

DEPARTMENT OF PLANNING AND DEVELOPMENT

THE HONOURABLE W.M. NICKLE, Minister

A. H. Richardson, Chief Conservation Engineer

**CREDIT
VALLEY
CONSERVATION
REPORT
1956**

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The Credit River Valley presents the most rugged topography of any in Southern Ontario. This gives the river many advantages such as striking scenery, clear cold water, farm and orchard land and large areas of reforestation land where trees could be economically maintained as permanent cover. These advantages, however, combined with the proximity of the river to large urban centres are the very factors which make it vulnerable to exploitation and their preservation presents a challenge to all people interested in true conservation.

One hundred and sixty-five copies
of this report have been prepared,
of which this is

Number 74

Honourable W. M. Nickle, Minister,
Department of Planning and Development,
Parliament Buildings,
Toronto, Ontario,

Honourable Sir:

I take pleasure in transmitting
herewith the complete Conservation Report for
the Credit Valley.

The report covers History, Land,
Forestry, Water, Recreation and Wildlife.

Yours very truly,

A. H. Richardson
Chief Conservation Engineer

Toronto, May 24, 1956

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INTRODUCTION

Conservation has long been a subject of concern to the people of Ontario. This concern had to do originally with the protection of forests because of their importance as a source of revenue to the Province; but allied with this was the problem of wildlife management and the protection of source areas of rivers and streams. In Southern Ontario interest in conservation was indicated first by reforestation and woodlot management, but more recently this has broadened out to include flood and pollution control, improved land use and provision for recreation facilities.

While the progress in these activities has been steady up to the present, most of the programs heretofore were initiated by government departments. Recently, however, there has been a growing conception of personal obligation, especially where land use problems, farm ponds and small reforestation projects are concerned. On the other hand, control of flooding, summer flow and pollution; large reforestation projects; and recreation areas have come to be considered the responsibility of the community - the community in this case being the river valley.

With the advent of this new concept of personal and community responsibility in conservation, the Authorities movement was born, and the willingness of our people to undertake conservation in this way is indicated by the fact that in the last ten years 19 Authorities have been established, with a total membership of 287 municipalities and an area of 12,013 square miles.

The first step in establishing a Conservation Authority is undertaken by all the municipalities wholly or partly within a watershed. Two such municipalities must first by resolution petition the government to call a meeting for the purpose of ascertaining whether or not an Authority should be established. Two-thirds of the number of representatives which the municipalities are entitled to appoint

(on a population basis) must be present to make the meeting legal. If two-thirds of those present vote in favour of establishing an Authority a resolution is forwarded to the Government. The Authority is then established by Order-in-Council and under the Act becomes a body corporate, including representatives from all the municipalities in the watershed.

While some Authorities were brought into being because of flooding within their areas, all were aware of the necessity of carrying out such supplementary measures as improved methods of land use, reforestation, proper woodlot management, prevention of pollution, investigation of underground water supplies, wildlife studies and recreation. But the Authorities were not equipped to carry out the extensive investigations that would indicate where such work should be done. Consequently the Conservation Branch of the Department of Planning and Development undertook to carry out the preliminary investigations as a service to the Authorities, to appraise, by means of surveys and reports, the conservation needs of each watershed, and to submit to the Authority a detailed report outlining the conservation measures that should be implemented.

The survey work is grouped under five general headings, namely, Land Use, Forestry, Water, Wildlife and Recreation. The scope of the studies made in each of these subjects varies with the condition and needs of the area under investigation. In addition to the five topics indicated above, a study of the history of the area is incorporated. This serves as a backdrop to all the conservation problems of the watershed and compels the reader to understand the abuses of the past and the need for a diversified program in the future.

The starting point for all surveys is aerial photography. Before the survey is commenced in the field all such contributing data as maps, old records, photographs, unpublished reports and other useful information are thoroughly

explored and recorded, While the survey is in progress similar data are gathered locally, and agricultural representatives, zone foresters, municipal clerks and other officials and private citizens are interviewed for additional material.

The results of these conservation surveys, together with the recommendations based upon them, are set down in the reports presented to the Authorities and intended to serve them as a blueprint. The carrying out of any scheme is not the work of the Conservation Branch of the Department of Planning and Development, because it is not an operating department. Its active participation for the most part ceases when the planning is complete and the report is submitted, although it stands by to interpret the report and give advice and assistance in carrying out the plans recommended in the report. The Authority must assume responsibility for initiating the schemes which it considers most urgent; it must also make approaches to the government departments or other bodies from which it hopes to get assistance.

If, for example, an Authority undertakes a scheme having to do with land use, it must seek assistance from the Department of Agriculture; if it involves a forestry or wildlife problem, then the Department of Lands and Forests is approached. In the case of flood control, however, as there is no department of the Government doing hydraulic surveys except the Conservation Branch, whose staff is not large enough to carry through the engineering works of several Authorities, the Authority must engage a consulting engineer to do the final engineering and designing and to carry the work through the construction stage. Similarly, where an Authority undertakes a scheme which has to do with recreation, it may have to employ men specially trained in this work.

As the work being done by Authorities is a new approach to the conservation problem, in that the responsibility

of carrying it out is left entirely in the hands of the Authority concerned, much directing and assistance have been necessary from the Conservation Branch and, in the case of fifteen Authorities, a member of the staff of the Department of Planning and Development has been assigned to work in the watershed. The Credit Valley Conservation Authority has not been operating long enough to justify an officer of this type, but during the present summer a fieldman will be assigned to it for part-time duty from Head Office.

The Credit Valley Conservation Authority was established by Order-in-Council on May 13, 1954, following an organization meeting which was held at Brampton on April 29, 1954 when 15 representatives out of a total of 18 attended the meeting and 11 voted in favour of establishing the Authority. Later, after a meeting held at Snelgrove on January 26, 1955, the area under the jurisdiction of the Authority was enlarged by Order-in-Council dated February 17, 1955, to include the watersheds of Cooksville Creek and streams between the westerly boundary of Toronto Township and the Etobicoke Watershed.

As mentioned above, the Department of Planning and Development, as a service to an Authority, undertakes to carry out a conservation survey of the valley for the guidance of the Authority, but the commencement of conservation work in the valley does not necessarily have to wait until such a survey has been made and the report presented. This has been the case with the Credit Valley Authority, and much excellent work and planning have been done independently of the reports which have been prepared by this department.

The reports for the different sections of work for the Credit Authority have been issued as separates as they became ready. These are: Land Use, Forestry, Water, Wildlife and Recreation. These five reports, together with the section on History, are now presented in one volume.

RECOMMENDATIONS
STATED OR IMPLIED IN THIS REPORT

History

1. That, before carrying out any project, the Authority ascertain from the Royal Ontario Museum of Archaeology at Toronto whether the area concerned is likely to contain archaeological material and if necessary arrange for the investigation of the site before operations make this difficult or impossible.
2. That where records, buildings and objects exist of sufficient interest as illustrating the life of the watershed during the period of development, the preservation of these relics be considered an aspect of conservation; and that where such records and other relics are the private property of individuals and corporations within the watershed, the Authority take definite measures to encourage their preservation by their owners or their commitment to proper care in libraries, museums, archives and other suitable repositories.
3. That when sites, buildings or ruins of structures, of this kind form part of, or are adjacent to, properties acquired by the Authority for flood control, reforestation or recreation, the possibility of including them in the scheme be considered.
4. That in such cases sites be marked, ruins preserved and buildings restored and used for some purpose in connection with the project compatible with retaining their original character,
5. That the Authority appoint an Historical Sites Advisory Board to make recommendations to it with regard to matters of historical interest, including the preservation of historical buildings and relics.

6. That this selection include the sites of the Government House in Port Credit, of the Mississauga Mission Village, of all mills known for certain to have been built before 1830; of some later mills, factories and tanneries of particular interest and of some other buildings of historical interest which have disappeared; also the "Radical's Hole" at the Forks of the Credit; some early roads and trails; and some existing buildings interesting for their associations or age.
7. That from the large number of sites and buildings of historic interest (in the wider sense used in these recommendations) to be found within the watershed, a few be selected for eventual inclusion in the scope of the activities of the Authority, besides those connected with recommended projects.
8. That wherever possible, the buildings be left on their original sites and continued in their original use or adapted to some suitable purpose in connection with the normal life of the community.
9. That the Authority provide as part of its recreation program an area or areas where buildings which it is desired to preserve may be re-erected when they cannot be retained on the original site.
10. That all these recommendations be taken as applying with particular force to the Limehouse and Meadowvale-Churchville Conservation Areas as outlined in the Recreation Section of this Report, and to the areas around Cataract, Belfountain and the Forks,,

Land Use

11. That the Authority, through its Farm Planning and Land Use Advisory Board, set up demonstrations, or pilot farms, in several sections of the watershed in order to

display and promote the various soil and water conservation measures, and the advantages of farm planning. These demonstrations might be carried out on private land in co-operation with the owners or on land acquired by the Authority. p. 59

12. That the individual farmer be made more aware of the effect on the flow and siltation of the river as a result of his use of his land; and the part that conservation measures can play in improving stream flow and stream conditions. p. 11
13. That the Authority keep in mind the fact that the pattern of land use within the watershed is changing and that in the best interests of the area this change should be directed, wherever possible, along lines which will be to the common good. p. 31
14. That the Authority take a lead in promoting the adjustment of land uses to the capability of the land, p. 35
15. That the Authority make full use of the technical assistance available from the various branches of Government in the solution of problems relating to the improvement of the land and water resources of the area; and that full co-operation be effected with groups such as the Soil and Crop Improvement Association in the promotion of the soil and water conservation program. p. 58
16. That the Authority carry out an extended and intensive program of publicity directed toward the improvement of land and water resources; and that appropriate literature relating to land improvement be obtained from the Department of Agriculture through the Agricultural Representatives for distribution to interested farmers; and that full use be made of the several O.A.C films relating to farm improvement; and that the farmer be made more

fully aware of the nature of soil and what happens to it under use. p. 63

17. That the Authority use, where feasible, parts of land acquired for other purposes, such as reforestation, for improved pasture demonstration. p. 63
18. That the Authority give serious attention to the reclamation and improvement of the areas of seriously eroded red clays in the vicinity of Cheltenham and Terra Cotta. p. 65
19. That the Authority give assistance to private owners, where possible, in the establishment of windbreaks and shelterbelts on the sandy lands subject to wind erosion. p. 67
20. That the Authority promote, as far as possible, the installation of drainage measures on the imperfectly and poorly drained soils of the Peel Plain and elsewhere, and the restriction of artificial drainage on the strategic headwater areas where drainage is possible or accomplished. p. 68

Forestry

21. That the Authority, under agreements with co-operators or through lease or purchase of suitable woodlots, undertake the development of Woodlot Improvement Projects to demonstrate the advantages of better forestry practice. p. 28
22. That a Credit Authority Forest be established and that it be expanded through a definite program of annual additions and planting until the total recommended area of 4743 acres is acquired and reforested, p. 32
23. That the Authority encourage private reforestation by purchasing a tree-planter and providing a planting service at nominal cost on land suitable for machine planting, and by offering a planting subsidy where hand

planting is necessary. p. 31

24. That the Authority, by purchase of equipment, organization of cutting crews, or direct subsidy, encourage private owners in thinnings and improvement cuttings in their woodlots. p. 35
- 25.(a) That the Authority investigate the Halton County fencing scheme, and adopt such a modified scheme as seems most likely to result in elimination of woodland grazing, p. 40
- (b) That the Authority publish a simple, attractive bulletin on the disadvantages of woodlot grazing.
26. That the Authority co-operate with schools, government departments> and all other groups and agencies possible to publicize the need and the methods of reforestation and woodlot management; and in particular that the Authority sponsor tours, practical demonstrations and field days for this purpose. p. 33
27. That the Authority act as co-sponsor for:
 - (a) 4-H Forestry Clubs, p. 26
 - (b) The Tree Farm movement, p. 23
28. That the Authority assist in investigating and publicizing markets and marketing methods for woodlot products to encourage:
 - (a) maximum use of low-grade materials from thinnings and improvement cuttings, p. 34
 - (b) Closer and more uniform appraisal of timber, whether standing or in the log, p. 51
 - (c) marking of trees for removal, p. 26
 - (d) securing of competitive bids for timber, p. 54
 - (e) insistence on a written Timber Sales Contract, p. 55
- 29 That the Authority investigate and urge the implementation of the best method of providing fire protection for wooded areas within the watershed in co-operation with the Department of Lands and Forests, p. 43

30. That the Authority encourage the establishment of windbreaks, shelter belts and snow fences. p. 49

Water

31. That mill ponds which are no longer used for power purposes be properly regulated or emptied during the winter months to prevent the formation of heavy ice sheets. p.27
32. That abandoned encroachments such as old bridge piers, abutments and embankments be removed from the flood plains and river bed, p.28
33. That, where practical, properties within the flood plains be expropriated and the lands retained for recreational purposes and that no further encroachments be permitted before being thoroughly investigated from the standpoint of flooding. p.29
34. That the conservation measures outlined in the Land Use and Forestry sections be implemented to help moderate the extremes of river flow, p. 32
35. That local channel improvement work be carried out at Churchville, Meadowvale and Glen Williams without delay at an estimated cost of \$174024.00. p.44
36. 36. The 5-day B.O.D. of tannery effluents be kept down permanently below 200. p.64
37. That the settling basin for the Acton Tannery wastes be divided into six compartments and that the effluent be run into each in turn on succeeding days and that the remaining debris be raked off before any effluent is run into the section again. p.64
38. That the dam holding the final effluent back from the river be reinforced to prevent it from collapsing and allowing the wastes to enter the river, p. 65

39. That refuse dumps along the streams be properly covered to prevent pollution of the streams during heavy rains and in the spring. p. 66
40. That sewage treatment plants be adequately designed to take care of the growing populations to prevent overloading and the subsequent polluting of the streams. p. 67
41. That the silt in wash water from gravel-washing plants be removed in settling basins before the water is returned to the river. p. 68
42. That the Orangeville and Cataract Reservoirs be considered for early construction at a cost of \$1,590,000.00. p. 79
43. That steps be taken to acquire lands for the Belfountain, Silver Creek, Glen Williams and Georgetown reservoir sites, p. 79
44. That a number of community ponds be constructed throughout the watershed, particularly those in or adjacent to proposed recreational areas, to provide added recreational facilities. p. 86

Wildlife

45. That the Authority urge the Department of Health to install a permit system for every new outlet (except agricultural tile drains) which leads into a watercourse, p. 33
46. That the Authority urge the Department of Health to set a time limit within which all municipalities, industries, gravel operators and home owners who now pollute a stream or streams must adequately treat their industrial or other wastes. p. 33
47. That the Authority carry out an extensive educational program concerning pollution. p. 33.

48. That the Authority consider the possibility of acquiring, or at least urging the acquisition for the public of, a stretch of the river below Credit Forks for public fishing. p. 37
49. That the Authority encourage farmers to construct or improve farm ponds for fish. p. 38
50. That the Authority sponsor a demonstration of improvements of a trout stream. p. 36
51. That the introduction of fish into the watershed be restricted to those parts of the river shown on the map "Biological Conditions of Streams" to be suitable for the species concerned. p. 29

Recreation

52. That the people of the Credit Valley be advised by the Authority of the exceptional recreational potential of the Credit Forks area, and of the great possibilities for the future of this area. pp. 10-24
53. That the Authority establish four multiple-use Conservation Areas as follows:
- | | | |
|--|-----------|-----------|
| Meadowvale-Churchville Conservation Area | 377 acres | pp. 26-28 |
| Limehouse Conservation Area | 315 acres | pp. 28-31 |
| Terra Cotta Conservation Area | 500 acres | pp. 31-32 |
| North Caledon Conservation Area | 550 acres | pp. 32-33 |
54. That the Authority establish and publicize a Scenic Route of 62 miles running from Lake Ontario to Orangeville. pp. 52-66
55. That the Authority make agreements with landowners to establish public footpaths linking the conservation areas. p. 25

CHAPTER 1
THE FIRST INHABITANTS

1. Pre-Iroquoian

The earliest inhabitants of the Credit Watershed belonged to those prehistoric races (called the Pre-Iroquoian) which left evidence of its presence in many widely separated parts of Ontario. It does not appear that they occupied the Credit area at all intensively. At any rate they have left few traces behind them. It is unlikely that they neglected to use the region for hunting and fishing; for the salmon of the rivers and the deer of the forests must have been as attractive to these people as they were to later tribes who used the area. Some small sites and surface finds of Pre-Iroquoian origin have been recorded in the southern part of Peel County, but at present these do not constitute evidence of any intensive occupation.

2. Petuns, Neutrals or Hurons

It would seem natural that the flats of the Credit and its salmon fisheries should have led the peoples of the Iroquoian language group to occupy the area in the sixteenth century and it is quite possible they did so. But when Champlain reached the land of the Hurons in 1615 and began to collect information about the Great Lakes Regions, he seems to have heard of no tribes occupying the north shore of Lake Ontario east of the country of the Neutrals and directly south of the Hurons and Petuns. Champlain knew of a river rising in the north-west and flowing south-east into "Lake St. Louis" (Ontario) between the Humber and the west end of the lake. He shows such a stream on his map of 1632, but on this map he places no villages on the north shore near Lake St. Louis.

This has been explained as a result of Iroquois pressure and there have been various speculations as to the

tribes living in the area before the arrival of the French. On the strength of a tradition of the Petun or Tobacco Nation, it has been supposed that this people once located near the Credit. The archaeological evidence does not confirm this tradition and as far as it has any basis in fact it probably refers to settlements farther east.

In the Humber area and eastward evidence of early occupation by peoples related to the Hurons and Petuns is fairly clear, but no such traces have been found west of the Etobicoke.

In the same way the suggestions of occupation by the Neutrals in 1625 - 1650, based on the accounts of missionary journeys from Huronia are not confirmed by any archaeological remains. The Petuns and Neutrals had the same culture as the Hurons and Iroquois. They lived in large villages, some of them fortified with palisades, and placed on easily defended sites on high ground, some a way back from the lake. They cultivated corn fields and gardens and stayed on the same site until these became less productive or firewood difficult to find near the village. This might be for ten, twenty or thirty years, as Champlain reports of Huronia. On the southern river-sites it was possibly even longer, for the river flats were fertilized almost annually with flood silt and the vegetation checked at the same time. Cultivation with the stone hoe or the digging stick was easy under these conditions. The fields could be tilled for a long time without loss of fertility. Though an exceptional flood might reduce one flat to bare gravel, it would probably produce a new one not far off.

Such settlements leave very definite traces and scientific excavation can reveal a great deal about the lives of their inhabitants. The absence of any finds of this type is strong evidence that the area was not occupied by any peoples of this culture. The country between the Etobicoke and the Sixteen-Mile-Creek is at present a blank

on the archaeological map, as it was on Champlain's map of 1632.

Champlain received his first information about this region from Etienne Brule, who passed close to the Credit on his journey southward from near Atherley to the country of the Andastes. If Brule took the Humber Trail, as he is believed to have done and as seems most probable, he will have passed the mouth of the river in coasting along the lakeshore. The Indians, when going to Niagara, were in the habit of following the north shore at least as far as Oakville before turning south; or Brules Huron guides may have taken him by the Head of the Lake and the Grand River. Brule' was the first European to learn the Huron language and no doubt he questioned his companions about the country that lay inland from the shore. *

By 1632, however, Champlain had other sources of information, Missionaries from Huronia had visited the Neutrals in 1626-27. Father Joseph de la Roche-Daillon made an overland journey with a Petun Chief in 1626. He stayed with the Neutrals for some months until Father Grenolle was sent to bring him back, when rumours had reached Huronia that Father Joseph's life was in danger. Father Joseph had had little success with the Neutrals and they were actually on the point of killing him as a witch. He was therefore ready to return with Grenolle, These three journeys were carried out without canoes. It has been assumed that they were all made by the Humber Trail, but they may easily have been by the Grand River, or even possibly by the Credit itself. This seems much less likely, for there is no evidence of an important route using the Credit Valley. The topography of the upper watershed is too rough to make this a much travelled route,

* Champlain gives no hint as to the route followed by Brule before he reached the south shore of Lake Erie. He is usually assumed to have gone by the Humber.

though a trail of some kind following the river and crossing the divide to the Nottawasaga is likely to have existed in all periods.

The same remarks apply to the journeys of the Jesuits, Brebeuf and Chaumonot, in 1640 and 1641. They travelled overland on foot, and their journey in November, 1640 may have been by one of several routes, that by the Grand River being perhaps the most likely. In March, 1641, they seem to have returned by the Humber and in doing so most probably crossed the Credit River at some point. This is likely to have been at the ford below Erindale on the inland trail.

There can have been little movement of traders in this area during the first half of the seventeenth century. The account in the Jesuit Relations of Brebeuf's mission of 1640-1 says that Frenchmen had visited the Neutrals to trade although de la Roche-Daillon was the first priest to do so. The St. Lawrence route seems to have been avoided even before 1635. In that year Brebeuf himself writes that "the fear of enemies and the few conveniences to be met with cause that route to be unfrequented". After the Iroquois destroyed the Hurons, Petuns and Neutrals in 1649-50, this route was completely closed to the French for about seven years.

The travellers to the Neutral country had come from the north. Even if they did not actually follow the north shore from the Humber, they could learn a good deal about its topography. Some information of this kind reached the French mapmakers. Several of the maps made after 1632 omitted the Credit altogether, but Du Creux's map, published in 1660, shows a river with sources far inland at the bases of two ranges of hills, one running from south-west to north-east and the other nearly at right angles to it. This is a fairly accurate representation of the course of the Credit, though the western branches

should have been shown as rising beyond the escarpment and not at its base. When Du Creux was writing his history all this region was the territory of the Five Nations Iroquois, who began more and more to depend on it for both fishing and trapping. Before long they built villages on this side of the lake, scattered at intervals from Napanee to the Humber, and possibly to the Head of the Lake.

Once again, the absence of archaeological sites makes it unlikely that any of these villages were located near the Credit. There were probably some smaller villages of Senecas in this part of the north shore besides the two whose names and approximate locations are known from French sources. Without archaeological evidence these cannot be placed west of the Etobicoke. The vagueness of some of the mapmakers as to the location of Teiaiagon, would make it possible to argue that this village was near or on the Credit, but the written evidence is in favour of the accepted location on the Humber and this is supported by a good deal of archaeological evidence.

The French explorers, priests and laymen both, who were travelling in this region after 1666, were primarily concerned with finding new and easier routes to the north-west or with opening the trade to the French and diverting it from the Dutch at Albany. Their maps show these trails in some detail, but often ignore streams that had no connection with trade routes. Some of the earliest and best maps of this period also omitted the Credit altogether. It does, however, appear on Raffeix's map of 1688. This was evidently intended to give the outstanding features at the ends of the portages so that the trails could be recognized. This map shows a river running from some miles inland through a deep valley, approximately in the position of the Credit, This may

mean that the stream had some significance for travellers, either as the starting point of a minor trail, or more probably, as a land mark for those going west along the north shore.

The introduction of sailing vessels in 1678 had the effect of concentrating attention on the Humber Trail, which had good anchorages near its mouth. The larger vessels, brigantines and 'barques, crossed the lake direct from the Humber to the Niagara River. Far ties in open boats, going from Niagara to Fort Frontenac by the north shore, were in the habit of coasting west for about 13 "leagues" to a point where there was a "traverse of four leagues" to the other shore. This would place them between Burlington and the Credit, whatever value we give to the league,* and they must have passed the mouth of the river just as travellers by land must have crossed it. This was the course followed by the various contingents of the Marquis de Denonville's army, returning in the summer of 1687 from destroying the Cayuga villages east of Niagara. The French probably burnt the Seneca villages in the Toronto area as they certainly did those of the Oneidas farther east. They were accompanied by Ottawas from the north-west as allies and also probably by some Chippewas and Mississaugas, who belonged to the same language group.

3. The Mississaugas - 1690 - 1783

These tribes had been fighting the Iroquois for forty years and had defeated them in battle more than once. The Five Nations had over-extended themselves in their conquests of 1649-51, and far from being able to subdue the northern tribes, could not prevent them from moving south into the lands from which they had driven

* The "modern" league equalled 2.5 miles; but its value in the seventeenth century is hard to determine. It was usually longer than the modern league, but occasionally shorter. In any case it was more than the modern mile.

the Hurons and Petuns, By 1680 the French mapmakers were already placing the Mississaugas east of the Georgian Bay, close to the end of the Toronto Portage. Denonville's expedition did not destroy the Iroquois and for some time only made things worse for the French trade. It did, however, so weaken the Senecas that they had to abandon their castles north of Lake Ontario. During the last quarter of the century the Mississaugas pushed steadily south. Near its end we hear of them deciding to establish themselves at the mouths of the Rouge and the Humber and to make a treaty with the British at Albany. They are said at this time to have had sixteen "castles".

The Mississaugas had a less developed economy than the Iroquoian tribes, closer to that of primitive wandering hunters. They grew corn and vegetables on river flats and had semi-permanent villages near their fields; but they were in the habit of deserting these for long periods, all the families moving together to some location where the hunting, fishing or gathering was particularly good at that season. On these migrations they followed the same trails and camped in the same places, often burying their dead close by the camp site. Such sites will produce relics and are likely to be many and widely scattered. When it was safe, the Mississaugas were in the habit of wandering in small bands, We hear of single families living alone in the woods. Each of these bands would have its favourite locations to which it returned regularly and occupied for some time. The villages also were more primitive than those of the tribes that had been displaced. They were easily moved to a new site in the same vicinity, when sanitary conditions made this necessary.

Until some sites are carefully examined, it is hard to say which of the casual finds in the Credit area represent permanent settlements. Certain French maps of the eighteenth century place a village symbol near the mouth of the river. There is evidence that one existed here at some time. Any trace of it would by now be destroyed by recent building.

No name seems to have been attached to the village. Some maps call the river Ononront but this does not seem to be a Mississauga word. There is some reason to think that the Mississaugas called the Credit or some part of it "Small Pine River", using a word that could be written as Chinguacousy", but this will be discussed later in connection with the naming of the township. Augustus Jones in a list of the Mississauga names of rivers compiled in 1796, calls this river Mes. sin .ni. ke" and translates this as "Trusting River - Credit". The name Riviere au Credit appears on a French map or chart of 1757 made by Boucher de la Brocquere, a naval officer of the Lake Ontario squadron. It was evidently connected with trading. * The Mississaugas had adopted it by Jones' time, but may also have used their own name for the river.

That the river was important to the Mississaugas seems certain, They had some traditions attached to it, such as the one which told how a spirit had taken up his abode in a large rock above Port Credit, They certainly frequented it during the eighteenth century and trading probably took place there before the building of the fort at the Humber. In fact a good argument could be collected from maps and documents for placing the first "Fort Toronto" at the Credit. This post was

* Some maps of 1787-9 have "R/ivie/re au Credai", evidently a misrendering of the French pronunciation of "credit". One map, a copy, has "Rre. au Cedre", obviously a misreading of "Credai".

founded about 1720, a little after the building of Fort Niagara. It was intended to prevent the Mississaugas from going to Oswego and is usually referred to as being "at the end of the Lake" (au Fond du Lac). This was a vague term that might include all the shore west of the Humber, Some maps also place Fort Toronto at the mouth of a river that is probably meant for the Credit, This location might seem a good one for trading with the Mississaugas ; but these arguments would apply equally to the Twelve-Mile (Bronte) and Sixteen-Mile (Oakville) Creeks. A post west of the Humber would be of little use in checking the trade with Oswego. On the whole it seems safer to assume that the first Fort Toronto *was* somewhere on the Humber Trail and that those who placed it at the Credit were in error. This mistake was to have some influence when the first township in the Mississauga tract received its name in 1806.

The first Fort Toronto was closed in 1729. For twenty-one years the official headquarters was at Niagara. Voyageurs who carried on a surreptitious trade along the north shore would probably seek the Indians in their camps and villages and so are likely to have visited the Credit. When a new and larger fort was finished east of the Humber in 1751, every effort would be made to confine trading to this royal post. The Mississaugas formed a new camping ground between the Humber River and the fort. If there was a village near the mouth of the Credit, it was probably abandoned about this time, for the Mississaugas of the Credit appear to have been living farther up the river in the latter part of the eighteenth century, though they had a favourite camping place on low ground near the mouth of the river.

The unlicensed traders who were giving the British Commandant at Niagara such trouble just after 1760, would also prefer the Credit to the Humber. The latter was liable to be visited by detachments of soldiers from Niagara, who arrested the traders and carried them and their goods to Niagara to have their passes examined and their goods confiscated if these were found defective, The British authorities at this time were imitating the French in attempting to limit trade to the posts as far as possible and to suppress the trade in rum. In 1762 General Gage refused to issue passes to traders from Montreal to carry any liquor with them even for their own use and in 1764, after the outbreak of Pontiac's War, all trade in the interior was forbidden for some years. The Mississaugas were involved in this conspiracy, but soon made their peace. The restriction on trade was continued, chiefly it would seem in the interests of the Albany merchants who were trading at Niagara, They objected to the competition of traders from "Canada" who went to the Indians instead of following the approved and safer policy of making the Indians come to them at the forts. In 1767 Sir William Johnson writes with approval of the arrest of two traders "at Toronto where they were trading contrary to authority" and adds -

" I am informed that there are several more from Canada trading with the Indians on the north side of Lake Ontario, and up along the rivers in that quarter, which, if not prevented, must entirely ruin the fair trader. "

An attempt was made to enlist the help of Wabecomnegat, Chief of the Mississaugas, in preventing this trade, However, though Wabecomnegat gave some assistance and said he did not approve of the trading it may be doubted whether he felt very strongly in the matter. Before long the authorities changed their policy and decided that the best way to control the trade from Montreal was

to license responsible traders who would post bonds to obey the regulations. In September 1770 Jean Bonaventure Rousseau, called St. Jean or St. John, was licensed to trade at Toronto "and from thence to any markets or parts which he should find advantageous for the sale of his merchandise", His party was to consist of one canoe with six men besides himself, and his merchandise, valued at £ 300, included a fair quantity of rum, a smaller amount of wine, four rifles, 300 pounds of gunpowder and 1600 pounds of shot and ball. For this license Rousseau posted a bond of £600, Provincial Currency. *

It seems fairly certain that the Credit River was one of the "markets or parts" that Rousseau intended to visit. The fact that he took his license in September would indicate that he wished to reach the Toronto area about the time of the corn harvest. He would thus be in time to establish relations with the Mississaugas before they dispersed for the season's trapping; to collect whatever they had to trade at that time of year - ginseng, some deer skins and a few furs - and advance them supplies for the coming winter. These would be paid for when the winter's take of prime pelts was brought in for trading. This form of credit barter had long been a commonplace of fur trading, for the less settled tribes had no means of storing either supplies or furs for any length of time. The rivers of the north shore provided good locations for seasonal barter . The Indians came to them regularly for the salmon run in the late spring and in some cases stayed to plant corn. Whether it was worth while for some of the traders to remain through the winter would depend on the local supply of game, on the cost of an extra journey to

* See P.J. Robinson: "Toronto under the French Regime", pages 210-1. Rousseau's license and bond are in the Canadian Bureau of Archives at Ottawa as well as those of the other traders licensed to trade at Cataragui in these years . Quite a large number were licensed (almost all French) and some may have visited the Credit besides the Rousseaux.

and from Montreal, and the danger of being forestalled by rivals. Some traders are known to have had houses in the Quinte region during the war, but there is no mention of a semi-permanent post at the Credit at this time.

Jean Bonaventure Rousseau or his son Jean Baptiste (also called St. John) were trading at Toronto between 1770 and 1785, with interruptions caused by their duty as Government interpreters. There were other traders operating on Lake Ontario at this time, but all trade was probably interrupted in 1775-6 when the Continental forces were invading Lower Canada, and were for some time in possession of Montreal. Some Mississaugas from this region had helped defend St. Johns on the Richelieu against a preliminary attack in 1775, but departed when they found the French Canadians unwilling to resist the rebels. During the rest of the war there was no fighting on Lake Ontario. The forts were never seriously threatened, although they were lightly garrisoned and were being used as bases for raids. During these years the Mississaugas remained friendly with the British, but showed more interest in their profitable trade in ginseng and furs than in fighting for their allies. It was probably at this time that salmon, and maple sugar gained importance in the Indian trade. The soldiers and refugees at the forts needed provisions of all kinds which had to be brought at great trouble and expense from Montreal. Any local supply was of value and it was partly for this reason that a settlement of Loyalists was begun at Niagara before 1780.

A good deal of the increased traffic on the lake was carried in boats and canoes and for these the mouth of the Credit was a convenient landing place, Captain Walter Butler travelling to Montreal from Niagara in the spring of 1779 (an early spring apparently)*, reached

* Butler makes no mention of ice. This passage is quoted in Robinson op. cit. from Transactions Canadian Institute, 1892-1893, p.280.

Burlington Beach the first night. His diary goes on:

"March 12 - Set off at seven o'clock this morning; the wind at N.W.; too much off shore to sail; rowed till 11 o'clock; put into the river called the Credit, 17 miles from the last station. The shore in general good for boats to land; the land low and a good beach, except points which are bluff. Two Mississaugas came to me and informed me a number of them lived up this river. Gave them bread and put off at 12..."

