tract of fertile land becoming available. Major irrigation improvements were made at Cook's Ferry and Lower Nicola Indian Reserves. A survey was completed on the Redstone Flats and Anaham Lake Reserves in the Williams Lake Agency preparatory to bringing an extensive area under cultivation. Interest was maintained in Men's Agricultural Clubs, and lectures on better farming methods and animal husbandry were well attended throughout the winter months.

ALBERTA

Most vacancies in field staff were filled by promotions and new appointments. A re-grouping of agency responsibilities and a conference of Superintendents and Assistant Agents held at Calgary during the year were aimed at improving agency management.

Good yields were reported in the north central agencies, but generally it was not a good crop year. Good prices for grain, however, have helped to balance returns for this type of farming. Heavy rains prevented the harvesting of large crops, some fields being left as green feed, and on others the grain had to be threshed tough and damp. Results of gardening in the northern areas proved encouraging, but lack of rainfall ruined attempts to cultivate gardens in southern Alberta.

The severe winter caused heavy losses of horses and cattle except in the extreme south. Losses of calves were particularly heavy at the Blackfoot and Sarcee Reserves. Frequently blocked highways and high feed prices made the winter hard for stock owners. Stock sales again brought lucrative returns. Throughout the Province 3,119 head of cattle were sold for $351,850 or an average of $113 per head. The Blood Agency alone sold 2,780 horses for $55,500. Hogs at the Coppock-Crawford ranches brought a return of $7,600. Fifty purebred bulls were purchased at the Calgary and Edmonton Bull Sales at a total cost of $18,979. All these bulls were financed from Welfare funds except ten purchased by the Blackfoot Indians from their Band Funds.

Cattle raising remains the principal industry on reserves in southern Alberta and as long as price levels remain high and range lands are undisturbed it will continue to be a valuable source of revenue.

A rising market and a reasonably good catch by hunting and trapping earned some $430,000. New methods of handling beaver and muskrat pelts and the appointment of Superintendents in certain areas as Class "B" fur dealers are expected to provide more competition than the old system.

Although there is a considerable amount of merchantable timber on many Indian reserves, it is planned to process such timber in keeping with a sound conservation program. During the year $57,000 was received from timber sales, chiefly on the Hobbema, Edmonton, and Stony-Sarcee Agencies.

The old entrance to the coal mine on the Blackfoot Reserve was abandoned during the year and a new one begun under the direction of a Mine Supervisor. A good seam of coal was encountered which has produced up to 70 tons a day.

More than $313,000 was earned by oil-producing operations during the year, with absolutely no effort on the part of the Indian and little inconvenience. A large part of this income is held in band funds for future use. The most important oil development program during the past year was conducted in the Edmonton Agency, where more than a quarter of a million dollars was paid into band funds.

A small area south of Nordegg has been acquired as a new reserve for the Nordegg Indians. Land sales on the Blackfoot Reserve added $50,000 to band funds. Land surrendered from the Blood Reserve during the year will be flooded upon completion of the St. Mary's Irrigation Project.

The purpose of Family Allowances is becoming more clearly understood by Indian women, who are spending their allowances wisely and for the direct benefit of their children. As a result, the administration of Family Allowances has been simplified and attendance at school has improved.

A program of construction of additional day schools was initiated to provide educational facilities for large numbers of children who have not yet had the benefits of the educational services. This program was initiated by building two schools in the Edmonton Agency and one at Atikameg. Two additional classroom blocks were purchased from War Assets for St. Paul's and St. Mary's Residential Schools on the Blood Reserve. Some of the Stony Indian children at the Morley Indian Residential School receive their education on a day school basis in order to make room for more children in residence. About a dozen Indian students are taking higher education at various institutions throughout the Province. This is done largely at the expense of the Department.

SASKATCHEWAN

A reorganization survey of the Saskatchewan Indian Field Service was begun by an official of the Civil Service Commission and many staff reclassifications were made. Some agency territorial boundaries were rearranged. File Hills and Qu'Appelle Agencies were amalgamated, and Onion Lake Agency was abolished. A new agency, Meadow Lake Agency, was formed, and the number of agencies in Saskatchewan has been reduced from nine to eight.

Lack of rain resulted in a disappointing crop season for 1947. Wild hay became so scarce that difficulty was experienced in securing sufficient feed for wintering valuable cattle owned by Indians on many reserves. Garden acreage has been increasing as Indians are taking a greater interest in growing vegetables for home use.

One hundred and sixty-two new Indian homes were erected during the year and 258 were repaired. There are still many Indian houses that need improving, but general building and improvement is controlled by the availability of necessary materials.

Fur conservation projects and good prices for pelts resulted in satisfactory incomes for Indians who depend on trapping for their livelihood. The extension of present fur conservation areas and policies will enable many more Indians living in the northern part of the Province to benefit from muskrat and beaver trapping. Indians who engaged in fishing had a disappointing season as many of them operated in areas where whitefish were attacked by parasites.

A new teacher's residence was built at Montreal Lake Day School. Lack of necessary building material restricted the building of day schools to one at Assiniboine Reserve, Crooked Lake Agency.

MANITOBA

Indians on the Fisher River and Peguis Reserves enjoyed good returns from farming and stock raising. They harvested heavy crops of alfalfa. The digging of seneca root provided a good source of income for many Indians in the Fisher River Agency. Land that escaped the abnormal spring floods in the Griswold Agency produced good grain crops, but hay land acreage was greatly reduced by the long period of floods. Grain growing, and the raising of cattle, horses, sheep, and poultry were the principal farming activities in the Portage la Prairie Agency.

Reserves adjacent to lakes in the Clandeboye Agency enjoyed a revenue of approximately $62,000. In the northern agency of Norway House, the earnings from fishing operations during 1947 are estimated at $45,000. A small number of Indians in the Portage la Prairie Agency earned $3,660 from fishing.

Trapping was the chief occupation of Indians in the Norway House and The Pas Agencies. Indians of the Churchill and Portage la Prairie Agencies also carried on successful trapping operations, the latter group earning $37,200.

During 1947 various employment opportunities provided Indians throughout the Province with ways to supplement their incomes in addition to farming, fishing, and trapping. Depending upon environment, they found opportunities to engage in bush camp work, cutting fuel and pulpwood, heavy logging, lumbering and sawmill operations, digging for seneca root, growing potatoes, mining and tourist guiding, and berry picking and harvesting wild rice.

ONTARIO

Throughout the year employment conditions among Indians in Ontario were maintained at a high level. There were excellent opportunities for steady employment offered in lumber camps, sawmills, and as farm labour, and for seasonal employment on fruit and tobacco farms and in canning factories. The number of Indians engaged in various industries shows an increase over previous years, and more families were established in the immediate vicinity of their year-round employment. A greater number of Indian industrial workers found employment, on favourable terms, in United States towns and cities adjacent to the Ontario reserves.

In many cases continuous employment has resulted in the erection of new homes, extensive repairs and additions to existing homes, and the installation of electric lighting and other modern conveniences. There was steady increase in the number of Indian families accepting seasonal employment on tobacco farms throughout the southern part of the Province. The good wages earned greatly augments revenue from the operation of their small reserve farms and considerably raises their living standards. Indian guides were fully employed during the summer and autumn.

Despite a wet, late spring in many sections of the southern part of the province, a satisfactory yield was obtained generally from agricultural operations on Indian reserves. Average hay, grain, and fodder crops were harvested in good condition. The numbers of cattle and hogs raised on the farms showed an increase over previous years largely because of the establishment under the Veterans' Land Act of many Indian war veterans on dairy and mixed farms.

Satisfactory returns were received from field crops of corn, pumpkins, peas, and beans. These crops were grown for canning factories. There were only fair returns from a large contracted acreage planted to tomatoes because of adverse weather conditions in the growing and harvest periods. The acreage

planted to small fruits, chiefly strawberries and raspberries, showed a marked increase over previous years. Excellent market prices were obtained in central Ontario and on Manitoulin Island, where beef and hog raising are the chief activities. Holstein-Friesian cattle herds, owned by Indian farmers on the Tyendinaga Reserve, continue to show an improvement in production records. One new herd, entirely purebred and eligible for registration, has been purchased.

Indians engaged in commercial fishing in the Lake Superior and Georgian Bay area of Lake Huron had an average season's catch. Bands possessing commercial fishing licences in the Kenora Agency did well, and the Sioux Lookout Agency Indians reported that, next to trapping, commercial fishing was their most important industry.

Reforestation of sub-marginal lands on a number of Indian reserves was continued and approximately 175,000 conifer seedlings were planted.

In the northern regions of the Province, where more than 12,000 Indians derive their livelihood from trapping, the overall returns for the year were somewhat below normal. In some areas a scarcity of fine fur was experienced which necessitated relief being distributed to a number of families. In the Kesagami and Albany areas, where large beaver and fur preserves have been created exclusively for Indian trappers, satisfactory progress has been maintained. These preserves are managed under a controlled trapping and conservation plan. Restocking of depleted areas with live beaver has continued with the full co-operation of the Indians. A marked improvement in living standards was noted among families that participated in the controlled system of trapping.

During the year more Indian Women's Clubs were formed and added to the already well organized groups on many Indian reserves throughout the central and southern parts of the Province. It is gratifying to note the continued progress being maintained by these self-managed women's organizations which have, by their willingness to co-operate and the untiring efforts of their own leaders, assisted greatly in the improvement of social and home life on their respective reserves.

QUEBEC

Staff changes involving new appointments and relocating of Indian Superintendents were made during the year at Bersimis, Cacouna, Maniwaki, and Seven Islands.

A program aimed at expanding farm activities is being organized on a number of reserves containing good farming land, such as St. Regis, Oka, Maniwaki, Pointe Bleue, Restigouche, Timiskaming, Pierreville, and Caughnawaga. During the summer farm machinery was purchased and machinery sheds erected on the Maniwaki and Timiskaming Reserves with band funds. The equipment will be for common use. The Indians will pay costs of operating and maintaining their new equipment. Farming Indians were advised to join in farm co-operatives, and, where production was sufficient to warrant a farmers' co-operative, they were encouraged to organize.

The three bands that have been active in lumbering are at Bersimis, Restigouche, and Maniwaki Reserves, and revenue from dues alone at Bersimis amounted to $60,000. The majority of the Indians were employed in bush operations by a large timber holding company and income from such labour proved satisfactory. A policy of cutting under closer control was recommended at Restigouche to allow young trees to reach maturity.

Indians on most of the organized reserves have been fully employed, earning good wages in timber cutting, fishing, guiding, manufacturing, farming, and iron work activities. However, the advantages of saving and planning for more difficult times do not seem to be appreciated in many cases.

Indian Superintendents, guided by the Family Allowances Divisions of the Dominion Government, have made good progress in impressing on Indians the benefits to be obtained from the proper use of Family Allowances. School attendance by children has improved considerably, as Indian parents are now taking a greater interest in the educational services available. A two-classroom school and residence was erected at St. Regis, and a one-classroom school was built at Timiskaming.

Steady progress has been made on the building program. A number of veterans had residences built or repaired under assistance from the Veterans' Land Act. Some reserves voted money from band funds for home building and improvements and only lack of necessary materials held up progress.

NEW BRUNSWICK

Many Indians were employed in lumber camps cutting pulpwood, pit props, and timber. The State of Maine again attracted a large number of Indians for seasonal employment in harvesting the annual potato crop. A number of Indians excel in handicraft work and receive top prices for potato and fancy baskets, and for axe and pick handles.

With the exception of the Kingsclear group of Indians, who put in small vegetable gardens, the St. John River Valley Indians do not engage in farming or livestock raising. In the eastern reserve division a few Indians farm in a small way, growing vegetables and some grain. The goat herd, which was moved from Golden Lake Reserve in Ontario to Kingsclear Reserve, is increasing and goats from this herd will be moved to other reserves in New Brunswick to provide additional supplies of milk.

Twenty-one new dwellings were completed during the past year for Indians along the St. John River Valley. Twelve such houses were financed by Welfare appropriations and nine under the Veterans' Land Act. In New Brunswick East, four new houses were constructed, one from Welfare funds and three under Veterans' Land Act. These buildings were erected on cement foundations with full brick chimneys, and will do much to improve housing conditions. The shingle mill at Kingsclear Reserve manufactured approximately 500,000 cedar shingles, which were used in conjunction with the building program.

NOVA SCOTIA

During the past year steady employment was at a low ebb for the Indians of the Province. Some Indians secured employment cutting and loading pulpwood, pit props, and lumber. Financial returns to Indians engaged in handicraft work have been satisfactory. Handicraft workers produced potato and fancy baskets, flowers designed from basswood, and axe, peavey, and pick handles.

Vegetables for home consumption and hay and green feed for their livestock were grown. At Eskasoni Reserve, goat raising has become popular and the milk is used at all meals. Indians at Shubenacadie showed little interest in goats, but at the present time have some milch cows.

Twenty-eight new houses were constructed on the Eskasoni Reserve and twenty-two were built at the Shubenacadie Reserve, as part of the centralization program. Many Indian families demonstrated interest in improving home surroundings and living conditions by planting flower gardens, lawns, and building small fences. Indians continue to co-operate in the centralization scheme and at both reserves the requests for houses greatly exceed the number that can be erected each year. One million and five hundred feet board measure of logs were cut last year on the two main reserves. These logs will be manufactured

into lumber by Indian labour at their sawmills and used for the construction of houses. This work has provided employment at a time when it was impossible for Indians to obtain other employment.

The new six-room school that was opened at Eskasoni last year had an attendance of 138 children. A new school bus has helped to maintain an excellent attendance record at the school.

With the construction of the Royal Canadian Mounted Police residence the building program at the Eskasoni Agency headquarters was completed.

At Shubenacadie houses have been completed for the Superintendent, the school principal, and five teachers. The Agency office and warehouse was also completed. Agency buildings were provided with an up-to-date water system, electricity, and telephones.

PRINCE EDWARD ISLAND

The majority of the Indians residing on Lennox Island Reserve grow their own vegetables, including potatoes, turnips, beets, carrots, and cabbage. Many of the Indians on this reserve earn good incomes fishing for lobsters and oysters. Their incomes are supplemented by handicraft work, good prices being received for axe and pick handles and potato and fancy baskets.

Six new houses with cement foundations and full brick chimneys were built last year at Lennox Island Reserve. In addition cement foundations were constructed under nine houses previously built. The cost of this work was provided from the Welfare appropriation and employment was given Indians at a time when they could not secure work in the Province.

Shortages of materials and skilled labour during the past two years have prevented the construction of buildings for the Agency Staff at Lennox Island. The Department purchased a hospital building and two pumping stations from the Mount Pleasant Airport, Prince Edward Island. These buildings were dismantled during the winter months and moved across the ice to Lennox Island to be available for reconstruction during the summer of 1948.

YUKON

A poor fur season and a scarcity of moose and caribou made it necessary to provide special relief allowances to the Indians of the Frances Lake area. Allowances were provided through arrangements with the factor at the Frances Lake Post.

At Whitehorse, a troop of Boy Scouts was formed among the Indian boys, who are enthusiastic about their new organization and earn money for their uniforms by performing chores around the town.

Vegetable growing was encouraged among Indians at Mayo Indian village and valuable assistance was received from the experimental farm at Haines Junction.

NORTHWEST TERRITORIES

During the summer, many Indians were able to find employment around Fort Simpson. The construction of a new building for the experimental farm station provided work until the fishing season opened in September at Great Slave Lake, when a number left to engage in commercial fishing. They were also employed cutting winter fuel and transporting lumber.

Most of the Indians were able to trap a few marten again and early trappers received good prices for these pelts. The opening of a new beaver trapping area provided an additional and welcome source of income.

Moose were plentiful during the winter, but caribou were scarce in the Fort Simpson area, because of a change in their seasonal movements. Consequently, meat supplies of settlements were limited and prices were high. In spite of such restrictions in diet, the health of the Indians appeared to be improving. Fewer cases of tuberculosis have been observed and less general sickness has occurred in outlying districts.

The decline in fur prices, coupled with smaller catches, resulted in a lower volume of trading at most trading posts in the Fort Norman region. Although economic conditions had not affected the Indians adversely, it is expected that the number of families requiring relief assistance will increase unless returns from hunting and fishing can be augmented by other employment between these two important seasons.

During the annual treaty payment trip, Indians were X-rayed for tuberculosis and the natives generally expressed satisfaction and approval of the methods being used to control this disease. The treaty trip also provided opportunities for explaining the importance of conservation measures introduced during the year through the new game regulations.

RESERVES AND TRUSTS SERVICE

RESERVES DIVISION

Land Sales and Leases.—There were 137 sales of parcels of Indian lands during the fiscal year, and of this number 80 were cash sales realizing $591,247.98 and 57 were time sales totalling $118,114.35. Receipts from cash sales and collections on land sales contracts amounted to $741,936.65, and of this total $716,561.74 represented principal payments and $25,374.91 interest payments.

Seventy-two purchasers of Indian lands on a time sale basis completed their payments and 2 sale contracts were cancelled. Letters Patent were issued in favour of 129 purchasers of Indian lands.

Rentals collected under leases and permits during the fiscal year totalled $371,751.04.

Indian Estates.—During the fiscal year, 196 estates of deceased Indians were referred to the Branch, and the administration of 431 estates was concluded by distributing the estate assets.

Location Tickets.—Five hundred and seventy-eight Location Tickets were issued during the year on Indians who acquired holdings on Indian reserves by purchase, devolution of estates, or by allotment from Indian Band Councils.

Petroleum and Natural Gas.—Receipts from oil permits and leases totalled $272,553.59. Although no Indian reserve produced oil, exploratory work by permittees and lessees was carried out on various reserves in Saskatchewan and Alberta. Drilling was done on Blackfoot, Stony Plain, Ermineskin, and Stony Indian Reserves, and Pidgeon Lake, Louis Bull, Samson, and Montana Reserves were explored by reflection seismic reconnaissance.

On Michel Indian Reserve, gravity and reflection observations are being completed. Reconnaissance seismograph work was carried out on Alexander Reserve and a gravity meter survey was made on Wabamun Reserve.

Mining.—Revenue from mining rentals and sales of sand and gravel totalled $47,985.82.

Ten prospector's permits were issued. In Kenora Reserve No. 38B, 8 mining claims and 2 mining leases were cancelled for non-payment of rent and in Fort Hope Reserve No. 64, claims cancelled for failure to apply for leases totalled 6. Non-performance of work resulted in cancellation of 40 claims in Abitibi Reserve and the Township of Kehoe. Five claims in Fort Hope Reserve and 6 claims in Kenora Reserve remain of record.

No claims were recorded during the fiscal year.

Timber.—Forty-eight timber licences were in force at the beginning of the fiscal year and of this number 6 were completed, 3 forfeited, one not renewed for failure of the licensee to make returns, and the remaining 38 were renewed.

Nineteen new licences were issued and 57 leases were in force at the end of the fiscal year. One thousand and fifty-six timber permits were issued to Indians.

Receipts from dues, interest, and ground rent under licences totalled $137,310.07 and dues under permits realized $71,406.22, bringing the total receipts from timber to $208,716.29 for the fiscal year.

Forest Protection.—Thirty-seven forest fires were reported and $2,332.56 was spent in their suppression.

Enfranchisements.—There were 379 Indians enfranchised during the fiscal year.

Fur Rehabilitation.—Continued progress was made in rehabilitating fur bearers in the interest of the thousands of Indians who follow the trapline as a means of livelihood.

Three of the 7 beaver preserves, 2 in Quebec and one in Ontario, were brought into production, and in the past year yielded profits of almost double the amount expended on their development. Production was as follows:

Abitibi (Quebec) 813 pelts	$30,751
Nottawa (Quebec) 1,009 pelts	37,600
Kesagami (Ontario) 772 pelts	18,625

All other preserves show satisfactory increases, and one, the Old Factory, Quebec, will produce its first crop next year.

Excellent progress was made in the co-operative program instituted in the Prairie Provinces. Beaver populations are increasing rapidly, owing to extensive live trapping operations by provincial administrations. In Saskatchewan 625 beaver were successfully moved from farming districts to depleted areas in the northern part of the Province.

During the year, Ontario introduced registered traplines on a province-wide scale. In the predominantly Indian areas, the group area system has been adopted, and with the active co-operation of the various superintendents of Indian Agencies the initial stage of this re-organization has been completed and beaver trapping placed on a quota basis.

TRUSTS DIVISION

The credit balance of the Indian Trust Fund on March 31, 1948, was $18,561,449.27, an increase of $984,084.70 over the previous year. Interest on trust funds paid by the Government of Canada at the rate of 5 per cent amounted to $889,602.64. In Alberta, petroleum has made some hitherto poor bands comparatively wealthy. A total of $272,553.59 was paid by various oil companies for drilling and exploratory rights on the reserves of Indian bands in the foothills province. These funds were placed to the credit of the trust accounts of the bands concerned. A distribution of part of the increment was made at once to such bands. Sale of surplus lands of a few bands resulted in a substantial income to the trust funds. Other sources of income were land leases, mining licences, timber royalties, sale of gravel, repayments on band loans, and fines.

Items of expenditure were: distributions of cash, relief, pensions awarded by the band to destitute members, housing construction and repair, improvement of roads on reserves, farming, ranching, enfranchisements, and commutations. Where practicable, the expenditures were managed in such a way as to foster

self-reliance and individual enterprise among the Indians. When Indians, through no fault of their own, are in danger of losing their possessions, they are encouraged to seek assistance from the Trust Fund of their band. Again, where arable reserve land is available but not cultivated, it is brought into production by expenditure from the Trust Fund of the particular band. When the proceeds have repaid the Trust Fund, deserving young Indians are launched as farmers by expenditures from the same source. Band projects in farming, fishing, lumbering, and house construction are formulated, guided, and developed, whereby Indians concerned are enabled to work at current wage rates while receiving training and instruction in managing such enterprises.

Annuities.—During the fiscal year annuity moneys were distributed in accordance with the various treaties as follows:

No. of Chiefs paid at $25—169	$ 4,225
No. of Headmen paid at $15—387	5,805
No. of Indians paid at $5—51,930	259,650
No. of Indians paid at $4—174	696
No. of Indians paid at $12—9	108
No. of commutations of annuity paid at $50—114	5,700
No. of Enfranchised Indians paid $100 in lieu of Annuity—121	12,100
Amount paid on account of arrears for previous years	5,859
General advance re Robinson Treaty to be added	10,700
Less credits of overpayment in previous years re File Hills—5	5
Total	$304,838

In addition to the above number there were 7,082 Indians who received annuity under the Robinson Treaty and 5,841 who received annuity under Treaty Nine (James Bay). This brings the number of Indians in Canada receiving treaty annuity to 65,592.

Personal Savings Accounts.—There were approximately 2,300 individual Indian Savings Accounts in effect at the end of the year. The total on deposit has increased by $41,363.03. The following statement summarized the year's transactions:

	Dr.	Cr.
April 1, 1947—Balance	$	$410,512.52
Government Interest	.....	20,525.63
Deposits to savings	.....	118,104.19
Withdrawals during year	97,266.79	.....
March 31, 1948—Balance	451,875.55	.....
	$549,142.34	$549,142.34

Band Loans.—During the fiscal year applications for loans from bands were received from 263 Indians. A total of $58,177.90 from band funds was loaned to 214 individual band members, the average loan being $271.86. The sum advanced was for the purposes and in amounts as follows:

For the purchase of live stock and equipment	$24,228.20
For the purchase of property—land and buildings	2,050.00
For repairs to buildings—houses, barns, etc.	12,770.00
For construction of new buildings, and the sinking of wells	10,955.00
For miscellaneous purchases	8,174.70
	$58,177.90

There were 98 band loans totalling $18,798.74 fully retired during the fiscal year.

Loan funds were set up from the capital funds of ten additional bands during the fiscal year, thus making a total of 56 Indian bands who have funds which range in size from $800 to $25,000.

EDUCATION SERVICE

The table of pupil enrolment and attendance follows:

Fiscal Year	Residential Schools		Day Schools		Total (All Schools)		
	Enrolment	Average Attendance	Enrolment	Average Attendance	Enrolment	Average Attendance	Percentage of Attendance
1937-38.....	9,233	8,121	9,510	5,978	18,743	14,099	75·22
1938-39.....	9,179	8,276	9,573	6,232	18,752	14,508	77·36
1939-40.....	9,027	8,643	9,369	6,417	18,396	15,060	81·87
1940-41.....	8,774	8,243	8,651	6,110	17,425	14,353	82·37
1941-42.....	8,840	8,283	8,441	5,837	17,281	13,935	80·63
1942-43.....	8,830	8,046	8,046	5,395	16,876	13,441	79·64
1943-44.....	8,729	7,902	7,858	5,355	16,587	13,257	79·92
1944-45.....	8,865	8,006	7,573	5,159	16,438	13,165	80·09
1945-46.....	9,149	8,264	9,532	6,691	18,805	15,043	79·99
1946-47.....	9,304	8,192	10,181	7,344	19,622	15,641	79·91
1947-48.....	8,986	7,863	10,982	8,178	20,101	16,151	80·34

It will be noted from the above statistics that the enrolment at residential schools decreased during the year by 318 and that the enrolment at day schools increased by 801.

