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**LA THÈSE A ÉTÉ
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RIVER BASIN DEVELOPMENT: PERSPECTIVES
ON THE OTTAWA RIVER SYSTEM

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Thesis presented to the School of Graduate Studies
in partial fulfilment of the requirements for a
master's degree of Geography

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J. Hincks, Ottawa, Canada, 1978.

ABSTRACT

A study of the development of the Ottawa River basin during the less than four hundred years it has been known to white man, shows that uses of the river and their effects have changed and become more complex over time.

For nearly two hundred years the river was used primarily as a highway to the Great Lakes and beyond. This use did not change either the quality or physical nature of the river. Navigational difficulties were overcome by adopting the Indian canoe and by developing techniques for getting round falls and rapids. Thus man adapted himself, rather than his environment, in order to use the river for his needs.

In the 19th century the trade in square timber, which was accompanied by settlement in the Ottawa basin, was the start of man's interference with his natural surroundings. The denuding of the large forest trees resulted in erosion of stream banks and the deposition into the watercourses of silt and sand. Later in the century saw mills resulted in the dumping into the river of large amounts of sawdust, bark etc., and alterations in the flow of streams by dam-building for water power. Increasing population and urbanization resulted in the dumping into the river of greater amounts of domestic wastes. Conflicts arose between the uses of the river for waste disposal and for water intakes and navigational uses.

During the present century the river system has provided water for domestic, industrial and, to a small extent, agricultural purposes; for hydro power; for cooling purposes for a nuclear power plant; and to an ever

increasing extent for recreation. The use of the river for domestic and industrial waste disposal has been in conflict with most of these in situ and withdrawal purposes. These conflicts could not be resolved on an individual level, and in the 1950s legislation relating to water quality was passed by the Ontario government and a few years later by Québec. In 1970 the federal government passed legislation designed to control water quality in Canadian rivers. In the case of the Ottawa River, the position is complicated by the fact that it comes under the jurisdiction of three governments. These governments have ample legislation to control pollution in the river basin, but enforcement requires concerted action by the three governments and large expenditures of money. It appears that since 1970 there has been some decrease in the volume of wastes entering the river system, but the condition in certain sections is in conflict with most other uses. Until recently planning efforts have concentrated on the amounts of biological oxygen demand, dissolved oxygen and coliform bacteria as indicators of man-made pollution: to-day other indicators, such as temperature changes, heavy minerals, nutrients, viruses, radioactivity and nitrogen super-saturation, are necessary.

RÉSUMÉ

Un étude du développement du bassin de la rivière des Outaouais au cours des quatre derniers siècles montre que les utilisations de la rivière et leurs effets on changé et sont devenus plus complexes depuis qu'elle a été connue de l'homme blanc.

Pendant près de deux cents ans la rivière fut surtout utilisée

comme axe de circulation vers les Grands Lacs et au-delà. Cette utilisation ne changeait ni la qualité ni la nature physique de la rivière.

Les difficultés de navigation pouvaient être surmontées par les canoes indiens et en utilisant certaines techniques pour contourner chutes et rapides. Ainsi s'était l'homme qui s'adaptait plutôt que l'environnement pour utiliser la rivière selon ses besoins.

Au 19^e siècle, le commerce du bois qui accompagna la colonisation du bassin de la rivière fut le commencement de l'interférence humaine dans le milieu naturel. Dénuder les forêts eut pour conséquence l'érosion des rives et le dépôt dans le cours d'eau d'alluvions et de sable.

Plus tard, les scieries rejetèrent dans la rivière de grosses quantités de sciure, d'écorce, etc., et modifièrent le cours d'eau en construisant des barrages pour en utiliser l'énergie. L'augmentation de la population et l'urbanisation eurent pour résultat le rejet dans la rivière de quantités de plus en plus grandes déchets et la prise d'eau ou la navigation créèrent de multiples conflits.

Au cours de notre siècle, la rivière a procuré de l'eau pour des utilisations domestiques, industrielles et à une plus petite échelle agricole; pour l'énergie hydroélectrique; pour le refroidissement d'une centrale nucléaire et de plus en plus pour la récréation. L'utilisation de la rivière pour des rejets domestiques ou industriels est en conflit avec la plupart des utilisations d'extraction ou "in situ". Ces conflits ne pouvaient être résolus sur une base individuelle et dans les années cinquante le gouvernement de l'Ontario et plus tard celui du Québec passèrent une législation sur la qualité des eaux. En 1970, le gouvernement fédéral légifera aussi pour contrôler la qualité des eaux dans les rivières canadiennes.

Dans le cas de la rivière des Outaouais, sa situation se complique du fait qu'elle est sous la juridiction de trois gouvernements. Ces gouvernements ont une législation amplement suffisante pour contrôler la pollution dans le bassin de la rivière mais appliquer cette législation demande une action concertée de ces trois gouvernements et de forte dépenses. Il semble que depuis 1970, il y a eu une diminution des déchets dans la rivière mais la condition de certaines sections est en conflit avec la plupart des autres situations. Jusqu'à récemment les efforts de planification ont été concentrés sur la demande en oxygène biochimique, l'oxygène dissous, et les bactéries coliformes comme indicateurs de la pollution par les humains; aujourd'hui d'autres indicateurs tels que changements de température, minéraux lourds, matières nourissantes, virus, radioactivité et saturation excessive en nitrogène sont nécessaires.

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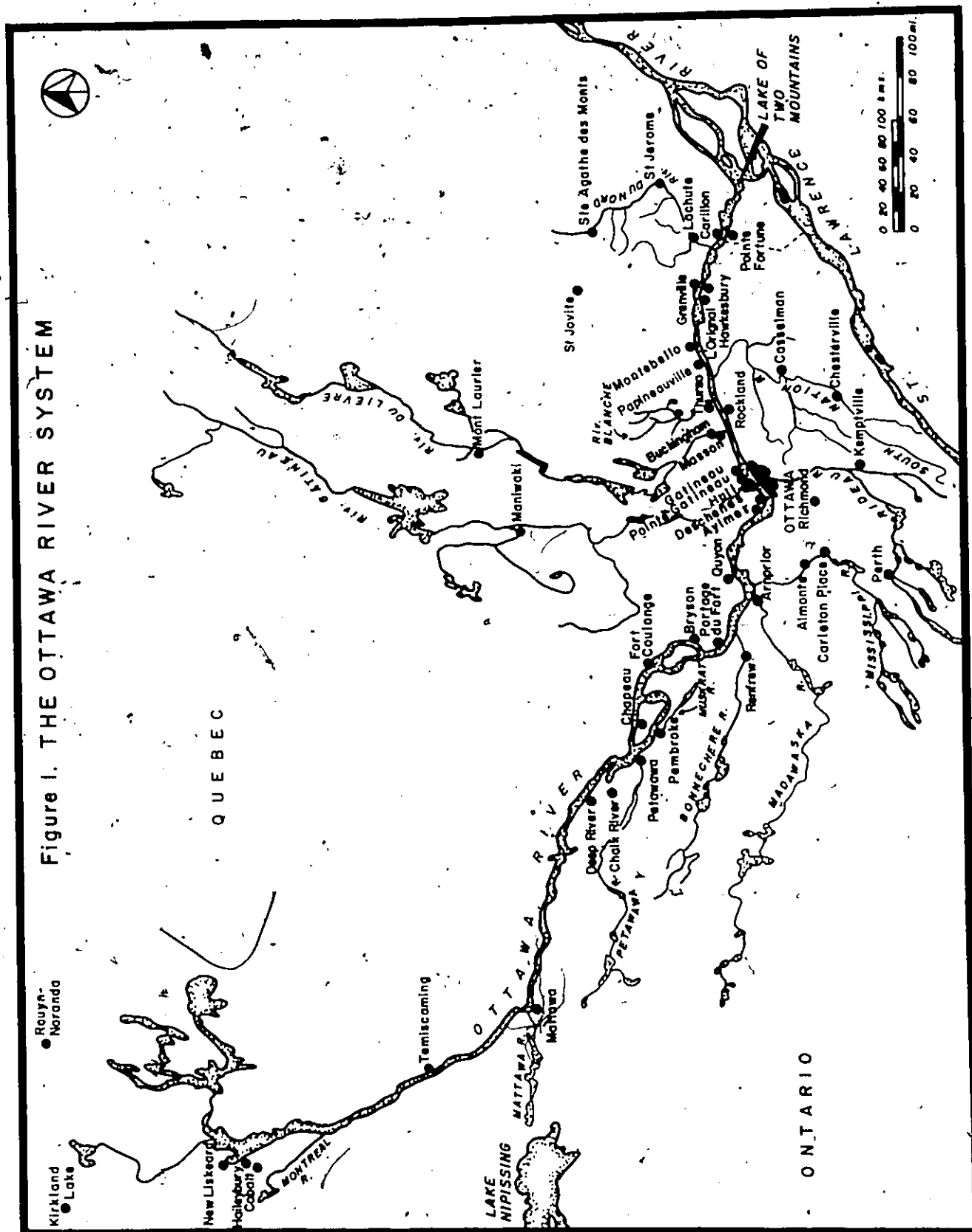
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Figure 1. THE OTTAWA RIVER SYSTEM



CHAPTER I

INTRODUCTION

This paper will trace the uses that have been made of the Ottawa River system since its first exploration by white man at the beginning of the 17th century until the present time. It will endeavour to determine how these uses have changed and increased over time and space, and the factors which have brought about these changes; the effects of various uses on water quality; conflicts which have arisen as the result of the uses made of the river system and how they have, or have not, been resolved; and the extent to which legislation by various levels of government has been effective in resolving conflicts between different users. Most of the literature on the river deals with it as the background for man's activities: the latter will be dealt with in this paper, but the emphasis will be on the effect of man's activities on the river system.

Water quality is of primary importance, since water free from bacteria and viruses is essential for good health and, indeed, for life. Moreover, recreation has become one of the major uses of the Ottawa River system and shoreline population has greatly increased. Bacteria- and virus-free water is essential for water-related activities such as swimming, fishing, water-skiing, boating etc. While water supplies for domestic use can be made innocuous by treatment, it is not possible to treat water in the river to make it fit for recreational purposes. The fact that all public beaches on the Ottawa River in the City of Ottawa were closed during 1976

(and were periodically opened and closed for several summers before) is evidence that contamination of the river was such that it was, as late as 1976, unsuitable for recreational purposes in the Ottawa area.

Even in their natural state, rivers exhibit differences in turbidity, alkalinity, dissolved oxygen, temperature and trace elements, all of which place limits upon the biota which can survive.

Conflicts between the users of rivers for a number of purposes arise because rivers have been treated as common property and because the uncontrolled use for waste disposal of a river, which by its nature is constantly moving, causes externalities for downstream uses.

Much literature has been written regarding the effects of treating environmental resources as a common good. Alchian and Demsetz¹ define the meaning of ownership as being rights to use resources, and point out that although communal rights include the use of a resource, they do not include the right to exclude others from using it. This results in a first-come, first-served basis for determining the use of a resource. Persons who own communal rights tend to use them in ways which ignore the full consequences of their actions. Where the right to exclude is absent, a free-rider problem is created, since refraining from the use of the right does not benefit the abstainer but those who continue to use the right. Moreover, they note that under the communal rights system, a person has the private use to a resource once it is taken or captured, but only a communal right before. Hardin² expresses his views on the effect of resources being held in common as follows:- "Ruin is the destination towards which all men rush, each pursuing his own best interest in a society that believes in the freedom of the common." Trelease³ considers that water law should provide

for maximum benefits for its use by granting private property rights for water, subject to public regulation only when private economic action does not protect the public interest. He also notes that because of the transient nature of water and the interdependence of its use in common with a number of other users, the market cannot be relied on to produce optimum results, and there is no market control. Dales⁴ advocates the creation of pollution rights to solve the problem of common property and the resultant failure of the market system as far as water resources are concerned.

The use of a river for waste disposal provides a classic example of the effects of treating an environmental resource as a common right. The industrialist, farmer or municipality who uses a river for this purpose does so because it is the cheapest way of disposing of unwanted materials. This causes externalities down-stream, but also keeps the cost of the product (or municipal taxes) lower than would otherwise have been the case. Those who suffer damage from such action often include those who cause the damage, for example the use of a watercourse for the disposal of wastes by cottagers may affect other uses of the water for recreational purposes by the same people; some injured parties, for example users of the river for domestic drinking water and recreationalists, may include consumers of the offending industry's products. Moreover, users who suffer damage from upstream uses of the river are also probably causing externalities to others downstream. To this extent, it would probably be true to say that all users of a river are polluters of a common good.

The uses which man has made and makes of the river can be classified as in situ uses (transportation, hydro-electricity generation and most recreational purposes); withdrawal purposes (domestic, industrial,

agricultural and some recreational purposes); and waste disposal uses (from any source). Assuming that none of the water withdrawn from a river were returned to it, there would be little change in water quality, although obviously water quantity would be affected.

The use of a river for the deposition of wastes, whether bacterial, viral, organic, inorganic or toxic, is a frequent cause of externalities for in situ or withdrawal uses downstream. The value of a river for recreational purposes and for wildlife may be reduced or eliminated as a result of upstream uses of the water. The water may be unsafe for swimming because of its bacterial count or the presence of viruses; the organic waste load may reduce dissolved oxygen to a level where the best fish are unable to survive; toxins from industrial plants or agricultural lands may kill fish, interfere with their life cycle or affect their source of food; in reservoirs and lakes algal growth and decay may cause their deeper parts to become uninhabitable for fish. The presence of toxins such as mercury in water may be injurious to humans who eat fish from such waters; viruses, such as polio, may pose a hazard to human health. The discharge of water at temperatures higher than that of the receiving water may have an adverse effect on fish. Alterations in river flow caused by the building of dams may have adverse effects on the use of a river downstream for recreational purposes. Upstream pollution affects domestic water supplies, since the amount and character of treatment is related to the quality of the intake, which affects the appearance and palatability of the domestic water supply.

Kneese⁵ divides pollutants from man's domestic, industrial and agricultural activities into conservative, persistent and non-conservative. Conservative pollutants, mainly inorganic chemicals such as chlorides,

metallic salts and other toxic materials, are not altered by the biological processes which occur in natural waters: they are only diluted. The same is true of sands and sediments resulting from land erosion, which may be hastened by deforestation, construction for buildings, roads etc. The progress of decay of radiological pollutants is so slow that they must be considered among the conservative pollutants. Many synthetic organic compounds, while not strictly conservative pollutants, are resistant to treatment and are often termed "persistent" organics. These include DDT, 2,4D, chlordanes, cyanides and synthetic detergents. Non-conservative pollutants are substances, such as the organic wastes from domestic sewage, which are changed in form and/or reduced in quantity by the biological, chemical and physical phenomena characteristic of natural waters. Bacterial pollution may be considered as non-conservative, since bacteria tend to die off rather quickly after leaving the body. Bacteria are of concern since they cause infectious diseases such as typhoid, dysentery and cholera. The presence of viruses in watercourses has recently become of concern because they are more viable outside the human body than pathogenic bacteria.

Human and animal wastes are degraded after a few days and a few miles, the rate of recovery depending on such things as the temperature of the water and aeration. There are, however, limitations to the natural purification processes, which, in any event, do not prevent short-run pollution while the recovery process is taking place, and water will become continuously polluted when the rate of discharge of organic wastes exceeds the absorptive capacity of the particular body of water concerned. At higher temperatures bacterial action is accelerated, wastes are degraded more rapidly and the dissolved oxygen in the water is more rapidly depleted.

Externalities caused to other users by the use of a river for waste disposal tend to vary directly with the geographical concentration of human populations. Thus, if the population of the Ottawa River system were spread out evenly, there would probably be no pollution problem. Similarly, when farm animals were kept in fields, their wastes enriched the soil and were beneficial to crop production: the concentration of animals and poultry in feed lots and batteries results in huge accumulations of wastes which are difficult to dispose of and, if carried into a watercourse by run-off, may cause a pollution problem.⁶

In the late 19th century awareness of pollution problems in the river resulted either from offences to man's aesthetic sense or, ~~obstacles~~ to navigation. Later, the connection between water-borne bacteria and certain diseases became apparent. It was not until the last decade or so, when federal and provincial governments became actively involved in water quality, that frequent monitoring and testing of river water revealed the presence of viruses and minerals which may pose a danger to health, and demonstrated the effects of pollution on fish life and algal growth.

Two features, one favourable and the other unfavourable to pollution control, are noteworthy in the Ottawa River system. Since there are comparatively few types of industries on the river, the major polluters are more easily identified than on many rivers in industrialized countries. On the other hand, the political and geographical boundaries along the Ottawa are a considerable obstacle to effective pollution abatement, since in addition to the federal government, two provincial governments, several municipalities and many government agencies are involved. All levels of government equate the value obtained from pollution control against the value

which would be derived from the same money spent for other purposes.

Environment Canada's Monograph on Comprehensive River Basin Planning⁷ points to the necessity of defining "a geographical unit which can be viewed as a system, so that all factors, including water utilization, water quality and land resources can be integrated appropriately into the plan." The most effective unit within which this integration can take place is the river basin, since all water-related activities in a region are linked by the movement of water through the basin, and interdependencies between the various activities can only be defined by examining the river basin as a complete system. As the Canada Water Year Book, 1976,⁸ points out, these interdependencies of use make the river basin a logical unit for planning and management despite the problems of coordinating physical basin boundaries with other political or economic boundaries.

Gilbert White⁹ examines the ways in which people make choices in managing water from place to place and from time to time. He discusses strategies of water management in terms of single-purpose construction by private and by public managers; multi-purpose construction by public managers; single-purpose action using multiple purpose means; research; and the merging of multiple-purpose and multiple means. Multi-purpose planning involves many purposes; river basin planning; and the promotion of social change. White states that, with the growing concern for exploration of alternative means of water management and for the continuing assessment of the nature of public preferences, the making of discreet, long-term plans for a basin is fading in prominence. He considers that while there should be awareness of the hydrologic unity of river basins, there should be no attempt to conform the social process of choice to the physical entities of watershed lines. White

concludes that public judgment about water quality shifts over time and varies from one environment to another, and he considers that, as water uses and the technology of water management increase, the less permanent will be group preferences. He therefore stresses the needs for flexibility in water management for the future; for leaving open as many choices as possible; and for making fresh demands on science to predict the consequences of, and to provide alternatives to meet, changing needs.

The three following chapters will look at the development process in the uses of the Ottawa River system during three major periods. There was, of course, overlapping between periods, for example, the use of the river for travel by canoe continued to a minor extent long after the early 1800s and still continues for recreationalists; uses of the river by the pulp and paper industry and for recreation started before the 20th century.

Chapter II will deal with the canoe era: major period 1613 to 1822. The sources of information for this chapter will be mainly first-hand accounts by missionaries, explorers, fur traders and other travellers along the river. Additional information relating to specific aspects will be obtained from books and articles, including those of Harold A. Innis (on the fur trade), G.P. de T. Glazebrook (on transportation), Eric W. Morse (on navigational difficulties), J. Richardson (on settlement), E. Voorhis (on forts and trading posts) and Robert Legget (general).

Chapter III will deal with the period of settlement and early industrialization in the river basin during the 19th century. Sources of information will include A.R.M. Lower (on the square timber and lumber trades), G.P. de T. Glazebrook, J.R. Morgan and Brenda Lee-Whiting (on transportation and rivercraft), Norman Thompson and J.H. Edgar (on railways), C.C.J. Bond

(on domestic water supplies and sewage disposal in Ottawa), J.L. Gourlay's account of life in the Ottawa basin during the second half of the 19th century, and Robert Legget and W.E. Greening (general). Information will also be obtained from Sessional Papers, newspapers and the Census of Canada, 1848 to 1901.

Chapter IV will deal with the era of growing complexity: the 20th century. Material used will include reports by the federal, Ontario and Québec governments, publications by the federal Department of Fisheries and Environment, Ministry of Natural Resources, Ontario, Ministry of Industry and Tourism, Ontario, Pulp and Paper Directories, reports on Ottawa water supplies, Ontario Hydro Statistical Year Book, Census of Canada, 1901-1971, industrial surveys, newspaper reports and verbal information.

The last chapter, Chapter V, will describe the legislation relating to water pollution passed by the federal, Ontario and Québec governments, and will attempt to compare the present condition of the river with that reported at the time the Canada Water Act was passed in 1970. Information will be obtained from the Statutes and Revised Statutes of Canada, Ontario and Québec; the Canada Gazette, Québec Official Gazette, Revised Regulations of Ontario, Canada Year Book, newspaper reports and verbal information from the federal Department of Fisheries and Environment, Ministry of the Environment, Ottawa, Cornwall and North Bay, and the Department of Microbiology and Immunology Faculty of Medicine, University of Ottawa.

Lists of references will be given at the end of each chapter, and a bibliography is attached at pp. 205-216.

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CHAPTER II
THE CANOE ERA: THE OTTAWA RIVER
IN THE 17TH AND 18TH CENTURIES

Before the advent of the white man on the Ottawa River, the Indians used it as a means of transportation by canoe. From 1613, when Champlain explored the Ottawa River as far as the present Morrison's Island, near Pembroke, until 1821, when the Northwest Company was amalgamated with the Hudson's Bay Company, the river was used for transportation by canoe by explorers, fur traders, missionaries, military personnel and other travellers. After 1821, the Ottawa route ceased to be used for the transport of furs, and in 1822 the first steamboat appeared on the Lower Ottawa. Travellers along the Ottawa during this period also used the river for supplies of water for drinking etc., purposes and for waste disposal.

By the 16th century Europeans were making frequent trans-Atlantic voyages, which depended economically on cod fishing in the Northwest Atlantic. Early trade in fur appears to have been started by sailors bartering with the Indians for "fancy" furs when they went ashore for supplies of fresh water. By the end of the century fishing had been extended to the more remote parts of the Gulf of the St. Lawrence, and contact had been made with the hunting tribes of the Saguenay area. At about the same time beaver hats were becoming fashionable in Europe and led to a great demand for beaver skins, especially castor gras. Trade in beaver spread rapidly up the St. Lawrence and Ottawa Rivers, and gradually became less dependent on fishing, finally becoming completely dissociated from that activity.¹

The beaver, which is a non-migratory and not highly reproductive animal, soon became exterminated in the areas most accessible to the St. Lawrence. As early as 1685 the Jesuit Relations contained a warning that the indiscriminate slaughter of beaver would lead to their extermination around Three Rivers.² The depletion of the beaver along the St. Lawrence, and later along the Ottawa, led the French to push continually westwards in search of new supplies.

As early as 1610 Champlain had allied himself with the Hurons against the Iroquois. Subsequently this alliance with the weaker side, and competition from the English and Dutch, barred the Upper St. Lawrence as a way to Lake Ontario and Lake Erie. The French effort was, therefore, directed to the difficult route via the Ottawa River-Mattawa River-Lake Nipissing-French River to Lake Huron.³

At first the French relied on the Indians for the acquisition and transportation of furs from the interior to the French colony. As beaver in the Ottawa River area became extinct, the Hurons of that region adopted the roles of purchasing and transport agents for the French, bartering European manufactured goods obtained on credit for furs from the Indians to the West, and they annually brought stocks of furs down the Ottawa for sale at the great fairs in Montreal.⁴ This led to rivalry between Iroquois, who were allied to the Dutch and English, and the Hurons resulting in bitter warfare, conducted with European firearms. Military intervention was necessary to save the French colony from attack, and eventually fortified posts were established near the sources of fur to build up influence over the local tribes and to bring trade goods nearer to them. By the middle of the 17th century it had become necessary for the French to provide transportation

of goods to the pays d'en haut and of furs back to Montreal.

Expansion of trade to the interior necessitated the development of a technique by which trade could be carried on over long distances. An important feature of this was the creation of a base of supplies in the interior. The country of the Hurons provided corn which was the staple food for the return journey up the Ottawa, often being supplemented by fish and game taken on the journey. The Indians left caches of corn in birch baskets on the journey down to Montreal for use on the upward journey. After the conquest, the technique of the fur trade which had been built up by the French remained practically intact. Bases for the production of agricultural supplies in the interior had been established and the voyageur with his knowledge of the river and navigation remained. The Ottawa route continued to be used to bring furs from the Northwest to Montreal after the conclusion of the War of the American Independence, as being the fastest route. The great days of the fur trade passed before the middle of the 19th century. The sale of beaver decreased gradually from 1844 to 1850 as a result of "nursing the beaver territories" and of the substitution of silk hats for beaver hats which became more marked after 1839. "Fancy" furs took the place of beaver.⁵ After the amalgamation of the Hudson's Bay and Northwest Companies in 1821, the Ottawa route was abandoned except for the transport of personnel and mail, all goods being taken in at York Factory.

I. The Use of the Ottawa River for Transportation

During the early part of the 17th century, explorers, missionaries, fur traders and military personnel had certain common perceptions of the

nature of the water highways of Canada, and the motives for their journeys were to a certain extent similar. In a Petition to the King written by Champlain between 1610 and 1618 he set out his reasons for his explorations in New France as (1) to establish the Christian faith; (2) to enable the King to make himself master of the country; and (3) to discover "the South Seas Passage to China and to the East Indies by way of the river St. Lawrence".⁶ The purpose of his journey up the Ottawa River to the present Morrison's Island in 1613 was to discover the Northern Sea. In 1634 Jean Nicolet was sent by Champlain on an expedition westwards to become acquainted with the tribes lying beyond the "mer douce" (Lake Huron), to extend the fur trade and to find the way to China. In order to be properly clothed for his entry to the China Sea Nicolet "wore a grand robe of China damask, all strewn with flowers and birds of many colours."⁷

Missionaries, like explorers, were interested in the discovery of the route to China. The Relation of 1659/60 spoke of information received from the "Savages" by one of the Fathers "touching the route to Japan and China for which so much search has been made".⁸

The Jesuit Relation of 1660/61 reported

We have long known that we have the North Sea behind us . . . ; that this sea is contiguous with that of China, to which it only remains to find an entrance; and that in those regions lies that famous Bay . . . which was first discovered by Husson (sic) who gave it his name but won no glory from it other than that of having first opened a way which ends in unknown Empires.⁹

In the Relation of 1669/70 Father Dablon gave two reasons for seeking out "That North Sea": the first was the conversion of the tribes and the second to discover whether the North Sea and Hudson's Bay were one and to verify conjectures that passage could be made by this route to the Japan Sea. He

added that, if it did, commerce would follow the passage¹⁰

The activities of the Recollet and Jesuit missionaries in New France added greatly to the exploration of the country, although their primary motive was the conversion of "the savages" to Christianity. Their efforts were at first conducive to the interests of the fur trade, by bringing far-distant tribes within the sphere of French influence. The Relation of 1642/43 noted of Jean Nicolet, an interpreter and agent for the Company of New France, that "in so far as his office allowed he vigorously cooperated with our Fathers for the conversion of these peoples, whom he could shape and bend howsoever he would, with a skill that can hardly be matched."¹¹

In the early days, missionaries often accompanied explorers, fur traders and military expeditions on their voyages. Champlain brought from France four Recollet priests to New France in 1615, one of whom, Le Caron, preceded Champlain up the Ottawa to Huronia. The Chevalier de Troyes, whose expedition in 1686 up the Ottawa-Lake Temiskaming-Abitibi route to attack the English at the bottom of Hudson's Bay, was accompanied by Father Silvie.¹² On his journey west, de la Verendrye recorded that "in passing Michillimacinac, I took the Jesuit Father Messaiger as our missionary."¹³

It was soon realized by the missionaries that only meagre results could be obtained unless the Indians were induced to lead a sedentary life, and efforts were made to change the habits of the natives by encouraging them to become agriculturalists instead of hunters. Father Paul le Jeune in the Relation of 1634 advocated sending a number of capable men to clear and cultivate the land and

work for the Savages, on condition that they would settle down, and put their hands to the work, living in houses that would be built for their use; by this means being located, and seeing this miracle of charity on their behalf, they could be more easily

instructed and won . . . it seems to me that not much ought to be hoped for from the Savages as long as they are wanderers; you will instruct them today, tomorrow hunger snatches your hearers away, forcing them to go and seek their food in the rivers and woods.¹⁴

Missionary efforts to encourage the natives to become agriculturalists and their opposition to the trade in brandy and rum, brought the missionaries into conflict with the fur traders, who often placed serious obstacles in the path of the Jesuits. In an Account of the Canadian Missions from the year 1611 to 1613, Father Jouvency gave a comparison of the condition of the missions then and in 1703. He reported that at Three Rivers "there formerly flourished the most successful mission of the Algonquins; but it has been much weakened through drunkenness induced by brandy, brought in by the European merchants who thus wickedly derive an easy profit."¹⁵ In a letter of 1702 by the Reverend Father Etienne de Carheil to Monsieur Louis Hector de Callieres, Governor, complaint was made of "two Infamous sorts of Commerce which have brought the missions to the brink of destruction . . . The first is the Commerce in brandy; the second is the Commerce of the Savage women with the french". He complains of the Commandants of the French garrisons who

in reality come here solely for the purpose of trading in concert with the soldiers, without troubling themselves about anything else. They have no intercourse with the missionaries, except with regard to Matters wherein they consider the latter useful for the furtherance of their own temporal affairs; and beyond that they are hostile to the Fathers as soon as these undertake to oppose the misconduct, which being in accord neither with the service of God nor the Service of the King, is nevertheless advantageous to the trade of the Commissioners.¹⁶

While the motives of the people using the Ottawa River route were sometimes harmonious and at others in conflict, all users were in agreement regarding the hazards of the river as a means of transportation. These

included falls, rapids, strong adverse winds and currents, floods, ice and shortness of the navigation season. Most accounts of transportation on the Ottawa route relate to the upstream journey. On the downstream journey it was often possible to shoot the rapids; the journey, after passing the height of land east of Lake Nipissing, was with the current and often with a following wind. Moreover, as the downstream journeys were usually made at the end of the summer or early autumn, there was no danger of ice.

In the Relation of 1635 Father Brebeuf mentioned two "ordinary difficulties", the chief of which were the rapids and portages. The second was in regard to provisions, especially when the caches of corn were missed on the return journey.¹⁷

On Father Gabriel Sagard's upstream journey to the Hurons he described the difficulties of the various portages -

Sometimes also we had to pass through troublesome bogs from which we could only disengage ourselves with great labour . . . Sometimes also one has great difficulty in making a passage with head and hands through dense woods, in which also a great number of trees that have rotted and fallen on one another are met with, and these one must step over. Then there are rocks and stones and other obstacles which add to the toil of the trail, besides the innumerable mosquittoes which incessantly wage most cruel and vexatious war upon us.

Other hardships involved in travelling on the Ottawa, according to Sagard, included "besides the danger of death on the way", hunger, the stench of the natives, sleeping on the bare ground in the open country, walking in the water and "all the evils that the season and weather can inflict."¹⁸

On the return journey from Huronia Sagard wrote

I do not here enumerate all the risks we encountered on our way, nor all the rapids round which we had to carry all our packs by very long and toilsome paths, nor how many times we risked our lives by drowning in falls and watery gulfs . . . because these

risks and dangers are so frequent and matters of such daily experience that if I described them all they would seem hackneyed repetitions.