Lieutenant-Colonel John Butler of Butler's Rangers, the father of Captain Butler, was, as Indian agent after the war, to negotiate some of the treaties by which the Mississauga lands were purchased for settlement; but not long after this journey Walter Butler fell while leading a raid against his old neighbours of the Mohawk Valley in New York.

THE APPROACH OF SETTLEMENT

When the Provisional Treaty of 1783 ended the Revolutionary War in America, the British Government was pledged to find homes for American Loyalists and to compensate their losses. The simplest and most satisfactory way to do this was to provide lands in the remaining North American territories. This made it necessary to open lands on the St. Lawrence and lower lakes for settlement. It was the established policy of the Government that this could only be done by formal treaties with the Indian allies. This policy had been followed strictly after 1760. In 1763 a proclamation had made private negotiations for the purchase of Indian lands not only illegal but actually treasonable. Purchases made without the authorization of the Home Government had been revoked, even those made by the governments of colonies.

This proclamation against private purchase was repeated more than once in Canada after 1783,* The Government showed no reluctance to buy territory from Indian nations when the demand for land made this desirable. But it consistently refused to recognize titles arising from gift, purchase or lease not expressly authorized by the Indian Department. Even in the vexed case of the Mohawks on the Grand River and the Bay of Quinte, who held their land by grant from the Crown, such assignments were approved with great reluctance and under considerable pressure. In the case of the Mississaugas, Chippewas and other nations the issue was clear; petitions to occupy lands outside the treaty areas or parts within them reserved for Indians were very rarely successful,

In 1783 the only lands in Ontario that belonged to the Crown were a small strip on the west bank of the Niagara River purchased in 1764 and small areas at Cataraqui and on

* Ontario Department of Archives Report, 1920, pages 220-3. An elaborate set of rules governing the making of purchase treaties was laid down in 1794.

the Detroit and Ottawa Rivers that had been in French hands at the Conquest, The need for further purchases had been foreseen and steps taken before the signing of the provisional treaty. Early in October, 1783, the chiefs of the Mississaugas assembled at Cataraqui to negotiate the sale of their lands between that place and the "Grand Ecors" or High Land in what is now Scarborough Township." Owing to the absence of some chiefs from the Toronto Region, it proved only possible to buy the land as far as the Trent at this meeting. Three years later the "Toronto Purchase" was negotiated at Carrying Place on the Bay of Quinte. This was to run from a line beginning on the lakeshore at the west end of the High Land to another line beginning at the mouth of the Etobicoke, and was intended to include the whole of the Humber Portage.† The Purchase was made not so much for immediate settlement as to ensure the free use of this route to the Montreal traders.

The Mississaugas had evidently realized by this time that the arrival of settlers on their rivers meant an end to their full control of the fisheries, In the Purchase Treaty they had reserved the fisheries of the Toronto rivers, but this did not satisfy some of the tribes. When Alexander Aitkin attempted to survey the boundaries in August, 1788, the only chief on the spot tried to confine him to the area between the Don and the Humber. It was only after the arrival of Colonel John Butler with some other chiefs that the Indians would agree to accept the boundaries laid down in the treaty, Even then they would not allow the straight line of the western boundary to be run from the mouth of the Etobicoke, crossing the river at two points. "The Creek", they said, "was a Boundary that could not be altered or moved but that a line in a few years would soon grow up with Brush and trees." **

* Now Scarborough Bluffs. Highland Creek takes its name from this High Land.

† It was discovered later that owing to miscalculations the northern end of the portage was outside the purchase.

** Robinson, Toronto under the French Regime, pages 166-8. The quotation is from a letter from Aitkin to John Collins, in the Canadian Bureau of Archives, Ottawa.

The line (which was not surveyed until later) had to begin on the left bank at Summerville, Except for the first three miles, where the river was later made the boundary of Etobicoke Township, it is still the boundary between York and Peel Counties. For thirty years this line separated the "Mississauga Tract" from the lands open to settlement to the east. These now stretched from this line along Lake Ontario and the St. Lawrence River to the future boundary between Upper and Lower Canada. Butler and the chiefs had just come from signing a treaty that extinguished the Indian title to the north shore from Toronto to the Trent. In 1792, after the formation of the Province of Upper Canada, another Mississauga Purchase fixed the western boundary of the Tract at a line running north-west from the opening of Burlington Bay. This short stretch of shoreline was now of great importance to the Mississaugas as their only remaining foothold on Lake Ontario. Its rivers became their principal salmon fisheries, for, as they had feared, the arrival of settlers inevitably interfered with the fishing. There were no permanent settlers near the Tract in 1792, but the founding of York in the following summer entirely changed the situation and placed the Tract across the main line of communication between the new capital and the western part of the province.

1. The Beginning of Dundas Street

It seems most probable that from the earliest times there had been two main Indian paths crossing the lower part of the Credit Watershed. The path along the lakeshore seems to have been less clearly marked. It would be most used in winter, when there was firm ice; at other seasons there would be difficulty in crossing the larger streams." Both paths were part of the great trail that led round the lake from

* Some of the Berczy settlers, driving the cattle round the head of the lake to Markham Township in 1794, were ferried across the Credit "in the canoe" by some Mississaugas.

Cataraqui to Niagara, crossing many others leading to the north and west, It was used in turn by the successive nations who dominated the area, and after 1720 by the French winter couriers between Forts Frontenac, Niagara and Detroit,

By the mid-eighteenth century there was one regular winter post between the forts, a custom continued by the British after 1759. The couriers (usually Indians) seem to have started in January, when the weather could be expected to be settled for some time, They travelled on foot, usually with snowshoes. Special couriers were sometimes used for shorter journeys, like the unfortunate soldier, La Lime, who was sent with dispatches from Niagara to Fort Rouille (Toronto) in 1752. He never arrived at Fort Rouille; his body was found weeks later by Mississaugas (sent by Lefebvre du Chouquet, storekeeper at Fort Rouille), partly eaten by wolves but with no wound on what remained.

Portions of this inland path are shown on certain early maps made before it can have been much altered by settlers, These are chiefly east of the Humber, and no such map has been found for the Mississauga Tract. The path ran from the lowest ford on one river to the lowest ford on the next, taking the most convenient route between fords. After crossing the Etobicoke a little below Summerville, its line was nearly that of Old Dundas Street as shown on the maps of 1798 and 1806. It followed the foot of the bluff a little above the seepage line, only occasionally climbing to higher ground, In this way the bluff formed a convenient landmark, and a dry path could easily be found on its lowest slopes,, This would cross the longer streams where the sides of the gullies were low and go around the swampy sources of the shorter creeks.*

The Credit seems to have been crossed some distance below Erindale. Beyond this ford the path may have

* Davenport Road in Toronto follows part of this path west of Poplar Plains Road,

forked, one branch running south-west to join the lakeshore path and the other continuing to follow the bluff and eventually climbing to the high ground above the Escarpment,

Such paths were hardly satisfactory as the only land communication between the settlements, but they were the only ones available on this side of the lake in 1793. The opening of roads was one of the objectives of Colonel John Graves Simcoe, the Lieutenant-Governor of the new Province of Upper Canada. It was for this purpose that he had urged the formation of the Queen's Rangers as a Pioneer Corps, He had conceived the idea of a great road to connect Detroit with Kingston and Niagara, The course of the first section was determined by his journey to Detroit, January - March, 1793. It was to serve as a portage road between Lake Ontario and the River Thames and was to run as directly as possible from the highest boat landing in Cootes Paradise, near the site of the town of Dundas, to the Upper Forks of the Thames at the site of Woodstock. It was to be called Dundas Street, and to be continued along the north shore of Lake Ontario to York and eventually to Kingston and Lower Canada,

Surveys were made at once, and in September a party of 100 Queen's Rangers was sent to open the road, In May, 1794, Simcoe ordered Alexander Aitkin "to Mark a Road from York to join Dundas Street at the Widow Mordens, making an offset to the Beach at Burlington Bay..." as soon as he had finished opening part of Yonge Street. Aitkin seems to have carried his survey as far as the Beach by the middle of August, when he was summoned to continue the work on Yonge Street, About this time the Rangers were ordered to Niagara and no more was done for more than a year,

Aitkin was by then busy elsewhere and D.W. Smith, Acting Surveyor-General, wrote from York on July 18, 1795, to Augustus Jones, Deputy Surveyor:

"His Excellency the Lieut. Governor having been pleased to order that you should open a Horse path from York to the Bay of Quinte, as a Ground work

for the Continuation of Dundas Street, you will proceed upon that work, as soon as you have completed the Survey Westward of the River Nen.*

"In tracing this Road, you will have general regard to the proper Situations for its crossing the Creeks, which His Excellency conceives will be at about 2 Concessions distant from the Lake,, in the several Townships

.....
In perfecting this it will be necessary to connect the Road from Mrs. Morden's, that is, from the King's Landing place near Coot's Paradise, to where you discontinued it abreast of the Long Beach."†

More pressing work intervened and in November Smith again tells Jones to "connect" the road on his way to York from his home in Saltfleet Township, On Christmas Eve, 1795, Jones reports that he has done this.

Simcoe gave Augustus Jones orders the next spring to begin cutting the road, and a small party of Rangers was at work early in April, 1796, On April 24th Jones writes to David William Smith at Newark (Niagara-on-the-Lake):

"I am directed by His Excellency Lt. Gov'r Simcoe, to inform you that His Excellency has been pleased to order me to Commence Immediately, and open a road (part of Dundas Street) and to bridge the Creeks between the River Humber and the Out-let of Burlington Bay; which I have been employed at some time - there is also sent a Serjant with ten men, and three Artificers, of the Queen's Rangers, who are to assist at the afore said work - Capt. John Grahams Master Carpenter, at York, has been with to look out the most Eligible Places to erect Bridges a Cross the large Creeks he is of opinion that there Cannot be a bridge made to stand the floods a Cross the River Credit, where the line run by Mr. Aitkins Cross, nor no where neat (sic) it, on account of the low flats along the River, which are over washed evyery (sic) high Waters, in the Spring season; he says that the most Eligible Place to build a Bridge is near the Lake, inside of the Beach - I have opened, on the line, near the River Credit, about two and a half miles, Previous to Capt. Grahams & the Artificers Coming to me, when after I had their opinion in regard to the bridge, I left that part of the road and Came on With him to the Sixteen, where the Carpenters have begun getting out timber, for a Bridge, and the rest of the men, are Proceeding on the road, between that, and Burlington Bay, I have not as yet had any Written Instructions, Capt. Graham returned yesterday for

* The River Rouge - the survey was in Pickering Township.

† Survey Records, Lands & Forests; Instructions to Surveyors, Book 2, pages 183-4.

York, on his report to the Governor I hope he will order me a few lines, whether I am to change the road near the Lake, at the River Credit or to open it on the line."*

The Governor had already left York for Niagara before Graham^t returned, and it was the Acting Surveyor-General who, on May 3, 1796, wrote (rather dryly) to Jones on this matter:

"To Mr. A. Jones, D.P.S.
Saltfleet, or Surveying
North side of Lake Ontario

Sir,

I communicated your letter respecting the Bridge to be made over the River Credit, to His Excellency the Lieut. Governor who does not seem to approve of any great deviation, from the Line, as originally marked by Mr. Aitkin.

I am, Sir yrs. &c.

D. W. Smith"***

Jones acknowledges the receipt of this letter and two earlier ones on May 26th and says:

" ,,,I have been Busy on the road, north shore of the Lake, since I had the honor to write you last - and in a few days more will have it open, from Burlington Bay, to the River Credit, with the Bridges Compleat over the two large Creeks, the 12 and 16 miles."tt

The road had been completed to the Humber before the middle of July. Jones shows the "Road leading from Burlington Bay" on a plan of the King's Mill Reserve dated July 7, 1796. The larger bridge over the main channel of the

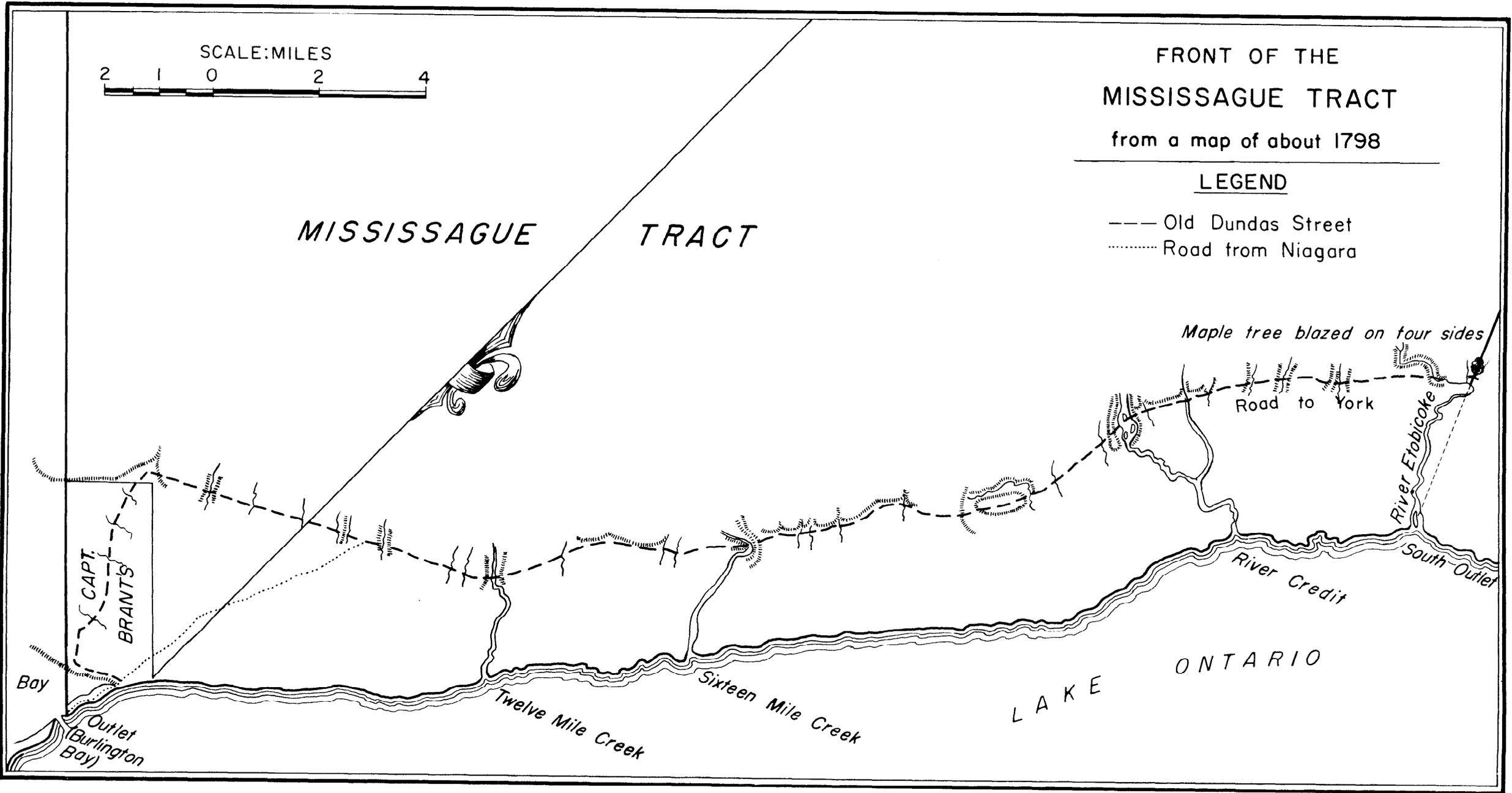
* Survey Records, Lands & Forests; Surveyors' Letters, Volume 28, pages 91-4.

t Colonel John Graham had not yet moved to his lands on Yonge Street in Whitchurch Township, south of Aurora. He was at this time Captain-Lieutenant in the Rangers. Graham was a Loyalist from Nova Scotia who had brought two "Servants" with him to Upper Canada, one of them a mason. He seems to have been a carpenter-contractor by profession,

** Survey Records, Lands & Forests; Letters Written, Volume 5, page 1350. Jones had a habit of taking orders direct from the Governor and not notifying the Surveyor-General's office until the work was well advanced. The address of this letter hints at Smith's annoyance at not being kept informed of Jones' whereabouts.

tt Surveyors' Letters, Lands & Forests; Volume 28, No. 101.

Mississague Tract



Humber is marked as "proposed". The Executive Council approved an account on July 21st for a payment of £30 ls. 6d. "Dollar at 5/" (Halifax currency); for opening Dundas Street between Burlington Bay to the Humber".*

From this correspondence it is clear that Simcoe was responsible for the inland location of Dundas Street, and that little deviation from this line was permitted until the road was straightened as a settlement road in 1806. The reasons for this were not simply those given by Smith - that it provided better crossings of the rivers, Dundas Street was a military road; its location was not chosen primarily for the convenience of the settlers, who would have preferred the Rangers to spend their time in areas already occupied.[†] A road along the shore would be difficult to keep open if an enemy should get control of the lake, and a bridge on the beach could be destroyed by one or two gunboats without landing a man and would be quite as vulnerable to floods. Without a bridge it would be necessary to ferry over the deep reach near the mouth; at the rapids the river could be forded as soon as the water had fallen,

If any bridges were finished over the Humber and Credit they were soon swept away, Joseph Brant, in December, 1797, says "the rise of the waters" had made it dangerous to travel from the Head of the Lake to York,**and there were probably freshets in the spring of 1797 and in 1798. It was the difficulty of maintaining passable bridges and causeways near the mouths of the creeks that kept Dundas Street in use after the opening of the Lakeshore Road in the summer of 1798.

Plan in Survey Records, Lands & Forests, reproduced in Lizars: "Valley of the Humber". Minutes of the Executive Council, Simcoe Papers, Ontario Historical Society, 1931, Volume V., page 199.

† In a letter of 1793 The Honourable Richard Cartwright complained that the Rangers were not being used "for the service for which they were ostensible raised, of opening roads and building bridges between the different settled parts of the country..." Simcoe Papers, Volume II, page 89

* * Russell Papers, Volume II, page 41.

This is made clear in a letter from the Surveyor-General read in Council on August 6, 1798.

" I think it my duty to suggest to your Honor, whether the purposes intended to be effected by the opening of the new Road to the River Credit, will not be lessened unless Mr. Jones is instructed to cut out the fallen timber from the old road, as soon as he has perfected the new one - submitting it to your Honor, that until Bridges are built over the mouths of the Humber, Etobecoke, and Credit the whole of the old road, should be cleared of such fallen timber - It may not be improper to mention that the Bridge over the main branch of the 12 Mile Creek, is the only one remaining between this and the head of the Lake, and to inform your Honor that in the opinion of several from whom I enquired, the Bridge over the outlet might be set upright at small expence - the Road altogether is lessened of its consequence by the steepness of some of the hills, which I apprehend might be improved, without much cost ..."*

The Council ordered the old road cleared and bridged and the hills cut down as Smith had suggested, Augustus Jones was working on these roads in August,[†] but the clearing of Dundas Street was left to a party of Queen's Rangers, commanded by a sergeant who had been instructed by Jones, There seems to have been some doubt as to whether these men had done their work properly and John Stegman, D.P.S., was sent to inspect it. He wrote to the Surveyor-General on January 16, 1799, from the Head of the Lake:

"...that in my coming up to this place, I met the party of the Rangers on the Road at the 16 Mile Creek - who were on their way going to the Garrison. I produced your Instructions to the Serjeant, and told him, that I thought the old road was not sufficient; then he made answer, that it was Mr. Jones* orders, to cut up the fallen timber in the old road only - however in my going along the said Road found that in many places, the Road will not admit of Slays passing each other agreeably to your Instructions - therefore I thought it proper to begin at the head of the Lake with my party and make such amendments as may be most necessary, until I meet the party of the Queen's Rangers from Yonge Street -
....."***

* Upper Canada State Books (Public Archive of Canada), microfilm copy, Ontario Archives, page 197. **Minutes of Executive Council, August 6, 1798.**

† Lizars. Valley of the Humber, page 50.

.. Upper Canada State Books (Public Archives of Canada), microfilm copy, Ontario Archives. Minutes of Executive Council, York, January 19, 1799, pages 313-4.

Stegman sent this letter by Samuel Street Wilmot, his assistant, whom he had placed in charge of the party coming from Yonge Street. When the letter was read in Council on January 19th, another party of nine Rangers was ordered to go to meet Stegman.

The improvement of the roads west of York in 1798 was part of a scheme to complete the military waggon road across the province. Asa Danforth's road from York to Kingston, opened in 1799-1802, formed the main part of this highway, and it has been said that he also opened Dundas Street west of York. No evidence has been found that Danforth had any connection with the roads between York and Burlington. In fact the improvement of these roads seems to have set the standard for Danforth's contract, Dundas Street west from Cootes Paradise had been "opened for Carriages" in 1793 by clearing the brush and small timber from a strip "about three perches wide" (nearly 50 feet). A second party followed to cut down trees under eighteen inches or thereabouts" from the actual roadway "as near the ground as possible". Larger trees seem to have been left standing; no grading is mentioned except some terracing with logs along the hillsides, Jones's continuation to York in 1796 was probably similar, but since it is called a "horsepath" it may have been narrower, with less terracing and slighter bridges."

Danforth's contract of 1799 called for thorough clearing of a strip two perches (33 feet) wide, All brush and trees were to be removed, and as near the centre of the strip as possible, a roadway 18 feet wide was to be made "smooth" with the stumps cut close to the ground, Steep hills were to be graded, and strong bridges and causeways of cross-logs the full width of the road were to be built over all

* Survey Records, Lands & Forests; Letters Received Volume 2, page 655. Jones is writing in answer to an inquiry from D. W. Smith in 1794 as to how he and Captain Smith of the Rangers had opened Dundas Street. William Berczy had just contracted to open Yonge Street in the same fashion. The wide strip was cleared to facilitate the cutting of the larger trees.

streams and swamps, These specifications became standard for roads opened by government before 1812. They seem to have been worked out in improvements to Dundas and Yonge Street in 1798.

There were military reasons for improving communications as fast as possible. The situation seemed even more threatening than it had a few years before. Troops might have to be moved at short notice and in the winter season. Regular news from Detroit and Philadelphia was of vital importance. There was already a fortnightly mail from Fort Niagara (New York) to Canandaigua and Geneva, with arrangements for collecting and delivering letters in Canada.* In August, 1800, a scheme was drawn up for mails once a week from Niagara to York and from York to Montreal, to be carried by land,

Couriers were to leave York every Monday morning, arriving at Kingston on Tuesday evening and exchanging bags with a courier from Point au Bodet on the border of Lower Canada. In the same way a courier from York would meet one from Niagara (and later one from Detroit) at the King's Head Inn and return the next day. It was hoped that the mails from Montreal would be carried in light waggons, but the couriers to the Head of the Lake were evidently expected to go on horseback. This program probably had to be modified in practice. The time allowed to Kingston was too short for any waggon, except in the most favourable weather and with fairly frequent changes of horses, However, regular mails of some sort were established about this time.^t

2. The Government House at the Credit

It has been stated that John Coon was squatting at the Credit "before 1793" as a trader and innkeeper. If so,

* Upper Canada Gazette, May 12 and 26, 1798.

† Survey Records, Lands & Forests; Letters Written, No. 11, pages 668-9; Memorandum by D. W. Smith "Weekly Post", August 23 1800. Smith thought the cost of the post to Point au Bodet would be 14 plus the couriers' wages and that to Niagara £4.

he must have built the first house in the watershed, No authority is given for this and no contemporary reference has been found to place a John Coon here before 1798.* There seems to have been no house near the river in 1793-8, for there are accounts of travellers spending the night in their boat when delayed by bad weather, Some shelter for travellers was needed where the highway crossed Indian lands or other unsettled areas, and a large inn called the "Government House" or "King's Head Inn" was built in 1794 at the south end of Burlington Beach, This was to be combined with a depot for naval and military stores, but the houses which Governor Simcoe planned for the points where the road crossed the Credit and the Grand were intended as "post houses" where shelter, food and fodder would be available and possibly relays of horses for couriers.

Writing of the Mississauga Tract in September, 1794, Simcoe says:

"When it shall be expedient, permission is granted to cut a road thro' it, & to build a Post House where it may be proper - At present the Communication is in boats around the Lake..."^t

Governor Simcoe himself made one of these boat trips to York in November, 1794, and was forced to spend a snowy night in camp at the Sixteen Mile Creek on the north shore.** He had no opportunity to carry out his intention before he left Upper Canada in August, 1796. Early in June of that year the whole Simcoe family again made the boat trip from Niagara to York and were windbound for several days at the King's Head Inn.

* Bull, William Perkins. From Strachan to Owen, page 49. No documentation is given. Coon is said also to have operated a boat between the Credit and York, The latter was not founded until 1793, and "1793" may be a misprint for 1798. Coon may have settled at the Credit before that year, or he may have applied for land there in 1797. Russell Papers, Volume II, p. 74; Russell to D. W. Smith.

† J. G. Simcoe to the Committee for Trade and Plantations; Simcoe Papers, Volume III, page 59.

** On November 15; Simcoe Papers, Volume III, page 203.

Mrs. Simcoe gives a full description of that house in her diary and mentions the intention to build one on the Grand River.* The entry in the diary for June 16th records their departure from the King's Head Inn:

"Thurs, 16th June, 1796 - Rode to the inlet and embarked in the boat, for the continued east wind had raised such a swell we thought the canoe would not be pleasant. The wind was light. It soon became calm and continued so until 12 o'clock, when it rose violently from the west, which coming against the swell formed a terrifying sea,

"The motion of the sea was disagreeable and my fears awoke also, till we landed at 3 o'clock at the River Credit, 12 miles from York, We were surprised to see how well the canoe made her way through this heavy sea. She rode like a duck on the waves. After dinner we walked by the River Credit. Numbers of Indians resort here at this season to fish for salmon, and the Governor wishing to go some way up it, which our boat was too large to do, he made signs to some Indians to take us into their canoe, which they did; there were two men in her, which with ourselves and Sophia completely filled the canoe. They carried us about three miles, when we came to rapids and went on shore,

"The banks were high, one side covered with pine, and a pretty piece of rocky country on the other. On our return to the canoe a small snake was in it and the Indians took it out with caution and abhorrence, They hate snakes, which they seem to dread more than the Europeans do, We returned to our boats; Where, not having any provisions left, or money, the Governor made signs to know they should be recompensed for their trouble if they came to York; There is abundance of salmon caught in this river. About five, the weather-being calm, we set out and arrived at York at Nine,"

Three miles up the windings of the river would take them near to the line of Old Dundas Street and well above Wilmot's "1st Rapid". Probably a loaded canoe could pass this first shallow in a moderately wet season. The stop at the Credit had most likely been planned to allow the Governor to look over the ground and decide on the location of the bridge, He may well have selected a site for the inn, but it is probable that this was changed when the actual order to build it was given in 1798, after the Government Offices and the Courts had

* Two hundred acres had been obtained from the Mohawk Chiefs in August, 1794. The inn was to be at a ferry "where the road crosses the Ouse or Grand River to Oxford on the Thames". As this would most probably mean Dundas Street to Woodstock, the inn would have been near Paris, In the end one was built west of "Brant's Ford".



The "Government House" at the Credit re-drawn from a sketch in Robertson's "Landmarks of Toronto" based on descriptions by the last owners-Destroyed 1861.



*Near Erindale - this cottage, on Lot 33, S.D.S. granted to Peter Covenhoven (Conover) in 1806, is typical of the style of 1815-1825. Conover's Tavern was **not far off** and Conover's Brewery stood a little to the east in 1859 - stucco or roughcast on frame was considered warmer than clapboard.*

Silverdale-This round-log house stood to the north of the sawmill around which grew the first village of 'Sligo'. Its size and central chimney suggest that it was built as a tavern. The house may date from before 1830.



rise above the flats and appears to have faced away from the river." The Lakeshore Road turned down at this point and boats could land directly below the inn. There were probably Indian paths down both sides of the Credit from the "upper Road". The western one was to be improved into a road, but travellers from York who preferred Dundas Street could reach the inn by the left bank.

Twelve hundred silver dollars was a good sum to spend on a house in 1798, The Government House was not particularly small by the standards of that time. Judging by sketches made from descriptions furnished by people who had seen the house, it may have been about 40 feet by 30 feet. It was substantially built of squared timbers and may have been covered with clapboards from the first. This was commonly done with log houses before 1830, and boards could easily be brought by water from the Humber or the Head of the Lake. The two big chimney stacks were of stone from the river bed, They were placed on the line of the partition between the two large front rooms and the narrower back rooms. Each of them probably served two or more hearths. The sketches show large windows with many panes, in the style of the King's Head or of Brant House at Burlington, but the inn had only a low attic storey above a ground floor of ordinary height. It may have contained eight or nine rooms.[†] The fitting up was probably not in the same comfortable style as the King's Head.

See Wilmot's plan of Toronto Township, 1806. Lynn's plan of Port Credit in 1837 shows a little house in this position on the "Government Reserve" marked "Inn". This appears to face south, but a plan of 1852 shows an unnamed building with its length parallel to the bank and a narrower wing at the end towards the lake. This last may be an addition, as it does not appear in Robertson's Sketches. These were based on a description given by the Lynd family. Robertson. Landmarks of Toronto, Series V, pages 316-8 and 486.

† That such a house could be built for £300 Currency in 1798 is evident from some surviving contracts for houses in York. Some storey-and-a-half houses had as many as seven or eight fireplaces with two central stacks, but three to five was more usual. The house was to be built by contract, but it may actually have been built by the Queen's Rangers, as has been stated. The Rangers had built some private houses in York as well as public buildings.

The next official reference to the Government House, in the list of Government Property in Upper Canada in 1799, gives the same reason for building the house and adds some details as to how it was maintained.

"River Credit - a house was built at this place for the accommodation of travellers passing to and from the seat of government through the Mississauga Tract of land. This house is in the occupation of Mr. Allan, merchant, under a lease of one dollar per annum and an obligation to have it properly kept for the accommodation of travellers."*

Colonel William Allan, J. P., was a prominent merchant in York and soon (1801) to be appointed the town's first Collector of Customs, He never lived at the Credit and fulfilled his obligation through employees or sub-tenants, Allan's lease probably began after the house was finished in 1798 and ran for seven years. During this time the inn was actually occupied by a series of tenants whose names are known from documents. Peter Russell, reporting Brant's manoeuvres in September, 1798, says of the Credit: "...Coon who keeps the Public House there is not to be trusted.† Coon's tenancy was short, for in 1801 Benjamin Gilbert is referred to as "trader at the Credit" in that and the previous year. In 1803 Gilbert took a tavern license, giving his residence as "at the Credit". A year later John Kendrick, one of a well-known York family, took a license for the Credit.**

The assessor for Etobicoke Township returned " ...Ingorsal" as an inhabitant in March, 1805, with a household

* The original of this list is in Upper Canada Sundries, 1800; Canadian Bureau of Archives, Ottawa. It was prepared for the information of Governor Hunter,

† Russell Papers, Volume II, page 261; Russell to Prescott. The Sergeant John Coon who was finishing the first house on the Don when Mrs. Simcoe visited him in September, 1793, had a son of the same name. There seems to have been at least one other John Coon in the Home District at this time, The John Coon who was "actually living" on Yonge Street in July, 1798, is not likely to have been at the Credit in September,

** Bull, Perkins. From Strachan to Owen, page 49, note 329, quoting the Minutes of Quarter Sessions for York County,

of eight persons,* There is no evidence that Major Thomas Ingersoll ever lived in Etobicoke. More probably he was already installed at the Credit and was listed as the only white householder in the Tract. Ingersoll can be shown to have been living in his township of Oxford-on-Thames until late in 1804. He was keeping the inn in August, 1805, when he furnished refreshments to the officials gathered there for the treaty meeting, The fact that the assessor did not know his Christian name strengthens the assumption that he was not actually a householder in Etobicoke in March.

The "Ingorsal" household in March, 1805, consisted of Thomas, his wife, a "female child" over 16, two sons and two daughters under 16, and one servant. Thomas Ingersoll and his third wife[†] had six children living in 1805, all under 15. A daughter by a previous marriage was part of the household, but the two elder boys were away from home, possibly attending school at Newark and living with their half-sister, Laura Ingersoll Secord. Ingersoll's third daughter, Myra, had married Julius Hitchcock before the family left Oxford; and the second, Elizabeth, married in 1806 Daniel Pickett,** who was one of the early grantees on Dundas Street, She may

* Robertson, Landmarks of Toronto, Series I page 310. Thomas Ingersoll, with "numerous associates" received an Order-in-Council reserving Oxford Township in March, 1793. He kept a tavern at Queenston for some time, but seems to have moved his family to Oxford in 1796-7, after the marriage of Laura, his eldest child. Nathan Bangs, the missionary, records a visit to the family, in their homestead on the site of Ingersoll, in the early fall of 1804.

† Thomas Ingersoll had married Mrs. Sarah Backus in 1789. It may have been her daughter who was living with them in 1805 and not Elizabeth or Abigail Ingersoll. Their eldest child, Charles (b. 1791), may already have been apprenticed to the merchant in Newark (Niagara-on-the-Lake), for whom he was working in 1812, but Thomas (b. 1796) was too young to "bind out". Their two brothers were under 7, but their sisters (12 and 11) were old enough to help their mother.