The drop in residential school attendance has resulted from the closing of two residential schools by fires and one for major repairs.

The rise in day school attendance has resulted from the opening of many new schools in both temporary and permanent quarters. The building program has met with delays caused by both shortages of material and labour. One room day schools with attached teachers' quarters were erected on the following reserves: Notre Dame du Nord, P.Q., Mississauga, Ont., Mission Bay, Ont., Fisher River, Man., Cross Lake, Man., Stoney Plain, Alta., and Michel, Alta. Buildings formerly used by the armed forces were moved and modified for school use on the Six Nations Reserve, Ont., Alert Bay, B.C., Turnour Island, B.C., and Kitkatla, B.C. At several points day schools were opened in improvised quarters.

New school buses were purchased and are now serving the four-room consolidated schools at Eskasoni, N.S., and Muncey, Ont.

The Thunderchild Residential School near Delmas, Sask., and the St. Clair Day School near Sarnia, Ont., were destroyed by fire.

The distribution of vitamin biscuits was continued to Indian day schools in northern Ontario, Manitoba, Saskatchewan, Alberta, and the Northwest Territories.

The standard of the teachers employed in Indian day schools has shown considerable improvement since the introduction of a teachers' salary schedule. This has been modified recently and the new scale will come into effect on September 1, 1948. Day school teachers have also been made eligible for pension privileges under the Civil Service Superannuation Act. This marks a great step forward in raising the status of teachers. They have greater security in the form of both an established salary scale and pension privileges.

The new salary schedule requires attendance, at the end of certain periods, at professional and academic summer courses. As a result more teachers attended such courses last summer than in the past. The resultant improvement in their teaching technique was the subject of favourable comment by several provincial school inspectors.

The teachers' magazine is of great help, particularly to teachers who are new to Indian work. Several experienced teachers have made valuable contributions to the magazine during the year.

The number of teachers employed in hospitals, operated by the Indian Health Services, continues to grow. There are two teachers at Brandon, Man., two at Clearwater Lake, Man., one at Dynevor, Man., two at Charles Camsell, Edmonton, Alta., two at Coqualeetza, Sardis, B.C., one at Nanaimo, B.C., and one at Miller Bay, B.C. These teachers do both bedside and classroom teaching and their services are available to both children and adults. In this way Indians who are hospitalized have an opportunity of improving their education. In some cases old Indians who have never previously attended school are taught to read and write.

The number of Indians receiving secondary education continues to improve in a satisfactory manner. In addition to the pupils shown above as attending Grade IX and X, the Branch is also providing an increasing number of tuition grants for Indian children who are attending technical schools and universities. Four are attending normal school and should be available for teaching duties next year. This should increase the number of Indians in the teaching service to forty-four.

One student in British Columbia is taking a course in dentistry, and one young Indian in Quebec is attending medical college.

WELFARE SERVICE

The Division which formerly administered Indian Welfare and Indian Education (Welfare and Training Division) was divided during the past year and each division now has a separate superintendent. This action was considered advisable because of the greatly increased activities of each service.

The Welfare Division is now comprised of the following sections: (1) Welfare (General); (2) Family Allowances; (3) Veterans' Land Act Administration; (4) Indian Handicraft.

From the following table of welfare expenditures by provinces it will be noted there was an increase of $376,146.84 or 35·6 per cent over the previous year. This increase is accounted for generally by increased costs for commodities and services and increased assistance and service being rendered.

	1947-48	1946-47
Nova Scotia	$224,857.91	$194,539.86
Prince Edward Island	21,603.46	14,306.17
New Brunswick	83,821.89	56,109.09
Quebec	208,272.89	175,716.27
Ontario	239,062.21	197,667.92
Manitoba	242,942.87	153,602.31
Saskatchewan	132,162.63	121,710.82
Alberta	152,714.33	105,412.40
British Columbia	195,863.47	132,253.52
Northwest Territories	34,471.14	22,047.79
Yukon	14,011.56	10,668.31
Headquarters Salaries	33,250.61	29,050.82
Triennial Clothing	5,091.41	3,985.83
Miscellaneous	18,177.39	11,852.02
Handicraft	711.12	1,944.92
	$1,607,014.89	$1,230,868.05
Net Increase		$ 376,146.84

In addition to increased costs and services generally, special assistance to Indians in certain areas was necessary because of a scarcity of country food.

Of these, the James Bay area in northern Ontario and Quebec, and the Northwest Territories were most seriously affected. In the James Bay area the natural game cycle has reached a low point and in the Northwest Territories many species have become so scarce during recent years that a strict conservation program has been put into effect. It was necessary during the year to amend the game laws of the Northwest Territories to provide a closed season on certain wild animals and to limit the number of others that may be taken legally. Indians who previously earned a fair living are now unable to obtain the ordinary necessities of life and the Branch, in order to prevent suffering, has taken over this responsibility.

In some areas there was a decrease in employment available to Indians during the year and a tendency was noted on the part of those with suitable land at their disposal to resume or adopt agricultural pursuits. The price received for farm products was good but inclement weather conditions caused a serious decline in production in many farming communities, particularly in Western Canada.

Some Indian fishermen were affected when a severe slump in the market occurred in certain areas. Types and grades of fish, particularly fresh-water fish, which found a ready market during the war years were no longer in strong demand, resulting in a serious glutting of the market.

The need for improved housing facilities on Indian reserves received major consideration during the year, and in spite of difficulty in obtaining materials substantial progress was made. On some reserves, where timber resources warranted, portable sawmills were installed. However, notwithstanding the foregoing, much remains to be done in this field.

At the close of the fiscal year there were approximately 60 Indian Women's Homemakers' Clubs active on Indian reserves throughout the Dominion. These clubs are encouraged and assisted when necessary because of the important part they play in improving home life on Indian reserves. A convention of members of Homemakers' Clubs in Eastern Canada was held on the Caughnawaga Reserve in Quebec in June, 1947. The convention was addressed by the Director and several of the senior officials of the Indian Affairs Branch, and was well attended by the Indian women of Eastern Canada. For several weeks an Indian woman residing on a reserve in southern Ontario was employed as a travelling organizer of Homemakers' Clubs on reserves in that part of the Province.

HANDICRAFT

During the early part of the year, sales of Indian craft goods were rather slow, but before the end of the year there was a revival of interest, and large orders were placed by merchants for spring delivery. Collections during the year amounted to well over $25,000, and in addition, orders for spring delivery totalled over $5,200.

Several carloads of black ash logs for basket-work were shipped to reserves, and workers were kept supplied with the necessary dyes, sweet grass, and cord, as well as basswood logs used in producing souvenir articles such as paddles, tomahawks, and peace pipes. There appears to be an almost unlimited market for baskets suitable for packing fruit and candy, as well as baskets used for

shopping, knitting, and sewing; but it has been necessary to stop production of several lines of wastebaskets as there are on the market many types of these baskets made from metal, which are currently very popular.

A number of Indian workers have become interested in weaving willow basketry, and it is hoped that this material will gradually become more widely used. However, Indian workers are slow to change from one basic material to another. Adequate supplies of willow have been made available to Indian workers from plantations which have been started on several reserves, and as the workers become aware of the wide market which exists for willow basketry, they are more willing to devote their time to the production of heavy market baskets, clothes baskets, picnic hampers, and other such articles.

Assistance was given in marketing some of the fine hand work produced by members of the Indian Homemakers' Clubs. There were also many shipments of pyjamas and dressing gowns, made by the various Clubs, which were checked and sorted for reshipment to Indian Hospitals and other points where these articles, as well as shipments of salvaged clothing, were required.

Machinery for stone polishing and silver-work has been loaned to a few interested Indian craftsmen in the vicinity of Spanish River, and these workers report that there is sale for everything they produce, especially during the tourist season.

Grants to Agricultural Exhibitions and Indian Fairs

	1947-48	1946-47
Ontario		
Oshweken Agricultural Society, Brantford	$225.00	$225.00
Garden River Agricultural Society, Sault Ste. Marie	100.00	100.00
Caradoc United Indian Fair, Muncey	150.00	150.00
Manitoulin Island Unceded Agricultural Society	150.00	150.00
Canadian Lakehead Exhibition	250.00	250.00
Mohawk Agricultural Society, Deseronto	100.00	100.00
Manitoba		
Manitoba Provincial Exhibition	250.00	250.00
Rossburn Agricultural Society	25.00	25.00
Saskatchewan		
Prince Albert Agricultural Society	400.00	400.00
Regina Agricultural & Industrial Exhibition Ass'n, Ltd.	400.00	400.00
Alberta		
Calgary Exhibition	500.00	500.00
Edmonton Exhibition	500.00	400.00
British Columbia		
North and South Saanich Agricultural Society, Cowichan	50.00	50.00
Windermere and District Fall Fair, Kootenay	175.00	175.00
Chilliwack Agricultural Association, Chilliwack	150.00	150.00
Armstrong Fall Fair, Okanagan	250.00	250.00
Bulkley Valley Agricultural and Industrial Association	100.00	100.00
General		
The Canadian Handicrafts Guild	50.00	50.00
Garden Prizes, Standing Crop Competitions	1,500.00	1,500.00
Home Improvement Competition	1,500.00	1,500.00
Ploughing Matches—Expenses of Indian Competitors	150.00	.....
	$6,975.00	$6,725.00

FAMILY ALLOWANCES

Registration.—There were 18,517 Indian families registered for Family Allowances as of December 31, 1947, listing 51,530 eligible children. These figures show an increase of 2,229 children over last year, which reflects both the natural annual increase in population and a partial breakdown of prejudice toward Family Allowances previously noted in the Clandeboye, Six Nations, St. Regis, and Caughnawaga Agencies.

Eligible families have by now had ample opportunity to register for Family Allowances, and provisions for retroactive payment for periods in excess of one year have been tightened in consequence. Formerly such retroactive payments were at the discretion of the individual Regional Directors of Family Allowances, but must now be referred to the National Director.

Method of Payment.—Payment to Indian families is being made as follows:

(*a*) Cheque direct to Indian	12,237		
(*b*) Cheque direct to Indian, but mailed c/o Indian Agent	2,031		
		14,268	77 %
(*c*) Administered through Indian Agency Trust Account		665	3·6%
(*d*) Allowances in kind		3,584	19·4%
		18,517	

The following shows registration and method of payment by Province:

Province	Families	Children	Payment			
			a	*b*	*c*	*d*
British Columbia	4,233	11,415	3,837	.....	313	83
Alberta	1,985	5,870	1,316	310	25	334
Saskatchewan	2,407	6,784	1,196	774	63	374
Manitoba	2,520	7,130	1,815	632	17	56
Ontario	4,101	11,397	2,725	200	92	1,084
Quebec	1,749	4,838	644	115	126	864
Prince Edward Island	37	103	37	.....	.....	.....
Nova Scotia	372	1,035	362	.....	10	.....
New Brunswick	320	906	301	.....	19	.....
Northwest Territories and Yukon	793	2,052	4	.....	.....	789
	18,517	51,530	12,237	2,031	665	3,584

School Attendance.—The betterment in school attendance which attended the inception of Family Allowances has been maintained, although its optimum effect has apparently been exerted. There remains a minor, but hard core of absenteeism and truancy which the provisions of the Family Allowances Act relative to school attendance have not influenced to date.

Vital Statistics.—The registration of Indian Vital Statistics has been brought into sharp focus by the necessity of verifying the birth of children registered for Family Allowances. The various Regional Directors of Family Allowances have, in most cases, checked Indian births against the National Index and submitted lists of children for whom no verification of birth could be established.

Except in provinces where Indian Agents are not recognized as Deputy Registrars of Birth, considerable progress has been made by Agents. Provincial Registrars have been co-operative in extending the field of admissible evidence of birth to include details secured from Treaty Rolls in the absence of other proof of birth. When certified by the Agent, such facts are now acceptable for the purpose of birth registration in Manitoba, Saskatchewan, and Alberta.

In the Yukon, the Indian Agent has recently been appointed Deputy Registrar of Vital Statistics for Indians and the employment of Form 1 (Registration of a Live Birth of an Indian) has been authorized. This change in procedure should result in considerable improvement in the Vital Statistics picture in this area.

Current registrations of birth for Vital Statistics purposes are made concurrently with registration for Family Allowances wherever the Indian Agent is so empowered by the Provincial authority. Delayed registrations of births present many problems, but are gradually being brought up-to-date.

RE-ESTABLISHMENT OF INDIAN VETERANS

During the year, 314 new applications for grants under Section 35A of The Veterans' Land Act were approved. In addition, 141 applications for supplementary grants were approved.

The number of Indian veterans for whom grants have been approved to March 31, 1948, was 743; the average grant was $2,138.

The following table shows the purpose for which grants have been made and the average amount approved for each purpose:

Type of Grant	Indians Given Grants	Total	Average
	No.	$ cts.	$ cts.
Land and buildings	161	128,593 00	799 00
Building materials	535	564,298 00	1,055 00
Clearing	116	44,388 00	383 00
Livestock and equipment	461	586,749 00	1,273 00
Forestry equipment	4	8,545 00	2,136 00
Commercial fishing equipment	92	140,461 00	1,527 00
Fur farming equipment	51	25,987 00	510 00*
Household equipment	417	89,835 00	215 00†
Total	.....	1,588,856 00	

* Restricted to $850. † Restricted to $250.

A comparison with the previous fiscal year shows that approvals and expenditures for 1946-47 and 1947-48 have been substantially the same.

	1946-47	1947-48
New Grants approved	390	314
Amount	$771,761.00	$741,095.00
Expenditures	$315,193.00	$286,731.00

The benefit to Indians resulting from these grants cannot be over-estimated. The expenditures represent permanent improvements. They are spread over 70 agencies from coast to coast excluding only the far north and other remote areas. From eastern Ontario to the Maritimes, the re-establishment is mainly small holdings. Among those on the Great Lakes and the Pacific Coast, commercial fishing predominates, and in the northern areas fur farming and trapping leads. The remainder are for full-time farming operations.

INDIAN HEALTH SERVICES

Since November, 1945, the responsibility of Indian Health Services has been assumed by the Department of National Health and Welfare. For a full report on the activities of the Indian Health Services, see annual report of the Department of National Health and Welfare.

Indian response to medical attention proved very encouraging during the year. Isolation of northern agencies has been overcome to some extent by improved air transport services. Although several epidemics developed, prompt action by the Indian Medical Service prevented serious outbreaks. Close co-operation from the British Columbia Department of Health helped to keep

the death rate in some areas at a minimum. A determined preventive innoculation and vaccination program was carried on among children under the direction of the Regional Superintendent of Indian Health Services.

A new nursing station was built during the year in the Abitibi Agency, Quebec, for bands having no reserves, and others are being constructed at Restigouche and St. Regis. Thirty-five beds have been put at the disposal of Indian Affairs Branch for male tuberculosis patients in Parc Savard Hospital in Quebec City. It is estimated that between 3 and 4 per cent of the Indians in the Province of Quebec have tuberculosis and while there appear to be sufficient beds for adults, it has not yet been possible to provide adequate hospitalization for children with tuberculosis. Four girls trained at LaTuque Hospital are acting as nurses aides, assisting graduate nurses.

CONSTRUCTION AND ENGINEERING WORK

Agency Buildings and Structures

Repairs and improvements were carried out at practically all Indian Agencies in Canada, and extensive alterations, repairs, and improvements to agency buildings were made at Walpole Island, Ont., Touchwood Agency residence, Sask., and at Prince Albert where buildings from the ex-Basic Training Centre were taken over for Indian Agency (Carlton Agency) purposes and altered or improved to suit requirements. Space over the Indian Office at Norway House was utilized to provide living quarters for the clerk, and water was installed. Work on Lennox Island dock was carried out under supervision of the Department of Public Works.

New buildings were constructed as follows:

Prince Edward Island: Materials were salvaged from Mount Pleasant Camp and transported to Lennox Island Agency, where a warehouse was built in which to store them.

Nova Scotia: A barn and quarters for Royal Canadian Mounted Police were built at the Eskasoni Indian Agency.

Ontario: Quarters for the Royal Canadian Mounted Police were built at Manitowaning, and two prefabricated houses were erected at the James Bay Agency, Moose Factory Island. The implement shed on the Tyendinaga Reserve was completed.

Manitoba: Warehouses at Split Lake and Pelican Narrows, The Pas Agency, were completed; a warehouse was constructed at Maria Portage, materials for a house for the Assistant Agent at Island Lake were purchased and a tractor shed at Island Lake was built, all in Norway House Agency; a residence for the Superintendent and a power-house were built at Fisher River Agency; an oil storage was provided at Portage la Prairie Agency, Sandy Bay Reserve; a ration house was built on Lizard Point Reserve, Birtle Agency, and a barn was built at Little Saskatchewan Reserve in Portage la Prairie Agency.

Saskatchewan: The residence for the Indian Superintendent of the Meadow Lake Agency was completed; warehouses at Nut Lake, Day Star, and Fishing Lake Reserves were built, and a stable and farmhouse were constructed on the Nut Lake Reserve, all in Touchwood Agency; a farmhouse, barn and warehouse were constructed on the Keeseekoose Reserve, Pelly Agency; a barn was completed on the Big River Reserve, Carlton Agency; warehouses were provided at Sweetgrass, Little Pine, Red Pheasant, Thunderchild, and Meadow Lake Reserves, Battleford Agency.

Alberta: An addition to the office warehouse building at headquarters of the Hobbema Agency was provided and a barn on Farm 2 of this agency was built.

British Columbia.—A boathouse was commenced at the Babine Agency and materials for a garage secured; a storeroom was built from materials salvaged from Port Hardy Military Camp at the Kwawkewlth Agency, Alert Bay.

Lands and Buildings

Property was purchased in Cardston, Alta, for a residence for the Superintendent of the Blood Agency, and a lot was acquired in the Village of St. Regis, Que., as a site for Indian Agency and Indian Health Services buildings.

Road Work

Road work was carried out on many Indian reserves and particular attention was paid to improving roads in the St. Regis Indian Agency, Que., Eskasoni and Shubenacadie Indian Agencies, N.S., and Caradoc Agency, Ont. A large road grader was acquired for the St. Regis Agency.

Water Systems

A number of water supply systems were provided, particularly in British Columbia, and a report regarding them will be found in the report of the Lands and Development Services Branch. The work undertaken by the Indian Affairs Branch included the following:

Improvements to water works system, Lorette, Que.; a well on Mistawasis Reserve, Carlton Agency, Sask.; wells at Blood Agency, Alta., and at Redstone Meadows Reserve in the Williams Lake Agency, B.C.

Irrigation Works

The Lands and Development Services Branch were provided with funds for the construction of irrigation systems in British Columbia, and repairs and improvements were carried out to existing systems by the Indian Affairs Branch.

Miscellaneous Works

Nova Scotia.—The heating system for the office and warehouse building was extended to heat the storekeeper's quarters, and oil-burning ranges were installed in the Superintendent's, Clerk's, and Royal Canadian Mounted Police constable's quarters at the Eskasoni Agency; an oil range was installed in the Superintendent's residence at the Shubenacadie Agency.

Quebec.—A new heating system was installed in the Superintendent's residence, Timiskaming Indian Agency; a space heater was purchased for the St. Regis Agency Royal Canadian Mounted Police quarters.

Ontario.—An electric range was installed at the Superintendent's residence Fort Frances Agency; an oil heater was acquired for the Indian Office at Chapleau and for the Walpole Island Indian office; an electric range was acquired for the Superintendent's residence, Caradoc Agency.

Manitoba.—Kitchen ranges were installed in the Superintendent's residence, farm residence and clerk's residence, Fisher River Agency; a heater was acquired for Island Lake, and kitchen ranges for the Agency residences at Island Lake and Norway House.

A new lighting plant was installed at Fisher River Agency buildings and a new distribution system and wiring of buildings undertaken.

Saskatchewan.—An electric range was installed in the Indian Superintendent's portion of the Touchwood Agency residence, and a new furnace was installed in Muscouequan Farm residence in the same agency; a kitchen range was acquired for the Muscowpetung and Piatot farmhouse, Qu'Appelle Agency; a heater was installed in File Hills Agency farmhouse; a heating system was installed in building No. 28 of the ex-Basic Training Centre at Prince Albert, and an electric range and refrigerator were also supplied for this building which is now part of the Carlton Agency headquarters. Five stoves were supplied for five warehouses in Battleford Agency.

Batteries were purchased for the Qu'Appelle Agency and Carlton Agency buildings.

Alberta.—A heater was installed in Rocky Mountain House office; a furnace was installed in the Agency residence at Lesser Slave Lake and in the Blood agency office.

Equipment in connection with an electric lighting plant for Athabaska Agency was provided; a lighting plant was installed at the Stockman's residence, Blood Agency, and one for the Crawford Ranch House at the Stony-Sarcee Agency was supplied.

British Columbia.—An oil heater was purchased for the Indian office Babine Agency. A lighting plant was installed in the Stikine Agency office.

In addition, poles were purchased for a telephone line to Eskasoni Reserve, N.S.; traffic signs were erected at Caughnawaga Reserve, Que.; pumping equipment was installed at Norway House Agency, Man.; a septic tank was provided for the farmhouse on Sintaluta Reserve, Qu'Appelle Agency, Sask.; cisterns were provided for the Agency residence, Clerk's residence and farmhouse (Mistawasis Reserve) Carlton Agency, Sask.; furniture was purchased for the superintendent's residence, Athabaska Agency, Alta.; a snow plough was supplied to the Saddle Lake Agency, Alta.; and a large storage tank and cradle for the Peigan Agency, Alta.

SUMMARY OF INDIAN AGENCIES BY PROVINCES AND TERRITORIES

The local administration of Indian lands, on the reserves scattered throughout the Dominion, is conducted through the Department's 91 agencies. The number of bands included in an agency varies from one to more than 30. In addition to the agent, the staff of an agency may include various officers, such as clerk, farm instructor, constable, and stockman, according to its special requirements. Medical staff is provided for agencies as required by the Department of National Health and Welfare. The work of the agencies is supervised by the Department's provincial inspectors. There is an Indian Commissioner at Vancouver, acting in a supervisory capacity for British Columbia.

Locations of Indian Agencies in Canada

Prince Edward Island.—The only agency is located at Lennox Island. A large number of Indians live on Lennox Island, and others live at Rocky Point, near Charlottetown, Morell, St. Andrews, and Scotch Fork.

Nova Scotia.—There are 2 Indian agencies in Nova Scotia, one in Hants County (Shubenacadie) and the other in Cape Breton County (Eskasoni).

New Brunswick.—The 3 agencies in New Brunswick are the Northeastern, at Rexton; the Northern, at Perth; and the Southwestern, at Fredericton.

Quebec.—The 18 Indian agency offices in Quebec are located as follows: Amos (Abitibi), Bersimis, Cacouna (Viger), Caughnawaga, Gaspe, Gentilly (Becancour), St. Augustin, Maniwaki, Mingan, Natashquan, Notre Dame du Nord (Timiskaming), Oka, Pierreville, Pointe Bleue (Lake St. John), Restigouche (including the former Maria Agency), St. Regis, Seven Islands, and Village des Hurons (Lorette).

Ontario.—The Indian agency offices in Ontario, 24 in number, are located as follows: Chapleau, Chippewa Hill (Saugeen), Christian Island, Deseronto (Tyendinaga), Fort Frances, Golden Lake, Highgate (Moravian), Kenora, Longford Mills (Rama), Manitowaning (Manitoulin Island), Moose Factory (James Bay), Muncey (Caradoc), Parry Sound, Peterborough (Rice and Mud Lakes), Port Arthur, Sarnia, Sault Ste. Marie, Scugog, Sioux Lookout, Brantford (Six Nations), Sturgeon Falls, Virginia (Georgina and Snake Islands), Wallaceburg (Walpole Island), and Wiarton (Cape Croker).

Manitoba.—There are 9 agencies in Manitoba, located as follows: Birtle, Griswold, Hodgson (Fisher River), Ilford (Nelson River), Norway House, Portage la Prairie, Dauphin, Selkirk (Clandeboye), and The Pas.

Saskatchewan.—The following are the 8 agencies in this Province: Fort Qu'Appelle (File Hills-Qu'Appelle), Battleford, Broadview, (Crooked Lake), Duck Lake, Kamsack (Pelly), Meadow Lake, Prince Albert (Carlton), Punnichy (Touchwood).

Alberta.—Locations of Alberta's 12 agency offices are: Cardston and Brocket (Blood and Peigan), High Prairie (Lesser Slave Lake), Fort Chipewyan (Athabaska), Fort Vermilion, Gleichen (Blackfoot), Hobbema, Morley, Calgary and Rocky Mountain House, (Stony-Sarcee), Saddle Lake, and Winterburn (Edmonton).

British Columbia.—In British Columbia there are 18 agencies, located as follows: Alert Bay (Kwawkewlth), Bella Coola, Cranbrook (Kootenay), Duncan (Cowichan), Fort St. John, Hazelton (Babine), Kamloops, Lytton, Masset (Queen Charlotte Islands), Merritt (Nicola), New Westminster, Port Alberni (West Coast), Prince Rupert (Skeena), Telegraph Creek (Stikine), Vancouver, Vanderhoof (Stuart Lake), Vernon (Okanagan), and Williams Lake.

Northwest Territories.—The 3 agencies are at Fort Simpson, Fort Resolution, and Fort Norman.