Of the "several waterfalls and many rapids and dangerous precipices" which Sagard encountered he considered the Chaudière "the most wonderful, dangerous and terrifying of all."¹⁹ de Troyes set out from the Island of Montreal on 29 March, 1686, with a hundred men and thirty five canoes. At Calumette Portage "some of the men were afraid they could not make it, because it is two thousand feet long, with very steep slopes and bogs full of fallen trees." Above Pine Point "some of the best canoeists tried to go up the rapids, but they proved to be so perilous that the canoe was lost although the men managed to save themselves." At Mattawa de Troyes left the usual route and turned north, following the Upper Ottawa. At the second rapid past Mattawa "one of our canoes was smashed, having been swamped in a waterfall". The fifth rapid above Mattawa was "extremely difficult because of the vicious current in five or six places along its two leagues. Several canoes were smashed." At the ninth portage beyond Mattawa some of the men wished to shoot the rapids instead of portaging "their rashness caused three canoes to founder; the gear was soaked, and the canoes themselves were split in several places, but, by good fortune, no one was lost." After eleven more portages were crossed they reached the height of land - "Lakes no longer drain towards Quebec but discharge themselves into the Northern Bay descending there by a series of rapids and cascades."²⁰

Travellers on the Ottawa-Georgian Bay route give varying accounts of the number of portages and décharges encountered. In the Relation of 1635 Father Brebeuf stated, in his account of his journey from Three Rivers to the Huron country, "I kept count of the number of portages and found that

we carried our canoes thirty five times and dragged them at least fifty."²¹ Alexander Mackenzie described twenty nine portages and seven décharges between Lachine and Grand Portage.²² John Long, who made the journey in 1777, gave the number of portages between Lachine and Michillimackinac as thirty-six.²³ According to Colonel Landmann of the Royal Engineers, in 1792, "from the starting place (Lake of Two Mountains) to Lake Huron, there were fifty-four places, even in the spring of the year, when the waters are high, where the whole of the contents of the canoes had to be carried by the canoemen in order to pass some of the rapids or cascades, and of these there were thirty-six where even the canoe also was unavoidably carried, where the navigation was totally obstructed."²⁴ Nicholas Garry, in 1821, described twenty-two portages and twelve décharges.²⁵

Accidents were by no means uncommon when travelling the Ottawa-Georgian Bay route, and most accounts include references to crosses at various rapids marking the burial place of canoeists drowned in the rapids. William Harmon, who travelled up the Ottawa in 1800, commented that at nearly every rapid they had passed between Montreal and Georgian Bay he had seen a number of crosses erected, and that at one place he counted no less than thirty.²⁶

In addition to falls and rapids, several travellers of the Ottawa route mention strong adverse currents on the upstream voyage. Alexander Henry recorded that "above (Chats Falls), for six miles, there are many islands, between which the current is strong."²⁷ McLean mentioned that the French River was "a rapid and difficult stream."²⁸ John Bigsby noted that "the current, as we ascended the Ottawa . . . was strong against us", and that above Chats Falls "we could not venture on the river itself, full of islets

here; its current was above our strength."²⁹ On the other hand, on the downstream journey, the current was helpful - Sagard mentioned that after reaching Lake Nipissing "we had nothing but rivers and streams, and a current to help us as far as Quebec . . ."³⁰ On his journey down the Ottawa route Landmann stated that "by keeping in the middle of the stream, which, as it was with us, we were enabled to follow with advantage."³¹

Flooding of the river could be an advantage or disadvantage, usually the latter. de Troyes recorded that between the Calumet and Allumette Portages "the river rose more than three feet that day because of the rains", and because of this and bad weather generally they were compelled to lay over for two days. Six days later they were again prevented from leaving owing to rain, snow and wind and in addition "the water rose more than a foot during the day."³² Alexander Henry recorded that "the lands (above the Grand Calumet) above the carrying-places, and near the water are low; and, in the spring, entirely inundated."³³ Bigsby noted that the river at the Long Sault Rapids was "eight feet above its usual level . . . and, in places, the woods around were flooded." At the Chats Falls "the river was so swollen and furious, overleaping its banks into the adjacent woods, that previous experience was at fault." Above the falls they "crept with exceeding slowness through the woods by temporary channels". Sometimes, according to Bigsby, floods were an advantage: above the Cheneaux Rapids "our course . . . was not always so harassing, for sometimes the flood overspread low lands, and the current moderated. It was very new to me to float in the twilight of thick woods, among their gnarled and huge trunks."³⁴

Adverse winds are mentioned by travellers of the Ottawa route as a difficulty. de Troyes recorded that below the Allumette Portage he was

"obliged to spend the day in camp because of a strong west wind which blew all day."³⁵ Harmon recorded that six days after leaving Lachine "we have had so strong a head wind that we could not march." On Lake Nipissing "toward noon the wind was so high as to oblige us to encamp on a small island."³⁶

A further hazard of the river was ice. de Troyes, who started on his journey earlier than was usual, had considerable difficulty at the start when men and oxen (used to drag canoes, supplies and munitions over the ice) broke through the ice. His men lined and poled their canoes up the Long Sault Rapids, and the canoes were frequently damaged by drifting ice. It was necessary to load and unload the canoes continually because of ice-jams which covered a quarter of a league of the river. During the portage over the ice, two canoes were smashed and one of the canoeists swam ashore despite the extreme cold.³⁷ Sir George Simpson recorded in the course of a journey up the Ottawa in May, 1841, "in the morning - the morning, be it observed, of the ninth of May - the water was crusted with ice thick enough to require the aid of poles in order to break a path for the canoes."³⁸

Another hazard, shallow water, was mentioned by John McLean. "The passage of the Little River (the Mattawa) was effected with much toil and difficulty, from the shallowness of the water."³⁹ Alexander Henry mentioned beaver dams as causing an obstruction in the region of the Portages of La Vaze - "We saw many beaver-houses and dams; and by breaking one of the dams, we let off water enough to float our canoes down a small stream, which would not otherwise have been navigable."⁴⁰ Forest fires presented a further hazard and are mentioned by de Troyes when he was

travelling on the Upper Ottawa,⁴¹ and by Landmann on his downstream journey.⁴² Even forest fires, or their result, could prove an advantage - when making a décharge at the Roche Capitain, Garry recorded "Here we had to walk about two miles over a mountainous Country which had been overrun by Fire, which much facilitated our March and had destroyed the Musquitoes."⁴³ The abundant insect life along the route is mentioned by practically every traveller of the Ottawa route from Champlain and the Jesuits onwards. Garry seems to have been particularly plagued by them and scarcely a day passed without his recording in his diary the miseries which they inflicted. Among the insects which attacked him, he mentioned "Musquitoes, Mouchestik or Sand Fly, Flies, Spiders" and "some little irritating insect, not visible, which ran over the whole Body and produced a Degree of Irritation and Misery not to be described."⁴⁴

From the start of exploration and trading, the French adopted the Indian canoe as the only possible craft which could, at that time, be used on the rivers of the Canadian Shield. While the French learned to handle the canoes as skillfully as the Indians, they seldom tried to build them. The method of making the canoes did not vary, but with time they tended to increase in size. At the latter part of the 17th century they were described as being from ten to twenty seven feet long and about two feet wide in the middle, and carrying from two to fourteen persons.⁴⁵ Three Rivers became an important centre for making canoes which were taken, as soon as conditions on the river were satisfactory, to Lachine, where merchandise and provisions for the journey up the Ottawa-Georgian Bay route were loaded into the canoes. Brigades of big Montreal canoes or canôts du maître, each paddled by ten or twelve voyageurs and carrying up to three tons of cargo moved off for the

pays d'en haut. By the end of June the brigades had reached Grand Portage on Lake Superior. Here was the rendezvous for the smaller, northern canoes. In the late summer or autumn the cargoes of fur went downstream to Montreal.

Many descriptions of these craft have been written by travellers of the Ottawa, e.g. Alexander Henry, Colonel Landmann, John Long, and John Bigsby.⁴⁶ Perhaps the most complete description of the construction of a canôt du maître is that contained in the diary of Nicholas Garry, who travelled up the Ottawa route in 1821. The following is his account of the canoe in which he travelled:

Our Canoe is 36 feet in Length and about 6 Feet extreme Breadth. It is constructed entirely of Bark, Cedar Splints, the Roots of the Spruce, and the Pitch of the yellow Pine, with no Iron except a few Nails to fasten the Top of Frame of Gunwale. The extreme width is six feet from whence it tapers gradually towards Bow and Stern to a wedge like Point and is turned over from the extremities towards the Centre so as to have in some degree the Resemblance to a Head of a Violin. They are made of the Bark of the White Birch which is peeled from the Tree in large Sheets, left to dry for some time and then bent over a slender frame of Cedar Ribs, confined by Gunwales which are kept apart by slender Bars of the same wood running across. Around this the Bark is sewed by the slender and flexible Roots of the young Spruce Tree called Wattape and also where the pieces of Bark join so that the Gunwales resemble the Rim of an Indian Basket. The joinings are afterwards luted and rendered watertight by a coat of Pine Pitch called Gum. In the third cross Bar an Aperture is cut for the Mast so that a Sail can be employed. Seats for the Paddlers are made by suspending a strip of Board on the Cords in such a manner that they do not press against the Sides. The paddles are made of Cedar and are about four feet and a half in Length.⁴⁷

The Indians did not use sails, either because they did not understand the principle or did not have the material to make them. Sails were introduced by the French, but were apparently only used in light, following winds. According to Le Jeune's Relation of 1636 every canoe in which any of the Fathers embarked was given a large sheet which served as a sail to relieve them of paddling. In spite of this the "Barbarians" often made the

Fathers take a paddle. de Troyes mentioned that during his 1686 voyage they sailed to the Calumet Islands with a light easterly wind, and above the Portage they were able to sail the entire day with a southerly wind. Harmon sailed part of the day in Lake Nipissing, and Landmann sailed his canoe across Lake Huron for thirty hours.⁴⁸

Alexander Henry's account of his travels covers the period from 1760 to 1776. He described the typical freight canoe as carrying eight men, with a guide to every three or four canoes, which formed a brigade. Each canoe had skillful men in the bows and the stern, these men being paid at double the wage of the other paddlers. The following is Henry's description of the carrying capacity of a canoe:

The freight of a canoe . . . consists in sixty pieces, or packages, of merchandize, of the weight of from ninety to a hundred pounds each; and provisions to the amount of one thousand weight. To this is to be added, the weight of eight men, and of eight bags, weighing forty pounds each, one of which every man is privileged to put on board. The whole weight must therefore exceed eight thousand pounds; or may perhaps be averaged at four tons.⁴⁹

Nicholas Garry described in his diary the method of loading the canoes:

The first Part of the Loading is to place 4 Poles or long Sticks at the bottom of the Canoe which run the whole Length. These support the whole weight and prevent the Bottom being injured. The Pieces or Packs which weigh about 90 lbs. each are then placed in the Canoe and with wonderful precision, each Piece seeming to fit. The most weighty Goods are put at the Bottom, the Provisions, Cooking Utensils, Liquor, &c., are likewise put in; at the Bow is placed a large Roll of Bark in case of Accident, with a supply of Wattape, Gum, &c. A Canoe takes 60 Pieces and this with the Weight of Provisions &c., bring the Gross weight to about 4½ Tons, an immense freight when this frail Conveyance is considered. When loaded you wonder where the Men are to sit but at the Word of Command they at once place themselves, the Guide at the Bow, the Steersman at the Stern; then the Canoe sinks into the water and the space between the Water and the Gunwale is not ½ a Foot. In this frail Bark they go for thousands of Miles seldom meeting with serious Accidents.⁵⁰

Landmann, writing of a journey made up the Ottawa in a light canoe in 1798, described a canoe of similar size as the freight canoes and mentioned that each man had a ten-foot setting-pole, of good ash, shod with an iron ferrule at each end, for assisting the men towing with a strong line in ascending the rapids. On arriving at a carrying-place, everything was unloaded with expedition and care; and whilst six men were required to transport the canoe, the others hastened to carry the goods, each man bearing two packs, and sometimes, as a display of strength, three. He stated that the canoe he was in had twelve men and no merchandise, nothing but provisions and baggage, which gave them a wonderful advantage in passing the carrying-places, as two trips were always found to be sufficient to carry the whole. The carriers of the canoe had the severest work, and as it weighed about fifteen hundred pounds, each man of the six was expected to bear, on level ground, about two hundred and fifty pounds, but when the ground was at all uneven the whole weight was unequally divided. He added "It was very interesting to me to see the extraordinary facility with which these men reversed the canoe and in an instant shouldered it, which required great expertness, as any slip or accident would have destroyed the vessel, beyond the power of repairing."⁵¹

With the canoe navigational obstacles were overcome in a number of ways.

Waterfalls had to be portaged whether going up - or down-stream. On the upstream journey, rapids were passed in four ways, depending on the amount of drop, volume of water etc. When the stream was fairly shallow, had a rocky bottom and was small enough in volume not to swamp the canoe, the canoe was poled or lined up the rapids. When the current was too strong

to paddle the fully loaded canoe and the water was too deep for poling, the canoe was paddled with half the load, the other half being portaged: this was known as a demi-charge. A décharge entailed portaging the whole load and pulling the empty canoe up by line. The last inescapable extremity was portaging, which entailed carrying the canoe and load. Often two or three trips were needed to transport the whole load. Going downstream there was a great danger of hidden rocks in shooting the rapids. The guide in charge of a brigade, who stood in the bows of the leading canoe, was responsible for leading the way through the rapids.⁵²

Nicholas Garry described the manner in which the canoe and loads were carried:

The manner of carrying the Canoe:- She is first turned over. Four men then go into the water, two at each End, raise the Canoe and then two more place themselves about midships of the Gunwale on either side . . . The Goods are carried on the Shoulders of the men and in this manner: each Canoe Man is provided with a leather Sling broad in the middle; the Ends he fastens to a Package, this is placed on his shoulders, the broad part of the Sling placed across his Forehead. On this Package a second is placed and in this manner they generally carry two Packages of 90 lbs., and sometimes a third.⁵³

Bigsby noted that the voyageurs took their loads at once "to the farther end of the Portage, if it be not long, and at a slow trot, with the knees much bent, stopping for a few minutes every half hour, this rest being technically called a pipe."⁵⁴

The voyageurs, although not big men, were of great strength and endurance. They showed a remarkably competitive spirit in racing their canoes and hurrying over portages. The normal day started at two a.m. and frequently the men paddled for twelve to eighteen hours a day. They used light paddles and rapid strokes; one traveller counted forty strokes a

minute, another one stroke a second.⁵⁵ In Simpson's time canoe brigades averaged from five to six miles an hour.⁵⁶

The time taken to navigate the Ottawa-Georgian Bay route varied with the amount of goods taken and the time of year. de Troyes, with one hundred men and thirty five canoes, carrying provisions and equipment, and starting earlier in the year than usual, took thirty four days to travel from the Long Sault Rapids to Mattawa (9 April to 12 May, 1686). Henry and Harmon, both travelling in heavy canoes with merchandize etc., took twenty eight and twenty six days respectively (4 August to 31 August, 1761 and 29 April to 24 May, 1800). McLean, who travelled from Lachine to Hull by steamer, left the latter place by canoe on 27 April and arrived at Georgian Bay on 12 May, 1833 (16 days). Garry and Simpson, travelling in light canoes, i.e. without trade goods, made the voyage from Lachine to Lake Huron in nine days and twelve days respectively (13 to 21 June, 1821 and 1 to 11 June, 1841). No concessions were made when Simpson's young bride travelled with him from Lachine to York Factory via the Ottawa: the journey from Lachine to Georgian Bay took ten days 2-11 May, 1830).⁵⁷

Accounts of the downstream journey are fewer than for the difficult upstream one. The downstream journey was easier and quicker since it was possible to shoot many of the rapids; the current, after passing the height of land east of Lake Nipissing, was with the traveller; and the return journeys were usually made later in the year. When Colonel Landmann returned to Montreal from St. Joseph he determined to do it in a shorter time than had the great McTavish, head partner in Canada of the Northwest Company, who had taken seven and three quarter days. Landmann travelled light in a twenty five foot canoe with a famous guide and nine specially picked voyageurs.

The equipment was such that it could be carried over the portages in one trip, with Landmann himself carrying a full load. In spite of the woods being on fire for at least seven hundred miles of the country they passed over, and in many parts on both sides of the river, and burning cinders and sparks repeatedly setting fire to the contents of the canoe and the men's clothes, he completed the entire journey in the incredible time of seven and a quarter days. Landmann was aided by a fair wind at the outset and said that from St. Joseph to the French River he performed this distance, without landing or striking the small sail, in thirty hours. Farther on in the journey he was able to take advantage of the current by keeping in the middle of the stream.⁵⁸

An extract from Sir George Simpson's account of his journey up the Ottawa in 1841, in which he described a typical day in the life of a voyageur on the river is attached at Appendix I. Extracts from his wife's diary, giving her impressions of a journey made in 1830 are quoted in Appendix II.

II. The Use of the Ottawa River for Drinking Water, etc.

While there are few references to the use of the river for drinking etc. purposes, it seems obvious that this was the source from which drinking water was obtained. On his journey up the Ottawa in 1613 Champlain mentioned that at the feast provided by the Indian Chief Tessouat on Morrison's Island, "For drink we had fine clear water".⁵⁹ In "The Life of a Montagnais Missionary, presented to his successors in the Montagnais mission for their instruction and great consolation," dated 21 April, 1697, Father François de Crépieu stated that "His (the missionary's) usual beverage is water from

the Streams or from some pond - sometimes melted snow." This applied to the missions at "Tadoussak and Chegeutimy", but it was also doubtless true on the Ottawa.⁶⁰

Before 1800 settlement along the Ottawa was almost non-existent, consisting of a few Indian villages and small trading posts. Missionaries, fur traders and explorers alike used the river as a means of transportation, not as a region for settlement. The only liquids mentioned as being taken on voyages up the river were brandy and rum. It must, therefore, be assumed that water for drinking, washing etc., was obtained directly from the river.

III. The Ottawa River as a Source of Food

There seems to be little doubt that during the canoe period there were abundant fish and wildlife in and about the Ottawa River. In his journey up the Ottawa in 1613, Champlain mentioned that the area of the Rideau Falls was full "of all sorts of game so that the Indians like to make a halt here". He reported that Muskrat Lake was "so abundant in fish that the surrounding tribes do their fishing here", and that the Indians of the nearby settlement preferred to hunt rather than till the soil. He also noted that the water surrounding Morrison Island "abounds in fish". The feast provided by Tessouat included "meat and fish". On his return journey he noted that they "caught some fine fish" ten or twelve leagues below Morrison Island. On arrival back at the Lachine Rapids Champlain recorded that the French he had left behind had been occupied in hunting, fishing etc. He mentioned stags, pigeons and fish, the latter including pike, carp, sturgeon, shad, barbel, turtle, bass and others "not known to us". He

observed that those who stayed behind were in better fettle than he, since "for the greater part of the time I had eaten but one meal a day of badly cooked, half roasted fish."⁶¹

Sagard mentioned that "in places on the river and the lakes where the Indians thought they might catch fish they dragged behind them a line, putting on and fastening to the hook a piece of skin cut from a frog, and sometimes they caught fish with it, which gave taste to the pot. But when not pressed for time, as on their way down to trade, some of them after having made their evening camp would go and set their nets in the river, in which they often caught good fish, such as pike, sturgeon and carp (not like ours, however, neither so good nor so big) and several other kinds of fish which we have not got here." On his return from Huronia, Sagard mentioned that after leaving Lake Huron they obtained "a small piece of fresh fish in barter for Indian corn". After they had crossed Lake Nipissing they "obtained . . . a piece of sturgeon in trade for a small clasp-knife". Above Allumette Island Sagard spoke to some Indians "but the poor wretches said nothing to us that could give offence. They were thinking simply of their fishing and hunting. . . ." He recorded that farther down the river "we encamped in a place very suitable for fishing, where we caught a quantity of fish of various kinds, which we ate, boiled and roasted."⁶²

de Troyes mentioned that above the Calumet Portage they shot a moose, and that three days later near the Allumette Portage "the hunters that I normally had out ahead of us killed a young moose." Later in the Lake Temiskaming area he "came across a native cabin whose inhabitants had killed a large moose the previous evening."⁶³

Alexander Henry noted that after passing the Long Sault Rapids, the

Ottawa presented, on either side, "only scenes of primitive forest, the common range of the deer, the wolf, the bear and the Indian". He recorded that there was an abundance of fish. Above the Grand Calumet he bought some dried and fresh fish from some Indians. Of the Lake Nipissing area he recorded "Both the lake and river abound in black bass, sturgeon, pike and other fish . . . In two hours, with the assistance of an Indian, we took as much fish as all the party could eat." He noted that the area also afforded "beaver, marten, bear and caribou."⁶⁴ Landmann recorded that above Ottawa "our people killed a deer with their setting poles as he was crossing the river". At Lake Nipissing they "found a family of Indians, from whom we purchased two fine sturgeons, weighing about sixty or seventy pounds each, and for which we paid a bottle of rum (half water)".⁶⁵ Harmon recorded that at the Grand Calumet he went duck shooting.⁶⁶

It seems unlikely that most travellers on the Ottawa had much time for fishing, but, as recorded above, they sometimes obtained fresh or dried fish from the Indians whom they met on their journeys.

IV. The Effects of the Uses of the Ottawa River and Conflicts Between Users in the 17th and 18th Centuries

Until the beginning of the 19th century permanent settlements along the Ottawa River system were few, and consisted mainly of Indian villages, forts and trading posts. Table 1 shows the various forts and trading posts on the Ottawa River system at various times: not all of these were in operation at the same time. The fur trade followed routes which were well-organized to handle trade over vast distances and was not conducive to

TABLE 1FORTS AND TRADING POSTS ON THE OTTAWA RIVER
SYSTEM AT VARIOUS PERIODS*

Fort Carillon
Fort Coulonge
Fort du Lièvre
Fort Dumoine
Fort Joachim
Lac des Chats
Lac des Deux Montagnes
Fort Lac des Sables
Fort Longue Sault
Mattawa House
Petite Nation Fort
Fort Rivière Desert
Fort Timiscamingue
Fort William
Fort Wrath

*Source: E. Voorhis, Historical Forts and Trading Posts of the French Régime and of the English Fur Trading Companies, Ottawa, Department of the Interior, 1930, pp. 46-47, 55, 62, 87, 993-94, 105, 110, 137, 149, 170, 178 and 180.

settlement. Missionary efforts to settle the country were confined to the Lower St. Lawrence valley and the country of the Hurons. They did not establish missions in the Ottawa valley, although "the river was familiar to travelling missionaries, who frequently ministered to the tribesmen along its banks either at the native villages or during the annual trading councils at the French posts of Montreal, Three Rivers and Quebec".⁶⁷ Towards the end of the 18th century, permanent settlement in the Ottawa valley started on the shores of the Lake of Two Mountains, close to the Island of Montreal.⁶⁸ The first recorded settler in the Upper Ottawa was Joseph Mondion, who applied for a grant of 1,000 acres below the Chats Falls portage on a point east of Pontiac Bay in 1792, at which time he said he had been established there for six years. Subsequently the land passed into the hands of the Northwest Company and later to the Hudson's Bay Company. At the turn of the century Philemon Wright was making preparations for his settlement in Hull.⁶⁹

Only one reference can be found indicating how wastes were disposed of during this period. Sagard on his journey up the Ottawa to the Huron country noted that sagamite was served in bowls of birch-bark which "could hardly have a pleasant smell, for when they (the Indians) were under the necessity of making water in their canoe they usually used the bowl for the purpose . . .".⁷⁰ In view of the speed with which the journeys up and down the river were made, it is unlikely that wastes went anywhere but in the river. The amount of wastes entering the river from travellers along it, Indian villages and occupants of forts and trading posts must have been very small in relation to the unharnessed river, and well within its powers to dilute.

The users of the river during the 17th and 18th centuries did not

alter the course, and therefore the flow, of the river in any way. Neither did they alter the natural vegetation along the river banks to any appreciable extent, the only uses made of the forests being to provide fuel for cooking and warmth and for the construction ~~of~~ the very small numbers of buildings in the valley. Apart from a few animals kept at trading posts, there were few domestic animals in the Ottawa valley during these centuries.

It would appear that the various uses of the river during the period before 1800 were not in conflict. The conflicts which arose were between man and man, and man and the difficulties of the river.

VI. Summary

The main uses of the river during the 17th and 18th centuries were for transportation of travellers along its course; water for drinking etc.; as a source of food; and, to a small extent, as the recipient of waste. The fur trade was not conducive to settlement in the Ottawa valley, and the missionaries did not establish missions there. Settlement along the river was almost non-existent throughout the period.

Wastes from travellers on the river, from Indian villages and trading posts were small in amount and easily assimilated by the river. There were apparently no conflicts between the various uses of the river during this period.

The cessation of the use of the river for the transportation of furs marked the end of the hunter-gatherer era, when the major problems related to the use of the river were those posed by its navigational difficulties. The 19th century marked the beginning of a new era in the uses made of the

river which, before the century ended, were to present problems of a different nature.

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CHAPTER III

SETTLEMENT AND EARLY INDUSTRIALIZATION: THE OTTAWA RIVER IN THE 19TH CENTURY

While the importance of the Ottawa River was based, during the 17th and 18th centuries, on the exploitation of the beaver, during the 19th century it rested on the exploitation of the forest. Both activities depended on cheap water transportation, and in each case exploitation led to the depletion of the most accessible sources of supply, resulting in the movement of activity westwards and northwards up the Ottawa River and its tributaries. The fur trade involved the export of a commodity which was highly valuable in relation to its weight and bulk and a return cargo of heavy manufactured goods. Forest industries, on the other hand, involved the export of a heavy, bulky commodity, of low value in relation to its weight and bulk, making it desirable to find a westbound return cargo. Immigrants provided the answer to this problem, and also met the demand for labour in lumber camps and for canal and railway building. After the 1812 war, concern over the possibility of invasion by the United States resulted in the colonial government encouraging emigration to British North America. Emigration from the United Kingdom was stimulated by unemployment resulting from the Industrial Revolution and by disasters such as the Irish potato famine.

Before the 19th century, lumbering primarily proceeded as an accompaniment to agriculture and provided a cash return in the form of potash. The forests along the lower St. Lawrence had been largely cleared before the end of the French regime, but the Ottawa River at the beginning of the 19th

century was still practically untouched forest, much of it consisting of red and white pine. The square timber trade in the Ottawa valley resulted from overseas demands arising out of the necessities caused by the Napoleonic wars, which resulted in the closing of the Baltic ports, Great Britain's traditional source of timber. The imposition by Great Britain of duties on the imports of foreign timber in 1811 stimulated the square timber industry in British North America.¹

In the early days of the square timber industry, settlers and lumbermen provided services for each other. The lumberman provided a market which offered high prices for the settlers' products, especially oats, hay and pork, and also offered the farmer winter employment in the lumber camps. The lumberman was able to obtain from the settler supplies, which were a major problem to him, from near at hand. As supplies of pine were exhausted and lumbering proceeded farther upstream, the farmer often found himself with no market for his produce. Moreover, following the lumberman often resulted in unwise settlement. There were frequent complaints by lumbermen of farmers being responsible for forest fires, caused by burning off the land, and of the cutting down of trees to make mountain farms.²

Each year, as the nearer timber was cut out, rafts came from farther afield and, after slides had been constructed at the major falls, cutting spread rapidly almost to the headwaters of the Ottawa. By 1837 pioneers had reached Lake Temiskaming. The timbermakers extended into the tributaries simultaneously with the main stream. The Bonnechère was first exploited about 1820 and the Madawaska had been ascended to its headwaters by 1847. By 1850 the whole Ottawa system was well known, though not used, above Lake Temiskaming. Exports of square timber to Britain reached an all-time high

in 1845, related to railway building in the United Kingdom, and a secondary peak in 1863-4, after which exports fell off.³

The move towards free trade by Britain during the 1840's, culminating in the complete removal of protection in 1860, led to the search for an alternative market in the United States and the bringing-in of American capitalists to develop the forest industries. The Reciprocity Treaty (1854 to 1866) allowed sawn lumber, especially planks and boards, to enter the United States free of duty. The expansion of the lumber trade with the United States was hastened by the introduction of steam and railways.

During the 19th century sawmills catered for three different markets. Firstly, there were many small mills which cut local supplies for local needs. As settlement grew, every small source of water power seems to have been used. These mills grew up along with grist mills, blacksmith shops etc. Secondly, there were mills cutting deal for the English market. These were highly specialized in product, methods and location, and they were not usually closely integrated with the lumber industry proper. The product was a deal plank about three inches thick of high quality pine or spruce. The deal industry remained centred on the lower Ottawa valley chiefly at Hawkesbury, Buckingham and Ottawa. From 1870 onwards deal-sawing declined in importance. Lastly, there were sawmills designed for commercial lumber production chiefly for export to the United States or for home consumption. Efforts were constantly made to increase the speed at which logs could be sawn up and resulted in the substitution of the whip saw, gang saw, circular saw, band saw and gang-band. Inventions to "clear the saw" were introduced, and eventually the log track, with its endless chain taking logs out of the water and drawing them up to the saw, was introduced. There were limits to

the number of saws the water-wheel would drive: this was overcome by the iron turbine wheel in 1860. After 1851 the use of steam increased rapidly, and by about 1875 was the more common motive power. Steam came in slowly because of the cheapness and abundance of water power.⁴

After 1855 American demand and the immigration of American personnel and capital resulted in the rapid increase in the number and size of mills. By 1865 the group of mills about Ottawa had grown immensely in annual output - one firm was producing 40 million feet a year, and there were at least five mills (J.R. Booth, Perley & Pattie, Wright, Batson and Currier, Bronson and Weston and the Gilmours) producing upwards of thirty million feet a year. By the end of the century production was even higher. Gillies of Braeside were cutting forty million feet a season and Bronson and Weston, fifty million feet. J.R. Booth topped all competitors with a capacity of 110,000 million feet.⁵ By the end of the 19th century, the best pine limits were exhausted and the pulp and paper industry was becoming increasingly important.

I. Use of the Ottawa River for Transportation

A. Types of Craft Used

Throughout the 19th century the difficulties presented by the river as a means of transport remained substantially the same as during previous centuries, and a variety of craft was designed to meet the difficulties of the river.

Birchbark canoes continued to be used for transportation by fur traders until 1821, and after that date by the Hudson's Bay Company for carrying personnel and mail. The Company continued to use the river for

this purpose until the late 1860's.

Prior to steamboat services on the Ottawa, canoes were used for getting men and supplies to the lumber camps. Even after the pointer and steamer replaced the canoe on the larger stretches of water and until rough bush roads replaced the portage trails, the canoe held its own when rapids made portages numerous. After the snows came, the remainder of the requirements were brought in by team.⁶ Canoes were also used on the river to bring in supplies and equipment for settlers, labourers on the canals, and surveyors and military engineers travelling up the tributaries of the Ottawa in search of an alternative route to the Great Lakes. Gourlay noted that "the early settlers had to canoe it to Montreal for their goods", and cited the case of one settler who did this single-handed. Canoes were also used to cross rivers and streams in the absence of bridges, for example they were used for crossing the Carp River and the Rideau at Burritts Rapids. They were also used for local journeys: Gourlay stated that two settlers in Torbolton "had to carry wheat to the river where they could borrow a canoe and go to Pinheys' or Le Breton's mill at Deschenes." Log canoes were used for local purposes.⁷

Canoe travellers on the Ottawa in the 19th century continued to circumvent navigational difficulties as they had done in previous centuries, that is by portaging, making décharges, poling and lining.

Lumber rafts were used to transport square timber to Québec. The first lumber raft was sent down the Ottawa River to Québec by Philemon Wright in 1806. In 1860 it was reported that as many as a dozen rafts would arrive at Québec in a day. The last raft went down the river in 1908, after which large timber from the Valley went by rail.

After timber had been squared, the sticks were hauled out by oxen to the nearest stream and floated down to the main river. Success in getting out sticks and logs during the spring drive depended on the adroit use of the spring freshets. If the peak of the high water was missed, logs might remain in the shallows until the following spring. Drivers worked frantically to prevent jams: when these occurred it required great skill and courage to free the key log. In order to overcome this difficulty, dams were built to enable water to be released as required to assist in floating the logs.⁸ On the main river, cribs consisting of about twenty sticks were made and put together into rafts, which consisted of about a hundred cribs. The rafts were constructed in such a way that they could be broken down into their component cribs at the major falls and rapids and each crib was passed separately over the rapids. Before the building of timber slides even the cribs had to be taken apart to pass the Chats and Chaudière Falls and the separate timbers had to take their chance. Oak had to be taken on rafts of lighter wood and to be carted around the portages. Once over the rapids or falls, the rafts (and cribs if the timber had gone over separately) would be reassembled. In addition to their crews, rafts often transported shantymen coming home from their winter's work. The rafts were fitted up with living quarters, and eventually included a cook camp, with open central fireplace and raised ovens in which bread could be baked; sleep camp; etc. The rafts were equipped with sails, for use on the long stretches of unbroken water.

One of the most important technical improvements in rafting was the timber slide. This was a runway alongside the falls built with timbers and carrying the cribs down at an incline instead of allowing them to pitch over headlong. The slides had "flats" at intervals to check the velocity.

The first slide on the Ottawa was built at the Chaudière Falls by Philemon Wright in 1829. In 1836 a second slide was built on the south side of the Chaudière. Soon afterwards one was built at Chats Falls, and by 1846 the provincial government had built a series of slides extending up the Ottawa to the Des Joachims rapids, thus allowing crib navigation clear through from Lake Temiskaming. As further aids to navigation, reefs, shoals and even islands were removed from the river and its major tributaries, and booms, cribs, piers and dams were maintained. By 1870 public works maintained for the assistance of the lumber industry consisted of eleven stations on the Ottawa; one on the Gatineau; fifteen on the Madawaska; one on the Coulonge, thirty-one on the Black; thirty-one on the Petawawa; eleven on the Dumoine; and five on the St. Maurice. A station was anything from a slide to a dam.⁹

The introduction of the steam tug between 1850 and 1870 revolutionized rafting by enabling rafts to be towed on the long stretches of quiet water and dispensing with the necessity for sails and oars. They could not, however, be used on the innumerable small and inaccessible lakes of the interior. On the larger of these the alligator was used.

Before the days of steam, shallow lakes and streams were navigated by warping. This was done by building a raft about forty feet square, in the centre of which was a wooden capstan with two long levers to which horses could be attached. An anchor on a long cable was laid out from this and the boom was warped up to the raft as the horses turned the capstan, winding up the cable. When the ~~tow~~ reached the end of the cable, the horse capstan was moved ahead by rowboat and anchored, and the process repeated, until the lake was crossed.

In 1889 the horse capstan was superseded by an amphibious boat known as an alligator, which continued in use for half a century. Alligators were flat-bottomed scow-shaped craft fitted with a twelve h.p. steam engine which could be used to propel it and to warp in a cable while the alligator remained moored. It had a very shallow draft and the flat underside had two runners placed six feet apart, shod with steel or iron. These runners enabled the boat to travel on land across portages, logs and skids being placed across the trail to keep the runners from grinding on rocks. The mode of transport on land was similar to that on the water, but friction was greater and anchorage was obtained by running the cable from a tree to a block pulley attached to the bow chain, then taking it to another tree opposite the first. By 1903 alligators with screw propulsion were available.¹⁰

The pointer boat was designed to aid river drivers in the task of pushing and pulling hewn timbers from the twenty odd tributaries of the Ottawa to the main river, where they could be rafted. The first pointers were made under contract to J.R. Booth, and they continued to be built from the 1860's until 1969. The pointer was a long, narrow boat with two high pointed ends and varied in length from sixteen to fifty feet. It was noted for its shallow draught, ease of handling, stability and toughness. The only modification made to the pointer was the square-stern version made since 1947 for use with an outboard motor. The two prowd types were controlled and propelled by oars, and could be swung around with one strong stroke of an oar.¹¹

The first steamboat on the Lower Ottawa (The Union of the Ottawa) was built at Hawkesbury in 1822 and plied between Grenville and Hull. In 1832 the Ottawa and Rideau Forwarding Company was formed, and shortly afterwards

gained control of the carrying trade on the Lower Ottawa. The Company owned all the steamers on the route and towed their own barges. By 1841-2 they ran a daily service between Montreal and Ottawa. With the enlargement of the St. Lawrence canals, the forwarding business went to that river. The Ottawa River Navigation Company was formed, and ran a number of steamboats on the Lower Ottawa. During the steamboat era on the Upper Ottawa, the river was uncharted, and accidents were not uncommon. Operations depended on lumbering and the establishment of settlers. Towing of timber rafts was not adopted for a number of years.