** From the Doomesday map it would appear that Pickett's name was entered on Lot 13, Concession I, S.D.S., in 1806-7 and he had returned his certificate by May, 1810; he did not patent until 1818. Elizabeth Pickett is said to have died in 1811, and Daniel's work as a Methodist preacher must have taken him away from his farm on Dundas Street.

have lived for a time not far from the Government House, Ingersoll's youngest child, Sarah, was born in January, 1807, one of the first white children born in what is now Peel County. The servant was probably a hired man, for Thomas, at 56, would need some help with the farm and chores.

The following year (1806) Major Ingersoll petitioned for a lease of the inn for seven years at \$2.00 a year, offering to put the house in good repair and to lath and plaster three of the rooms. Apparently Ingersoll had arranged to take over the last twelve months of Allan's lease to see whether the inn offered a better living for his family than seemed likely to be possible in Oxford until that settlement began to develop more quickly. He had evidently decided that the opening of Dundas Street for settlement would make the inn more profitable, increasing boat traffic without immediately reducing that on the road or lessening the value of the trading post. It had been the latter that had chiefly interested Allan and his tenants; the income from the inn must have been small before 1806.

The family continued to keep the inn for some years after Thomas Ingersoll died in 1812, but were probably gone from the Credit by 1816 or 1817. The inn was then taken by Wesley Watson, a British subject who left New York for Canada during the war. It passed to his daughter and his son-in-law, Moses Polley, who was drowned in 1839. By that time the Government House was too small to compete with the larger inns that were being built in the village. Mrs. Polley continued to live in the house after she became Mrs. Robert Lynd in 1841, but it does not appear to have been one of the two inns listed in 1846-1851. In 1858 Robert Lynd patented the lot and three years later took down the house to rebuild it on a farm. In 1863 fire destroyed the timbers of the first inn on the Credit.

3. The Beginning of the Lakeshore Road

The Indian path along the lakeshore had been used by travellers both before and after the opening of Dundas Street, It may have been possible to use it as a bridle path, but there was no waggon road until the Order-in-Council quoted in the last section was carried out in the summer of 1798.

The Surveyor-General's letter of August 5, 1798, goes on:

".....and in case the Road along the Lake to the Credit, from this town, is to be considered as a public Road, for the convenience of all His Majesty's Subjects, your Honor will probably see the necessity of carrying it without the Garrison,

"I enclose a proposal left at the Office by Mr. Miles, and copies of two applications from Mr. Jones."

It was ordered "that the Road be brought into the Town of York so as not to pass through the Garrison".

Abner Miles's proposal was an offer to build bridges over the Humber and Credit for \$600 each. It was determined to build these by contract, and other tenders were received, but no bridges had been built by the end of 1798. If any were built at this time they were soon destroyed. The lease of the Humber ferry was renewed, and we are told of one run by the tenant of the Government House at the Credit, The work seems to have gone on slowly or to have been badly done.

A notice in the Upper Canada Gazette for August 18, 1804, inserted by the Commissioners appointed to superintend the spending of money recently voted for roads calls for tenders "from any Person or Persons disposed to contract for the opening and repairing the Road and building Bridges between the Town of York and Burlington Bay". Some of the detailed specifications that follow are for an extension of Lot (Queen) Street to the Humber, so it was evidently the Lakeshore Road that was in question. There is no separate mention of a bridge over the Credit or of the section of the road between that river and the Humber.

Wilmot does not show any bridge over the Credit in his map of 1806. He shows Dundas Street forking just after

entering the Indian Reserve from the south-west, the right-hand fork curving downwards toward the lake, corresponding for a short distance with the present Mississauga Road, but mostly running a good deal farther to the west of the river. It ends near the mouth some distance below the Government House. The Lakeshore Road can be made out on the original map. The broken line has been mostly erased, either in making corrections of the entries on the lots, or deliberately because the Third Concession South of Dundas Street was considered to have taken the place of the old road. However, the words "Road to York", lettered by Wilmot along the curve of the road, help to determine its irregular course, much closer to the shore than the present highway which follows the Third Concession South,

Besides this map we have a contemporary account of Dundas Street and its lakeshore branch written not long after Wilmot finished his work when settlers were just beginning to enter the new purchase. Charles Askins of Detroit has left an account of a journey on horseback from that place to York made in the summer of 1806. On the night of July 3rd he slept at Augustus Bates's on the site of Burlington, near Captain Brant's "fine house". The next morning they set out for the Twelve Mile Creek. Askins explains carefully that the Creek was so called because it was 12 miles from "government house, on head lake, where another Bates lives", and that to reach Government House you had to cross "the bridge, which is over the isthmus of Burlington Bay". He goes on:

"Stopped and baited our horses at 12-mile Creek; here there was a cabin, & in it a very fine woman; her husband, she said, was going to build a mill on this creek lower down; then from 12-mile Creek to 16-mile Creek is 4 miles more; from that to about the middle of the plains, where the roads going to York separate, then to the upper and lower roads is seven miles more; the lower road is the right-hand road; I came by the upper one; where the roads separate is a tree marked 23 miles, which is that number of miles from government house where Bates lives; from that tree to the River Credit is about 1 mile which is a most beautiful, rapid river, with a stony bottom, now not more than 2 or 3 feet deep, where we

forded it, and a small island in it; the banks very high indeed, but not very near the river; from this fine, little river to the River Humber is ten or eleven miles;....."

After describing the Humber and its Pineries, and commenting on the absence of houses and the "high and steep hills" along the road, Askins adds:

"The land from the head of the lake to this was purchased from the Indians last winter, and a road is partly to be laid out from here to there, but no lands to be given unless they clear the front of the lot and make the road; there are 70 lots already taken on these conditions..."

Later, in summing up his journey, he repeats this information in a slightly different way:

".The only disagreeable part of the road to travel is the Moravian Town to the Pinery, and the head of the lake to this, on account of its not being settled, and the roads bad but government last winter extinguished the Indian title to the land between the head of the lake and this, and have laid out a road, which will sure be made, as no lots will be given but to those who will make the road in front of their lots."*

4. The First Purchase, 1805

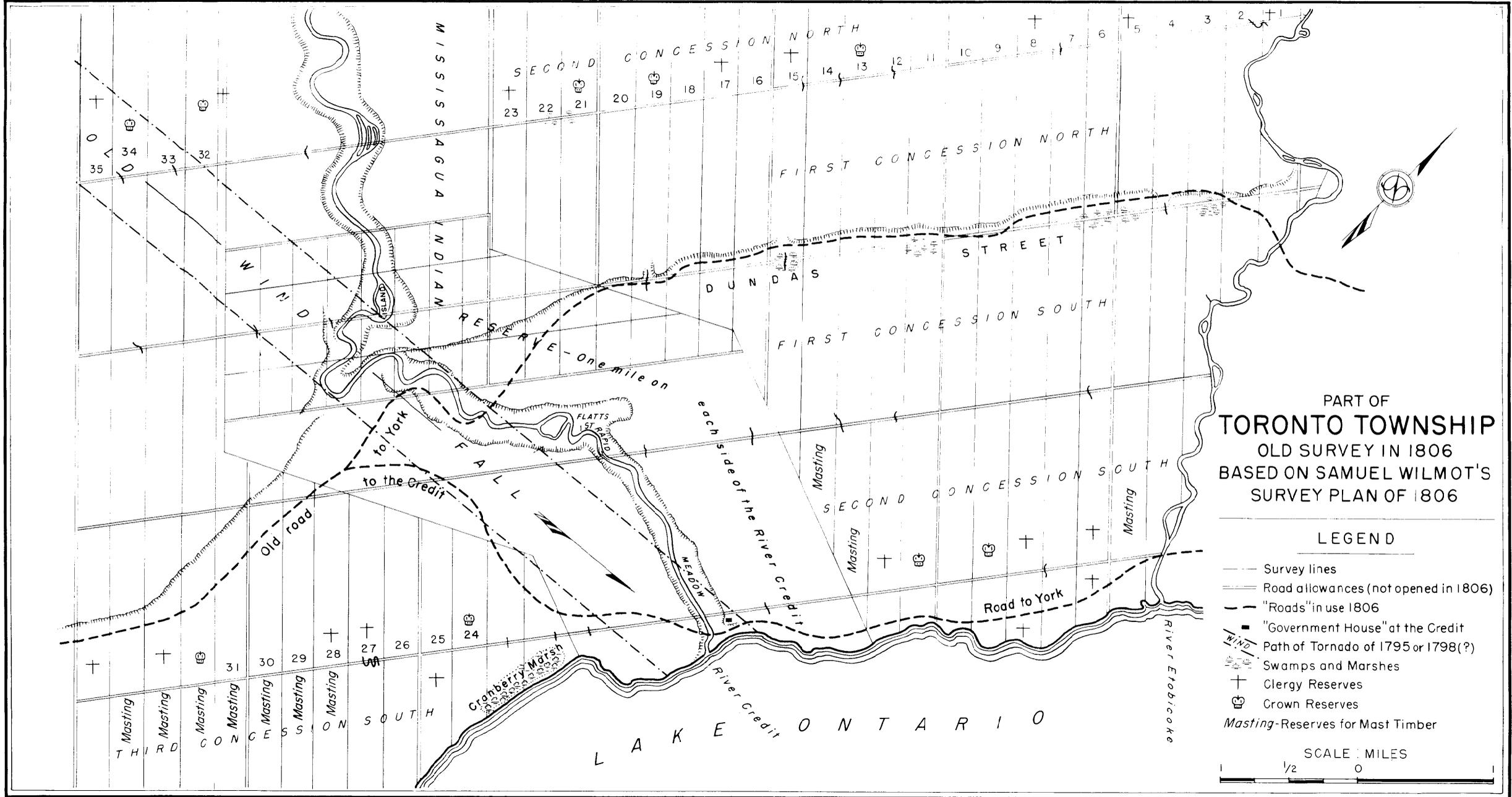
In the same dispatch of September, 1794, in which he mentions his intention to establish a post house, Simcoe writes:

"Between York and Burlington Bay there intervenes a space of Ground of thirty or forty miles in extent, unpurchased of the Indians; and such I wish it to remain, both for their comfort and as an ample Magazine for Ship Timber."†

However, the founding of York had made it almost inevitable that this decision would soon be reversed, and in fact this seems to have been done by the end of 1795. Writing to Lord Dorchester on April 9, 1796, Simcoe discusses the recent purchase of a corner of the Tract to be granted to Captain Joseph Brant as military lands and adds:

* Ontario Historical Society, Papers and Records, Volume VI, pages 16-20; "Journey from Sandwich to York", 1806, Charles Aikins (sic), The name "Aikins" is an error, The writer of the journal was certainly Charles Askins, a member of a well-known Detroit family, Askins had had to lead his horse between Moraviantown and the Delaware Pinery and even so had had some difficulty. This stretch of Dundas Street was probably not so bad but was evidently a very rough track in 1806.

† Simcoe Papers, Volume III, page 59.



PART OF
TORONTO TOWNSHIP
 OLD SURVEY IN 1806
 BASED ON SAMUEL WILMOT'S
 SURVEY PLAN OF 1806

LEGEND

- Survey lines
- Road allowances (not opened in 1806)
- - - "Roads" in use 1806
- "Government House" at the Credit
- WIND Path of Tornado of 1795 or 1798(?)
- Swamps and Marshes
- + Clergy Reserves
- ⊕ Crown Reserves
- Masting-Reserves for Mast Timber

SCALE : MILES



It may also be very proper at this period to conclude the purchase which has formerly been ordered of the lands laying between the head of the Lake Ontario and Burlington and the Tobicoke, and so far into the Country as to form Townships 12 miles in depth, because there is obvious reason to believe that the price will be greatly enhanced should this purchase be any longer deferred, and it appears not improbable that Brant will make the present proprietors, the Mississaguas, subservient to his interested views.

"It may also be not improbable that if the King does not purchase these lands, the subjects of the United States may in their intercourse with the Indians occasion considerable difficulties to this Government,

"These lands should be purchased so as to leave the Mississaguas in full possession of their rivers and fishing grounds nor do I think it by any means advisable to grant them universally but only in such detached lots as might tend to facilitate the communication between this place and Burlington Bay."*

What Simcoe feared was that the Mississaugas would ask a price for the Tract as high or higher than that recently offered to Brant for "Block No. 1" (Dumfries Township) on the Grand. Brant had asked Simcoe to approve this sale in 1795, and the matter was still under discussion when this dispatch was written. Both Simcoe and Dorchester felt that it would be politic to satisfy Brant and the Mohawks in this matter if it could be done without setting up a dangerous precedent in respect to private purchases of Indian lands. Shortly before Simcoe went to England on leave in August, 1796, Brant was given "an Engagement, in behalf of the Government, that royal Deeds should be given to the Indian Assigns.,., "† On the strength of this, Brant proceeded to sell several more blocks and demand that they be approved by Peter Russell, who, as President of the Executive Council became Administrator of

* Simcoe Papers, Volume IV, page 239. Brant's grant was the block of 3,400 acres running north from the end of Burlington Beach, on which Brant House was built. Simcoe had had the lands purchased in October, 1795, for £100. Brant did not get the deeds for this property until 1797.

† Russell Papers, Volume II, pages 19-22; Memoir by William Dummer Powell, 1797. This matter brought up the question of the Six Nations' title to their lands on the Grand, which was found to be technically imperfect, The chiefs were highly disturbed over this and had recently refused a deed that limited their right to assign,

Upper Canada while Simcoe was on leave in England. When Russell hesitated, Brant resorted to an adroit mixture of diplomacy and bullying to get his promise of confirmation,

The prices given for these blocks ranged from nearly 2 shillings an acre to about 3s. 11d. an acre - the average being about 2s. 7.5d. an acre, Brant's manoeuvres had greatly increased the dislike and distrust with which he was regarded by Russell and some of his Council. When the Mississaugas in 1797 refused "to cede to the King, for less than three shillings an acre, a Tract indispensable necessary to connect the population of the Colony, with the seat of the King's Government...", their alarm and indignation at Brant's "meddling" was unbounded, In the "Memoir" from which these quotations are taken, William Powell, Judge of the King's Bench, dilates on the "unreasonable nature" of this demand, when the Treaty Presents had hitherto amounted to no more than twopence an acre, and American speculators had just made large purchases from the Senecas of New York State for "five Cents of a Dollar per Acre". He writes of "the Mischiefs hourly to be expected from these Hords, if once they are satisfied that our Conduct towards them is influenced by apprehension of their resentment....." He adds, however, that "if the pretensions of the Mowhawk Indians are submitted to", the "native Proprietors can hardly be expected to sell their lands for less..."

Brant's opinions on the matter are given in a letter to William Claus, dated April 5, 1797:

"You have required me to give my opinion on the Mississague Lands, but I am rather fearful to do so, notwithstanding the deceased Chief requested me to take them under my Care, Government are so very ready to blame people for Meddling, I have already given my opinion in my Memorandum that it is too much resembling the Yankies to grasp the land too eagerly, as I don't see any Necessity of making this Acquisition and I think that if they will wantonly take it they should pay a good price for it, at least 2/- an Acre, unless they would allow the Indians to reserve where they please. I have marked it with a pencil a Mile to the West of the 12 Mile Creek to extend 3 Miles from the Lake and then a Straight line of the River of Credit

3 miles from the Lake by that means the fisheries
of all the Rivers will be reserved and otherwise
it would be impossible for if the Mouths of the
Creeks should be Settled it would Certainly Spoil
the fishery.....
.....

This proposal now seems not unreasonable, even when we translate the 2 shillings (then worth nearly half a silver dollar) into its modern equivalent of \$4.50 to \$5, but at that time it was impossible for the Government to accept it. The large reserve would go far to defeat the main object of the purchase, and the advance in price was too great. Brant had accepted very long mortgages as security for all but a small cash payment, so that the purchasers were in a position to wait for a rise in land prices, Even so, the prices were inflated, and by 1810 most of the land had been surrendered to the trustees and resold at a lower rate. The Government could not be expected to pay inflated prices for land five-sevenths of which would be granted at once to settlers, either gratis or for fees amounting to less than sixpence an acre,

Brant probably expected to use the price of three shillings and fourpence as a bargaining price, and he expected to compromise on his later proposal also. He was claiming to act as the attorney of the Mississaugas, At a meeting at the Mohawk Village on the Grand River on April 30, 1798, Wabanip, Head Chief of the Mississaugas, made a speech confirming this appointment and renewing their promise not to sell lands without Brant's advice and consent. The next day there was a review of the Six Nation Indian Volunteer Company, when four hundred warriors performed battle drill in a most efficient manner. This was followed by a public dinner given by Brant at his own house, The Mesuagua Indians attended by particular invitation. The day following a council was held by their chiefs and those of the Six Nations,

* Russell Papers, Volume II, page 135.

The council lasted three hours and was conducted with the utmost harmony and solemnity."*

In spite of the many loyal toasts drunk at the dinner., these doings can have done little to allay the fears of the President, These had been so great in 1797 that the Chief Justice was given a military guard when he passed through the Mississauga Tract. Such fears were exaggerated but not entirely imaginary. The "hordes" of the Mississaugas of the Credit were estimated in 1795 to amount to six hundred souls - men, women and children.t But the province was underpopulated and undergarrisoned; Russell had no confidence in the Militia; and the forces that Brant might raise with his four hundred trained warriors as a nucleus could easily cause a serious catastrophe.

It would have been a futile catastrophe in the long run, as Brant fully realized. He had no intention of proceeding to extremes. Russell could not know this, and he underrated Brant's intelligence, his loyalty and his sincere concern for the interests of the Indians. Brant could not be accepted as agent for another nation, and there was nothing for it but to drop the matter of the purchase until a new Lieutenant-Governor took office, Both Russell and Brant were loath to do this, Brant again roused Russell's fears by going to the Credit in September, 1798, ostensibly "to get some salmon" but actually to meet some Mississauga chiefs from Lake Simcoe, The following year the idea of a purchase was revived when the Comte de Puisaye asked for a township on the lake where he could settle such members of his party as were unsuitable for such a remote location as the village of "Windham" (near Richmond Hill). Russell favoured buying part

* Upper Canada Gazette, Saturday, May 12, 1798

† This was the number reckoned as entitled to share in the £100 paid for Brant's lands at Burlington. Simcoe Papers, Volume IV, pages 144-5; Letter Wm. Johnson Chew to Joseph Chew, 23 November 1795.

of the Tract, but Brant "meddled" once more. He first offered a direct sale to de Puisaye and then to sell to the Crown with such stipulations and at such a price (1s. 3d. Currency) that Russell felt he must refuse. Brant appealed to General Prescott, who told him to wait until General Peter Hunter, the new Lieutenant-Governor, arrived at York, Simcoe had resigned late in 1797, and Lieutenant-General Peter Hunter reached York in August, 1799. He was in no hurry to take up the matter of this Purchase, and the Mississaugas enjoyed undisturbed control of their fisheries for another five years."

They continued to camp at the mouth of the Credit and in September, 1804, were surprised in their encampment by a flash flood. This gathering may have had some connection with the orders recently issued by Governor Hunter that part of the Tract should be purchased for the Crown as soon as possible. It was, however, not till the following August that the Mississauga Chiefs again assembled at the Credit to meet members of the Indian Department accredited by the Governor to discuss this purchase and another treaty that finally confirmed the Toronto Purchase.

The latter treaty was signed on August 1, 1805, and the following day the chiefs set their marks to a new provincial treaty that ceded to the Crown for £1,000 Sterling the lands along Lake Ontario between Etobicoke and Burlington Bay to a depth of between five and six miles from the shore.

"Reserving for ourselves and the Mississague Nation the sole right of the Fisheries in the Twelve Mile Creek and the Sixteen Mile Creek, the Etobicoke River together with the flats or low ground on the said creeks which we have heretofore cultivated and where we have our camps and also the right of the Fishery in the River Credit and one mile on each side, of the said river."

* For the attempt to obtain a township for the French Royalists see Russell Papers, Volume Index, under "Mississauga". The proposal did not affect the Credit area directly as the tract was to extend only 5 miles east of Burlington. It was, however, to contain nearly 70,000 acres.

i Indian Treaties and Surrenders, Ottawa, 1891, Volume 1, pages 35-6.

This Purchase was less than half as deep as the one contemplated by Simcoe and Russell.

It was reckoned to contain 84,000 acres, so the Indians were to receive less than 3 pence Sterling an acre.

Peter Hunter died at Quebec within three weeks of the signing of these treaties. Commodore Grant, as President of the Council, now became Administrator of Upper Canada, and when writing for fresh instructions suggested that the price might be increased to £1,700. This increase was approved, but the maps used proved to be inaccurate and the acreage much larger than had been supposed, As no further increase was made in the purchase price, the Indians did not get the full benefit of Grant's good intentions. This misunderstanding about the size of the Purchase caused further delays, and the treaty was finally ratified by Lieutenant-Governor Gore in September, 1806.

The sale of this tract at first made comparatively little difference to the Mississaugas of the Credit, They did not limit themselves to their reserve but used the whole area almost as before, We hear of thirteen winter camps not far from Cooksville about 1808. The settlers found the Indians useful rather than troublesome. They kept the wolves and bears away from the stock, They still met every year at the Credit to get their presents. In May, 1807, Governor Gore met them there for a different purpose, "when thirty-seven of them were vaccinated by Dr, Korbe. They testified much gratitude for his Excellency's benevolent condescension, and received him at the government house with a salute of small arms."*

Their numbers were now probably rather fewer than they had been in 1795, and much less than when they had first come into the area, The fatal epidemic of measles that is recorded among the Mississauga of Lake Simcoe in 1793 was probably not limited to that vicinity. Nor can the Indians

* York Gazette, May 23, 1807.

have entirely escaped the outbreaks of smallpox and contagious fevers" that are mentioned from time to time at the beginning of the century, When the Mississaugas were protesting against the removal of their council fire in 1798 from the Grand to the Credit, those living to the westward estimated their numbers at 330 and said that they were "much greater than those of the River Credit, On another occasion it was said that not more than three families were living at the Credit, These may be understatement, but it is certain that the number of Mississaugas living permanently on the river was very small and grew smaller as settlement advanced, The attempt to make a permanent settlement of Mississaugas on the lower river belongs to a later period.

THE OLD SURVEYS - 1806-16

Though there was delay in ratifying the treaty there was no delay in starting the survey or in granting lands in the Purchase, Three townships were to be laid out between the Etobicoke and Captain Brant's Grant. It was at first proposed to call these "Toronto", "Alexander" and "Grant", but when the news of Nelson's victory and death reached York the last two names were changed to "Trafalgar" and "Nelson", This was probably done by the Acting Lieutenant-Governor, Commodore Alexander Grant, in whose honour they had originally been chosen, The name "Toronto" may have been due to the old error of certain maps that showed a "Fort Toronto!" near the Credit.

The layout of Dundas Street was to resemble that of Yonge Street in York Township. The new straight road was to run parallel to the north-west boundary of the Purchase a little over two miles and a half from it (201 chains). This allowed two normal concessions "North of Dundas Street" and three south, with a Broken Front westward of the Credit. From a little south of the river the trend of the lakeshore reduced the Third Concession S.D.S. of Toronto Township to a series of broken lots, The angle of the north-east boundary, the Toronto Purchase Line, formed a "gore" from near Summerville which remained part of Toronto Township for many years until the Etobicoke was made the Townline through the whole of the old survey.* The survey was carried by Samuel Street Wilmot

See the second map illustrating this section, based on Wilmot's plan of June 28, **1806**. This plan was used to enter grants and as a result it is so confused by entry and erasure of names that it could not be satisfactorily reproduced, It is not likely that location tickets were issued before the plan was available and the size of broken lots determined, but tentative grants were made earlier. A good deal of research has failed to discover exactly when the Etobicoke became the Townline above Summerville, but it seems to have been after **1846** and probably after 1850. This gore has been omitted from the map as not concerning the Credit area.

in the first half of 1806. He had finished it before June 28th. Grants had probably been made in the area from the beginning of the year, but location tickets had now been issued and settlers could move onto their lands,

Whoever told Charles Askins towards the end of July, **1806**, that seventy grants had been made on Dundas Street was understating the facts, Thomas Ridout, Principal Clerk in the Surveyor-General's office, wrote to the President on July 29th "that only Twelve whole Lots, remain unlocated throughout Dundas Street, including both sides of the communication'*,+* in the Tract. He had heard that the Council was still making grants and wished to know if lots in the other concessions were to be drawn for like those on Dundas Street. The Council had recommended on June 20th that no reserves be made on Dundas Street; that the "Numerous applicants" be made to sign the conditions of settlement before receiving their locations; that the lots on Dundas be located first,

" - by throwing into some covered vessell a parcel of rolled up Tickets equal to the Number of Lots thereon - whereon shall be marked the Number, Concession and Township - and let the applicants take their chances by drawing each a single Ticket as he presents himself - and when this principal object shall be obtained that the other disposable lots may be drawn for in like manner, or disposed of in such a way as shall appear best to Your Honors Wisdom ." †

Three or four grants had already been made free of duties in the Second Concession S.D.S., but Grant seems to have decided that the rest should be on the same terms as on the Street. There was less demand for these lots and they were located more slowly.

That the lots were located so quickly shows the demand for good locations in the Home District and the lack of grantable lots near the lake or the main highways. Grantees

* Survey Records, Lands & Forests; Letters Written No. **20**, pages **3693-94**, Thomas Ridout to Wm. Stanton.

† Ibid. Letters Received No, 15, pages **2245-6**; Extract, Minutes of Council, June 20, 1806.

who did not wish to occupy in person knew that they might sell at a high price to an actual settler soon after getting their patents, Some lots of two hundred acres sold for £100 - a very high price even twenty years later for a farm with only about five acres cleared, but not so exceptional in the Home District between 1800 and 1812.* In many cases these were privileged grants which were really free and the Regulations of 1804,† which governed ordinary grants until 1819, had only raised fees to £8 4s. 1d. for 200 acres, including the cost of survey. Settlement duties could be done for not more than £. 35, so these transactions were very profitable, and in some cases the purchaser was willing to do the duties as part of his contract.

The lack of grantable lots which caused these inflated prices was due to the policy of the British Government, who found it easier to reward past, present or future colonial services with generous grants of land than to extract money for such payments from the British taxpayers. The shortage of lots is often referred to in documents - inquiries about single lots that might be grantable and statements from the Surveyor-General that there were no lots in the District to meet the claims of the sons and daughters of Loyalists. These claims were increasing every year as more children came of age and entitled to 200 acres. Many of the older generation of Loyalist and Military claimants had still unfilled claims, dating from about 1798, when such grants had been increased and many new categories added to those entitled to "grants in

* For the various transfers at this time see William Perkins Bull, "From Strachan to Owen" notes,

† All grants in the Old Surveys and some in the New were made under these regulations, "Regs. 1804" or some similar notation appears prominently on the deeds, and this has led to misunderstanding as to the date of the grants, Except Brant's block, no purchases from the Indians were approved and all titles are subsequent to June, 1806. The real date of the patent is written out in the body of the deed and often repeated under the signature which is another guide to the date,

addition? Absentees of these groups had absorbed most of the grantable lots near York and from about 1802 were making profitable sales to immigrants from the United States who wished to settle in groups in particular locations.

The majority of the grantees were Loyalists and their children from the Niagara District but other groups were also represented. Some intended to become permanent settlers at once, others were willing to do so when they had sold their improved farms elsewhere, But householders in York, like Paul Marian, the baker, or Joseph Cawthra, the merchant, were not likely to move to their holdings in person and some of every group, including the children of Loyalists, were only interested in selling their lots as well as possible. All, however, had first to complete their duties to clear their title.

A few years before, this would have troubled absentee owners very little, Their grants had sometimes been free of these duties and except on Yonge Street and a few other locations almost no attempt had been made before 1798 to find out what settlers were doing to improve their holdings, Yearly inspections of Yonge Street had shown much slackness and threats of forfeiture had been uttered in 1798, but very few lots had been declared vacant for nonperformance. Fees did not have to be paid until the patent was applied for and many lots were held for years and assigned more than once on the strength of a recommendation from the Land Board and an entry on the Surveyor-General's map.

Peter Hunter on his arrival had determined to change this and soon succeeded in frightening the dilatory grantees as much as he had the sluggish officials. From 1800 to 1804 more and more owners, often residents for five to ten years, were sending in their certificates, paying their fees and getting their patents, In 1804 General Hunter ordered fees to be paid within three days of the date of the location

ticket. This removed another reason for delay in patenting at the expense of some hardship to settlers who were short of cash.* The Governor had already done what he could to hasten the slow process of issuing the actual deed† The system set up by Hunter was continued until after the war and settlement duties were still being enforced in 1806-12 when Dundas Street was being settled,

The Regulations of 1804 had made little change in the settlement duties laid down in 1798. The time for performance had been increased to eighteen months. Within that period the grantee had to build a house 16' by 20' "in the clear", see that it was occupied by a family; clear, fence and plant five acres, clear half the road allowance across the front of his lot, and remove the brush and logs from the roadway, cutting the stumps low enough for a waggon to pass over. On Yonge Street and some other highways the settlers had been required to burn the brush and logs, This applied to Dundas Street and now another regulation required that all trees must be cut across the front of the lot for 100 feet from the line of the road allowance. This strip did not have to be brushed or logged, Settlers on the street were also expected to see that their house was up to a certain standard and covered with something better than bark - possibly a shingle roof was required.**

These conditions could be fulfilled in several ways without the owner moving to the lot. Philip Cody, who

* There was no compulsion to patent, but once the fees were paid there was less object in delay, though some still did so. The demand for farms was responsible for some of the increase in the number of patents issued, but not for all,

† About eight officials were involved, some more than once, Each was entitled to a fee, including the Governor.

· The requirements as to the size of house and clearing had been laid down in 1768 in instructions to the Governor of Canada. They had not been insisted on in Upper Canada - the first location tickets contain only an undertaking to settle and improve, One after another these conditions had been adopted for the military roads, In 1798 they were extended to all grants.

had sold the farm on Yonge Street which he patented in 1802, had completed the duties on Mrs. Sarah Grant's Lot 10 S.D.S. in April, 1807. Mrs. Grant received the patent on May 19th and Cody bought the 200 acres for £100. Cody had probably come in the autumn of 1806. The next patents were issued early in November, 1807, and most of these settlers probably came in that spring. Those who came by water like the Joseph Silverthorns were delayed by a late break-up. There was ice in York harbour on April 19th. Cody was planning to open a tavern. The Silverthorns lodged with him until their house was built on Lot 11 N.D.S. At that time and place almost every patent issued meant a house built and a household temporarily in residence, though by no means always the household of the owner. Fraudulent certificates were not unknown, In 1810 Wilmot remarks that some "person or persons must have sworn hard, as some of the lots that Deeds have issued for, have but a Small appearance of an axe having been used...."

There was much coming and going for some lots were sold soon after patenting, the original grantee going home and the new owner leaving the farm vacant, Others went home to return years later, but there were some permanent settlers and arrivals probably balanced departures. When the first town meeting for Toronto Township was held in January, 1808, there were possibly more than twenty households in the township. The only assessors' return for this period was preserved by chance among the papers of Thomas Ridout, then Clerk of the Peace for York County. When an error in the total for Toronto Township is corrected, this shows 175 inhabitants, or between 29 and 35 households, in March, 1809. Six was considered an average household until after 1860, but some held that five persons was near the average in newly settled areas such as the Old Survey was at that time. Probably there were more than thirty householders, but some had no family with them in the township, The number of households shows that

hard swearing had not been as prevalent as Wilmot implied. More than two-thirds of the patentees had found occupants for their holdings, allowing for some eight to ten families who may have been living on land not yet patented.

The relatively small population of Toronto Township was a result of the large number of reserves in the back concessions. In all three townships the Crown and Clergy Reserves omitted on Dundas Street had to be made up in these concessions and in Toronto Township the lots marked for Masting were still unoccupied unless by squatters, Very few Reserves had been leased; there was less demand for lots in these concessions and both reserved and unreserved lots were available after 1812. An inquiry from the Governor in December, 1808, as to the ownership of lots was apparently caused by a report that road work was being neglected in the Second Concession South. In reply Ridout and Chewett, as Acting Surveyors-General, reported that

"..... Lot No. 7 in the 2nd Concession on the South side of Dundas Street in Toronto of which --- Vanatter is said to be the owner was located to James Glennon on the 13th August 1808 and the time given for the performance of settlement duty on the said Lot will not expire until eighteen months from that period....., opening of the Road ought to have been the first object with Jas. Glennon.

" Lot No. 10, in the 2nd Concession on the South side of Dundas Street in Toronto, of which John Clyne is said to be the owner, - was located to Joseph Cawthra on the 5th of Aug-1806 for which the certificate of Settlement duties having been performed, having been returned and the description for the same has issued -

" Lot No. 11 in the 2nd on the South side of Dundas Street in Toronto, of which Andrew Kitchen is said to be the owner, is a Reserve for the Crown it has been petitioned for by Joseph Cawthra, - but no Fiat has reached this office for a Lease of the same - "

The first two of these reputed owners may have been tenants, but Andrew Kitchen was most probably squatting on the Reserve Lot.