Yukon Territory.—The one agency in Yukon Territory is at Whitehorse.

Summary of Tribal Origins of Canadian Indians

Prince Edward Island.—Micmac tribe, of Algonkian stock.

Nova Scotia.—Like the Indians of Prince Edward Island, those of Nova Scotia also bear the distinctive name of Micmac, and are of Algonkian stock.

New Brunswick.—Mostly Micmacs, though there are some bands of Maliseets, also of Algonkian stock.

Quebec.—The principal tribes found in Quebec are: Iroquois at Caughnawaga, Lake of Two Mountains, and St. Regis; the Hurons of Lorette are also of Iroquoian stock; the Montagnais, who are of Algonkian stock, at Bersimis, Mingan, Lake St. John, Seven Islands, and Abitibi; the Têtes de Boule, of Algonkian stock, at Abitibi; the Abenakis, of Algonkian stock, at Becancour and the Micmacs, of Algonkian stock, at Maria and Restigouche; the Maliseets, of Algonkian stock at Viger, and the Naskapis, also of Algonkian stock, in the northern area.

Ontario.—Most of the Indians of Ontario are Ojibwas, Chippewas, and Missisauga tribes, which are all of Algonkian stock. There is a band of Algonkians at Golden Lake. The Oneidas of the Thames, the Mohawks of the Bay of Quinte, the Mohawks of Parry Sound district, and the Six Nations of Grand River are of Iroquoian stock. There is a band of Pottawottamies at Walpole Island, and of Delawares at the Caradoc (Muncey) Agency; these are of Algonkian stock. Crees, also of Algonkian stock, are found in northern and northwestern Ontario.

Manitoba.—Manitoba Indians are mostly Ojibwas and Crees of Algonkian stock. Bands of Swamp Crees found at the Norway House and Fisher River Agencies and in the York Factory district are also of Algonkian stock. The Indians located at the Griswold Agency are Sioux; there are also Sioux at the Birtle and Portage la Prairie Agencies. There is a band of Chipewyans at Churchill; this tribe is of Athapaskan stock.

Saskatchewan.—The most numerous tribes among the Saskatchewan Indians are Ojibwas, Swamp Crees, and Plains Crees, which all belong to the Algonkian stock. In addition to these, Sioux Indians are found at Crooked Lake, Qu'Appelle, and Carlton Agencies, and on the Moose Woods Reserve. In the Onion Lake Agency, there is a band of Chipewyans who are of Athapaskan stock. There are also a few Chipewyan Indians in the Ile à la Crosse district.

Alberta.—The Alberta Indians are of Algonkian stock, with the exception of the Sarcees near Calgary and the Beavers and Slaves in the Lesser Slave Lake Agency, who are Athapaskan; the Paul's Band in the Edmonton Agency, who are Iroquoian, and the Stonies, who are of Siouan stock. The Algonkian Indians of Alberta are subdivided into Blackfoot Nation, comprising the Indians of the Blackfoot, Blood, and Peigan Agencies; and Plains Crees found in the Lesser Slave Lake, Saddle Lake, Edmonton, and Hobbema Agencies.

British Columbia.—The Indians of the Bella Coola, Cowichan, Kamloops, Lytton, New Westminster, Nicola, Vancouver, and Okanagan Agencies belong to the Salish tribes. The Kootenay tribe is located in the agency of the same name. The Kwakiutl-Nootka tribe is located at the Kwawkewlth and West Coast Agencies; the Haidas, in the Queen Charlotte Islands; the Tlingits, in the Stikine; and the Tsimshians in the Skeena Agency. The Indians of the Babine, Stuart Lake, Fort St. John, and Williams Lake Agencies belong mostly to the Athapaskan race. The Indians of the Peace River Block are Athapaskan, with the exception of a small group of Saulteaux and Crees at Moberly Lake who are Algonkian.

Northwest Territories.—The principal tribes found in the Far North are the Slaves, Hares, Loucheaux, Dogribs, Sekani, Yellow Knives, Chipewyans, and Caribou-Eaters. All these tribes are of Athapaskan stock. The most northerly tribes are the Takudah, whose territory extends to the Mackenzie Delta, and the Copper Mines, who are located along the Coppermine River. The territory occupied by these two last-named tribes is contiguous to that inhabited by the Eskimos.

Yukon Territory.—The Forty-Mile, Blackstone, and Moosehide bands belong to the Takudah tribe. There is a band of Slaves at Lancing Creek who migrated from Good Hope on the Mackenzie River; another band of Slaves, called Nahani, is located at the headwaters of Pelly River. All these Indians are of Athapaskan stock. At Mayo, Selkirk, Little Salmon, and Carmacks there are bands belonging to the tribe known as Stick Indians. Bands belonging to the Tlingit tribe are found at Whitehorse, Teslin Lake, Champagne Landing, and Carcross.

TABLE No. 1

Census of Indians: Arranged Under Provinces and Territories, 1948

Province	Number in Band	Religion							Under 7 years		From 7 to 16 inclusive		From 17 to 21 inclusive		From 22 to 65 inclusive		From 65 years upwards	
		Anglican	Baptist	United Church	Presbyterian	Roman Catholic	Other Christian Beliefs	Aboriginal Beliefs	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Alberta	12,441	1,518	.....	1,537	.....	6,347	.....	72	1,380	1,439	1,551	1,515	581	571	2,495	2,224	309	376
British Columbia	25,515	5,831	.....	4,425	62	14,465	694	38	2,350	2,573	3,056	3,171	1,238	1,127	5,548	4,808	825	819
Manitoba	15,933	5,791	52	3,438	528	5,388	438	298	1,663	1,665	1,828	1,711	1,020	1,005	3,102	2,923	461	555
New Brunswick	2,047	.....	.....	.....	.....	2,047	.....	.....	210	202	244	238	109	105	445	414	46	34
Northwest Territories	3,816	667	.....	.....	.....	3,149	.....	.....	374	403	434	436	212	209	775	745	90	138
Nova Scotia	2,364	6	.....	.....	1	2,357	.....	.....	259	259	231	240	130	131	534	457	65	58
Ontario	32,421	10,494	1,281	5,925	307	10,338	1,147	2,929	2,630	2,739	3,189	3,351	2,094	2,101	7,283	6,904	1,042	1,088
Prince Edward Island	266	.....	.....	.....	.....	266	.....	.....	27	22	28	34	14	15	57	57	5	7
Quebec	15,194	2,932	.....	557	1	11,517	93	94	1,319	1,360	1,750	1,718	804	878	3,471	3,010	463	421
Saskatchewan	14,158	4,804	.....	1,499	163	6,934	42	716	1,572	1,611	1,683	1,646	642	639	2,828	2,779	355	403
Yukon	1,531	1,224	.....	.....	.....	307	.....	.....	147	157	180	195	74	71	331	278	54	44
Total Indian Population	125,686	33,267	1,333	17,381	1,062	63,115	2,414	4,147	11,931	12,430	14,174	14,255	6,918	6,852	26,869	24,599	3,715	3,943

TABLE No. 2

Land, Property and Live Stock, Fiscal Year Ended March 31, 1948

Bands	Land				Property				Live Stock						
									Horses			Cattle			
	Total Area of Reserve (Acres)	Acres Under Wood	Acres Cleared but Not Cultivated	Acres Under Cultivation	Private Houses	Churches	Council Houses	Saw-Mills	Stallions	Geldings and Mares	Foals	Bulls	Steers	Milch Cows	Young Stock
Prince Edward Island	2,741	1,320	800	200	28	1	1	.....	.....	6	1	1	8	10	10
Nova Scotia	18,187	12,720	556	1,066	318	5	.....	2	.....	43	2	1	.....	61	13
New Brunswick	36,962	33,140	1,127	339	353	5	4	1	.....	29	.....	.....	.....	8	5
Quebec	177,338	139,243	13,978	9,271	2,157	25	5	1	1	558	68	54	37	1,493	873
Ontario	1,352,948	1,121,193	104,267	27,814	4,737	116	43	21	25	2,305	159	65	601	2,586	1,562
Manitoba	522,395	210,075	158,121	18,390	4,050	91	27	12	19	2,399	67	27	286	1,607	1,140
Saskatchewan	1,202,743	501,410	714,610	70,066	2,625	50	22	3	11	6,390	127	102	1,158	2,773	2,337
Alberta	1,419,047	327,834	797,683	63,513	2,344	33	8	3	169	8,259	1,414	238	2,466	7,733	4,656
British Columbia	832,782	445,373	247,356	41,491	6,712	164	81	13	109	7,023	1,113	231	7,890	4,567	3,955
Northwest Territories and Yukon	5,634	3,575	32	35	423	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	5,570,777	2,795,883	2,038,480	232,185	23,747	490	191	56	334	27,012	2,951	719	12,446	20,838	14,551

TABLE No. 3

Statement of Ordinary Expenditure, Fiscal Year Ended March 31, 1948

—	Branch Administration	Indian Agencies	Reserves and Trusts Admin.	Welfare	Education	Grants to Residential Schools	Grants to Exhibitions	Total
	$	$	$	$	$	$	$	$
Nova Scotia	.....	76,446	.....	224,858	110,488	33,355	.....	445,147
Prince Edward Island	.....	10,589	.....	21,603	6,788	.....	.....	38,980
New Brunswick	.....	20,553	2,049	83,822	27,942	.....	60	134,426
Quebec	805	128,329	19,033	208,273	182,585	19,135	116	558,276
Ontario	4,127	227,761	12,220	239,062	325,103	323,139	1,331	1,132,743
Manitoba	752	159,078	1	242,943	219,091	228,108	468	850,441
Saskatchewan	882	247,052	61	132,163	136,552	368,485	846	886,041
Alberta	892	220,442	5,052	152,714	83,889	444,131	2,915	910,035
British Columbia	1,545	214,982	2,579	195,863	242,081	475,435	1,600	1,134,085
Northwest Territories	.....	22,141	.....	34,471	55,242	70,235	.....	182,089
Yukon	.....	9,370	.....	14,012	15,554	15,948	.....	54,884
Headquarters and Miscellaneous	78,300	45,464	49,223	57,231	214,077	.....	.....	444,295
British Columbia Special	.....	27,390	.....	48,270	17,441	.....	.....	93,101
	87,303	1,409,597	90,218	1,655,285	1,636,833	1,977,971	7,336	6,864,543
Pensions and Gratuities	.....	.....	.....	.....	.....	.....	.....	1,914
Statutory—Indian Annuities	.....	.....	.....	.....	.....	.....	.....	304,838
Statutory—Pensions	.....	.....	.....	.....	.....	.....	.....	517
To provide for cash stolen at Parry Sound	.....	.....	.....	.....	.....	.....	.....	1,214
To re-imburse James Smith Band for salaries of Farming Instructors	.....	.....	.....	.....	.....	.....	.....	9,613
Total Ordinary Expenditure	.....	.....	.....	.....	.....	.....	.....	7,182,639

TABLE No. 4

Statement of Special Expenditure, Fiscal Year Ended March 31, 1948

FUR CONSERVATION

Quebec	$ 22,329
Ontario	12,336
Manitoba	45,570
Saskatchewan	75,960
Alberta	21,107
British Columbia	280
Northwest Territories	—
Head Office	12,531
Total Special Expenditure	190,113
Total Ordinary Expenditure	7,182,639
Grand Total Ordinary and Special Expenditure	7,372,752

TABLE No. 5

Open Account—Advances for Assistance to Indians, Fiscal Year Ended March 31, 1948

EXPENDITURE		
British Columbia	$ 569.63	
Saskatchewan	8,787.21	
Manitoba	36.26	
Ontario	4,888.09	
Quebec	335.50	
Nova Scotia	1,650.16	
		$16,266.85
REPAYMENTS		
British Columbia	$ 120.00	
Alberta	1,432.91	
Saskatchewan	4,213.10	
Ontario	155.00	
Nova Scotia	10.00	
		5,931.01
Expenditure over repayments		$10,335.84

TABLE No. 6

Indian Trust Fund

Showing transactions in connection with the fund during the fiscal year ended March 31, 1948.

Balance April 1, 1947	.....	$17,577,364.57
Collections on land sales, timber and stone dues, rents, fines, fees, etc.	.....	2,217,201.01
Interest for the year ended March 31, 1948	.....	889,602.24
Credit transfers during the year	.....	20,241.84
Expenditure during the year	$ 2,112,206.02	.....
Transfers by Warrant, etc.	30,754.77	.....
Balance March 31, 1948	18,561,449.27	.....
	$20,704,410.06	$20,704,410.06

TABLE No. 7

Annuities Paid and Interest on Indian Trust Funds, Fiscal Year Ended March 31, 1948

Alberta	$ 304,310.92
British Columbia	114,587.87
Manitoba	121,498.50
New Brunswick	2,835.26
Northwest Territories	20,970.00
Nova Scotia	3,175.59
Ontario	374,127.88
Prince Edward Island	.20
Quebec	25,261.36
Saskatchewan	196,416.33
Yukon Territory	29.56
	$1,163,213.47

TABLE No. 8

Indian Education Ordinary Expenditure, Fiscal Year Ended March 31, 1948

—	Day Schools	Residential Schools	General	Total
	$ cts.	$ cts.	$ cts.	$ cts.
Nova Scotia	104,760 79	39,082 31	.....	143,843 10
Prince Edward Island	6,788 42	.....	.....	6,788 42
New Brunswick	27,941 72	.....	.....	27,941 72
Quebec	182,359 15	19,360 68	.....	201,719 83
Ontario	278,015 75	370,226 31	.....	648,242 06
Manitoba	181,455 23	265,744 20	.....	447,199 43
Saskatchewan	81,534 97	423,501 82	.....	505,036 79
Alberta	40,720 25	487,299 84	.....	528,020 09
British Columbia	188,421 59	529,093 94	.....	717,515 53
British Columbia Vocational Instruction	.....	.....	17,440 77	17,440 77
Northwest Territories	54,273 28	71,203 99	.....	125,477 27
Yukon	13,382 70	18,119 11	.....	31,501 81
Assistance to ex-pupils	.....	.....	68,436 28	68,436 28
Freight and express	.....	.....	1,148 20	1,148 20
Salaries and travel	.....	.....	36,422 71	36,422 71
Stationery	.....	.....	102,490 43	102,490 43
Miscellaneous	.....	.....	5,579 60	5,579 60
	1,159,653 85	2,223,632 20	231,517 99	3,614,804 04

TABLE No. 9

Statement Showing Enrolment by Provinces in the Different Classes for the Fiscal Year Ended March 31, 1948

RESIDENTIAL SCHOOLS

Province	Denominations					Number on Roll			Average Attendance	Percentage of Attendance	Grades										
	Number of Schools	Church of England	Presbyterian	Roman Catholic	United Church	Boys	Girls	Total			I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Nova Scotia	1	.....	.....	1	.....	79	82	161	149	92·54	39	22	28	27	18	10	11	5	1	....	....
Quebec	2	1	.....	1	.....	26	34	60	38	63·33	23	12	13	6	6	.....	.....	.....	....	....	....
Ontario	12	5	1	6	.....	710	800	1,510	1,318	87·28	406	213	190	170	148	122	99	83	79	....	....
Manitoba	8	1	1	4	2	449	573	1,022	892	87·28	260	162	146	142	130	78	62	23	19	....	....
Saskatchewan	13	2	.....	9	2	818	998	1,816	1,576	86·78	489	276	274	249	205	152	99	53	19	....	....
Alberta	19	5	.....	12	2	946	1,090	2,036	1,777	86·78	722	308	255	246	217	147	84	53	4	....	....
Northwest Territories	4	1	.....	3	.....	100	136	236	191	80·93	111	50	29	22	13	7	.....	2	2	....	....
British Columbia	13	2	.....	9	2	1,002	1,074	2,076	1,887	90·89	484	357	311	267	240	166	132	82	37	....	....
Yukon	1	1	.....	.....	.....	38	31	69	35	50·72	29	13	19	3	3	2	.....	.....	....	....	....
Total—Residential Schools	73	18	2	45	8	4,168	4,818	8,986	7,863	87·50	2,563	1,413	1,265	1,132	980	684	487	301	161	....	....

TABLE NO. 9—*Continued*

DAY SCHOOLS

Province	Number of Schools	Number on Roll			Average Attendance	Percentage of Attendance	Grades										
		Boys	Girls	Total			I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Prince Edward Island	1	17	16	33	27	81·81	12	5	4	7	3	.....	.....	2	.....	.....	.....
Nova Scotia	9	212	248	460	356	77·39	177	79	57	58	33	34	18	4	.....	.....	.....
New Brunswick	10	182	206	388	284	73·19	115	73	61	47	37	26	21	6	2	.....	.....
Quebec	30	769	871	1,640	1,270	77·44	571	276	212	199	150	114	63	37	18	.....	.....
Ontario	80	1,527	1,716	3,243	2,494	76·59	981	550	457	385	338	206	170	142	10	3	1
Manitoba	49	844	838	1,682	1,104	65·64	908	301	195	117	88	45	14	12	2	.....	.....
Saskatchewan	31	443	457	900	761	84·55	354	202	159	78	58	39	7	3	.....	.....	.....
Alberta	3	93	115	208	175	84·13	71	27	18	22	44	17	4	4	1	.....	.....
Northwest Territories	5	35	36	71	50	70·42	33	6	15	5	5	5	2	.....	.....	.....	.....
British Columbia	59	1,041	1,136	2,177	1,522	69·91	1,036	372	267	185	171	78	46	21	1	.....	.....
Yukon	8	79	101	180	135	75·00	115	31	24	5	4	1	.....	.....	.....	.....	.....
Total—Day Schools	285	5,242	5,740	10,982	8,178	74·37	4,373	1,922	1,469	1,108	931	565	345	231	34	3	1

COMBINED WHITE AND INDIAN SCHOOLS

Province	Number of Schools	Number on Roll			Average Attendance	Percentage of Attendance	Grades										
		Boys	Girls	Total			I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Quebec	2	28	31	59	56	94·91	50	4	3	2	.....	.....	.....	.....	.....	.....	.....
Ontario	3	28	25	53	50	94·33	9	12	6	11	5	5	3	2	.....	.....	.....
Manitoba	2	9	12	21	12	57·14	7	6	4	2	2	.....	.....	.....	.....	.....	.....
Total—Combined White and Indian Day Schools	7	65	68	133	118	88·72	66	22	13	15	7	5	3	2	.....	.....	.....

TABLE No. 9—*Concluded*

SUMMARY OF SCHOOL STATEMENT

Province	Classes of Schools			Total Number of Schools	Number on Roll			Average Attendance	Percentage of Attendance	Grades										
	Day	Residential	Combined		Boys	Girls	Total			I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Prince Edward Island	1	.....	.....	1	17	16	33	27	81·81	12	5	4	7	3	.....	.....	2	.....	.....	.....
Nova Scotia	9	1	.....	10	291	330	621	505	81·32	216	101	85	85	51	44	29	9	1	.....	.....
New Brunswick	10	.....	.....	10	182	206	388	284	73·19	115	73	61	47	37	26	21	6	2	.....	.....
Quebec	30	2	2	34	823	936	1,759	1,364	77·54	644	292	228	207	156	114	63	37	18	.....	.....
Ontario	80	12	3	95	2,265	2,541	4,806	3,854	80·10	1,396	775	653	566	491	333	272	227	89	3	1
Manitoba	49	8	2	59	1,302	1,423	2,725	2,008	73·69	1,175	469	345	261	220	123	76	35	21	.....	.....
Saskatchewan	31	13	.....	44	1,261	1,455	2,716	2,337	86·04	843	478	433	327	263	191	106	56	19	.....	.....
Alberta	3	19	.....	22	1,039	1,205	2,244	1,952	86·98	793	335	273	268	261	164	88	57	5	.....	.....
Northwest Territories	5	4	.....	9	135	172	307	241	78·50	144	56	44	27	18	12	2	2	2	.....	.....
British Columbia	59	13	.....	72	2,043	2,210	4,253	3,409	80·15	1,520	729	578	452	411	244	178	103	38	.....	.....
Yukon	8	1	.....	9	117	132	249	170	68·27	144	44	43	8	7	3	.....	.....	.....	.....	.....
Totals	285	73	7	365	9,475	10,626	20,101	16,151	80·34	7,002	3,357	2,747	2,255	1,918	1,254	835	534	195	3	1

IMMIGRATION BRANCH

A. L. JOLLIFFE, DIRECTOR

The number of immigrants admitted to Canada during the fiscal year was 79,194, as compared with 66,990 in the fiscal year 1946-47, an increase of 18·2 per cent.

Immigrants arriving at ocean ports numbered 70,160 and from the United States, 9,034. Their racial origins were: British, 49,864; French, 1,589, the remaining 27,741 representing 45 other racial groups. Classified by nationality, 47,829 were British subjects; 8,099 United States citizens, the remaining 23,266 comprising 45 nationalities. Classified by sex, 42,124 were males and 37,070 females. Non-immigrants entering Canada numbered 37,492,118, an increase of 8·7 per cent over the previous fiscal year.

Tourist Movement

During the year, 37,579,485 persons applied for entry to Canada. Of this number 8,173 were refused admission. The figure of 37,492,118 represents the actual number of non-immigrants examined at ports of entry, and not necessarily the number of different individuals who entered Canada. Out of the total of 37,492,118 persons who entered Canada, it is estimated that approximately 23,305,324 were tourists, an increase of some 2,682,920 over the preceding year. The breakdown of tourists by districts and from overseas and by their method of entry is as follows:

Atlantic	5,211,491
Eastern	15,787,808
Western	1,198,549
Pacific	1,086,155
Overseas	21,321
	23,305,324
Highway and Ferry	21,489,881
Train	1,461,528
Boat	332,594
From Overseas	21,321
	23,305,324

The tables appearing below show the comparative figures of non-immigrant entries for the past ten years:

Non-Immigrants Entering Canada

—	Via Ocean Ports	From U.S.A.	Totals
Fiscal year ended March 31, 1939	53,822	29,099,356	29,153,178
" " 1940	42,126	28,295,332	28,337,458
" " 1941	34,035	18,381,660	18,415,695
" " 1942	28,395	17,983,877	18,012,272
" " 1943	31,530	15,109,056	15,140,586
" " 1944	24,665	16,356,484	16,381,149
" " 1945	25,311	21,236,327	21,261,638
" " 1946	29,645	28,890,785	28,920,430
" " 1947	40,807	34,652,434	34,693,241
" " 1948	45,750	37,446,368	37,492,118

Residents of Canada Returning After Visits Abroad

—	Via Ocean Ports	From U.S.A.*	Totals
Fiscal year ended March 31, 1939	30,446	12,098,397	12,128,843
" " 1940	18,757	11,590,952	11,609,709
" " 1941	10,687	5,224,356	5,235,043
" " 1942	14,113	4,047,167	4,061,280
" " 1943	15,294	4,394,613	4,409,907
" " 1944	11,551	5,860,609	5,872,160
" " 1945	13,127	8,547,051	8,560,178
" " 1946	13,941	11,076,564	11,090,505
" " 1947	16,919	14,047,603	14,064,522
" " 1948	24,429	14,153,356	14,177,785

* Includes residents of Canadian border cities.

The following table shows, by Immigration districts, the number of persons examined upon application for entry to Canada and their disposition:

Admissions and Rejections by Districts, Fiscal Year, 1947-48

—	Admitted as Immigrants	Admitted as Non-immigrants	Rejected
Atlantic	47,396	9,378,845	1,206
Eastern	10,956	23,368,683	5,740
Western	1,294	2,381,595	215
Pacific	2,022	2,362,994	809
Through U.S.A. Ocean Ports	17,328	.....	192
Not shown	198	1	11
Totals	79,194	37,492,118	8,173

Returning Canadians

It is interesting to note that the number of Canadians returning from abroad to make their homes in Canada again shows an increase this year. During the year, the number of returning Canadians was 9,009, as against 6,315 in the fiscal year 1946-47. Figures for the years 1924 to 1934 appear on page 181 of the report for the year ended March 31, 1944. Figures for subsequent years are shown in the following table:

—	Canadian Born	British Born Outside Canada	Canadians Naturalised	Totals
Fiscal year 1934-35	5,811	937	870	7,618
Fiscal year 1935-36	4,854	418	542	5,814
Fiscal year 1936-37	4,522	319	223	5,064
Fiscal year 1937-38	4,524	356	329	5,209
Fiscal year 1938-39	3,825	360	386	4,571
Fiscal year 1939-40	3,687	505	369	4,561
Fiscal year 1940-41	4,910	177	53	5,140
Fiscal year 1941-42	3,123	143	52	3,318
Fiscal year 1942-43	3,056	167	30	3,253
Fiscal year 1943-44	2,090	93	19	2,202
Fiscal year 1944-45	2,156	130	18	2,304
Fiscal year 1945-46	2,653	207	35	2,895
Fiscal year 1946-47	5,448	756	111	6,315
Fiscal year 1947-48	6,406	2,297	306	9,009
Total	57,065	6,865	3,343	67,273

Students

During the fiscal year 6,163 students were admitted to Canada for the purpose of attending school, college or university, as compared with 5,310 during the previous year. Of this number 384 were British subjects, 4,336 United States citizens, 240 from Central and South America and 1,203 from 45 other countries.