The first steamer on the Upper Ottawa was the Lady Colborne, which was put into service in 1833 and plied between Aylmer and Chats Falls three days a week. Gradually the service was extended to the upper reaches of the river. Steamboats were put into service from Chats Falls to the head of Chats Lake in 1840; from Pembroke up Allumette Lake to Des Joachims in 1854; from Des Joachims to Rocher Capitaine, Deux Rivière and Mattawa by 1873. By 1847 the Union Railway and Forwarding Company dominated the carrying trade of the Upper Ottawa, and at one time operated fourteen steamboats above Ottawa. By 1849 the old portage road from a point on the south bank of the Ottawa, about a mile below Portage du Fort, had been improved to the foot of Muskrat Lake. A stage-coach operated on this road, and a small stern-wheeler sailed the length of Muskrat Lake and down the Muskrat river to the rapids three miles upstream of Pembroke.

For a few years it was possible to sail the full length of the Ottawa River from St. Anne's to Mattawa, steamers at the start of the journey being large and well-equipped, those upstream becoming progressively smaller. Steamers were able to ply only between the falls and rapids. To get past

these stage coaches were provided, for example between Bytown and Hull to Aylmer; from Portage du Fort to Bryson; from Gould's Wharf to Cobden on Muskrat Lake. At the Chats Fall an ingenious alternative to the rough portage trail across Victoria Island was provided by a three mile railway on the north side of the river. The conveyance consisted of two small horse-drawn cars on rails. The complete steamer service did not last long. The railway was slowly advancing up the valley, and steamboat service, with its many interruptions to by-pass falls and rapids, could not compete with the year-round, uninterrupted service provided by the railways. By 1879 the Union Forwarding Company abandoned its passenger and freight business on all parts of the river and confined its business to the towing of logs, until 1882, when the Company was dissolved. Its place has since been taken by the Upper Ottawa Improvement Company. The G.B. Greene, in addition to towing logs on Lake Deschenes also provided occasional passenger trips out of Aylmer, especially evening excursions. She was scrapped in 1917.

Steamboat services between Montreal and Ottawa were continued for passengers until 1910, and excursions were continued until the mid 1920's, as were those on the Rideau Canal and on Lake Temiskaming.¹²

Before the development of rail and road transport during the second half of the century, the river provided the easiest method of winter travel. Philemon Wright, who had prospected the Hull area in 1796 and 1799, travelled over the ice of the Ottawa from Montreal to Hull with twenty five men and five families to settle in 1800. Gourlay crossed the river on the ice from Bytown to Wright's mill in Hull to obtain their grist. They returned the same way "as the first wooden bridge had gone down the current for ever".¹³

In the mid 1800's train gangs of a score or more sleighs, with a

driver, set out from Bytown with supplies of salt pork, beans and flour for the lumber camps, travelling on the frozen Ottawa River and its tributaries as far as Lake Temiskaming.¹⁴

B. Effects on River Transport of Canal-Railway- and Road-Building

The building of canals in the 19th century aided river transportation: the coming of railways and roads resulted in the virtual ending of river transportation of passengers and freight.

At the time of the American war of 1812-14 all supplies for Kingston, which was a vital fortress with a naval dockyard serving Lake Ontario, had to be brought from Montreal up the St. Lawrence. Fears of an American invasion continued for many years after the war ended, and it was considered desirable to develop a navigable water route away from the international border between Montreal and Kingston.

The Rideau Canal was to constitute the major part of the alternative military route, but it could not be effective until the Ottawa River canals and the lock at St. Anne du Bellevue had been completed. The canal at Lachine had been completed by 1825, extending navigation across Lake St. Louis to the mouth of the Ottawa. The rapids at St. Anne de Bellevue could be navigated only with difficulty, and upstream of the head of the Lake of Two Mountains there was a stretch of twelve miles broken by rapids. The Rideau Canal was completed in 1832, and the Ottawa Canals at Carillon, Chute à Blondeau and Grenville, all on the north side of the river, went into service two years later. The locks at Grenville were more than ten feet narrower than those on the Rideau Canal and thus controlled the size of vessels using the Ottawa-Rideau route from Montreal to Kingston. In 1870 the Ottawa River Canals were rebuilt with considerably larger dimensions than those of the Rideau Canal.

A small lock had been built at St. Anne de Bellevue in 1816 and a larger one was constructed in 1846.¹⁵

Although the canals were built for military purposes and continued under military control until 1857, they were speedily used by steamboats carrying passengers and freight.

As soon as the Rideau and Ottawa River Canals were completed, agitation sprang up for the canalization of the Ottawa River-Lake Nipissing-French River to Georgian Bay route. Military interest in the building of the waterway continued throughout the 19th century, and its economic significance soon became apparent, since this route would shorten the voyage from Thunder Bay to Montreal by 300 miles, and the journey from Chicago to Montreal by 350 miles, when compared with the Great Lakes-St. Lawrence route.

Surveys of the Madawaska, Black, Petawawa and Muskoka Rivers had been carried out by members of the Royal Engineers and Royal Artillery between 1819 and 1827, as possible routes between the Ottawa and Lake Simcoe. The reports were adverse owing to the succession of rapids and falls and, in places, of shallow water.¹⁶ The building of the Ottawa-Georgian Bay canal was recommended by Colonel By in 1829, following a report by Charles Sherrif of Fitzroy. Subsequent surveys declared the project feasible, and in 1856 Walter Shanley estimated the cost at \$24 million. A later (1859) survey by J.C. Clarke estimated the cost at \$12 million. In 1904 a Royal Commission was appointed to make a further survey of the Ottawa route and of the Welland Canal. The following year the Commission recommended the enlargement of the Welland Canal. They estimated that a twenty two foot waterway along the Ottawa route would cost \$100 million, and annual maintenance was estimated at \$900,000, including the operation of a storage reservoir for control of the flood waters

of the Ottawa.¹⁷

In 1894 the Georgian Bay Canal Company was chartered, and for thirty years became the vehicle for the Ottawa Valley and Northern Ontario opposition to the economic dominance of the Lower Lakes region of Ontario. Increasing pressures from both sides meant that if the Government supported one side, it would alienate the other. In an election speech in 1911 the Prime Minister, Sir Wilfrid Laurier, stated that the Georgian Bay Canal would be the shortest and cheapest route to the sea for the wheat of the West. He promised that if re-elected he would "take up the Georgian Bay Canal as soon as revenue permits." Laurier lost the election and his successor, Sir Robert Borden, was faced with a similar dilemma. By this time, however, the question whether hydro power should be in private hands had arisen and had led to a clash between Sir Alan Beck and the Georgian Bay Canal Company, whose charter gave them power rights on the Ottawa. The Company proposed to build the canal and rent out hydro power, thus making tolls superfluous. Southern Ontario warned that the canal might be a gigantic power project in disguise. Supporters of the canal were split among themselves over the question of private hydro rights, while supporters of the Welland Canal were united. A Royal Commission appointed in 1913 issued two reports, both unfavourable to the Georgian Bay Waterway, before fading into oblivion. The adverse reports were based on the argument that the greater part of the tonnage was in coal and iron being shipped to Great Lakes ports which would not go by the Georgian Bay route, and that wheat from the Prairies was not sufficient to support two deep-water projects, the St. Lawrence and Welland Canals being more than adequate for the grain traffic.

In 1923 Mackenzie King informed supporters of both the St. Lawrence and Georgian Bay canals that owing to the recession and railway debt the

Government was unable to assist either project. Thereupon rights in the Georgian Bay Canal Company were transferred to the Sifton interests, who were convinced that electric power would cover the cost of the canal. Since hydro power was running short in southern Ontario, the Ontario Government opposed any private ownership of power on the Ottawa River. The renewal of the Georgian Bay Canal Company charter was debated in Parliament from 25 February to the 28 March, 1927. After a second reading a Special Committee on Railways, Canals and Telegraph Lines was set up. The Committee voted against the charter which was allowed to lapse.¹⁸

Opposition to the Georgian Bay Canal came, from the inception of the project, from those favouring the development of the St. Lawrence route. The more southerly route traversed a relatively populous, developed and wealthy region, while the Ottawa-Georgian Bay route was, for much of the route, through an almost uninhabited wilderness. After the turn of the century, conflict over private rights to hydro-electric power was a factor operating against the building of the Ottawa Canal by a private company.

Only two attempts were made to canalize the Upper Ottawa. The first was an attempt to build a canal around Chats Falls, started in 1854 and abandoned two years later. The second was the building of a dam at the Calbute Rapids and the installation of two locks in 1875. As a fixed bridge had been built across the approach channel, larger vessels were unable to use it until it was replaced by a swing bridge in 1880. By that time, the railway had reached Pembroke and all passenger traffic on this part of the Ottawa had been abandoned the previous year. The canal was used for a few years by small vessels, but it was officially abandoned in 1889.¹⁹

In the 1850's, soon after the canal-building era, railway development

started, the earliest lines being portage railways and those serving the lumbering interests.

In 1847 a portage railway had been opened to bypass the Lachine Rapids, and seven years later the first railway along the Ottawa River was opened between Carillon and Grenville, a distance of twelve and a half miles to bypass the Long Sault Rapids. This railway, which provided a much quicker journey than that using the canals, worked in conjunction with steamboat services and together they provided a through route from Montreal to Ottawa during the summer months. Portage railways were also built towards the end of the century to bypass the rapids below Lake Temiskaming.²⁰ Two lumber railways were built from the St. Lawrence back into the Ottawa Valley - the Prescott-Ottawa Line, opened in 1854, was a continuation of the Boston-Ogdensburg Line and owed much to the enterprise of Boston; and the Brockville and Ottawa Line was completed in 1859 to Almonte, and was extended to Arnprior in 1865. These lines were designed to feed the main line of the Grand Trunk Railway and the water transport of the St. Lawrence and to connect with American railways.²¹ The Kingston/Pembroke Line was built in 1884.

The first railway from Montreal to Ottawa was completed in 1860, and a line from Montreal to Aylmer along the north shore was opened in 1877. A line was built from Ottawa to Carleton Place about 1870, where it connected with the Brockville and Ottawa Line. The line was extended to Pembroke in the mid 1870's. By 1881 it had reached Mattawa, and the following year it was extended to North Bay on Lake Nipissing, where it connected with the Canadian Pacific Transcontinental to Port Arthur and Winnipeg. The first transcontinental route went from Montreal up the Ottawa Valley to North Bay, Winnipeg and the Pacific in 1886.²²

During the second half of the 19th century, the function of the river as a means of transportation tended to be shared with the railway, which opened up areas reached only with difficulty by water routes. The tendency was for lumber going by rail to increase at the expense of the water-borne lumber.

Although canals were built during the first half of the 19th century and railway construction started in mid-century, roads appear to have been limited, for the first half of the century, to rough tracks following portage trails and to short distances between settlements: in fact throughout the century most roads were crude gravel or plank roads, macadam roads being the exception. Conditions were not favourable to road building owing to the climate, forest cover, swamps, innumerable streams and rivers, sparse population and small revenue.

By the 1820's covered stagecoaches were being operated between Montreal and Grenville, but the roads were so bad that the journey took three days. As late as 1821 there was no passable road from Montreal to Hull.²³ Such roads as there were, were mainly used for walking. There was a road from Grenville to Hull about 1830, but it appears to have been little used. Other roads connected St. Andrew to Grenville, and Pointe Fortune to L'Orignal. Lumbermen were responsible for making lumber roads from their camps. Gourlay refers to a journey he made in 1833 from Bytown to Huntley along the Richmond Road "which had been opened by the cutting of trees and brush, but the stumps not extracted but stood as obstacles to teams which got round as best they could".²⁴ Francis Simpson's description of a nine mile journey by road from Bytown to the Chats is described in Appendix I.

During the 1850's the Government of the United Province of Canada was

anxious to encourage settlement of a loyal population, and planned the Opeongo, Addington and Hastings Roads. These were built through undeveloped country, and settlers were offered one hundred acres of free land adjacent to the roads. The Opeongo Road was surveyed in 1852-3 from Farrell's Landing on Lake des Chats, inland through Renfrew to about midway between the Bonnechère and Madawaska Rivers. It was never finished, and ended some five miles from the present town of Madawaska. Although intended to encourage settlement, these roads were used mainly by lumbermen to freight in supplies.²⁵

II. Uses of the Ottawa River for Domestic and Agricultural Purposes

As in previous centuries, the river continued during the 19th century to provide water for drinking and other domestic purposes, and for agricultural uses. Bigsby, describing the area between Hamilton Mills and the Chaudière in 1819 mentions that planks were pushed out into the river and fastened, in order to obtain water.²⁶ When the Government was moved to Ottawa in 1865-6 there was no piped water. A correspondent noted that except for a few wells on street corners, the only water supply was from the water carts at the rate of 18d. for a small barrel. It was further stated that the water was often muddy. When the Government buildings were built, the government had to provide its own water supply by means of a pumphouse on the river shore and water tanks in the towers of the building. Town water works were not provided until 1874.²⁷

No doubt the situation in most of the Ottawa River settlements was similar to that in Ottawa. It seems probable that lumber camps also made use of the river water for domestic purposes.

As settlement extended back from the river system, ground water was used for domestic and agricultural purposes. Gourlay noted "The innumerable places where a well can be had by sinking six feet, made it easy to procure an abundance of pure water." He also refers to "the sparkling water of W. Kemp's deep well."²⁸

At the end of the 18th century, apart from a few scattered trading posts, settlement hardly extended beyond the Lake of Two Mountains. After 1800 settlement was generally preceded by lumbering and, after the 1812-14 war, government action encouraged the settlement in the Ottawa basin of a loyal population consisting of emigrants from the United Kingdom and disbanded officers and men. Large numbers of immigrant labourers, mainly Irish, were employed on the building of the Rideau Canal and, on its completion, entered the lumbering industry. The opening of the Opeongo Road in 1858 resulted in the settlement of three hundred Polish settlers in the area of Wilno.²⁹ During the first half of the 19th century settlement advanced methodically upstream from Hawkesbury and Hull, which were first settled in 1800, to the present sites of Aylmer, Fitzroy, Arnprior and Pembroke. It continued spreading westwards up the river during the second half of the century, and villages and towns grew up and expanded mainly as sawmill or supply centres, although the depression years, from 1870 to 1890, resulted in many immigrants and Canadians migrating to the United States and Western Canada.³⁰

The census figures for villages and towns on the Ottawa River and its tributaries, as recorded in the Census Returns from 1848 to 1901, are shown in Appendices III and IV. These figures show that urban population on the main stream and its tributaries increased more than ten-fold between 1851 and 1901.

The increasing population and urbanization on the lands draining into the Ottawa and its tributaries throughout the 19th century, obviously adversely affected the water quality of the river. An example of domestic waste disposal by a riverine town is afforded by Bytown. Bytown had been selected as the capital of Canada in 1858 and in September, 1865, a start was made to move the government from Québec to the capital. At that time there was no trunk sewer. The winter's accumulation of garbage and night soil often remained behind houses to be taken away and placed on the river ice in the spring. This was subsequently forbidden, but Ottawa continued to dump raw sewage into the river until 1962.³¹

Thus, at the beginning of the century, little domestic waste was deposited in the river, since the area was almost uninhabited. As the century wore on and lumbering and settlement advanced up the river and urbanization increased, the amount of waste from domestic sources entering the river continually increased, and the sources of such waste were extended progressively upstream.

Owing to the nature of the terrain and the character of the soil, only a small percentage of the Ottawa Valley is suitable for agriculture, although the demands of the lumber camps encouraged the establishment of farms in areas which were not suitable for agriculture. Judging from Gourlay's account of the Ottawa Valley in the 19th century, the early settlers appear to have carried on mixed farming, producing for their own needs and those of the lumber camps. As lumber camps proceeded farther upstream and when the wheat-growing areas of the West were opened up, there was greater concentration on dairy cattle and livestock in the Ottawa Valley. Some waste from farm animals was no doubt carried into the river system.

III. Use of the River as a Source of Food

There are few references to the river's being used as a source of food in the 19th century. Personnel of Hudson's Bay posts during the first half of the century relied to some extent on fish from the river, and local game. Nicholas Garry mentioned in 1821 that employees of the Northwest Company at Chats Falls often lived for months together on fish and literally nothing else, and John McLean reported in the same year that "fish was the staff of life" at the Temiskaming post. However, when McLean reached his post at Lac du Sable he found a comfortable dwelling house and a large farm with pigs, poultry and cattle in abundance.³²

It would appear that as the valley became settled and suitable land farmed, people depended less on the river as a source of food. It is possible that fish and wildlife supplemented farm produce. Gourlay, describing the wildlife in the Richmond area as it was in the mid 1850s noted

Game was very abundant. Deer, bears, rabbits and hares were plentiful, and were shot and trapped at will, and there were no closed seasons. Venison was sent round as people succeeded in shooting . . . Wild geese, and especially wild ducks in flocks, frequented the streams and lakes. But the most plentiful of all was the wild pigeon that came in spring, flying in clouds almost obscuring the sun. The woods were swarming with them all summer. Old muskets or shot guns as Americans say, were freely used and many were the victims. Partridges drummed in the vicinity of their brooding mates, often within hearing of one another. River, lake, stream and brook teemed with fishes - these remain but not in such numbers; but the winged creatures have almost wholly disappeared.³³

IV. Use of the River as a Source of Power

During the 19th century saw, grist and woollen mills on the Ottawa

River and its tributaries were located wherever a fall of water provided sufficient power to drive the mill wheels. Saw mills producing planks, boards and scantling for the American market became very numerous in the second half of the 19th century and were widespread along the Ottawa River and its tributaries as far as Lake Temiskaming. Mills reached their largest size between 1870 and 1900 and thereafter declined. Mills cutting deal were located on the lower stretches of the river at Hawkesbury, Buckingham and Bytown, each of these centres having good supplies of water power.

Relatively small hydro-electric projects were undertaken on the Ottawa as long ago as 1862, when a local industrialist of Pembroke used the water wheel in his mills to generate electric current, first for his own firm and later for lighting and industrial purposes in the town. Two or three years later Pembroke was one of the first towns in Ontario to install a system of electric lighting in its streets. In the 1890s Ottawa built two small power plants at the Chaudière to supply its own industrial and residential power and those of Hull.³⁴

Between 1880 and 1895, large scale application of the generator; Edison's invention of the central electric station, based on direct-current electricity; and the transformer, which made alternating currents systems practical, were developed. It was not until the present century, however, that large hydro-electric dams were built on the Ottawa and its tributaries to provide electricity for local use and for transmission to the industrialized areas of Southern Ontario (see Chapter IV, p. 99).

V. Uses of the Ottawa River for the Forest Industries

The Ottawa River system was used by the forest industries for the transportation of square timber and lumber, personnel and supplies for the lumber camps and for water power - see Sections I and IV above. In addition the industry used the river for waste disposal.

While the square timber industry did not lead to the deposition of bark, sawdust etc., into the river, since the squaring process was done in the forests, it did result in the denudation of the forests which, in turn, led to widespread erosion. The consequent deposition of non-degradeable silt, sand etc., and vegetative material into streams and rivers resulted in the silting up of many of the smaller streams, as noted by Gourlay towards the end of the 19th century.

Logs for the lumber industry were not de-barked before being floated to the mills: as a result tannic acid from the bark and particles of bark entered the river. Waste from the saw mills, including sawdust, bark, chips, were deposited directly into the river. Some of the residue was used as fuel for the boilers of steam-powered plants, and some of the mills found other uses for the waste, e.g. E.B. Eddy used the by-products of his mills for making pails of compressed sawdust. Most of the waste material, however, after being broken into fragments in a hogging machine found its way into the river.³⁵ Sunken logs, accumulated sunken waste, particularly sawdust, are still on the river bed and have been encountered by scuba divers and engineers whenever work has to be carried out on the river bed in the vicinity of the old saw mills.

VI. The Effects of the Uses of the Ottawa River and
Conflicts Between Users in the 19th Century

During the 19th century transportation had little effect on water quality, with the exception of the disposal of human waste into the river from steamboats and lumber rafts. The flotation of logs resulted in tannic acid and fragments of bark entering the watercourse.

With increasing settlement during the century, the growth of towns, numerous lumber camps and the influx of immigrants for work on the canals, the river became increasingly the recipient of domestic waste, raw sewage being dumped directly into the river. Waste from farm animals no doubt also seeped into the river and its tributaries.

The square timber industry led to the denudation of the forests, with consequent erosion of the river banks and silting up of many of the smaller tributaries.

The building of dams for power and to provide flodable water for log driving restricted the use of the river for other users.

With the rapid growth of saw mills throughout the valley during the second half of the 19th century, sawdust, bark and wood chips increasingly found their way into the river.

In November, 1886, The Evening Journal (Ottawa), printed a memorandum by one Antoine Ratté, who had been operating as a boatman and boathouse keeper in Ottawa below the Chaudière Falls since 1864. He claimed that when the civil servants were transferred to Ottawa in 1865

no finer stretch of river navigation was to be found in America than that presented by the River Ottawa in its reach from this city to Grenville . . . the water was pure, the bottom and shores sandy . . . no floating obstructions . . . and the fishing excellent. The special charm to all residents in and visitors to the, then, small city of Ottawa was, undeniably, boating on the broad bosom of the Ottawa. . . . Every person owned, or owned in part, a boat and the summer evenings saw the water covered with pretty craft.

He said that all this was changed by the saw mills at the Chaudière Falls. According to him the number of logs cut at the Chaudière Falls increased from 966,322 in 1866 to 3,777,225 in 1884, and he mentioned that the Government had specially exempted the Ottawa River for two miles from and below the Chaudière Falls from the operation of the River and Streams Protection Act, which prohibited the throwing in of mill refuse etc. As a result

Boating is almost killed off; the water is polluted, and has to be filtered before using it for cooking purposes; sail-boats cannot plough their way through the rubbish floating down from the wasteful mills; steam yachts foul their propeller wheels and cannot plough their way through the wooden crust; boats are upset by the oars catching in the blocks; oars break; persons have been drowned from mistaking the sawdust accumulation for the dry ground. . . . The bed of the river is fast becoming levelled up with the enormous quantity of saw dust torn from the Canadian forest produce by the wasteful American saw-teeth.

As a result of the deteriorated condition of the river, Ratté's income as a boatman and boathouse keeper had declined from \$2,000 a year in 1867 to \$500 in 1879, in spite of a better stock of boats and an improved boathouse. He suggested that the mill owners purchased his property and compensate him for loss; otherwise he proposed to sue for damages in the Courts. Finally he stressed that "we should keep our naturally noble river from pollution" for aesthetic reasons.³⁶

In July, 1887, Henry A. Gray, Assistant Chief Engineer, Chief Engineer's Office, Public Works Department, Ottawa, was asked to make certain examinations of the bed of the Ottawa River between the Chaudière Falls and the Canal at Grenville to ascertain by cross sections and borings the effects, if any, upon the navigation of the river caused by mill refuse and sawdust deposited in the river by different mills. His report was published the following year.

Gray made a complete survey between the Chaudière Falls and the mouth of the Gatineau River. He found that forty feet of sawdust had accumulated since an earlier survey of 1857, and reported that behind the Houses of Parliament and at the entrance to the Rideau Canal the very large accumulation of mill refuse at low water gave "trouble and delay to vessels in and out of the canal." For a distance below Nepean Point the river bottom was covered entirely with mill refuse. At the mouth of the Gatineau River bays were becoming filled with sawdust and the channel was gradually being encroached upon with the same material.

Gray took twelve sections across the river from three miles below Ottawa to Grenville and took a number of borings along each section. He found that five miles below the Rideau Canal the North channel was impassable at low water for anything but small row boats. Twenty five years earlier there had been twenty feet of water in the channel; which was now filled with sawdust, mill refuse and sand. East of Kettle Island he noted a constant escape of gas generated from the decomposition of sawdust on the river bed. Below the Petite Blanche River, the Québec shore was covered with chips, mill refuse and sawdust. The originally deep channel between the Ontario shore and Leonard Islands were filled with from six to twenty feet of slabs, sawdust and other mill refuse. Gas from decomposed sawdust was "unbearable" in the summer. East of the Lièvre River there was an immense bank of sawdust which had accumulated during the previous twenty years and the accumulation was from twenty five to thirty feet deep at the water's edge. The Lièvre itself was full of mill refuse which formed large shoals on each side of the river and, in some places, islands. Mills on the Lièvre were cutting from twenty five to thirty five million feet of lumber a year and deposited all

their refuse in the river.

Twenty one miles from the Rideau Canal at Rockland a boring near the Québec shore showed a large quantity of mill refuse. Mills owned by Mr. Edwards, M.P., at Rockland were burning their sawdust for fuel, but sawdust from upstream had nearly filled the bay or pond used for booming the logs, and dredging was required. Opposite Thurso on the Québec side below the Blanche River, the shore was covered with mill refuse, which extended over one hundred feet into the river. The bottom of the channel between Clarence Island and the Ontario shore was entirely covered with sawdust and was filling rapidly. Thirty four miles from the Rideau Canal, a boring fifty feet from the shore on the Québec side included decomposed sawdust; and the same thing was found on the Ontario side. The shores of the Ottawa and the mouths of the North and South Nation Rivers were covered with mill refuse and sawdust. Gray noted that two mills on the South Nation River burned all their refuse, but those on the North Nation River deposited all their refuse in the stream. Sawdust was also found at forty four miles, fifty one miles and fifty seven miles below the Rideau Canal.

Gray pointed out the difficulty in obtaining information regarding the disposal of mill refuse from mill owners. He concluded that it could not be denied "that millions of yards of sawdust and mill refuse fill the bays and creeks, and cover the Ottawa River, gradually encroaching upon the channel, and in many places obstructing navigation."³⁷

On 30 January, 1889, Sandford Fleming, C.M.G., C.E., reported to the Committee of Lumber Manufacturers, Ottawa, who had asked him to make an examination of the Ottawa between that city and Grenville "to ascertain to what extent the refuse from the various sawmills interfere with public and

private rights, and more especially to determine definitely how far navigation of the river is obstructed from the same cause."

According to Fleming a large proportion of the heavy refuse was sold for fuel, the rest being broken down by hogging machines. All or nearly all the light refuse found its way into the river. He estimated that the annual product of manufactured lumber at the mills around Ottawa averaged 300 million board feet. Allowing 10 per cent for wastage, he calculated the annual volume of refuse as 92,592 cubic yards, a large proportion of which went into the river. He noted that property owners especially around Ottawa

claim to suffer damage from the deposit of mill waste in front of their lands, and likewise from its presence on the surface of the water. In an artistic point of view the broad expanse of sawdust often seen during the summer months floating on the river, is undoubtedly detrimental to the landscape. Likewise it is objected to by those who indulge in pleasure boating.

On the other hand, he pointed out that floating debris was an advantage to "another class of people" for whom it provided a free supply of fuel.

Fleming found large deposits of sawdust in side channels, bays, eddies and inlets, but after taking soundings on the lines of cross sections examined by Government engineers the previous year, he found that at only five points on the whole distance of sixty miles was the water under ten feet at extreme low water. He concluded that with the exception of the deposit, mainly of sawdust, at the entrance to the Rideau Canal "it is established beyond all question that no appreciable injury has been done to the navigable channel of the river through the operations of the lumber manufacturers." He considered that the removal of less than 10,000 cubic yards by dredging in front of the Rideau Canal would enable all vessels using the canal to enter at ease during the lowest water. He pointed out that, judging from the tolls paid at the Grenville Canal, lumbering interests were more deeply

concerned in the maintenance of the navigational flow than all other interests.³⁸

On 1 February, 1890, it was announced that Ratté (see pp. 63-4) had won a suit brought against Booth, Perley & Pattee, Bronson & Weston and James Gordon for having prior to and during 1884 thrown into the river a large mass of sawdust, slabs, edgings and other refuse which was carried to that part of the river in front of his establishment.³⁹

The second half of the 19th century saw many minor alterations in the flow of the river as a result of the lumber industry. Small rivers were dammed to provide floods to float down logs to the main stream, and dams to provide power were built on most of the rapids and falls on the main river and its tributaries. When dams were built by private enterprise, the question arose whether the owner of the dam had the sole right to its use, thereby making the rights of others having timber limits on the same stream of questionable value.

The first Act to regulate the construction of dams was passed by the legislature of Upper Canada in 1828. An Act of 1849 swept away doubts as to the rights of the public to use "floatable" streams; but omitted reference to streams made flitable by privately built dams. The dispute dragged on for many years, but the lawsuit of 1881 between Peter McLaren and W.C. Caldwell eventually led to its settlement. The Courts upheld McLaren's contention that the dams on the streams he had built, tributaries of the Mississippi, itself a tributary of the Ottawa, were private property. Since this ruling would have affected some 243 streams in Ontario, the Ontario Government secured the passing of an Act for Protecting the Public Interest in Rivers, Streams and Creeks. This statute was disallowed three times by the Governor-in-Council.

Finally, in 1884, on the decision of the Privy Council in favour of Caldwell, the Dominion Government yielded, and this Rivers and Stream Act has been the regulating measure in Ontario ever since. Its main principle is that although one party may build dams and otherwise improve streams, he cannot refuse to allow other parties having necessary business on those streams to use his improvement on payment of reasonable tolls.⁴⁰

The Ontario Saw Logs Driving Act of 1887 required that provision be made for breaking of a log jam by the person whose logs caused it and stipulates that, if he does not do so, other parties may put men on to clear the obstruction, provision being made for arbitrating the cost. Prior to the passing of this Act, log jams were doubtless a cause of many conflicts. The Ottawa lumbermen combined and formed the Upper Ottawa Improvement Commission in 1870 for handling and sorting logs.⁴¹

Conflicts between users and uses of the Ottawa River during the 19th century appear to have arisen over pollution which was apparent to the eye or nose and to the physical alterations of the river which prevented its use by others for certain purposes. Thus, complaints regarding dumping of sewage into the river at Ottawa appear to have been related to the unsightliness of the winter's accumulation of waste being placed on the ice, rather than its effect on the quality of the water. Complaints regarding the water supply appear to have been related to the price and inconvenience of obtaining water, rather than its quality.

Many references are made in the literature to outbreaks of cholera and typhoid throughout the 19th century. In 1819 John Bigsby, a medical officer in the British army, was called upon to investigate an extensive and fatal outbreak of typhoid fever at Hawkesbury, which had recently been

settled by Irish. He was deputed to look after the sick and report on the causes and nature of the pestilence. Unfortunately he does not, in his book, state the cause of the outbreak. Such outbreaks were usually attributed to immigrants from overseas but the diseases were spread by drinking polluted river water.

Similarly, the objection to floating waste from sawmills was based on appearance and to the creation of hazards to navigation caused by sunken logs and the raising of the river bed by the accumulation of sawdust.

Conflicts over the building of dams and the creation of log jams resulted from the withdrawal of the use of the river for other lumbermen.

VII. Summary

While 17th and 18th century uses of the river had practically no effect on other uses and therefore did not result in conflict between users, the effects of 19th century uses became increasingly apparent as the century progressed. Increasing population, the growth of urban centres, the square timber industry and saw mills resulted in increasing amounts of waste being dumped into the river system. The disposal into the river of bacteria-containing domestic and agricultural wastes were in conflict with the use of river water for domestic drinking purposes. Wastes from domestic sources and from saw mills caused conflicts with other users because of their visual and olefactory effects. Erosion of river banks caused by the denudation of the forests by the square timber industry and sawmill wastes resulted in conflicts with other users because of the effect of these uses on navigation. In addition conflicts arose as a result of the building of dams for water

power or for making streams flutable for log-driving, since these constructions made the use of streams unavailable to other users. The effects of the uses of the river on water quality, as such, does not seem to have been recognized.

By the end of the 19th century the river had ceased to be a means of transportation for people and freight, apart from excursion trips, ferries and for local use, having been supplanted by the year-round service offered by railways. Towards the end of the century roads also were being improved and extended. The river continued to be used as a means of transportation of logs.

The square timber trade declined in the second half of the 19th century, while the same period saw the great increase in sawn lumber. By the end of the century saw mills also were declining in size and number.

Towards the end of the 19th century the Ottawa River system was starting to be used for recreation, and during the last decade many of the old saw mills were being converted into pulp and paper mills. These two groups of users of the river had very different requirements for water quality and were to become a major source of conflict in the 20th century. These uses of the river, together with its uses for the ever-increasing urban populations along its banks and for hydro-electric and storage dams, were to lead to increasing complexity and conflicts between users.

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CHAPTER IV
THE ERA OF GROWING COMPLEXITY:
THE OTTAWA RIVER IN THE 20TH CENTURY

By the end of the 19th century the use of the river for transportation of freight and passengers had become negligible as the result of rail and road development. Its use for transportation during the present century has been limited to ferrying, the flotation of logs and recreational boating. The various dams built across the river in the 20th century were provided with slides or chutes for the passage of logs but, with the exception of the Carillon Dam, no locks were provided to enable boats to get from one stretch of the river to another. This seemed to put a stop to the idea of the Ottawa becoming part of a through waterway to Georgian Bay. Interest in the idea still survives. In 1974 the Department of Public Works conducted a feasibility study based on the concept of a small boat canal up the Ottawa to Georgian Bay. Small-scale portage rails were proposed to transport boats from one level to another. The estimated costs were considered prohibitive.¹ The mayors of Pembroke, North Bay and Mattawa are pressing for government action in the construction of a canal to Georgian Bay or at least to Lake Temiskaming for pleasure boats.² The St. Lawrence Seaway Authority has warned about the limitations of the Welland Canal, which is being used to capacity, and some consider there may still be a need for the Ottawa-Georgian Bay Canal.³

After 1900 the pine lumber industry declined, fairly slowly at first and then with increasing rapidity, with the depletion of the pine forests. Present saw mills tend to be smaller than those of the 19th century.