Settlement duties in this area were evidently being carefully watched. Samuel Wilmot made a regular

inspection on May 9, 1810 of all grants in the Purchase on which the time for performance had expired without a certificate being returned, This showed that several more families had moved into the township and that there were now several families in the Second Concession N.D.S. South of the Street settlement was much more scattered and remained so east of the river until after 1830. The inspection seems to have stimulated settlement. Owners began to file certificates within a few weeks of the inspection. A dozen certificates from Toronto Township were copied into the Letters Received Books of the Surveyor-General's Office between August 30, 1811 and March 6, 1813. These date mostly from 1811. They account for most of the remaining lots on Dundas Street, but still for only a few in the back concessions especially south of the Street, As might be expected they show some variation in the circumstances of the settlers. Few report more than the required five acres cleared and fenced, though some of the clearings may actually have been larger? On the other hand, some preferred to make their houses a little larger than 16' by 20'. One, Hugh McIlmoyle's, was slightly smaller, but 18' by 20' was a popular size. John VanZante's log house (16' by 22') had "... a good Shingle Roof, two Boarded Floors, and a good Chimney". Evidently these features were a little exceptional, Still more unusual was the "good framed House", 26 by 38', built in 1811 by Joshua Pollard on his three broken lots between the Indian Reserve and the Second Concession N.D.S. near Sheridan,

These settlers of 1810 to 1812 were probably fairly representative of the community that stretched along Dundas Street at the outbreak of war, It was still a primitive, frontier settlement. The clearings had grown a little every year as new pieces were cleared for the next year's wheat crop, The half-cleared strip through which the

highway had run in 1809 was now a nearly continuous opening in the woods, 266 feet wide, The fenced fields would extend in some places more than a quarter of a mile from the road allowance. They were interrupted at intervals by patches of swamp or gullies left uncleared and fairly often by farms where the house stood empty and the first small clearing was running back to brush, There were no reserves to make long stretches of wood, but some residents had been buying more land than they could expect to farm or let on shares and not all the absentees could find tenants.

The two miles through the Mississauga Reserve probably was the longest stretch of woodland on this part of Dundas Street. When Lieutenant Francis Hall on his way to York in 1817 recorded that "The thread of settlement is slender and frequently interrupted by hemlock swamps and pine barrens", he was thinking of such stretches as this and of the "plains" near the Humber. Returning by Dundas Street he was moved to remark:

" Nothing looks less cheerful than the hut of a primitive settler especially when isolated in the mass of a heavy forest, yet it is the first glance only which is unpleasant, the second shows present comfort and progressional improvement. I do not remember to have seen one of them abandoned except for a better house; there are more ruined cottages in the vicinity of Cork, than in all North America."

This was a sensible generalization for the part of America which Hall had seen. It applied reasonably well to Dundas Street in 1817, when the first houses were beginning to be replaced by larger and better ones of dressed timbers. In the past ten years these settlers had gone through the routine of opening up a new holding, This closely resembled the experience of the settlers in the townships that were soon to be opened farther inland. They had had to endure many of the same hardships, but they had begun with certain advantages. These did not consist only in the fact that at some seasons they could reach York, Niagara or

Ancaster with comparative ease, The same selection of applicants had been used for Dundas Street as had been applied to Yonge Street ten years earlier. Care was taken to see that the grantees were reasonably well equipped for the task of forming a settled communication as soon as possible.

This did not imply a great deal, The possession of one yoke of oxen had been held to qualify a settler for a lot on Yonge Street in 1795. In 1817 the inhabitants of Trafalgar Township had placed "the want of capital" as the first cause of the slow progress of the country, They said that most settlers began with "...little more than a cow, a yoke of oxen, a log chain and an axe..... those that weather the first ten years spend the rest of life in comfort". This was by no means minimum equipment for starting life in the bush then or later, Some pioneers had no oxen and so could not use a log chain if they had one. Such settlers were not found among the grantees in this area; these were substantial farmers and merchants, or their sons.

The actual occupants of the farms belonged, as a rule, to the same class. Most were accustomed to chopping, logging and fencing as part of the yearly routine. Some had already made a tract of forest into a productive farm. Joseph Silverthorn a young man of twenty, started with two milch cows, but found it hard to keep even one, what with bears, wolves and accidents. He had the same trouble with his hogs and poultry, but seems to have been able to replace the losses. Within a year of his arrival he had some sheep and was taking his wife's yarn to be woven by his mother. A little later he possessed a "hos" and a mare, probably in addition to the essential work-oxen, He was by then using a plough in some of his fields, though the stones and half-rotted roots seem to have been hard on plough points.

The community had a blacksmith from the first and soon there were other taverns besides Cody's at Dixie and

Samuel Covenhoven's (or Conover's) near the Trafalgar Townline. The highways had the additional advantage for the settlers of making it easier to maintain such establishment and giving them some local market for produce, The Credit River, on the other hand, did not play the normal part in the life of the settlement. It provided a sheltered landing for boats, but they were debarred from using its waterpower for mills and up to 1812 had to depend on the Humber grist mills, though Daniel Harris may have built his sawmill near "Harrisville" (Cooksville) before the war. Later, grist mills were built on the Etobicoke and the Sixteen-Mile Creek, Strictly speaking the settlers were barred from hunting in the reserve or fishing for salmon. There can be no doubt that they did both, as well as trading with the Indians for salmon, venison and maple sugar and deerskins, all of which came chiefly from the Credit Valley.

Strictly speaking only two settlers were living east of the Reserve in the Credit Watershed in 1812, Peter Wolfe and Patrick Murphy, both in Con. II N.D.S. But the settlement between the Reserve and the Dixie Sideroad belonged to the Credit area, as was recognized at the time. So did the settlers in the southern concessions to the west of the reserve as well as the six or seven families actually living in the watershed to the east of the Trafalgar Townline - Shains, Covenhovens and others. In Trafalgar Township Samuel Marlatt and Obadiah King were the only settlers on Dundas Street who are likely to have had their houses within the watershed, though several others had lots that extended north-west over the divide, There were very few settlers in Con. II N.D.S. in Trafalgar by 1812. Stephen Greeniaus had been the pioneer of the group near Sheridan, but the certificates mentioned show that several others had arrived before the war.

The war brought a greatly increased traffic along the highways that eventually led to improvements to Dundas Street, it meant a great rise in the price of all farm produce and far more cash in circulation than ever before, Probably the great demand for flour was partly responsible for the building of grist mills on the Sixteen and of the Silverthorn Mill at Summerville. The interruptions of water traffic by enemy forces on the lake was a further encouragement. The absence of most of the younger men on military duty for periods of varying length must have disturbed the life of the settlement and there were doubtless alarms when armed boats appeared offshore. The actual fighting came no nearer than the Humber, but some of the men took part in hard fighting. Their services were eventually to be rewarded by grants in the new Purchase. There was probably some ill-feeling between neighbours. Some settlers were in sympathy with the enemy, though few seem to have forfeited their lands by leaving during the war.

When the war ended the Old Survey was considerably more advanced than it had been in 1812, though the number of inhabitants was probably not much greater, Within a few years it became the base from which settlement moved into the New Purchase. In this settlement members of the established families on Dundas Street played a large part. They moved into the new area as actual settlers or received militia grants, Silverthorns, Wilcoxes, McNabbs and Robinetts from east of the Reserve helped to develop the new area as well as Conovers and Shains from within the watershed. The new settlers lodged in the Dundas Street taverns; they travelled to their holdings up trails that the old settlers had opened to reach the Second Concession North. Until they were established they depended on the mills, smithies, tanneries and stores of the Old Surveys for much of the supplies and services that they could not provide themselves.

For those in the Credit Watershed Dundas Street and the mouths of the Credit and Sixteen formed the outlets to civilization. The story of the settlement of the Old Survey of Toronto is a necessary introduction to the settlement of the Credit Valley, though so little of it took place in the drainage area of the river.

THE SETTLING OF THE NEW PURCHASE1. The Treaties of 1818

Both immigration into Upper Canada and the granting of Crown Lands to settlers were discontinued soon after the outbreak of war in 1812. Though land grants were resumed in 1815, in the Home District it was seven years before the number of grants approached the yearly average of 1805-12. By that time the great movement of immigrants from overseas was well under way, though still small compared to those of the 1830's and 1840's. Emigration from the British Isles had been discouraged since before 1812, but it was realized that this could not continue once peace was established. The Home Government had no notion of the large numbers who were willing to emigrate, but they were prepared to encourage settlement, partly to improve the military situation in the event of another war with the United States.

To provide land for this settlement a number of purchase treaties were negotiated in 1818-25 with the Mississaugas and other Chippewa nations, These added huge areas to the ungranted Crown Lands, sufficient to connect those on the Ottawa with those on Lake Simcoe and to open almost the whole of the area south of the Georgian Bay. The provisional treaty by which the Mississaugas "inhabiting the river Credit, twelve and sixteen mile Creeks" surrendered the remainder of their tract, was signed on October 28, 1818. A treaty with the Chippewas to the north-west, signed in the same year, gave the Crown title to a large area containing the small remainder of the Credit Watershed, The Mississaugas seem to have been very willing to surrender these lands, They were using them very little, even for salmon fishing, no lands or fisheries were reserved for the Indians in the New Purchase and as they soon surrendered most of the old reserve, the Credit was available to the settlers both for fishing and for waterpower.

2. Surveys and Locations

Petitions for land in the Mississauga Tract began to be received and approved as soon as it was known that a purchase was intended. Until surveys were completed such assignments could not be definite. One of these tentative assignments passed the Council on October 20, 1818. The copy of the minutes sent to the Surveyor-General ordered that

'...a Tract of Land favorably situated be set apart for the reception of John Beatty, James Beatty & their Associates to be located on their respective arrivals in Proportion of one hundred Acres & upwards to each according to their respective means of Improvement.....'

This tract was to be held until August 1, 1819. Three days later Thomas Ridout, now Surveyor-General, informed the Lieutenant-Governor's Office that he had

'...set apart a Tract of Land for the reception of about 150 families,,,,, in rear of the Township of Toronto, bounded Westerly by the River Credit and Easterly by a line produced Northerly from the East Boundary of Lot No. 11 in the 2nd Concession North of Dundas Street.....!†'

The two Beattys were members of a large group of emigrants from the north of Ireland who had been living in New York at the outbreak of war. Most of them had prospered in America, but they had not been entirely satisfied and, in most cases, had not become American citizens.** Their treatment as enemy aliens had increased their dissatisfaction and they decided to move to Canada, where they hoped friends and relatives from Ireland would join their settlement. The Beattys, Thomas Reid and Joseph Graham had come in advance to arrange for the grant of a tract.

* Patent Office, Lands & Forests, Order-in-Council Book 4, pages 399-400.

† Survey Records, Lands & Forests, Letters Written, Vol. 24 pages 48-49. Ridout to Hillier, Oct. 23, 1818.

** A wartime act to prevent United States citizens from acquiring lands in Canada was not repealed until 1829. At this time a large number of British subjects, living in the United States, applied for land in Upper Canada, often after a very brief stay in North America.

It seems that Graham and Reid arrived in York after the Beattys and made a separate application for land. On November 3, 1818, Major George Hillier, Secretary to Sir Peregrine Maitland, the new Governor, order 51 lots of 100 acres to be reserved for "Mr. Joseph Grame (sic) and Thomas Reed, natives of Ireland". Ridout had scribbled "Keep for John Beatty & others" on the upper margin of Wilmot's plan of the Old Survey. He now wrote "Joseph Graham,.. reserved 51 lots of 100a." farther to the east and informed Hillier that he had reserved a tract behind Lots 2-10. When it appeared that the whole party was not expected to exceed 150 families, several other names were inserted between the tracts, curtailing Beatty's frontage by about a third.

These other entries, with a few west of the river, have little significance in connection with the Credit.* But a grant of 200 acres on the Toronto-Trafalgar Townline resulted in the first actual settlement in the New Survey, A letter, signed by Benjamin Geale, then a clerk in the Lieutenant-Governor's Office, directed Ridout to "locate Mr. McKinnon on Lot No. 35 in the 3rd Con'n North of Dundas Street".† McKinnon's name was duly entered on the plan along a continuation of the Townline; his Christian name, Malcolm, being added later. Malcolm McKinnon seems to have gone to his holding before the end of 1818. He was living there when the survey was made the following February. He was the only recorded settler in the New Survey of Toronto before May-June 1819 and in 1833 is referred to as the first settler in the area.

* Most were names of officials who in the end took their land in other townships. Major Hillier was one of these.

† Patent Office, Lands & Forests, Order-in-Council Book 4, page 368. Description No. 4424 RJ., to Malcolm McKinnon, 18 June, 1818. Rev. J. Carruthers, "Retrospect" 1861, page 50. "...13th, January (1833) Visited Mr. McKinnon, the first settler in the New Survey of Toronto Township, in the year 1818....."

These grants were made on the assumption that the new surveys of Toronto, Trafalgar and Nelson would be carried out on the same plan as the old. Evidently other townships had been laid out on paper and named by Sir Peregrine. On the same day that Geale wrote to Ridout about McKinnon's location, he and James FitzGibbon addressed a memorial to Maitland stating that

"They have been employed to locate land for nearly 500 persons, that some of these were located in the Townships of Nassagaweya, Trafalgar, Albion and Caledon;There are now on their lists 144 persons for whom locations could not be found in those townships for lack of land".*

Until the townships were surveyed it could not be certainly known how much land was available, Probably the Surveyor-General had been given a safe figure which was not to be exceeded in making tentative locations. The names of the townships did not become official for some months. The Townships continued to be referred to by numbers until April 2, 1819, when Hillier informed Ridout that His Excellency had decided

"the following names shall be given to the three Townships in the Missisque Tract now under order of Survey - namely, to the Western Township (in rear of Nelson) that of Nasagiweya

" To the centre Township (in rear of Trafalgar) the name of Esquesing;

" And to the Eastern Township (in rear of Toronto) that of Chinguacousy, being the Indian names of the principal Rivers in each respectively".t

This letter makes plain the intention in the naming of these townships, though it involves a curious error in geography. That these were Mississauga names for the three rivers is clear from the list of Indian names of rivers prepared by Augustus Jones in 1792, and from a list of Mississauga words and their meanings published by his son Peter in 1861.

Canada Bureau of Archives, Ottawa, U.C. Sundries 1818, "Memorial of Messrs. Geale and FitzGibbon" Nov. 11, 1818. Some of the grants made in Caledon under the Regulations of 1804 - that is before Jan, 1, 1820 - may have been to persons on Geale and FitzGibbons' list.

† Patent Office, Lands & Forests, Order-in-Council Book 5, page 1010.

Both father and son give the name of the Sixteen Mile Creek on the north shore (Oakville Creek) as the equivalent of Nassagaweya, meaning "Two Outlets" or "having two mouths". Augustus Jones gives "Es.qui.sink" as the name of both Twelve-Mile Creeks, and translates it "Last Out", while Peter Jones gives "That which lies at the end" as the meaning of Esquesing, without actually saying that it was the name of a river. As, however, he follows "Esquesing" with "Nassagaweya" and both with "Chinguacousy", which he translates as "Young Pine River", he was probably naming the Creeks of the north shore. He says that Chinguacousy was pronounced "Shing-wau-koons-see-be", "Seebe" being a common Ojibway word for a river or creek?*

As has been noted, Augustus Jones calls the Credit "Mes.sin.ni.ke" - a translation of its French name; but there can be little doubt that both Maitland and the Reverend Peter Jones regarded "Chinguacousy" as one name for the River Credit. The name may derive from "Chinguacouse" or "Young Pine", the chief who had distinguished himself during the war of 1812. It is probably older. There may well have been a stretch of young pine near the river in the first half of the eighteenth century, for the pines in that area in 1806, though well grown, were still not tall enough to be reserved for masts. In any case Chinguacousy Township seems to have been named after the Credit and not after the chieftain.

As for Esquesing Township, it is drained in great part by the "Nassagaweya" or Sixteen-Mile Creek, while Nassagaweya Township is largely drained by the "Esquesing" or Twelve-Mile. This curious reversal is more likely to be due to Maitland or Hillier than to Colonel Samuel Smith or any of

* Survey Records, Lands & Forests; Surveyors' Letters, Vol. 28, pages 103-106. List of names of rivers and creeks A. Jones, July 4, 1796. Jones, Rev, Peter; History of the Ojibway Indians, 1861. Augustus Jones gives "Small Pine River" as the Indian name of "Long Point Creek" and his spelling of the Mississauga word shows that the pronunciation was very similar to that given by Peter Jones for Chinguacousy.

the Council, most of whom would be familiar with the order of the creeks. The names of Albion, Caledon and Erin (which seems to have been suggested by the first two) were then the usual poetic names for England, Scotland and Ireland. They belong to a group of township names of this period that reflect an interest in the half-mythical history of ancient Britain.*

The error in naming the townships proved to be one of the more permanent results of all this preliminary planning. In December, 1818, the Council decided that surveys should be done by contract and paid for with a percentage of the land in the township surveyed. At about the same time a new layout of the concessions was adopted. These were now to run parallel to the south-west boundary of the Tract (the Purchase line of 1792) instead of to Dundas Street and to be only $66 \frac{2}{3}$ chains apart instead of 100 chains. They were to be divided into lots with a frontage of 30 chains instead of 20 chains. Each lot would be divided into halves of approximately 100 acres, making the farms much nearer to a square (30 chains by $33 \frac{1}{3}$ chains). Grants would consist of one or more half-lots, described and patented separately. In this way settlement duty would (in theory) be done on both sides of each concession road, as on Yonge Street and Dundas Street. A larger number of roads would in this way be opened quickly into the interior,

The new layout involved a relocation of all grants that had been promised. Malcolm McKinnon's "Lot 35, Con III N.D.S." now became "Lot 1, Con. VI West Centre Road"; for in Toronto Township New Survey and the townships behind it the base line was to be a Centre Street of Communication",

* Other examples are Merlin, Caradoc and Madoc. The naming of townships was a prerogative of the Lieutenant-Governor which Maitland seems frequently to have delegated to his wife. Tiny, Tay and Flos are said to have been named for Lady Sarah Maitland's dogs and others may derive from the Government House library. Such fanciful names are much less common after 1828, when the Maitlands left Upper Canada.

continuing the sideroad between Lots 15 and 16 in the Old Survey. In Nelson and Trafalgar the south-west boundary formed the base line. The percentage system meant a reduction in the number of grantable lots and a delay in making final locations until the claims of the contractors were met. A rather vaguely worded advertisement was published in various newspapers+ in December, 1818, calling for tenders for surveying a township or townships in the Mississauga Tract. At first the deputy surveyors seem to have hesitated to tender. Few of them had the means to finance survey parties on this scale and the value of the land offered in payment was uncertain until the conditions on which it would be granted were stated. Without this information they could not tell what percentage would be reasonable and safe to offer,

The easiest way for a surveyor to raise the funds needed was to find a well-to-do layman ready to share the contract in return for part of the payment in land. Timothy Street ("of Niagara Township, Saddler")†, "a relation of Mr. Samuel Street of the Fall Mills, and of a Loyal Family"**, called on Thomas Ridout on January 11, 1819 "signifying an inclination to enable Mr. Richard Bristol, a licensed Surveyor, to Survey the Townships in the Missaga Tract...."**. Street wished to know the details about the land offered in payment. Ridout could answer few of his questions. He told Street, as to the apportionment of the land,

* Samuel Ryckman saw the notice in the "Spectator paper". The advertisement was dated Dec. 14, 1818. It almost certainly appeared in the York Gazette and probably in several other papers as well as the "Spectator".

† In the description of his lands in Toronto Township, Street's name is followed by the words "Tanner & Currier". These are crossed out and the word "Saddler" written above, Quite probably Street followed all three trades.

Survey Records, Lands & Forests; Letters Written, Vol. 24, page 115. The letter is one of introduction to be delivered by Timothy Street in person.

"probably it will be determined by lot, on all the Lots of the Township after the Crown & Clergy Reserves have been selected".*

Street was then given the letter quoted above and sent to Major Hillier, who does not seem to have added much information.

Several tenders sent to the Survey Office were dated before January 22nd, but so slow were the mails that Ridout had only received two by January 28th. Most asked too high a percentage, but when it was known that the lands would be free of settlement duty and might be sold at once, Street and Bristol immediately reduced their offer to 4.5\$ per cent.t

In the end the various surveys affecting the Credit Watershed were contracted for and carried out in the following way:

<u>Township</u>	<u>Date of Survey</u>	<u>Contractors</u>
Toronto New Survey	Feb.12-April 16,1819)	
Trafalgar " "	April 26-June 12,1819	Timothy Street &
Chinguacousy S.Part	June 20-Aug.24, 1819	Rich, Bristol
Esquesing " "	Finished Aug.25, 1819.	D.P.S.
Chinguacousy N. "	Sept.9-Oct. 1, 1819	
Esquesing N. "	Finished Sept. 7, 1819)	Abraham Nelles &
Erin S. "	" Nov.10, 1819)	Chas. Kennedy
		D.P.S.
Caledon E. "	Finished by Nov.10,1819)	James Chewett
		D.P.S.
		R. Sherwood D.P.S.
Caledon W. "	Finished by May 2,1820)	Contract sur-
		rendered to Sam.
		Ryckman D.P.S.
Erin N. "	Finished by Apr.5,1821)	Samuel Ryckman
Garafraxa All	" by Oct.20,1821)	D.P.S.

Street and Nelles were simply backers. Charles Kennedy did the actual survey work in his parts of Esquesing and Erin. Richard Bristol seems to have kept more than one party in the field, with one or more surveyors in each. Bristol visited the field parties frequently and signs the

* Survey Records, Lands & Forests; Letters Written, Vol.24, page 115. The letter is one of introduction to be delivered by Timothy Street in person.

† The first tenders ranged from 6 per cent to 8 per cent. Ryckman was allowed 5 per cent for the north part of Erin and Garafraxa, presumably because these were distant and swampy areas.

final copies of the Field Notes and Diaries, Street and Bristol drew their lots in Toronto Township on April 19, 1819. The lots were scattered through the concessions and they do not appear to have had any choice of locations. Street received 1,000 acres in Toronto and Bristol 600 acres, This was about the proportion of their shares in the other townships.*

The grants already promised could now be located. The changed layout and the reduction of the grantable lots by another 1600 acres made it impossible to place the parties exactly as proposed. Some degree of choice seems to have been allowed and groups of friends were able to locate together. The Council approved a few grants to settlers not connected with either of the Irish groups. The Grahams seem to have feared that the township would be filled before all their group had arrived. Joseph Graham petitioned on behalf of his "followers" on June 16, 1819 and was told that "when the remainder of Settlers come in they will be located as conveniently as possible".

In the end the original arrangement was not greatly altered. The Beattys located lots near Meadowvale and Joseph Carter, their chief "associate", at Derry West. Their "followers" were mostly west of the Centre Road, some of them west of the Credit, The Grahams located on the Sixth Line Road around Grahamsville. The locations of their "followers" extended westward until they mingled with the other group in the First Concession E.C.R. The two groups were not sharply divided and some of the Graham connection settled near Streetsville. Some had to buy land from the contractors or to lease reserves to get the locations they wished. When the restriction on sale ended the usual selling and exchanging of lots began at once.

* The later complaint that the surveyors chose the best lots was certainly-not true of the townships surveyed in 1819-26. To arrange a dishonest draw would be difficult. Samuel Benson added a list of desirable lots to his diary of the survey of Toronto Township - only one of these was among the sixteen drawn by his employers,

3. Actual Settlement; 1819-39

The first location tickets were issued about May 1, 1819. Some settlers moved in at once and began their clearings. In June Samuel Benson, the surveyor in charge of Bristol's party in Chinguacousy, mentions in his diary "a small improvement" on "Mr. Scott's Lot" (E.5, 15, Con, III, W.C.R.). The next Sunday some of the party went "to a meeting at Mr. Todd's, No. 14, 1st Con. W.". Location tickets for these lots had been issued to Andrew Scott and William Todd, Senior, on May 1st, with a number to other grantees, William Todd, Junior, "Surgeon", was one of these (Lot 15, Con, I, W.C.R.). The Todds were probably among the "associates" who petitioned with Joseph Carter on June 30th for Crown Reserve Lot 11, Con. I, E.C.R. They wished to build a "Public School" on the lot and described themselves as "settled in the New Survey of Toronto Township**". The petition may have resulted from the meeting at William Todd's, but it is most probable that this was also a "church meeting".*

A good many settlers must have been waiting for their locations in York or in the Old Survey. A party of "about twenty-six families" with a train of twenty-six wagons are said to have made the difficult spring journey from New York. They had probably arrived about the middle of April.† Other families probably came direct from Ireland a few weeks later. In all there may have been forty or fifty families in the New Survey when Chinguacousy was opened in September, 1819. It had been realized that settlement in Toronto Township would be rapid. The Council had already (April 22nd) set aside 200 acres as a glebe to provide for a clergyman and

* The Todd's were later prominent Methodists. Joseph Carter was a lay-preacher. Although he was an Episcopalian, John Strachan seems to have suspected him of Methodist tendencies. Patent Office, Lands & Forests, Order-in-Council Book 5, page 11. The school would be a "Common School" under the Act of 1816.

† Several settlers of these groups received orders-in-council for land on April 20-23.

ordered a Crown lot to be vested in trustees "for the use of the Schoolmaster first appointed in the Township and his successors" (Lot 3, Con, I, W.C.R.). For this reason they refused to grant the whole of Lot 11 for school purposes and only allowed four acres for a schoolhouse. There seems to have been no provision for mills in Toronto Township, such as was being made in Chinguacousy.

"Esquesing and Chinguacousy being chiefly intended for settlement of associated persons", there were already a number of groups anxious to locate in those townships. Lists were being prepared by several of the survey contractors. It was an advantage of the contract method that one or two men of means had a direct interest in furthering the development of each township. By allowing (or encouraging) them to prepare lists, the Council practically placed these men in the position of leaders of parties, The contractors were not the only ones allowed to hand in lists, James McNabb, of Dundas Street in the Old Survey of Toronto Township was given this privilege. He had petitioned on behalf of "Thirty Scotch families now residents of the United States who are anxious to settle in Canada and are desirous of obtaining a Block of Land on which they can settle near to each other....." He was told that they might "locate in the Town of Caledon when it is surveyed".*

This decision was soon altered to allow McNabb to place settlers in Esquesing (possibly in Chinguacousy as well). James Hunter on McNabb's behalf wrote to Ridout on August 9th to ask about vacant lots in Esquesing and the procedure in making out lists. Ridout gave what details he could, but much was still unsettled.† Shortly after Ridout begged leave to submit to His Excellency's consideration and pleasure

* Ontario Archives (microfilm), Minutes of Executive Council, May 5, 1819.

† Survey Records, Lands & Forests, Letters Written No. 24, pages 417- Ridout to Jas. Hunter, Aug. 9, 1819.

such questions as whether the lots were to be drawn for and how many privileged grants were to be made in Chinguacousy, Esquesing, Caledon and Albion:

".....I have called upon Mr. Street and Mr. McNabb &c for the names of such as wish to be located in the respective Tracts, but have not as yet received any return - Albion and Caledon as intended I believe for the Settlement of Individuals, who have not thrown themselves into Companies - I could wish, that locations therein, might be made, not subject to Draft, but if, from the number of applicants, a Draft may be deemed expedient, I humbly submit, that in such case the Southern half of each of the last mentioned two Townships may be located by families who wish to reside together, and the Northern halves only, be subject to Draft".*

The "&c." in Ridout's letter included Charles Kennedy for Esquesing and Erin, Samuel Ryckman for Erin and Caledon and James Chewett for Caledon. Street and McNabb seem to have divided the southern parts of Esquesing and Chinguacousy between them, but the "respective Tracts" were not clearly defined, Timothy Street may have placed a few settlers in Toronto and Trafalgar. Abraham Nelles placed some on Kennedy's lists. Settlers applying directly to the Council were allowed to locate wherever was convenient. The greater part of McNabb's Scottish settlers located in the "Scotch Block" of Esquesing, but he may have placed some in Caledon as well. Contractors drew their lots, but it is not clear whether ordinary settlers could choose their locations, A notice concerning locations in Chinguacousy published on August 25th does not refer to a draught. It says only that 228 lots of 100 acres each would be open for location on September 9, 1819 and the rest when the survey was complete.†

This notice was to be placed in the Niagara Gleaner as well as the Upper Canada Gazette (York). Street, Kennedy, Nelles and Ryckman were all recruiting settlers from

* Ibid., pages 425-26, Ridout to John Small, Aug. 17, 1819.

† Later reminiscences of early settlers often say they "drew" their lots, but they appear to contradict this by saying they chose particular locations - See accounts of Charles Haines and others in the Peel Historical Atlas.

among their old neighbours south of the lake. The great proportion of the grantees in Esquesing were "yeomen" from the townships of the south shore and in the other townships there were many grants of the same type. Not all moved to their holdings, and some sold them and moved on again within a generation. In the first few years the proportion of Canadian settlers was high in the eastern part of Esquesing, the southern part of Erin and in the part of Chinguacousy drained by the Credit.

The Surveyor-General had been told in August that only eight "U.E.L.'s" were to be located in the southern part of Chinguacousy; but this order had hardly been issued before the Council began to make exceptions. A number of military grants were also made, some of them free of settlement duty. The restriction of grants to 100 acres, implied in the notice, was not always observed, there were several of 200 or 300 acres. These were usually military or Loyalist grants, often part of a much larger acreage made up with lots in other townships. It had been intended to place such larger grants in Albion, Caledon, Erin and the northern halves of Chinguacousy and Esquesing. When the returns of survey of these areas were expected at the Surveyor-General's Office, Ridout wrote to ask if military claimants and children of Loyalists might be located in these townships.

"The Sons and Daughters of U. E. Loyalists and Military Claimants being numerous and exceedingly pressing for their Lands induces me respectfully to submit that one third part of the vacant and grantable land in each Township may be located to them indiscriminately, and the other two thirds to Emigrant Settlers & others"*

When Ridout wrote this letter, the only military grants being made in the tract were to men who had served with the regular forces. The announced intention of the Government was to set aside one or more townships in each

* Survey Records, Lands & Forests; Letters Written Vol. 24, page 454, Ridout to John Small, Oct. 9, 1819.

district in which militia veterans could locate their land grants. Ridout may already have known that this arrangement had been abandoned and have anticipated a rush of militia claims when it was known that these could be located wherever vacant lots could be found. The official notice of this change was given on January 19, 1820. Militia-men from the Old Surveys and from the Niagara and Gore Districts began at once to apply for grants in Esquesing and Chinguacousy. A number of the applicants had already taken lands as settlers and wished to locate their militia grants as close as might be to these holdings.

This was not always easy; vacant lots were growing fewer in these townships. Militia claimants from other areas were competing for grants, Adam Stull was able to secure another 100 acres, close to his family holdings at Limehouse, for service "as a private in a Flank Company of the 1st Lincoln Regiment". But Morris Kennedy had to be content with a lot in the Sixth Concession of Chinguacousy. Charles Kennedy, "Sergeant in Capt. Nelles's Flank Company of the 4th Lincoln Regt. " had to locate his 200 acres in Erin, even farther from the family settlement at Georgetown, It was much easier to find vacant lots in Erin and Caledon, A great many military, naval and militia grants were made in these townships, In the southern part of Erin and in Caledon more than half the grants were privileged, for many family grants were also being made there, In the rest of Erin such grants accounted for most of the unreserved lots.

It is obvious that many of these grants would be absentee holdings, A number of non-commissioned officers and privates, discharged from the regular forces, settled on their grants for a time at least. So did some children of Loyalists. A grant to the daughter of a Loyalist was likely to produce an absentee holding, for her husband very likely had a grant of his own. Officers received more lands than

they could farm and a private in the militia who was the son of a Loyalist or married to a Loyalist% daughter was likely to be in the same position. An extreme case is that of Amos Wilcox who during much of the war had been working for Joseph Silverthorn. In November, 1818, Amos married **Ann Pabst**, daughter of a Loyalist settled in Etobicoke Township. In 1819 he bought a 200-acre farm in the Second Concession N.D.S. and seems to have moved there at once. This did not prevent him from applying for the East .5, Lot 8, Con. I W.C.R. in Chinguacousy which he patented in 1821. At the same time his wife patented her family grant of 200 acres (Lot 22, Con. I, W.C.R.) Caledon. A year later Amos patented his grant as "Private in Captain Chisholm's flank Company of the late 2nd Regiment of York Militia" (East .5, Lot 5, Con. II, W.C.R. Caledon). This young couple now owned 600 acres in four holdings in three townships, no two holdings being contiguous. They and their descendants continued to live on the purchased farm in the Old Survey of Toronto Township,

Settlers had begun to move into Chinguacousy and into Esquesing below Lot 18 before the end of October, **1819**. John Bagwell, an English immigrant,, was building "a small log house" on Lot 14, Con, V E.C.R. in Chinguacousy on November 3rd. He believed that he was "the very first settler in this Township", but it seems more likely that others began improvements at about the same time near the western Townline without Bagwell being aware of it, A few locations in the northern areas were also occupied before the end of **1819**. Generally speaking, settlement in these sections began in 1820. The western half of Caledon was not open for locations until the summer of 1820, the remainder of Erin about twelve months later and Garafraxa towards the end of 1821.

Thomas Ridout, reporting locations in the Mississauga and Chippewa Tracts on January 29, 1821, gives the numbers for the townships of the Credit region as follows:

Locations

Trafalgar (new survey)	175
Toronto (" ")	178
Esquesing	350
Chinguacousy	416
Caledon	271
Erin	103

The figures for Chinguacousy and Toronto probably include the adjacent parts of Toronto Gore Township which is not listed, These figures show that there were still some unlocated lots in each township, Vacant lots were already few in the southern townships. There was a large number in Erin and a considerable number in Caledon. This was still the case when the system of fees was abolished in 1826 and many were sold by auction in the 1830's.

The relatively small number of occupied locations is evident when the populations given in the assessment rolls for some of these townships are compared with the number of holdings, The figure for Toronto Township includes both surveys.