Legislation and Regulations

(1) By Order in Council P.C. 1329, dated the 19th day of April, 1947, the provisions of Order in Council P.C. 1413, dated the 7th day of August, 1929, prohibiting the landing in Canada of contract labour other than farmers, farm labourers and houseworkers or any contract labourer where the Minister of Mines and Resources is not satisfied that his labour or service is required in Canada, were suspended, in view of the existing employment situation.

(2) By Order in Council P.C. 1734, dated the 1st day of May, 1947, the admissible classes were widened to include the husband or wife and unmarried children of first degree relatives of persons legally resident in Canada, and the age limit of admissible orphaned nephews or nieces of such residents was raised from 18 to 21 years. P.C. 1374 also permits the landing of a person entering Canada for the purpose of marriage to a legal resident of Canada.

(3) Order in Council P.C. 2180, dated the 6th day of June, 1947, granted authority for the immediate admission to Canada of 5,000 individuals from the displaced persons camps in Europe, by waiving the provisions of P.C. 695.

(4) Order in Council P.C. 2388, dated the 17th day of June, 1947, further amended Order in Council P.C. 3016, dated the 29th day of November, 1938, to exclude from the necessity of obtaining the visa of a Canadian Immigration Officer, non-immigrant nationals of European countries with which Canada has a reciprocal agreement abolishing visas.

(5) Order in Council P.C. 2856, dated the 18th day of July, 1947, granted authority for the admission to Canada of an additional 5,000 displaced persons.

(6) Order in Council P.C. 2908, dated the 31st day of July, 1947, revoked the provisions of Order in Council P.C. 1373, dated the 9th day of April, 1946, prohibiting the admission of enemy aliens, insofar as they applied to nationals of Finland, Hungary, Italy, and Roumania, in view of the ratification by Parliament of treaties of peace with those countries.

(7) By Order in Council P.C. 2951, dated the 31st day of July, 1947, immigrants from countries where the rate of tuberculosis is higher per capita than in Canada were required to produce an X-ray film of the chest with a radiologist's report certifying that they are free from tuberculosis.

(8) Order in Council P.C. 3926, dated the 1st day of October, 1947, granted authority for the admission to Canada of an additional 10,000 displaced persons.

(9) Order in Council P.C. 4849, dated the 26th day of November, 1947, revoked P.C. 695, dated the 21st day of March, 1931, as amended, for the purpose of consolidating into one Order the regulations governing the classes and occupations admissible to Canada.

(10) Order in Council P.C. 4850, dated the 26th day of November, 1947, revoked Order in Council P.C. 1373, dated the 9th day of April, 1946, and excluded the landing in Canada of enemy aliens, with the exception of those who can satisfy the Minister of Mines and Resources that they were opposed to an enemy government, and the nationals of Finland, Italy, Hungary, and Roumania with whose countries treaties of peace have been ratified by Canada.

(11) Order in Council P.C. 4851, dated the 26th day of November, 1947, revoked P.C. 3016, dated the 29th day of November, 1938, as amended, for the purpose of consolidating into one Order the regulations governing the production of passports or travelling documents by immigrants upon entry into Canada.

Administration and Inspectional Work

The increased activity of the Immigration Branch noted in the report for the fiscal year 1946-47 was further intensified during the present year. In spite of an overall increase in staff of 170, the personnel of the Branch were severely taxed to carry out their duties. With the return of more normal travelling conditions and as the result of the difficult economic situation prevailing in many European countries, the migration trend to Canada has been noticeably accentuated. The undertaking by Canada to assist in relieving the plight of refugees and displaced persons in Europe and the measures taken by the Government to honour its pledge have been carried out in large part by the Immigration Branch. The setting up of an organization in occupied territory for the civil and medical examination of thousands of displaced persons, with the attendant large volume of investigational work in Canada, has been an undertaking of some magnitude.

While a concerted effort has been made to give effect to the policy of the Government in relation to displaced persons, an extensive movement of agriculturists from the flooded areas of the Netherlands has been initiated during the year. This highly desirable movement has involved a good deal of planning as well as a large volume of investigational work by the field staff in Canada.

Immigration from the British Isles has continued to occupy a high priority in the activity of the Immigration Branch, and the re-establishment of immigration facilities in Europe, which had been beset by serious difficulties owing to the unsettled conditions as an aftermath of the war, is now well under way.

FIELD AND INSPECTIONAL SERVICE, CANADA

Servicemen's Dependants.—The movement of servicemen's dependants practically ceased during the year. Outstanding applications, numbering 225, were investigated and forwarded overseas. Applications for free transportation ceased to be accepted after December 31, 1947, but travel warrants issued prior to that date were honoured up to February 28, 1948.

During this period, approximately 700 outstanding cases were re-investigated. On February 2, 1947, the Immigration Branch took over from the Department of National Defence the issuing of travel warrants and the responsibility for the movement of servicemen's dependants. From April 1, 1947, to March 31, 1948, 720 wives and 616 children, a total of 1,336 dependants came forward, bringing the total number of servicemen's dependants brought to Canada to 43,454 adults and 20,997 children, a total of 64,451 dependants.

Polish Ex-Servicemen.—Under a special plan, authority was granted for the admission of Polish ex-servicemen to assist farmers in urgent need of help. These Poles agreed to remain in agricultural employment for a period of two years. Their employers, in turn, agreed to provide employment at prevailing rates of pay and to supply living accommodation. It is the intention, at the end of two years, to give consideration to the granting of permanent admission to Canada to these persons. During the fiscal year under review 1,650 Polish ex-servicemen were brought to Canada bringing the total to 4,527.

Examination of Ships' Crews.—Examination of ships' crews during the year was as follows:

District	*Number of Ships*	*Number of Crew*
Atlantic	3,848	189,287
Eastern	1,725	49,563
Western	395	10,016
Pacific	3,129	108,990
Total	9,097	357,856

Air Traffic.—A total number of 209,932 persons arrived in Canada by air during the fiscal year as compared with 186,199 during the previous year. Of these, 32,443 were from overseas as compared with 12,897 during the previous year. The arrivals by districts were as follows: Atlantic, 82,326; Eastern, 64,834; Western, 19,559; Pacific, 43,213.

Under the Ontario Provincial Immigration Scheme a total of 207 flights had arrived from Britain at Malton Airport by March 31, 1948, carrying 6,963 immigrants, 7 non-immigrants, and 100 returning Canadians.

Investigational Work.—There was a marked increase in the number of investigations conducted during the year. Investigations, including those pertaining to settlement conditions, constitute one of the most important phases of Immigration Branch work. The investigations by districts were as follows: Atlantic, 21,050; Eastern, 35,547; Western, 21,437; Pacific, 3,386.

Deportations.—During the year 386 persons were deported: 93 to the United States and 293 to other countries. Of this total, 10 were deported because they had become public charges, 202 for having gained entry by misrepresentation, 117 following convictions for criminal offences, 5 for having been previously deported, 33 on grounds of mental disability and 19 for infraction of the Opium and Narcotic Drugs Act.

Naturalization.—Applications for citizenship made to the Registrar of the Canadian Citizenship Branch of the Department of the Secretary of State are referred to the Immigration Branch for proof of legal landing. During the fiscal year 14,316 such cases were referred to the Immigration Branch.

Immigration Facilities.—It was possible during the year to improve immigration facilities at ocean ports and inland offices. At Halifax more spacious quarters were provided on Pier 21. Plans have been completed and approved for the erection of immigration quarters and inspectional facilities at West Saint John, N.B. A new building has been erected at Edmundston, N.B. At Quebec the Louise Embankment accommodation has been renovated and put in order for detention purposes. Extensive alterations were made to the Montreal building and plans are under consideration for the erection of inspectional facilities to be used jointly by Customs and Immigration at Armstrong, P.Q. Improved office accommodation has also been obtained at Toronto, Malton Airport, Niagara Falls, Hamilton, London, and Cornwall. A new office was opened at Sudbury on February 2, 1947.

FIELD AND INSPECTIONAL SERVICE, OVERSEAS

United Kingdom.—While the interest in Canada continues high in the British Isles and immigrants presenting themselves are of a high standard, the continued shortage of shipping facilities has retarded the movement of immigrants from the British Isles. Steps designed to ensure more shipping accommodation next year are under consideration. The number of inquiries at the London office during the fiscal year totalled 82,565. During the same period the London office granted 1,744 immigrant and 534 non-immigrant visas to aliens resident in the United Kingdom. Fifty-three applications were refused.

There has been a marked increase in the number of examinations conducted by the medical officers of the Department of National Health and Welfare whose doctors, together with British roster doctors, examined 63,519 persons. Beginning in October, 1947, an X-ray examination of the chest was required for all immigrants from countries where the incidence of tuberculosis per capita is higher than in Canada.

Immigration Facilities.—After much searching, suitable office premises have been secured at 42-46 Weymouth Street, London, W.1. It is hoped that they will be ready for occupancy in the late summer. Negotiations for the lease of office accommodation at Liverpool and Belfast are also in progress. It is expected that it may be possible to occupy more adequate offices at 34 Moorefields in Liverpool, toward the end of 1948.

Continental Europe.—There was a general increase in the work of Continental offices located at Paris, Brussels, and The Hague. The fourth office on the Continent was opened at Rome on January 20, 1948.

A brief statement of visas granted and refused in Continental offices is as follows:

Country	*Visas Granted*		*Visas Refused*
	Immigrant	*Non-Immigrant*	
Paris	963	1,805	516
Brussels	1,580	512	497
The Hague	4,377	685	712
Rome	520	34	35
Total	7,440	3,036	1,760

Netherlands Farm Families.—Due to the loss of land in the Netherlands, owing partly to inundations caused by the German armed forces during World War II, the problem of surplus agricultural population became a pressing one for the Netherlands Government. Both the Netherlands authorities and Netherlands agriculturists turned their eyes to Canada as the country of their first preference. From this developed one of the most interesting and valuable immigrant movements. Through the efforts of the Netherlands authorities and the co-operation of the Stichting Landverhuizing (Netherlands Immigration Foundation), an agency of the Netherlands Government, applications from Dutch farmers are carefully examined in the Netherlands, while applications for Dutch agriculturists received from farmers in Canada are investigated by the Immigration Branch field staffs in respect of settlement arrangements. Applications are also received from Provincial Governments, National Employment Service offices, the Colonization departments of the railways and from other sources. As settlement conditions are approved, applications are forwarded to the Immigration Branch office at The Hague for the issuance of the necessary visas.

Netherlands farmers are not farm labourers. They are bona fide farm owners with capital sufficient to purchase farms in Canada. Owing to exchange difficulties they are not for the present able to export their capital but eventually expect to acquire farms of their own. The Netherlands farm families movement has been most successful during the fiscal year and it is intended that it should be continued and amplified during the course of the next fiscal year. The first boat carrying Dutch farmers arrived at Montreal on June 27, 1947.

Displaced Persons.—The movement of displaced persons in the occupied territory of Germany and Austria has been a major project. The first immigration teams reached Germany in March, 1947. The first refugees sailed for Canada on April 4, 1947, on the *S.S. Aquitania.*

In co-operation with the Department of Labour and the Department of National Health and Welfare immigration teams, operating under extreme difficulties owing to lack of transport and hotel facilities, were able to examine over 20,000 displaced persons.

An Immigration-Labour Committee was set up at Ottawa to deal with the admission of displaced persons under bulk labour schemes. This Committee is responsible for approving in principle the admission of stated numbers of displaced persons in the light of existing labour requirements. From time to time representatives of various industries proceeded to Germany to assist in trade-

testing displaced persons otherwise admissible to Canada. In many cases industries have agreed to bear the rail transportation costs from Canadian ocean ports to the destination of their prospective employees. Employment is offered displaced persons at prevailing rates for a period of one year after which they are free to find their own level in the national economy. Up until March 31, 1948, the Immigration-Labour Committee had given its approval to the following group movements:

Miners	2,222
Railway workers	2,100
Steel workers	375
Woods workers	3,622
Aluminum workers	50
Foundry workers	64
Hydro construction workers	2,000
Clothing industry workers	2,316
Domestics	4,500
Farmers	2,000
Fur workers	500
Shoe workers	100
Textile workers	50

In addition to displaced persons whose entry to Canada is authorized by Order in Council, first degree relatives of displaced persons may apply for their admission. Up until the end of the fiscal year, 28,546 applications had been received for the admission of such first degree relatives. Of these 22,917 had been investigated and approved as to settlement arrangements in Canada and their names forwarded to immigration offices in occupied territory and to the International Refugee Organization. The selection, processing, transportation, and reception in Canada of displaced persons are being carried out in co-operation with the International Refugee Organization and with the Departments of Labour, National Health and Welfare, and Justice. The following tables show the movement of displaced persons to Canada since its inception, by occupational groups, racial origins, and sex.

Admissions of Displaced Persons to Canada, by Occupational Groups, by Province of Destination during the Fiscal Year 1947-48

—	N.S.	P.E.I.	N.B.	Que.	Ont.	Man.	Alta.	Sask.	B.C.	Y.T.	Totals
Domestics	49	5	78	1,090	261	193	31	11	.....	.....	1,718
Woodworkers	.....	.....	.....	.....	3,599	.....	.....	.....	.....	.....	3,599
Textile workers	.....	.....	.....	106	101	.....	.....	.....	.....	.....	207
Miners	.....	.....	.....	570	366	26	.....	.....	1	20	983
Garment workers	.....	.....	.....	715	88	.....	.....	.....	.....	.....	803
Garment workers' dependants	.....	.....	.....	502	67	.....	.....	.....	.....	.....	569
Steel and foundry workers	.....	.....	.....	19	149	20	.....	.....	.....	.....	188
Steel and foundry workers' dependants	.....	.....	.....	2	8	10	.....	.....	.....	.....	20
Railway workers	.....	.....	.....	167	22	75	.....	.....	25	.....	289
Hydro workers	.....	.....	.....	.....	246	.....	.....	.....	.....	.....	246
Domestic married couples	2	.....	.....	78	.....	.....	.....	.....	.....	.....	80
Totals	51	5	78	3,249	4,907	324	31	11	26	20	8,702
Jewish orphans											506
Relatives											5,042
Grand Total											14,250

Admissions of Displaced Persons to Canada, by Racial Origins, during the Fiscal Year 1947-48

Croatian	82	Ruthenian (Ukrainian)	3,321
Czech	38	Greek	5
Dutch	732	Slovak	6
Esthonian	502	Magyar (Hungarian)	83
German	233	Roumanian	23
Hebrew	2,181	Finnish	2
Jugo-Slavian	198	French	2
Latvian	877	Turkish	1
Lithuanian	1,978	Austrian	3
Polish	3,604	Bulgarian	4
Russian	272		
Serbian	98	Total	14,250
Swedish	5		

Admissions of Displaced Persons to Canada, by Sex, during the Fiscal Year 1947-48

Adult Males	8,544
Adult Females	4,004
Children under 18 years of age	1,702
TOTAL	14,250

The procedure relative to the admission of relatives of displaced persons to Canada is for the sponsor to make application to the nearest immigration office. From the information supplied on Immigration Form 55 an investigation is made on settlement arrangements in Canada. In approved cases the list of relatives is forwarded to the Immigration Headquarters, at Karlsruhe, Germany, with copy to I.R.O. From the approved lists I.R.O. field staffs seek out and assemble the proposed immigrants for examination by Immigration teams.

During the fiscal year the Government authorized the admission of 20,000 displaced persons under Orders in Council, P.C. 2180, P.C. 2856, and P.C. 3926. (*See Legislation and Regulations.*)

Canadian Christian Council for Resettlement of Refugees:—The C.C.C.R.R. was formed in June, 1947, to assist in the processing overseas and movement to Canada of approved immigrants who are displaced persons in occupied territory but who do not come within the mandate of I.R.O. The C.C.C.R.R. is a voluntary organization consisting of the following members:—The Catholic Immigrant Aid Society, The Canadian Mennonite Board of Colonization, The German Baptist Colonization and Immigration Society, The Canadian Lutheran World Relief, The Sudeten Committee, and The Latvian Relief Fund of Canada.

This organization has representatives in Germany. The C.C.C.R.R. also undertakes to have approved immigrants X-rayed and blood-tested, documented, and assembled for examination by Immigration teams. This work is performed in exactly the same manner as for approved immigrants coming within the mandate of I.R.O. Almost all immigrants handled by the C.C.C.R.R. are first degree relatives of residents of Canada.

Immigrants from Malta:—By arrangement with the Government of Malta, Canada authorized the admission of 500 Maltese with their dependants. The placement of the heads of families in Canada is to be arranged by the Department of Labour. The dependants will join the heads of families when they are in a position to receive and care for them.

CHINESE IMMIGRATION

The Chinese Immigration Act, first enacted in 1885, was repealed on May 14, 1947. As of that date Chinese became subject, with the nationals of other countries, to the provisions of the Immigration Act and Regulations. With the repeal of the Chinese Immigration Act, Chinese who are Canadian citizens are entitled to apply for the admission of their wives and unmarried children under 18 years of age.

TABLE 1

Immigration to Canada from 1900 to 1948

		From Overseas			From U.S.A.				Grand Totals
		British Nationals	Others	Totals	U.S.A. Citizens	British Nationals	Others	Totals	
Six months ended June 30,	1900	5,141	10,211	15,352	.....	.....	.....	8,543	23,895
Fiscal year ended June 30,	1901	11,813	19,349	31,162	.....	.....	.....	17,987	49,149
" "	1902	17,270	23,721	40,991	.....	.....	.....	26,388	67,379
" "	1903	42,200	36,691	78,891	.....	.....	.....	49,473	128,364
" "	1904	51,050	34,110	85,160	12,648	4,145	23,946	40,739	125,899
" "	1905	65,967	36,756	102,723	15,477	2,263	22,190	39,930	142,653
" "	1906	88,174	43,094	131,268	33,013	2,108	17,675	52,796	184,064
Nine months ended Mar 31,	1907	59,272	30,736	90,008	20,479	1,309	10,369	32,157	122,165
Fiscal year ended March 31,	1908	126,783	77,374	204,157	31,411	2,674	19,067	53,152	257,309
" "	1909	55,463	31,613	87,076	33,474	2,894	17,926	54,294	141,370
" "	1910	63,757	41,239	104,996	65,190	3,662	22,196	91,048	196,044
" "	1911	126,170	63,463	189,633	77,353	5,007	22,524	104,884	294,517
" "	1912	141,504	79,023	220,527	91,840	6,236	16,250	114,326	334,853
" "	1913	152,373	111,050	263,423	92,061	7,398	19,959	119,418	382,841
" "	1914	144,513	132,835	277,348	74,745	6,374	8,773	89,892	367,240
" "	1915	44,117	40,893	85,010	34,745	3,541	3,482	41,768	126,778
" "	1916	9,032	2,568	11,600	21,370	2,796	1,687	25,853	37,453
" "	1917	9,980	4,005	13,985	43,261	3,324	4,558	51,143	65,128
" "	1918	4,879	2,881	7,760	47,818	3,444	6,923	58,185	65,945
" "	1919	10,701	6,286	16,987	28,280	1,725	1,950	31,955	48,942
" "	1920	60,659	7,021	67,680	36,628	2,250	1,850	40,728	108,408
" "	1921	75,783	24,635	100,418	33,891	2,768	1,651	38,310	138,728
" "	1922	39,606	21,048	60,654	18,782	1,825	1,063	21,670	82,324
" "	1923	36,360	14,520	50,880	14,095	1,641	830	16,566	67,446
" "	1924	78,740	49,299	128,039	14,928	1,478	805	17,211	145,250
" "	1925	54,943	40,601	95,544	13,171	1,794	853	15,818	111,362
" "	1926	37,569	39,717	77,286	15,442	2,251	1,085	18,778	96,064
" "	1927	50,378	72,586	122,964	17,820	2,239	966	21,025	143,989
" "	1928	51,552	75,041	126,593	21,260	2,696	1,051	25,007	151,600
" "	1929	59,497	77,666	137,163	26,539	3,061	960	30,560	167,723
" "	1930	64,962	67,599	132,561	26,751	3,121	855	30,727	163,288
" "	1931	28,144	35,799	63,943	20,723	2,938	619	24,280	88,223
" "	1932	7,332	4,123	11,455	12,277	1,815	205	14,297	25,752
" "	1933	3,283	3,303	6,586	11,172	1,806	218	13,196	19,782
" "	1934	2,454	3,709	6,163	6,545	1,032	163	7,740	13,903
" "	1935	2,408	3,768	6,176	5,104	769	87	5,960	12,136
" "	1936	2,264	3,718	5,982	4,322	709	90	5,121	11,103
" "	1937	2,521	4,389	6,910	4,301	742	70	5,113	12,023
" "	1938	3,351	6,651	10,002	4,727	852	64	5,643	15,645
" "	1939	3,831	7,634	11,465	4,685	917	61	5,663	17,128
" "	1940	3,962	6,495	10,457	4,383	1,234	131	5,748	16,205
" "	1941	3,428	625	4,053	5,295	2,064	84	7,443	11,496
" "	1942	2,353	201	2,554	5,075	1,180	56	6,311	8,865
" "	1943	2,524	94	2,618	3,457	1,344	26	4,827	7,445
" "	1944	4,519	80	4,599	3,302	1,101	38	4,441	9,040
" "	1945	10,564	118	10,682	3,687	907	30	4,624	15,306
" "	1946	21,463	2,164	23,627	6,051	1,354	49	7,454	31,081
" "	1947	54,036	1,544	55,580	9,546	1,771	93	11,410	66,990
" "	1948	47,009	23,151	70,160	8,027	820	187	9,034	79,194

TABLE 2

Immigration to Canada for the Period July 1, 1900, to March 31, 1910

—	Fiscal Years										Totals
	1900–1	1901–2	1902–3	1903–4	1904–5	1905–6	Nine Months Ended March 31, 1907	1907–8	1908–9	1909–10	
English	9,331	12,783	32,087	36,003	48,847	65,135	41,156	90,380	37,019	40,416	413,157
Irish	933	1,311	2,236	3,128	3,998	5,018	3,404	6,547	3,609	3,940	34,124
Scottish	1,476	2,853	7,046	10,552	11,744	15,846	10,729	22,223	11,810	14,706	108,985
Welsh	70	312	423	691	770	797	502	1,032	463	728	5,788
Totals	11,810	17,259	41,792	50,374	65,359	86,796	55,791	120,182	52,901	59,790	562,054
African, South	.....	.....	.....	21	35	46	23	76	53	97	351
Arabian	98	70	46	58	48	19	31	50	4	14	438
Armenian	62	112	113	81	78	82	208	563	79	75	1,453
Australian	3	11	46	58	204	322	185	180	171	203	1,383
Austro-Hungarian	5,692	8,557	13,095	11,137	10,089	10,170	4,045	21,376	10,798	9,757	104,716
Brazilian	.....	.....	.....	2	1	2	5	1	4	.....	15
Bulgarian	.....	1	7	14	2	71	179	2,529	56	557	3,416
Chinese	7	2	.....	.....	.....	18	92	1,884	1,887	2,156	6,046
Doukhobor	.....	12	.....	.....	24	204	.....	.....	.....	.....	240
Dutch	25	35	223	169	281	389	394	1,212	495	741	3,964
East Indian	.....	.....	.....	.....	45	387	2,124	2,623	6	10	5,195
Egyptian	1	3	1	3	2	18	10	8	2	2	50
Finnish	682	1,292	1,734	845	1,323	1,103	1,049	1,212	669	1,457	11,366
French and Belgian	492	654	1,240	2,392	2,539	2,754	1,964	3,885	2,658	2,637	21,215
German	984	1,048	1,887	2,985	2,759	1,796	1,903	2,377	1,340	1,533	18,612
Greek	81	161	193	191	98	254	545	1,053	192	452	3,220
Hebrew	2,765	1,015	2,066	3,727	7,715	7,127	6,584	7,712	1,636	3,182	43,529
Italian	4,710	3,828	3,371	4,445	3,473	7,959	5,114	11,212	4,228	7,118	55,458
Japanese	6	.....	.....	.....	354	1,922	2,042	7,601	495	271	12,691
Malay	.....	5	.....	.....	.....	.....	.....	.....	.....	.....	5
Maltese	.....	.....	2	.....	.....	.....	.....	.....	.....	.....	2
Mennonite	.....	52	38	11	.....	.....	.....	.....	.....	.....	101
Negro	.....	.....	.....	.....	5	42	108	136	73	7	371
Newfoundland	.....	.....	335	519	190	340	1,029	3,374	2,108	3,372	11,267
New Zealand	.....	.....	2	23	57	89	30	70	65	82	418
Persian	.....	1	40	5	8	7	31	7	1	5	105
Polish	162	230	274	669	745	725	1,033	1,593	376	1,407	7,214
Portuguese	.....	.....	.....	.....	1	6	2	2	2	2	15
Roumanian	152	551	438	619	270	396	431	949	278	293	4,377
Russian	1,044	2,467	5,505	1,955	1,887	3,152	1,927	6,281	3,547	4,564	32,329
Scandinavian	1,750	2,451	5,448	4,203	4,118	3,859	2,296	4,073	2,082	3,782	34,062
Serbian	23	.....	2	10	7	19	4	48	31	76	220
Spanish	14	1	7	5	10	12	29	61	32	42	213
Swiss	30	17	73	128	150	172	112	195	129	211	1,217
Syrian	464	1,066	847	369	630	336	277	732	189	195	5,105
Turkish	37	17	43	29	30	357	232	489	236	517	1,987
U.S.A. citizens, via ocean ports	68	73	.....	58	109	123	89	133	94	186	933
West Indian	.....	.....	23	55	77	194	90	278	159	203	1,079
Total, Continental, etc...	19,352	23,732	37,099	34,786	37,364	44,472	34,217	83,975	34,175	45,206	394,378
From the United States.	17,987	26,388	49,473	40,739	39,930	52,796	32,157	53,152	54,294	91,048	457,964
Total immigration	49,149	67,379	128,364	125,899	142,653	184,064	122,165	257,309	141,370	196,044	1,414,396