The main uses of the river during the present century have been the flotation of logs for the pulp and paper mills and, to a far lesser extent, the lumber industry; the provision of water for the pulp and paper and mining industries, domestic and agricultural purposes and a nuclear power plant; the provision of energy for hydro-electricity; the provision of amenities for recreation; a habitat for fish and wildlife; and as the recipient of waste from the pulp and paper industry, domestic and agricultural sources and from mine tailings; and as the recipient of heated water from a nuclear power plant.

The uses of the river have changed little during the present century, but the quantity of most uses has greatly increased. The effects of the various uses on other uses has become more complex.

The report, The Ottawa River Basin: Water Quality and its control in the Ottawa River,⁴ of the Ontario Water Resources Commission and the Québec Water Board, published in 1971 (which will subsequently be referred to as the Ontario/Québec Water Quality Report) will be used in this chapter to indicate the water quality of the river immediately prior to the passing of the federal government's Canada Water Act 1970,⁵ since the report was based on monitoring of the river for three years from 1968 to 1970. The report deals only with the interprovincial section of the river. Reports and accounts of the water quality of the river after the Canada Water Act came into effect will be dealt with in Chapter V.

I. Uses of the Ottawa River by the Pulp and Paper Industry

Early paper mills in Canada had to be built on or near streams which

provided power for machinery and water for use in the pulp-making process. They depended on rags as their source of raw material.

The development of the paper industry at the end of the 19th century depended on a number of inventions, especially those which made it possible to make pulp from wood; social changes; and government policies. Demand in North America for newsprint, books, magazines, writing paper, wrapping paper etc., grew as population and the degree of literacy increased. The demand for paper products continued to increase dramatically during the present century for packaging of merchandise, paper bags, cartons etc., and to meet the requirements of mass advertising. The development of postal services further increased the demand for paper. Restrictions imposed by the Ontario and Québec Governments in 1910 on the export of pulp logs from Crown lands further encouraged the building of pulp and paper mills in the Ottawa River basin.

The locations of most pulp and paper mills on the Ottawa system are those of the old saw mills, and these locations have changed little during the 20th century, although there have been changes in ownership, for example, the purchase in 1925 of the Riordon mills by Canadian International Paper (CIP); the formation of Tembec, a cooperative venture established when OIP closed the mill at Temiskaming in 1973. Products have become more diversified during the present century.

Appendix V shows that the production capacity of the various pulp and paper mills has increased fairly constantly from 1938 to 1977: the Appendix also gives a brief history of the mills. Since 1950 various divisions of CIP have been producing masonite board, wood fibre insulating boards and various plywoods. Appendix VI shows the production capacity of

of these products from 1950 to 1977.

The pulp and paper industry uses the Ottawa River system for four purposes, namely, for the flotation of pulp logs to the mills; the provision of water for processing, cooling and for boilers; as a recipient of waste; and the provision of power.

Pulp logs, after being hauled to the nearest stream by tractor, are floated downstream in vast booms to the pulp and paper mills. In 1965 it was reported that the number of logs floated down the Ottawa River system had remained constant at about one million cords. Of this amount, about 50,000 cords were saw logs, as compared with about one million saw logs using the river for transportation at the turn of the century.⁶ Estimates of the loss of logs floated down the river vary from three per cent to six per cent.⁷

Flotation of logs on the Ottawa River system includes driving, floating and towing of logs in booms, and holding. During the driving season (May to November) releases are made from reservoirs to facilitate the log driving operations, and reservoirs are kept at levels suitable for log towing. Extensive logging booms and holding grounds, where logs can be concentrated for towing and sorting, are maintained by the logging interests.

In addition, there are many glancing booms along the river to guide the logs into the proper channels where the logs are driven instead of being towed. Log chutes are used to by-pass most power dams; where there is no provision for this, the logs are flushed through the spillway gates.⁸

The Upper Ottawa Improvement Company, which operates under charter from the federal government, conducts log driving and towing facilities above Ottawa, and the Gatineau Boom Company, which operates under charter from the Québec government, performs similar services below Ottawa.⁹

In the late 1940s road transport began to compete with water transportation of logs. Land transport by road and rail has increased but has levelled off recently owing to concern over energy requirements. In terms of cost, water transportation of logs for distances of 100 miles or more is still cheaper than other forms of transport.

Data available on the effects of log flotation on water quality is limited. Because of this and the complexity of the pollution problem, it is not possible to make any exact analysis, but the broad effects of this activity are given below.

The handling of logs during dumping, sorting, booming, transportation and storage, results in the deposition of large amounts of bark into the river. Subsequently it becomes water-saturated and sinks, or is washed ashore. Bark accumulations are particularly concentrated in dumping and storage areas. Pulp logs are almost completely debarked by the time they reach the mill; sawlogs arrive with much of their bark intact. Underwater bark deposits undergo a lengthy process of decay, during which an oxygen demand is exerted and organic compounds, such as tannins, wood sugars, nutrients and lignin, are leached from the bark or formed as the result of microbial activity. Tannins and lignin often impart a yellowish-brown colour to the water. These effects may be considerably modified by the dilution process.

In certain cases bark deposits smother fish eggs in spawning grounds and destroy invertebrate bottom fauna in nursery areas. In some cases permanent compaction will eventually occur and eliminate spawning altogether. Free-floating logs may result in stream bank erosion and, together with the denuding of river banks by water flow alterations, may affect stream

bank stability and release silt and sediment into the water. This can result in the smothering of fish eggs on spawning grounds. River drive improvements clear major obstructions to prevent jams, thereby affecting fish resting pools and spawning beds.

Bulldozing logs into the water deposits earth from the landing site into the water, another cause of silting problems. The flotation of logs makes it necessary to clean up debris in front of hydro dams to protect the turbines. Ontario Hydro estimates that its annual expenditure on this operation amounts to \$75,000 in respect of the generating stations at Des Joachims, Chats Falls, Chenaux and the Otto Holden. Booms may create access difficulties for swimmers and boat users. Lastly, floating woods can be a physical hindrance to swimming, fishing and boating: submerged deadheads are particularly dangerous to small boats.

The above effects result in conflict between the flotation of logs and the maintenance of fish life and the use of the river for swimming, boating and fishing, the operation of hydro dams and municipal water intakes. Some attempts have been made by mill owners to resolve these conflicts, for example at Consolidated Bathurst's saw mill at Brantford a gap is left in the booms for swimmers and boat users; south of Deep River, where there is a considerable growth in pleasure boating, the Ottawa Improvement Company pays close attention to the cleaning up of beaches and has installed protection booms. The company encourages the public to make any complaints directly to them.¹⁰

The pulp and paper industry uses water for three main purposes, cooling, processing and for boilers. By far the greatest quantity (78 per cent) is used in the various processes (including digesting, cooking wood

chips for pulp production, pulp washing); about five per cent is used for cooling; seven per cent is used for boiler feed; and about eight per cent for other purposes.¹¹

Table II shows the quantities of water taken from the Ottawa River system by each of the seven major mills. These mills account for 233 mgd of the total 303 mgd industrial consumption of water in the Ottawa River system.

The pulp and paper mills at Temiskaming, Gatineau and Masson have their own water supply systems from the Ottawa River; other mills are supplied through municipal sources.

The pulp and paper industry in Canada recirculates over sixty five per cent of the water it uses, and returns to the source some ninety six per cent of its water intake.¹²

Water returned to the Ottawa River system by the industry contains suspended solids (fibre, bark, wood chips), soluble organic compounds, colour-- and odour-causing materials, toxic materials and, in the past, mercurial compounds. Between 1967 and 1969 the pulp and paper industry was responsible for ninety nine per cent of the 190 tons a day of suspended solids discharged into the Ottawa River and over ninety per cent of its oxygen demand load.¹³

The Ontario/Québec Water Quality Report clearly defined gross degradation of water quality downstream from the town of Temiskaming, and downstream from Ottawa and Hull, for which the pulp and paper industry was largely responsible. Below the mill at Temiskaming coarse wood waste material formed sludge deposits which completely blanketed the river bottom for six miles downstream of the outfall. High concentrations of wood fibres were measured up to ten miles downstream. Floating sludge mats and odour

TABLE II

WATER CONSUMPTION OF PULP AND
PAPER MILLS ON THE OTTAWA RIVER

<u>Mill</u>	<u>Location</u>	<u>Consumption (mgd)</u>
<u>Ontario</u>		
E.B. Eddy	Ottawa	6.7
CIP	Hawkesbury	24.0
<u>Québec</u>		
Consolidated Bathurst	Portage-du-Fort	14.5
E.B. Eddy	Hull	33.2
CIP	Gatineau	45.6
Thurso Paper	Thurso	10.4
<u>Tributaries</u>		
CIP (now Tembec)	Temiskaming	90.0
James MacLaren	Masson	8.8
<u>TOTAL USE</u>		<u>233.2</u>

Source: Based on Ontario/Québec Water Quality Report, Vol. 1, p. 80.

problems associated with anaerobic decomposition of these bottom deposits were frequently observed in the same area. Increased levels of sulphur bacteria were measured in water and sediment downstream from this mill. Oxygen demanding wastes discharged by the mill caused a significant depletion of oxygen, and complete recovery to saturation levels was not observed until the Des Joachims area. Below Ottawa and Hull the river was grossly contaminated by waste discharges from the pulp and paper mills and municipalities. There was little evidence of recovery downstream of the Carillon Dam, and the value for most uses of this stretch of the river was seriously limited. The adverse conditions caused by the pulp and paper waste discharges in this stretch of the river included extensive bottom sludge deposits and floating sludge mats; high concentrations of wood fibre; elevated levels of biochemical oxygen demand (BOD),* ammonia and conductivity; excessive slime odours; and significant mercury contaminants of sediments and in flesh of sport and commercial fish species. Dissolved oxygen levels at several points were commonly as low as 5.0 to 5.5 mg/l and during a period of somewhat restricted flow decreased to 4.3 mg/l at Carillon Dam. The composition of bottom fauna was significantly altered from the natural conditions throughout the zone.

Pulp and paper wastes added considerably to the nutrients in the river. Inputs of nitrogen from the mills on the Ottawa River system amounted to 50,000 lbs. a day, most of this originating from the ammonia-based sulphite pulping process carried on at Temiskaming and Hawkesbury. The paper-making process employed at the other mills contributed little to the nitrogen levels

* Biochemical Oxygen Demand (BOD) is a measure of the organic pollution load which indicates the rate at which dissolved oxygen (DO) is drawn upon in a stream.

of the river.

The report also noted mercury contamination in the lower river, apparently related to pulp and paper wastes discharged into the river before 1971. Waste discharges from the pulp and paper mills on the Ottawa River system had led to conditions in the river which are in conflict with most other uses.

The dumping into the river system of wastes from the pulp and paper mills had affected fish life and was therefore in conflict with its use for commercial fishing and for sport fishing by recreationalists.

The Ontario/Québec Water Quality Report noted the decimation of bottom fauna for some six miles below the mill at Temiskaming, and damage to normal bottom fauna extended for about forty three miles before complete recovery took place. Below Ottawa and Hull wood sugars and other organic compounds promoted slime bacteria below all mills discharges and adversely affected the hatching success of fish eggs and the survival rate of fry. The additional oxygen demand created by benthic deposits reduced the dissolved oxygen content of the river downstream of Temiskaming and below Ottawa and Hull to levels unsuitable for the maintenance of warm water fish species. Bottom deposits smothered spawning beds, and the lowering of dissolved oxygen resulted in a change of fish species to those of a coarser type. Mercury contamination of several fish species in the lower river had led to the closing, in 1970, of commercial fishing downstream of the Chaudière Falls, and sportsmen were advised to limit the number of fish taken from this part of the river. It is likely that mercury in excess of acceptable levels will persist in fish flesh for many years in this part of the river.

Soluble organic waste materials from pulp and paper mills caused conflicts with municipal water supply systems and hydro installations.

Increased maintenance costs had been reported at Otto Holden Dam (related to the Temistaming mill wastes) and at Chenaux Dam (related to the Portage du Fort mill wastes).

Solid wastes from pulp and paper mill discharges were in conflict with the use of the river for recreational purposes. Slime growths resulting from soluble organic materials were aesthetically displeasing and lessened the attractiveness of the river for recreational purposes. Discharges from mills of phosphorous and nitrogen added to the amount of man-made nutrients entering the river, resulting in the production of aquatic vegetation which was considered to be of nuisance proportions for some recreational activities, since such growth in bathing areas made swimming unpleasant and the presence of weeds on rudders and propellers interfered with boating.¹⁴

Tannins and lignin from decaying bark imparted a yellowish-brown colour to the water. This causes a conflict with municipal uses of the river for drinking purposes. A considerable number of processes undertaken at the Britannia Filtration Plant in Ottawa are concerned with colour removal.¹⁵

The pulp and paper mills in the Ottawa River basin use either purchased hydro-electric power from Hydro Québec or Ontario Hydro Commission, to which the Ottawa River system supplies power, or generate their own electricity from the river, for example, the Eddy Paper Company, James MacLaren Co., Ltd., supplementing this with purchased electricity.¹⁶

II. The Mining Industry in the Ottawa River Basin

Mining and related activities in the Ottawa basin are, or have been, located in two main regions, the first being in the Upper Madawaska area, Ross Township above Chats Falls and Bristol, near Quyon, in Québec; and the second being in the Lake Temiskaming, Kirkland Lake and Rouyn-Noranda of the Upper Ottawa and its tributaries.

Four mines in the Upper Madawaska, none of which is now operating, produced graphite, corundum, pyrites and molybdenite. Chromas Company (formerly Dominion Magnesium Ltd.), has been extracting magnesium near Haleys in Ross Township since 1942. A magnetite mine was worked periodically at Bristol, Québec, from 1873, and last closed down in 1977. The waste pile from this mine is 230 feet high. A lead-zinc deposit was worked on Calumet Island from 1943 to 1968.¹⁷

More spectacular strikes were made in the area bordering Lake Temiskaming and on the tributaries and lakes in the northwest section of the basin.

In 1903 silver was discovered at Cobalt, where the mines reached their maximum production after hydro-electricity became available with the building of the Hound Chute and Fountains Falls dams in 1910. The discovery of silver at Cobalt led to exploration further north. Gold was discovered in Gowganda, Swastika, Kirkland Lake and Larder. Willroy Mines in the Kirkland Lake area milled over eight million tons of copper-, zinc-, lead-, silver- and gold-bearing ores between 1957 and 1975.¹⁸

In 1922 gold was found in the Rouyn-Noranda area, and a year or so later copper was discovered. Rouyn reached its peak as a gold-mining centre in 1925, after which it became the supply, commercial and residential area

for Noranda. The building of the Quinze Dam in 1926 solved Noranda's power problems, and meanwhile communication difficulties were overcome by the building of railways and roads. Noranda Mine Company's smelter went into operation in 1926, and from 1930 onwards fed the company's electrolytic refinery in Montreal East. By 1939 Noranda was the second largest producer of copper in Canada and the world's largest producer of gold. In 1956, Noranda began smelting copper concentrates from outside the region, e.g. from Manitoba. Between 1927 and 31 December, 1975, the Noranda Division of Noranda Mines Limited smelted 59,589,000 tons of ore, 59,000,000 tons of which came from the Horne Mine, which ceased operations in mid-1976 when known ore deposits became exhausted. In addition Noranda custom smelted 22,443,000 tons of ore during the same period. Falconbridge Copper Limited, Dufault Division, produced 28,168,000 lbs. of copper and 29,981,000 lbs. of zinc in 1975.¹⁹

The principal water uses in mining and milling are for processing and cooling purposes. Water is introduced to the ore to form a slurry in the grinding operation and is used when the flotation method of concentration is adopted. Water is also used for washing the ore at various stages in the production process and for carrying away the mill tailings. In the actual mining operation, water is used at the ore face for mucking and slushing operations and for cooling drills and other excavating equipment. The water used in the mine is often groundwater.²⁰

Withdrawals of water for use in the manufacture of primary metals in Canada are the second highest among primary manufactures in Canada. The amount of water used in mineral extraction and related activities depends on the type of circulation system in use at a particular mine site. The obce-

through and tailings ponds plus decant systems require the most water, and in the latter system there may be an additional loss of water at the mine due to evaporation of water in the tailings pond. The tailing plus recirculation system recycles the waste water back to the milling operations with some waste treatment before recirculation. Some operations recycle most of their waste water, significantly reducing their consumption.²¹

Whatever type of circulating system is employed in mineral extraction and processing, considerable amounts of mineral wastes enter the river system. In the once-through system all wastes are discharged into the river system. In the tailings pond and decant system, the waste first enters tailings ponds or shallow basins. The heavier particles in the waste water settle on the bottom, but excess water is allowed to flow over the tailings dam into the river system. The tailings plus recirculation may temporarily reduce the amount of waste entering a water course, but eventually the waste particles will be dumped and natural run-off will carry them into the river system. Additional metallic wastes enter the water course from abandoned tailings, dumps and mines.

Waste entering the river system from mining activities contains materials which are frequently toxic to fish and may be a danger to human life.

In the early 1960s it was stated that wastes from the Rouyn-Noranda area had "destroyed fish and practically all animal life" in the adjacent lakes.²²

It would appear that the use of the river system for the disposal of wastes from mining activities on the one hand and its use for recreation, wildlife and water intake for domestic purposes, on the other, creates serious local conflicts. By the time the water reaches Lake Temiskaming,

the adverse effects have apparently disappeared: the Ontario/Québec Water Quality Report stated that the water of the lake was excellent for fishing and generally of a quality suitable for recreational purposes.²³

The only mine operating below Lake Temiskaming in the Chromas Company mine and smelter near Haleys. This mine, in 1971, discharged less than one mgd of waste water which contained seven mg/l of chromium. The Hilton Mines near Quyon (which closed in 1977) also discharged less than one mgd of waste water which contained high suspended solids from iron mine wastes. There are no recorded adverse effects of these discharges.²⁴

Hydro-Québec supplies Rouyn-Noranda with hydro-electricity generated at the various dams on the Upper Ottawa.

III. Uses of the Ottawa River for Domestic Purposes

Most municipalities adjacent to the Ottawa River and its tributaries obtain their water from those sources, other communities obtaining their water from groundwater supplies. Municipalities use water for domestic purposes; to meet the needs of commercial and smaller industrial establishments; and for public purposes. Indoor residential uses include water for drinking, washing and cleaning, flushing away waste. The proportional uses of water used for indoor residential purposes are:- bathing and personal 28 per cent; laundry and dishwashing 23 per cent; toilets 45 per cent; drinking and cooking four per cent. Seasonal peaking is caused by outdoor uses of water for lawn- and garden-sprinkling, car washing, private swimming pools etc. Public uses include water for street cleaning, watering of public parks and gardens, public swimming pools and fire-fighting. Of the water used by

municipalities across Canada, the breakdown is

Residential	65	gallons	a	day,	per	person
Commercial	31	"	"	"	"	"
Public	21	"	"	"	"	"

The average daily consumption of water by municipalities across Canada is estimated at 116 gallons a day per person.²⁵ The actual amount of water used by any particular municipality will depend on the extent and type of industry in the municipality and/or the affluence of the population which will be reflected in the number and types of water-consuming devices being used. The total amount of water withdrawn, for municipal purposes, from the whole river basin was estimated at 100 million gallons a day in 1965: such withdrawals from the interprovincial section of the main stem were estimated at 56 million mgd in 1971.²⁶ Appendix VII lists the municipalities using Ottawa River water for domestic supplies, their rates of water consumption and types of treatment. About eighty per cent of water withdrawn from the river for domestic uses is returned to the river.

The domestic use of water has risen dramatically with the introduction of water-intensive appliances such as automatic washing machines and dishwashers. The trend towards private swimming pools and the widespread use of air conditioners could push personal daily consumption of water up to 200 gpd by 1981 and to between 300 and 350 by 2,000.²⁷

The Ottawa River system has received raw sewage from the towns and villages along its banks from the time of its earliest settlement until the present time. The amount of domestic waste entering the Ottawa River system has continually increased with the growth of population and, more especially,

with the shift from rural areas and small hamlets to urban centres.

Appendices VIII and IX show that between 1901 and 1971 the population in centres of over 1,000 on the main stream increased more than fivefold and on the tributaries almost fivefold. In 1971 nearly eighty three per cent of the population in centres of over 1,000 people bordering the main stream were living in the Ottawa/Hull area (including Ottawa, Hull, Aylmer, Deschenes, Vanier, Rockcliffe Park, Pte. Gatineau and Gatineau).

Estimates of population growth and distribution based on Statistics Canada data from 1941 and earlier records predict the continuing slow growth in the basin, a continuing shift from rural to urban centres, and the overriding factor of the National Capital Region. The ratio of urban to rural users is expected to be 5:1 by 1991, with a total population for the whole basin of 1,853,000. It is considered that urban growth will be accompanied by the expansion of industrial development especially in the National Capital Region, Temiscaming, Pembroke and Hawkesbury.²⁸

The shift of population from rural to urban areas and the general increase in population has led to ever-increasing amounts of bacteria, BOD, inorganic materials and nutrients entering the river from municipal outfalls, and where industries such as slaughter houses use municipal services these add to the load of organic material deposited in the river.

Until comparatively recently all domestic sewage was dumped untreated into the river system. It was not until 1963 that Ottawa, by far the largest contributor to the river of municipal sewage, first treated its wastes. Hull still continues to dump untreated sewage into the river, as do most Québec municipalities bordering the Ottawa and its tributaries.

Table III shows the populations, BOD loads and types of treatment in

TABLE III

MUNICIPAL DISCHARGES TO THE OTTAWA RIVER
(Population, BOD Load, Type of Treatment)

<u>Municipality</u>	<u>Population</u>	<u>BOD Load (1971)</u> (lbs/day)	<u>Type of Treatment</u>	<u>Permissible</u> <u>BOD Loading</u>
<u>Québec</u>				
Ville Marie	2,400	410	None	120
Temiscaming	2,800	475	None	140
Chapeau	562	96	None	30
Fort Coulonge	1,815	18	Secondary	90
Campbell's Bay	1,150	200	None	60
Shawville	1,800	50	Secondary	90
Quyon	834	140	None	40
Aylmer	5,430	900	None	280
Deschenes	4,070	660	Primary	90
Hull	60,500	10,000	None	3,100
Pte. Gatineau	11,800	2,000	None	600
Gatineau	18,000	3,000	None	920
Templeton	3,216	545	None	160
Angers	615	104	None	30
Masson	2,300	391	None	120
Thurso	3,694	628	None	190
Papineauville	1,384	26	Secondary	70
Montebello	1,500	255	None	80
Fasset	525	90	None	30
Grenville	1,500	255	None	80
TOTAL	125,895	20,243		6,320
<u>Ontario</u>				
New Liskeard	4,850	90	Secondary lagoon	250
Bucke Twp.	1,295	0	Septic tanks*	70
Halleybury	2,550	40	Secondary (contact stabilization)	130
Mattawa	1,400	8	Secondary (lagoon)	50
Deep River	5,100	170	Imhoff tanks	500
Chalk River	1,000	0	Septic tanks*	50
Buchanan Twp.	1,000	80	Primary	50
Petawawa	10,700	540	Primary	550
Pembroke	15,142	1,800	Primary	750
Renfrew	8,400	1,200	Primary	260
Amprior	5,728	3,000	Primary	1,800
Neapean Twp.	24,000	500	Secondary (activated sludge)	650
Ottawa	320,000	40,000	Primary	15,000
Cumberland	1,000	100	Primary	50
Rockland	1,120	10	Secondary (lagoon)	60
Plantagenet	855	0	Septic tanks*	40
L'Orignal	1,295	0	Septic tanks*	70
Hawkesbury	9,049	1,600	None*	460
TOTAL	388,439	49,138		20,790

* Provincial project under development by the Ontario Water Resources Commission.

Source: Based on Ottawa River Basin: Water Quality and its Control, Tables 3.2.1, p. 31 and table 4.2.1, p. 46.

1971 and permissible BOD loads for thirty eight municipalities on the main stem of the Ottawa from Ville Marie to Grenville in Québec and from New Liskeard to Hawkesbury in Ontario. In Québec three municipalities (all with populations of under 2,000) provided secondary treatment; one provided primary treatment; and sixteen no treatment at all. In Ontario four municipalities provided secondary treatment; seven provided primary treatment; five had septic or imhoff tanks; and one provided no treatment. In Québec seventeen municipalities out of twenty exceeded permissible BOD loadings; in Ontario seven municipalities out of eighteen exceeded the permissible loadings.

Primary treatment of municipal wastes removed from 25 per cent to 30 per cent of the BOD by removing solids, and kills harmful bacteria by chlorination prior to discharge into the receiving stream. Soluble BOD is not removed. Secondary treatment, which is based on biological processes, results in the removal of from 85 per cent to ninety per cent of suspended solids and total oxygen demand; it does not remove nutrients such as phosphates. Tertiary treatment removes any additional contaminants such as heavy metals, inorganic dissolved solids, nutrients etc.²⁹

Municipal wastes in 1971 were the main source of bacteriological contamination and contributed to the inorganic nutrients and BOD in the Ottawa River. In 1971 the daily discharge of organic waste from 38 municipalities along the Ottawa totalled 69,500 lbs. a day of BOD, representing about six per cent of the total BOD discharged into the river. Municipal wastes also included 5,200 lbs. a day total phosphorus, about 43 per cent of which originated from the Ottawa/Hull area, and about 19,000 lbs. a day of nitrogen.³⁰ Municipal wastes may also contain non-degradable materials such as dust and

sand washed from city streets, salt from roads and highways, and fertilizers and pesticides washed off residential gardens and public parks into roads and sewers.

Contamination of the river as a result of municipal discharges occurred locally in many areas upstream of the Chaudière and extensively downstream of Ottawa and Hull, there being particularly high levels of contamination below Hull where large volumes of untreated wastes enter the river.³¹

Municipal and other domestic waste discharges into the river system have caused conflicts with the use of the river for municipal water intakes throughout the century. This is illustrated by the history of water treatment in Ottawa, which installed its first public water supply system in 1874.

In a report by Allen Hazen dated 5 October, 1910, sewage pollution was sufficient to make the water unfit for use with confidence in its raw state, and was increasing. He also regarded the colour of the water as objectionable.³²

In 1911 a Pure Water Commission was set up and found that Ottawa River water was polluted and would become more so. Three of the four members of the Commission proposed that "pure" water should be led to Ottawa by gravity from the Blanche River, a reservoir to be formed by a dam at the head of McGregor Lake. The one dissenting member was Thomas O. Keefer, who considered the Ottawa to be a better present and future source of supply. He urged the construction of separate sewers on both sides of the river between Britannia and Aylmer to a safe outfall below the Ottawa water intake.³³

Epidemics of typhoid had been common during the 19th and early 20th centuries. In 1912 a serious epidemic of typhoid broke out in Ottawa and was found to be caused by sewage finding its way into the water pipes. This was

remedied by temporary mechanical means. From 1913 onwards the city water was chlorinated; and in 1915 a new pump house and overland pipe system were installed on Lemieux Island. The resultant decline in cases of, and deaths from, typhoid is shown in Table IV.

The Ontario/Québec Water Quality Report noted that raw and inadequately treated domestic wastes causing bacteriological contamination, which interfered with swimming and boating, occurred locally in many areas upstream of the Chaudière and extensively downstream of Ottawa/Hull. There was a particularly high level of contamination below Hull resulting from a large volume of untreated municipal and slaughter house wastes. The report also recorded that the addition of nitrogen and phosphorus from municipalities and other sources resulted in concentrations significantly higher than normal background levels, particularly in the lower river, where it was attributed mainly to the waste discharges of Ottawa and Hull and certain industries. Aquatic plant production was considered to be of nuisance proportions for recreational activities. The reduction in the dissolved oxygen resources of the river for which domestic and industrial wastes are responsible adversely affected the number and especially the species of fishlife. The deposition of BOD into the river from both these sources created undesirable conditions of colour and odour below the outfalls. These effects caused conflicts with users of the river for recreation, commercial and sport fishing and for wildlife.³⁴

IV. Uses of the Ottawa River for Agriculture

Owing to the topography of the Ottawa basin and the character of its soil, only a small percentage of the area is used for agriculture, and the

TABLE IV

CASES OF, AND DEATHS FROM, TYPHOID
IN THE CITY OF OTTAWA FROM
1912 TO 1917

<u>YEAR</u>	<u>TYPHOID CASES</u>	<u>DEATHS</u>
1912	1,300	84
1913	90	14
1914	86	9
1915	47	12
1916	12	4
1917	12	1

Source: Report on the City of Ottawa, Water Works Supply,
City Engineer's Office, Ottawa, 12 April, 1919.

amount of arable land to total farmed land is considerably smaller.

The main agricultural areas in the basin are parts of Temiscamingue, Papineau, Labelle, Argenteuil and Deux Montagnes in Québec; parts of the section east of Pembroke and a small area around Haileybury in Ontario.

Appendix X shows that in 1971 the farm population in the Census Divisions of Labelle, Papineau, Pontiac, Temiscamingue and Vaudreuil in Québec was only 6.4 per cent of the total population in those districts: the proportion of farming population in the Census Divisions of Lanark, Ottawa-Carleton, Prescott, Renfrew, Russell, Nipissing and Temiskaming in Ontario was 4.8 per cent. The farm population for these Divisions was 18.2 per cent and 12.2 per cent for Québec and Ontario respectively five years earlier. The decline in rural non-farm population between 1966 and 1971 was from 28.8 per cent to 23.8 per cent in the Québec Divisions and from 27.3 per cent to 14.9 per cent in the Ontario Divisions.

Whereas during the second half of the 19th century, mixed farms, growing wheat and oats and supporting cattle, were typical of the agricultural areas of the Ottawa basin, the tendency during the present century has been to concentrate on livestock. The census figures of farms with sales of \$2,500 or more in 1971 show that 86.2 per cent of the farms in Argenteuil, Deux Montagnes, Gatineau, Hull, Labelle, Papineau, Pontiac, Temiscamingue and Vaudreuil in Québec were classified as dairy, cattle, sheep, poultry and combinations of livestock farms. In Ontario 93.3 per cent of such farms were so classified for the counties of Lanark, Ottawa-Carleton, Nipissing, Prescott, Renfrew, Russell and Temiskaming. (See Appendix XI)

In 1971 about one mgd of water from the Ottawa was used for irrigation purposes on the Ontario side.³⁵ Cattle use shallow streams for drinking, but

most of the water used for agriculture is probably from groundwater sources. The withdrawal uses of the river for agricultural purposes may be considered as negligible.

Since the proportion of arable land in the basin is relatively small, inorganic fertilizers, pesticides etc., have a limited use and make little significant contribution to nutrient enrichment of the river.³⁶

Since agriculture in the Ottawa basin is mainly livestock, the main adverse effects are from the wastes of animal feedlots, and poultry batteries or from cattle discharging wastes directly into streams or flood water, thus adding bacteriological and nutrient wastes to the river. Feedlots and batteries can be a serious run-off problem because of the high animal and poultry densities involved. It is estimated that one beef or dairy animal produces about fifteen tons of manure a year.

Pollution of water by farm animals causes conflicts with the use of the river system for recreation, fish and wildlife.

The processing of agricultural products adds to the BOD demand on the river. In 1971 Quyon Farmers Co-operative, a butter factory, discharged .005 mgd of waste water which contained sixty lbs/day BOD; the Agricole de Papineau discharged .13 mgd and wastes contained 770 lbs/day BOD; Arnold Farms discharged .002 mgd and wastes contained twenty lbs/day BOD.³⁷

V. The Use of the Ottawa River System for the Production of Electricity

Hydro-electricity was generated locally on the Ottawa River system during the latter half of the 19th century (see p. 61). It was not until the present century that large hydro dams were built in the river basin.

The development of electrical technologies in the late 19th century made possible long-distance transmission and giant regional central electric stations which could take advantage of the economies of large-scale operations. Large water sites in rough country away from markets became potentially valuable sources of power.³⁸

These inventions and the increasing demand for electric power for industrial and domestic use led to the building of dams on the Ottawa River system for local use and for transmission to the industrialized regions of southern Ontario where, by the 1920s, existing power was insufficient. In 1943 the Ontario and Québec governments signed an agreement allocating between them the undeveloped water power sites on the Ottawa River. Most of the largest dams on the Ottawa were built after that date.³⁹

The major generating stations on the Ottawa system and their capacity are shown in Appendix XII.

The latest dam, the Arnprior Power Project, was completed in 1976, and is the fifth on the Madawaska.⁴⁰

In addition to hydro dams there are a number of storage or regulating dams built on the Ottawa system to improve the seasonal low flows during late summer and early fall for the purposes of power generation and navigation for the logging interests. These dams serve incidentally as flood controls, since the levels in the reservoirs are allowed to drop before the beginning of the spring floods, which usually have two peaks, several weeks apart. The floods fill the reservoir and allow normal water flow down the river. In spite of this, when the volume of water is too great, the water is let go and flooding may then occur downstream. A project is now being studied by the Ottawa River Sub-Committee on Flow Regulation, Montreal Region, to increase

the storage capacity of the Quinze Reservoir to help prevent flooding in the Montreal region (and, incidentally, other areas upstream of Montreal).

The main storage dams are on the Ottawa, Montreal, Madawaska, Gatineau and Lièvre Rivers. A schematic diagram showing the locations of hydro and storage dams is at Figure II.