<u>Township</u>	<u>Population, 1821</u>
Toronto	803
Esquesing	424
Chinguacousy	412
Caledon	100

About one location in four in Esquesing was occupied by a family in 1821, about one in four or five in Chinguacousy and only about one in fourteen in Caledon. No figures are available for Erin Township which was not yet completely open to settlement. If the proportion was the same as in Caledon, there were about eight households in the southern half of the township in 1821.

This seems a probable figure, for practically the only settlement in Erin at this time was near the southern Townline, especially near Ballinafad. Here members of the Roszel family had settled on their holdings by 1820. They had a few neighbours in Erin Township and more in the northern corner of Esquesing. These settlers had followed the line of

the Eighth Concession of Esquesing and spread out along the Townline. Much of the settlement in the southern part of Esquesing was outside the Credit Watershed, but there were clearings along the Townline below Norval. In the northern part of the township settlement was less evenly distributed, but the groups of clearings near the sites of Georgetown and Limehouse were larger than those in the corresponding part of Chinguacousy. The most thickly settled part of the watershed, outside of Toronto Township, was probably the section of Chinguacousy between Churchville and Alloa, extending through all six concessions west of the Centre Road. Even here groups of two to six clearings were separated by unimproved holdings and reserves. Beyond Alloa the clearings were still few and widely scattered.

There were three groups of settlers in Caledon by the end of 1820. One was in the south corner of the township, where several grants had been made to actual settlers before the end of 1819 and a number of grants to immigrants in 1820. Some of the latter were for fifty acres "patent gratuitous".* Others took 100 acres and paid fees or made some arrangement with privileged claimants. Some of these early arrivals became permanent settlers and were joined later by friends and relations. Farther north, near the Sleswick-Caledon Sideroad, a group of Scottish immigrants were given grants in 1819 and 1820. The more compact part of this settlement was near the old road from the Townline at Lot 10 to Lot 16, Con. III E.C.R. There were some early grants in the west corner of the township between Rockside and Belfountain. A good many of these grants changed hands before 1837, some of them being assigned more than once before being patented. It was here that John "McDonall, a native of Paisley,

* This phrase usually appears in descriptions of grants of 50 acres to poor settlers. In the case of privileged grants to veterans and Loyalists "Patent free" is more usual.

Renfrewshire, Scotland" settled with, it is said, about seventy members of his family, There is, however, some doubt as to whether the MacDonald group were living in Caledon at the time of the assessment in March 1821. John and James MacDonald had performed their settlement duty by December, 1821.* Most of this group bought their land from previous grantees.

Settlers arrived in larger numbers during the next two years. The population of all the townships increased as more holdings were occupied. By 1823 there are signs that the demand for land was slackening and that settlers in this area were growing discouraged, The reasons were partly economic. In 1819 John Bagwell had written home from Chinguacousy of British subjects coming to Canada:

"They are flocking from the United States by hundreds every week and bring most wretched accounts of it as to trade, yellow fever, and want of money & confidence....."

Canada was spared the yellow fever, but the post-war depression that was encouraging migration began to be felt there about 1821. Some of its effects are still observable as late as 1828. It was not only financial difficulties that induced actual settlers to sell out and try their luck elsewhere, as a number are known to have done in the Credit area at this time. There can be no doubt that the great quantity of unoccupied land was delaying settlement, Its effects were especially marked in Erin and Caledon, less so near the lake. In Toronto Township reserves were being leased and absentees were selling their holdings in the early 1820's; but in more remote areas, where settlement duties could more easily be

* The doubt arises from the wording of the description of the E.5, Lot1, Con, VI W.C.R. After giving John MacDonald's name and origin as quoted it adds "just arrived in this Province, now of the Town of York, Yeoman" The date is Dec. 31, 1821. James MacDonald is also described as "of York" on Dec. 20, 1821. Descriptions were not made until certificates were filed but the natural assumption is that the MacDonalds left their families in York until 1822. This is contrary to family tradition. Perhaps the clerk simply copied from the location ticket.



Near Erindale - Built not long after 1820 by Lieutenant-Colonel Peter Adamson "Toronto House" seems to show the influence of the "General's" service in Spain and Portugal. Arranged in a single story around three sides of a court it is quite unlike most Canadian houses of the time. The two bays are an English Regency feature.



More typical of the 1820's and 1830's is this house on the hill north of the mills at Churchville. The narrow plan, pilastered doorway and five windows above were recognized as characteristic of Loyalists' houses before 1840.

This house almost opposite the site of the grist mill at Meadowvale retains many features of the 1830's but the square plan, "cottage roof" and other details suggest a date nearer 1850. Like the one above, this house was re-sashed after 1875.



evaded, these unimproved lands cut off settlers from "the front" and separated them from each other.

Up to 1820 grants were still made under the Regulations of 1804, though the constant modifications since 1815 must have been exceedingly confusing to everyone. Fees had been raised; settlement duties made compulsory on all grants; occupancy for one year required and sale forbidden until three years after the date of the location ticket. However, the settlement duties recorded by John Bagwell in 1819 are practically the same as in 1804. A new set of regulations took effect on January 1, 1820. These abolished restrictions on sale; provided fifty-acre grants without fees for poor immigrants; greatly increased the fees on grants of 100 acres and up and ordered each settler to clear 2.5 chains across the front of his holding instead of five acres where he chose.

Many settlers in the Tract had received their grants before January, 1820 and the new rules were not retro-active. They would have handicapped later settlers, for on the old lots with twenty chains frontage this strip was exactly five acres; on thirty-chain lots like those in the New Purchase it amounted to 7.5\$ acres on each front - 15 acres in every 200. After Ridout pointed this out to the Governor on January 20, 1820, an adjustment was made that lightened settlement duties. Settlers were now to clear half an acre around their house "which with the Road, & Chain Slashed would complete the five acres required".*

The higher scale of fees also caused trouble. Settlers who would have taken 100 acres and paid £5 14s. Id. under the old scale were unwilling to label themselves as "indigent" by applying for fifty acres without fees. They took 100 or 200 acres; paid the first instalment and, when the time came to file their certificate and pay the second instalment,

* Survey Records, Lands & Forests, Letters Written, No. 25, pages 284-85; Ridout to Daniel Martin, Dec. 5, 1821.

found they had not the money. They delayed sending in their certificate and became liable to forfeiture. This was adjusted in 1821 by allowing the certificate to be filed without payment, provided the patent was sued out and the arrears paid within a year of filing, The result (which might have been foreseen) was that certificates were filed and nothing more done for ten, fifteen or twenty years. The settler was content to take the slight risk of forfeiture rather than pay the fees, It was probably in 1821 that Thomas Ridout had "S.D.P.d" (Settlement Duty Performed) lettered on certain lots on the "Domesday Maps", to indicate that a certificate had been filed and no patent or description issued. Some of these were patented within a year or two; but in other cases settlers had filed certificates in the 1820's who died long after without patenting their land.

If no certificate was filed in two years the lot was technically forfeited; but the settler could get a sworn report from a deputy-surveyor as to his improvements. This involved some expense, Hugh Black, D.P.S., who had settled in Esquesing, wrote to Ridout in June, 1823:

"I have been lately often called on to examine forfeited land in this Neighbourhood, which employment would be of considerable assistance to me were it not that I cannot serve the people without being more chargeable to them than I would wish, though I believe I still give my services cheaper than any other Surveyor in this country - the reason of this charge is that there is not a Magistrate within twenty miles of this Settlement so that to certify an oath requires I should travel at least 40 miles."*

He suggested the oath of a deputy-surveyor be accepted without certification. This could not be permitted, but Ridout offered to have any settler Black recommended appointed Justice of the Peace. Black replied that "Mr. Adam Stull Lot No. 21, in the Sixth Concession" was the only one suitable "as the body of the settlers are nowise qualified for such an office....."

* Survey Records, Lands & Forests, Surveyors Letters Vol. 11, No. 36, & No. 37.

Making inspections in Eramosa in the spring of 1824, Hugh Black was (or professed to be) shocked by the amount of perjury that had occurred there and in other townships, In his letter to Ridout he blames this on the requirement of sworn certificates.

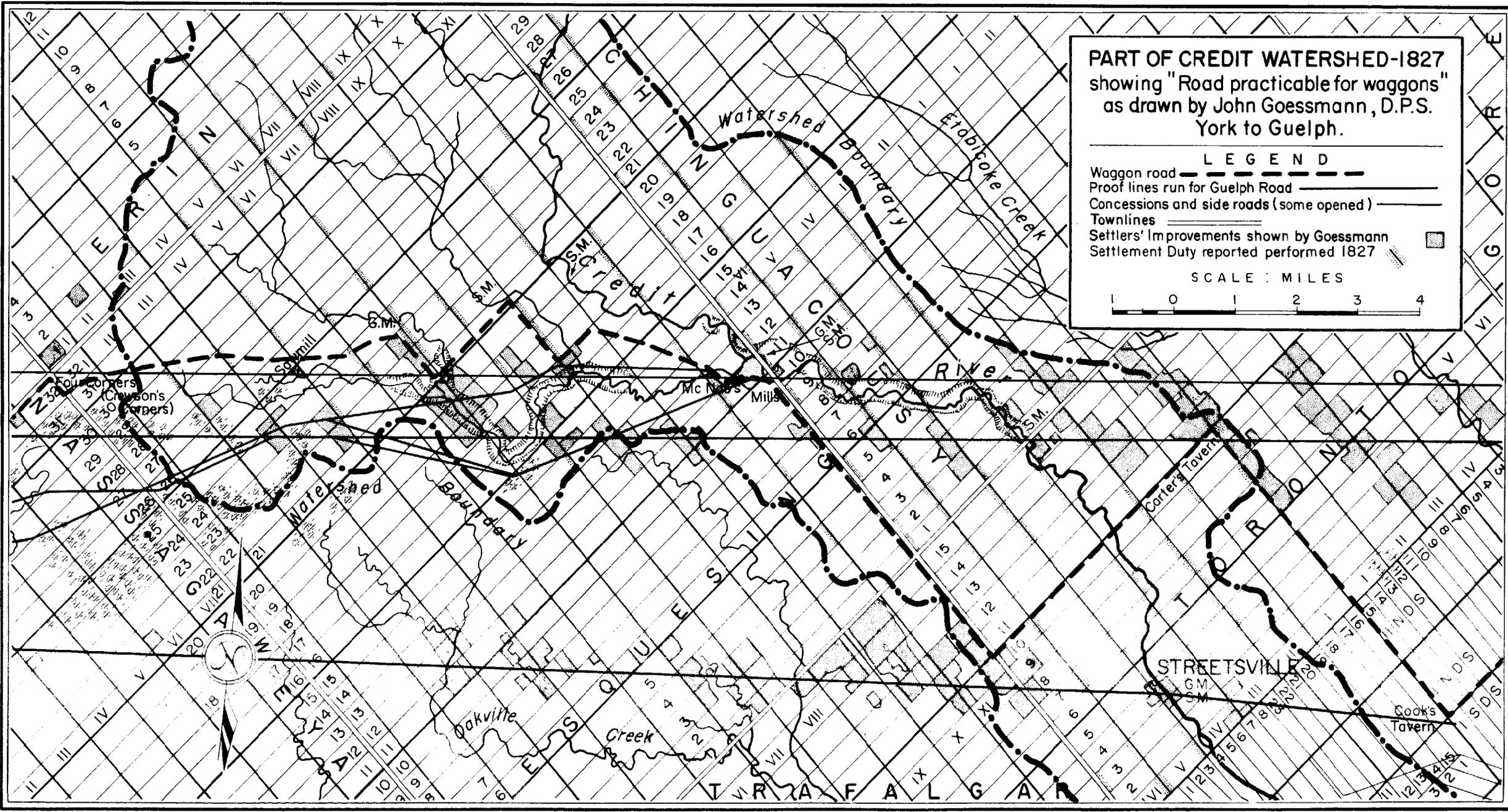
"The present Regulations bear hard on the honest man & the rogue is at any time for a few shillings able to evade them. Every thing is to be proved by an oath, & making oaths so fashionable has already destroyed that awe & reverence that an appeal to the Almighty ought to raise in the mind of every good man. I can now for a sum less than a dollar procure an oath to any purpose whatever & I am sorry to say where public morals are not sunk already the ingenuity of some of our Magistrates will soon destroy all regard to conscience.....The poor man that owns 100 Acres will scarcely be willing to perjure himself for the property but a man with a thousand can easily procure a wretch who will swear to anything. I now return you a number of lots forfeited & the owners have to my certain belief honestly paid for doing the settling duties bona fide & after all there is not a bush cut on them yet certificates are sworn to for procuring the deeds."*

Black goes on to name a magistrate in Nelson who granted "such dispensations to Oaths as would have been something of a puzzle to Pope Leo himself". Another "Squire" in Albion was said to be equally slack or corrupt, He names three men who were making a trade of false swearing in the western part of the Tract and a fourth in Caledon, a contractor "who swears to settling duties in that quarter & without doing any thing of the work".

".....by these means the roads are never cleared & property in the rear Townships will not be of any value in our days & poor settlers can never do any thing to their lands so far back."

Here Black was voicing a common grievance of the time, though he may have exaggerated the number of complete evasions. He was apparently an honest man, but like other surveyors he had lands "in the rear Townships" and may have had other reasons, not quite disinterested, in getting rid of the oaths. Nevertheless the amount of evasion and its consequences fully justified the discontent.

* Ibid. Vol. 11, No. 43.



PART OF CREDIT WATERSHED-1827
 showing "Road practicable for waggons"
 as drawn by John Goessmann, D.P.S.
 York to Guelph.

LEGEND

Wagon road ————

Proof lines run for Guelph Road ————

Concessions and side roads (some opened) ————

Townlines ————

Settlers' Improvements shown by Goessmann [shaded area]

Settlement Duty reported performed 1827 [diagonal lines]

SCALE : MILES

0 1 2 3 4

The bad times were not only responsible for some removals of recent arrivals in the area, They caused the failure of some of the enterprises that the first applicants had been so ready to undertake in return for special grants. Some of these were possibly mere excuses to get a good location, or were too far ahead of the development of the country, like Duncan Buchanan's project for a cotton mill near the Centre Road which was rejected by the Council. The proposed salt-works in Caledon did not depend on a Crown grant, for the sites of the spring and the mills at the Falls had been granted without conditions to militia claimants, Matthew Crooks was able to buy the site from the original nominee and leased a number of reserves in that part of Caledon in 1822. The salt spring is said to have been found by a young man employed in Crook's store at Ancaster when looking for gold, This "gold rush" must have taken place in 1819, for in May, 1820, Samuel Ryckman mentions having heard of "a valuable Salt Spring". He thought that this and the advantages of the soil would produce a "flourishing settlement". The salt spring proved nearly as great a delusion as the gold. These projects and the Crooks sawmill at the Falls may have been partly responsible for the large number of privileged applicants in that part of Caledon, most of whom were absentees, Certainly these enterprises produced little permanent settlement,

Several holdings containing mill sites were sold in 1822-24, possibly because their owners no longer wished to invest in mills and feared to lose the security they had given to do so. Among these were the Comfort, Street, McNabb and Williams sites. They passed to owners willing to become resident operators with considerable benefit to the inhabitants, A tax on wild lands, imposed for eight years in 1819 and made permanent in 1824, encouraged absentees to sell when a good opportunity offered, though it was too small to force sale at a low price, Owners eight years in arrears had to pay in twelve

months or lose their holdings. The price of land was rising; when Crown Lands ceased to be granted to ordinary settlers for fees alone in 1826 and sale by auction was substituted, the upset price in the Home District was set at 6 - 4 shillings an acre.

A second movement of settlers into the Credit area began about 1826 and the number of new arrivals grew steadily in the next seven years, Land had now to be leased or purchased; it could no longer be obtained directly by grant to ordinary settlers. Under the new regulations poor immigrants could buy farms between the sales at the upset price and on easy terms of payment. Other settlers had to attend the Crown Land sales and bid against well-to-do immigrants and speculators, It was often cheaper and more convenient to buy an unimproved holding or the assignment of the "scrip" of a military or Loyalist claimant who had not yet located his free grant, although privileged grants were still subject to settlement duty, Land bought at the sales could be paid for in instalments and the patent issued when payment was complete, without inquiry as to improvements.

The Settler could also lease or sub-lease a Clergy Reserve in the desired location or buy a Crown Reserve from King's College or the Canada Company, In 1822 it had been made possible for a tenant to purchase a Crown Reserve at any time and a few lessees in the Credit area availed themselves of this privilege. A little later some Crown Reserves were set aside as an endowment for a Provincial College and a number of those in the area were patented by King's College in 1828. In 1826 the Crown Reserves not already disposed of were sold to the Canada Company. An attempt to sell the Clergy Reserves to the Company did not succeed, but from 1829 some Clergy Reserves were sold every year, The Canada Company was a profit-making concern and it had purchased an immense tract of wild land to

the north-west.* It would be some time before the returns from the "Huron Tract" would cover the Company's expenses. The only source of immediate revenue was the sale of Crown Reserves in settled townships. The sale of these, on a system of three annual instalments, was pushed as rapidly as possible. Some lots were sold at once to settlers already in the Province and the Company began an active campaign to attract emigrants from Britain. The first sales, completed by 1829, included some of the few Crown Reserves bought by the Company, in Toronto Township, several in the watershed in Chinguacousy and Esquesing, and a few in Erin and Caledon†

To a large proportion of the settlers entering the Credit Watershed from 1826 to 1830 the location of their holdings was of special importance, They were Irish or Scottish immigrants who wished to live near their friends in the area and it was often hard to find Crown land in the right neighbourhood. It was by private purchase and by leasing reserves that members of the Stubbs family obtained locations on the Centre Road in Caledon when they came from Ireland about 1826. The Stubbs were joined by friends who had been living for five or six years in the New Survey of Toronto Township. A number of privileged grants made in this area in 1819-20 had been patented so promptly as to suggest that their owners had been victims of the unscrupulous contractor named by Hugh Black, These were available for sale or lease and between 1825 and 1835 most of them were occupied by new arrivals. A considerable settlement had grown up by the early 1830's along the Centre Road on both sides of the site of Caledon Village.

* This 1,000,000 acres was offered to the Company instead of the Clergy Reserves, when it was objected that the latter were worth more than the Company proposed to pay.

† Most of the Crown Reserves in Toronto Township went to King's College or were sold to tenants. The Company usually received patents for lots when the sale to a settler was completed,

The older settlements in Caledon near Star, Silver Creek and Rockside were expanding and new ones were forming near Belfountain and Alton, where children of Loyalists and some veterans occupied their holdings by about 1830. It was in the late twenties also that settlement began in the vicinity of Orangeville. In 1835 the population of Caledon was 1,414, fairly evenly distributed to east and west of the Centre Road but less evenly through the concessions, A number of families are reported to have moved into Erin about 1824. The township contained 75 households in 1830, totalling 368 persons. A good many of these families had been on their lands long enough to have sizable clearings. In the next five years new arrivals brought the population to 963. These figures are from the assessment rolls and cannot be taken as exact. But the rapid settlement they reflect was certainly taking place in the early 1830's.

In the more accessible parts of the watershed this process was still more rapid. The population of Toronto Township in 1835 was well over 4,000 and it was the third largest in the Home District, ranking after York and Markham Townships, Settlement in the New Survey had greatly increased after 1821, especially in the late twenties when the villages were coming into being. After 1830 the village population grew still more quickly and by 1835 it may have accounted for nearly a fifth of the total,, Apart from this the township was among the more populous areas in Upper Canada and the concessions west of the Centre Road were probably the most thickly settled part of the township. Chinguacousy and Esquesing, with populations of 2,428 and 2,206, were far from being fully occupied, but they were as populous as several longer-settled townships, There was little village population in either, In Chinguacousy the section drained by the Credit was probably about as well settled as any other. There had been fewer absentee holdings to restrict settlement in the 1820's, and the

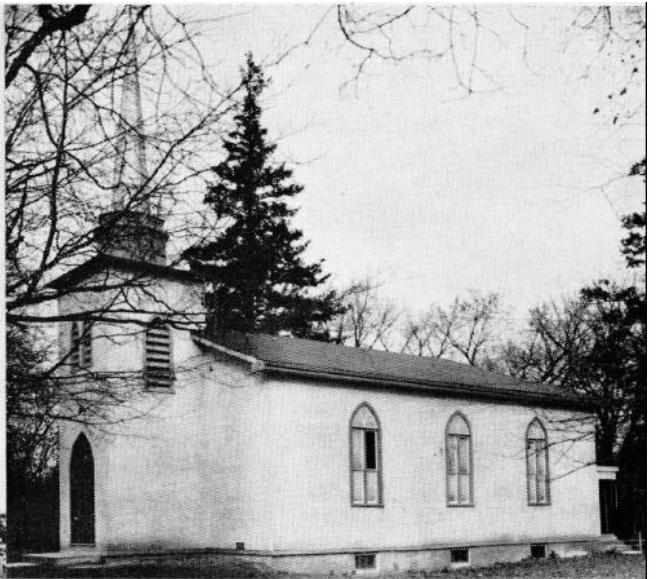
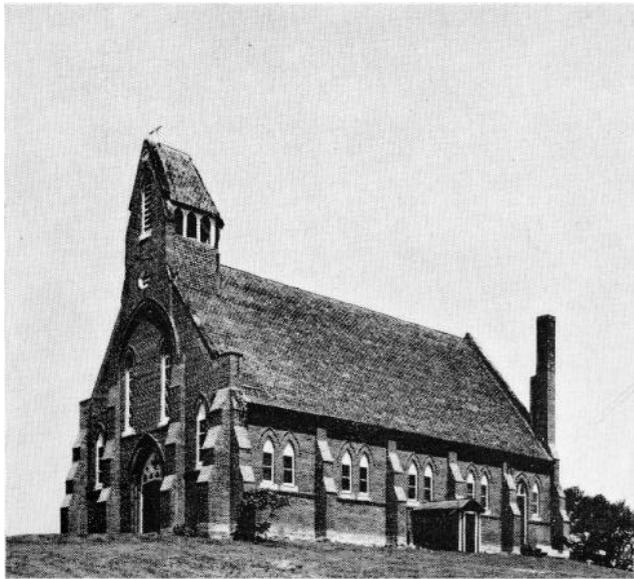
fine farmland had been quickly occupied. This left less room for newcomers after 1830 and the rate of increase was slower. In the northern part of Esquesing there was far less land of this type, but after 1826 developments to the north and north-west of the watershed began to stimulate the development of this township,

The Company had disposed of most of its holdings in the Credit Watershed by 1837. In December, 1840, a return was made of immigrant settlers in thirty-eight counties who had completed purchases from the Company. Erin was not included among these townships. The figures for the others in the Credit area are given in the grouping used in the return, but the estimates of the settlers' property in 1840 have been omitted.

<u>Township</u>	<u>No capital</u>	<u>£:20 or less</u>	<u>£:20 or more</u>	<u>Total</u>
Chinguacousy	24	19	18	61
Esquesing	27	2	7	36
Caledon	26	6	4	36
Toronto	2	-	-	2

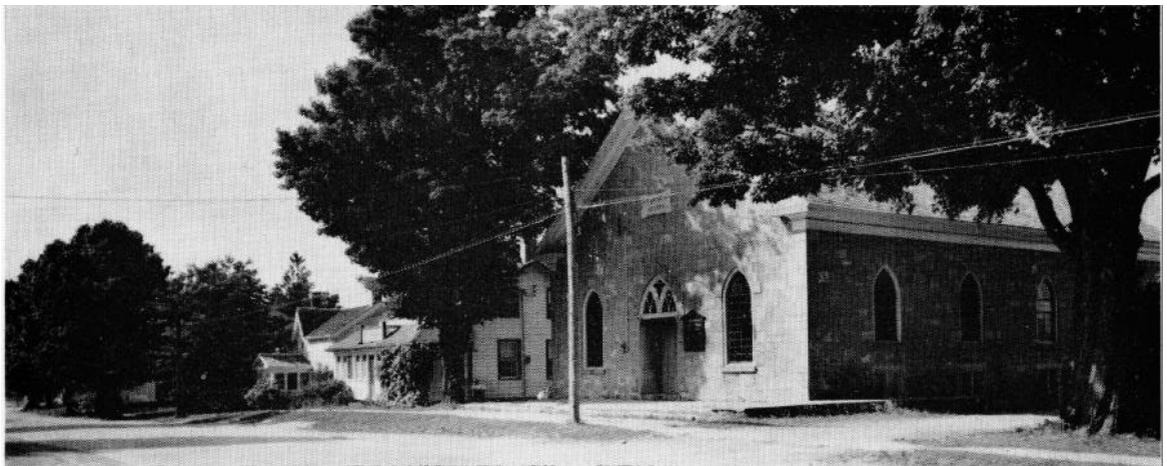
These figures take no account of sales made to owners of adjoining lands, to tenants and squatters, to other residents of Upper Canada, or to immigrants who had not completed their payments. The proportion of sales to immigrants had been high in Chinguacousy; it must have been lower in the other townships including Erin, but still accounted for the majority of sales. In Erin and Caledon some purchasers had difficulty in meeting their payments. The Company only evicted an occupant as a last resort, but some parcels in Erin seem to have come back on its hands and were still unsold in 1859.

The Crown Reserves were now as readily available as any other land in the area. A considerable number of Clergy Reserves had been leased in the early 1830's and were occupied in 1837. Very few had been sold by that year, but the

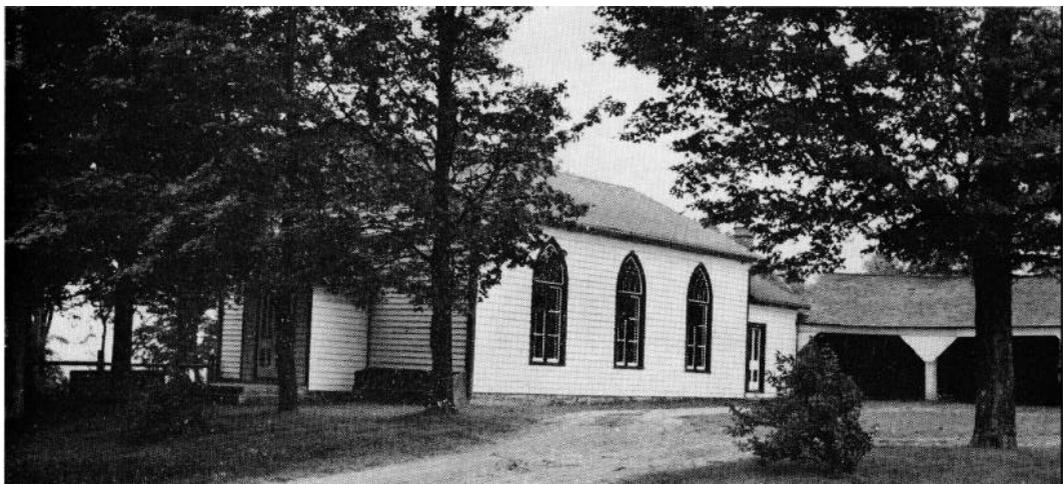


St. Cornelius Roman Catholic Church, Silver Creek (Caldwell P.O.) Caledon Township - built about 1884 to replace a much earlier church shown in 1859 as 'St. Constantine's'. Both dedications were suggested by the Christian names of members of the Murphy family who donated the land on which the church stands.

St. Paul's Anglican Church, Norval - built 1846, restored 1950.



St. Andrew's Presbyterian Church — Hillsburgh, 1869 — one of several churches that replaced the "Union" church mentioned in 1846 and 1851.



Near Limehouse — this early church built near "McCallum's" grist mill, the first mill in Esquesing, has continued in use when a newer one in the village was abandoned.

interruption of settlement by the reserves was much less than it had been before 1830. The great immigration of 1830-34 had done much to advance the development of the Credit area, but in 1835 immigration in Upper Canada dropped sharply and suddenly. The effects of this were soon apparent, An inhabitant of London, Upper Canada, visiting Toronto in July, 1835, wrote in his diary:

"Toronto is exceedingly dull, There have been scarcely any immigrants arrived and consequently little money has been brought into the country and that shows the dulness of the times; there comes up to the city little merchandise,, The streets are almost deserted, what a contrast to the year 32".

This "dulness" in both Canada and the United States culminated in the depression of 1837. It was probably not so quickly evident in the Credit area where recent arrivals were still establishing themselves and spending the money they had brought with them. This had been sufficient to lessen the shortage of cash which was one of the chief difficulties of the time. The 29 purchasers of Crown Reserves who had more than 520 each had brought altogether £ 2,362 10s. Sterling. They did not represent the wealthiest class of settlers; there were some who were seeking improved farms or millseats whose means were greater than the £.111 which was the average capital of seven Canada Company settlers in Esquesing. The average of this group in Chinguacousy was £78 and in Caledon £44.

There was, however, little increase of population in 1835-37 and this inevitably checked the business developments that had been going on in Toronto Township and were beginning in Esquesing and Chinguaccusy. After the disturbances of 1837-39 some settlers left the area in addition to those involved in the outbreak, Immigration was again gradually increasing, but, except in Chinguacousy, settlement in the area was slow until after 1840. This was particularly true of Caledon. Toronto Township had filled up so quickly in the early thirties that some slackening was to be expected.

Chinguacousy, besides the advantage of better farmland, was close enough to the lake to benefit by the growing trade in lumber and grain. The traffic to the north-west continued to benefit the settlements in Esquesing. It mostly by-passed Caledon at this time, because of the difficult roads through the township, It was because of this that so little advantage had been taken of the water-power in Caledon compared to developments in Esquesing, and better communications also probably explain the slow, but steadier, progress in Erin Township. The gain in population in the late 1830's was too slow to produce the rapid development that had been hoped for in 1832-35 or to satisfy the impatience of those whose fortunes or livelihood depended on this development,

CHAPTER 5

CHANGES IN THE OLD SURVEY

While the New Survey was rapidly changing from a wilderness to a settled countryside, change was also taking place in the Old Surveys, Except along Dundas Street this did not involve a rapid increase in the degree of settlement, There were already some large holdings in the area by 1812, the result of the buying and exchanging referred to in the last chapter. A good deal of land changed hands between 1818 and 1830 and some two-hundred-acre farms were broken into smaller parcels. But as a rule these sales tended to throw parts of several holdings into one large one. The average holding in Toronto, Old Survey, in 1835 seems to have been near 190 acres, although there were several farms of less than fifty acres and still smaller parcels in the villages,

There was now almost no vacant Crown Land in the Old Surveys, especially near the Credit, Most of the reserves had been occupied before 1818 and the few vacant lots taken up, including land forfeited during the war. The situation was a very good one and prices were high. The area was attracting the type of purchaser who wished to acquire a large tract and with so much land available in the New Purchase there was less division of holdings among several heirs,

The area in 1817-22 was experiencing a "settlement boom" such as often occurred in a settled region adjacent to recently opened areas. Apart from the increase in traffic along the highway, settlers preparing to move into the new townships required lodging, food, fodder and equipment, and often help in building and clearing. Most of the immigrants located in the New Survey of Toronto were able to pay for more than the minimum of goods or assistance and some, like the Grahams and Joseph Carter were men of means,, There was also a demand from absentees for settlement duty contracts. Some of the Scots-Irish settlers preferred like William Hawkins, to buy lands in the Second Concession N.D.S. and take their

grants in the New Survey as additional lands. Some absentee owners now settled on holdings they had patented nearly ten years before. Andrew Cook is reported to have moved in 1816 to the lot near the Toronto Townline that he had patented in 1808. His son Jacob bought land at "Harrisville" and obtained a contract for carrying the mails. When Daniel Harris returned to the United States in 1828, Jacob Cook bought more of the Harris holdings and the name of the village was later changed to Cooksville, though it seems to have been called "Millbrook" in the interval.

Inns multiplied along Dundas Street; new industries were set up, stores, sawmills, tanneries, a distillery and a brewery. Around the old taverns, where trails led northward into the New Survey, the hamlets began to grow into villages. The Government took steps to make the water-power of the Credit available for mills and to found villages on the river. In 1820 the Mississaugas surrendered all but 200 acres of their reserve on the Credit, to be sold by the Crown, partly for their benefit and partly to defray the cost of roads through the Indian tracts. The reserve was surveyed in three blocks. The centre block (E) on each side of Dundas Street was to be sold at once to pay for the roads and was laid out "in Lots of Fifty Acres and a Village".

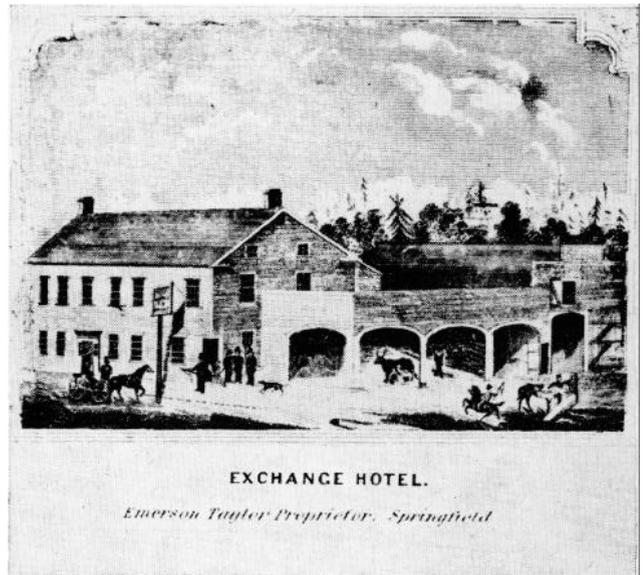
An Order-in-Council of October 13, 1821 directed that this block be vested in trustees* for this purpose. Two weeks later the trustees announced that it would be sold by auction on November 17th, but no sales were made at that time. In May, 1822 notice was given that the Block would be sold as one parcel and it was purchased by Thomas Racey, who was apparently expected to build mills and lay out the village. Racey had made a good beginning by 1825, but the times were hard and he was unable to meet his payments. Like so many others Racey had over-estimated his ability to carry through

* Col. Samuel Smith of Etobicoke and John Beverly Robinson, then Attorney-General.