TABLE 3

Immigration to Canada for the Period April 1, 1910, to March 31, 1920

	Fiscal Years										Totals
	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16	1916–17	1917–18	1918–19	1919–20	
English	84,707	95,107	108,082	102,122	30,807	5,857	5,174	2,477	7,954	45,173	487,460
Irish	6,877	8,327	9,706	9,585	3,525	818	958	174	336	2,751	43,057
Scottish	29,924	32,988	30,735	29,128	8,346	1,887	2,062	473	1,518	10,997	148,058
Welsh	1,505	1,699	2,019	1,787	598	102	88	54	106	682	8,640
Totals	123,013	138,121	150,542	142,622	43,276	8,664	8,282	3,178	9,914	59,603	687,215
African, South	86	144	22	56	23	11	1	4	.....	23	370
Albanian	.....	.....	.....	3	4	.....	.....	.....	.....	.....	7
Arabian	3	2	10	16	.....	.....	.....	.....	.....	.....	31
Argentinian	.....	.....	.....	2	5	.....	.....	.....	.....	2	9
Armenian	20	60	100	139	36	.....	3	2	.....	10	370
Australian	266	184	106	106	51	32	18	34	35	88	920
Austro-Hungarian	16,285	21,651	21,875	28,323	7,150	15	1	.....	2	8	95,310
Belgian	1,563	1,601	1,826	2,651	1,149	172	126	19	48	1,532	10,687
Brazilian	13	.....	.....	5	.....	2	.....	.....	.....	.....	20
Bulgarian	1,068	3,295	4,616	1,727	4,048	1	.....	.....	.....	1	14,756
Chinese	5,278	6,247	7,445	5,512	1,258	88	393	769	4,333	544	31,867
Cuban	.....	.....	.....	10	1	1	3	1	.....	2	18
Doukhobor	41	24	108	4	.....	.....	.....	.....	.....	.....	177
Dutch	931	1,077	1,524	1,506	605	186	151	94	59	154	6,287
East Indian	5	3	5	88	.....	1	.....	.....	.....	.....	102
Egyptian	3	.....	7	5	.....	.....	.....	.....	.....	.....	15
Finnish	2,132	1,646	2,391	3,183	459	139	249	113	2	44	10,358
French	2,041	2,094	2,755	2,683	1,206	180	199	114	222	1,584	13,078
German	2,533	4,664	4,953	5,537	2,472	27	9	1	1	12	20,209
Greek	777	693	1,390	1,102	1,147	145	258	45	4	39	5,600
Hebrew	5,146	5,322	7,387	11,252	3,107	65	136	32	22	116	32,585
Italian	8,359	7,590	16,601	24,722	6,228	388	758	189	49	1,165	66,049
Japanese	437	765	724	856	592	401	648	883	1,178	711	7,195
Macedonian	.....	.....	.....	17	132	.....	.....	.....	.....	.....	149
Maltese	.....	.....	128	402	19	4	109	144	2	405	1,213
Mexican	.....	3	9	9	.....	.....	.....	1	3	.....	25
Montenegrin	.....	.....	36	13	9	.....	1	.....	.....	.....	59
Negro	12	138	211	266	202	34	98	35	22	61	1,079
Newfoundland	2,229	2,598	1,036	496	338	255	1,243	1,199	512	443	10,349
New Zealand	116	61	39	24	21	18	12	13	15	31	350
Persian	19	19	20	19	7	3	.....	2	2	.....	91
Polish	2,177	5,060	9,945	9,793	1,976	8	12	.....	4	76	29,051
Portuguese	13	6	9	58	8	.....	1	1	.....	3	99
Roumanian	511	793	1,116	1,504	361	4	4	.....	.....	21	4,314
Russian	6,621	9,805	18,623	24,485	5,201	40	25	42	42	51	64,935
Scandinavian—											
Danish	535	628	798	871	326	167	145	74	44	233	3,821
Icelandic	250	205	231	292	145	15	9	3	12	11	1,173
Norwegian	2,169	1,692	1,832	1,647	788	232	303	235	91	179	9,168
Swedish	3,213	2,394	2,477	2,435	916	177	332	156	101	241	12,442
Serbian	50	209	366	193	220	6	1	.....	1	12	1,058
Spanish	197	191	296	1,138	755	11	76	28	12	15	2,719
Swiss	270	230	246	269	209	42	30	12	11	100	1,419
Syrian	124	144	232	278	79	3	9	2	.....	18	889
Turkish	469	632	770	187	33	.....	5	.....	.....	1	2,097
U.S.A. citizens, via ocean ports	203	143	121	121	41	15	20	28	21	55	768
West Indian	455	393	495	719	389	47	315	307	223	66	3,409
Others	.....	.....	.....	2	18	1	.....	.....	.....	20	41
Total, Continental, etc.	66,620	82,406	112,881	134,726	41,734	2,936	5,703	4,582	7,073	8,077	466,738
From the United States	104,884	114,326	119,418	89,892	41,768	25,853	51,143	58,185	31,955	40,728	678,152
Total immigration	294,517	334,853	382,841	367,240	126,778	37,453	65,128	65,945	48,942	108,408	1,832,105

TABLE 4

Immigration to Canada for the Period April 1, 1920, to March 31, 1925

—	Fiscal Years					Totals
	1920-21	1921-22	1922-23	1923-24	1924-25	
English	47,687	23,225	19,188	37,030	26,466	153,596
Irish	6,384	3,572	3,668	9,719	9,379	32,722
Scottish	19,248	11,596	11,071	25,057	16,174	83,146
Welsh	943	627	581	1,113	1,159	4,423
Totals	74,262	39,020	34,508	72,919	53,178	273,887
African, South	63	32	41	60	87	283
Albanian	6	6	1	7	2	22
Arabian	8	5	2	.....	.....	15
Argentinian	4	.....	4	.....	.....	8
Armenian	85	70	59	486	304	1,004
Australian	90	76	67	112	162	507
Austrian	26	14	23	82	75	220
Belgian	1,645	503	316	1,662	1,300	5,426
Bermudian	8	2	7	4	4	25
Brazilian	.....	.....	.....	.....	1	1
Bulgarian	4	27	19	267	69	386
Chilean	.....	.....	.....	.....	3	3
Chinese	2,435	1,746	711	674	.....	5,566
Cuban	.....	.....	.....	1	.....	1
Czecho-Slovakian	308	152	101	2,757	2,084	5,402
Dutch	595	183	119	1,149	1,637	3,683
East Indian	10	13	21	40	46	130
Egyptian	9	2	.....	3	3	17
Esthonian	.....	.....	12	51	49	112
Finnish	1,401	274	1,171	7,640	4,261	14,747
French	861	332	281	370	326	2,170
German	137	178	216	1,769	2,215	4,515
Greek	357	209	177	292	237	1,272
Hebrew	2,763	8,404	2,793	4,255	4,459	22,674
Hungarian	23	48	23	364	1,052	1,510
Italian	3,880	2,413	2,074	6,379	2,349	17,095
Jamaican	18	13	30	24	8	93
Japanese	532	471	369	448	501	2,321
Jugo-Slavian	89	180	136	1,306	1,620	3,331
Latvian	.....	.....	1	11	20	32
Lettish	.....	.....	.....	6	2	8
Lithuanian	.....	19	106	236	125	486
Luxemburg	16	5	3	85	35	144
Maltese	140	34	57	148	26	405
Mexican	1	.....	.....	1	.....	2
Negro	144	42	42	42	39	309
Newfoundland	1,042	367	1,552	5,346	1,288	9,595
New Zealand	40	25	33	50	107	255
Persian	1	9	1	5	18	34
Polish	4,061	2,707	2,921	4,211	2,734	16,634
Portugueses	4	.....	2	.....	3	9
Roumanian	969	759	427	1,431	2,056	5,642
Russian	1,077	321	222	3,058	5,411	10,089
Scandinavian—						
Danish	511	541	382	1,355	1,830	4,619
Iceland	50	31	21	27	49	178
Norway	429	480	507	2,424	2,550	6,390
Swedish	715	442	948	3,536	2,138	7,779
Spanish	202	6	15	39	3	265
Swiss	235	187	152	1,585	680	2,839
Syrian	443	123	91	286	210	1,153
Turkish	8	3	3	27	29	70
Ukrainian	491	89	36	832	26	1,474
U.S.A. citizens via ocean ports	110	67	32	134	96	439
Venezuela	.....	.....	1	6	.....	7
West Indies	110	24	44	37	37	252
Total, Continental, etc	26,156	21,634	16,372	55,120	42,366	161,648
From the United States	38,310	21,670	16,566	17,211	15,818	109,575
Total immigration	138,728	82,324	67,446	145,250	111,362	545,110

TABLE

Statement of Immigration to Canada, by Origins, From Overseas and

Racial Origin	1925-26			1926-27			1927-28			1928-29		
	From Overseas	From U.S.A.	Totals	From Overseas	From U.S.A.	Totals	From Overseas	From U.S.A.	Totals	From Overseas	From U.S.A.	Totals
English	19,689	5,923	25,612	24,890	6,045	30,935	25,991	7,291	33,282	30,355	9,181	39,536
Irish	5,993	2,125	8,118	9,187	2,366	11,553	8,756	2,966	11,722	9,199	3,767	12,966
Scottish	10,295	2,139	12,434	14,296	2,432	16,728	14,341	2,856	17,197	16,137	3,453	19,590
Welsh	1,053	210	1,263	1,411	226	1,637	1,784	289	2,073	3,189	300	3,489
Totals	37,030	10,397	47,427	49,784	11,069	60,853	50,872	13,402	64,274	58,880	16,701	75,581
Belgian	1,063	78	1,141	2,080	69	2,149	2,171	78	2,249	1,222	79	1,301
Danish	1,112	299	1,411	2,030	225	2,255	3,835	284	4,119	3,311	351	3,662
Dutch	1,180	541	1,721	1,674	568	2,242	1,928	537	2,465	1,599	741	2,340
Finnish	1,617	63	1,680	5,180	88	5,268	4,765	112	4,877	3,651	100	3,751
French	498	1,821	2,319	548	2,499	3,047	868	3,138	4,006	745	3,934	4,679
German	7,356	2,318	9,674	12,540	2,681	15,221	12,032	3,190	15,222	12,806	3,803	16,609
Icelandic	53	22	75	30	32	62	28	18	46	24	23	47
Norwegian	1,072	800	1,872	3,384	1,255	4,639	4,327	1,330	5,657	2,434	1,419	3,853
Swedish	1,335	620	1,955	2,628	693	3,321	3,134	757	3,891	3,297	874	4,171
Swiss	320	98	418	568	101	669	614	134	748	490	156	646
Totals	15,606	6,660	22,266	30,662	8,211	38,873	33,702	9,578	43,280	29,579	11,480	41,059
Albanian	14	.....	14	17	.....	17	30	3	33	28	7	35
Arabian	10	.....	10	4	.....	4	6	1	7	1	1	2
Armenian	85	17	102	65	13	78	44	9	53	17	10	27
Austrian	75	79	154	401	129	530	606	153	759	409	100	509
Bohemian	8	63	71	22	85	107	7	67	74	8	86	94
Bulgarian	47	4	51	126	2	128	249	2	251	282	2	284
Chinese	.....	.....	.....	.....	.....	.....	3	.....	3	1	.....	1
Croatian	1,006	2	1,008	1,085	2	1,087	902	5	907	990	24	1,014
Czech	805	33	838	721	7	728	714	13	727	846	5	851
Dalmatian	1	.....	1	.....	.....	.....	.....	.....	.....	1	.....	1
East Indian	62	1	63	60	2	62	56	.....	56	52	1	53
Esthonian	28	2	30	92	.....	92	110	2	112	92	.....	92
Greek	217	41	258	340	45	385	583	72	655	736	70	806
Hebrew	3,587	427	4,014	4,471	392	4,863	4,296	470	4,766	3,301	547	3,848
Herzegovinian	.....	.....	.....	3	.....	3	4	.....	4	.....	.....	.....
Italian	1,638	138	1,776	3,301	165	3,466	3,593	190	3,783	792	272	1,064
Japanese	421	.....	421	475	.....	475	478	.....	478	445	1	446
Jugo-Slavian	1,604	23	1,627	2,084	18	2,102	1,450	19	1,469	2,824	32	2,856
Korean	.....	.....	.....	1	.....	1	.....	.....	.....	.....	.....	.....
Lettish	24	3	27	60	4	64	77	8	85	74	3	77
Lithuanian	165	23	188	842	6	848	1,037	15	1,052	1,608	18	1,626
Magyar	4,112	75	4,187	4,863	77	4,940	5,318	103	5,421	6,242	106	6,348
Maltese	21	.....	21	33	1	34	39	1	40	18	1	19
Mexican	.....	4	4	1	2	3	.....	1	1	.....	.....	.....
Montenegrin	.....	.....	.....	5	.....	5	.....	.....	.....	.....	.....	.....
Moravian	6	.....	6	36	.....	36	33	2	35	4	1	5
Negro	53	269	322	51	241	292	88	237	325	96	280	376
North American Indian	.....	7	7	.....	13	13	.....	28	28	.....	23	23
Persian	11	.....	11	6	.....	6	4	.....	4	1	.....	1
Polish	2,535	190	2,725	6,505	199	6,704	6,733	254	6,987	8,269	246	8,515
Portuguese	3	3	6	14	4	18	7	4	11	12	10	22
Roumanian	265	26	291	292	38	330	237	38	275	284	48	332
Russian	925	167	1,092	1,127	169	1,296	948	184	1,132	908	285	1,193
Ruthenian	4,259	58	4,317	9,995	66	10,061	10,128	61	10,189	15,571	39	15,610
Serbian	454	4	458	885	8	893	411	15	426	390	20	410
Slovak	2,046	23	2,069	4,274	10	4,284	3,714	20	3,734	4,303	40	4,343
Spanish	12	17	29	29	20	49	28	17	45	18	49	67
Spanish American	.....	.....	.....	6	2	8	.....	.....	.....	3	4	7
Syrian	134	22	156	218	23	241	82	31	113	75	44	119
Turkish	17	.....	17	8	2	10	4	2	6	3	4	7
Totals	24,650	1,721	26,371	42,518	1,745	44,263	42,019	2,027	44,046	48,704	2,379	51,083
Grand totals	77,286	18,778	96,064	122,964	21,025	143,989	126,593	25,007	151,600	137,163	30,560	167,723

5

from the United States, for the period April 1, 1925, to March 31, 1935

1929-30			1930-31			1931-32			1932-33			1933-34			1934-35		
From Overseas	From U.S.A.	Totals	From Overseas	From U.S.A.	Totals	From Overseas	From U.S.A.	Totals	From Overseas	From U.S.A.	Totals	From Overseas	From U.S.A.	Totals	From Overseas	From U.S.A.	Totals
32,278	9,379	41,657	14,662	7,498	22,160	4,275	4,525	8,800	1,940	4,153	6,093	1,375	2,623	3,998	1,380	2,053	3,433
10,159	3,762	13,921	4,233	2,904	7,137	791	1,716	2,507	323	1,512	1,835	283	905	1,188	291	727	1,018
18,640	3,638	22,278	7,872	2,917	10,789	1,843	1,732	3,575	764	1,747	2,511	547	1,038	1,585	472	734	1,206
3,005	332	3,337	817	231	1,048	179	147	326	70	92	162	55	77	132	55	55	110
64,082	17,111	81,193	27,584	13,550	41,134	7,088	8,120	15,208	3,097	7,504	10,601	2,260	4,643	6,903	2,198	3,569	5,767
696	92	788	255	105	360	47	31	78	37	42	79	41	23	64	61	18	79
2,685	319	3,004	820	184	1,004	53	87	140	55	53	108	43	47	90	21	28	49
1,755	703	2,458	344	444	788	33	236	269	33	226	259	27	137	164	44	104	148
4,565	82	4,647	2,297	57	2,354	92	38	130	30	29	59	51	16	67	59	21	80
697	4,419	5,116	347	4,391	4,738	87	2,734	2,821	88	2,702	2,790	74	1,130	1,204	86	809	895
14,281	3,733	18,014	7,724	2,673	10,397	727	1,532	2,259	518	1,180	1,698	401	755	1,156	301	656	957
6	28	34	25	17	42	.....	10	10	1	6	7	.....	10	10	1	12	13
2,256	1,149	3,405	740	645	1,385	70	171	241	44	218	262	31	108	139	37	93	130
2,918	736	3,654	730	366	1,096	79	195	274	17	165	182	19	110	129	10	83	93
473	117	590	211	83	294	24	28	52	17	41	58	19	30	49	22	21	43
30,332	11,378	41,710	13,493	8,965	22,458	1,212	5,062	6,274	840	4,662	5,502	706	2,366	3,072	642	1,845	2,487
26	1	27	25	1	26	5	.....	5	.....	.....	.....	1	.....	1	3	.....	3
7	2	9	2	.....	2	.....	.....	.....	2	.....	2	.....	.....	.....	1	.....	1
14	16	30	21	1	22	4	1	5	1	4	5	7	3	10	1	4	5
437	75	512	116	68	184	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
20	81	101	11	57	68	.....	21	21	7	16	23	.....	10	10	.....	9	9
296	10	306	[295	.....	295	15	3	18	3	5	8	12	2	14	5	.....	5
.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	1	2	.....	2	.....	.....	.....
771	11	782	482	2	484	106	5	111	96	4	100	108	6	114	155	.....	155
434	14	448	225	8	233	69	9	78	65	7	72	52	7	59	77	4	81
7	.....	7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
58	.....	58	80	.....	80	47	.....	47	62	1	63	33	.....	33	33	.....	33
117	2	119	63	2	65	6	1	7	.....	1	1	2	2	4	2	.....	2
634	48	682	388	48	436	20	43	63	37	32	69	34	26	60	35	17	52
3,544	620	4,164	2,908	513	3,421	202	447	649	346	426	772	599	344	943	335	289	624
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1,277	236	1,513	1,007	228	1,235	414	166	580	255	142	397	267	109	376	325	56	381
194	.....	194	204	1	205	195	.....	195	115	.....	115	104	1	105	93	.....	93
921	35	956	364	27	391	57	9	66	56	11	67	63	3	66	120	2	122
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
70	8	78	28	1	29	4	2	6	.....	4	4	4	.....	4	.....	.....	.....
964	22	986	466	11	477	45	5	50	57	6	63	37	2	39	37	5	42
5,688	99	5,787	2,401	71	2,472	397	41	438	364	20	384	509	18	527	362	20	382
40	1	41	13	6	19	5	.....	5	2	4	6	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	1	1	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	2	2	3	.....	3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
23	.....	23	2	.....	2	.....	1	1	3	.....	3	.....	.....	.....	.....	.....	.....
195	251	446	120	158	278	15	83	98	9	60	69	19	57	76	5	16	21
.....	22	22	.....	8	8	.....	34	34	.....	20	20	.....	8	8	.....	6	6
1	.....	1	2	.....	2	.....	.....	.....	1	.....	1	.....	.....	.....	.....	.....	.....
6,610	227	6,837	3,997	226	4,223	554	103	657	360	99	459	374	50	424	406	40	446
13	11	24	5	10	15	2	2	4	1	6	7	2	4	6	2	3	5
383	62	445	179	44	223	22	15	37	26	11	37	27	7	34	52	5	57
765	173	938	879	97	976	74	32	106	62	35	97	61	16	77	60	25	85
11,291	41	11,332	6,413	78	6,491	502	38	540	414	47	461	421	8	429	586	15	601
375	29	404	140	18	158	31	16	47	26	18	44	37	10	47	26	3	29
2,879	46	2,925	1,957	32	1,989	337	9	346	252	8	260	395	6	401	595	12	607
26	37	63	8	26	34	9	11	20	7	16	23	7	6	13	7	7	14
.....	4	4	1	1	2	2	.....	2	.....	1	1	4	.....	4	.....	.....	.....
61	51	112	54	22	76	15	16	31	19	26	45	14	26	40	13	7	20
6	1	7	7	.....	7	1	1	2	.....	.....	.....	2	.....	2	.....	1	1
38,147	2,238	40,385	22,866	1,765	24,631	3,155	1,115	4,270	2,649	1,030	3,679	3,197	731	3,928	3,336	546	3,882
132,561	30,727	163,288	63,943	24,280	88,223	11,455	14,297	25,752	6,586	13,196	19,782	6,163	7,740	13,903	6,176	5,960	12,136

TABLE

Immigration to Canada, by Origins, via Ocean Ports and from the

Racial Origin	1935-36			1936-37			1937-38			1938-39			1939-40		
	From Over-seas	From U.S.A.	Totals	From Over-seas	From U.S.A.	Totals	From Over-seas	From U.S.A.	Totals	From Over-seas	From U.S.A.	Totals	From Over-seas	From U.S.A.	Totals
English	1,286	1,744	3,030	1,445	1,738	3,183	1,949	1,870	3,819	2,247	1,824	4,071	2,489	1,878	4,367
Irish	249	626	875	262	617	879	364	686	1,050	387	726	1,113	375	710	1,085
Scottish	484	677	1,161	519	639	1,158	604	737	1,341	665	707	1,372	643	702	1,345
Welsh	30	56	86	38	69	107	55	48	103	74	60	134	59	75	134
Totals	2,049	3,103	5,152	2,264	3,063	5,327	2,972	3,341	6,313	3,373	3,317	6,690	3,566	3,365	6,931
Belgian	72	9	81	93	13	106	123	22	145	187	15	202	100	23	123
Danish	21	33	54	22	44	66	40	43	83	49	34	83	71	39	110
Dutch	111	97	208	90	102	192	119	113	232	237	139	376	264	147	411
Finnish	43	24	67	49	16	65	79	14	93	58	14	72	57	20	77
French	95	724	819	135	711	846	134	774	908	138	860	998	152	794	946
German	209	471	680	367	529	896	523	571	1,094	586	507	1,093	1,021	510	1,531
Icelandic	6	6	12	.....	2	2	3	5	8	.....	8	8	.....	4	4
Norwegian	31	94	125	25	74	99	27	91	118	21	84	105	40	89	129
Swedish	26	89	115	16	73	89	47	95	142	15	90	105	13	80	93
Swiss	32	18	50	49	16	65	87	18	105	75	22	97	49	32	81
Totals	646	1,565	2,211	846	1,580	2,426	1,182	1,746	2,928	1,366	1,773	3,139	1,767	1,738	3,505
Albanian	1	.....	1	4	.....	4	8	1	9	10	.....	10	4	.....	4
Arabian	.....	2	2	.....	.....	.....	4	.....	4	4	2	6	.....	.....	.....
Armenian	4	1	5	3	1	4	4	3	7	5	1	6	2	1	3
Bohemian	1	6	7	1	13	14	5	6	11	2	10	12	332	9	341
Bulgarian	22	2	24	18	1	19	28	2	30	29	.....	29	15	.....	15
Chinese	.....	.....	.....	1	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....
Croatian	157	.....	157	240	.....	240	277	4	281	265	3	268	106	2	108
Czech	106	1	107	134	4	138	188	3	191	169	4	173	290	3	293
Dalmatian	.....	.....	.....	1	.....	1	.....	.....	.....	1	.....	1	.....	.....	.....
East Indian	20	1	21	13	.....	13	14	.....	14	14	.....	14	11	.....	11
Esthonian	2	.....	2	5	.....	5	2	1	3	12	.....	12	3	1	4
Greek	53	19	72	75	20	95	115	11	126	127	10	137	115	10	125
Hebrew	655	225	880	391	228	619	317	267	584	621	269	890	1,321	302	1,623
Italian	341	49	390	299	58	357	408	69	477	365	58	423	186	64	250
Japanese	83	.....	83	103	.....	103	139	.....	139	46	.....	46	36	.....	36
Jugo-Slavian	106	3	109	106	3	109	116	9	125	250	3	253	55	6	61
Lettish	3	.....	3	2	3	5	11	.....	11	4	.....	4	3	2	5
Lithuanian	22	3	25	42	10	52	37	6	43	39	6	45	49	5	54
Magyar	314	22	336	328	11	339	622	24	646	532	22	554	329	37	366
Maltese	.....	.....	.....	4	1	5	2	.....	2	1	5	6	.....	.....	.....
Mexican	.....	1	1	6	.....	6	1	.....	1	2	.....	2	.....	.....	.....
Montenegrin	.....	.....	.....	.....	.....	.....	2	.....	2	8	.....	8	.....	.....	.....
Moravian	.....	.....	.....	.....	.....	.....	3	.....	3	9	.....	9	52	.....	52
Negro	3	20	23	5	17	22	9	17	26	7	24	31	7	22	29
North American Indian	.....	2	2	.....	2	2	.....	11	11	.....	13	13	.....	4	4
Persian	.....	.....	.....	1	.....	1	2	1	3	.....	.....	.....	1	.....	1
Polish	362	42	404	432	35	467	615	46	661	586	68	654	297	51	348
Portuguese	4	3	7	2	.....	2	1	2	3	1	2	3	1	3	4
Roumanian	33	4	37	65	2	67	77	11	88	102	2	104	20	8	28
Russian	84	13	97	79	19	98	120	22	142	134	14	148	134	47	181
Ruthenian	418	8	426	855	15	870	1,356	13	1,369	1,837	19	1,856	1,509	16	1,525
Serbian	29	.....	29	35	3	38	83	4	87	70	5	75	17	4	21
Slovak	432	11	443	520	7	527	1,249	13	1,262	1,450	19	1,469	206	22	228
Spanish	6	5	11	10	11	21	14	2	16	6	4	10	9	10	19
Spanish American	.....	.....	.....	.....	1	1	3	.....	3	.....	.....	.....	.....	1	1
Syrian	26	10	36	19	5	24	15	8	23	18	10	28	14	15	29
Turkish	.....	.....	.....	1	.....	1	1	.....	1	.....	.....	.....	.....	.....	.....
Totals	3,287	453	3,740	3,800	470	4,270	5,848	556	6,404	6,726	573	7,299	5,124	645	5,769
Grand Totals	5,982	5,121	11,103	6,910	5,113	12,023	10,002	5,643	15,645	11,465	5,663	17,128	10,457	5,748	16,205