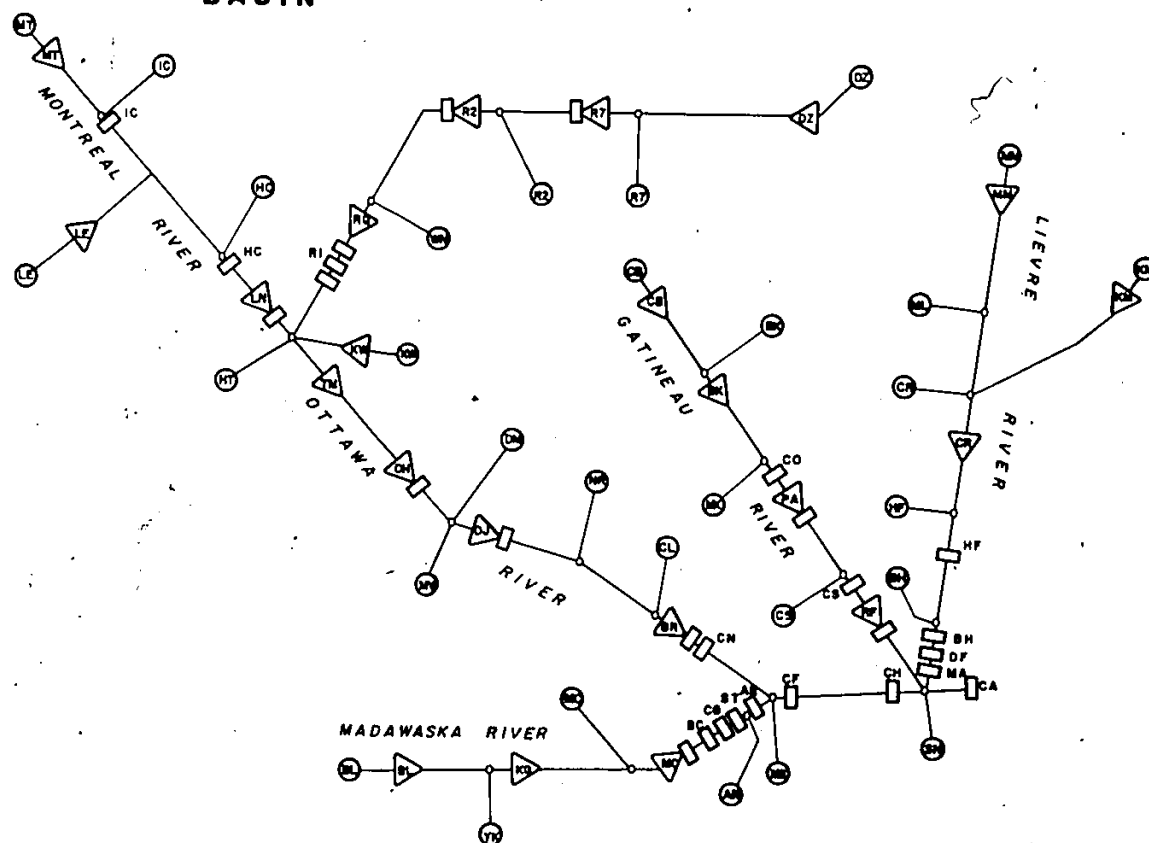
The use of the Ottawa River system for the production of hydro-electricity is an in situ one which does not withdraw water and does not add anything to it. The building of dams does affect the flow of the river and may indirectly affect water quality.

The building of a dam may obstruct fish swimming upstream. When waters back up behind the dam, land and wildlife habitats are lost. Moreover, in the case of the dams on the Ottawa, forests were not usually cut down prior to flooding, and as these decay an additional demand is made on the dissolved oxygen in the water.

In the headpond upstream of a dam there may be changes in temperature and temperature stratification. This in turn may affect the water temperatures below the dam, since releases are typically from the bottom of the reservoir. Such temperature changes, above and below the dam, may have an adverse effect on fish. The decrease in the flow of the river above the dam may cause sediment to build up in the reservoir, which in its turn may alter the pattern of sedimentation downstream. The dropping of sediment in a reservoir may increase the penetration of sunlight, thus encouraging algae to grow more extensively, with a resulting decrease in dissolved oxygen at the bottom of the reservoir.

Storage of water in the reservoir may also lessen the total flow downstream because of evaporation from the enlarged water surface above the dam. Re-aeration capability will be reduced, affecting the ability of the —

Figure 2. POWER AND STORAGE DAMS ON THE OTTAWA RIVER BASIN



LEGEND



INDEX TO ABBREVIATIONS

AR	ARNPRIOR	DJ	DES JOACHIMS	MS	MISSISSIPPI
BC	BARRETT CHUTE	DM	DUMOINE	MT	MISTINIKON
BM	BUCKINGHAM	DZ	DOZOIS	MW	MATTAWA
BK	BASKATONG	HC	HOUND CHUTE	NR	NOIRE
BL	BARK LAKE	HF	HIGH FALLS	OH	OTTO HOLDEN
BR	BRYSON	HT	HAUT TEMISCAMINGUE	PA	PAUGAN
CA	CARILLON	IC	INDIAN CHUTE	RF	RAPIDE FARMER'S
CB	CABONGA	KG	KAMANISKEG	R1	RAPIDE DES ILES
CF	CHAT FALLS	KM	KIAMIKA	RQ	RAPIDE DES QUINZE
CG	CALABOGIE	KW	KIPAWA	R2	RAPID 2
CH	CHAUDIERE FALLS	LE	LADY EVELYN	R7	RAPID 7
CL	COULONGE	LN	LOWER NOTCH	SN	SOUTH NATION
CN	CHENAUX	MA	MASSON	ST	STEWARTVILLE
CO	CORBEAU	MC	MOUNTAIN CHUTE	TM	TEMISCAMINGUE
CR	CEDAR RAPIDS	MK	MANIWAKI	WN	WINNEWAY
CS	CHELSEA	ML	MONT LAURIER	YK	YORK
DF	DUFFERIN MILLS	NM	MITCHINAMECUS		

river to cope with the demands exerted on it by oxygen-consuming wastes.⁴¹

The use of the river for the generation of hydro-electricity conflicts with recreational uses in many ways. Since no locks were provided in the dams (with the exception of the one at Carillon), pleasure boats are able to use only the stretches of water between dams. Variations in water levels may make reservoirs unpleasant for recreational purposes by exposing muddy shores at times of low water. The holding up of water coming over the dams at times of low demand on electricity, for example at weekends, will result in lower water levels downstream of the dam and may make the river less attractive for swimming and boating because of muddy shores and shallow water. Another conflict between dam-builders and recreationalists concerns the loss of "white water" for canoeing.

Fishlife may be affected by the dam obstructing the way upstream; by temperature changes; and by changes in water levels, which may leave fish stranded.

Any eutrophication increases caused by dams, which in effect turn the river above the dam into a lake, are in conflict with fishlife, sport fishing and recreation. They may also cause conflicts with uses of the river for waste intakes by increasing the costs of treatment to remove tastes, odours and colours.

The building of the Des Joachims Hydro dam led to a conflict with the lumber firm of James MacLaren Co. in 1960, which resulted in Supreme Court action. MacLaren claimed that after the building of the dam they were no longer able to let their logs float downstream because of the decrease in the flow of the river. The use of tugs caused the company a financial loss.⁴²

A dam built in 1905 for saw mills, woollen and grist mills, resulted

in conflict with local farmers in Osceola, as the dam resulted in the flooding of farm land and roads at the time of the spring floods. The decision handed down by the High Court of Justice in Pembroke was that on receiving the sum of \$20,000 the mill owners were to hand over to the municipal corporation of the Township of Bromley their lands, waterways, water privileges and rights. The dam was destroyed, and the prosperity of the community declined.⁴³

The actual effects on water quality of Ottawa River system dams are difficult, if not impossible, to estimate, since other uses would have similar effects. It seems probable that the effects on water quality of dams on the river are slight when compared with those of the pulp and paper mills and municipal wastes. This seems to be borne out by the fact that the Ontario/Québec Water Quality Report noted that water quality was impaired and the composition and abundance of benthic communities were adversely affected from the Kipawa mill to Des Joachims Dam, whereas from below the dam to above the Chaudière the water quality was generally satisfactory for recreational purposes.

VI. The Use of the Ottawa River for Nuclear Power Production

In 1955 Ontario Hydro designed and built a small experimental nuclear research station at Rolphton, Ontario. This plant began feeding power into the provincial grid in 1962. The annual energy output of the Rolphton station in 1974 was 158,934,000 kwh.⁴⁴

The nuclear power plant at Rolphton uses 26.0 mgd of river water for condenser cooling. The combined withdrawal use of water by Rolphton power plant and the Atomic Energy nuclear laboratories at Chalk River amounts to sixty six mgd.⁴⁵ After use the water used for cooling is returned to the

river at temperatures about 12°C higher than the normal water temperature. Small quantities of radioactive materials are discharged to the Ottawa River from the Rolphoton plant and the Chalk River nuclear laboratories, but it is stated that regular water quality monitoring of the river had shown no significant increase in background levels of radioactivity as a result of these discharges.⁴⁶

The use of the river for nuclear power production may be in conflict with fishlife for a number of reasons. Small fish, their eggs and the larvae of many creatures may be drawn directly through the plant along with the water used for cooling. If the cooling water temperatures are raised high enough, the fish and other organisms may be killed or injured. The return of cooling water to the river at a higher temperature may have beneficial or detrimental effects on fish and other organisms, depending on the species. Reproduction may be improved or impaired; organisms may grow faster and larger, or their metabolism may speed up, causing them to require more food than may be available. The oxygen levels in the river may be altered, since the amount of dissolved oxygen depends partly on the temperature of the water (less being dissolved at higher temperatures) and partly on the turbulence of the water, which increases the oxygen level. High temperatures may accelerate and aggravate the effects of man-made nutrients in the river and thus accelerate the growth of algae. As the aquatic growth decomposes it consumes large quantities of oxygen, which is then not available for fish and other aquatic life. Fish may gradually disappear or be replaced by other, poorer species.

As noted above, trace amounts of radioactive substances from the nuclear power plants are discharged into the Ottawa River. In addition, stack gases from the plant may contain radioactive substances, some of which may find

their way into the river. Trace quantities of radioactive substances could be ingested by fish and plants. Fish retain and accumulate such substances, which are subject to a marked degree of biological magnification through the food chain.⁴⁷

VII. Uses of the River System for Recreational Purposes and Wildlife

The value of the Ottawa River system for recreational purposes was recognized during the second half of the 19th century. Advertisements for steamship trips on the Ottawa extolled the attractions offered by the scenery, and at the turn of the century evening pleasure trips were offered by the G.B. Greene, which plied from Britannia Pier.⁴⁸ Boating was a popular pastime during this period: in the 1880s, according to Antoine Ratté, "every person owned, or owned in part, a boat and the summer evenings saw the water covered with pretty craft."⁴⁹

During the second half of the 19th century, recreational facilities were generally close to towns. This period saw the growth of cottages, especially in areas where there was good transportation from nearby towns, for example in Britannia, which was almost predominately a summer cottage community until about thirty years ago. In the 1860s a nebulous organization known as the Britannia-on-the-Bay Yachting Society was formed to meet the boating needs of the summer residents of Britannia. Britannia was served by a good railway service from Ottawa, and from 1902 by a streetcar service. To encourage people to use the streetcar, Britannia Bay Park was laid out and a pier built. The park contained changing rooms for swimmers, and rowboats could be hired.⁵⁰

With the growth of population, urbanization, increased disposable incomes and leisure, the extension and improvement of roads and the ubiquitous use of the car, the use of the river system for recreational purposes and tourism has progressed steadily during the present century, especially since World War II, and today they are one of the main uses of the river system. Cottages, camping grounds and resorts are to be found in previously inaccessible areas; and near towns there has been a strong tendency to convert riverside cottages to year-round homes and to build permanent houses on the river banks. Some cottage communities, such as Britannia, have become part of the Ottawa urban complex, while others, such as Constance Bay, have an increasing number of winterized and permanent homes from which people commute into Ottawa.

The recreational uses of the river include swimming, boating of all kinds, water skiing, scuba diving, fishing and hunting, cottage life, walking along the shores of rivers and lakes, enjoyment of the scenery, the pleasures of a simpler life in "natural" surroundings.

Table V shows the results of interviews with sixty four cottage users of the Ottawa River conducted by the Ontario Water Resources Commission and the Québec Water Board to find out the level of interest of the cottagers in various water-based activities. By far the highest preference was for swimming, for which water quality requirements are high.

Some indication of the importance of recreational uses of the river system may be inferred from the number of cottages, provincial parks, camping grounds, tourist accommodation, facilities for boat launching, marinas and boat clubs in the basin.

The Ontario/Québec Water Quality Report of 1971 estimated that there were then about 5,000 cottages on the river between Pt. Fortune and Lake

TABLE V

LEVEL OF INTEREST IN VARIOUS
WATER-BASED ACTIVITIES OF COTTAGERS
ON THE OTTAWA RIVER

Interest Rating		Percentage of Cottagers			
		Swimming	Boating	Angling	Water-skiing
5) 4)	High	75.0	45.3	37.5	14.1
3) 2)	Moderate	12.5	29.7	21.9	17.2
1) 0)	Low	12.5	25.0	40.6	68.7
<u>Average Rating</u>		3.9	2.7	2.5	1.3

Source: Ontario/Québec Water Quality Report, p. 84.

Temiskaming in Ontario and between Carrillon and the lower Lake Temiskaming in Québec.⁵¹ This refers only to cottages on the main stem. If account were taken of all cottages on the main stem, tributaries and lakes of the Ottawa system in both Ontario and Québec, the number would be many times greater: there are stated to be 1,272 cottages on Mississippi Lake alone.⁵² The chief cottage developments are on both sides of the river between Ottawa and Chats Falls and on the shores of the many lakes or extensions of the Gatineau, Rideau, Mississippi, Madawaska and Bonnechère Rivers, and to a lesser extent on Lake Temiskaming.

In 1893 Algonquin Provincial Park, an area of 1,466 square miles which includes the headwaters of the Petawawa, Bonnechère and Madawaska Rivers flowing into the Ottawa, and two rivers flowing into Georgian Bay, was established. The purposes of the Park were stated to be the maintenance of the water supply in this region of Ontario; the preservation of species of birds and wild animals; the provision of a field for experiments in forestry; and provision of a new resort and recreation area in northern Ontario.

There are now sixteen Provincial Parks in the Ontario section of the Ottawa basin. In 1974 these parks had an acreage of 1,889,142 and provided 3,595 camp sites. The recorded number of visitors and campers during the year were 1,662,879 and 284,180 respectively. 522,645 vehicles were recorded as being admitted to the parks. (See Appendix XIII). In Québec the Deux Montagnes Park, consisting of 700 acres on the north shore of the Lake of Two Mountains, was used by 85,000 visitors in 1964. The Dollard-des-Ormeaux Park, created in 1967, had 325 campsites.⁵³ Other river- and lake-side parks are maintained by many municipalities within the river basin, in addition to which the National Capital Commission has created an extensive riverside parkway

along the Ottawa River. The Ontario section of the Ottawa basin has at least 154 camping grounds, excluding those in provincial parks. These 154 camping grounds occupy 12,035 acres and provide 8,448 camp sites and 130 launching ramps. They are located in forty-five different places, some on the main river, the majority on tributaries and lakes in the basin. (See Appendix XIV).

Other facilities relating to recreational use of the river system are tourist establishments. In the Ontario section of the Ottawa basin, 251 establishments situated on the shores of the river, its tributaries and lakes in fifty two locations have tourist accommodation consisting of 526 rooms and 1,681 cottages. 119 of these establishments have natural shores and 132 have beaches. Twenty nine include package hunting and/or fishing plans in their amenities. (See Appendix XV.) In the case of Québec, no breakdown is available to establishments located directly on the river system.

Further evidence of the increased use of the river for recreational purposes is the growth and expansion of yacht clubs and marinas. The section of the main river which is most used for boat sailing is that between Britannia and Chats Falls.

During the past ten years three new sailing clubs (Lake Deschênes Sailing Club, Shirley Bay, March Sailing Club and the Club de Voile de Grande Rivière, Aylmer, Québec) and two marinas (Marina du Lac Dechênes, Aylmer, and Port of Call, Dunrobin) have located on Lake Dechênes. Membership of the Britannia Yacht Club, the oldest yacht club in the area, had increased from 321 members in 1950 to 569 by 1960 and to 1,300 by 1967. The number of boats increased from forty in 1950 to 350 by 1967. The 1967 fleet was 1,500 per cent of the 1914 figures of twenty boats.⁵⁴ The membership in 1977 was 1,815 and there has been a waiting list for a number of years, owing

mainly to the limitation of mooring spaces. Since members can bring their families and visitors and as members' children under ten years of age are not eligible to become members, the number of people using the club is probably three to four times the actual membership.⁵⁸

Table VI shows the yacht clubs on the Ottawa River system in the vicinity of the City of Ottawa, and the types and numbers of boats.

Marinas in the Ontario section of the Ottawa River system are shown at Appendix XVI. Sixty six marinas in twenty five locations all have mooring and docking facilities. Twenty four marinas in fifteen of the locations have pump-out facilities. Some yacht clubs also have pump-out facilities, e.g. Britannia Yacht Club, which is now installing a second such pump.

Recreational activities, as such, have little, if any, effect on water quality, and no adverse effects from this use of the river were recorded by the Ontario/Québec Water Quality Report. The disposal of wastes by recreationalists using cottages, trailer parks, camps and boats can and do add to the pollution of the river system. Motor boats can cause deterioration of water quality through oil and gasoline spills, in addition to which high speed motor boats can cause undermining and erosion of lake and river banks, thereby increasing the amount of undegradable matter, such as sand and silt, in the water course. Motor boats also create audio and odoriferous pollution. The effects of the uses of the river system for recreation are dealt with more fully in Chapter V.

TABLE VI

YACHT CLUBS IN THE
OTTAWA AREA - 1977

Gatineau River Yacht Club, Kirke's Ferry, Québec	70 boats, mainly centreboard dinghies
Ottawa New Edinburgh Club, Rockcliffe	75 boats, mainly centreboard dinghies
Canadian Forces Sailing Association, Dow's Lake	20 boats, mainly club-owned, centreboard dinghies
Ottawa River Sailing Club, Dow's Lake and Shirley Bay	24 centreboard dinghies, club-owned
RA Yacht Club, Dow's Lake	20 centreboard dinghies, club-owned
Britannia Yacht Club, Britannia	Number of boats not known (390 in 1974). Wide variety of keelboats and centreboard dinghies
Club de voile de Grande Rivière, Aylmer, Québec	50 keelboats and centreboard dinghies
March Sailing Club, Dunrobin	20 centreboard dinghies

Source: Information supplied by Mr. Don Martin, Manager,
 Britannia Yacht Club.

VIII. Summary

The Ottawa River basin in the 20th century has experienced population expansion and a dramatic shift of population from rural to urban centres, and from small urban centres to larger ones. The most important industry of the region, pulp and paper, has shown a constant growth throughout the century. Municipalities and the pulp and paper industry are responsible for most of the man-made wastes which have entered the river during the present century.

During the same period, the use of the river system for recreational purposes has increased rapidly. The increasing use of the river for waste disposal by municipalities and the pulp and paper industry, on one hand, and the rapidly growing importance of its use for recreation, on the other, is the main cause of conflicts between users of the river. The Ontario/Québec Water Quality Report clearly defined areas of degradation of the river as the result of its use by the pulp and paper industry and municipalities, and the effects of this on the use of the river for recreation and wildlife. In addition the Report drew attention to the presence, and the long-lasting effects, of the deposition in the river of mercury, and noted traces of radioactive material, considered to be within the specified limits, from a nuclear power station. The effects of the building of hydro dams during the present century are debatable: dams may well compound the adverse effects of other uses of the river. Changes in water levels definitely affect the use of the river for recreationalists, and changes in water temperature and the physical barrier imposed by dams may affect fishlife.

By the late 1960s it had become clear that the riparian doctrine, which gave individuals the right to make reasonable use of the waters of a stream flowing by their land, so long as that use did not substantially diminish either the quantity or quality of the water passing to landowners downstream,

no longer worked. The Ottawa River system has increasingly been used as a common good, waste being dumped into it without regard to the downstream effects. Until the past decade or so, pioneer attitudes remained, viewing water as an abundant "free good" with little general awareness of the consequences. With the growth of recreation, much of which is water-oriented, the public became more aware of the growing degradation of water resources. From the 1970s onwards the federal and provincial governments have sought to respond to the demand that economic growth be made compatible with the maintenance of water quality.⁵⁶

Unfortunately, recognition of the degraded state of the Ottawa River system has been very much post facto, as it was during the previous century, and remedial action required by legislation for old-established mills and for municipalities, which have been using the river system for over seventy years as a free dumping place for their wastes, will be extremely costly. In addition, there is the problem of passing legislation which will take into account future uses of the river and their effects on water quality. The position is further complicated by the interjurisdictional nature of the river.

The following chapter will deal with provincial and federal legislation relating to water quality, especially since the passing of the Canada Water Act and conflicts which have arisen since the Act was passed. It will also endeavour to assess the effect of provincial and federal legislation on the water quality of the Ottawa River system.

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52. "Cottagers pollute lake", Ottawa Journal, 24 March 1977, p. 3.
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CHAPTER V
GOVERNMENT LEGISLATION RELATING TO WATER RESOURCES,
ITS EFFECTS AND PRESENT CONFLICTS

Until the early 1930s water management was related mainly to the avoidance of epidemic diseases, and effective legislation was with the provincial governments, mostly under Health Acts and municipal by-laws. During the depression years of the 1930s little government action was taken regarding industrial pollution problems, since such action might have resulted in plant closures and further reductions in employment. During the Second World War little concern was shown for increasing water degradation resulting from the accelerated movement of population into large urban centres and industrial expansion. War-time attitudes continued into the post-war years. Increasing health hazards resulting from the concentration of populations in urban centres and water pollution problems posed by rapid industrial expansion led, by the mid 1950s, to new administrative structures coming into being to cope with the growing water pollution problem. The Ontario Water Resources Commission, which was set up in 1956, has had a profound and beneficial impact on water pollution problems in Ontario and has served as a prototype for similar agencies in other provinces. Eventually agencies tended to broaden their primary aim of protecting health to include issues of aesthetics, ecology and recreation.¹

Legislation passed in the early 1970s by the federal, Ontario and Québec governments relates to the many aspects of water management and to the numerous conflicting uses of water bodies. Legislation has been passed

by the three levels of government involved in the Ottawa River basin specifying degrees of pollution for various uses, having regard to their effects on other users. The problem of enforcement is a difficult one, which in the case of the Ottawa is greatly magnified by the interjurisdictional nature of the river system, since each province is responsible, under the British North America Act, for its own natural resources, while the federal government's jurisdiction includes navigable waters, fisheries, and national parks. The development of appropriate policies of water management is, therefore, closely dependent on federal-provincial co-operation, and with increasing complexity in the uses of water, such co-operation has become increasingly evident during the 1970s.

The federal government delegates some of its powers to the provincial governments, for example its administrative powers over fisheries in Ontario and Québec have been delegated to those provinces. The Provinces in their turn delegate much of their responsibilities to regional, municipal or local governments. These latter have the main responsibility for water supply systems, sewage treatment, urban recreation, health and land-use planning, although the provincial governments retain their powers to approve local concerns, provide funds to supplement local sources, and enforce minimum standards of quality and adequacy for local government services. The present tendency is for provincial governments to exercise greater central control over matters delegated to municipalities.²

I. Ontario, Québec and Federal Legislation Relating to Water Resources

The major Ontario, Québec and federal Acts which are relevant to the

Ottawa River system are shown at Table VII and summarized below:

A. Water Resource Legislation in Ontario

The Ontario Water Resources Commission Act, 1957 (see Table VII), gave the Commission, which had been established the previous year, responsibility for the general supervision of all surface and ground waters in Ontario used as a source of water supply for any purpose, in respect of their quality. The Commission or any individual could apply to the Supreme Court of Ontario for an order for the removal or abatement of any injury.

The Commission also had the power, notwithstanding any other Act, to control and regulate all phases relating to water intakes for public purposes; to construct and maintain water and sewage works; and to make agreements with one or more municipalities or persons with respect to water supplies and sewage disposal. The discharge by municipalities or persons of polluting material into any waters or the shores or banks thereof was liable, on summary conviction, to a fine of not more than \$1,000 or a term of imprisonment of not more than one year, or both. The discharge of sewage from sewage works that had been constructed and operated with the approval of the Department of Health or the Commission was not a contravention. Plans for the contemplated establishment or extension or change of water or sewage works had to be submitted to the Commission before the work could proceed.

The Ontario Water Resources Act, 1972, (see Table VII) embodied most of the legislation contained in the Ontario Water Resources Commission Act and amendments of 1960 and 1970 (see Table VII). The Ontario Water Resources

TABLE VII

MAJOR LEGISLATION ON WATER MANAGEMENT
WHICH IS APPLICABLE TO THE OTTAWA RIVER BASIN

A. ONTARIO

Ontario Water Resources Commission Act (repealed)	<u>Statutes of Ontario, 1957, c.88, as amended by 1960, c.79 and 1970, c.124.</u>
Ontario Water Resources Act	<u>Revised Statutes of Ontario, 1970, c.332, as amended by 1972, c.1, s. 70.</u>
The Pollution Abatement Incentive Act	<u>Statutes of Ontario, 1970, c.62.</u>
The Environmental Protection Act	<u>Statutes of Ontario, 1971, c.88.</u>
The Environmental Protection Amendment Act	<u>Statutes of Ontario, 1972, c.106.</u>
The Environmental Protection Amendment Act	<u>Statutes of Ontario, 1973, c.94.</u>
The Environmental Assessment Act	<u>Statutes of Ontario, 1975, c.69.</u>
Lakes and Rivers Improvement Amendment Act	<u>Statutes of Ontario, 1971, c.50, s. 50.</u>
The Mining Amendment Act	<u>Statutes of Ontario, 1970, c.79.</u>
The Beds of Navigable Waters Act	<u>Revised Statutes of Ontario, 1970, c.41.</u>

B. QUEBEC

Water Board Act (repealed)	<u>Revised Statutes of Québec, 1964, c.183.</u>
Watercourses Act	<u>Revised Statutes of Québec, 1964, c.84.</u>

Mining Act

Statutes of Québec, 1965, c.34.

Environment Quality Act

Statutes of Québec, 1972, c.49.

C. FEDERAL

Fisheries Act

Revised Statutes of Canada,
1970, Vol. III, c. F.14.

An Act to Amend the Fisheries Act

Revised Statutes of Canada,
1970, Supp. 1, c.17.

An Act to Amend the Canada Shipping
Act

Revised Statutes of Canada,
1970, Supp. 2, c.27.

The Navigable Waters Protection Act

Revised Statutes of Canada,
1970, Vol. V, c. N.19.

Canada Water Act

Revised Statutes of Canada,
1970, Supp. 1, c.5.

The Environmental Contaminants Act

Statutes of Canada, 1975,
Vol. II, c.72.

The Municipal Improvements Assistance
Act

Revised Statutes of Canada,
1970, c. M.16.

An Act to Amend the National Housing
Act

Statutes of Canada, 1975,
Vol. I, c.38.

An Act to Amend the National Housing
Act and the Central Mortgage and
Housing Corporation Act

Statutes of Canada, 1975,
Vol. II, c.82.

Commission was dissolved, and the Minister of the Environment was appointed to administer the Act. An Environmental Hearing Board was established under the Act to hold public hearings and report thereon to the Minister of the Environment.

Under Section 30 of the Act, the

quality of water shall be deemed to be impaired if, notwithstanding that the quality of the water is not or may not become impaired, the material deposited or discharged or permitted to be deposited or discharged, or any derivative of such material causes or may cause injury to any person, bird or other living thing as a result of the use or consumption of any plant, fish or other living matter or thing in the water or in the soil in contact with the water.

The Act prohibits the discharge or deposit, without approval, by a municipality or person of deleterious materials into a water body, its banks or shores; and the adding, without permit, to any waters of any substance for the purpose of killing or affecting plants, snails, insects, fish or other living matter or thing. Every municipality or person who discharges material which is not in the normal course of events, or from whose control material escapes into any water which may impair its quality, is required to notify the Minister. Plans and specifications for the establishment or extension of any waterworks or sewage works must be approved by the Minister. If the collection, transmission, treatment or disposal of sewage of an industrial or commercial enterprise is considered unsatisfactory, the enterprise may be required to install and operate such facilities as directed. The Act requires municipalities, industrial and commercial enterprises to have available at all times such equipment, chemicals and other materials necessary to alleviate the effects of any impairment of water quality caused by such an establishment, where it is considered in the public interest to do so. Where a discharge of sewage into a sewage works may interfere with its

proper operation, notice may be served requesting the municipality or person responsible to stop or regulate the discharge or to take such measures in a manner and within such time as the notice may require. Permits are required in certain circumstances for withdrawals of water in excess of 10,000 gallons a day, or where the taking of water interferes with any public or private water interests, with the exception of the taking of water for domestic or farm purposes or for fire fighting. Contraventions of the requirements of the Act draws fines, on summary conviction, of varying amounts, the most severe not exceeding \$5,000 for the first offence and not exceeding \$10,000 for each subsequent offence, each day the contravention occurs constituting a separate offence. In some cases a term of imprisonment may be imposed. The Act provides for a hearing by the Environmental Appeal Board against decisions to refuse to issue or renew, or to cancel or suspend a licence or permit, or to refuse to grant an approval; regarding the terms and conditions in issuing a licence or permit or in granting an approval; regarding the alteration of the terms and conditions of a permit after it is issued; or regarding any notice, direction, report or order. The Act gives the Minister authority, on application from any one or more municipalities, to construct and operate waterworks or sewage works on behalf of the municipality.

Regulation 284/69³ under the Ontario Water Resources Act prohibits the discharge or deposit, into any water, of sewage from a pleasure boat. The owner or operator of every pleasure boat in which a toilet is installed shall ensure that, while the boat is on water,

- (1) the boat is equipped with approved storage equipment; and
- (2) such toilet and approved storage equipment are installed so as to

be non-portable.

The equipment installed must include such connecting piping as is necessary for the removal of toilet waste by shore-based pumping equipment, and equipment designed for incineration and storage of human excrement must have such electrical currents as is necessary to reduce to ashes all such excrement deposited.

Regulation 261/70⁴ under the Ontario Water Resources Act requires that operators of marinas shall provide pump-out facilities for the use by occupants of pleasure boats in which toilets are installed; and shall transfer and dispose of sewage from any pump-out facility at the marina in accordance with applicable law.

The Pollution Abatement Incentive Act, 1970 (see Table VII), authorizes a grant equalling the tax on the purchase of pollution abatement equipment for the purposes of sewage treatment, treatment of waste disposal or treatment of water to produce potable water by any person, municipality, university, school or hospital.

The Environmental Protection Act, 1971 (see Table VII), gives the Minister of the Environment powers to investigate problems of pollution, waste management and disposal, litter management and disposal; to conduct research related to contaminants, pollution, waste management etc.; to conduct monitoring programs, and "to conduct studies of environmental planning designed to lead to the wise use of the natural environment by man." The Act gives the Minister authority to make grants and loans for research relating to contaminants, pollution, waste etc., and for the training of personnel. He may establish and operate demonstration and experimental waste disposal sites. Part IV of the Act prohibits the addition of any substance to water that will or is likely to cause injury to any person.

animal, bird or other living thing as a result of the use or consumption of any plant, fish or other living matter or thing in the water or in the soil in contact with the water, without a permit or licence. Part VII requires certificates of approval for the construction of private sewage disposal systems.

An amendment to the Act in 1972 (see Table VII) gives a lengthy definition of "contaminant" as used in the Act, and prohibits the sale of any pesticide except under the authority of a licence issued by the Director:

The Environmental Protection Amendment Act, 1973 (see Table VII) deals, inter alia, with ice shelters on or over ice over any water for more than a day. The Act prohibits the discharge or deposit of any waste upon or over the ice over the water except in accordance with regulations. "Waste" is defined as human excrement or any refuse that is discharged or deposited in or from an ice shelter. Ice shelters may be removed if placed or allowed to remain on ice over water in contravention to the regulations.

The purpose of the Environmental Assessment Act, 1975 (see Table VII), is "the betterment of the people of the whole or any part of Ontario by providing for the protection, conservation and wise management in Ontario of the environment." Under this Act enterprises by or on behalf of Her Majesty in right of Ontario or by public bodies, municipalities (and at a later date major commercial or business enterprises) are required to submit to the Minister an environmental assessment of the undertaking. Such assessment shall include the effects of the enterprise on the environment and the actions necessary to prevent, change, mitigate or remedy such effects. A description of the undertaking and alternative methods are required to be given.

The Minister, after reviewing the facts, has power to approve such undertaking. Where the proposed enterprise is not considered acceptable by the Minister, the matter may go before the Environmental Review Board.

The purpose of the Lakes and River Improvement Amendment Act, 1971 (see Table VII), is to provide for the use of the lakes and rivers of Ontario, to regulate improvements in them and to provide for

- (1) the preservation and equitable exercise of public rights in or over such waters;
- (2) the protection of the interests of riparian owners;
- (3) the use, management and perpetuation of the fish, wildlife and other natural resources in such waters;
- (4) the preservation of the natural amenities of such waters and on the shores and banks thereof; and
- (5) ensuring the suitability of the location and nature of improvements in such waters.