Erindale - this cottage on the old highway at the eastern end of the village, probably dates from the first ten years of Springfield's existence. It was long occupied by Dr. Dixie whose surgery with its fittings remained until recently in one of the rooms.

From Tremaine's Map of Peel County, 1858 - This Stage House of the 1830's stood between Dundas Street and the millrace where "Jarvis Street" led to the grist mill. The Magrath homestead, "Erindale House" shows among the trees above the drivesheds.



St. Peter's Anglican Church, Erindale - stone church of 1887 that replaced the built fifty years earlier.

the scheme and in November, 1827 the block was again advertised for sale, "unless the former purchaser shall, on or before the first day of June next, have fulfilled the condition of his purchase". This time the tract was sold in smaller parcels. A considerable area around the mills was bought by James McGill, a Scottish settler, thirty-seven and a half acres were reserved for a town-plot and most of the remainder was sold off in parcels of 100-200 acres.

The area was now beginning to attract a type of settler who was to become more common in Upper Canada after 1830. They were immigrants of ample, though often somewhat reduced, means who came to Upper Canada seeking estates rather than farms. Their capital was usually much larger than that of the average well-to-do settler, like those in the New Survey, and if they were prudent they spent some of this on improved land in a settled area for their home farm, though they might take a good deal of bush land in addition as a speculation or to provide the income from rents which was part of their scheme of existence. If they did not settle in a bush township, they were often successful in carrying out their plans and their large stake in the country, with their connections at home, gave them the ear of the authorities at York. They could, if they wished, become active magistrates and take the lead in local affairs in a way that was not always pleasing to their neighbours.

One of the first of such colonists to locate near the Credit was a major in the 71st Highland Regiment, who had served in the Peninsular War and been placed in command of a Portuguese regiment. Peter Adamson had risen to the rank of Lieutenant-General in the Portuguese service and in 1817, eight months after being placed on half-pay, was gazetted a Lieutenant-Colonel in the British Army. He seems usually to have been spoken of as "General Adamson", but is almost always called "Lt.-Colonel" in contemporary documents until his appointment to the Legislative

Council made him "the Honourable Peter Adamson." In 1821 he came to Canada and took land in Trafalgar and other townships as his military grant, It was, however, on a block of land in Toronto Township west of the Credit and south of Dundas Street that he built "Toronto House", a one-storeyed stone mansion of some size, A little later his brother, Dr. Joseph Adamson, settled on the Middle Road near Sheridan.

General Adamson was an energetic and able man, but he appears also to have been arrogant and hot tempered. Opposition to his wishes seems to have roused him to fury. Even the Council despaired of adjusting his dispute with the Reverend James Magrath. General Adamson had been active in a group of prominent settlers who succeeded in establishing an Anglican congregation "at the Credit" and in building St. Peter's Church near the new village of Springfield or Credit Post Office in 1827. He was instrumental in getting a rector appointed for Toronto Township and at first approved the choice of Mr. Magrath, who seemed highly suitable from Adamson's point of view.

Unfortunately Magrath was also anxious to acquire an estate. He was a middle-aged Irish Clergyman who had come to Canada to provide better opportunities for his children, some of whom were already grown-up in 1826. He bought 200 acres fronting on the north side of Dundas Street from the trustees of the Racey Tract and built his homestead "Erindalet" some distance north of the village. It appears to have been at Magrath's and Adamson's suggestion that the block north of Racey's Tract was surveyed and sold in 1828. At the time of the survey Magrath tried to have the lots laid out parallel to Dundas Street so as to front on the river. At the sale the two Adamsons each bought lots and the Magraths extended their holding to the north-west, John Goessman, who had surveyed the block, bought a lot between the General's holding and Magrath's. When he had to forfeit this, the General and the Rector were allowed to

buy it jointly. This lot contained a mill site on which Adamson wished to build a sawmill, but the General supposed this to be on his own lot, When he discovered his mistake, he insisted that Magrath give up his share of the lot.

The Rector had no other river frontage and refused to agree, though he was willing to divide the property. The dispute was carried to the Council and raged for five years, Adamson angrily demanding his way and Magrath blandly standing on his rights and suggesting arbitration. Finally in 1833 the Council expressed their "total inability to reconcile the conflicting interests and statements of the parties concerned". They again recommended arbitration and pointed out

"that the party declining to resort to it, must feel his claim to be untenable, and will afford a strong presumptive reason for such a conclusion.**

After this broad hint the matter was settled by giving the General the north-west half with a mill site where a sawmill was built later. Mr. Magrath received the remaining fifty acres, which was nearer his house and was also traversed by the Credit.*

The feud was not ended; the General withdrew his countenance from St, Peters and the increasing prominence of the younger Magraths in the affairs of Springfield and Streetsville is not likely to have pleased him, although their politics agreed with his. About 1838 he bought McNabb's mills and a large block of land at Norval. He built a house there and transferred much of his interest to Esquesing, though he retained his properties near Dundas Street,

The opening of Block F did not produce much settlement near the river. Most of the other lots went to inhabitants of Springfield and Dundas Street. They were

* General Adamson had a similar dispute with James Graham about a Clergy Reserve near Streetsville that Graham had leased and assigned to his brother-in-law, James Glendinning. Adamson wanted the lot for a servant, but in the end Glendinning retained possession.

occupied very gradually, but some householders are listed in 1837 and some other sawmills may have been built before 1840. It was probably intended to sell Block D, between Racey's tract and the lake, in the same way, but in 1825 it was decided to put it to a different use which delayed settlement for a generation, For many years a party of Mississaugas had had a village on the Grand River below Brantford. They had recently been converted to Christianity by Methodist missionaries. At this time Peter Jones, the son of Augustus Jones by "Tuhbenahneequay, daughter of Wahbanosay, a chief of the Messissauga Tribe of the Ojebway nation" was living in Brantford. He had passed most of his boyhood wandering with his mother and her people, but in 1816, when Peter was fourteen, his father placed him and his older brother John in school for some years, He had been converted at a camp meeting in 1823 and since that time had been devoting a good part of his time to the work of the Mississauga mission.

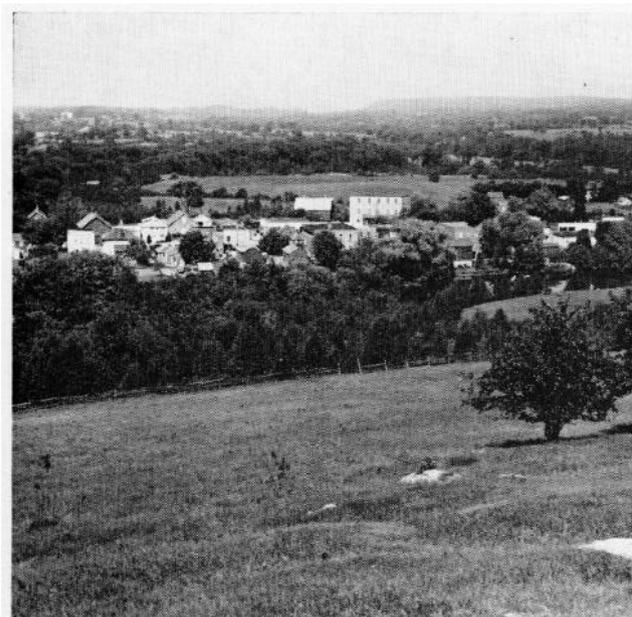
The object in moving the Mississaugas was to wean them from their half-nomadic life and, by placing them on their own land, to encourage them to depend on farming for their subsistence. It was also desired to remove them from the influence of the pagan Iroquois and the settlers in the Reserve on the Grand. The idea of the return to the Credit may have originated with Peter Jones, and he had a great part in putting it into effect,

Tenders for building houses for the Indians were called for in the fall of 1825. In December Thomas Racey wrote to ask if it was too late for him to be awarded the contract, hinting that it would help him to meet the payments on his tract. The houses had evidently not yet been begun, They were dressed log cottages with two rooms, of the type built as a second house by settlers who had been five to ten years on their farms. Most families had only one room, but the chief's house had at least two rooms downstairs and a half-storey above. The house built for John Jones, who went with the Indians as schoolmaster, was probably of this type



Port Credit - The old "Wilcox Hotel". This old inn was probably built in the late 1840's when the planking of the Lakeshore and Georgetown Roads brought more traffic to Port Credit. James Wilcox, the builder, closed the hotel after the railway was built in 1856. The rather unusual arrangement of windows is original, but a recent restoration has added a porch and removed two oval ventilators still on the gable in 1908. By that time the lower front windows had been re-sashed.

Cheltenham from the south-east. This group of brick buildings - a house, a store block and a hotel - represent the 1870's, 1880's and 1860's, when the village was prospering. There were buildings on the site in 1859. Older houses stand near the river at the north-west end of the street (left). The site of Charles Haines clearing of 1822 and grist mill of 1829 is reached by the road leading to the right.



Erin from the south. The main street runs between the lower mill pond (right) and the stone flour mill in the middle distance. This mill replaced earlier grist mills built by Daniel McMillan in 1830-1849. It is powered by the larger pond (out of sight to left). The Trout sawmill and store of 1826 were probably south of the road towards the right of the picture. In the distance is the gap through which the Credit flows down the Escarpment

and the one built later for the missionary may have been larger. Peter Jones probably shared John's house when at the Credit and it was there that he began his translation of the Gospels into Ojibway. Egerton Ryerson lodged with John Jones during his short term as a missionary at the Credit.

When Ryerson arrived at the village in September, 1826 the Indians were living in bark wigwams. This may have been from choice, rather than because their houses were not finished. Egerton Ryerson lived in one of these wigwams until the weather became cold. He was at this time assisting his brother William, on the York circuit, the other assistant being "Squire" John Beatty of the New Survey who still owned his land at Meadowvale but had begun his career as a Methodist preacher. Although he had often to be at York, Egerton Ryerson accomplished a great deal during his time at the Credit. He threw himself into the work of clearing and of teaching the Mississaugas everything connected with a settled life, from building fences to cooking. In less than a year he learned enough Ojibway to be able to preach to his charges in their own language. He started a subscription among the Indians for a combined schoolhouse and chapel.* Peter Jones mentions going to Racey's sawmill for boards for this building in 1827.

Later the Government built a sawmill for the Indians; a separate chapel was built and various crafts were started in addition to farming. The village had been located on the high ground south of the Credit, not on the 200-acre reserve on the flats, which was subject to flooding. A village plot with intersecting streets had been laid out, just beyond the point where the Mississauga Road bends to the south-west, near the Mississauga Golf Club. However, all the buildings seem to have been along the road. In 1837 there were about fifty of the two-family houses, At this time the Indians had a storehouse near the mouth of the river, possibly the one built by Thomas Racey in 1823. In 1840 they had

* He did this to prevent the Anglicans from building a church, which they were rumoured to be contemplating doing. The schoolhouse had an upper room which was used as a council-house. This room was probably the first chapel.

about 500 acres cleared and under cultivation. From the end of 1827, when James Richardson Jr. succeeded Egerton Ryerson, there was usually a white missionary living at the Credit. Richardson was followed by George Ryerson, whose wife died at the Credit in July, 1829.

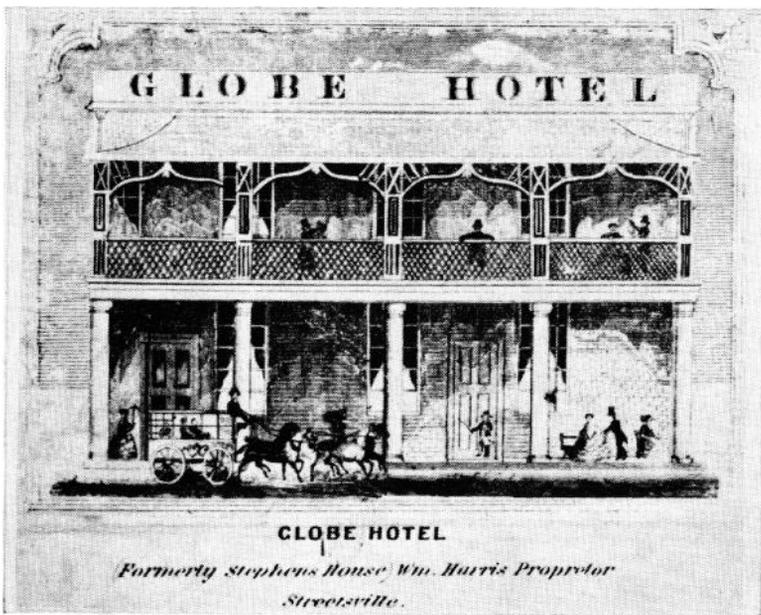
Much of the success of the mission was certainly due to Peter Jones and his brother John. From 1827 to 1833 Peter was often away from the Credit, on fund-raising tours in the United States and in England, on trips to the other Chippewa missions and on journeys to York to forward the printing of his translation of the Gospels. He received a good deal of encouragement in this work from Sir John Colbourne, Archdeacon Strachan and other prominent Anglicans, and in these interviews he established friendly relations with the men who were engaged in a bitter controversy with his white colleagues over the Clergy Reserves, Peter Jones kept aloof from these disputes. He won the approval of the Reverend Mr. Magrath, who sometimes preached at the mission with Peter as interpreter. As a result of these good relations and of the interest roused in high places by his first English tour, there was no attempt to interfere with the Credit Mission such as Egerton Ryerson had feared in 1827.

After his return from England Peter Jones became "the first Indian minister" and was regularly stationed at the Credit, though he usually had a white minister as colleague. It was to his "comfortable house" in the Mississauga Village that he brought his talented English wife after their marriage in New York in 1833. Peter Jones remained at the Credit until he was moved to Munsey on the Thames, shortly before the mission was closed in 1847. The experiment had been a success in many ways, but no devotion on the part of the missionaries could check the ravages of disease. The thirties and forties were an unhealthy time in Upper Canada, and among the Indians even the mildest contagious diseases became fatal epidemics, The numbers of the

Mississaugas declined during their stay at the Credit. Soon they would be too few to warrant the maintenance of a separate mission. The area was developing rapidly and becoming less suitable for Indians who had not entirely adapted themselves to living with settlers. The Mississaugas were allowed to return to their old home on the Grand or to move to Munsey or other missions. For years their houses remained standing along the road. They disappeared one by one until only the chief's house remained on the Golf Club grounds as a memorial to the Mississaugas of the Credit and even this relic seems to have perished in recent years.

The Indians had leased a tract of land near the mouth of the river to Moses Polley which was surveyed by Hugh Black in 1830. There may have been a few other assignments, but there could be little settlement below the Racey Tract. Walton lists about six to eight inhabitants whose locations are given as in the "Indian Reserve" in 1837. He gives about six inhabitants of Port Credit. This agrees well with other evidence, so the laying out of the first or south townplot in 1834 had not yet produced much settlement. Nor was the Lakeshore Road much occupied between the Etobicoke and the Credit,, The accounts of travellers before 1840 all describe it as running through woods with only occasional openings to the lake. Beyond the river settlement was much more advanced, for the area was more likely to attract well-to-do immigrants, Some of the settlers of means who had taken up masting reserves in 1808-12 were still occupying their holdings and some, like Colonel Thomson, had enlarged theirs into considerable estates. Others had sold all or part of their land to newcomers and this section of the watershed was already, in effect, an extension of the select neighbourhood that was forming near Oakville.

Streetsville - Timothy Street's house, 1825, said to be the first brick house in the Township. This long, low building resembles houses built before 1812 more than those of the 1820's. The bricks will have been burnt locally by itinerant brick makers. The porch is modern.



From Tremaine's Map of Peel County, 1859 - To make the building appear more imposing the artist has reduced his figures to dwarfs. The main part still stands at Main and Queen Streets, with modern store fronts on the ground floor. A trellis gallery above heavy pillars was not uncommon in the 1850's - compare the porch of the Ramsay House.

Barber Brothers built their large stone woollen-mill and brick store south of Streetsville in 1853. Additions were made to both buildings at various dates, but the two-storied front of the store is little altered since 1859. It was here that William Lyon Mackenzie took refuge with the miller, William Comfort, in 1837 when escaping from the fight at Montgomery's Tavern.



CHAPTER 6

THE REBELLION OF 1837

Ever since the end of the war dissatisfaction with the management of affairs in Canada had been growing. The causes of this discontent went back in most cases to the early days of the Province. In upper Canada these were chiefly connected with the distribution of land, the lack of roads and schools, the management of the reserves and the tendency to give the Church of England a privileged position in regard to marriage, education and the revenue from the Clergy Reserves. Before the war the opposition that resulted from these grievances had been sporadic and had not been carried on by a distinct party. Much of the opposition to Hunter had come from officials at York who resented his attempt to improve the efficiency of government offices and enforce settlement regulations. They accused him of being influenced by one or two Scottish officials and of favouring immigrants at the expense of Loyalists. Later Gore had trouble with members of the Legislature who were strong Tories in the 1820's.

By 1825 the belief that a small group were using their influence with the Governor and their control of the Legislature to further their own interests had become fixed in the minds of many settlers. A party was forming that held that the redress of grievances could never be obtained until the Crown could be persuaded to accept in Canada some of the limitations imposed by custom in Britain and strengthen the power of the Assembly by making the Executive Council responsible to it and not simply to the Governor.

The Home Government had shown some readiness to listen to the complaints of inhabitants. They had, by 1830, reformed the system of land grants; got rid of the leasehold system in connection with the Crown Reserves and tried to do so in connection with the Clergy Reserves; forced the Legislature to accept the tax on wild lands and to widen the basis of representation by the formation of new constituencies.

A system of common schools, partly supported by Government, had been established in 1816 and a number of schools had been opened. A considerable amount of money had been spent on roads, bridges and canals and still more was to be spent in the next few years.

None of these measures satisfied the Reformers. In practically every case they had wished for something more, or had disapproved of the solution adopted. They complained that the same group was mismanaging the new systems; that they were arranging land sales to suit their friends, appointing unqualified magistrates to control township affairs through Quarter Sessions, favouring their friends in the courts and using wartime regulations to keep out American settlers, They felt that the Government was retarding the development of the country and that Responsible Government would solve most of the problems,

The real difficulty was lack of population and wealth and the consequent lack of public revenue. Revenue from taxes was insufficient for ordinary expenditure. Nor would the Crown Lands produce much revenue until settlement raised the value of land, The most hopeful sources of funds for schools, roads, railways and so forth were the British taxpayer and the British capitalist. The former already considered himself overtaxed and the latter as yet knew little of Canada and, before the panic of 1837, was investing much of his surplus capital in the United States. Successful experiments in assisted settlement were made in the twenties and the progress in Upper Canada between 1815 and 1830 is, when viewed as a whole, quite remarkable, but it fell far short of the hopes of the inhabitants,

The rapid growth of population in the early thirties seemed likely to solve some of the country's problems and it increased the power which the Reform Party had been steadily gaining in the Legislative Assembly. The party had found able leaders among both the old and the new settlers.

The most violent and vocal was William Lyon MacKenzie, who had come from Scotland in 1820. He was sincere in his desire for reform and fearless in attacking abuses, But he was excitable and unstable, though his polemics against the Family Compact lost nothing in effect by being violent, exaggerated and occasionally untrue. He was skilful in taking advantage of the stupidity of his opponents who frequently played into his hands by equally violent actions and abuse.

The Reformers had a considerable following in the Mississauga Tract, particularly in the Second Riding of York County, which corresponded closely to the present Peel County. They had adherents and opponents in every group and class. The Second Riding had usually elected Reformers during the twenties and early thirties. Mackenzie himself was elected for this riding in 1829. Mackenzie had some warm supporters in and around Streetsville and Churchville. On the other hand many of the North of Ireland settlers in Toronto and Chinguacousy were Orangemen, and usually strong supporters of the Government. This did not prevent some of them from favouring reform, but prevented them from giving unqualified support to Mackenzie and the extreme group. Settlers with American connections were apt to be extreme Radicals and to advocate separation from the Empire and sometimes union with the United States. As a result the loyalty of the party became more and more suspect.

A large proportion of the settlers in Caledon were strong adherents of Mackenzie and his group. There were equally strong Tories in the township. During the thirties a local feud was carried on in this township, the larger group using the limited powers of the "Town Meeting" against their political opponents in matters of fences, cattle pounding and so forth. The Radicals had supporters in the Scotch Block of Esquesing and in Erin. With such a division of opinion in a primitive community clashes could be expected

and as party feeling grew stronger in the late 1830's faction fights became common. The first is said to have occurred at Streetsville in 1833. A Reform banquet had been arranged at "Mother Hyde's" Inn in Streetsville. Just as the company was about to sit down and while, it is said, Malcolm McKinnon was saying a Gaelic grace, a party of Orangemen broke in, drove out the Radicals and ate up the feast in spite of all Mrs. Hyde could say or do,

Orange Church was a strong Radical and the middle storey of his new grist mill at Churchville was a favourite place for Reform meetings. According to one account a meeting held on November 11, 1834 ended in a "Homeric battle". The "Townline Blazers" and other local Orangemen had attended with clubs and rotten eggs. They were met by Reformers from the Scotch Block with a few French Canadian lumbermen, Martin Switzer, a Reformer from near the Trafalgar Townline, was pelted and the principal speakers, Mackenzie and Samuel Lount, were driven from the platform and forced to take refuge in the Scotch Block.*

A similar, but more serious, riot is recorded at Voles Corners" in 1836. The Reformers had obtained a good majority in 1835 and had tried to begin their program of reforms. They were soon at odds over Responsible Government with the new Lieutenant-Governor (from whom some of them had expected support). When Sir Francis Bond Head dissolved the Legislature in 1836, the Tories rallied to defeat the Radicals. It has been remarked that, obtuse as he was, Bond Head may have made a shrewder estimate of Mackenzie's influence with the mass of voters than Mackenzie and his coterie. Certainly some moderate reformers were becoming uneasy about the views of the more extreme leaders. Some leaders of the moderates were too loyal to the party to make

* Ontario Dept. of Archives, Perkins Bull Papers under "Churchville". This account seems to represent Harry Cole as a Tory. There may be some confusion with the meeting of 1836.

their feeling public before the election, but Egerton Ryerson withdrew his support of Mackenzie and carried along with him a large body of Methodists and the "Christian Guardian", which also circulated among the moderate Anglicans, both Radicals and Tories.

It is possible that the Reform Party might have lost its majority in any case; but unfortunately the Governor most improperly behaved as if he was the Tory leader and encouraged the Tories to resort to intimidation, cajolery and bribery to reduce the number of Reform votes, The events at Voles Corners" were typical of what went on in many other places. It was described by the Radicals as "an Orange outrage". ". . .Some of the Orangemen brought their guns and FIXED BAYONETS to the meeting - and they had a waggon load of clubs covered with hay, and two women sitting on it to prevent suspicion." "Harry Cole, the Orange Bully, brought with him a club in his hand, and a boy bearing his rifle loaded with ball" The Tory candidate and some of his "respectable" supporters, merchants from Streetsville and others, are said to have applauded the Orangemen "for cutting and slashing a number of 'quiet and respectable unarmed men'". An "orange brute" climbed the platform and tried to throw Mackenzie down on the "knives and clubs of his enraged and infuriated banditti". John Stewart, Junior, intervened to protect Mackenzie, but "Three of them...., chased him until he got across the Credit, with dreadful threatenings".*

This account comes from Mackenzie's own "Advocate? It may be questioned whether Mackenzie's friends were quite so quiet or the Orangemen such bandits as is represented, However, the Tories certainly took the initiative in the disturbances at first, Such scenes took place at many polling places in the Province in 1836. This allowed the

* Ontario Archives, Perkins Bull Papers. Also "From Strachan to Owen.

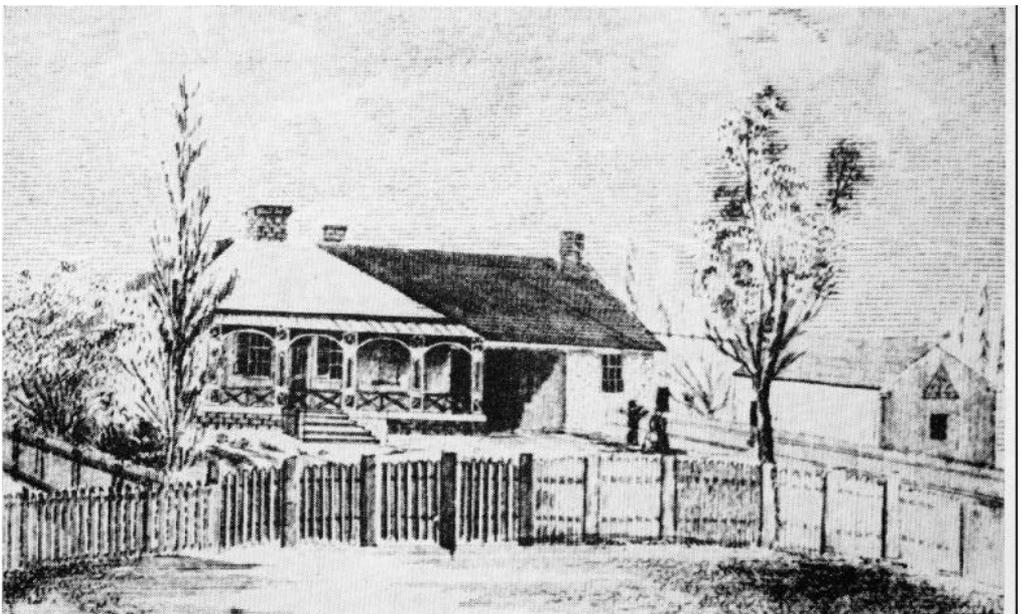


Alton, Caledon Township - a house of 1845 to 1855. The Greek Revival doorway is typical of this decade, but the windows and the general long lines of the building reflect an earlier manner of building.



North of Streetsville - this farmhouse, built by the Ramsay family on land bought from earlier settlers, is fairly typical of the 1850's, but the brick drivesheds and panelled chimneys are less usual features. This design of verandah seems to have been popular near Streetsville before 1859.

From Tremaine's map of Peel County, 1859, the James Barber house, Barber's Mills near Streetsville. This modest brick cottage was replaced before 1877 by the large mansion still standing nearer the highway.



extreme Radicals to believe that they had been cheated out of their victory and concealed the fact that they were losing support. Their defeat at the polls made them desperate and the depression of 1837 added to their discontent. They began to organize to resist strong-arm methods, and to tighten their political organization. A series of meetings were held and armed resistance began to be discussed. When Mackenzie went from a meeting at Bolton to one in Caledon in August, 1837, twenty-six horsemen rode with him and kept the Orangemen of Albion at their distance. In Caledon there was less chance of trouble, but when Mackenzie, with twenty horsemen, went on to John Campbell's house near Cheltenham, his opponents also gathered there in force. Both groups were armed and to avoid bloodshed the Radicals held their meeting indoors. At this meeting a resolution was passed suggesting independence, as well as those already passed by other meetings, expressing sympathy with the movement in Lower Canada and calling for a convention at Toronto.

This was an important step and one that lost the extremist some further support. Many people believed that independence was only a step to annexation. Some leading Radicals certainly hoped that this would be the result, though Mackenzie and Lount were not among them. The desire for violent action was increasing. The idea of a great armed demonstration was substituted for a convention. By autumn the Radicals were drilling more or less openly and some of the inner circle were planning to change the demonstration into a rebellion. They were badly supplied with arms, and blacksmiths in Caledon and elsewhere began to forge heads for pikes, an obsolete weapon, useful against cavalry but awkward against infantry armed with muskets and bayonets. At this point Bond Head sent the regular troops in the Province to assist in putting down the rebellion in Lower Canada. This left six thousand stand of arms almost unguarded at Toronto.

The possibility of seizing these arms with the capital city tempted the Radical leaders into hastening their preparations and calling for the concentration of December, 1837 which ended in the disastrous attack on Toronto and the defeat at Montgomery's Tavern. They had over-estimated their own strength and preparedness and the secrecy of their plans. They underrated the determination and organization of their opponents and their ability to move quickly to assist the volunteers at Toronto. In the Credit area the loyal element is said to have been particularly well organized. The militia was called to arms by the drums of the Orange Lodges and moved quickly to suppress the rising. Some of the companies were sent post-haste to York. "Captain Magrath and his Volunteer Cavalry" were among the first to arrive and with other units from West York took part in the fight at Montgomery's Tavern. The whole affair was over so quickly that some people close to Dundas Street were unaware that it had taken place. After Montgomery's Tavern a thorough rummaging of the countryside took place. Arms and horses were confiscated, suspects arrested and no known Reformer was safe from disturbance unless he had turned out with the militia. Some did this reluctantly and under pressure, but loyal Reformers were willing to resist what was now obviously an armed rebellion against the Crown.

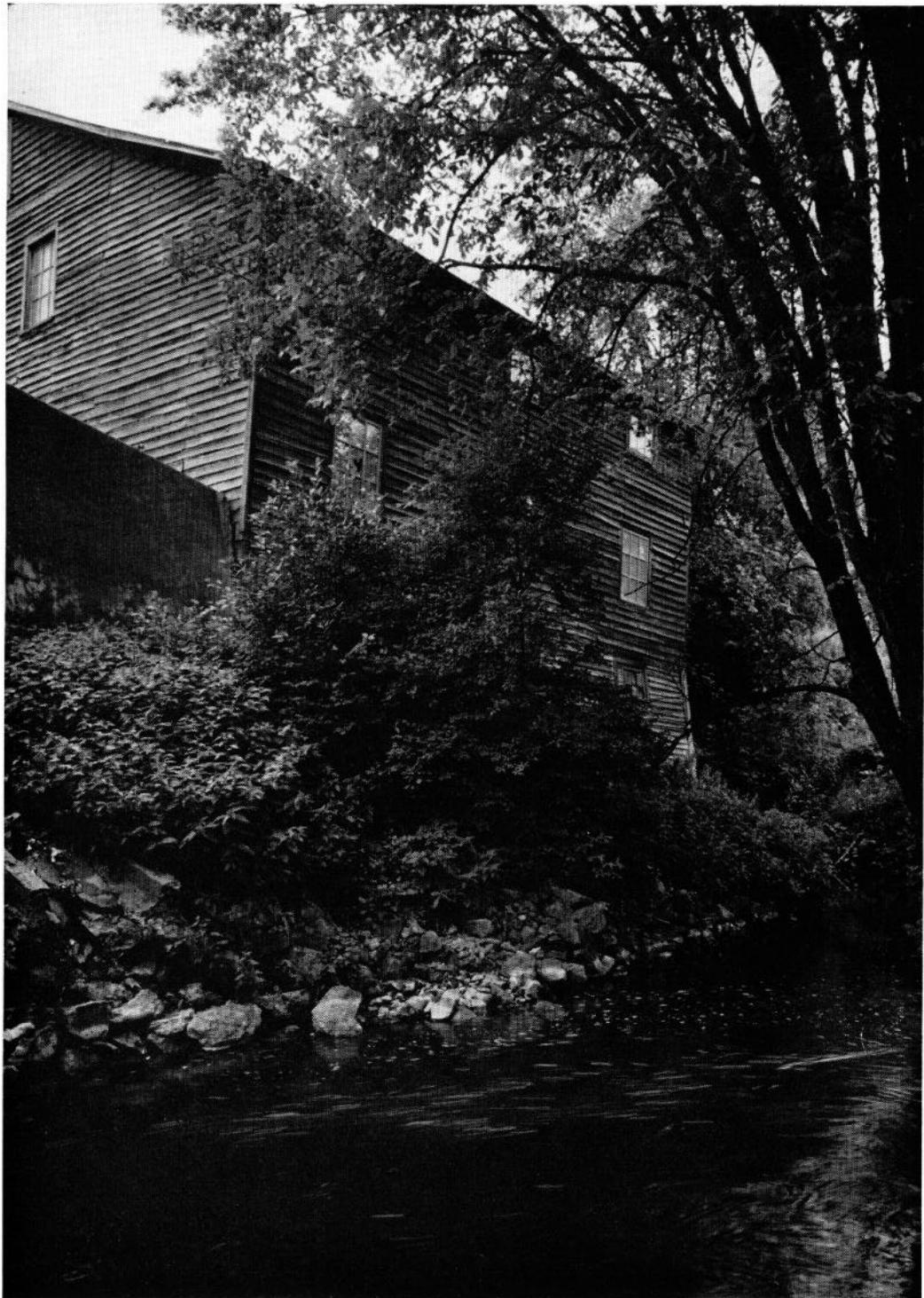
Mackenzie fled westwards from Montgomery's Tavern determining to make his way to the United States as quickly as possible. His route was determined very largely by the need to find safe places for crossing the rivers, The bridges were being guarded and the streams were slightly swollen. After wandering some distance to the north, he spent the first night at Absalom Wilcox's house near Dixie, Next day he and Allan Wilcox made their way (probably by back roads) to William Comfort's mill on the Credit below Streetsville. Here the crossing was unwatched and Comfort had not heard of the rebellion. He gave them dinner and a waggon to take them

on. Turning south to Dundas Street they saw the proclamation offering £ 1,000 reward for Mackenzie. Soon after, mounted troops came up behind them and they found the bridge over the Sixteen Mile guarded. They had to abandon the waggon and the rest of Mackenzie's journey to the Niagara Frontier was made mostly on foot or on horseback. It included many narrow escapes but these took place far from the Credit Watershed.