6

United States, for the Period April 1, 1935, to March 31, 1945

1940-41			1941-42			1942-43			1943-44			1944-45		
From Overseas	From U.S.A.	Totals	From Overseas	From U.S.A.	Totals	From Overseas	From U.S.A.	Totals	From Overseas	From U.S.A.	Totals	From Overseas	From U.S.A.	Totals
2,408	2,841	5,249	1,852	2,234	4,086	1,992	1,703	3,695	3,470	1,491	4,961	8,178	1,574	9,752
235	953	1,188	122	926	1,048	170	592	762	352	610	962	652	540	1,192
406	1,013	1,419	179	888	1,067	230	718	948	411	580	991	989	549	1,538
55	91	146	29	88	117	26	62	88	45	43	88	124	48	172
3,104	4,898	8,002	2,182	4,136	6,318	2,418	3,075	5,493	4,278	2,724	7,002	9,943	2,711	12,654
30	20	50	10	17	27	.....	11	11	6	9	15	13	8	21
22	63	85	4	42	46	3	22	25	9	28	37	12	36	48
51	187	238	11	192	203	10	136	146	8	123	131	28	131	159
2	30	32	1	18	19	.....	22	22	.....	15	15	2	10	12
129	849	978	104	632	736	69	580	649	149	586	735	305	653	958
39	359	398	23	371	394	15	256	271	11	302	313	55	312	367
.....	4	4	.....	5	5	1	4	5	1	4	5	1	6	7
21	79	100	14	96	110	19	84	103	12	51	63	13	55	68
6	117	123	1	72	73	6	53	59	3	53	56	6	91	97
12	42	54	15	36	51	3	18	21	4	10	14	9	13	22
312	1,750	2,062	183	1,481	1,664	126	1,186	1,312	203	1,181	1,384	444	1,315	1,759
.....	.....	.....	.....	.....	.....	.....	1	1	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2	3	5	.....	.....	.....	1	4	5	.....	2	2	1	2	3
3	12	15	.....	11	11	.....	6	6	.....	7	7	1	3	4
1	1	2	.....	.....	.....	.....	.....	.....	.....	2	2	.....	2	2
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
7	6	13	.....	3	3	1	2	3	2	3	5	.....	1	1
49	18	67	17	10	27	6	2	8	8	4	12	18	9	27
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
6	.....	6	3	.....	3	.....	.....	.....	.....	.....	.....	.....	.....	.....
1	.....	1	1	.....	1	1	.....	1	2	.....	2	2	.....	2
26	20	46	3	27	30	1	14	15	1	11	12	3	15	18
284	342	626	111	277	388	31	239	270	56	182	238	93	237	330
43	85	128	1	66	67	.....	43	43	3	81	84	26	51	77
44	1	45	1	.....	1	.....	1	1	.....	.....	.....	.....	.....	.....
1	6	7	.....	5	5	.....	3	3	.....	6	6	1	10	11
1	6	7	.....	2	2	1	2	3	1	.....	1	1	1	2
6	8	14	.....	4	4	1	4	5	4	5	9	3	7	10
35	21	56	4	29	33	.....	27	27	3	26	29	19	24	43
.....	4	4	1	.....	1	.....	1	1	1	.....	1	1	.....	1
.....	.....	.....	.....	2	2	.....	1	1	1	.....	1	1	.....	1
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2	.....	2	.....	.....	.....	.....	.....	.....	1	.....	1	.....	.....	.....
45	30	75	13	31	44	5	53	58	5	24	29	23	42	65
.....	16	16	.....	15	15	.....	6	6	.....	16	16	2	21	23
.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	1	.....	.....	.....
25	100	125	5	102	107	5	71	76	7	63	70	43	76	119
4	2	6	5	4	9	3	2	5	3	.....	3	6	2	8
6	4	10	2	5	7	.....	3	3	3	8	11	2	4	6
9	31	40	11	35	46	6	22	28	4	19	23	9	42	51
3	19	22	.....	19	19	.....	15	15	.....	30	30	14	17	31
7	5	12	.....	9	9	.....	5	5	.....	4	4	1	3	4
5	23	28	2	20	22	4	19	23	1	21	22	.....	7	7
19	14	33	5	7	12	2	5	7	8	2	10	12	3	15
2	2	4	2	4	6	5	2	7	2	1	3	6	4	10
1	16	17	2	7	9	.....	13	13	1	19	20	7	15	22
.....	.....	.....	.....	.....	.....	1	.....	1	.....	.....	.....	.....	.....	.....
637	795	1,432	189	694	883	74	566	640	118	536	654	295	598	893
4,053	7,443	11,496	2,554	6,311	8,865	2,618	4,827	7,445	4,599	4,441	9,040	10,682	4,624	15,306

TABLE 7

Immigration to Canada, by Origins, from Overseas and from the United States for the Period April 1, 1945, to March 31, 1948

Racial Origin	1945-46			1946-47			1947-48		
	From Overseas	From U.S.A.	Totals	From Overseas	From U.S.A.	Totals	From Overseas	From U.S.A.	Totals
English	15,781	2,416	18,197	35,596	3,767	39,363	31,209	2,939	34,148
Irish	1,410	936	2,346	3,073	1,441	4,514	3,460	1,028	4,488
Scottish	2,642	934	3,576	8,166	1,556	9,722	9,107	1,016	10,123
Welsh	329	102	431	1,141	103	1,244	1,012	93	1,105
Totals	20,162	4,388	24,550	47,976	6,867	54,843	44,788	5,076	49,864
Belgian	33	28	61	766	31	797	1,034	9	1,043
Danish	34	57	91	83	80	163	286	74	360
Dutch	97	235	332	2,365	298	2,663	4,264	286	4,550
Finnish	6	20	26	31	50	81	66	27	93
French	571	936	1,507	1,615	1,420	3,035	630	959	1,589
German	234	580	814	338	861	1,199	530	842	1,372
Icelandic	3	12	15	14	7	21	8	4	12
Norwegian	125	124	249	235	176	411	219	134	353
Swedish	27	110	137	88	154	242	81	172	253
Swiss	18	37	55	70	40	110	222	32	254
Totals	1,148	2,139	3,287	5,605	3,117	8,722	7,340	2,539	9,879
Albanian	.....	.....	.....	.....	4	4	5	.....	5
Arabian	.....	.....	.....	.....	.....	.....	1	1	2
Armenian	3	3	6	13	1	14	5	2	7
Bohemian	10	10	20	11	17	28	14	15	29
Bulgarian	.....	1	1	1	3	4	13	3	16
Chinese	1	.....	1	7	.....	7	24	1	25
Corsican	.....	.....	.....	1	.....	1	.....	.....	.....
Croatian	1	2	3	5	6	11	84	9	93
Czech	43	12	55	176	20	196	285	24	309
Dalmatian	.....	.....	.....	1	.....	1	2	.....	2
East Indian	1	.....	1	7	1	8	130	37	167
Esthonian	8	1	9	9	1	10	572	5	577
Greek	32	23	55	60	49	109	840	50	890
Hebrew	1,345	368	1,713	605	600	1,205	3,922	532	4,454
Italian	58	125	183	142	159	301	204	170	374
Japanese	.....	.....	.....	1	2	3	.....	3	3
Jugo-Slavian	10	18	28	17	19	36	220	28	248
Lettish	1	.....	1	8	2	10	897	2	899
Lithuanian	4	5	9	23	12	35	1,992	19	2,011
Magyar	38	49	87	64	74	138	191	61	252
Maltese	5	1	6	16	.....	16	27	11	38
Mexican	3	2	5	2	.....	2	2	1	3
Moravian	.....	3	3	1	.....	1	10	.....	10
Negro	75	52	127	110	43	153	85	111	196
North American Indian	.....	20	20	11	26	37	1	19	20
Persian	1	.....	1	4	1	5	2	.....	2
Polish	528	95	623	336	163	499	4,269	117	4,386
Portuguese	12	4	16	34	10	44	27	11	38

TABLE 7—*Conc.*

Immigration to Canada, by Origins, from Overseas and from the United States for the Period April 1, 1945, to March 31, 1948—Conc.

Racial Origin	1945-46			1946-47			1947-48		
	From Overseas	From U.S.A.	Totals	From Overseas	From U.S.A.	Totals	From Overseas	From U.S.A.	Totals
Roumanian	5	15	20	21	26	47	45	20	65
Russian	59	53	112	145	64	209	389	53	442
Ruthenian	18	30	48	103	49	152	3,386	40	3,426
Serbian	1	4	5	5	14	19	111	6	117
Slovakian	4	13	17	5	15	20	193	24	217
Spanish	28	3	31	37	6	43	27	3	30
Spanish American	5	3	8	7	12	19	28	19	47
Syrian	14	11	25	9	26	35	27	22	49
Turkish	4	1	5	2	1	3	2	.....	2
Totals	2,317	927	3,244	1,999	1,426	3,425	18,032	1,419	19,451
GRAND TOTALS	23,627	7,454	31,081	55,580	11,410	66,990	70,160	9,034	79,194

TABLE

Immigration from Overseas, showing Country of Birth

Country of Birth	Totals	Albanian	Arabian	Armenian	Belgian	Bohemian	English	Irish	Scottish	Welsh	Bulgarian	Chinese	Croatian	Czech	Dalmatian	Dutch	East Indian	Esthonian
Africa (British)	127	..	..	..	.....	....	87	3	20	3	..	..	..	....	..	3	....	....
Africa (Not British)	24	..	..	..	.....	....	7	.....	2	.....	..	..	..	....	..	1	....	....
Albania	5	4	..	..	.....	....	.....	.....	.....	.....	..	..	..	....	..	.....	....	....
Arabia	2	..	..	..	.....	....	1	.....	.....	.....	..	..	..	....	..	.....	....	....
Argentine	29	..	..	..	.....	....	18	.....	3	.....	..	..	..	....	..	2	....	....
Australia	378	..	..	..	.....	....	281	31	42	6	..	1	..	....	..	2	....	....
Austria	240	..	..	..	.....	....	1	.....	.....	.....	..	..	1	13	..	.....	....	....
Bahamas	19	..	..	..	.....	....	14	1	2	.....	..	..	..	....	..	.....	....	....
Barbados	66	..	..	..	.....	....	34	8	3	.....	..	..	..	....	..	.....	....	....
Belgium	1,125	..	..	..	999	....	15	.....	2	1	..	..	..	1	..	8	....	....
Bermuda	35	..	..	..	.....	....	28	1	1	.....	..	..	..	....	..	.....	....	....
Brazil	39	..	..	..	.....	....	7	.....	2	.....	..	..	..	1	..	7	....	....
Bulgaria	17	..	..	..	.....	....	.....	.....	.....	.....	12	..	..	....	..	.....	....	....
Canada	68	..	..	..	6	....	26	1	7	.....	..	..	..	....	..	5	....	....
Central America, N.E.S.	12	..	..	..	.....	....	3	1	1	.....	..	..	..	....	..	.....	....	....
Chili	18	..	..	..	.....	....	11	.....	6	.....	..	..	..	....	..	.....	....	....
China	134	..	..	..	.....	....	73	6	9	3	..	19	..	....	..	.....	....	....
Cuba	12	..	..	..	.....	....	3	.....	1	1	..	..	..	....	..	.....	....	....
Czecho-Slovakia	668	..	..	..	.....	6	.....	.....	.....	.....	..	..	..	230	..	.....	....	....
Danzig	7	..	..	..	.....	....	1	.....	.....	.....	..	..	..	....	..	3	....	....
Denmark	270	..	..	..	.....	....	2	.....	.....	.....	..	..	..	....	..	.....	....	....
Dutch East Indies	28	..	..	..	.....	....	2	.....	1	.....	..	..	..	....	..	22	1	....
Ecuador	1	..	..	..	.....	....	.....	.....	1	.....	..	..	..	....	..	.....	....	....
Egypt	29	..	..	..	.....	....	11	2	2	.....	..	..	..	....	..	.....	....	....
Eire	1,248	..	..	..	.....	....	75	1,147	16	1	..	..	..	....	..	.....	....	....
England	28,495	..	..	..	10	1	26,340	394	615	179	..	..	..	14	..	29	....	1
Esthonia	558	..	..	..	.....	....	1	.....	.....	.....	..	..	..	....	..	.....	....	541
Finland	74	..	..	..	.....	....	2	.....	.....	.....	..	..	..	....	..	.....	....	2
France	513	..	..	..	8	....	24	1	1	.....	..	..	..	1	..	3	....	....
Germany	662	..	..	..	.....	....	15	2	2	.....	..	..	..	1	..	51	....	1
Greece	789	..	..	..	.....	....	.....	.....	.....	.....	..	..	..	....	..	.....	....	....
Guiana, British	36	..	..	..	.....	....	11	4	3	.....	..	..	..	....	..	.....	....	....
Hawaiian Islands	7	..	..	..	.....	....	5	2	.....	.....	..	..	..	....	..	.....	....	....
Holland	3,408	..	..	..	2	....	6	1	2	.....	..	..	..	1	..	3,369	....	....
Honduras, British	8	..	..	..	1	....	5	.....	.....	.....	..	..	..	....	..	.....	....	....
Hong Kong	15	..	..	..	.....	....	8	1	4	.....	..	1	..	....	..	.....	....	....
Hungary	291	..	..	..	.....	....	1	.....	.....	.....	..	..	..	1	..	.....	....	....
Iceland	6	..	..	..	.....	....	.....	.....	.....	.....	..	..	..	....	..	.....	....	....
India	653	..	..	..	.....	....	382	45	72	4	..	..	..	....	..	1	128	....
Iraq	6	..	..	1	.....	....	2	.....	1	.....	..	..	..	....	..	.....	....	....
Ireland, Northern	1,396	..	..	..	.....	....	70	1,278	42	2	..	..	..	....	..	1	....	....
Italy	146	..	..	..	.....	....	3	.....	1	.....	..	..	..	....	..	1	....	....
Jamaica	117	..	..	..	.....	....	59	5	20	.....	..	1	..	....	..	1	....	....
Japan	23	..	..	..	.....	....	17	.....	3	1	..	..	..	....	..	.....	....	....
Jugoslavia	489	..	..	..	.....	....	.....	.....	.....	.....	..	..	82	2	..	.....	....	1
Latvia	885	..	..	..	.....	....	1	.....	1	.....	..	..	..	....	..	.....	....	....
Lesser British Isles	81	..	..	..	.....	....	67	1	4	.....	..	..	..	....	..	.....	....	....
Lithuania	1,952	..	..	..	2	....	.....	.....	.....	.....	..	..	..	....	..	.....	....	....

8

by Racial Origin, for the Fiscal Year ended March 31, 1948

Finnish	French	German	Greek	Hebrew	Italian	Jugo-Slavian	Lettish	Lithuanian	Magyar	Maltese	Mexican	Moravian	Negro	North American Indian	Persian	Polish	Portuguese	Roumanian	Russian	Ruthenian	Danish	Icelandic	Norwegian	Swedish	Serbian	Slovak	Spanish	Spanish American	Swiss	Syrian	Turkish
...	2	2	...	1	...	...	...	...	...	...	...	...	1	...	..	...	..	..	...	...	...	2	2	..	...	...	...	...	1	..	....
...	12	...	...	2	...	...	...	...	...	...	...	...	...	...	..	...	..	..	...	...	...	...	...	..	...	...	...	...	...	..	....
...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	..	...	..	..	...	...	...	...	...	..	...	...	...	...	...	..	....
...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	..	..	...	...	...	...	...	..	...	...	...	...	...	..	....
...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	..	...	..	..	...	...	...	1	...	..	...	...	...	2	...	1	....
...	3	1	...	3	3	...	...	...	...	...	...	...	...	...	..	...	..	..	2	...	...	...	2	..	...	...	1	...	...	..	....
...	...	75	...	92	...	5	...	...	6	...	...	...	...	...	..	14	...	..	2	29	...	...	...	..	2	...	...	...	...	..	....
...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	..	...	..	..	...	...	...	...	...	..	...	...	...	...	...	..	....
...	...	...	...	...	...	...	...	...	...	...	...	...	20	1	..	...	..	..	...	...	...	...	...	..	...	...	...	...	...	..	....
...	32	...	...	52	...	...	...	1	...	...	...	...	...	...	..	8	..	..	...	4	...	...	1	1	...	...	...	...	...	..	....
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	2	..	...	...	3	...	...	..	...	...	...	...	...	..	....
...	...	5	...	1	...	...	...	...	...	...	...	...	...	...	..	5	4	..	2	2	...	...	...	..	...	...	...	1	1	1	....
...	...	...	...	3	...	...	...	...	...	...	...	...	...	...	..	...	..	..	1	1	...	...	...	..	...	...	...	...	...	..	....
...	9	2	1	2	2	...	...	1	...	...	...	...	...	...	..	...	..	..	...	...	2	..	2	1	...	...	...	...	1	..	....
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	..	..	...	...	...	...	...	..	...	...	...	7	...	..	....
...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	..	...	..	..	...	...	...	...	...	..	...	...	...	...	...	..	....
...	3	1	1	4	1	...	2	1	...	...	...	...	...	...	..	1	2	...	7	...	...	...	...	..	...	...	...	...	1	..	....
...	...	...	...	4	...	...	...	...	...	...	...	...	...	...	..	...	..	..	...	...	...	...	...	..	...	...	...	3	...	..	....
...	...	21	...	169	...	2	...	...	19	...	...	7	..	...	..	9	...	..	8	19	...	...	...	..	1	173	...	...	4	..	....
...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	..	...	..	..	...	...	...	...	...	..	...	...	...	...	1	..	....
...	...	1	...	3	...	...	...	...	...	...	...	...	...	...	..	2	..	..	...	1	261	..	...	..	...	...	...	...	...	..	....
...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	..	...	..	..	...	...	...	...	...	..	...	...	...	...	1	..	....
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	..	..	...	...	...	...	...	..	...	...	...	...	...	..	....
...	3	...	1	2	2	...	...	...	...	5	..	1	..	...	..	...	..	..	...	...	...	...	...	..	...	...	...	...	...	..	....
...	1	1	...	3	...	...	...	...	...	...	...	...	...	...	..	...	..	..	1	...	1	...	...	2	...	...	...	...	...	..	....
...	49	28	10	657	42	4	...	...	2	...	...	...	2	...	2	38	..	2	27	3	9	..	7	13	...	...	3	..	14	..	....
3	...	...	...	1	...	...	4	2	...	...	...	...	...	...	..	...	..	..	1	2	...	...	...	3	...	...	...	...	...	..	....
62	...	1	...	...	...	...	1	...	...	...	...	...	...	...	..	...	..	..	2	...	...	...	2	2	...	...	...	...	...	..	....
...	390	1	...	36	3	...	...	...	...	...	...	...	...	...	..	34	1	..	2	4	...	...	...	..	...	...	...	...	4	..	....
...	2	126	...	236	1	1	9	29	2	...	...	...	...	...	..	93	..	..	6	79	...	...	1	..	...	...	...	...	5	..	....
...	...	...	784	4	...	...	...	...	...	...	...	...	...	...	..	...	..	..	1	...	...	...	...	..	...	...	...	...	...	..	....
...	1	...	...	...	...	...	...	...	...	...	...	...	6	...	..	...	11	..	...	...	...	...	...	..	...	...	...	...	...	..	....
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	..	..	...	...	...	...	...	..	...	...	...	...	...	..	....
...	5	3	...	11	3	...	...	...	1	...	...	...	...	...	..	1	..	..	...	1	...	...	...	2	...	...	...	...	...	..	....
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	..	..	...	...	...	...	...	..	...	...	...	2	...	..	....
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	1	..	...	...	...	...	...	..	...	...	...	...	...	..	....
...	...	2	...	135	...	...	...	...	147	...	...	...	...	...	..	1	..	..	...	...	...	...	...	..	...	3	...	...	1	..	....
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	..	..	...	...	...	6	...	..	...	...	...	...	...	..	....
...	8	2	1	2	3	...	...	...	...	...	...	...	...	...	..	...	1	1	1	...	1	...	1	..	...	...	...	...	...	..	....
...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	..	...	..	..	...	...	...	...	...	..	...	...	...	...	...	1	....
...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	..	...	..	..	...	...	...	...	...	..	...	...	1	...	...	..	....
...	2	...	...	7	125	...	...	...	...	...	...	...	..	...	..	5	..	..	...	2	...	...	...	..	...	...	...	...	...	..	....
...	...	2	...	3	...	...	...	...	...	...	...	...	23	...	..	...	..	..	...	...	...	...	...	..	...	...	...	...	3	..	....
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	1	..	..	...	...	...	...	...	..	...	...	...	...	1	..	....
...	...	50	1	21	...	202	...	...	7	...	...	...	...	...	..	2	..	1	6	1	...	...	...	..	108	6	...	...	...	..	....
...	...	...	...	15	...	...	828	26	...	...	...	...	..	...	..	7	..	..	4	2	...	...	...	..	...	...	...	...	...	..	....
...	9	...	...	...	...	...	...	...	...	...	...	...	..	...	..	...	..	..	...	...	...	...	...	..	...	...	...	...	...	..	....
...	...	10	...	51	...	...	3	1,880	...	...	...	...	...	...	..	6	..	..	...	...	...	...	...	..	...	...	...	...	...	..	....

TABLE

Immigration from Overseas, showing Country of Birth

Country of Birth	Totals	Albanian	Arabian	Armenian	Belgian	Bohemian	English	Irish	Scottish	Welsh	Bulgarian	Chinese	Croatian	Czech	Dalmatian	Dutch	East Indian	Esthonian
Luxemburg	7	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..
Malta	27	..	..	..	..	..	3	..	2	..	..	..	..	..	..	..	..	..
Mexico	24	..	..	..	..	..	6	1	..	..	..	..	..	..	..	..	..	..
Newfoundland	2,924	..	..	..	..	..	2,468	319	55	17	..	..	..	..	..	..	..	..
New Zealand	218	..	..	..	..	..	156	19	35	..	..	..	..	..	2	..	..	..
Norway	193	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Palestine	39	..	..	..	..	..	2	..	2	..	..	..	..	..	..	..	..	..
Paraguay	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Persia	4	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..
Peru	16	..	..	..	..	..	7	..	4	..	..	..	..	..	..	..	..	..
Philippine Islands	6	..	..	..	..	..	2	2	..	..	..	..	..	..	..	..	..	..
Poland	9,174	1	..	..	..	5	2	..	1	..	..	..	..	9	..	35	..	5
Portugal	8	..	..	..	..	..	2	..	2	..	..	..	..	..	..	..	..	..
Roumania	267	..	..	..	..	1	..	..	..	..	1	..	..	..	..	..	..	..
Russia	1,446	..	..	..	..	1	4	..	2	2	..	..	..	8	..	681	..	20
St. Pierre and Miquelon	8	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..
Scotland	8,555	..	..	..	1	..	280	135	8,025	8	..	..	..	2	..	2	..	..
South America, N.E.S.	8	..	..	..	..	..	3	..	..	..	..	..	..	..	..	4	..	..
Spain	31	..	..	..	..	..	7	..	8	..	..	..	..	..	..	..	..	..
Straits Settlements	21	..	..	..	..	..	14	1	3	..	..	2	..	..	..	..	..	..
Sweden	55	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	1
Switzerland	208	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..
Syria	27	..	1	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Trinidad	49	..	..	..	..	..	18	1	5	..	..	..	..	..	..	..	1	..
Turkey	41	..	..	2	..	..	4	..	..	..	..	..	..	..	..	..	..	..
Ukraine	59	..	..	..	..	..	..	..	..	..	..	..	..	..	..	26	..	..
United States	225	..	..	..	2	..	117	15	44	2	..	..	1	1	..	2	..	..
Uruguay	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Venezuela	3	..	..	..	..	..	1	2	..	..	..	..	..	..	..	..	..	..
Wales	1,171	..	..	..	..	..	333	23	17	782	..	..	..	..	..	..	..	..
West Indies (British), N.E.S.	55	..	..	..	..	..	22	3	2	..	..	..	..	..	..	..	..	..
West Indies (Not British)	17	..	..	..	..	..	1	1	..	..	..	..	..	..	..	5	..	..
Others	61	..	..	..	..	..	35	2	8	..	..	..	..	..	..	..	..	..
Totals	70,160	5	1	5	1,034	14	31,209	3,460	9,107	1,012	13	24	84	285	2	4,264	130	572

8—*Conc.*

by Racial Origin, for the Fiscal Year ended March 31, 1948—Conc.