The Act deals at length with the building of dams. It also provides that

where any tree, part of a tree, refuse, substance of matter has been thrown or deposited in a lake or a river or on the shores or banks thereof in such a manner as, in the opinion of the Minister, impairs the natural beauty of the lake or river

the Minister may order the offender to remove same within a specified time. Where the Minister finds that any refuse, sawdust, chemical, substance or matter from a mill is being thrown, deposited or discharged into a lake or river (or on to its shores), he may order the owner or occupier to desist and where it is practicable to do so order the offender to remove the matter within a specified time. Failure to comply with either of these orders may involve a fine, on summary conviction, of \$50 for each day of non-compliance

from the date of the order.

Section 168 (1) of the Mining Amendment Act, 1970 (see Table VII), requires that a mine manager plant and maintain vegetation or otherwise stabilize, to the satisfaction of the district engineer of mines, tailings areas which will not be required for future impounding of tailings. A mine manager is required to submit to the district engineer of mines at least one year before the cessation of operations, two copies of a plan showing the extent of the tailings areas on which planting of vegetation or stabilization must still be completed.

The Beds of Navigable Waters Act, 1970 (see Table VII), limits riparian owners from ownership of the beds of navigable waters.

It will be seen from the above that Ontario water resource legislation is designed to control water pollution by prohibitions, enforced by fines and/or imprisonment; the granting of permits, approvals and licences; and incentives for pollution abatement. While earlier Ontario legislation was concerned mainly with water and sewage works, later legislation deals also with the effects of water pollution on the ecology and the aesthetic value of water bodies, the Environmental Assessment Act requiring certain bodies to submit an assessment of the effects on the environment of proposed undertakings.

B. Water Resource Legislation in Québec

The Water Board Act, 1964 (see Table VII), established the Régie des

eaux du Québec which empowered the Minister of Municipal Affairs to "supervise and control the purity of surface and subterranean waters", to examine such waters to determine their degree of pollution and the causes thereof, and to make regulations pertaining to all operations entailing the pollution of waters. The Act required municipalities or persons to obtain permits from the Board before undertaking water supply or sewage systems.

The Watercourses Act, 1964 (see Table VII); deals with the rights of riparian owners to improve any watercourse "bordering upon, running along or passing through" his property; the expropriation of lands required for the development and utilization of certain water powers; the right to drive timber down watercourses, the construction of works for such purposes, and the rights of any other person to drive or float timber down a watercourse which had been made flutable, or where flotability had been improved, by some other person, and the payment of tolls for such use. Under the Act any person "throwing into any river, stream, creek or brook, any bark, slabs, waste stuff or other refuse of any saw mill, or stump, root, shrub, tan-bark or leached ashes, and allowing the same to remain and obstruct such river", is liable for a fine of not more than \$20.00 and not less than twenty cents for each day during which such obstruction remained, over and above all damages resulting therefrom. The Act also deals with the storage of water by the building of dams to regulate flow and ensure uniform supply to waterworks systems, mills and hydro powers.

Under section 226 of the Mining Act, 1965 (see Table VII), a mining operator is allowed to "draw such water as is necessary provided he does not prejudice the rights of others in the same sources of supply." Section 243 requires every operator of a mine, concentrator, smelter or refinery to have

the site where rejected material is to be deposited approved by the Minister. Regulations made in 1970⁵ under the Mining Act require operators to show for proposed mine sites, the maximum amount of water required and the purposes to which the water would be put in order to obtain a permit from the Minister of Natural Resources. The Minister may set a minimum amount of water to be kept in a watercourse, or the extreme levels not to be exceeded in lake or reservoir. The operator is required to indicate the means he will take to respect these limitations.

The Environment Quality Act, 1972 (see Table VII), defines the functions of the Minister as being

to elaborate and propose to the government an environment protection policy; to implement such a policy and to coordinate its application. His functions shall also be to supervise and preserve the quality of the environment, to promote its depollution and to advise the government, its Departments and bodies on the prevention of deterioration of the environment and the protection of living species and property.

The Act provides for the appointment of a Director of Environmental Protection Services, and for the establishment of an Advisory Council on Environment. The Advisory Council is empowered to undertake studies regarding environmental quality; to hear petitions and suggestions of individuals and groups on any questions contemplated by the Act, and to advise the Minister. The Act prohibits the emission, deposit, issuance or discharge into the environment of a contaminant in excess of that provided in the regulations. No one may erect or alter a structure undertaken to operate an industry, carry on an activity, use an industrial process, increase production "if it seems likely that this will result in the emission etc., of contaminants into the environment or a change in the quality of the

environment", unless he had obtained from the Director a certificate of authorization. (Certain specified structures and undertakings are excluded from this provision by the General Regulations respecting the administration of the Environmental Quality Act.) Under the Act the Director may order any person responsible for the presence of a contaminant in the environment to cease, finally or temporarily, or to limit the emission etc., of the contaminant. The Director may order the person responsible for a source of contamination to use any class or type of apparatus which he indicates to abate or eliminate the emission or discharge. He may also order the person responsible to install equipment for measuring the concentration, quality and quantity of any contaminant and oblige him to send data to the Director. This also applies to municipalities.

Sections dealing specifically with water quality and the management of waste water require the Director's authorization before establishing any waterworks, water supply intake or purification, sewage works or the installation of treatment devices for waste water. This also applies to the reconstruction and extension of old installations. Permits are required to operate waterworks, sewage systems and water treatment plants. The Director may oblige any person or municipality to build, enlarge or renovate, a system of waterworks, sewers, water treatment plants, or to connect it with a municipal system.

The Act provides that regulations may be made to

- (1) classify waters;
- (2) define physical, chemical and biological water quality standards according to its different uses for all or part of the Province;
- (3) determine, for every class of contaminant or source of contamination,

the maximum quantity or concentration the discharge of which is allowed into water either for all the territory or for a region, river, watercourse, lake or underground water area;

- (4) determine the mode of discharging and treatment of waste water;
- (5) prescribe, as regards any motor boat, standards for the leakage of oil or gasoline, for the elimination of waste and for toilets;
- (6) prohibit or limit for purposes of pleasure, the use of rivers and lakes by motor boats so as to protect the quality of the environment;
- (7) determine construction standards for waterworks, sewer and water treatment systems.

The Act gives the Minister power to grant subsidies for studies and research concerning environmental protection, and to make loans and subsidies to municipalities for the construction, acquisition and operation of waterworks, sewage works, water treatment and waste management systems; and to any person for the construction and operation of any waste treatment or water treatment system.

Contravention of certain sections of the Act involves fines of not more than \$5,000 for a first offence and not exceeding \$10,000 for any subsequent offence. The general regulations of August, 1975,⁶ respecting the administration of the Environmental Quality Act, set out the information required when application is made for a certificate of authorization. This is to include a list showing all points of emission of contaminants into the environment; the nature of the contaminants; and, in the case of discharge into water, the concentration of contaminants, the quantity of contaminants per unit of time, the temperature and pH of the discharge and the volume of

effluent, where applicable.

In 1975 regulations⁷ made under the Public Health Act, required permits for operating liquid waste management systems; certificates for the removal and transport of liquid waste, and the keeping of registers by establishments receiving waste and by carriers of waste. For the purpose of these regulations liquid waste was defined as any liquid or semi-liquid waste produce at 20°C composed of organic or inorganic matter, even diluted with water, with the exception of agricultural waste, whey, sludge from septic pits, residues from street catch basins, blood, sanitary waste water, sludge from waste water treatment plants or filtration plants, sludge and residues from the manufacture of pulp and paper processes, residues of starch, cellulose and adhesives constituted of animal proteins.

Legislation in Québec, like that of Ontario, contains general prohibitions of polluting activities; requires certificates of authorization for activities which are likely to change the quality of the environment, authority to establish water and sewage works and permits to operate such works. Fines may be imposed for contravention of certain sections of the Acts. Legislation gives the Minister authority to make loans and subsidies to municipalities for the construction and operation of water and sewage works and waste management systems.

C. Federal Legislation Relating to Water Resources

Until the late 1960s the federal government's role in environmental

pollution control was restricted primarily to data collection, research, financial aid and general co-ordination. Since then it has become increasingly involved in policy-setting and regulatory aspects of pollution control, which had previously been a provincial prerogative. During the 1970s the federal government has developed regulations under the Fisheries Act (see Table VII) concerning specific industrial wastes which degrade water and make it deleterious to fish, while under the Canada Water Act (see Table VII) it is empowered to make agreements with the various provinces to formulate and implement comprehensive water resource management plans. The structure of federal administration has tended towards greater concentration and integration. Environment Canada (now the Department of Fisheries and Environment), set up in 1971, combined the former Department of Fisheries; the Canadian Meteorological Service of the Department of Transport; the Air Pollution Control and Public Health Engineering Divisions of the Department of National Health and Welfare; the Water Sector of the Department of Energy, Mines and Resources; the Canada Land Inventory of the Department of Regional Economic Expansion; and the Canadian Wildlife Service of the Department of Indian and Northern Affairs. A number of other Departments are still involved with aspects of water management. These include the Department of Transport (navigation and shipping); the Department of Energy, Mines and Resources (hydro-power); the Department of Agriculture (irrigation and drainage, regulation of pesticides); the Department of Indian and Northern Affairs (water resource development in the North, water in national parks, recreational canals, prevention of pollution on Indian reserves); the Department of Regional Development and Economic Expansion (land and water conservation and development in economically disadvantaged regions), and

others.⁸

A brief review of federal legislation which is applicable to the Ottawa River basin is given below. In addition, legislation exists regarding international, maritime and Arctic waters etc.

The Fisheries Act, 1970 (see Table VII), provides that the owner or occupier of any slide, dam or other obstruction shall make any provision considered necessary for the free passage of both ascending and descending fish during the period of construction, and if considered necessary must provide a sufficient flow of water over the spillway with connecting sluices into the river below to permit the safe and unimpaired descent of fish. The owner of such slides etc., must also permit to escape into the water below sufficient water for the safety of fish and for flooding of spawning grounds as is necessary for the safety of ova deposited there. The Act also deals with the injury to fishing grounds and the pollution of waters. The throwing overboard of prejudicial or deleterious substances in any river or water where fishing is carried on is prohibited. The Act prohibits any person engaged in logging, lumbering, land clearing or other operations to put, or knowingly permit to be put, any slash, stumps or other debris into any water frequented by fish, or that flows into such water, or on the ice over either such waters, or at a place from which it is likely to be carried into either such waters.

Fines and/or a term of imprisonment can be imposed for contravention of the Act.

An Act to amend the Fisheries Act, 1970 (see Table VII), stipulates that no person shall deposit or permit the deposit of a deleterious substance of any type ~~on~~ water frequented by fish, or in any place where such a

substance might enter waters frequented by fish, except of a type, in a quantity and under the conditions authorized by regulation. Fines were increased to not exceeding \$5,000 for each offence, each day of such violation being regarded as a separate offence. Under the Act, as amended, regulations can be made prescribing substances and classes of substances; quantities or concentrations of substances in water; treatments, processes and changes in water. The Act requires plans to be submitted to the Minister of any construction, alteration or extensions of works, which on completion will form an operation which may deposit deleterious substances into water frequented by fish. The Minister has power to require modification of such plans or to prohibit the carrying out of such work. Failure to comply is an offence punishable by fines not exceeding \$5,000.

An amendment to the Canada Shipping Act, 1970 (see Table VII), defines pollutant as

any substance that, if added to any waters, would degrade or alter or form part of a process of degradation or alteration of quality of those waters to an extent that is detrimental to their use by man or by any animal, fish or plant that is useful to man.

Pollutants includes any water containing a substance in such a quantity or concentration or that has been so treated, processed or changed, by heat or other means, that it would, if added to any waters, degrade or alter, or form part of a process of degradation or alteration of, the quality of those waters to an extent that is detrimental to their use by man or by any animal, fish or plant that is useful to man.

The Governor in Council is empowered to make regulations prescribing substances and classes of substances that are, for the purposes of the Act, pollutants; the types of pollutants and quantity that may be carried on

board ship as cargo or otherwise; and respecting the method of retention of oily or other wastes by ships carrying pollutants. Fines not exceeding \$100,000 may be levied, on summary conviction, on any person who discharges pollutants in contravention to any regulation under this Act.

The Navigable Waters Protection Act (see Table VII) requires the prior approval of the Minister of works such as bridges, dams, piers, docks, tunnels, pipes, dumping of spoil, excavation of materials from the bed of a navigable river. Where approval is not obtained and/or works are built which are not in accordance with plans, the Minister may order the owner to remove or alter the work; if this is not complied with the Minister may remove, destroy the structure and sell, give away or otherwise dispose of the material. A fine of \$5,000 may be imposed.

Under the Act, the throwing of sawdust, edgings, slabs, barks or like rubbish that is liable to interfere with navigation in any water, any part of which is navigable, or that flows into any navigable river, is prohibited. The throwing or deposition of stones, gravel, ~~earth~~, cinders, ashes or other material or rubbish that is liable to sink to the bottom in any water, any part of which is navigable or that flows into any navigable water where there is not at least ~~twenty~~ fathoms of water at all times, is prohibited. Certain rivers or places may be exempted from these provisions if it is shown that the public interest would not be affected.

The Canada Water Act, 1970 (see Table VII), is the federal government's major legislative instrument for conserving, developing and utilizing water resources. Under Part I of the Act, the Minister may make agreements with one or more of the provincial governments to formulate comprehensive water resource management plans and, after taking into account the views expressed

by the public, to implement projects for the conservation and use of those waters. These may be undertaken directly by the Minister in the case of any federal interjurisdictional, international or boundary waters.

Under Part II of the Act the Minister has power, where water quality is a matter of urgent national concern, to enter into agreement with a province or provinces to designate water quality management areas and to set up water quality management agencies to determine and to forecast the nature and quantity of water; to develop water quality management plans; to determine the treatment that may be required, the effluent discharge fees to be paid and the charges to be made for waste treatment and analysis. With the approval of the Minister, the agency may construct and operate waste treatment facilities; collect charges for waste treatment; collect effluent discharge fees; and regularly inspect any waste treatment facilities in its area. In the case of any interjurisdictional water, where the water quality has become a matter of urgent national concern, the Governor in Council may, provided he is satisfied that all reasonable efforts have been made by the Minister to reach an agreement with one or more of the provincial governments and that such efforts have failed, or where the Minister and the provincial government(s) disagreed with the recommendations of the agency, authorize the Minister to act unilaterally.

Part III of the Act prohibits the manufacture, sale or importation of any cleaning agent or ~~wate~~ conditioner which contains a prescribed nutrient in a concentration greater than the prescribed permissible maximum. Under the Regulations the maximum permissible concentration of nutrients in laundry detergents is prescribed.

Part IV provides for the appointment of inspectors and analysts; the

setting up of advisory committees; the publication of information regarding conservation, development and utilization of water resources; and the imposition of fines not exceeding \$5,000 a day for pollution. The Act requires the Minister to prepare at the end of each fiscal year a report on the operations under the Act.

On 1 April, 1976, the Environmental Contaminants Act (see Table VII), came into force. The purpose of this Act is "to protect human health and the environment from substances that contaminate the environment."

For the purpose of ascertaining whether any substances are entering or likely to enter the environment in quantities that may constitute a danger to human life or the environment, the Minister of the Environment may cause to be published in the Gazette, and in any other manner considered appropriate, a notice requiring persons who import, manufacture or process (or intend to do so) any substance or any substance that is a member of a class of substances, specified therein, to furnish him with information respecting the quantities of such substances as specified in the publication. The information required relates to twelve months before the notice appears and intentions for twelve months ahead.

Where the Minister of the Environment or the Minister of National Health and Welfare suspect that a substance is entering or likely to enter the environment in quantities which may endanger human life and the environment, either Minister may collect data and make investigations regarding the nature of the substance, the effect of its presence in the environment on human health; the extent to which it can be dispersed and to which it will persist in the environment; methods of controlling its presence; methods of testing the effects, etc. Under the Act the Minister may appoint

an Advisory Committee, and may enter into agreement with the provinces to facilitate data collection. If the federal government informs the province concerned of the entry of such a substance into the environment and an offer to consult is not accepted, the federal government may recommend to the Governor General an order amending the Schedule, by adding to it the substance or class of substance. An Environmental Contaminants Board of Review would be established to hear objections.

The Act stipulates that no person shall, in the course of a commercial, manufacturing or processing activity, wilfully release, or permit the release of, a substance specified in the Schedule to the Act into the environment in any geographical area prescribed in respect of that substance or class of substance, or, if no geographical area is prescribed, in Canada, in a quantity or concentration that exceeds the maximum prescribed. No person shall import, manufacture or offer for sale a product which contains a substance, included in the Schedules, in a quantity or concentration that exceeds the maximum specified for the substance. The Act provides for the appointment of inspectors and/or analysts, and gives the Minister the right of search and seizure.

The Municipal Improvements Assistance Act, 1970 (see Table VII), gives the Minister power to enter into arrangements with any municipality to make loans for the construction, extension, improvement or renewal of municipal projects. One of the conditions for the loan is that the work is urgently needed and will assist in the relief of unemployment in the municipality concerned. Such loans bear at least two per cent interest to be paid half yearly for a fixed period.

Under an Act of 1975 amending the National Housing Act, (see Table VII), loans in respect of sewage treatment projects may be made to municipalities

up to two-thirds of the cost at interest rates to be prescribed. The stated purpose of these loans is to assist in the elimination or prevention of water and soil pollution. When a project has been completed to the satisfaction of the Corporation, the latter may forgive payment of twenty five per cent of the principal amount of the loan and twenty five per cent of the interest that has accrued on the loan. If a province or municipality has completed a sewage project to the satisfaction of the Corporation and no loan has been made, the Corporation may grant to the province or municipality an amount not exceeding twenty five per cent of the amount of the maximum loan which could have been made.

In December 1975, an Act amending the National Housing Act and the Central Mortgage and Housing Act, (see Table VII), was passed, under which loans can be made for water supply projects on the same terms as for sewage projects. The stated reason for loans for water supply projects was to encourage comprehensive land use and residential development in previously undeveloped areas.

It has been shown above that all three governments have general prohibitions of polluting activities, without permit. They also require certificates of authorization, permits or approval before any enterprise likely to deposit deleterious substances into watercourses is constructed, extended or altered. All have authority to conduct research into various aspects of water pollution and to monitor water quality.

All three governments have powers of enforcement and offer incentives for pollution abatement. The legislation provides for fines for non-compliance, and the Canada Water Act makes provision also for charges for

water treatment and effluent discharge fees. In a number of municipalities Ontario supplements sewer charges by charging industrial users of public systems per unit of waste discharged in excess of certain base limits.

Incentives to pollution abatement include long-term low interest loans to provinces and municipalities by Central Mortgage and Housing Corporation for the construction or expansion of sewage treatment facilities. DREE provides federal funding in special areas and growth centres for infrastructural development, which includes water supply and waste disposal. DREE grants can also include support for pollution abatement by private industry. Such costs are also eligible for an Accelerated Capital Cost Allowance, under the Income Tax Act, which permits accelerated depreciation rates on a straight-line basis on water pollution abatement equipment. Québec has legislation covering the provision of financial aid for municipal waste treatment purposes, and Ontario has funds available for municipalities whose sewage treatment costs per household exceed provincial norms.⁹

The federal government has made regulations under the Fisheries Act relating to effluent treatment in pulp and paper mills. Permitted deposits of total suspended solids in the effluent of mills in pounds per ton are prescribed for various processes in

- (1) existing kraft, sulphite or semi-chemical mills;
- (2) new, expanded or altered kraft, sulphite or semi-chemical mills; and
- (3) new, expanded or altered mechanical mills.

Requirements are more stringent for kraft and sulphite mills than for mechanical mills; and for new, expanded or altered mills than for existing mills.

Permitted deposits of oxygen-demand decomposable organic matter in

pounds of BOD per air-dry ton of product are prescribed for seven types of sulphite, kraft and semi-chemical pulping. Again, the permitted deposits from new, expanded or altered mills are more stringent than for existing mills.

The regulations prescribe tests to be carried out to determine the toxicity of mill effluent, which is considered to be toxic if less than eighty per cent of fish survive the test for ninety six hours.

New, expanded or altered mills were expected to meet the requirements from 24 November, 1971. No dates are specified in the regulations for existing mills, and it was intended that individual dates for compliance with the Regulations would be developed with every existing mill in Canada.

Where provincial control requirements differ from those of the federal regulations, the more stringent are to apply.¹⁰

Ontario and Québec have made no specific regulations regarding pulp and paper effluents. In general Ontario implements the federal government's requirements and may make requirements which are more stringent. Québec has draft regulations, but these have not yet been finalized. A Parliamentary Committee in Québec has discussed the whole future of the pulp and paper industry, the final meeting being held in October/November, 1977. At that time no final decision had been made regarding regulations.¹¹

* At the conclusion of the Ontario/Québec Water Quality report, the Ontario Water Resources Commission and the Québec Water Board set down water quality standards, some of which (such as the discharge of wastes containing bacteria, fungi or viruses, toxic materials, nutrients) apply to all zones in the interprovincial section of the river, and others (such as amounts of dissolved oxygen, suspended solids, turbidity and colour), which vary for different zones.

II. An Assessment of the Effectiveness of Government Legislation on the Water Quality of the Ottawa River Basin

Many uses contribute to the man-made contamination of the Ottawa River system. By far the greatest contributors are easily identifiable as municipal waste deposits, which are mainly responsible for bacteriological and viral pollution, and the pulp and paper industry, which is the greatest contributor of suspended solids, BOD and toxic materials. Local contamination of the river system results from domestic wastes from private waste disposal systems. In addition, there is some "no point"* pollution, by heavy metals, materials eroded from river banks as the result of man's activities, run-off of sand and salt from highways and city streets, leaded gasolines from motor boats, deposition of chemicals from the atmosphere, materials in agricultural run-off.

The following is an attempt to determine whether and, if so, to what extent government legislation has resulted in a reduction of pollution in the Ottawa River system. The Ontario/Québec Water Quality Report of 1971 gave a detailed account of the degrees of pollution in various sections of the river immediately before the passing of the Canada Water Act, the Québec Environmental Quality Act and Ontario's Water Resources Act. The report will be used as a yardstick with which to compare present conditions.

No comprehensive study of the Ottawa River system has been made since the Canada Water Act was passed in 1970. The question of doing such a study was raised by the federal government at about the time Environment Canada was

* "No point" pollutants are those the sources of which are difficult to pin-point as opposed to wastes from identifiable points, such as municipal and some industrial waste discharges.

set up, but the Ontario and Québec governments were unwilling at that time to co-operate in such a study. It is anticipated that such a study will eventually be undertaken.¹² In the latter part of 1977 the Department of Fisheries and Environment completed the first report of a five-group study to be undertaken, in co-operation with the Ontario and Québec governments, to update the 1971 Ontario/Québec Water Quality Report on the Ottawa River. Publication of the first report "Review of municipal and industrial pollution control on the Ottawa River" still awaits agreement by the Québec government. Other groups will be reporting on water quality and effects of hydro dams and log flotage. The following account of the present condition of the Ottawa River system is based on reports issued since 1971, newspaper accounts and verbal information.

A. Achievements

Both the federal government and Ontario have taken measures to enforce the reduction of the amounts of phosphates entering watercourses. Regulations under the Canada Water Act reduced the permissible amount of oxide phosphates in laundry detergents to twenty per cent in 1971 and to five per cent in 1973, from an original amount of about ~~thirty~~ thirty eight per cent. These reductions relate only to laundry detergents, no suitable substitute having been found for other detergents.¹³ Various substitutes for phosphates in laundry detergents were tested and nitrilotriacetic acid (NTA) was the preferred choice, partly because of a price advantage. NTA has been questioned with regard to its environmental acceptability and its possible effect on human populations. The United States reversed a prior decision to approve its use,

Targely because of the risk of cancer in humans caused by changes during the degradation processes. Canadian tests led to the conclusion that there is no firm evidence to indicate health or environmental hazards from NTA in the quantities being used in detergents.¹⁴ The only fines imposed under the Canada Water Act have been in respect of the phosphorus content of laundry detergents.¹⁵

In 1971 the Ontario government required municipalities with effluents containing one part or more of phosphorus to one million parts of water to install phosphorus removal processes in their waste removal facilities by certain dates, which varied from region to region. The date for municipalities in the Ottawa River region was 1975. Phosphorus removal in waste disposal systems also has beneficial effects on the amounts of BOD and dissolved solids loadings, by a process of coagulation.

Municipalities on the Ottawa River system which have installed phosphorus removal processes include Green Creek plant in Ottawa (which removes over eighty per cent of phosphorus); Petawawa (which removes eighty-t~~one~~ ninety per cent of phosphorus); Renfrew; Arnprior; Watts Creek, Nepean; Smiths Falls; Kemptville; Westport; and Goulbourn. Pembroke is in the process of upgrading its sewage system and installing phosphorus removal, and Perth is under pressure to install phosphorus removal. Chalk River, Eganville and Carleton Place have secondary treatment and construction of a secondary treatment plant at Killaloe is expected to start early in 1978. New Liskeard, Buckle Township, Haileybury, Mattawa, Almonte, Deep River, Carleton Place, Rockland, Plantagenet and L'Orignal are not required to have phosphorus removal as effluents are below one part per million.

In 1971 seven (Buchanan Township, Pembroke, Renfrew, Arnprior, Ottawa

Cumberland and Hawkesbury) of eighteen municipalities on the Ontario side of the main stem of the Ottawa exceeded the permissible loadings of BOD (see Table III). Of these, three (Ottawa, Renfrew and Arnprior) are now below the permissible amounts, and the Cumberland facility has been connected with the plant at Green Creek. The only municipalities on the Ontario side of the main stem which still exceed permissible amounts are Buchanan Township, Pembroke and Hawkesbury. Atomic Energy of Canada operates the treatment system for Buchanan Township and has asked a firm of consultants to design and build works to upgrade their facility to meet requirements; Pembroke is in the process of expanding its treatment facilities and is considering phosphorus removal; and Hawkesbury has a plant under construction, which should be completed by 1979, to provide secondary treatment with phosphorus removal.¹⁶ Appendix XVII shows in detail the present position of municipal waste disposal on the Ontario side of the Ottawa River system. In addition to the resultant decrease in the amount of BOD, dissolved solids and nutrients entering the main river from municipalities on the Ontario side, the installation of phosphorus removal by municipalities on the Ontario tributaries of the Ottawa (for example, Smiths Falls, Kemptville, Westport) and the construction of secondary treatment facilities (for example at Eganville and Carleton Place) should reduce BOD, dissolved solids and nutrient loadings in the receiving streams and eventually in the main river.

In general, combined storm and sewage sewers cause difficulties, for example at Green Creek after heavy rains there is not sufficient time to allow for the phosphorus removal process.

Ontario treats the Rideau River as a special case in view of its historical associations and the fact that it flows through the capital.

Retention ponds and other devices on land are constructed to slow down run-off.

Most of the waste treatment plants in the Ottawa area have been installed and are maintained by the Ontario Ministry of Environment, and charges are amortized over forty years.

All new septic tanks or other private waste treatment facilities in Ontario have to be approved by the Ontario Ministry of the Environment or the Medical Officer of Health: this also applies to renewals of or alterations to existing systems. The Ontario Ministry of the Environment monitors certain lakes each year, the ones being selected being those with the highest population densities, the oldest inhabited and about which the largest number of complaints have been received. In 1977 a complete cottage to cottage survey was undertaken of the Mississippi Lake area, and in 1978 it is proposed to conduct similar surveys of the Golden Lake and Round Lake areas. In the opinion of an Ontario Ministry of the Environment official, the public response has been very encouraging, and, judging from results of measures taken in the Haliburton area, a significant decline in algal growth in recreational lakes may be expected.¹⁷

On the Québec side of the river nothing appears to have been done to upgrade the municipal sewage systems.

After years of negotiations, an agreement was reached in late 1976 under which the federal government would pay half of a \$120 million sewage treatment project to serve Aylmer, Hull and Gatineau, the remaining portion being shared by the Québec government and the Outaouais Regional Community. Since then there have been reports of delays due to the apportionment of costs, escalating prices and wrangling as to which firms were eligible to submit

tenders. In the meantime these towns continue to dump raw sewage into the river, a position which is made worse by the transfer of thousands of public servants to Hull.¹⁸

For the Canadian pulp and paper industry in Canada as a whole, the total suspended solids were reduced by six per cent and biochemical oxygen demand by fifteen per cent between 1974 and 1976, during which period production remained essentially steady. Two-thirds of the reduction in BOD was due to the closure of a sulphite operation in British Columbia. Considerable improvement must be made before the federal Pulp and Paper Effluent Regulations can be met. Although eighty three per cent of production of total suspended solids and seventy one per cent of production of BOD have compliance programs, some still have no programs. Seventy six per cent of mills have current toxicity tests, but a large number (sixty two per cent) do not yet have toxicity compliance schedules. Expenditures from 1960 to 1976 amounted to about \$450 million, of which one-third was spent between 1974 and 1976.

The newsprint sulphite sector of the pulp and paper industry continues to pose the most difficult problem in the abatement program. Many such mills in Ontario and Québec are old and small in size. Dissolving grade sulphite operations discharge very large amounts of BOD per product ton in comparison with other processes. It is stated that two such mills on the Ottawa, Tembec Forest Products at Temiskaming, Québec and CIP, Hawkesbury, Ontario, will have liquor recovery by 1982.

The number of mills in Canada in compliance for toxic effluents increased from nineteen to twenty eight per cent between 1974 and 1976, but the percentage of production in compliance only increased from nineteen to

twenty three per cent. It is estimated that by 1980 thirty six per cent of mills, representing thirty five per cent of Canadian pulp and paper production, will be in compliance for toxicity.¹⁹

According to the Ontario Ministry of the Environment, the CIP mill at Hawkesbury now meets federal regulations with regard to the removal of suspended solids from effluents; it is under control orders to install BOD recovery by 1980; and is under orders to inform the Ministry of its plans for dealing with the problem of toxicity resulting from the high ammonia content in the effluent from spent sulphite liquor and bleach.²⁰

The Ontario government uses federal regulations for the pulp and paper industry on the Ottawa and St. Lawrence Rivers. Elsewhere they may, if they consider it necessary, apply their own objectives, which are more stringent than those of the federal government. Québec also has deadlines and objectives with regard to the industry, but as far as the Ottawa River is concerned enforcement is not a priority, other watercourses being considered more critical.

No fines have been levied by the federal government under the Canada Water Act, apart from those in respect of the phosphorus content in washing detergents.²¹ Ontario has imposed a fine on the mill at Hawkesbury.²²

Two sulphite mills in Hull and Gatineau have been closed down. The closure of the Hull mill was the result of its purchase for parkland by the National Capital Commission: the Gatineau mill changed from sulphite to other processes, the cost of pollution abatement being part of the considerations taken into account when the decision was reached.²³

A report of a study undertaken to project estimates of the capital and operating costs that will be incurred by the pulp and paper industry in

complying with the federal pulp and paper effluent regulations was published in 1977. Of the total 157 mills assessed, sixty two were deemed by the Environmental Protection Service to be in compliance with the regulations, including twenty eight mills discharging to municipal sewers. The capital cost of control facilities for the mills not in compliance has been projected to be \$1,034 million, and annual operating costs of these facilities for all mills have been projected to be \$34.3 million.²⁴

A report written for the Water Pollution Control Directorate, Environment Canada, summarizes the effect of wood flotage upon water quality and the environment, and considers alternative methods of wood transport. The report includes a case study carried out in 1973-4 of wood flotage on the Ottawa River. The report concludes

In spite of the concerns over conflicting water uses, the ecological impact upon water quality from wood flotage appears minimal. Trucking as a major alternative may have negative aspects which have not been well evaluated, particularly with respect to the construction of new roads, noise pollution and traffic nuisance.

At the present time, concern over energy is a further argument used against the use of road transport over river flotage. The report enumerates a number of log-handling techniques that could be introduced by the forestry industry to reduce significantly the environmental impact of current wood flotage operations. The following are some of the recommended practices:

- (1) Abrasive methods of dumping logs into water, i.e. free fall and bulldozing, should be replaced with less abrasive methods such as slides, lower-in procedures and landing the wood on river and lake ice.
- (2) Collection and disposal methods of bark and wood debris should be employed at log dumps, booming areas and mill-site handling zones.

- (3) In locating log dumps, storage areas etc., more consideration should be given to the type and value of the biological community at the proposed sites.²⁵

It would appear from the above that there has been some improvement, since the Ontario/Québec Water Quality Report, in the amounts of contaminants being deposited into the Ottawa River system. On the Ontario side all major towns on the main stem of the river and many towns on its tributaries will soon meet the requirements for municipal effluents. Inspection of lakes and private sewage disposal systems in Ontario is a long-term project which should have beneficial results on water quality. The decrease in the phosphorus content of washing detergents resulting from federal action and from the installation of phosphorus-removal in Ontario municipal treatment plants should decrease algal growth in lakes and streams. The closing of two sulphite mills and the installation of pollution controls at Hawkesbury should have some effect on the water quality of the river.

Unfortunately the lack of action in enforcing objectives for the disposal of wastes by municipalities and the pulp and paper industry in Québec, minimizes the effects of pollution control elsewhere in the Ottawa River system.

In spite of the slight improvement which should have occurred, a number of unresolved issues remain, some of which are noted below.

B. Unresolved Issues

The Inland Waters Branch of the Department of the Environment collected

sediment samples at two or three mile intervals along the Ottawa River from Ottawa to Thurso and along the Rideau River from Smiths Falls to Ottawa between 19 and 24 July, 1971. The sediments were analyzed for lead, mercury, zinc, copper, nickel, cobalt, iron, manganese and chromium. The report showed high mercury concentrations near three paper mills on the Ottawa River.