Some of the local rebels also fled to the States and others took to the hills where hiding out was comparatively easy. A number were concealed in the cave near the Forks which in 1869 was known as the "Radical's Hole". They were fed by sympathizers until the amnesty of 1838 allowed them to return to their homes. There are other tales of successful concealment and this is possibly the reason that fewer arrests seem to have been recorded in this area, Many of those first seized had been released almost at once. Among those arrested was William Comfort, but he also seems to have returned home before long. There are other tales of successful concealments, but Mackenzie himself did not hide in Caledon either in a cave or under a lady's skirts. Perhaps some less known fugitive, also of small stature, had recourse to the latter strategem.

Units of the local militia were very soon sent to garrison the Niagara Frontier, including Captain Magrath's Company of Volunteer Cavalry "from Toronto". In January, 1838 a meeting was held at Hurontario Church, Derry West "to help the families of persons on the frontier". This garrison service was prolonged for two or three years, for even after Mackenzie abandoned Navy Island there was still danger of raids from across the border. None of the alarms of 1838-9 directly affected the Credit area. By 1840 the country was settling down. The outbreak had been a failure and had probably done little to hasten the concession of responsible government. It had, however, done good by focusing British attention on Canadian problems and the need for more care in dealing with

the colony. In Upper Canada it sickened many people of violence and, though politics continued to be conducted with a good deal of heat and rowdiness, attempts to revive the old abuses were no longer passively accepted by respectable opinion.



Alton - the grist mill from the river - still in use as a chop mill. This is the lower type of frame grist mill usual before 1845. It may well be the first grist mill, built about 1851.

CHAPTER 7

MILLS ON THE CREDIT

1. Sawmills and Grist Mills

The Indian reserve on the Credit prevented any mills being built on the main river before 1820. At first the settlers in the Old Survey had to depend on grist mills on the Humber and the Sixteen-Mile Creek, but by 1818 there were mills on the Etobicoke at Summerville. The journey to Cooper's Mills was troublesome if the grist was carried overland and the rapids above the King's Sawmill must have made it difficult to reach with boats. Still the inconvenience was less than in some areas at that time and not sufficient to encourage the building of mills on the branches of the Credit outside the reserve.

The first settlers in the new townships were likely to suffer more from the lack of mills. The Council was aware of this and tried to ensure that mills would be built soon after the settlers began to go to their land. Surveyors were instructed to report any millseats they met with in running their lines. This was not likely to reveal all the possible sites, and in fact the surveyors did not find some of the best sites which lay in the centres of the lots. Some that they reported proved unsatisfactory, for it was difficult to judge the flow of a stream or the possibility of building a dam. The demand for millseats was so keen, however, that they were likely to be found by prospective settlers without delay. To ensure that they were not held as a speculation, the Land Boards were ordered in January, 1819, not to locate lots containing millseats until security had been given for the erection of mills.

A petition from Timothy Street was read in Council on April 22, 1819, "...praying for Permission to make choice of a Spot for the Erection of Mills in the Township of

Chinguacousy" and that land adjoining might be part of his payment for the survey. He was allowed 200 acres, but chose a lot without a good mill site. He now made the mistake of asking for the east half of a Clergy Reserve (Lot 3, Con, IV), which had a good site, with the 100 acres to the north as an additional grant. He was told to draw another lot for his 200 acres and in October notice was given that the two half-lots would be granted to any one who would build "a Grist and Sawmill".

Petitions were received from Anselm Foster, Timothy Street, and Peter Walker. They were referred to the Land Board and the Board's rather obscure report was read in Council on October 15, 1819.

Way it please your Excellency,

The Notice for application for a Mill Seat in the 4th Concession of Chinguacousy being erroneous from the representation of Timothy Street of a wrong number, and his original proposition being rejected from his demand of three Lots to accommodate the Mill Seat - further Notice was given on which Mr. Street renews his proposition to Erect a Saw Mill on a Grant of one Lot, half of 3 and 4, within eighteen Months from the location, And a Mr. Walker offers to Erect a Saw Mill immediately and a Grist Mill within eighteen months. The offer of Mr. McCollum being withdrawn in favor of Mr. Street - The Security offered by Mr. Street is unexceptionable - that by Mr. Walker more doubtful, but duly considering the Merit of Mr. Street to Grace from the Executive Government - The Board recommends the acceptance of Mr. Walker's proposal.

Which is humbly submitted

By Order

(signed) Wm. Dummer Powell C.J."

Similar grants in Esquesing were intended to provide two sawmills and a grist mill. On September 9, 1819 the Council ordered

"....that Charles Kennedy of Gainsborough Deputy Surveyor, shall have leave to locate the One Hundred Acres heretofore ordered him, on Lot No. 21, in the 8th Concession of Esquesing on which is a Mill Seat and that he shall receive a grant of the remainder of the said Lot on Condition that he shall build a Saw Mill on the said Lot and put it into operation within twelve months from this date, John Kennedy, Senior, and David Smith, both of Gainsborough aforesaid Yeomen are accepted as his Sureties for the performance of the said Condition?

In October Jonathan Howes, millwright, applied for the east half of Lot 27, Con. XI, Esquesing Township and was granted it on condition of giving "proper Security that he will build a Saw & Grist Mill within Eighteen Months and the Saw Mill immediately". Like Timothy Street, Howes had mistaken his lot and had to have the location changed to Lot 29, *Con. X*.

Howes had not built any mill on Lot 29, *Con. X* when Charles Kennedy inspected it in April, 1822. A small "Chanty" had been built near the mill site but very little else had been done to improve the lot. Nevertheless, Howes kept the lot and patented it in 1837; it is likely that he was given more time to build the mills. Kennedy's own sawmill was very likely finished in the specified time, though he also delayed about fifteen years before patenting. Certainly there seems to have been a sawmill on this site in the 1820's.

Peter Walker (an Emigrant from Aberdeen, Scotland, now of York, Merchant") received his patent for the two half-lots in Chinguacousy in June, 1822 - "Settlement duty performed". His dam is mentioned in 1826 and "Walker's Mill" in 1837. "Mill" used alone usually means a grist mill, so it may be that Walker ran a grist mill into the 1830's. There is nothing to indicate that Howes ever built a grist mill, There were settlers in that area, but this site was not easy of access. The McMillan family carried their grist over a bad road to MacCallum's mill near the site of Limehouse, until the mill was built in Erin Village and other settlers in this part of the watershed seem also to have gone there or to the mills at Belfountain or to Williams' Mills.

"MacCallum's Mill" was certainly running by 1821, though MacCallum did not then own the site. When he issued the description of Lot 24, *Con, VII*, Esquesing Township in that year, Thomas Ridout added a note that "there is also erected a Grist Mill driving one pair of stones and in full operation on this lot". The grant had been made to Abraham

Secord as the son of a Loyalist and it was to Secord that the description and patent were issued,

Tradition has placed the building of the Church sawmill, on the site of Churchville, in 1818. A more likely date is 1819-20. Samuel Benson surveyed both ends of the lot in the spring of 1819. In June he camped near the site and mentions the improvement on Andrew Scott's lot on which the mill was built, Neither entry mentions Amaziah Church or his mill. William Calder said, many years later, that when he settled less than three miles north-west of Churchville the nearest "mill" was on the Sixteen. Church's grist mill was probably built in 1821-22.

This would still make the Church sawmill the first in the New Survey, Timothy Street testified before the "Select Committee on Mill Dams" in 1826 that he had built his dam "four or five years" before. His sawmill was probably built at the same time and his grist mill a little later, In his testimony Street listed the dams across the Credit from the lake to Norval, giving rough estimates of the distance between each, In the following list the locations are given where possible and the type of mills added from other sources. Modern names are used for villages, The hearing took place on January 4, 1826 so these dams were all standing in 1825.

Some Mills on the Credit - 1825
As listed by T. Street, Jan. 4, 1826

<u>Name of Dam</u>	<u>Location of mills</u>	<u>Probable type of mills</u>
"Mr. Racey's"	Erindale	Saw & Grist
"Comfort's"	Lot 1, Con. IV W.C.R. Toronto Township	Saw & (?) Grist
T. Street's	Streetsville	Saw & Grist "and other machinery"
"ROW' s"	Lot 7, Con, IV.W.C.R. Toronto Township	(?) Saw
"Mr. Beattie's"	Lot 11, Con. 111 W.C.R. Toronto Township	Saw (?) & Grist
"Densmore's"	Near Churchville	(?) Saw

<u>Name of Dam</u>	<u>Location of mills</u>	<u>Probable type of mills</u>
"Walker's"	Lot 3, Con.IV W.C.R. Chinguacousy Twp.	Saw (? & Grist)
"McNabbs"	Norval	Saw & Grist

There is no difficulty about the first three mills, Garry Camp in his evidence said that he had built both Thomas Racey's and James McNabb's mills and implies that they were finished by 1825. The dams (which Camp did not build) were not quite complete at the time of the hearing, but Racey's sawmill may have been finished earlier and been powered by a long race. Camp says this was possible on Racey's site. Timothy Street said that "one Comfort" was building mills between his dam and Racey's. William J. Comfort seems to have run these mills until they were sold to Barber Brothers in the late 1840's.

The distance given by Street between his dam and "Row's" is too short. It was pretty certainly on the site of Christopher Row's later sawmill. Row probably built the sawmill soon after Mary Row patented the lot in 1822, but it is unlikely that there was a grist mill there until much later. The race across Clergy Lot 12, Con, III, which fed Beatty's Pond, is mentioned in Returns of Inspection of Clergy Reserves in 1829. John Beatty had leased this lot and patented it in 1831, ten years after his patent for Lot 11. The Returns seem to imply a grist mill on Lot 11, but there is no* tradition of Beatty having finished one before he sold to James Crawford about 1833. It seems certain that he had a sawmill as well as a dam in 1825.

"Densmore's" dam presents even more of a problem, Street's distance - "four or five miles" would place it either at Churchville or near the "Eldorado Mills". There seems to be no tradition of so early a date for the latter. Church's mills were certainly in existence by 1825, but Street may have omitted them because they were powered by a long race

without a dam across the Credit. In that case we can assume that Densmore's mill was on Lot 2, Con, III W.C.R. Chinguacousy. It was probably only a sawmill. The position of Walker's dam is in no doubt, and the location of McNabb's mills is well known. Street says there were several dams "where the Creek branches". Probably the clerk omitted the word "above" from this sentence, for there is no reason to think that there was even one dam at what is now know as the "Forks of the Credit" in 1826, or more than one at Norval which was then sometimes called the "Forks of the Credit".

These dams were below the Falls, which Street mentions as the end of the salmon run. They would include the Williams dam at Glen Williams. Charles Williams built his sawmill early in 1825 and may have finished his grist mill before the end of that year. There may have already been a sawmill at Terracotta, but there is no record of Charles Haynes having built any dam at Cheltenham before building his grist mill in 1827. William Franks is said to have built his grist mill soon after his arrival at the site of Belfountain in 1825 and this seems not unlikely, Timothy Street does not mention any mill at the Falls, though the one which Matthew Crooks probably built about 1822 was most likely still running in 1826.

These were the mills on the main river; they were probably all running by the end of 1827. Of those on the branches, the doubtful Howes mills, Kennedy's sawmill on Silver Creek in Esquesing, and the Secord-McCallum grist mill on what was then usually called the West Branch, have already been discussed, There was at least one other sawmill in Esquesing on this branch, possibly two, and probably another on Silver Creek. John Goessman uses a "Sawmill" as the next stage beyond McNabb's on his waggon road to Guelph in 1827. The distance given places this sawmill close to MacCallum's mill, but its exact location is doubtful. There may have been

another sawmill above the site of Limehouse. The Trout sawmill at Erin Village the first in the township, was built about 1826 and was pretty certainly running in 1827. Charles Haynes' small log grist mill in Chinguacousy was built in 1827 and was probably running in that year,

It does not seem likely that many mills on the main river were omitted from Street's list because they had no dams across the stream. Garry Camp said that he had heard that there were places where a mill could be built without such a dam but knew of none except Racey's. Besides the mills at Churchville, James Curry's sawmill below Norval is the only one of this type that seems likely to have existed in 1825-26. On the basis of this listing it is possible to form a rough estimate of the number of mills running on the Credit in 1827. There seem to have been at least 15 sawmills and 9 grist mills.

Twenty-four mills was a large number to have been built in seven or eight years of settlement, The high proportion of grist mills and the fact that some of these had no sawmills attached to them show that the export trade in sawn lumber was only beginning. The sawmills of Toronto Township were probably shipping lumber, and may have been rafting it down the Credit. The evidence given in 1826, mentions only staves as being sent down with the freshet. Possibly saw-logs and rafts were not obstructed by the dams. The sawmills in Esquesing above Norval must have depended much more on local demand. In a pioneer community this was limited, The settlers could get on without sawmills near them, but they ardently desired to be near a grist mill, As the Clergy Returns of Inspection show, the distance to a grist mill was an important factor in determining the value of a lot; a sawmill close by made no difference. The bad roads made many small grist mills possible, Two more were built before 1830. Daniel McMillan, who had bought the Trout sawmill at Erin, built a grist mill before the end of 1829. Timothy Chambers probably began his

mills on Silver Creek in Caledon about the time he patented the lot on March 20, 1828. He is described at the time as "of Leeds Township, Miller", so he had not been long in Caledon. As milling was his trade, he built his grist mill at once and waited some time before adding a sawmill.

Grist mills, in an area just settling, were usually small log buildings, though where a sawmill was built first a larger frame mill was sometimes put up at once, whether they were log or frame they were crudely fitted up. The traditions of the Credit mills show that they were no exception. Though the early date may be questioned, there is no need to reject the story that Amaziah Church and his sons carried the irons for their mill from Dundas Street and dragged the stones to the site. Preparing these home-made stones was a difficult job, but there were short-cuts. A missionary of the Church of Scotland, who visited Streetsville in 1833, gives the story of the building of Street's mill as he heard it more than ten years after the event,

"Mr. Street immediately got up a saw-mill, and soon after he erected an operative grist-mill, without bolts, and the settlers for a time were very glad to get their grists in that state. The reader will understand that the river is a powerful stream, Mr. Street therefore prepared two millstones in a summary way, without much chipping, and placed them together to work in contact, upon the mill frame; he then put a power of water on - the smoke arose, the flint, fire and stone flew in a fearful and dangerous manner, They were, however, allowed to run at a good speed, and at length became so far smoothed as to be fit for his use. Subsequently, the flour mills on the credit have and are doing a good business."

The gritty product of such stones made unpalatable and not too wholesome bread. The stories of long trips to a mill with grist, common in some settlers' reminiscences, often record journeys taken to get bolted white flour. Sieves and bolting-cloths form part of the equipment of some households. MacCallum's mill had a primitive bolt from an early date. A boy carried the grain and grist to the loft to pour it into the hopper and bolt. Joseph Carter evidently planned to have bolts in the mill for which he had procured the

irons before leaving Derry West in 1829. The mills that were being finished in 1825 were larger and better equipped. John McGill advertised flour of the "best Genesee brand" from his "Credit Mills" in 1829 and McNabb's Esquesing Mills" could compete with those farther down the river. In 1826 millers in the western part of York County had complained that the statutory tolls were too low to be profitable. Some adjustments were made; but as the supply of wheat and the demand for flour increased after 1830, so did the amount of "merchant-milling"-the production of fine flour for shipment outside the area from wheat bought for this purpose.

Some new mills of this better type were built in Toronto and Esquesing Townships between 1830 and 1840 and some of the old mills were improved or rebuilt, Improvements had evidently been made at Street's mills before 1833 and about that year Orange Church replaced his father's grist mill with the three-storeyed frame building used for political meetings in 1834-37. Walton's "Directory of York and the Home District" for 1837 lists "Messrs. Beatty - millers" at Streetsville. The Beattys had a saw and grist mill on the site next below Street's Mills. "George Moore - miller" was probably the tenant of Street's grist mill, all the members of that family being listed as merchants. On the other hand, "John Proctor - sawyer" probably had his own sawmill on the new dam above Street's, where McCrary's carding-and-fulling mill was almost certainly located in 1837.

A description of Georgetown published in 1848 says that "about ten years since" the village had only "a Grist-Mill, a small woolen Factory, Fulling and Carding Machine and if we recollect right, one Saw-mill,....." This brought the number of grist mills on the Credit in Esquesing to four if MacCallum's mill was still running, but it seems probable that this mill was not restored after the wheel-shaft broke in the late thirties "while grinding Butler Mann's grist"

The number of grist mills on the Credit in 1840 was about twelve, Information about new sawmills in this decade is more scanty, but it may be estimated that the number in 1840 was still under thirty.

The cutting of timber was going on at a great rate in the 1830's but the export trade was still chiefly concerned with squared timber, saw-logs, stave bolts and such unprocessed material, Four or five new sawmills seem to have been built in Toronto Township, the most advanced part of the watershed and the nearest to water transport, These included a sawmill built for the Mississaugas, the Adamson mill above Springfield and possibly another above it. Two new sawmills at Streetsville, the Simpson mill below Meadowvale and possibly a second sawmill at Churchville date from this period. So may the Ostrander sawmill in the Fifth Concession West in Chinguacousy and one or two others higher up in this township. About the same number may have been added in Esquesing, but no new sawmills were built in Erin or Caledon and the Crooks mill at the Falls was no longer running,

W. H. Smith in his "Canadian Gazetteer" of 1846 remarks that the number of new mills built on the river "in the last three years" had materially damaged the salmon fishing. Some of the "new" mills of which Smith was told were actually replacements of old ones. The sawdust from these mills was probably having an effect on the fish. The only figures available for this period are assessment and census returns for whole townships. In Caledon and Garafraxa all mills returned up to 1852 were on the Credit, So were all water mills in Chinguacousy after 1840, for the small grist mill built on the Etobicoke at Brampton had a short existence, In Toronto Township, however, there were at least five sawmills to the east of the watershed in 1845. One of the three near Cooksville was probably already a steam mill, Other steam saw and grist mills were built at Dixie, Summerville and Brampton in 1845-51.

Between 1842 and 1847 both lumbermen and millers were enjoying the advantages of favourable British tariffs. Wheat was being imported from the United States to be ground in Canadian mills and shipped to Britain with the advantage of the Colonial preference, This produced further expansion and modernization of older mills and a number of new sawmills. Only a few grist mills were built on new sites, but several were rebuilt. Charles Haynes finished a new grist mill at Cheltenham in 1847 to replace the one built in 1827. This had probably already been improved at least once. The process of improving and enlarging that was going on in the thirties and forties is well illustrated by the story of Daniel McMillan's mills at Erin Village.

Daniel McMillan, when a very young man, had rented the Trout sawmill from William Chisholm about 1825. A few years later

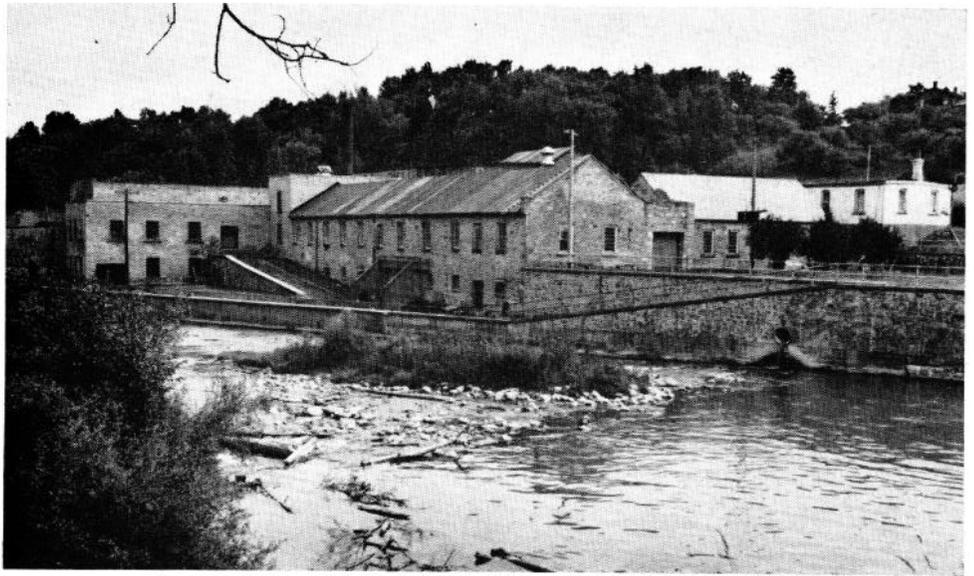
"...he bought the site between paying and promising to pay, for the sum of \$700, then thought to be a fabulous price...."

He built a faster sawmill, doing most of the work himself.

Before he had added "a small run of stones, about 34 inches in diameter" This was the only grist mill returned in Erin in 1830 and 1835. It was probably after 1840 that McMillan

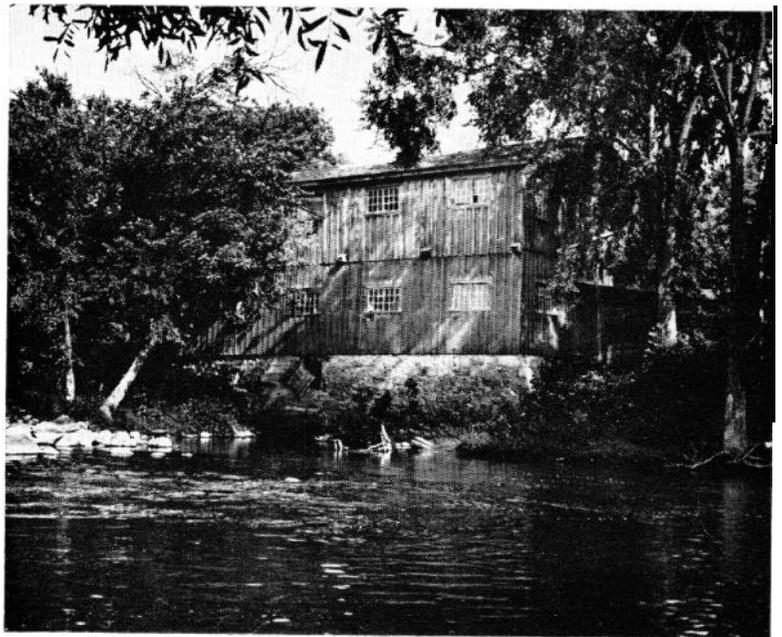
"....determined to build a grist mill on a larger scale. In this he also succeeded, having three run of stones of the best quality, with oatmeal works, capable of doing a large business and good work. The whole neighbourhood felt justly proud of this mill..."

In 1849 McMillan began "a first-class flouring mill", but died before it was quite finished, W. H. Smith mentions two grist mills with five run of stones in the village in 1850-51. The old mill had evidently been further improved. William Cornock was operating one of these mills, The flour mill may not have been finished for only one grist mill is returned in the Census of 1851-52.

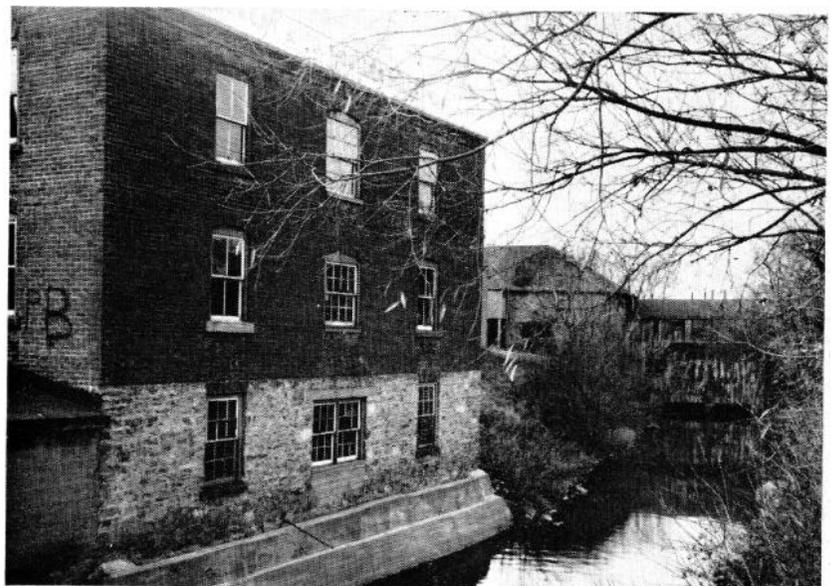


Barber Brothers' paper mill, Georgetown. The Barber's built their first mills at Georgetown about 1837, but it was in the fifties that they converted their woollen factory into the Credit Paper, Mill, after moving a large part of the woollen business to Streetsville. The central stone building housed the paper mill in 1859. James Barber's mansion on the hill to the right was new at that time. The paper mill has been moved nearer the railway.

Cheltenham - the mills - Charles Haines' small log mill of 1827 stood near this site. Larger mills were built about twenty years later and there have been later alterations.



Huttonsville - the mills and millrace. The buildings in the background stand on the site of Brown's mills of 1848 and Hutton's large saw, lath, shingle mills of 1855. The brick woollen mill was built in the 1880's.



When a mill was closed down for any reason it seems to have been omitted from the returns. Mills destroyed by fire were not always rebuilt at once, The mills at Springfield were burned before 1845 and not rebuilt until 1851. The grist mill at Meadowvale is not included in the returns for 1845, though Francis Silverthorn had acquired the site about 1840. This mill was certainly running in 1847, but was burned in 1848 or 1849. It was probably not returned in 1850, the two new mills in that year being additional ones at Streetsville and Churchville. Silverthorn's mill was soon rebuilt and is one of those returned in the Census of 1851-52.

It is not easy to determine how many sawmills were operating on the Sixteen-Mile Creek in Esquesing in the 1840's. Some had certainly been built by 1845, but all the grist mills and most of the sawmills returned in that year were evidently on the Credit, By 1851 one or two grist mills had been built in Esquesing outside the Credit Watershed. From the information available the following estimates have been made of the grist and sawmills on the Credit in 1845, 1848, 1850 and at the time of the 1851-52 Census of Canada. They can only be regarded as approximate and include only the mills returned. The returns themselves may not be accurate, but are close enough to illustrate the trend.

<u>Township</u>	<u>1845</u>		<u>1848</u>		<u>1850</u>		<u>1851-52</u>	
	<u>Grist</u>	<u>Saw</u>	<u>Grist</u>	<u>Saw</u>	<u>Grist</u>	<u>Saw</u>	<u>Grist</u>	<u>Saw</u>
Toronto	4	15	5	6	6	12	9	13
Chinguacousy	1	7	2	6	1	7	2	8
Esquesing	4	9	5	14	3	8	6	9
Caledon	3	1	3	5	3	2	4	4
Erin	1	2	1	2	1	2	1	2
Garafraxa	1	2	1	2	1	2	1	2
	<u>14</u>	<u>36</u>	<u>17</u>	<u>35</u>	<u>15</u>	<u>33</u>	<u>23</u>	<u>38</u>

These figures reflect the changes of the market for lumber and flour, The repeal of the favourable tariffs on lumber was making itself felt in 1847 and the repeal of the Corn Laws produced a depression in 1848-49 that was felt by farmers as well as millers and merchants. This checked the local demand from builders; the government program of plank roads and bridges was completed and the American trade reduced by an increase in the duties on lumber, At the same time the first-class timber near the lake began to be exhausted, By the end of 1849 conditions had improved, both export and local trade in lumber were recovering, though grist millers were still experiencing some difficulty.

W. H. Smith in 1851 noted with satisfaction the reduction in the number of sawmills shown in the 1850 assessment return, remarking that now the inhabitants of Toronto Township would pay more attention to farming. By that time the situation had improved still more; export trade was good and the planking of roads leading north from Dundas Street must have improved the local market for lumber, The improvement of the roads also made it possible for sawmills in the lower part of the watershed to draw their raw material from farther off and made it worth-while to build mills in Caledon. At the same time railway construction was beginning and the great wave of immigration in the forties and early fifties was having its effect on the prosperity of Canada, Even before the outbreak of the Crimean War and the Reciprocity Treaty of 1854 had brought a "wheat boom", the flour mills built in the forties were all in operation again and new ones had been built, By the time the railway lines across the area were completed in 1855-57 the number of water sawmills seems to have been about sixty, with four or five steam mills. The depression of 1857, following the wheat and railway boom, seems to have eliminated a few mills. Tremaine's maps of Peel and Halton Counties and the directories of the early 1860's do not give all those listed

in the villages by Lovell's Canada Directory of 1857. The mills shown by Tremaine, with those in the other counties on the Credit, are tabulated below by townships.

Mills - 1858-59

<u>Township</u>	<u>Sawmills</u>	<u>Steam S.M.</u>	<u>Flour or Grist</u>
Toronto	10	--	7
Chinguacousy	10	2	2
Esquesing	18	1	6
Caledon	13	1	5
Erin	3	--	4
Garafraxa	3	--	2
	<hr/>		<hr/>
	57	4	26

The location of these mills shows the effect of better communications as well as the reduction of the woodlands of the lower watershed. In Toronto Township, although one or two sawmills, such as the Simpson mill at Meadowvale, were doing a large business, flour-milling was much more important. The majority of the sawmills were attached to large flour or woollen mills and were in the nature of sidelines. Above Churchville there were a number of mill sites where a sawmill was the only industry using the power, or at least the most important, the others being woodworking trades connected with lumbering. Since 1840 larger and better-equipped mills had been replacing the old sawmills with the single upright saw. These old mills required only a moderate supply of water and were comparatively cheap to build, but they worked slowly and often turned out a rough product. They were mostly run for short seasons in the spring and fall and were easily combined with farming or other activities. Nevertheless some of these mills turned out a surprising amount of lumber.

Rotary saws were available from the 1840's but it was some time before their use became general,, A number of

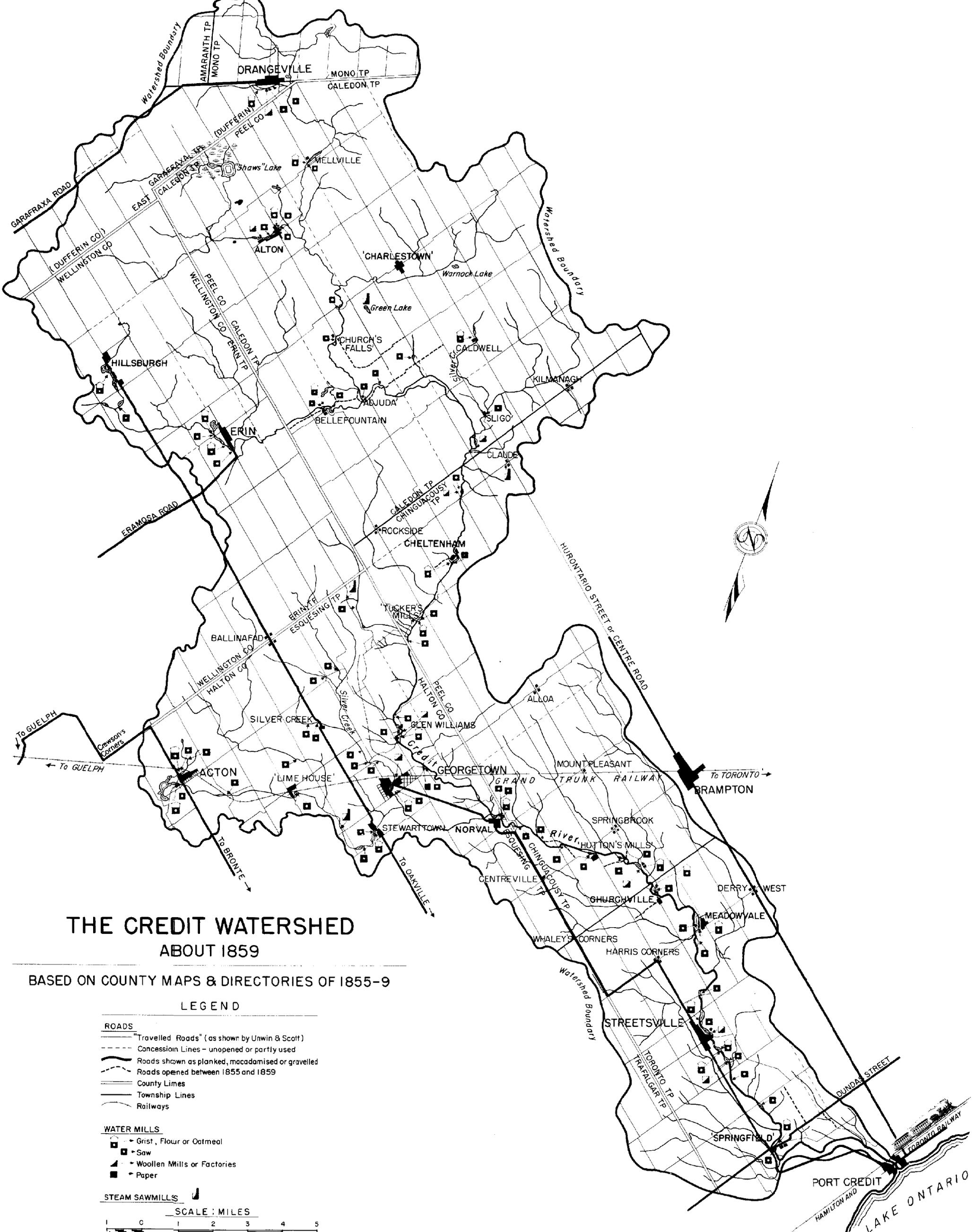
the old small mills continued in operation, running seasonally and becoming more and more dependent on custom work and more and more of a minor activity for their owners, The fifties had seen the building of several large mills, such as the saw and turning mill built by James P. Hutton in Chinguacousy in 1855 to replace a sawmill built in 1848; or the sawmill built by Richard Church on the site of the Crooks mill at the Falls. Some of the sawmills attached to other industries were large plants, like the Barber Brothers sawmill near Georgetown.