Finnish	French	German	Greek	Hebrew	Italian	Jugo-Slavian	Lettish	Lithuanian	Magyar	Maltese	Mexican	Moravian	Negro	North American Indian	Persian	Polish	Portuguese	Roumanian	Russian	Ruthenian	Danish	Icelandic	Norwegian	Swedish	Serbian	Slovak	Spanish	Spanish American	Swiss	Syrian	Turkish
...	1	1	...	1	....	....	....	.....	....	..	..	..	..	....	..	.....	..	..	....	1	....	..	....	..	....	....	..	....	....	..	....
...	...	...	...	....	....	....	....	.....	....	22	..	..	..	....	..	.....	..	..	....	.....	....	..	....	..	....	....	..	....	....	..	....
...	...	...	...	3	....	....	....	.....	....	..	2	..	..	....	..	2	..	..	....	.....	....	..	....	..	....	....	1	8	....	1	....
...	57	...	...	....	....	....	....	.....	....	..	..	..	..	....	..	.....	1	..	1	.....	1	..	1	..	....	....	3	..	....	1	....
...	...	1	...	3	....	....	....	.....	....	..	..	..	..	....	..	.....	..	..	....	.....	....	..	1	..	....	....	..	..	1	..	....
...	...	...	...	....	....	....	....	.....	....	..	..	..	..	....	..	.....	..	..	....	1	1	..	191	..	....	....	..	..	....	..	....
...	...	...	...	32	....	....	....	.....	....	..	..	..	..	....	..	1	..	..	2	.....	....	..	....	..	....	....	..	..	....	..	....
...	...	...	...	....	....	....	....	.....	....	..	..	..	..	....	..	.....	..	..	....	1	....	..	....	..	....	....	..	..	....	..	....
...	...	...	...	....	....	....	....	.....	....	..	..	..	..	....	..	1	..	..	2	.....	....	..	....	..	....	....	..	..	....	..	....
...	...	...	...	....	....	....	....	.....	....	..	..	..	..	....	..	.....	..	..	....	.....	4	..	....	..	....	....	..	1	....	..	....
...	...	...	...	....	....	....	....	.....	1	..	..	..	..	....	..	.....	..	..	....	.....	....	..	1	..	....	....	1	..	....	..	....
...	2	107	1	1,980	....	4	4	6	....	..	..	..	..	....	..	3,924	..	2	39	3,045	....	..	....	..	....	1	..	..	....	..	....
...	...	1	...	1	....	....	....	.....	....	..	..	..	..	....	..	.....	2	..	....	.....	....	..	....	..	....	....	..	..	....	..	....
...	...	14	...	166	....	....	....	.....	4	..	..	..	..	....	..	5	..	38	2	36	....	..	....	..	....	....	..	..	....	..	....
...	1	41	2	135	....	2	43	33	2	..	..	2	..	....	..	63	..	..	259	131	....	..	....	2	....	9	..	..	2	..	1
...	7	...	...	....	....	....	....	.....	....	..	..	..	..	....	..	.....	..	..	....	.....	....	..	....	..	....	....	..	..	....	..	....
1	2	2	...	45	13	....	....	8	....	..	..	..	2	....	..	22	..	..	....	1	3	..	3	..	....	....	..	..	....	..	....
...	...	...	...	....	....	....	....	.....	....	..	..	..	..	....	..	.....	1	..	....	.....	....	..	....	..	....	....	..	..	....	..	....
...	...	...	...	....	....	....	....	.....	....	..	..	..	..	....	..	.....	..	..	1	.....	....	..	....	..	....	....	15	..	....	..	....
...	...	1	...	....	....	....	....	.....	....	..	..	..	..	....	..	.....	..	..	....	.....	....	..	....	..	....	....	..	..	....	..	....
...	...	...	...	....	....	....	....	.....	....	..	..	..	..	....	..	.....	..	..	....	.....	....	..	1	52	....	....	..	..	....	..	....
...	6	14	...	3	2	....	1	.....	....	..	..	..	..	....	..	1	..	1	....	.....	....	..	....	..	....	....	..	..	179	..	....
...	...	...	...	....	....	....	....	.....	....	..	..	..	..	....	..	.....	..	..	2	.....	....	..	....	..	....	....	..	..	....	22	....
...	12	...	...	5	....	....	....	.....	....	..	..	..	3	....	..	.....	1	..	....	.....	....	..	....	..	....	....	1	2	....	..	....
...	...	...	30	4	....	....	....	.....	....	..	..	..	..	....	..	1	..	..	....	.....	....	..	....	..	....	....	..	..	....	..	....
...	...	3	...	....	....	....	....	.....	....	..	..	..	..	....	..	6	..	..	6	18	....	..	....	..	....	....	..	..	....	..	....
...	1	4	1	7	....	....	1	5	....	..	..	..	..	....	..	14	..	..	....	2	....	..	4	..	....	1	..	..	1	..	....
...	...	1	...	....	....	....	....	.....	....	..	..	..	..	....	..	.....	..	..	....	.....	....	..	....	..	....	....	..	..	....	..	....
...	...	...	...	....	....	....	....	.....	....	..	..	..	..	....	..	.....	..	..	....	.....	....	..	....	..	....	....	..	..	....	..	....
...	...	...	...	11	2	....	....	.....	....	..	..	..	..	....	..	2	..	..	....	.....	....	..	1	..	....	....	..	..	....	..	....
...	1	...	...	....	....	....	....	.....	....	..	..	..	27	....	..	.....	..	..	....	.....	....	..	....	..	....	....	..	..	....	..	....
...	3	3	...	....	....	....	....	.....	....	..	..	..	1	....	..	.....	..	..	....	.....	....	..	....	..	....	....	1	2	....	..	....
...	4	...	5	2	....	....	1	.....	....	..	..	..	..	....	..	.....	..	..	2	.....	....	..	....	..	....	....	..	..	1	..	1
66	630	530	840	3,922	204	220	897	1,992	191	27	2	10	85	1	2	4,269	27	45	389	3,386	286	8	219	81	111	193	27	28	222	27	2

TABLE 9

Immigration from the United States, Showing Country of Birth by Racial Origin for the Fiscal Year ended March 31, 1948

Country of Birth	Totals	Arabian	Armenian	Belgian	Bohemian	English	Irish	Scottish	Welsh	Bulgarian	Chinese	Croatian	Czech	Dutch	East Indian	Esthonian	Finnish	French	German	Greek	Hebrew	Italian	Japanese	Jugo-Slavian	Lettish	Lithuanian	Magyar	Maltese	Mexican	Negro	North Am. Indian	Polish	Portuguese	Roumanian	Russian	Ruthenian	Danish	Icelandic	Norwegian	Swedish	Serbian	Slovak	Spanish	Spanish American	Swiss	Syrian
Africa (British)	3					2		1																																					
Africa (Not British)	1					1																																							
Argentine	1																		1																											
Australia	25					13	1	7											1													2				1									
Austria	27					2													11		10													1		2				1					
Barbados	3																													3															
Belgium	4			3																	1																								
Bermuda	3					2	1																																					
Bulgaria	1									1																																			
Canada	1,083			3	1	356	132	208	8	1			2	21		1	2	221	44	2	34	7		1	1	1				4	1	1		4	2	9	7	3	3	1		1			1
Chili	1																																										1		
China	15					5		2													4													1					2	1					
Cuba	3																	1												1												1		
Czecho-Slovakia	26												11								4			4											1					6			
Denmark	5																																			5								
Egypt	4					2	1																				1																
Eire	23						23																																					
England	450					406	10	7	5					1				1	1		16							1		1		1												
Esthonia	1															1																												
Finland	10																10																											
France	26					1												23			1																							
Germany	61																		41		20																							
Greece	27																			27																								
Central America, N.E.S.	4						1												1															1								1		
Guiana (British)	2					1																											1										
Hawaiian Islands	4					2	1		1																																		
Holland	18					3								15																													
Honduras (British)	1					1																																					
Hungary	20					1													1		4						14																
Iceland	1																																				1							
India	49					6		5	1						37																													
Ireland, Northern	36						35														1																							
Italy	45					1													2			42																					
Jamaica	6					3		2																																		1		
Japan	8					5													1		1		1																				
Jugo-Slavia	23												2						1	1	1			5			5							3						4	1			
Latvia	2																				1				1																			

Lesser British Isles	5					4												1																												
Lithuania	5																				2					3																				
Malta	5																											5																			
Newfoundland	26					20	5											1																												
New Zealand	14					9	3	2																																						
Norway	16																																						16							
Peru	3						1	1																																				1		
Philippine Islands	5					4																																						1		
Poland	88																		2		51											27				8										
Portugal	1					1																																								
Roumania	18																		3		8						2							3							1	1				
Russian	63													2					6		30														25											
St. Pierre and Miquelon	1																	1																												
Scotland	127					3	2	121																													1									
South America, N.E.S.	1													1																																
Sweden	12																																							12						
Switzerland	8																	1																											7	
Syria	6	1																																												5
Trinidad	1																													1																
Turkey	1																			1																										
United States	6,578		2	3	14	2,074	812	660	66	1	1	7	11	246		3	15	707	725	19	343	121	2	18		15	40	4	1	100	18	86	9	9	24	20	60		113	158	1	14	3	13	24	16
Wales	19					7			12																																					
West Indies (British) N.E.S.	5					2												2												1																
Others	4					2													1														1													
Totals	9,034	1	2	9	15	2,939	1,028	1,016	93	3	1	9	24	286	37	5	27	959	842	50	532	170	3	28	2	19	61	11	1	111	19	117	11	20	53	40	74	4	134	172	6	24	3	19	32	22

TABLE

Origin, Sex, Occupation and Destination of Immigrant Arrivals

Racial Origin	Sex				Totals	Trade or								
	18 Years and Over		Under 18 Years			Farming Class			Unskilled and semi-skilled Workers			Skilled Workers		
	Males	Females	Males	Females		Males	Females	Children	Males	Females	Children	Males	Females	Children
Albanian	5				5	2			2			1		
Arabian		1			1									
Armenian		5			5									
Belgian	333	384	173	144	1,034	256	170	253	17	17	10	30	29	12
Bohemian	6	6	2		14		2					1	3	1
British—														
English	12,468	12,336	3,306	3,099	31,209	1,512	707	626	2,102	1,144	570	5,440	2,022	1,542
Irish	1,767	1,215	231	247	3,460	250	47	48	471	176	66	648	145	81
Scottish	3,685	3,674	869	879	9,107	332	134	136	640	415	192	1,810	550	371
Welsh	430	402	101	79	1,012	56	20	30	64	47	15	175	69	41
Bulgarian	3	6	2	2	13				1			1	1	1
Chinese	1	19	2	2	24									
Croatian	46	24	5	9	84	9	3	8	30	2		5	5	4
Czech	100	134	23	28	285	34	24	12	16	5	4	20	14	8
Dalmatian	1			1	2							1		1
Dutch	1,147	1,531	838	748	4,264	983	629	1,280	51	74	91	56	50	31
East Indian	111	10	9		130	4		1	86	2		4		
Esthonian	280	266	15	11	572	22	17	12	179	5	4	26	26	6
Finnish	21	32	4	9	66	4	5	2	5	3	3	7	2	
French	207	278	74	71	630	37	27	37	42	18	12	46	30	23
German	154	292	39	45	530	60	56	39	13	26	11	49	31	11
Greek	228	423	112	77	840	48	9	5	57	30	9	23	13	7
Hebrew	1,594	1,258	603	467	3,922	112	55	48	193	62	84	893	610	351
Italian	80	96	14	14	204	9	4	3	17	14	5	33	9	5
Jugo-Slavian	96	115	5	4	220	8	2		47	3	2	30	20	5
Lettish	576	280	23	18	897	14	8	12	409	7	2	41	42	21
Lithuanian	1,421	450	68	53	1,992	90	65	69	943	12	5	122	47	35
Magyar	72	91	12	16	191	15	8	2	21	4		25	11	16
Maltese	18	4	3	2	27	4			6	1	1	6		
Mexican		2			2		1							
Moravian	4	4	2		10	1						2	1	1
Negro	41	33	7	4	85	2			13	4		8	5	
North American Indian		1			1									
Persian	1		1		2									
Polish	2,679	1,217	181	192	4,269	828	256	211	1,170	38	19	264	207	69
Portuguese	14	10		3	27	1			1	1		2		
Roumanian	17	24	3	1	45	3	3	2	7	2		3	3	1
Russian	163	182	22	22	389	30	44	27	75	10	4	28	23	6
Ruthenian	2,404	738	123	121	3,386	526	186	170	1,412	18	9	184	93	49
Scandinavian—														
Danish	124	95	29	38	286	69	16	25	16	7	9	17	8	4
Icelandic	2	5		1	8							2	2	1
Norwegian	103	67	27	22	219	24	5	9	30	10	9	31	7	10
Swedish	27	29	13	12	81	4	4	3	5	1		10	4	10
Serbian	84	20	4	3	111	6	2	5	61	3		6	3	1
Slovak	40	129	13	11	193	21	5	4	10	5		4		
Spanish	6	19	1	1	27	1	2				1	2	2	
Spanish American	4	18	3	3	28			1	1	1			3	
Swiss	106	68	27	21	222	47	25	36	27	3		13	2	1
Syrian	6	17	2	2	27	2				2		1		
Turkish	1	1			2				1					
Totals	30,676	26,011	6,991	6,482	70,160	5,426	2,541	3,116	8,241	2,172	1,137	10,070	4,092	2,726

10

from Overseas for the Fiscal Year ended March 31, 1948

Occupation											Destination										
Trading and Clerical Classes			Mining Class			Female Domestic Servants		Other Classes													
Males	Females	Children	Males	Females	Children	18 Years and Over	Under 18 Years	Males	Females	Children	Nova Scotia	New Brunswick	Prince Edward Island	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Yukon Territory	Northwest Territories
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	2	.....	1	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	5	.....	.....	.....	.....	3	2	.....	.....	.....	.....	.....	.....
16	14	9	2	2	....	7	1	12	145	32	22	12	....	130	710	59	33	42	26	....	....
3	.....	.....	.....	.....	.....	.....	.....	2	1	1	.....	.....	.....	1	12	.....	.....	.....	1	.....	.....
2,324	2,495	804	97	14	17	585	67	993	5,369	2,779	1,201	492	102	2,910	18,158	1,033	864	1,427	5,019	....	3
262	235	68	25	2	3	119	8	111	491	204	114	60	3	408	2,240	99	89	76	369	2	....
579	752	194	37	5	6	218	7	287	1,600	842	203	126	20	817	5,534	341	219	410	1,436	....	1
84	57	26	9	4	4	17	1	42	188	63	25	22	7	90	590	36	30	66	142	4	....
.....	.....	.....	.....	.....	.....	.....	.....	1	5	3	.....	.....	.....	1	12	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	1	19	4	.....	.....	.....	1	8	.....	2	1	12	.....	.....
.....	1	.....	1	.....	.....	10	....	1	3	2	1	.....	.....	26	52	1	2	1	1	.....	.....
20	15	7	2	.....	.....	10	2	8	66	18	1	4	....	41	178	4	8	20	29	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	.....	.....	.....	.....	.....
26	36	22	1	1	....	97	6	30	644	156	95	67	7	150	2,450	391	187	406	509	1	1
15	.....	1	.....	.....	.....	.....	.....	2	8	7	1	.....	.....	.....	3	.....	1	1	124	.....	.....
4	7	2	49	.....	.....	202	.....	.....	9	2	8	22	....	188	302	14	2	16	19	1	.....
1	.....	.....	1	1	1	7	....	3	14	7	.....	2	....	14	40	.....	.....	.....	10	.....	.....
41	32	11	.....	.....	.....	10	3	41	161	59	42	12	....	339	127	35	17	19	39	.....	.....
15	31	7	.....	.....	.....	31	2	17	117	14	5	2	....	74	227	63	39	58	62	.....	.....
57	12	4	.....	.....	.....	50	2	43	309	162	11	7	....	153	587	10	10	14	48	.....	.....
189	172	57	2	1	....	54	....	205	304	530	30	14	....	1,967	1,608	125	27	35	115	1	....
9	5	.....	1	.....	.....	3	....	11	61	15	4	.....	.....	56	117	2	2	2	21	.....	.....
2	1	.....	7	.....	.....	77	....	2	12	2	3	4	....	119	81	7	1	.....	5	.....	.....
4	3	3	105	.....	.....	216	1	3	4	2	7	14	....	309	471	31	9	11	31	14	....
4	10	3	252	.....	.....	294	1	10	22	8	1	18	....	590	1,252	58	31	32	10	.....	.....
6	4	.....	1	.....	.....	29	....	4	35	10	1	4	....	73	88	1	4	7	13	.....	.....
2	1	.....	.....	.....	.....	.....	.....	.....	2	4	.....	.....	.....	4	22	.....	.....	.....	1	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	1	.....	.....	1	.....	.....
1	1	1	.....	.....	.....	.....	.....	.....	2	.....	.....	.....	.....	.....	9	.....	.....	.....	1	.....	.....
10	4	1	.....	.....	.....	8	....	8	12	10	11	.....	.....	48	23	2	.....	.....	1	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	.....
1	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	1	.....	.....	.....	1	.....	.....
30	24	8	333	.....	.....	549	3	54	143	63	31	25	....	1,085	2,086	453	195	268	123	3	....
9	2	1	.....	.....	.....	.....	1	1	7	1	1	1	....	12	9	1	.....	.....	3	.....	.....
3	2	.....	.....	.....	.....	7	....	1	7	1	.....	.....	.....	17	15	5	5	1	2	.....	.....
7	12	.....	14	.....	.....	58	....	9	35	7	1	4	....	85	136	72	9	16	66	.....	.....
11	9	3	219	.....	.....	385	....	52	47	13	38	9	5	693	1,992	304	153	162	28	2	....
12	7	6	.....	.....	.....	11	....	10	46	23	8	10	....	23	87	14	19	86	36	2	1
.....	3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5	.....	.....	3	.....	.....
12	5	2	.....	.....	.....	9	1	6	31	18	44	7	....	16	53	6	8	20	65	.....	.....
4	5	1	2	.....	.....	4	....	2	11	11	.....	1	....	14	23	3	.....	19	21	.....	.....
1	.....	.....	9	.....	.....	9	....	1	3	1	1	1	....	21	77	.....	2	6	3	.....	.....
3	2	3	.....	.....	.....	15	2	2	102	15	.....	.....	.....	18	135	12	2	14	12	.....	.....
2	3	1	.....	.....	.....	1	....	1	11	.....	.....	1	....	7	11	1	.....	2	5	.....	.....
2	5	4	.....	.....	.....	.....	.....	1	9	1	1	.....	....	12	8	1	4	.....	2	.....	.....
11	10	2	.....	.....	.....	4	....	8	24	9	2	.....	.....	59	88	9	4	32	28	.....	.....
2	2	1	.....	.....	.....	.....	.....	1	13	3	4	.....	.....	6	9	.....	.....	2	6	.....	.....
.....	.....	.....	.....	.....	.....	1	....	.....	.....	.....	.....	.....	.....	1	1	.....	.....	.....	.....	.....	.....
3,784	3,979	1,252	1,169	30	31	3,097	108	1,986	10,100	5,103	1,917	941	144	10,584	39,637	3,201	1,979	3,272	8,449	30	6

TABLE

Origin, Sex, Occupation and Destination of Immigrant Arrivals

Racial Origin	Sex				Totals	Trade or								
	18 Years and Over		Under 18 Years			Farming Class			Unskilled and semi-skilled Workers			Skilled Workers		
	Males	Females	Males	Females		Males	Females	Children	Males	Females	Children	Males	Females	Children
Arabian	1				1									
Armenian		2			2									
Belgian	3	6			9	1							1	
Bohemian	6	5	1	3	15	1			1				1	
British—														
English	1,050	1,152	366	371	2,939	123	55	89	119	50	51	271	87	80
Irish	390	374	152	112	1,028	78	22	42	55	9	19	78	28	33
Scottish	382	435	94	105	1,016	58	18	25	49	13	14	82	27	26
Welsh	41	34	10	8	93	3	2		5			15	3	3
Bulgarian	2	1			3	1						1		
Chinese		1			1									
Croatian	3	3	1	2	9	1			1					
Czech	11	11	1	1	24				2		1		2	
Dutch	106	101	38	41	286	22	6	5	11	4	3	20	7	8
East Indian	37				37	5			25			2		
Esthonian	1	2	1	1	5	1								
Finnish	11	13	1	2	27	3	2	1	1	1		2	2	
French	353	383	108	115	959	53	26	40	57	19	10	88	33	35
German	307	334	92	109	842	49	19	19	32	15	2	73	23	30
Greek	33	11	5	1	50	2	1		8			3	1	
Hebrew	217	219	44	52	532	2	1	2	9	3	5	48	19	9
Italian	74	61	19	16	170	4	3	4	13	2	1	23	7	3
Japanese		3			3									
Jugo-Slavian	9	13	4	2	28	1			1			3		1
Lettish	2				2	1			1					
Lithuanian	10	6		3	19		1		3			3		
Magyar	18	30	8	5	61	3	3	3			1	6	1	2
Maltese	3	3	1	4	11	1		3				2	2	1
Mexican	1				1				1					
Negro	66	31	7	7	111	1	1		40	4	2	7	3	4
North American Indian	1	7	7	4	19							1	1	
Polish	57	48	8	4	117	7			12	5		11	3	1
Portuguese	3	5	2	1	11		1		1			1		1
Roumanian	8	8		4	20	4	2	3	1	1		1		
Russian	18	28	2	5	53	4	2	3	1	1		3	2	
Ruthenian	20	13	5	2	40	1	1		4		2	3		1
Scandinavian—														
Danish	24	22	14	14	74	4	2	4	5	1	3	8		4
Icelandic	2	2			4									
Norwegian	44	53	16	21	134	10	6	5	1			9	2	5
Swedish	71	57	21	23	172	10	5	4	9	2	1	18	3	4
Serbian	3	3			6	1						1		
Slovak	7	13	2	2	24	1	2	1		1	1	2		2
Spanish	1	1		1	3							1		
Spanish American	8	8	1	2	19				2					
Swiss	14	11	2	5	32	1			2	1	2	2		2
Syrian	4	12	2	4	22									
Totals	3,422	3,525	1,035	1,052	9,034	457	181	253	472	132	118	788	258	255

11

from Overseas for the Fiscal Year ended March 31, 1948

Occupation											Destination										
Trading and Clerical Classes			Mining Class			Female Domestic Servants		Other Classes			Nova Scotia	New Brunswick	Prince Edward Island	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Yukon Territory	Northwest Territories
Males	Females	Children	Males	Females	Children	18 Years and Over	Under 18 Years	Males	Females	Children											
1																			1		
	1								1						2						
2	1								4		1			1	5	1			1		
4	2	2							2	2		1		1	5	4	3		1		
256	193	112	13	2	4	11		268	754	401	195	136	24	425	1,240	43	67	211	581	13	4
89	58	38	4			2		86	255	132	33	41	8	98	519	32	29	93	174	1	
89	69	26	7	3	2	6		97	299	106	89	45	17	92	469	39	27	59	177	2	
10	7		1			1		7	21	15	2	3		10	48	1	5	4	19		1
	1														2				1		
									1						1						
1									3	3					8				1		
6	2							3	7	1	2			3	12	1	1	2	3		
28	22	14	1					24	62	49	14	7	2	30	132	6	9	20	66		
3								2						1					36		
	1								1	2				3				2			
4				1		2		1	5	2		1			11		1	4	10		
91	43	30	1			16	1	63	246	107	36	95	7	500	229	11	2	29	49		1
78	40	30	5	3		3	1	70	231	119	20	12	2	89	426	29	54	92	113	5	
15	1							5	8	6	2			15	27		1		5		
103	46	18	1					54	150	62	8	11		230	197	33	7	17	29		
22	7	4	1	1		3		11	38	23	5	4		38	92	1	2	3	25		
									3										3		
2	1							2	12	5					25			2	1		
														1		1					
	2	1						4	3	2		1		3	11			2	2		
7	3	4						2	23	3				6	49		4		2		
									1	1				1	10						
																		1			
8	3					6		10	14	8	3	2		23	66	7	2	3	5		
							1		6	10		1		1	4		2	1	10		
13	5							14	35	11		1		16	80	6	2	4	7	1	
1	1								3	2	1			3	5			1	1		
2						1			4	1				1	10	1	1	6	1		
4	3	1						6	20	3	2		1	9	10	3	11	5	12		
7	3	2						5	9	2				2	22	11	2	3			
3	6	5						4	13	12	1			3	37	2	2	16	13		
								2	2							3			1		
17	11	8						7	34	19		1		7	32	5	18	24	47		
11	6	7	1		2	1		22	40	26	4	2	1	17	39	15	17	33	43	1	
								1	3					1	5						
2	2							2	8					2	17	1	1	3			
									1	1				1	1				1		
3	3	3						3	5		1			7	5	1			5		
5	1	1	1					3	9	2	1	1		9	9			9	3		
3	2	4						1	10	2				12	4		1	4	1		
890	546	310	36	10	8	52	3	779	2,346	1,140	420	365	62	1,661	3,866	257	271	653	1,450	23	6