Sediment samples taken close to a sewage treatment plant were found to be concentrated in several heavy metals, the sources of which were considered to be industrial from industries using municipal sewers for waste disposal. High lead concentrations were found at two sites on the Rideau River in the City of Ottawa. It was thought that this concentration, which coincided with a City of Ottawa snow dump, was a direct result of snow dumping which probably contained lead from automobile exhausts. In late 1971 the Ontario Water Resources Commission required a one hundred foot buffer zone to be left between snow dumps and watercourses. A possible reason for the higher lead levels in the Rideau than in the Ottawa was considered to be the larger number of motor boats using the shallower, slower-flowing Rideau.²⁶

In June, 1977, it was reported that three beaches on the Rideau River had been found "medically unsafe" for swimming on account of the high bacteria count.²⁷

In September 1977 it was reported that the result of tests undertaken by the regional municipality showed that the level of pollution on the Québec side of the river was well over one hundred times the safety level.

Dr. L.H. Douglas, Ottawa-Carleton Medical Officer of Health, reported that in some areas on the north side of the river the pollution was "so gross there was no use testing any further." The Ontario side was found to be well within the levels for health safety, but the coliform count increased in the middle of the river. There was no indication that any great amount of

pollution was being carried from the Québec shore to the Ontario side.²⁸

Concern over the water quality of Mississippi Lake led to the establishment in 1977 of the Mississippi Lake Committee, consisting of representatives from four provincial ministries, the district health unit and the Mississippi Valley Conservation Authority. The Committee found that bacteria counts were in excess of health safety standards, the sources being bacteria and nutrients, from defective cottage and trailer camp sewage systems and cattle-watering sites. The study classified fifty five establishments as either direct polluters or public health hazards. It was recommended that the owners be given a deadline of three months to take corrective action. The Committee also recommended that a temporary freeze be put on all new development within 1,500 feet of the lake, in view of the deterioration in the water quality and the "major undesirable" environmental changes which could be expected. Tourist operators with substandard facilities were to be "encouraged to upgrade them." The study reported that the yellow pickerel population was on the decline, there being a massive build-up of less desirable panfish. According to a fish and game supervisor of the Ministry of Natural Resources the decline of good fishing in the area had been gradual, but had become more noticeable recently. Opinions were expressed that flooding, which occurs in the area, may cause damage to fish and wildlife, and that the building of dams to stabilize water levels for motor-boating affected the fish population.²⁹

The head of the environmental section of the Renfrew County and District Health Unit was reported in November 1977 as saying that approved sites were needed to dump septic sludge. He said, "I hear rumours... about operators dumping septic sludge directly into streams."³⁰

In November 1976 it was reported that expansion in the Township of Stafford from twenty to over ninety homes had taxed the vicinity beyond the handling capacity of septic tanks and other waste disposal units. As a result well water contained a higher than acceptable count of nitrates, which have been associated with infant methemoglobinemia, and the Muskrat and Indian rivers, which run through the heart of the city of Pembroke, were polluted. The two rivers were banned for swimming in 1976 for the tenth year.³¹

Although harmful bacteria in municipal water intakes can be successfully treated by filtration and chlorination, viruses such as those causing poliomyelitis and infective hepatitis are more resistant to chlorination than pathogenic bacteria. Such viruses could and do lead to conflicts with municipal water intakes and with recreational pursuits such as swimming.

In 1976 all the beaches on the main stream in the area of the city of Ottawa were closed for swimming because of the possibility of polio virus in the water, in addition to a high faecal coliform count.

In September 1976, Le Droit reported that Dr. Syed Sattar of the University of Ottawa had conducted a study of the waste waters in the Ottawa River and recovered 365 different isolates, of which seventeen were polio. As a result 24,000 persons received polio vaccinations during the four months after the finding appeared in the newspapers, compared with 4,000 persons in 1975.³²

Dr. Sattar is presently (February, 1978) conducting virus tests on the portion of the river between Watts Creek and the intake for the Britannia Filtration Plant. Viruses were detected in Britannia Bay, but the types have not yet been identified. The main source of viruses is domestic sewage.³³

others being from farming operations and storm waters. How the polio virus got into the waste waters discharged into the water from the environs of Ottawa/Hull is something of a mystery, since no cases of polio have been reported in the area. There is a possibility that it could be related to the Sabin type of polio vaccine, the use of which is widespread in Québec. This type of vaccine makes use of live, harmless polio viruses. It is not regarded as acceptable in Ontario, where the ~~Salk~~ vaccine, which consists of dead polio virus, is used. The effects of the Sabin vaccine after passing through the human body and entering the receiving water in sewage is unknown. Dr. Sattar's tests were undertaken primarily to determine whether the Ottawa River water posed threats to health for recreational purposes. In his opinion there is a greater hazard of viruses getting into drinking water. Viruses have been taken in at Britannia Filtration Plant, and in Dr. Sattar's view there is a real danger of their getting into treated water and being very quickly distributed to the population, before being detected. He said that any improvement in sewage treatment would be beneficial and also considers that water treatment should be improved. He wants to conduct similar tests at the Lemieux Filtration Plant, where he thinks the situation may be worse.³³

A newspaper report in October, 1977, quoted an Environment Canada official as stating that six of the eight pulp and paper mills along the Ottawa River have failed to meet federal pollution requirements. Despite moves by two large plants (E.B. Eddy in Hull and CIP, Gatineau) to close the sulphite operations, the river still receives solid and dissolved wastes harmful to fish and plant life. The worst polluters are CIP, Hawkesbury, where more than 400 tons of dissolved solid waste is dumped into the river

daily, and Tembec of Temiskaming, which dumps 700 tons into the river daily. E.B. Eddy operations on the Hull side of the river are still dumping solid waste, which forms a visible cellulose fibre. A 1972 decision by the National Capital Commission to relocate the industry has stalled progress in correcting the pollution problem. Thurso Pulp and Paper Co., and James McLaren Co., meet neither the solid nor the dissolved waste minimum standards. CIP, Gatineau, has stopped dumping hundreds of tons of solid waste into the river daily, but does not yet meet toxicity requirements. The only companies meeting all federal standards are E.B. Eddy in Ottawa and Consolidated Bathurst in Pontiac County, Québec.³⁴

In 1972 it was reported that the sediments collected near three paper mills on the Ottawa River had mercury concentrations of 1.89, 1.99 and 2.64 ppm, respectively, as compared with the background concentration for mercury in Ottawa River sediments of only 0.28 ppm.³⁵ In December, 1976, the Ontario Health Ministry reported that walleye (yellow pickerel) in the Ottawa River and walleye and smallmouth bass in the Rideau River had been found to contain high mercury levels, and warned of the dangers of eating such fish. The mercury in the Ottawa River fish was "thought to be mercury wastes from pulp and paper manufacture", which source was discontinued in 1971. The source of mercury in fish caught in the Rideau River was being investigated. It was noted that long-lasting pollution had probably marred sport fishing for a long time.³⁶ In October, 1977, the Ontario ministry of the environment reported that fish in the Ottawa River northwest of Pembroke and in six lakes between Ottawa and Kingston had been found to be contaminated with mercury, the source of which was unknown. Warnings were issued against eating bigger fish since mercury builds up in older and bigger fish.³⁷

Between June, 1975 and May, 1976, samples of water were taken twice monthly from Rouyn-Noranda's drinking water and from Lac Dufault, the source of some of the cities' drinking water. Drinking water was found to be so contaminated by toxic materials from mining and industrial wastes as to pose a danger to health.³⁸

According to Ontario Hydro eastern Ontario may require two new thermal (coal-fired or nuclear) generating stations on the Ottawa or the St. Lawrence if it is to supply a projected fourfold increase in power demands over the next twenty years. Various shoreline sites have been identified and will be studied further, based on environmental, technical, economic, legal and social grounds.³⁹

There appears to be no evidence that the higher temperature of water returned to the Ottawa River, or the small quantities of radioactive materials which are discharged into it, have had any appreciable effect on the flora or fauna of the river. The effects of radio-nuclides are, however, not immediate and can take years or, in the case of genetic damage, generations to manifest themselves. Hence this use of the river may pose the most serious threat of all to users of the river. Opposition to the construction of a second nuclear power plant has been voiced by the Pontiac Anti-Nuclear Committee.⁴⁰ Others, such as the Deep River town council are actively supporting the location of any future nuclear power plant in their area, the creation of new job opportunities apparently being the underlying motive. The reeve and four of the Deep River councillors are employees of the Atomic Energy Commission Laboratories in nearby Chalk River.⁴¹ In February, 1978, it was reported that Ontario Hydro officials had dispelled any hope that a nuclear generating station will be constructed at this time in the Rolphton

area. Councillors were told that the selection of a site might take as much as two to four years, after which both site and transmission corridors would be subject to the Environmental Assessment Act. This assessment could take as much as two to four more years to complete. Chats Falls is the location that is currently favoured by Hydro.⁴² The decision to construct such power stations is still under debate.

In 1977 a complaint was reported of the way in which Ontario Hydro was handling the water level near the Mountain Chute Dam on the Madawaska River. It was said that the level of the river at the dam fluctuated by as much as fifteen feet and had a detrimental effect on the wildlife of the area. Before the building of the dam there was good fishing in the area. It was pointed out that fish spawn when the water level is low, but that when the dam is opened the eggs are washed away.⁴³

Finally, Mayor Henry Brown of Pembroke voiced his opinion in February, 1977, regarding federal and provincial laws which force Ontario municipalities to abide by strict environmental and pollution controls, while Québec continues to operate outside these stipulations. He said that sewage and waste disposal problems in the valley had been "pretty well looked after on the Ontario side" but the rules and regulations that apply to Ontario do not apply in Québec. He was also concerned with log-driving in Québec which he said polluted the river and made it unsafe for navigation.⁴⁴

III: Summary

It is clear that there is no lack of federal, Québec and Ontario legislation to control water pollution, and the three governments have powers to enforce these laws. The only fines imposed by the federal government have been in connection with the amount of phosphorus in laundry detergents. Ontario has imposed fines in respect of industrial pollution, including one against the pulp and paper mill at Hawkesbury. Although the federal government has power under Part II of the Canada Water Act to set up water quality management agencies who may construct and operate waste treatment facilities, where water quality is of urgent national concern, this part of the Act has not been implemented, mainly because of opposition from the provinces.

The two main groups of polluters of the Ottawa River system are the pulp and paper industry and municipal and other domestic waste disposal systems.

The main improvement in the amount of contaminants entering the river system from the pulp and paper mills results from the closure of two sulphite mills. The decision to convert the Gatineau mill from sulphite to other processes was partly due to government pollution abatement policies since the high cost of meeting pollution abatement requirements was part of the considerations taken into account when reaching this decision. The closure of the Hull mill was the result of its purchase by the National Capital Commission for parkland. The Status Report on Abatement of Water Pollution from the Canadian Pulp and Paper Industry - 1976 states that the mills at Hawkesbury and Temiskaming will have liquor recovery by 1982.⁴⁶ It is considered that Hawkesbury may achieve this objective, but that the possibility

of the Temiskaming mill doing so is very doubtful.⁴⁷

Since 1971 there has been some improvement in the amount of contaminants entering the river system from domestic wastes from Ontario, but the amount of such pollutants from Québec remains the same or may be greater, owing to increased population. Federal government action to reduce phosphorus in laundry detergents and the use of phosphorus removal processes in Ontario's sewage plants should have had some result in reducing the amount of nutrients entering the river system. Phosphorus removal in waste disposal plants also has beneficial effects in reducing BOD and suspended solids. The monitoring of private waste disposal systems around recreational lakes should result in a reduction of algal growth and bacteria content.

The present condition of the Ottawa River system is a striking example of the problems which arise when water quality comes under inter-jurisdictional management. Economic problems and fear of increased unemployment in the pulp and paper industry are possible reasons for the lack of enforcement action in Québec, in addition to which the Ottawa River is not regarded as a priority in that province. An Ontario Ministry of the Environment official has pointed out that it is fortunate that Ontario tackled some of its water pollution problems comparatively early, as it is doubtful whether sufficient financing would be available in the present climate of "tight money".⁴⁸ The state of the Ottawa River system reported in 1971, after decades of inaction as far as pollution control was concerned, emphasizes the necessity for taking early action on water pollution problems and for endeavouring to safeguard the effects on water quality of future uses of the river system. The economic argument against taking action to improve water quality in times of recession can be counterbalanced by the argument that lack of action now will undoubtedly prove immensely more costly later.

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CHAPTER VII

SUMMARY AND CONCLUSION

For nearly two hundred years after the first white man travelled up the Ottawa River the uses of the river hardly changed: the predominant use was for transportation for explorers, missionaries, fur traders and other travellers. The river also provided water for man's personal needs and food. There was virtually no permanent settlement in the basin until the beginning of the 19th century. The small amount of waste deposited in the river by 17th and 18th century travellers was easily assimilated by the unharnessed river system. The only conflicts were between man and man, and between man and the difficulties of the river for navigation. The latter were overcome by the type of craft used and by developing techniques for getting past the many falls and rapids.

The first half of the 19th century saw the start and growth of the square timber trade which, unlike the fur trade, encouraged settlement. Deforestation resulted in land erosion and the deposition of sands and other inorganic matter into the river, while increased settlement led to the river's being increasingly used as a receptacle for domestic and agricultural wastes. With the development of the sawn lumber trade and the beginning of urbanization in the second half of the 19th century, externalities, caused by the use of the river system for waste disposal and by interference with the flow of the river to facilitate log driving and to provide water power, became more evident. Conflicts arose between the

forest industries (log driving and saw mills) and other users: floating debris from saw mills and lumbering operations were a danger to navigation and were aesthetically displeasing, while sunken material from saw mills raised the river bed, again causing navigational difficulties. The building of dams to provide flotation for log driving threatened to make the streams so altered unavailable for others who wished to use the streams. The use of the river for domestic wastes offended man's sense of smell since early sewers, the contents of which were untreated, concentrated the odour-producing processes in the neighbourhood of the outfalls. Thus, during the 19th century conflicts were related to materials which could be seen in the water, or to acts which affected navigation of the river, whether for boats or log driving, rather than to deterioration of the actual quality of the water.

The present century has witnessed the growth in the Ottawa River basin of the pulp and paper industry; continued and accelerated urbanization; the change from mixed agriculture to one based mainly on animals and poultry and within the past decade or so the concentration of such livestock in feed lots and batteries; the building of huge hydro dams; the construction of a nuclear power plant; and the growth of recreation and the increase of river- and lake-shore dwellings, both permanent and for recreational purposes. Mining activities have developed and declined in the Upper Ottawa valley and other industries such as slaughter houses and other food-processing plants have also made demands on the river system. All these uses, with the exception of hydro-electric power generation and recreation, withdraw large amounts of water from the river system and return most of it to the system in a contaminated condition. The conflict between the use of the river

system for waste disposal purposes and its use for domestic intakes was recognized early in the century, as the relationship between bacteria in water and epidemics such as typhoid and cholera became recognized. This conflict was resolved by taking measures to avoid pollution damage, that is, by treating water intakes. This in effect meant that the users who suffered from the externalities caused by other uses were bearing the cost.

In the 1950s and 1960s the Québec and Ontario governments passed legislation dealing with municipal water intakes and waste disposal: later legislation related to the disposal into watercourses of contaminants from any sources. Until the late 1960s the federal government's role in combating environmental pollution was restricted to data collection and research. Since 1970 the federal government's main instruments for protecting the quality of Canadian waters have been the Fisheries Act and the Canada Water Act. The former Act stipulates that deleterious substances shall not be deposited in any waters frequented by fish except in the quantities and under conditions specified in the regulations. The Canada Water Act enables the Minister responsible to make agreements with one or more of the provincial governments to formulate comprehensive water resource management plans and to implement projects for the conservation and use of those waters. Where water quality is a matter of urgent national concern and efforts to reach an agreement with one or more of the provincial governments have failed, the Minister may act unilaterally in the case of any interjurisdictional water. The Act gives the Minister powers to impose fines, make effluent charges and appoint agencies to construct and operate waste treatment facilities.

The report, Ottawa River Basin: Water Quality and its control in the Ottawa River, of the Ontario Water Resources Commission and Québec Water

Board, which was the result of tests undertaken just before the setting up of the federal Department of the Environment, clearly showed that pollution of the river system resulted mainly from the pulp and paper mills and domestic sewage. Newspaper reports and verbal information obtained over the past eighteen months show that there has been little improvement in the water quality of the river system since 1971. While Ontario has made considerable advances in the treatment of municipal sewage disposal systems in the Ottawa River system, nothing has been done on the Québec side of the river. This illustrates the difficulties posed for environmental control where a river is shared by more than one province. It could be argued that, in such cases, the federal government should be able to take unilateral action even though the matter is not one of "urgent national concern", which presumably means that there is a danger to health and/or life.

Federal government action in reducing the permissible amount of phosphorous in laundry detergents, and the installation of phosphorous removal in many Ontario municipal waste treatment plants discharging into the river system, should have decreased the amounts of nutrients entering the system, with a consequent beneficial result in lessening algal growth.

There is probably slightly less pollution from pulp and paper mills as a result of the closure of two sulphite mills; the Hawkesbury mill is under orders to install pollution control by the early 1980s.

It is evident that pollution in the basin results largely from the concentration of people in towns and cities; concentration of farm animals; and to a certain extent concentration of pulp and paper mills (with the exception of the mills at Temiskaming and Portage du Fort, all the mills are situated between Ottawa and Hawkesbury and, with the exception of those in

Ottawa and Hawkesbury, they are all in Québec). Dispersal of the pulp and paper mills, even if it were possible, would probably result in a worse position, since the river does not recover from one mill (at Temiskaming) for over forty miles, and if the mills were spread out evenly along the river, the whole river might become seriously polluted, though to a slightly lesser extent than it is in the stretch below Ottawa. As it is, the reach from above Ottawa to the Des Joachims Dam, which is the section mainly used for recreational uses, is fairly satisfactory for that purpose. The effects on water quality of the concentration of pulp and paper mills below Ottawa and of the mill at Temiskaming were recognized in the Ontario/Québec Water Quality Report,¹ which divided the interprovincial part of the river into four zones. Although the report recommended water quality standards, for example, freedom from pathogens, including bacteria, fungi or viruses that might produce enteric disorders or eye, ear, nose, throat or skin infections, which were the same for all zones, objectives for dissolved oxygen, dissolved solids, turbidity and colour were less stringent for the zone below Ottawa; standards for the zone above Ottawa to the Des Joachims Dam required a higher level of dissolved oxygen and lower dissolved solids and colour levels; from Des Joachims to Temiskaming the standard for dissolved oxygen was lower than in the previous zone; and standards for Lake Temiskaming were the most stringent of all as far as dissolved solids, turbidity and colour were concerned.

As a result of government involvement in pollution control in the Ottawa River system, a considerable amount of monitoring and testing has been carried out and has shown the presence of viruses such as polio and harmful minerals such as mercury in the water. It is a matter for speculation whether

such substances are new to the river, or whether they have been there in earlier eras, but undetected.

Methods of controlling pollution must always take note of costs and benefits. The problem is that certain uses of a river, for example recreation and aesthetic benefits, cannot be valued in cash terms only. Moreover in apportioning costs, it has to be remembered that users of the river for withdrawal purposes often make use of the products of users of the river for waste disposal purposes. Allocating the costs of pollution on the polluters, raises the cost of their goods, which is ultimately paid by the consumers of the product. In the case of the pulp and paper industry, this is still among Canada's largest in terms of employment, capital invested, wages paid, value of production and export values. For the past fifteen years the industry has not been doing well financially, and there are already indications that in times of recession, such as the present, expenditures for pollution control may be among one of the first things to be reduced. The newly appointed (January, 1978) Environment Minister in Ontario, George McCague,² has said that Ontario's environmental protection laws may be holding back the development of industry in the province and that "over-regulation" of the environment has concerned him for some time. Federal industry minister, Jack Horner,³ placed "over-zealous environmental protection" first among several factors which he considered were hurting Canadian industries. He added that environmental standards were costing jobs and that it would not be harmful to relax minimum environmental standards in some cases. Opinions such as these overlook the facts that the reasons that environmental costs are so high now is that nothing was done to prevent pollution in the past and that some forms of pollution, even from organic

sources, are very long-lasting. An example of the latter is the great depths of sawdust which still exist on the river bed in the Ottawa/Hull area, nearly eighty years after sawmills ceased operations there. The building of the dams on the Lower Ottawa may have played a part in these accumulations by reducing the flow of the river. If there is now a switch to laissez faire as far as environmental protection is concerned, future generations will have a far bigger price to pay, not only in dollars but in terms of quality of life. Politicians should be concerned not only with the present, but the future. And the future may not, and perhaps should not, be merely an extrapolation of the present. It can be argued that material prosperity should be weighed against the quality of life for this and future generations. If a little less affluence would result in a more acceptable environment the public might be willing to accept slightly lower standards of material benefits. It can hardly be denied that many articles which a large number of people regard as necessities are, in fact, luxuries, some of which could be dispensed with without much hardship.

This study has shown the effects on the Ottawa River system of man's activities for almost four centuries. It is the story of man's courage and ingenuity in overcoming difficulties and developing new technologies. It shows man as the conqueror of his environment, giving little thought to the future effects of his activities. In doing so, he has gone a considerable way towards ruining his environment. In the early days man's activities led to the extinction of the beaver in the Ottawa Valley; later, the most valuable timber was denuded; and from the mid 1800s onwards there has been a continuing degradation of the water quality of the "Grand River". Only within the past decade or so has serious concern been shown regarding the

effect of man's activities on water quality. Technological advances have resulted in the production of nuclear energy and many new chemical processes and products, the wastes from which find their way into watercourses. While technology can also solve, at a high cost, the pollution problem it is suggested that products of future technological processes could release even more dangerous substances into Canadian waters.

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EXTRACT FROM SIR GEORGE SIMPSON'S AN OVERLAND JOURNEY
ROUND THE WORLD DURING THE YEARS 1841 AND 1842*

"Before bidding good-by to our old friend the Ottawa, let me here offer a description of a day's march, as a general specimen of the whole journey. To begin with the most important part of our proceedings, the business of encamping for our brief night, we selected, about sundown, some dry and tolerably clear spot; and immediately on landing, the sound of the axe would be ringing through the wood, as the men were felling whole trees for our fires, and preparing, if necessary, a space for our tents. In less than ten minutes our three lodges would be pitched, each with such a blaze in front, as virtually imparted a new sense of enjoyment to all the young campaigners, while through the crackling flames might be seen the requisite number of pots and kettles for our supper. Our beds were next laid, consisting of an oilcloth spread on the bare earth, with three blankets and a pillow, and, when occasion demanded, with cloaks and great-coats at discretion; and whether the wind howled or the rain poured, our pavilions of canvas formed a safe barrier against the weather. While part of our crews, comprising all the landmen, were doing duty as stokers, and cooks, and architects, and chambermaids, the more experienced voyageurs, after unloading the canoes, had drawn them on the beach with their bottoms upwards to inspect, and, if needful, to renovate the stitching and the gumming; and as the little vessels were made to incline on one side to windward, each with a roaring fire to

*Source: Sir George Simpson, An Overland Journey Round the World During the Years 1841 and 1842 (Philadelphia: Lea and Blanchard, 1847), pp. 27-28.

leeward, the crews, every man in his own single blanket, managed to set wind, and rain, and cold at defiance, almost as effectually as ourselves. Weather permitting, our slumbers would be broken about one in the morning by the cry "Levé! levé! levé!" In five minutes, woe to the inmates that were slow in dressing, the tents were tumbling about our ears; and within half an hour the camp would be raised, the canoes laden, and the paddles keeping time to some merry old song. About eight o'clock, a convenient place would be selected for breakfast, about three-quarters of an hour being allotted for the multifarious operations of unpacking and repacking the equipage, laying and removing the cloth, boiling and frying, eating and drinking; and, while the preliminaries were arranging, the hardier among us would wash and shave, each person carrying soap and towel in his pocket, and finding a mirror in the same sandy or rocky basin that held the water. About two in the afternoon we usually put ashore for dinner; and as this meal needed no fire, or at least got none, it was not allowed to occupy more than twenty minutes or half an hour. Such was the routine of our journey, the day, generally speaking, being divided into six hours of rest and eighteen of labour. This almost incredible toil the voyageurs bore without a murmur, and, almost invariably, with such an hilarity of spirit, as few other men could sustain for a single forenoon.

But the quality of the work, even more decidedly than the quantity, requires operatives of iron mould. In smooth water the paddle is plied with twice the rapidity of the oar, taxing both arms and lungs to the utmost extent; amid shallows, the canoe is literally dragged by the men wading to their knees or to their loins, while each poor fellow, after replacing his drier half in his seat, laughingly shakes the heaviest of the wet from his

legs over the gunwale, before he again gives them an inside berth; in rapids, the towing line has to be hauled along over rocks and stumps, through swamps and thickets, excepting that when the ground is utterly impracticable, poles are substituted, and occasionally, also, the bushes on the shore. Again on the portages, where the breaks are of all imaginable kinds and degrees of badness, the canoes and their cargoes are never carried across in less than two or three trips, the little vessels alone monopolizing, on the first turn, the more expert half of their respective crews. Of the baggage, each man has to carry at least two pieces, estimated at a hundred and eighty pounds avoirdupois, which he suspends in slings of leather placed across the forehead, so that he has his hands free to clear the way among the branches of the standing trees, and over the prostate trunks. But, in addition to the separate labors of the land and the water, the poor fellows have to endure a combination of both sorts of hardship at least three or four times every day. The canoes can seldom approach near enough to enable the passengers to step ashore from the gunwale; and no sooner is a halt made than the men are in the water to ferry us to dry ground on their backs. In this unique department of their duty they seem to take pride; and a little fellow often tries to get possession of the heaviest customer in the party, considerably exceeding, as has often been the case in my experience, the standard aforesaid, of two pieces of baggage."

EXTRACTS FROM THE DIARY FROM 2 TO 11 MAY, 1830OF FRANCES SIMPSON, WIFE OF SIR GEORGE SIMPSON*

Governor Simpson's eighteen year old bride was the first woman to travel by canoe from Montreal to York Factory via the Great Lakes. She married George Simpson on 24 February, 1830, and shortly after left on a highly unusual honeymoon trip. The following are extracts from her diary.

"May 2nd (1830) left La Chine at 4 A.M. in two Canoes manned by 15 hands each, all strong active fine looking Canadians. . . .

Our canoe, a most beautiful craft, airy and elegant beyond description, was 35 feet in length . . .

In this order we started, the voyageurs singing, and the Canoe almost flying through the water - the motion is perfectly easy, and in fine weather is the most delightful mode of travelling than can be imagined. . . .

At 9 O'clock we put ashore for Breakfast, above the Rapids of St. Ann

Mr. Simpson (after looking at his watch) gave the call of 'Take away' - the breakfast party were on their feet in a moment, the things washed, packed and the Canoe off again within the 45 Minutes usually allowed for this Meal.

At 11 A.M. we landed at the beautiful Indian village of the "Lake of the Two Mountains" (where the Company have an Establishment . . .

We remained about - an hour . . .

At 2 O'clock we put ashore, off the village of St. Andrews, when the

* Quoted in Grace Lee Nute's "Journey for Frances" in Beaver, Outfit 284, December 1953, pp. 50-54, and March 1954, pp. 12-17.

seats were arranged so as to accommodate the whole party in our Canoe for dinner . . . (We) travelled till 9 p.m. when we encamped, above the Chute of Blondeau. The Tents were immediately pitched, and supper prepared, soon after which, we retired to Bed, which consisted of our Cloaks, and a few Blankets laid upon the Ground.

3rd. Arose at 2 A.M. with aching bones, occasioned by the dampness, and hardness of my couch:- the people were aroused by Mr. Simpson's well known call of "Lève, lève, lève", . . . The Canoes were then laden and we embarked at 3 O'clock.

Soon after daylight, we came to some heavy Rapids where we were obliged to land, and walk 7 Miles up the banks of the Grenville Canal, till we came to the small village of Grenville . . . The Canoes here joined us, we then travelled till 9 O'clock and breakfasted at "Point Orignal".

The Sun was intensely hot and the water of the Grand or Uttowas river as smooth as glass; the Country on either side a thick Forest; the trees near the edge of the Water low & branching, chiefly Aspen: while those behind were Pine, straight as Arrows, and growing to an enormous height . . . Dined at 2 O'clock at Pappinoe Island and travelled till 9 when we encamped at Riviere de Lièvres.

4th. . . . Near this is situated the village of "Bytown", . . . we were very kindly received by Mrs. By . . . who insisted upon our stopping to breakfast with her.

The house stands in a good garden, overlooks one of the most beautiful spots I have seen in the Country: it commands an extensive view of the river, on the opposite side of which is the little Village of Hull . . . from the upper story are to be seen the fine and romantic Kettle (Chaudière) Falls,

and beneath runs the Rideau Canal . . .

After taking leave of our kind hostess we rode 9 miles in Carts . . . The road was so rough that it required some exertion to keep our seats, as the carts were without springs, indeed on rattling over a "Stripe of Corduroy" here, we narrowly escaped cutting a Sunset over the horse's head, into a deep slough through which we plunged . . . Travelled till 8 P.M. and encamped at the Company's Establishment of the "Chats" . . .

5th. The Establishment at which we encamped last night, may be considered the boundary between the Civilized and Savage Worlds, as beyond this point, the country is uninhabited by Whites, except where a Trading Post of the Honble. Hudson's Bay Compy. occasionally presents itself.

At 3 A.M. the signal for starting was given & in a few minutes after, the paddle kept time to the lively song. Our progress however, was soon interrupted by the Portage of the Chats Falls, which we passed before daylight; altho' the path which lay across rocks & precipices, was very rugged and intersected by a small Channel of the River over which I was carried in the arms of one of the men who waded thro' it, nearly breast high.

At day-break the Sky became cloudy, with the appearance of bad weather, and soon afterwards, rain came on, and continued more or less heavy, until 8 P.M. . . . We kept "en route", making several Portages . . . amounting in all to about 5 miles: thro' Mud & Water, over fallen trees, rocks, up hill & down . . .

At Sun set we encamped at the upper end of the Grand Calumet Portage. The Weather cleared up, immense fires were soon blazing cheerfully; a comfortable warm Supper was prepared, & by 10 O'clock there was such a Nasal Serenade set up in the Camp, as to drown the shrill notes of thousands of

Bull-frogs, which were luxuriating in a swamp hard by.

6th. We were in the Canoe before 2 this morning, but on pushing off from the Shore, discovered that one of our crew was missing . . .

At 9 A.M. got to Fort Colonge under the direction of Mr. Severight . . . with whom we breakfasted . . .

Towards Evening, got to another of the Company's Establishments at Lac des Allumettes . . . We stopped here $\frac{1}{2}$ an hour and then crossed the Lake altho' blowing very hard and the Canoe shipping much water. At dusk we got to the entrance of Riviere Cruse, where we put ashore and pitched our Tents in the Woods: the Evening bitterly cold, with occasional hail Showers.

7th. Some snow had fallen in the course of the night, and the morning was very cold: we left our encampment nevertheless at 2 A.M. the frost was so severe, as to form a thick crust of Ice on the paddles & sides of the Canoe. At 8 O'clock got to the Joacinth (Joachim) Portage, about $\frac{3}{4}$ of a mile in length, at the upper end of which, we breakfasted: then crossed a small basin or Lake, and made another Portage of the same name and about the same length: here, another of our crew deserted, and while searching for him, his example was followed by a third.

These runaways were Young Recruits, who were never on the voyage before and finding the labor greater than they expected, took French leave . . . the old experienced voyageurs are all upon honor & never desert . . .

9th. Took our departure at 2 this Morning . . . We left the Grand or Uttowas river at 7 O'clock and entered a little river called the Matowa, on a Portage of which we breakfasted at 8. Made several Portages in the course of the forenoon, in this turbulent little river, and at 2 O'clock got to one called the "Talon" Portage, the most wild and romantic place I ever

beheld . . . The approach to this Portage is truly picturesque: the river from being a considerable width, here branches into a variety of Channels, one of which we entered, so narrow as scarcely to leave a passage for the Canoe - on either side are stupendous rocks of the most fantastic forms . . . From the upper end of the Portage is seen a beautiful Waterfall, which dashes over immense masses of rocks thro' which it had worn itself many a channel, foaming & roaring to a considerable distance; the spray glittering in the Sun with all the varied hues of the Rainbow.

From thence, we passed thro' several small Lakes, crossed 2 Portages of $\frac{1}{2}$ a mile each, the last of which is the height of land, dividing the waters that fall into Lake Huron, from those of the Uttawas, which afterwards unite at Montreal: the former taking a circuitous course through the great Lakes Erie & Ontario and tumbling over the mighty falls of Niagara, into the St. Lawrence.

10th. . . . A sharp frost had set in last night and the morning was exceedingly cold . . . The Guide roused us for the purpose of making the "Prairie La Vase" Portage, about a mile & a half in length.

The walking would have been bad in broad daylight, but the darkness of the morning rendered it almost impassable, as it partly lay thro' a Morass knee deep, and blocked up with Wind fallen Timber: we contrived however to wade and scramble our way to the other end . . . We then passed thro' a small muddy channel (in the Canoe) which was terminated by another Portage even worse than the former (altho' not exceeding $\frac{1}{2}$ a mile in length) as it was not only knee, but waist deep in parts. . . .

(At) the end of the Portage, where all we washed & dried ourselves and had Breakfast; after which we descended a small river, passed thro' Lake

Nipisang, about 40 miles in length, then made a Portage, into the French River.

10th. Continued our route thro' this (French) river - which is a fine large stream, widening at times, so as to assume the appearance of a lake Encamped at 7 P.M. . . .

11th. At the Recollet Portage breakfasted . . . on going from the foot at Recollet Fall, were very nearly drawn under it, by a strong Eddy: . . . but by the exertions of the men at the paddle, regained the Stream and got into Lake Huron at 2 O'clock."

GROWTH OF URBAN CENTRES ON THE OTTAWA RIVER, 1848 TO 1901

URBAN CENTRE	1848	1851	1861	1871	1881	1891	1901
Ville Marie							502
Mattawa					322	1,438	1,400
Pembroke			637	1,508	2,820	4,401	5,156
Chapeau					201	250	230*
Fort Coulonge						323	482
Bryson					429	405	508*
Portage du Fort			742	652	564	592	449*
Arnprior			670	1,714	2,147	3,341	4,152
Quyon					410	668	682*
Aylmer		1,169	1,586	1,650	1,762	1,945	2,291
Bytown/Ottawa	6,275	7,760	14,669	21,545	27,412	38,942	59,928
Hull		2,811	3,711	3,800	6,890	11,264	13,993
Pte. Gatineau					1,460	1,520	1,583
Masson							1,012
Rockland						1,465	1,998
Thurso						578	525
Papineauville							722
Montebello					597	754	795
L'Orignal					853	1,002	1,026
Hawkesbury			1,259	1,671	1,920	2,042	4,150
Grenville					568	502	495
Carillon						255	233*
Pointe Fortune						322	264*
Rigaud					607	673	779
Como E.					388	400	623*
TOTALS	6,275	11,740	23,274	32,540	49,350	73,082	103,983

Source: Census of Canada, 1848 to 1901.

* Not included in 1901 totals on Appendix VIII as these centres were less than 1,000 in 1971.

GROWTH OF URBAN CENTRES ON TRIBUTARIES OF THE
OTTAWA RIVER, 1848 TO 1901

URBAN CENTRE	1848	1851	1861	1871	1881	1891	1901
<u>Bonnechere River</u>							
Eganville						710	1,107
Renfrew			700	865	1,605	2,611	3,153
<u>Ruisseau du Moulin</u>							
Shawville					375	432	648
<u>Mississippi System</u>							
Carleton Place				1,205	1,975	4,435	4,059
Almonte				2,080	2,684	3,068	3,023
Lanark (Clyde)				740	752	859	979*
<u>Jock River</u>							
Richmond		434	516	487	439	447	469
<u>Rideau River System</u>							
Perth (Jay)		1,916	2,465	2,375	2,467	3,136	3,588
Smiths Falls			1,137	1,150	2,087	3,864	5,155
Kemptville			1,068	872	1,188	1,226	1,523
Merrickville			908	923	819	1,072	1,024*
<u>Gatineau River</u>							
Maniwaki							999
<u>Rivière du Lièvre</u>							
Buckingham			1,186	1,301	1,479	2,239	2,936
<u>South Nation River</u>							
Chesterville						775	932
Casselman							707
<u>Little Rideau Creek</u>							
Vankleek Hill							1,674
<u>Rivière du Nord System</u>							
Ste Agathe des Monts							1,073
St. Jérôme			705	1,159	2,032	2,868	3,619
La Chute						1,751	2,022
TOTALS		2,350	8,685	13,157	17,902	29,493	38,690

Source: Census of Canada, 1848 to 1901

* Not included in 1901 totals in Appendix IX as these centres were less than 1,000 in 1971.

PRODUCTION CAPACITY OF PULP, PULP AND PAPER, AND PAPER MILLS, 1938-1977

Location and Company	Product	Production Capacity - short tons (2,000 lbs.) a day				
		1938	1950	1960	1970	1977
Temiscaming (Tembec: CIP prior to 1973; Riordon 1920 to 1925)	Bleached sulphite, dissolving wood cellulose 1938-1970. Dissolving specialty, glassine, roll pulp and commodity sulphite pulp 1977	365	367	440	440	470
Portage du Fort (Consolidated-Bathurst Ltd.; Gillies prior to 1963)	Bleached softwood or hardwood kraft pulps				500-550	525-635
Hull/Ottawa (E.B. Eddy Products Ltd., formerly E.B. Eddy Co. Ground mill started 1888; sulphite mill 1889; paper-making before 1900. On site of saw mills established 1870)	Fine and Specialty paper } Tissue, serviettes and towelling }	82*	215	255	360 155	370 155
	Paper Board		70	76	80	80
	Newsprint	115*	148	185	200	
	Groundwood	107*	210	195		
	Bleached and unbleached sulphite	123*	345	280		
Ottawa (J.R. Booth: groundwood mill 1904; paper mill 1905; sulphite mill 1908; board mill 1910; purchased by E.B. Eddy Co., 30 April 1946)	Sulphite pulp	65				
	Groundwood pulp	200				
	Box Boards	70				
The Bronson Co.	Newsprint, wrapping paper etc.	150				
	Groundwood	25*				
Gatineau (CIP, purchased from Riordon 1925)	Newsprint	760	825	1,020	1,020	1,400
	Groundwood pulp	630	700	803	815	615
	Refiner groundwood				450	600
	News sulphite fibre	260	180	245	245	
	Bleached sulphite dissolving wood cellulose		200	220		
Buckingham and Masson (The James MacLaren Co. Groundwood mill started 1889 or earlier)	Newsprint	350	350	410	430	438
	Sulphite fibre	80				
	Groundwood	275				

Location and Company	Product	Production Capacity - short tons (2,000 lbs.) a day				
		1938	1950	1960	1970	1977
<u>Thurso</u> (Thurso Pulp and Paper Co. - started production 1958; purchased by James MacLaren Co. December 1964)	Bleached hardwood sulphate			200	350	330
<u>Hawkesbury</u> (CIP - purchased from Riordon 1925 who bought out Hamilton Lumber Mills and built a sulphite mill there in 1898; Hamilton Lumber Mills operating saw mills there since early 1800s)	Bleached sulphite, dissolving wood cellulose for making continuous filament	185	194	260	270	287
<u>Lachute</u> (Price Wilson Ltd., previously J.C. Wilson. Paper mill established 1880.	Bags, kraft) Kraft wrapping paper) Towelling)	40	30	40	25 25 18	25 25 18
<u>St. Jérôme and Mont-Rolland</u> (Rolland Paper Co., Ltd. Paper mill 1882. Groundwood mill 1903.	Fine paper	45	115	196	285	381
TOTAL ALL COMPANIES		3,927	3,949	4,825	5,668- 5,718	5,719- 5,809

*Source gives production capacity in tons a year, reckoned as 365 days for purpose of this chart.

Source: Pulp and Paper Canada 1977, Business Directory; Pulp and Paper Directory of Canada, 1970; National Directory of the Canadian Pulp and Paper Industries 1959/60 and 1950; Business Publications Limited, Gardenville 800, Québec; and

George Carrouthers, Paper Making, (Toronto: The Garden City Press Co-operative, 1947), pp. 391-406, 611-12, 517, 553-7.

PRODUCTION CAPACITY OF OTHER WOOD PRODUCT DIVISIONS OF CIP

Location and Division	Product	Production Capacity - million square feet a year				
		1938	1950	1960	1970	1977
<u>Gatineau</u>						
Masonite Canada Ltd.	Masonite board etc.		78	115	138	135
Plywood Veneer Division	Plywoods etc.					165
International Fibre Boards Ltd.	Wood fibre insulating boards		115	135	135	
International Plywoods Ltd.	Hardwood plywood				34	
T O T A L			193	250	307	300

Source: Op. cit.

MUNICIPALITIES TAKING DOMESTIC WATER SUPPLIES FROM THE OTTAWA RIVER

(Consumption and Type of Treatment)

<u>Municipality</u>	<u>Consumption</u> (Thousands of gallons/day)	<u>Type of Treatment</u>
<u>Ontario</u>		
Ottawa	38,520	Alum, filtration, chlorination, fluoridation
Hawkesbury	2,900	Alum, silica, lime, filtration, chlorination
Pembroke	1,860	Screening, chlorination
Canadian Forces Base and Village of Petawawa	1,310	Screening, sedimentation, chlorination
Deep River	620	Filtration, chlorination, fluoridation
Rockland	350	Flocculation, filtration, chlorination
Haileybury	330	Alum, filtration, chlorination
T o t a l	44,990	
<u>Québec</u>		
Hull	9,000	Chlorination
Gatineau	1,800	Filtration, chlorination
Aylmer	650	Filtration, chlorination
Deschenes	180	Filtration, chlorination
Campbell's Bay	120	Chlorination
Quyon	100	Chlorination
Bryson	80	Chlorination
Portage-du-Fort	60	Chlorination
Chapeau	60	Chlorination
T o t a l	10,950	
Total mean daily consumption - Ontario and Québec	55,940	

Source: Based on Ottawa River Basin: Water Quality and Its Control, Table E.1, p. 79.

URBAN CENTRES (WITH POPULATIONS OF OVER 1,000 IN 1971) ON THE OTTAWA RIVER

Urban Centre	1901	1911	1921	1931	1941	1951	1961	1971
New Liskeard	-	2,108	2,268	2,880	3,019	4,215	4,896	5,488
Haileybury	-	3,874	3,743	2,813	2,268	2,346	2,638	5,280
Ville Marie	502	850	840	1,049	1,001	1,316	1,710	1,995
Temiscaming	-	-	1,021	1,855	2,168	2,787	2,577	2,428
Mattawa	1,400	1,524	1,462	1,631	1,971	3,097	3,314	2,881
Deep River	-	-	-	-	-	-	5,377	5,671
Chalk River	-	-	-	-	-	-	1,335	1,094
Petawawa	-	-	-	-	-	-	4,509	5,784
Pembroke	5,156	5,626	7,875	9,368	11,159	12,704	16,791	16,544
Fort Colonge	482	811	973	1,130	1,072	1,431	1,823	1,784
Campbell's Bay	-	447	700	897	900	975	1,024	1,186
Arnprior	4,152	4,405	4,077	4,023	3,895	4,381	5,474	6,016
Aylmer	2,291	3,109	2,970	2,835	3,115	4,375	6,286	7,198
Deschênes	-	-	321	294	284	1,169	2,090	1,806
Ottawa	59,928	87,062	107,843	126,872	154,951	202,045	268,206	302,341
Eastview/Vanier	-	3,169	5,324	6,686	7,966	13,799	24,555	22,477
Rockcliffe Park	-	-	-	951	1,480	1,595	2,084	2,138
Hull	13,993	18,222	24,117	29,433	32,947	43,483	56,929	63,580
Pte. Gatineau	1,583	1,751	1,919	2,282	2,230	3,874	8,854	15,640
Gatineau	-	-	-	-	2,822	5,771	13,022	22,321
Templeton	-	-	428	882	949	1,717	2,965	3,684
Masson	1,012	1,034	950	2,015	1,226	1,475	1,933	2,336
Rockland	1,998	3,397	3,496	2,118	2,040	2,348	3,037	3,649
Thurso	525	601	538	1,292	1,295	1,973	3,310	3,219
Papineauville	722	1,015	884	954	1,023	1,024	1,300	1,384
Montebello	795	954	997	1,501	1,260	1,397	1,486	1,285
L'Orignal	1,026	1,347	1,298	1,121	1,118	967	1,189	1,405
Hawkesbury	4,150	4,400	5,544	5,177	6,263	7,194	8,661	9,276
Grenville	495	1,383	701	719	737	1,069	1,330	1,495
Rigaud	779	856	939	1,099	1,222	1,579	1,990	1,743
Hudson	-	-	1,146	1,358	1,446	2,208	3,214	4,345
TOTALS	100,989	147,945	182,354	213,235	251,827	332,314	463,849	527,473

Source: Census Returns for 1901 to 1971. Dominion Bureau of Statistics and Statistics Canada.

GROWTH OF URBAN CENTRES (WITH POPULATIONS OF OVER 1,000 IN
1971) ON TRIBUTARIES OF THE OTTAWA RIVER, 1901 TO 1971

Urban Centre	1901	1911	1921	1931	1941	1951	1961	1971
<u>Tremoy Lake and Kenojevis</u>								
Rouyn	-	-	-	3,225	8,808	14,633	18,716	17,821
Noranda	-	-	-	2,246	4,576	9,672	11,477	10,741
<u>Murdock Creek and Blanche River</u>								
Kirkland Lake								
Swastika (Teck Twshp)*	-	-	1,170	9,915	20,409	18,392	17,422	15,205
<u>Blanche River</u>								
Englehart	-	670	759	1,210	1,262	1,585	1,786	1,721
<u>Farr Creek</u>								
Cobalt	-	5,638	4,449	3,885	2,376	2,230	2,209	2,197
<u>Bonnechère</u>								
Eganville	1,107	1,189	1,015	1,020	1,088	1,326	1,549	1,395
Renfrew	3,153	3,846	4,906	5,296	5,511	7,360	8,935	9,173
<u>Madawaska</u>								
Barry's Bay	-	-	-	-	1,198	1,218	1,439	1,432
<u>Ruisseau du Moulin</u>								
Shawville	648	715	735	801	892	1,159	1,534	1,745
<u>Mississippi System</u>								
Carleton Place	4,059	3,621	3,841	4,105	4,305	4,725	4,796	5,020
Almonte	3,023	2,452	2,426	2,415	2,543	2,672	3,267	3,696
<u>Jock River</u>								
Richmond	469	428	413	405	457	610	1,215	2,122
<u>Rideau River System</u>								
Perth	3,588	3,588	3,790	4,099	4,458	5,034	9,360	5,537
Smiths Falls	5,155	6,370	6,790	7,108	7,159	8,441	9,603	9,585
Kemptville	1,523	1,192	1,204	1,286	1,232	1,488	1,959	2,413

Urban Centre	1901	1911	1921	1931	1941	1951	1961	1971
<u>Gatineau River</u>								
Maniwaki	999	1,461	-	1,720	2,320	3,835	6,349	6,689
Gracefield	-	300	342	479	537	601	670	1,049
<u>Rivière du Lièvre</u>								
Mont Laurier	-	752	2,211	2,394	2,661	4,701	5,859	8,240
Buckingham	2,936	3,854	3,835	4,638	4,516	6,129	7,421	7,304
<u>South Nation River</u>								
Chesterville	932	487	967	1,012	1,067	1,094	1,248	1,252
Casselman	707	956	977	995	1,021	1,158	1,277	1,337
<u>Rivière de la Petite Nation</u>								
St. André Avellan	-	-	446	444	407	828	1,066	1,088
<u>Rivière Rouge</u>								
L'Annonciation	-	622	612	658	632	660	1,042	2,162
Labelle	-	826	641	685	709	1,003	1,224	1,492
St. Jovite	-	-	862	981	1,059	1,453	2,692	3,132
<u>Little Rideau Creek</u>								
Vankleek Hill	1,674	1,577	1,499	1,380	1,435	1,480	1,735	1,691
<u>Rivière du Nord system</u>								
Ste. Agathe des Monts	1,073	2,020	2,812	2,949	3,308	5,169	5,725	5,532
Val David	-	-	-	500	656	940	1,118	1,627
St. Jérôme	3,619	3,473	5,491	8,967	11,329	17,685	24,546	26,524
Brownsburg	-	-	-	-	3,105	3,238	3,617	3,481
Lachute	2,022	2,407	2,592	3,906	5,310	6,179	7,560	11,813
St. André Est	-	-	-	-	-	-	1,183	1,201
T O T A L S	36,687	48,444	54,785	78,724	106,346	136,698	165,599	175,417

* Kirkland Lake and Swastika shown under Tech Township.

Source: Canadian Census Returns, 1901 to 1971. Dominion Bureau of Statistics and Statistics Canada.

RURAL AND URBAN POPULATION, 1966 AND 1971

QUEBEC

Census Division	Total Population	Urban	Rural		
			Total	Non-Farm	Farm
<u>1966</u>					
Argenteuil	30,457	-	-	-	-
Deux Montagnes	44,963	-	-	-	-
Gatineau	50,150	-	-	-	-
Hull	96,244	-	-	-	-
Labelle	30,167	11,431	18,736	11,834	6,902
Papineau	31,952	16,570	15,382	9,169	6,213
Pontiac	20,113	4,582	15,531	10,399	5,132
Temiscamingue	60,312	34,863	25,449	14,574	10,875
Vaudreuil	34,053	26,096	7,957	4,897	3,060
% of total population (five Census Divisions)		53.0	47.0	28.8	18.2
<u>1971</u>					
Argenteuil	31,320	17,990	13,330	11,640	1,690
Deux Montagnes	52,370	45,325	7,045	5,075	1,970
Gatineau	55,730	30,265	25,460	21,745	3,715
Hull	109,945	105,225	4,720	4,175	545
Labelle	30,580	13,885	16,695	13,275	3,425
Papineau	31,795	16,615	15,175	10,980	4,195
Pontiac	19,570	4,715	14,855	11,645	3,215
Temiscamingue	54,660	32,985	21,670	15,350	6,320
Vaudreuil	36,595	28,150	8,445	6,570	1,875
% of total population (nine Census Divisions)		69.8	30.2	23.8	6.4

RURAL AND URBAN POPULATION, 1966 AND 1971

ONTARIO

Census Division	Total Population	Urban	Rural		
			Total	Non-Farm	Farm
1966					
Lanark	41,212	23,810	17,402	10,542	6,860
Ottawa-Carleton	413,692	-	-	-	-
Prescott	27,155	13,313	13,842	6,545	7,297
Renfrew	89,453	54,754	34,699	23,661	11,038
Russell	14,878	-	-	-	-
Nipissing	73,533	46,386	27,147	23,166	3,981
Temiskaming	47,154	30,369	16,785	12,145	4,640
% of total population (five Census Divisions)		60.5	39.5	27.3	12.2
1971					
Lanark	42,260	26,495	15,760	10,440	5,315
Ottawa-Carleton	471,930	428,940	42,990	34,185	8,810
Prescott	27,835	13,605	14,230	8,750	5,480
Renfrew	90,875	56,240	34,640	26,410	8,225
Russell	16,290	6,440	9,845	6,045	3,805
Nipissing	78,865	58,730	20,135	17,870	2,265
Temiskaming	46,485	31,020	15,470	12,040	3,425
% of total population (seven Census Divisions)		80.2	19.8	14.9	4.8

Source: Table II, 1971 Census of Canada: Population - Urban and Rural Distributions.

CENSUS FARMS WITH SALES OF \$2,500 OR MORE

CLASSIFIED BY TYPE

ONTARIO (1971)

Product type	Lanark	Ottawa- Carleton	Nipissing	Prescott	Renfrew	Russell	Temiskaming
Total farms with sales of \$2,500 or more	792	1,310	226	965	1,005	578	365
Dairy	329	725	136	808	298	514	193
Cattle, hogs, sheep	408	409	68	65	584	40	140
Poultry	9	18	4	44	9	7	8
Wheat	-	2	-	1	1	-	-
Other small grains	6	18	-	10	14	7	2
Other field crops	1	9	3	13	13	3	8
Fruit and vegetables	1	67	-	-	3	2	2
Forestry	9	2	6	2	21	-	2
Miscellaneous specialty	11	43	3	13	16	3	4
Mixed	18	17	6	9	46	2	6
Livestock combinations	11	9	3	4	36	1	4
Fieldcrop combinations	2	1	-	-	-	-	2
Other combinations	5	7	3	5	10	1	-
% dairy, cattle, hogs, sheep' poultry and livestock combinations to total farms	95.6	88.6	93.4	95.4	92.2	97.2	94.5
% " " " " " " " for seven census divisions				93.2			

QUEBEC (1971)

Source: Table 33, Census of Canada 1971: Agriculture.

HYDRO-ELECTRIC POWER DEVELOPMENTS IN THEOTTAWA RIVER BASIN

Development	Year Installed		Installed Capacity (Hp)
	First year	Latest Unit	
<u>Ottawa River</u>			
Carillon	1962	1964	840,000
Des Joachims	1950	1951	496,000
Otto Holden	1952	1953	272,000
Chats Falls	1931	1932	224,000
Rapide des Iles	1966	1967	200,000
Chenaux	1950	1951	168,000
Quinze	1923	1955	119,000
Rapid II	1954	1964	64,000
Rapid VII	1941	1949	64,000
Chaudière (7 plants)	1902	1955	87,170
Bryson	1925	1949	78,400
Des Prairies*	1929	1930	60,000
Other			1,000
Total on Ottawa River			<u>2,673,570</u>
<u>Gatineau River</u>			
Paugan	1928	1956	285,000
Chelsea	1927	1939	170,000
Farmers Rapids	1927	1947	120,000
Corbeau	1926	1926	2,500
Total on Gatineau River			<u>577,500</u>
<u>Lièvre River</u>			
Masson	1933	1933	136,000
High Falls	1930	1936	122,500
Dufferin Falls	1958	1959	50,000
Buckingham (2 plants)	1901	1939	30,800
Mont Laurier	1937	1951	3,150
Total on Lièvre River			<u>342,450</u>

Development	Year Installed		Installed Capacity (Hp)
	First year	Latest Unit	
<u>Madawaska River</u>			
Mountain Chute	1967	1967	224,000
Arnprior	1976	1976	105,000
Stewartville	1948	1948	84,000
Barrett Chute	1942	1942	56,000
Calabogie	1917	1917	6,000
Total on Madawaska River			<u>475,000</u>
<u>Montreal River</u>			
Lower Notch	1971	1971	306,000
Upper Notch			13,000
Ragged Chute)			
Hound Chute)			
Indian Chute)			
Fountain Falls)	1910	1924	18,340
Total on Montreal River			<u>337,340</u>
<u>Matabitchuan River</u>			
Matabitchuan	1910	1924	13,200
Total on Matabitchuan River			<u>13,200</u>
<u>Gordon River</u>			
Kipawa	1920	1926	24,200
Total on Gordon River			<u>24,200</u>
Others on the Madawaska, Mississippi, Blanche, Mattawa, North Nation, Lièvre, Nord, Rouge, Noire, Winneway and other rivers: 26 plants			61,636
Total on tributary streams			<u>1,831,326</u>
Total on Ottawa River system			<u>4,504,896</u>

* On outlet of Lake of Two Mountains
4,504,896 hp = approximately 3,500,000 kw-hr.

Based on Report on Hydrology and Regulation of the Ottawa River, Ottawa River Engineering Board, June, 1965; Ottawa River Basin, Water Quality and its control in the Ottawa River, prepared for the Provinces of Ontario and Québec by Ontario Water Resources Commission and Québec Water Board, 1971; and The Gifts of Nature, Ontario Hydro, 1974.

PROVINCIAL PARKS IN THE ONTARIO SECTION OF THE OTTAWA BASIN
(Facilities and Uses, 1974)

Park	Acreage	No. of camp sites	No. Vehicles	No Visitors	No. of Campers
Algonquin	1,862,400	1,322	254,477	723,230	108,091
Antoine	30	29	2,897	8,809	1,323
Bon Echo	16,417	400	37,330	188,515	28,695
Bonnechère	254	114	3,605	13,683	6,331
Carillon	1,715	302	26,069	97,928	16,769
Carson Lake	16	47	1,051	3,396	3,227
Driftwood	655	89	3,455	12,176	7,732
Finlayson Point	74	113	3,677	10,593	10,127
Fitzroy	486	251	48,080	139,423	18,796
Kap-Kig-Iwan	824	64	9,654	33,146	6,288
Lake St. Peter	61	57	16,788	61,004	4,322
Rideau River	213	186	38,999	116,960	18,074
Samuel de Champlain	5,807	212	24,914	85,404	15,789
Sharbot Lake	99	191	20,377	61,539	18,006
Silver Lake	78	190	24,627	81,207	16,958
South Nation	13	28	6,645	25,866	3,652
TOTALS	1,889,142	3,595	522,645	1,662,879	284,180

Source: 1974 Statistical Report, Ontario Provincial Parks, Ministry of Natural Resources, Ontario.

RIVER- AND LAKE-SHORE CAMPING GROUNDS IN THE ONTARIO SECTION OF
THE OTTAWA RIVER BASIN (EXCLUDING PROVINCIAL PARKS)
Acreages, number of camp grounds and sites and launching facilities
1977

<u>Location</u>	<u>Camping Grounds</u>	<u>Acreage</u>	<u>Camp Sites</u>	<u>Launching Ramps</u>
Amprior	3	57	115	2
Barry's Bay	1	55	75	1
Burnstown	1	3	10	1
Calabogie	10	875	369	10
Carleton Place	6	699	692	6
Cobalt	4	163	158	2
Cobden	5	874	586	5
Combermere	5	54	272	4
Crosby	4	2,000	120	4
Deep River	1	75	100	1
Deux Rivières	1	5	32	1
Dunrobin	1	2	16	1
Eganville	9	842	285	8
Elgin	2	2,015	95	2
Embrun	1	30	40	-
Godfrey	2	505	95	1
Golden Lake	8	64	452	8
Griffith	4	64	203	4
Haileybury	1	30	24	1
Inverary	1	10	34	1
Jones Falls	2	69	121	2
Killaloe	4	22	105	4
Kirkland Lake	1	5	12	1
L'Orignal	3	33	153	3
Lake St. Peter	5	85	260	5
Lanark	5	249	157	3
Larder Lake	1	100	60	1
Lombardy	3	29	87	3
Maberley	1	100	175	-
Madawaska	3	34	222	2
Mattawa	3	50	332	1
Merrickville	2	8	30	2
New Liskeard	1	5	14	-
Ottawa	2	14	80	-
Pakenham	1	12	80	1
Palmer's Rapids	1	5	15	1
Parham	1	10	51	-
Pembroke	4	462	212	4
Perth	4	94	500	3
Portland	5	405	229	4
Renfrew	4	298	243	3
Rolphon	1	4	22	1
Round Lake Centre	4	40	142	3
Smiths Falls	1	8	55	-
Swastika	1	40	80	1
Temigami	2	16	165	1
Westmeath	1	10	60	1
Westport	9	1,252	499	8
White Lake	9	154	514	9
TOTALS (49)	154	12,035	8,448	130

Source: Ontario/Canada Camping 1977, Ministry of Industry and Tourism, Toronto.

RIVER- AND LAKE-SHORE ACCOMMODATION IN THE ONTARIO SECTION OF
THE OTTAWA RIVER BASIN

(Rooms, cottages and facilities)

1977

<u>Location</u>	<u>No. of Establishments</u>	<u>Rooms</u>	<u>Cottages</u>	<u>Hunt/Fish Package Plans</u>	<u>Natural Shore</u>	<u>Beach</u>
Algonquin Park	3	50	42	-	2	1
Amprior	2	9	7	-	-	2
Barry's Bay	14	26	86	2	5	9
Bonnechère	1	-	10	-	1	-
Burnstown	1	-	3	-	-	1
Calabogie	11	30	76	2	2	9
Carleton Place	3	10	19	-	1	2
Cobalt	5	-	36	1	2	3
Cobden	2	-	11	-	1	1
Combermere	11	7	64	-	4	7
Crosby	2	-	13	-	1	1
Deep River	4	4	46	-	1	3
Deux Rivières	2	-	10	-	-	2
Eganville	7	-	44	-	-	7
Elgin	7	4	38	-	2	5
Godfrey	6	-	37	-	5	1
Golden Lake	11	14	96	-	4	7
Griffith	1	-	3	-	1	-
Haileybury	7	18	44	2	6	1
Inverary	1	-	8	-	1	-
Jasper	1	-	4	-	1	-
Jones Falls	3	40	7	-	3	-
Kanata	1	-	5	-	1	-
Killaloe	2	7	19	-	-	2
Kirkland Lake	1	-	5	-	-	1
Lake St. Peter	7	12	33	1	2	5
Lanark	3	9	11	-	2	1
Lombardy	4	7	32	-	2	2
Maberley	1	9	6	-	1	-
Madawaska	3	-	17	-	1	2
Manotick	2	-	23	-	1	1
Matachewan	3	-	18	-	2	1
Matawatchan	1	-	3	-	-	1
Mattawa	4	12	14	-	3	1
Merrickville	1	-	3	-	1	-
New Liskeard	4	-	27	-	3	1
North Cobalt	2	-	8	-	1	1
Ottawa	1	7	21	-	1	-
Pakenham	1	8	-	-	1	-

<u>Location</u>	<u>No. of Establishments</u>	<u>Rooms</u>	<u>Cottages</u>	<u>Hunt/Fish Package Plans</u>	<u>Natural Shore</u>	<u>Beach</u>
Parham	4	-	33	-	2	2
Pembroke	4	39	11	1	1	3
Perth	15	-	107	-	10	5
Petawawa	1	6	9	-	-	1
Plantagenet	1	20	-	-	-	2
Portland	5	-	54	-	3	2
Rideau Ferry	1	14	-	-	1	-
Round Lake Centre	3	-	22	-	-	3
Sharbot Lake	8	-	62	-	5	3
Swastika	2	6	19	-	1	1
Temagami	30	59	211	17	17	1
Temiscaming	1	-	7	-	-	1
Westmeath	3	19	34	-	2	1
Westport	16	57	91	-	11	5
White Lake	6	6	46	-	-	6
Whitney	5	17	26	3	1	4
TOTALS (52)	251	526	1,681	29	119	132

Source: Ontario/Canada Accommodations 1977, Ministry of Industry and Tourism,
Ontario.

MARINAS IN THE ONTARIO SECTION OF THE OTTAWA BASIN - 1977

(Location, number of establishments, docking and mooring and
Pump-out facilities)

	<u>No. of Establishments</u>	<u>Docking and/or Mooring Facilities</u>	<u>Pump-out Facilities</u>
Algonquin Park	1	1	-
Arnprior	1	1	1
Barry's Bay	4	4	1
Carleton Place	1	1	-
Chaffey's Locks	3	3	3
Cobden	1	1	-
Combermere	2	2	-
Crosby	2	2	-
Deep River	2	2	1
Dunrobin	1	1	1
Hawkesbury	1	1	-
Jones Falls	2	2	2
Kemptville	1	1	-
Manotick	3	3	2
Mattawa	1	1	-
Merrickville	1	1	1
New Liskeard	1	1	1
Ottawa (Rideau)	3	3	3
Parham	1	1	-
Pembroke	1	1	-
Perth	1	1	-
Plantagenet	1	1	1
Portland	4	4	4
Rideau Ferry	2	2	-
Rolphton	1	1	-
Sharbot Lake	2	2	-
Smiths Falls	1	1	1
Temagami	13	13	1
Westport	2	2	-
White Lake	4	4	1
Whitney	2	2	-
TOTALS (25)	66	66	24

Sources: Ontario/Canada Boating 1977, Ministry of Industry and Tourism, Toronto,
and Pump-out Stations, Ontario, Ministry of the Environment, Toronto,
April, 1977.

PRESENT POSITION OF MUNICIPAL WASTE DISPOSAL ON
ONTARIO SIDE OF THE OTTAWA RIVER SYSTEM

Main River

New Liskeard	Extended lagoon. Satisfactory. Phosphorus removal not required.
Bucke Township	Lagoon. Satisfactory. Phosphorus removal not required.
Haileybury	Secondary lagoon, extension completed in 1974. Satisfactory. Phosphorus removal not required.
Mattawa	Secondary lagoon. Satisfactory. Phosphorus removal not required.
Deep River	Imhoff tanks. Satisfactory.
Chalk River	Secondary treatment with extended aeration plant.
Buchanan Township	Arrangements being made to upgrade waste treatment facilities to meet requirements.
Petawawa	Primary treatment with phosphorus removal. Expansion of the plant and the possibility of installing secondary treatment are being discussed. The plant is operated by the federal government and serves the village and military base.
Pembroke	Primary treatment, nearing capacity. The municipality is in the process of determining phosphorus removal before extending the plant. DREE grants have been authorized towards expanding both water and sewage plants.
Renfrew	Has recently installed phosphorus removal facilities.
Arnprior	Primary treatment and has recently installed phosphorus removal facilities.
Watts Creek, Nepean	Secondary treatment with phosphorus removal. This plant will be phased out in the 1980s.
Green Creek, Ottawa	Primary with phosphorus removal (over 80% of phosphorus is removed). Ottawa now takes sewage from Cumberland and Uplands.

Cumberland	Now connected with Green Creek, Ottawa, facility.
Rockland	Lagoon serves only part of the town, the rest being served by septic tanks which cause localized problems. The lagoon is being extended within the next year to include effluents from the rest of the town. The lagoon removes from 70-90% of BOD and dissolved solids. Phosphorus removal not yet required.
Plantagenet	Lagoon servicing the whole town has been operating for the past two years. No problems. Phosphorus removal not yet required.
L'Orignal	Secondary treatment installed in 1976 -- quite satisfactory. Phosphorus removal not required.
Hawkesbury	Still discharges raw sewage into the river. A plant is under construction to provide secondary treatment with phosphorus removal and should be completed by 1979.

On Tributaries of the Ottawa

Killaloe	Tenders are out for the construction of a secondary plant. Construction should start early in 1978 and be completed by the end of the year.
Eganville	Secondary.
Perth	Lagoon. No phosphorus removal yet, but much pressure is being brought to bear on the municipality for this to be installed.
Smiths Falls	New primary plant with phosphorus removal.
Kemptville	Primary with phosphorus removal. Has reached capacity, and consultants are working on plans for expansion.
Carleton Place	Secondary treatment (no phosphorus removal facilities, as this is within acceptable limits).
Richmond	Lagoon - has reached capacity.
Westport	Lagoon with phosphorus removal.
Goulbourn	Lagoon with phosphorus removal.
Vankleek Hill	Lagoon built three years ago, discharging into the Little Rideau Creek. Satisfactory. Phosphorus removal not yet required.

Sources: Verbal information from Mr. Bob Dunn, District Officer of Municipal and Private Abatement Section, Ministry of the Environment, Ottawa, Ont.; Mr. Gerry McKenna, District Officer of Municipal and Private Abatement Section, Ministry of the Environment, Cornwall, Ont.; and Mr. Wain Scott, District Officer of Municipal and Private Abatement Section, Ministry of the Environment, North Bay, Ont.

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