TABLE

Total Immigration to Canada, Showing Racial Origin by Country of

Country of Last Permanent Residence	Totals	Albanian	Arabian	Armenian	Belgian	Bohemian	English	Irish	Scottish	Welsh	Bulgarian	Chinese	Croatian	Czech	Dalmatian	Dutch	East Indian
Africa (British)	109	..	..	..	2	....	64	2	10	3	..	....	....	....	..	3	....
Africa (Not British)	53	..	..	..	.....	....	6	.....	3	.....	..	....	....	....	..	.....	....
Australia	379	..	..	..	.....	....	253	34	50	6	..	....	....	....	..	3	....
Austria	89	..	..	..	.....	....	1	.....	.....	.....	..	....	4	....	..	.....	....
Belgium	1,193	..	..	..	999	....	5	.....	1	.....	..	....	....	3	..	12	....
Bermuda	56	..	..	..	.....	....	45	2	4	.....	..	....	....	....	..	.....	....
Bulgaria	18	..	..	..	.....	....	.....	.....	.....	.....	13	....	....	....	..	.....	....
Central America	22	..	..	..	2	....	9	3	.....	.....	..	....	....	....	..	.....	....
China	181	..	..	..	.....	....	53	7	14	.....	..	20	....	2	..	.....	....
Czecho-Slovakia	599	..	..	..	.....	6	.....	1	4	.....	..	....	....	210	..	.....	....
Denmark	282	..	..	..	.....	....	1	.....	.....	.....	..	....	....	....	..	1	....
Eire	527	..	..	..	.....	....	14	498	6	.....	..	....	....	....	..	.....	....
England	31,841	1	..	1	20	8	26,907	1,256	1,495	535	..	2	....	47	..	44	....
Esthonia	514	..	..	..	.....	....	.....	.....	.....	.....	..	....	....	....	..	.....	....
Finland	56	..	..	..	.....	....	1	.....	.....	.....	..	....	....	....	..	.....	....
France	749	..	..	1	3	....	13	3	.....	.....	..	....	4	9	..	2	....
Germany	473	..	..	..	.....	....	2	.....	.....	.....	..	....	....	....	..	31	....
Greece	809	1	..	..	.....	....	1	.....	.....	.....	..	....	....	....	..	.....	....
Holland	3,455	..	..	..	3	....	16	2	5	.....	..	....	....	1	..	3,388	1
Hungary	255	..	..	..	.....	....	.....	.....	.....	.....	..	....	....	....	..	.....	....
India	382	..	..	..	.....	....	165	27	49	2	..	....	....	....	..	.....	128
Ireland (Northern)	1,152	..	..	..	.....	....	71	1,047	24	3	..	....	....	....	..	1	....
Italy	134	1	..	..	.....	....	1	.....	.....	.....	..	....	....	....	..	.....	....
Japan	14	..	..	..	.....	....	10	.....	2	1	..	....	....	....	..	.....	....
Jugo-Slavia	457	..	..	..	.....	....	.....	.....	.....	.....	..	....	76	2	..	.....	....
Latvia	868	..	..	..	.....	....	.....	.....	.....	.....	..	....	....	....	..	.....	....
Lesser British Isles	74	..	..	..	.....	....	55	4	11	.....	..	....	....	....	..	.....	....
Lithuania	1,946	..	..	..	.....	....	.....	.....	.....	.....	..	....	....	....	..	1	....
Mexico	59	..	..	..	.....	....	1	.....	.....	.....	..	....	....	....	..	.....	....
Newfoundland	2,980	..	..	..	.....	....	2,489	322	76	21	..	....	....	....	..	.....	....
New Zealand	233	..	..	..	.....	....	160	20	38	1	..	....	....	....	2	.....	....
Norway	218	..	..	..	.....	....	12	1	1	.....	..	....	....	....	..	1	....
Palestine	107	..	..	..	.....	....	.....	.....	1	1	..	....	....	1	..	.....	....
Poland	8,811	1	..	..	.....	....	1	.....	.....	.....	..	....	....	3	..	41	....
Portugal	13	..	..	..	.....	....	.....	.....	.....	.....	..	....	....	....	..	.....	....
Roumania	210	..	..	..	.....	....	.....	.....	.....	.....	..	....	....	....	..	.....	....
Russia	1,057	..	..	..	.....	....	.....	.....	.....	.....	..	....	....	2	..	672	....
St. Pierre and Miquelon	8	..	..	..	.....	....	.....	.....	.....	.....	..	....	....	....	..	.....	....
Scotland	7,977	..	..	..	3	....	387	184	7,239	22	..	....	....	4	..	9	....
South America	198	..	..	..	.....	....	44	7	21	.....	..	....	....	1	..	29	....
Spain	9	..	..	..	.....	....	.....	.....	.....	.....	..	....	....	....	..	.....	....
Sweden	162	..	..	..	.....	....	2	.....	.....	.....	..	....	....	....	..	1	....
Switzerland	225	..	..	..	.....	....	2	.....	.....	1	..	....	....	....	..	3	....
Syria	27	..	1	2	.....	....	.....	.....	.....	.....	..	....	....	....	..	.....	....
Ukraine	20	..	..	..	.....	....	.....	.....	.....	.....	..	....	....	....	..	12	....
United States	9,038	..	1	2	9	15	2,940	1,028	1,017	93	3	1	9	24	..	286	37
Wales	662	..	..	..	.....	....	210	14	13	415	..	....	....	....	..	.....	....
West Indies, British	348	..	..	..	.....	....	175	20	34	1	..	1	....	....	..	2	1
West Indies, Not British	58	..	..	..	.....	....	11	1	2	.....	..	....	....	....	..	4	....
Others	87	1	..	1	2	....	21	5	3	.....	..	1	....	....	..	4	....
Total	79,194	5	2	7	1,043	29	34,148	4,488	10,123	1,105	16	25	93	309	2	4,550	167

12

Last Permanent Residence for the Fiscal Year ended March 31, 1948

Esthonian	Finnish	French	German	Greek	Hebrew	Italian	Japanese	Jugo-Slavian	Lettish	Lithuanian	Magyar	Maltese	Mexican	Moravian	Negro	North American Indian	Persian	Polish	Portuguese	Roumanian	Russian	Ruthenian	Danish	Icelandic	Norwegian	Swedish	Serbian	Slovak	Spanish	Spanish American	Swiss	Syrian	Turkish
....	..	2	3	...	11	...	..	..	..	....	..	..	..	..	N	..	..	3	..	..	....	1	....	3	1	....	....	....	..	..	....	..	..
....	..	15	2	1	17	1	..	..	..	....	..	4	..	..	..	..	..	3	..	..	....	....	....	....	....	....	....	....	..	..	1	..	..
....	..	4	1	3	5	7	..	..	..	....	..	..	..	..	..	..	..	....	..	..	8	....	....	....	....	4	....	....	1	..	....	..	..
1	..	....	12	...	43	....	..	6	....	....	1	..	..	..	..	..	..	5	..	..	2	12	....	....	....	....	2	....	..	..	....	..	..
....	..	36	2	1	89	....	..	..	..	2	..	..	..	..	..	..	..	26	..	..	3	11	1	....	....	1	....	1	..	..	....	..	..
....	..	....	....	....	....	....	..	..	..	....	..	..	..	..	..	..	..	....	1	..	....	....	4	....	....	....	....	....	..	..	....	..	..
....	..	....	....	3	1	....	..	..	..	....	..	..	..	..	..	..	..	....	..	..	....	1	....	....	....	....	....	....	..	..	....	..	..
....	..	....	....	....	....	....	..	..	..	....	..	..	..	..	..	..	..	....	..	..	....	....	....	....	....	....	....	....	..	8	....	..	..
1	..	7	11	...	35	....	..	..	..	....	..	..	..	..	..	..	..	....	3	..	20	2	1	..	1	....	....	1	..	..	3	..	..
....	..	....	17	1	157	....	..	2	....	....	19	..	..	1	..	..	..	6	..	..	8	13	....	....	....	....	....	154	..	..	....	..	..
....	4	1	4	...	5	....	..	..	2	4	..	..	..	..	..	..	..	3	..	..	6	3	248	....	....	....	....	....	..	..	....	..	..
....	..	4	....	....	2	....	..	..	..	....	1	..	..	..	..	..	..	....	..	..	2	....	....	....	....	....	....	....	..	..	....	..	..
4	4	89	153	23	882	59	..	5	1	2	18	3	..	4	6	..	2	116	2	9	48	8	19	1	8	20	3	2	7	2	24	1	..
494	1	....	....	....	1	....	..	..	2	3	..	..	..	..	..	..	..	1	..	..	5	2	....	....	....	5	....	....	..	..	....	..	..
....	50	....	....	....	....	....	..	..	..	....	..	..	..	..	..	..	..	....	..	..	2	....	....	....	3	....	....	....	..	..	....	..	..
....	..	364	4	1	152	10	..	1	....	1	2	..	..	..	..	..	..	133	..	3	12	22	....	....	....	....	2	2	..	1	4	..	..
5	..	1	64	...	128	....	..	1	16	49	..	..	..	..	..	..	..	59	..	1	12	103	1	....	....	....	....	....	..	..	....	..	..
....	..	....	....	797	7	1	..	1	....	....	..	..	..	..	..	..	..	....	..	..	1	....	....	....	....	....	....	....	..	..	....	..	..
....	..	7	11	...	12	3	..	..	..	....	3	..	..	..	..	..	..	1	..	..	1	....	....	....	....	1	....	....	..	..	....	..	..
....	..	....	1	...	125	....	..	..	..	....	126	..	..	..	..	..	..	....	..	..	....	1	....	....	....	....	2	....	..	..	....	..	..
....	1	2	....	....	....	3	..	..	..	....	..	..	..	1	..	..	..	1	..	..	2	....	....	....	....	1	....	....	..	..	....	..	..
....	..	....	1	...	2	....	..	..	..	1	..	..	..	..	..	..	..	1	..	..	....	....	....	....	....	....	....	1	..	..	....	..	..
....	..	1	1	...	17	103	..	6	....	....	..	..	..	..	..	..	..	3	..	..	....	....	....	....	....	....	1	....	..	..	....	..	..
....	..	....	....	....	....	1	..	..	..	....	..	..	..	..	..	..	..	....	..	..	....	....	....	....	....	....	....	....	..	..	....	..	..
....	..	....	49	...	14	....	..	194	....	....	6	..	..	..	..	..	..	1	..	1	9	3	....	....	....	....	100	2	..	..	....	..	..
1	..	....	....	....	9	....	..	..	834	12	..	..	..	..	..	..	..	5	..	..	5	2	....	....	....	....	....	....	..	..	....	..	..
....	..	4	....	....	....	....	..	..	..	....	..	..	..	..	..	..	..	....	..	..	....	....	....	....	....	....	....	....	..	..	....	..	..
1	..	....	5	...	32	....	..	..	11	1,890	..	..	..	..	..	..	..	....	..	..	....	6	....	....	....	....	....	....	..	..	....	..	..
....	..	....	1	...	13	....	..	..	..	....	..	..	2	..	..	..	..	30	..	..	2	....	....	....	....	....	....	....	1	8	....	1	..
....	..	57	....	1	3	....	..	..	1	....	..	..	..	..	..	..	..	....	1	..	1	....	1	....	3	....	....	....	3	..	....	1	..
....	..	....	4	...	5	....	..	..	..	....	..	..	..	..	..	..	..	....	..	..	2	....	....	....	1	....	....	....	..	..	....	..	..
....	..	....	3	....	....	....	..	..	..	....	..	..	..	..	..	..	..	2	..	..	....	1	1	..	196	....	....	....	..	..	....	..	..
....	..	....	....	....	98	....	..	..	..	....	..	..	..	..	..	..	..	2	..	..	4	....	....	....	....	....	....	....	..	..	....	..	..
10	..	2	101	1	1,715	....	..	4	16	15	4	..	..	..	..	..	..	3,795	..	2	47	3,053	....	....	....	....	....	....	..	..	....	..	..
....	..	....	....	....	7	....	..	..	..	....	..	..	..	..	..	..	..	1	2	..	....	....	....	....	....	....	....	....	3	..	....	..	..
....	..	....	12	...	134	....	..	..	..	....	4	..	..	..	..	..	..	1	..	25	6	28	....	....	....	....	....	....	..	..	....	..	..
2	..	....	14	...	40	....	..	..	4	6	2	..	..	..	..	..	..	20	..	1	166	99	....	....	....	....	1	27	..	..	....	..	1
....	..	7	....	....	....	1	..	..	..	....	..	..	..	..	..	..	..	....	..	..	....	....	....	....	....	....	....	....	..	..	....	..	..
....	1	4	11	...	53	11	..	..	..	7	..	..	..	..	2	..	..	28	..	..	....	1	3	..	4	1	..	1	..	1	....	1	..
....	..	4	9	4	18	....	..	..	..	....	..	..	..	..	3	..	..	12	13	..	9	6	5	..	2	1	1	....	..	2	4	3	..
....	..	....	....	....	....	....	..	..	..	....	..	..	..	..	..	..	..	....	..	..	....	....	....	....	....	....	....	9	..	..	....	..	..
53	5	....	4	...	33	....	..	..	10	....	..	..	..	..	..	..	..	4	..	..	2	....	1	....	....	47	....	....	..	..	....	..	..
....	..	2	15	...	7	2	..	..	..	....	3	..	..	..	..	..	..	2	..	3	....	1	....	....	....	....	1	1	..	..	182	..	..
....	..	....	....	....	....	....	..	..	..	....	..	..	..	..	..	..	..	2	..	..	2	....	....	....	....	....	....	....	..	..	....	20	..
....	..	....	....	....	....	....	..	..	..	....	..	..	..	..	..	..	..	1	..	..	....	7	....	....	....	....	....	....	..	..	....	..	..
5	27	959	842	50	533	170	3	28	2	19	62	11	1	..	111	19	..	117	11	20	53	40	74	4	134	172	6	24	3	19	32	22	..
....	..	....	1	2	5	2	..	..	..	....	..	..	..	..	..	..	..	....	..	..	....	....	....	....	....	....	....	....	..	..	....	..	..
....	..	15	2	1	12	....	..	..	..	....	..	..	..	..	72	1	..	....	5	..	....	....	....	....	....	....	....	....	..	3	3	..	..
....	..	1	3	..	26	....	..	..	..	....	..	..	..	4	1	..	..	1	..	..	....	....	....	....	....	....	....	1	3	....	....	..	..
....	..	1	9	1	6	....	..	..	..	....	1	20	..	..	..	..	..	1	..	..	2	....	1	4	....	....	1	..	..	..	1	..	1
577	93	1,589	1,372	890	4,454	374	3	248	899	2,011	252	38	3	10	196	20	2	4,386	38	65	442	3,426	360	12	353	253	117	217	30	47	254	49	2

TABLE 13

Immigration, Showing Nationality and Sex, for the Fiscal Year ended March 31, 1948

Nationality	From Overseas					From the United States					Grand Totals
	Totals	18 Years and Over		Under 18 Years		Totals	18 Years and Over		Under 18 Years		
		M.	F.	M.	F.		M.	F.	M.	F.	
Albanian	4	4									4
Argentinian	2	1	1								2
Austrian	80	25	43	8	4	9	4	4	1		89
Belgian	1,029	337	373	173	146						1,029
Brazilian	19	1	4	7	7						19
British	47,009	19,235	18,592	4,694	4,488	820	295	442	38	45	47,829
Bulgarian	18	6	8	2	2						18
Central American	7	1	4	1	1	1		1			8
Chilian	1	1									1
Chinese	6	1	3	1	1						6
Cuban	12	4	4	1	3	2	1	1			14
Czecho-Slovakian	636	214	295	72	55	11	3	6	1	1	647
Danish	265	121	82	28	34	3	1	2			268
Danzig	2		2			1		1			3
Dutch	3,409	965	1,117	706	621	6	1	5			3,415
Esthonian	576	280	271	15	10						576
Finnish	61	18	27	5	11	5	4	1			66
French	452	140	186	71	55	19	11	8			471
German	118	43	49	14	12	19	5	9	2	3	137
Greek	805	213	405	112	75	17	14	3			822
Hungarian	283	96	94	55	38	1	1				284
Icelandic	5	1	4								5
Italian	91	40	39	4	8	15	7	8			106
Jugo-Slavian	483	247	193	19	24	7	6	1			490
Latvian	913	588	288	21	16	1	1				914
Leitchenstein	9	4	2	1	2						9
Lithuanian	2,015	1,421	466	71	57	1		1			2,016
Luxemburg	5	5									5
Mexican	22	6	9	2	5						22
Norwegian	215	96	79	22	18	7	2	4	1		222
Peruvian	1		1			1		1			2
Polish	9,725	5,933	2,628	595	569	38	23	13	1	1	9,763
Portuguese	3	1	1		1	1		1			4
Roumanian	226	80	60	65	21	4	4				230
Russian	1,242	365	551	167	159	12	6	6			1,254
South American, N.E.S.	6	1		3	2						6
Spanish	13	4	9								13
Swedish	51	17	18	9	7	2	2				53
Swiss	198	98	54	28	18	2	1	1			200
Syrian	20	5	13	1	1	2	1	1			22
Turkish	4	2	2								4
Ukrainian	39	31	8								39
U. S. Citizens	72	20	23	18	11	8,027	3,029	3,005	991	1,002	8,099
Venezuelan	1	1									1
Others	7	4	3								7
Totals	70,160	30,676	26,011	6,991	6,482	9,034	3,422	3,525	1,035	1,052	79,194

TABLE 14

Rejections from Overseas, by Causes and Nationality, from 1902-03 to 1947-48 and Total Rejections from the United States from 1908-09 to 1947-48

	Fiscal Years													
	1902-3 to 1912-13	1913-14 to 1922-23	1923-1924	1924-1925	1925-1926	1926-1927	1927-1928	1928-1929	1929-1930	1930-1931	1931-1932	1932-1933	1933-1934	1934-1935
FROM OVERSEAS														
By Causes														
Medical	4,162	1,029	130	83	40	95	104	94	78	39	26	16	17	9
Civil	5,094	5,604	862	948	226	594	215	266	243	444	298	213	177	206
Totals	9,256	6,633	992	1,031	266	689	319	360	321	483	324	229	194	215
By Nationality														
British	1,240	978	187	199	109	209	150	154	160	251	180	126	123	150
American	175	134	6	11	.....	5	2	3	8	6	4	13	11	13
Other countries	7,841	5,521	799	821	157	475	167	203	153	226	140	90	60	52
Totals	9,256	6,633	992	1,031	266	689	319	360	321	483	324	229	194	215
	1908-9 to 1912-13													
TOTALS FROM U.S.A.	68,454	171,009	10,311	10,553	12,219	12,819	15,938	18,110	24,718	39,434	36,867	28,939	18,878	14,426
GRAND TOTALS	77,710	177,642	11,303	11,584	12,485	13,508	16,257	18,470	25,039	39,917	37,191	29,168	19,072	14,641

	Fiscal Years													
	1935-1936	1936-1937	1937-1938	1938-1939	1939-1940	1940-1941	1941-1942	1942-1943	1943-1944	1944-1945	1945-1946	1946-1947	1947-1948	Totals
FROM OVERSEAS														
By Causes														
Medical	13	11	8	7	10	11	20	16	16	16	24	24	33	6,131
Civil	183	236	202	170	167	225	129	122	169	130	314	403	341	18,181
Totals	196	247	210	177	177	236	149	138	185	146	338	427	374	24,312
By Nationality														
British	123	138	86	94	124	95	90	89	141	110	246	260	205	6,017
American	7	7	4	9	5	4	1	1	1	5	.....	7	4	446
Other countries	66	102	120	74	48	137	58	48	43	31	92	160	165	17,849
Totals	196	247	210	177	177	236	149	138	185	146	338	427	374	24,312
TOTALS FROM U.S.A.	12,290	13,178	11,094	10,160	9,996	11,821	7,368	3,424	2,866	2,716	6,396	8,561	7,799	590,344
GRAND TOTALS	12,486	13,425	11,304	10,337	10,173	12,057	7,517	3,562	3,051	2,862	6,734	8,988	8,173	614,656

TABLE 15

Deportations, After Having Been Admitted, by Causes, Nationalities, and Provinces, from 1902-03 to 1947-48

	Fiscal Years													
	1902-3 to 1912-13	1913-14 to 1922-23	1923-1924	1924-1925	1925-1926	1926-1927	1927-1928	1928-1929	1929-1930	1930-1931	1931-1932	1932-1933	1933-1934	1934-1935
By Causes														
Medical causes	2,296	2,213	649	420	410	470	519	650	600	789	697	476	301	144
Public charges	2,853	4,517	775	543	506	354	430	444	2,106	2,245	4,507	4,916	2,991	464
Criminality	1,083	3,989	511	520	453	447	426	441	591	868	1,006	836	493	267
Other civil causes	530	793	93	58	189	149	257	194	107	200	270	277	250	172
Accompanying deported persons	145	262	78	145	158	165	254	235	559	274	545	626	439	81
Totals	6,907	11,774	2,106	1,686	1,716	1,585	1,886	1,964	3,963	4,376	7,025	7,131	4,474	1,128
By Nationalities														
British	4,358	5,226	1,377	985	899	808	1,047	1,083	2,983	3,099	4,248	4,251	2,718	385
American	1,066	4,566	417	321	330	351	297	294	228	279	260	331	319	199
Other countries	1,483	1,982	312	380	487	426	542	587	752	998	2,517	2,549	1,437	544
Totals	6,907	11,774	2,106	1,686	1,716	1,585	1,886	1,964	3,963	4,376	7,025	7,131	4,474	1,128
By Provinces														
Maritime Provinces	147	409	38	32	43	48	48	70	93	148	252	244	260	62
Quebec	1,589	2,197	301	206	233	233	240	255	480	509	984	1,343	596	163
Ontario	2,896	4,243	547	675	620	581	646	600	1,115	1,788	2,828	2,626	1,827	347
Manitoba	.....	1,310	802	242	195	177	279	403	1,296	625	1,014	858	408	71
Saskatchewan	1,783	691	110	115	113	118	197	173	277	414	767	490	261	91
Alberta	.....	1,041	102	134	178	169	260	187	396	511	631	738	467	184
British Columbia	491	1,876	206	282	334	259	216	276	306	381	549	832	655	210
Yukon Territory	1	7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Totals	6,907	11,774	2,106	1,686	1,716	1,585	1,886	1,964	3,963	4,376	7,025	7,131	4,474	1,128

	Fiscal Years													
	1935-1936	1936-1937	1937-1938	1938-1939	1939-1940	1940-1941	1941-1942	1942-1943	1943-1944	1944-1945	1945-1946	1946-1947	1947-1948	Totals
By Causes														
Medical causes	81	47	42	36	29	12	14	20	15	21	24	17	33	11,025
Public charges	125	110	46	45	18	8	1	.....	2	3	1	11	10	28,031
Criminality	207	117	101	114	110	83	69	100	111	99	95	127	136	13,400
Other civil causes	163	240	203	229	237	322	371	121	101	58	178	179	207	6,148
Accompanying deported persons	34	57	21	10	5	3	3	3	1	.....	.....	.....	1	4,104
Totals	610	571	413	434	399	428	458	244	230	181	298	334	387	62,708
By Nationalities														
British	157	202	134	135	127	108	135	82	74	62	165	153	188	35,189
American	146	167	138	145	147	124	107	104	96	82	61	100	93	10,768
Other countries	307	202	141	154	125	196	216	58	60	37	72	81	106	16,751
Totals	610	571	413	434	399	428	458	244	230	181	298	334	387	62,708
By Provinces														
Maritime Provinces	42	61	27	40	61	136	150	96	85	67	150	101	90	3,000
Quebec	106	129	102	112	103	139	178	48	48	35	68	102	102	10,601
Ontario	167	127	123	121	96	80	82	59	43	41	35	60	91	22,464
Manitoba	43	32	21	22	8	14	4	5	6	3	6	4	8	.....
Saskatchewan	36	26	14	28	9	.....	1	9	9	3	5	8	7	18,919
Alberta	79	77	40	19	32	9	9	7	6	8	7	7	10	.....
British Columbia	137	119	86	92	90	50	34	20	33	24	27	52	79	7,716
Yukon Territory	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8
Totals	610	571	413	434	399	428	458	244	230	181	298	334	387	62,708