Sawyers were no longer dependent on water power. By 1860 a good deal of the lumber cut in the watershed was sawn by steam power. There were only four steam mills actually within the boundaries in 1858-59, but there were several just outside - at Cooksville, Brampton and Campbell's Cross, and several in the south-west part of Esquesing. Later some other large permanent steam sawmills were built in the watershed and waterpower was frequently supplemented by steam. When really portable steam sawmills came into use after 1880 the connection of lumbering with the river was further weakened. Lumbermen had already ceased to depend on the Credit for transporting either their raw material or their products. This made it possible to continue sawmilling in the lower part of the watershed, while at the same time it encouraged the building of mills in Caledon and other areas above Georgetown. Alton, Orangeville and Acton were lumbering villages by 1859, each with two or more sawmills. There were groups of sawmills near the Forks of the Credit and in the northern corner of Esquesing. In this area waterpower continued to be used, Two or three new water sawmills were built above Alton before 1878 and one existing pond seems to date from the 1880's. Sawmills were operating in 1877 on two early mill sites in Esquesing that seem to have been unused in 1858-62 - the Jonathan Howes site and the site of MacCallum's grist mill. It is unlikely, however, that the number of water sawmills on the Credit ever passed 60

at any one time or that the total of sawmills was more than 65. While new mills were being built on the upper streams, old ones were being given up farther down, The total number in 1880 was already below that of 1860. After 1900 the lumber mills were very few,

There had been no such spectacular increase in the number of grist mills after 1851, but the improvement in quality and quantity of output had gone on even more rapidly. There seem to have been about 27-28 grist or flour mills in 1857. The depression may have eliminated two or three of these, but it chiefly resulted in changes of ownership, Some of the millers who had improved or rebuilt during the past ten or fifteen years and had made large purchases of wheat at peak prices and were forced to take a heavy loss when the price dropped were forced to sell and the new owners frequently improved the mills and expanded the business, It was in this way that the family firm of Gooderham and Worts acquired the Silverthorn mills at Meadowvale. Francis Silverthorn had been particularly unfortunate, His grist mill had been burnt at least once before 1850 and in November, 1853, it was completely destroyed with a large stock of grain. The loss not covered by insurance was estimated at £ 3,000 to £, 4,000. In spite of this Francis Silverthorn appears to have restored the mills in a surprisingly short time and was still operating them in 1858-59. However, the depression had caused him further loss and by 1860 the Meadowvale mills had become Gooderham property.

The first Gooderham Mills had been the McNabb mills at Norval. James McNabb had sold these to General Adamson in 1838 and they had been acquired by William Gooderham about 1845. William Gooderham had extended his operations to Hillsburgh by 1850 and in the 1860's George Worts is listed as owner of one of the flour mills, Later this property is listed as "Gooderham and Worts". The Norval mills were sold by 1860, but not long after the "Alpha Mills" north of Streetsville, on



THE CREDIT WATERSHED ABOUT 1859

BASED ON COUNTY MAPS & DIRECTORIES OF 1855-9

LEGEND

- ROADS**
- "Travelled Roads" (as shown by Unwin & Scott)
 - - - Concession Lines - unopened or partly used
 - ▬ Roads shown as planked, macadamised or gravelled
 - · - · - Roads opened between 1855 and 1859
 - ▬ County Lines
 - ▬ Township Lines
 - ▬ Railways

- WATER MILLS**
- ◻ Grist, Flour or Oatmeal
 - ◻ Saw
 - ▲ Woollen Mills or Factories
 - Paper

STEAM SAWMILLS



Christopher Row's mill privilege of 1825, were acquired by the firm and these three mills - at Hillsburgh, Streetsville and Meadowvale - remained the property of Gooderham and Worts until towards the end of the century. They were managed, and possibly originally owned, by resident members of the family; but they seem to have been run as branches of a common enterprise and by 1878 were all listed under the firm name.

Several new flour mills were built in the sixties, mostly on sites where there was already a saw or woollen mill. Except for the Caslor mill at Boston Mills (1860) and a second flour mill at Glen Williams (1877), these were all in Caledon. The millers did well on the whole during the Civil War years and the number of flour and grist mills on the river was probably near its peak in 1865. The total may then have been over thirty. This was about the number in 1877; some new mills had been built in the interval, but others had been given up. The Churchville mills were all closed down between 1866 and 1877. The late 1870's are said to have been a time of difficulty for Ontario millers, but the number of mills was not much less in the eighties and nineties. Flour-milling continued to be an important industry on the river until after the turn of the century. By that time the tendency to concentrate the industry in the hands of a few large firms was making it difficult for independent millers to operate. Some mills were abandoned, some converted to other uses and some became chop mills. In 1911 the flour or grist mills on the Credit numbered about 10-12. By about 1920 there can have been few flour mills on the Credit and not many chop mills. One of the largest flour mills that survived was on a site where grist-milling was given up about 1849. The McCarthy Milling Company occupies the buildings of Barber's large woollen mill on the site of Comfort's mills of 1825. Another, on the William Beatty site nearer Streetsville, had begun as a grist mill, but through the fifties is listed as an "oat and barley" or "pot and pearl

barley mill". It does not appear as a flouring mill until 1869.

These two are large mills with an output as great or greater than the largest mills of the previous century. Some of the nineteenth century mills had been fairly large. The Gooderham mills at Meadowvale are reported to have ground more than 200 barrels a day and there were probably some other flour mills of this capacity by 1865. Most, however, were on the scale of the Chambers mill at Silver Creek (Caldwell) which was grinding 50 bbls. a day in 1865 or the Cheltenham mill with a capacity of about 5,000 bbls. a year. The Boston mills had this capacity in 1877, but by that time the output of the Cheltenham mills had been doubled. The Williams flour mill at Glen Williams was then producing about 400 bbls. a week. The Noble flour mill at Norval was credited at that time with from 200 to 250 barrels a day. The larger mills at Streetsville, Acton, Alton and probably at Georgetown and Orangeville were about the same size, so that just before 1880 some six or seven mills were producing over 50,000 bbls. of flour a year and more than twenty were capable of producing from 5,000 to 20,000 bbls.

This production of flour could hardly be sustained by the wheat grown in the area around the mills. It is likely that the wagons that carried flour once a day to the Grand Trunk station at Malton in the early 1860's brought back wheat for the Gooderham mills at Meadowvale and Streetsville. The traditions of wheat being teamed to the Credit mills from Grey and Bruce Counties are probably correct. They refer to a brief period in the sixties for soon after 1870 none of the larger mills was far from a railway and these lines gave ample connection with the lands to the north-west, then at the height of their wheat production, To keep up such production it was often necessary to keep the mill in operation throughout the twenty-four hours, as is reported to have been the case with the mills at Meadowvale. To do this a reliable source of power was

essential. By 1870 some millers were installing steam engines. There were a few steam flour mills on the Credit in 1877, but most millers found sufficient use for waterpower to retain their dams and ponds. Later other uses were found for them which in some cases prolonged the use of the pond well into this century. The growing use of diesel motors, especially for chop mills, has reduced the number of mills using waterpower and it is likely that no mills now depend on this form of power for grinding.

2. Other Mills and Industries

Sawmills and grist mills have been dealt with at some length because the great majority of dams on the Credit were built to supply one or both of these types of mills. There are one or two instances of dams being built for woollen mills, like the Corbett dam near Inglewood, and tanneries sometimes had small ponds of their own, like the Dayfoot tannery at Georgetown. Even in these cases it cannot be certainly stated that a sawmill was not the first industry on the site. As soon as the first mills were in operation, most mill-owners launched out into sidelines or leased power to other operators, Timothy Street told the Select Committee in 1825 that he had "other machinery" at Streetsville besides his saw and grist mills,

It will not be possible to deal fully with all the small industries that flourished in the area between 1820 and 1900. Some, like the asheries, were the direct result of pioneer conditions. They disappeared in each section of the watershed as it became settled, Others, equally dependent at first on the demands of a pioneer economy, like the carding mills and small tanneries, developed into industries of importance. Many of these industries were making some use of waterpower by 1840. The number of those doing so probably increased up to 1870, though more and more use was being made of steam power at that time, By the nineties such use as was still made of waterpower was almost entirely secondary,

(a) Tanning and Leatherworking

Tanning was one of the first industries to be established in the Credit area, The Robinette tannery near Dixie may date from before 1820. Timothy Street evidently preferred to call himself a saddler, but it is likely that he was also a tanner and currier and that the "other machinery" attached to his mills in 1825 was used in connection with the tanning of leather, However, "Francis Motherill" is the only "tanner and courier (sic)" listed by Walton in Streetsville in 1837. Richard Poynter's tannery at Churchville is said to date from 1830; there was one at Georgetown about 1838, and the tannery at Norval may also date from before 1840.

The first tannery at Acton was opened in 1842. New ones were built before 1850 at Stewartown, Erin, Churchville, Glen Williams and Georgetown. The second tannery at Churchville seems to have been closed by 1851, but one had been built at Belfountain. The number in the watershed in 1851 seems to have been about ten. The first tanneries were on a small scale and some remained small to the end, But by 1848 Messrs. Dayfootts "extensive Tannery and Boot and Shoe Establishment" was giving steady work to about 30 hands. This was big business in 1848. A few years later Richard Poynter, who had started with a "horse-power" for grinding the bark, was able to set up a water wheel and is reported to have had forty teams on the road at once bringing tan-bark to Churchville "from as far away as Orangeville". After the Nelles tannery at Acton was burned in 1852, it was rebuilt on about this scale, and William Campbell and Sons' "Orangeville Tannery" (built in 1857-58) was a large establishment for the period. The others were probably smaller, though not all of the smallest size. The highest total in the area (including the Cooksville tannery) seems to have been about 15-16 in 1865-67.

A new tannery was built at Alton in the sixties, but by 1901 none were returned for "Cardwell County" in which

Caledon was included for electoral and census purposes from 1871-1901; there was only one in the reduced County of Peel. Those at Norval and Glen Williams were gone by 1869. By that time there were two tanneries in Georgetown, besides the Day-foot plant, one of them of some size. It was in the 1870's that a great expansion took place in the leather trade at Acton. The original tannery had again been burned in 1872. G. L. Beardmore & Co., who had owned it since 1865, now rebuilt it with improvements that allowed them to produce 18,000 - 20,000 sides of sole leather in a year. By 1877 W. H. Storey's "Canada Glove Company" had a good-sized tannery of their own and A. B. Wright's new tannery was specializing in sheepskin leather. The Canada Glove Company was producing 70 different varieties of gloves and mitts, and Moore & Co. were selling about \$35,000 worth of gloves to Toronto and Montreal.

In Halton County tanning and leather-working remained important industries when they were declining in other parts of the area. In 1891 there were ten plants in the county, about seven being in the watershed. Twenty years later four firms in the county were turning out tanned leather and four, "gloves and Mittens". Waterpower had largely been given up by 1870, but the connection of the tanneries with the river remained fairly close and still raises some problems in the disposal of wastes. The Beardmore plant is still the chief industry of Acton, but most of the others have disappeared, some fairly recently.

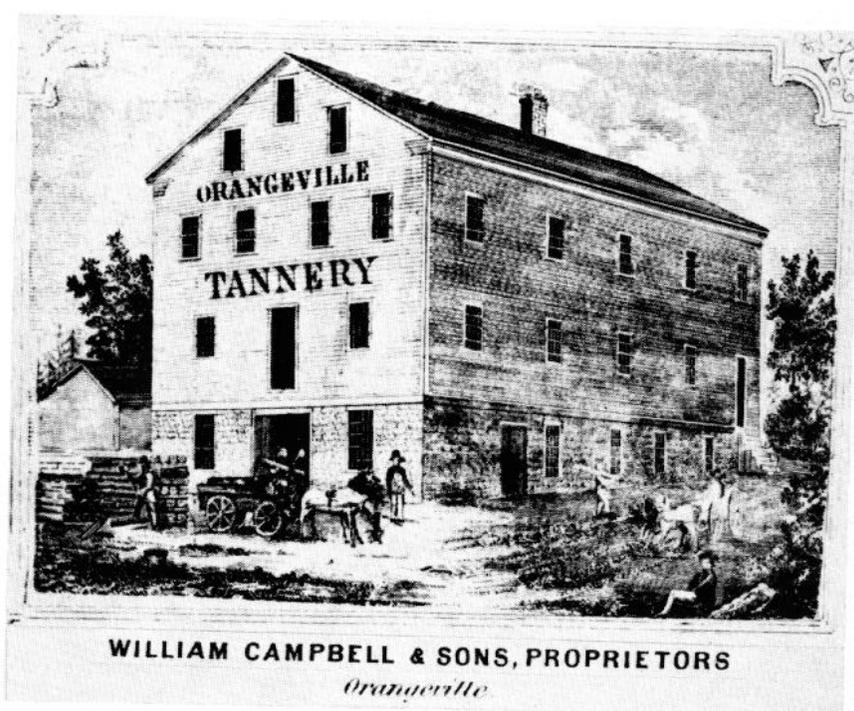
(b) Woollen Mills

The setting up of a carding and fulling mill in their neighbourhood considerably eased the labour of most pioneer housewives. How soon this was done on the Credit is uncertain. There seem to have been only two in 1837, and one, Barber Brothers' at Georgetown, was still very new, Joseph McCrary's dying and cloth-dressing establishment at Streetsville may have been built some years before 1837. It was



Orangeville, 1955 - Three of the five or six hotels that once stood on the south side of the principal street. The only one still used for this purpose was refronted in the 1880's. The inn beside it (right centre) had triple galleries and dates from the 1850's. Another in the foreground has the curved lintels and cast-iron balconies of the 1860's, but the height of the front was increased somewhat later.

From Tremaine's Map of Peel County, 1859 - Campbell's tannery stood west of the surviving grist mill. It was one of the six or seven mills and factories along the Credit on the southern edge of Orangeville in 1859.



Orangeville - The Town Hall and former market - 1876. Heads of cattle carved on the keystones of the market wing reflect the greater importance of stock keeping after 1870.



replaced before 1846 by Hiram Caslor's "woollen factory" which included a carding machine. The first woollen mill at Glen Williams was built by Jacob Williams in 1839.

From this beginning of three carding mills before 1840, there had developed within fifteen years a woollen industry of some importance. Barbers' mill at Georgetown had, by 1848, become a cloth factory employing forty hands. At about that time the Barbers bought Comfort's mills below Streetsville and replaced the grist mill with a woollen factory of about the same size as their Georgetown mill. It was at this time too that Jacob Bradt built a carding and fulling mill above Churchville. This was sold by 1850 to Jacob Snure, who built a large cloth factory which he named "Eldorado Mills". Thomas Corbett's woollen mill below Inglewood was probably the one returned from Caledon in the Census of 1851. Carding and fulling mills in Acton and Erin brought the total of woollen mills to about 8 in 1851.

In 1853 Barber Bros. built their four-storeyed stone mill below Streetsville and moved there the machinery from their mill near Georgetown. Another woollen mill seems to have been built in Georgetown in the 1850's and the McClure woollen factory was built at Alton in 1857-58. Hiram Caslor had sold his mill at Streetsville to J. C. Hyde and built a new one at Boston Mills before 1859. The Acton carding mill seems to have been given up, but a new mill was built at Orangeville. The total in 1859 was about 10 woollen mills and of these about seven or eight were weaving cloth, The number of mills fluctuated after 1860. Some carding mills were closed, but one or two new ones may have been built. The number of woollen factories steadily increased until there were about fifteen to eighteen on the Credit in 1881.

Barber's mill was probably the largest in the 1850's and may have remained so for some time. In 1865, when some additional buildings had been built, it contained

".....eight spinning jacks, each having 240 spindles, and 35 power looms in active operation. They are justly celebrated for their manufacture of substantial Canadian tweeds and other cloths".

The mill then employed over a hundred hands and turned out 1,000 yards of cloth a day. Benajah Williams' mill, as rebuilt after a fire in 1867, was a good-sized stone mill. It was powered by a 40 horse-power "Leffel" wheel; employed 50 - 60 hands and turned out "nearly 100,000 pounds of yarn" a year. No cloth is mentioned in connection with this mill, The other woollen mill at Glen Williams in 1877 was a "shoddy mill". Ross' large woollen mill at Norval was also built in the 1860's. In 1877 it was the "Norval Woollen and Cotton Batting Mill" and was leased by Smith, Wiltby & Co. of Toronto. The new mills built in the 1880's - at Cataract, Huttonsville and Alton - were all fairly large and the older mills at Inglewood and Alton had been rebuilt. By 1891 several woollen mills had closed down. There had been more specialization and some mills were producing knit goods by 1900. Of the seven or eight plants in the area in 1955, most are knitting mills and only a few produce yarn or cloth. Most of these plants are in the same places as old mills, but not always on the same sites, and in few cases has there been much continuity of ownership.

(c) Woodworking

Apart from the sawmills, the industries using wood as their principle raw material were, when taken together, the most important in the watershed, The most notable were the cooperages and stave mills; the shingle and lath mills; the carriage and wagon factories and the cabinet, chair and turning factories.

"Staves" were among the first special forms of lumber to be floated down the Credit, but those caught in the dams in 1825 were probably "stave blocks, bolts or pieces" rather than finished staves. There were already some coopers' shops, for these were usually to be found near grist mills.

Some were operated by the millers, who with the merchants were the largest consumers of barrels, casks and tubs, but there was a household demand as well and many coopers worked independently. Either type was likely to develop into a large cooperage. These soon began to use powered stave machines and to sell finished staves as well as barrels and they are not always distinguished from the stave mills proper.

There is reason to think that one of the coopers in Streetsville was employing several hands before 1840 and the two cooperages at Churchville were evidently large establishments before 1845, for there are references to "forty fighting coopers" in that village. Daniel Rowe's "extensive stave and shingle factory", which was damaged by fire in June, 1854, may have originated as one of the two Churchville cooperages. It was sold in the following March to John Willis, but only one cooper, John Allport, is listed at Churchville in 1857. The "stave and barrel factories" of the fifties were apt to be attached to sawmills, like Francis Silverthorn's at Meadowvale. Richard Church added a stave mill to his multiple establishment at Cataract in the 1860's. At this period there were cooperages in all the larger villages and the number of good-sized plants must have been greatest about 1867, though none were returned in the 1861 Census and very few in 1871. There is a steady increase in the number of cooperages returned until 1891, but actually the total number must have been less than in 1861. McMillan and Hall's stave mill at Erin was a large plant in the seventies. There were several others in the area, but most seem to have closed down by 1890. The stave and barrel trade practically disappeared from the area in the 1890's.

The making of shingles and lath was mechanized in the forties, but Rowe's shingle mill at Churchville is the first one mentioned in the area. The attempt to revive it after the fire appears to have failed, but there was a

shinglemaker in the village in 1869-71. Shingle mills were operating at Acton and Glen Williams in 1858 and these may have been founded, like Rowe's, soon after 1850. It was in this upper part of the watershed that shinglemaking was important. Two more mills were started in Acton in the 1860's and one in Glen Williams. There were two near Ballinafad in 1869, two in Erin and one each in Alton, Kilmanagh and Orangeville. There were probably others in this area, attached to sawmills or located outside the villages. The 1871 Census gives 99 shingle mills in Cardwell County and 17 in Halton. It seems likely that more than nine or ten of these mills were in the Credit area,,

The only large mill on the lower watershed at this time was at Huttonsville, though there were shinglemakers at Campbell's Cross and Cooksville. Hutton's shingle mill was a large one and probably gives the scale of the large mills at Acton and Glen Williams, It produced about 2,000,000 shingles in 1876. Hutton cut 400,000 feet of lath in that year. His lath mill was probably the largest of the six or seven in the watershed. Milled lath replaced the older "accordion" lath about 1865. A great many trees of small girth were consumed by the lath mills, but these mills were not many in the Credit area. Both shinglemaking and lath milling were ended in this area by 1900, perhaps because the raw material was exhausted,

The making of wagons and carriages was a major industry from the 1840's. For about fifty years it must have given employment to a great many of the inhabitants, By 1850 factories were to be found in most villages of any size in addition to the smaller shops. These factories varied greatly in size, but before 1860 there were some fairly large ones in the area. The improvement of the roads had brought a much greater demand for all sorts of carriages and increased the demand for wagons and coaches. By 1870 the industry was even

more widely dispersed. There were factories in many smaller villages and hamlets. The Census of 1871 gives 25 carriage factories in Halton County, 23 in Peel and 20 in Cardwell. As Peel then consisted (for electoral and census purposes) of only Toronto, Chinguacousy and Toronto Gore Townships, the number of factories there was greater in proportion than in Halton. The numbers are not much less in 1891.

Carriages are mentioned among the chief products of Streetsville in 1857. The two large factories in Acton also dated from the early 1850's. One of these was making sixty different types of "rigs" in 1877. The carriage industry in the Credit area dropped off after 1890. There had been a sharp reduction of the number of private carriages kept in the cities after the electrification of street railways, and in the towns people were depending more on hired vehicles. The chief cause of the decline was, however, competition from larger producers outside the area; for it was not till after the first war that motor vehicles seriously affected the demand for wagons, buggies and sleighs,

Cabinetmaking was one of the first trades to be established at Streetsville and we are told of fine maple furniture made at Streetsville before 1840. The methods used before 1867 did not lend themselves to mechanization or mass production and, though some of the cabinet shops were large establishments employing several workmen, they did not become factories in the modern sense until later in the century, after they had absorbed the specialized "chair factories". "Chair-making" included the manufacture of bedsteads, certain kinds of settees, tables and stands, childrens' cribs and cradles, spinning wheels and yarn winders - anything, in fact, that was composed chiefly of parts turned on lathes and assembled without much skill in joinery. The turning and shaving down of rungs, posts and legs was easy to mechanize and even without power something approaching assembly-line methods

could be used. The seating of the better chairs with rush, and later with cane, was a skilled craft, but even these could be assembled quickly and turned out in large numbers. There was a chair factory at Springfield by 1845 and one was combined with Kerr's large cabinet shop in Streetsville. Before long there were several in various parts of the area. To cater to these factories and to the carriage and implement makers turning mills were set up in several villages - Springfield, Cataract, Erin and Huttonsville among others,

The fashion for turned furniture began to die out after 1870 and the chair factories disappeared or were absorbed by cabinet factories. Some of the latter, like the two at Cheltenham, were of some size, but competition from larger plants outside the area was already severe and cabinet-making did not become an established industry on the Credit to the extent that it did in some other parts of Ontario.

With the turneries may be placed the pump factories that had some importance at Glen Williams and Ballinafad from 1860 to 1890 and the special trades, such as Church's "peg and last factory" at Cataract and the "peg" and "bobbin" factories at Glen Williams. These supplied the local makers of boots and shoes and the woollen mills. The bobbin factory had become a lath mill by 1877. Meadows Brock made "dulcimers" at his cabinet shop south of Belfountain (later in the village) in 1859 and organs were made at Georgetown a little later. There were some other makers of musical instruments in the area and the presence of a "reed-maker" in Orangeville in 1857, suggests that the industry was already developed at that time.

The building of boats and small vessels began at Port Credit with Daniel Harris' boat in the early days of settlement and continued intermittently until after 1870. There were two ship builders and a boat builder in 1857, but only one ship-carpenter is listed twelve years later. The

trade never was very large and it declined with the decline in lake shipping before the end of the century.

(d) Papermaking

Barber Brothers established their paper mill near Georgetown about 1853 and since that time papermaking has been one of the principal industries of the town. Except for a brief period around 1869, when a second "paper manufacturer" (Richard Baxendale) is listed in Georgetown, there seems to have been only one paper mill in the area. The original stone mill is still the property of the company, but the actual manufacture is now carried on at a newer mill in Georgetown near the railway. Until late in the last century papermaking here had little connection with the lumbering. The raw material was linen rags or flax. Linen was little used in Upper Canada in 1850 and the papermakers were encouraging the farmers to grow flax. This had some effect on the agriculture of the area particularly the northern part. There was a flax-mill at Cataract in the sixties and seventies, but it seems to have been the only one on the Credit.

(e) Quarrying and Lime

Stone was quarried in the bed of the Credit at least as early as the 1820's and one or two buildings in the Old Survey, such as Toronto House and the church at Dixie, show that stone was sometimes used for more than foundations and chimneys. It was, however, above Norval that quarrying soon developed into an important industry. Quarrying of building stone was continued in Toronto and Chinguacousy. Several stone mills were built after 1850 and the proportion of stone houses increased, but after 1860 much of this stone was coming from higher up the river. The surveyors reported a good quarry of freestone (fine-grained limestone or sandstone) near Glen Williams and others in Esquesing and Caledon. The first quarrying was probably for lime, burned in small quantities as close as possible to the building being erected. Lime was

fairly easy to transport by wagon, but the bad roads must have limited the export of stone until after 1850. Some lime and stone may have been exported before 1849, though at that time, and for some years after, the builders in Toronto were using Kingston and Niagara limestone for their finer work.

Some considerable development of quarrying and lime-burning must have taken place in Esquesing in the early 1850's, for when the Grand Trunk Railway was built in 1855-57 the quarries at Limehouse and in the Glen Williams - Terracotta area were well established. The Limehouse kilns may have influenced the choice of line for the railway and a spur line was built to Lot 28, Con. X west of Terracotta (then the property of James Pearson) where there was a quarry, This line would serve some other quarries en route, The first kilns of any size at Limehouse were Bescoby and Worthington% and Lindsay and Farquhar's. Both were probably amalgamations or extensions of smaller plants established before the building of John Newton's lime mill which is said to have occurred in 1850. There was a kiln near Silver Creek (Esquesing Twp.) in 1857. Bescoby and Co. sold to Gowdie and Moore about 1858-59. In 1876 Gowdie & Moore had six kilns producing 35,000 bushels of lime in that year, while their lime mill had a capacity of 6,000 barrels a year, Farquhar's kilns had about the same capacity at that time and his quarries were also producing freestone and flagstone.

There were now several lime kilns in Esquesing near the quarries north-west of Glen Williams, with a number of freestone quarries in the area between Georgetown, Limehouse and Silver Creek, Lime was being burnt in Erin; near Orangeville, near the "Horse Shoe Bend" on the Toronto, Grey and Bruce Railway south--east of Caledon Village and near Kilmanagh. There were larger lime-producing plants at Acton and Alton and a stone quarry near the latter; while K. Chisholm and Company had begun their operations at the Forks

of the Credit and were producing lime and limestone, The great days of the Chisholm sandstone quarries came a little later, in the 1880's and 1890's. Sandstone from the Forks was shipped all over the province and a great many buildings in Toronto are built wholly or partly of this stone, among them the Ontario Parliament Buildings (1886-92).

The smaller quarries at the Forks were closed about 1911 and the others not long after. The trade in lime had already declined and finally disappeared in the face of competition from larger firms in better situations. The stone quarries at Silver Creek are disused, as are most of those in Peel County, but some quarrying still goes on near Glen Williams and one or two quarries near Georgetown have been reopened since 1930. There was a considerable trade in flagstones for sidewalks about the turn of the century and some of these came from the lower river above Port Credit. This trade was revived recently when flagged paths became fashionable in gardens. Much of the stone was shipped by water from the mouth of the river. Not very long ago the "stone-hookers" could still be seen in Port Credit Harbour, but even in the 1920's they appeared to be rotting in disuse. The ruins of the Limehouse kilns add to the picturesqueness of a very attractive area below the village and might well be preserved as relics of what was a major industry in the Credit Valley.

(f) Brick and Pottery

Bricks were certainly burnt in the area from the early period of settlement, but until about 1840 this was done by itinerant brickmakers who dug their clay where they could find it near the building, or set up a temporary yard when there was a demand for chimneys in a neighbourhood. There was a permanent brickyard in or near Streetsville by 1850. A few years later there seems to have been one in the village as well as the one in the Old Survey, halfway between Streetsville and Springfield, By 1857 there were yards at

Claude, at Norval, at Orangeville and Ballinafad. In the late sixties yards were opened near Glen Williams and Salmonville. The brick works at Brimstone near the Forks appears to date from the 1880's. Most of these plants had a largely local market, but they produced a large quantity of bricks between 1860 and 1900. Several were still in operation in 1911. The large shale brick plant of the Interprovincial Brick Company was established at Cheltenham in 1917. It is now owned by the Cooksville firm, established about the turn of the last century.

An "earthen ware factory" is listed at Streetsville in 1851 and a second pottery was established in the fifties, Later there were potteries at Norval and Orangeville. Potteries and Brickyards often made field tile after 1865 and some, like the large Terracotta factory that changed the name of Salmonville in the 1880's, turned out the moulded architectural ornament that was used so much with Credit sandstone in the last years of the century,

ROADS AND RAILWAYS 1806-1900**1.** Dundas Street

Although Charles Askins in **1806** had believed that Dundas Street would "sure be made" as a result of settlement duties, the authorities were evidently aware that settlers* road work alone would not suffice. The Upper Canada Gazette for August 9, **1806** carried an advertisement that the Commissioners of Highways of the Home District would be ready on the 23rd to receive tenders from

".....any person or persons, who will contract to open and make the Road called Dundas Street, leading through the Indian Reserve at the River Credit; and also to erect a Bridge over the said River, at or near to where the Line of the said Road passes,

"Also to Bridge and Causeway, (in aid to the Statute Labour) such other parts of the said Road, passing through the Home District, where such Works are necessary, and for the performance of which the said Statute Labour is not sufficient?

Whatever was done by contract in **1806** was not enough to satisfy the settlers, Their settlement duty should have opened a strip through the forest **266** feet wide and cleared all logs and brush from the road allowance, But the inspection of 1809 shows that it was then far from complete and much more than clearing was needed to make a passable highway. The inhabitants evidently felt that they should not be forced to spend their statute labour on a provincial highway when it was needed to open sideroads to the lake and for opening the other concessions. For six years after their arrival they petitioned at regular intervals for additional help in causewaying, bridging and turnpiking.

In a petition of 1808 they point out that statute labour is insufficient for corduroying the various swamps along Dundas Street, or for grading the steep sides of the valleys north-west of the Credit. Down these hills they had to carry their goods on their shoulders "or go round by the

old road". Two years later they complain that they cannot get their grain to Cooper's Mills (Lambton) and say they will build a bridge over the Humber if the Government will build one over the Credit. The bridge built in **1806** had evidently been swept away by the floods of 1808.

This petition had some effect; on June **9**, 1810 the Gazette carried a notice calling for proposals for building a bridge over the Credit "near Dundas Street.....and also for amending part of the Commissioners Road leading from York to the head of the Lake" (probably the Lakeshore Road). The work was to be paid for out of funds recently voted by the Legislature. This was not quite what had been asked for and in 1812 fifty-nine inhabitants of Dundas Street petitioned for aid in corduroying certain specified cedar swamps between the Etobicoke and Daniel Harris' (Cooksville), saying that they had prepared timber to build a bridge over the Etobicoke.

Such importunity on the part of the settlers might have had more result if they had been prompter in finishing settlement duty and doing statute labour. The pathmasters had often to complain that road work was in arrears. In June, 1812 Philip Cody, as pathmaster for Toronto Township, reported certain prominent defaulters to the Quarter Sessions of the Home District, His list shows that the offenders were mostly men of substance with other interests besides farming.

"John Belcher, 3 days. Allan Robinet, 2 days.
Abraham Markle, 4 days. William Barber, 2 days.
Joseph Silverthorn, 2 days. James McNab, 2 days."

Allan Robinette, Senior, was pathmaster for the section between the Burnhamthorpe Sideroad and the Reserve, in which all these offenders lived. William Barber's lot was next to the Reserve and in the actual watershed of the Credit. After being given a chance to explain, they were told to do their road work for 1811 as well as that for 1812.

There had probably been some slight improvement during these years, but the military traffic during the war

made Dundas Street barely passable right across the Province, In 1814 the Legislature was forced to vote funds for a thorough improvement. In some areas this resulted in a good deal of re-alignment, including a new line from Cooper's Mills to the Etobicoke, but in the Credit area there were no radical changes of line. The improvements did not go beyond fresh turnpiking and causewaying, with some grading of hills and a fairly thorough removal of stumps and boulders. The highway was still a dirt road, crowned up in the centre, with many stretches of corduroy and very steep hills. Only in very favourable weather can it have been reasonably good by later standards. However, between 1814 and 1825 travellers seem to have thought that the stretch between the Etobicoke and the Credit compared fairly well with other roads in Upper Canada, The small swamps were gradually drying up and traffic and improvements had smoothed the roadway.

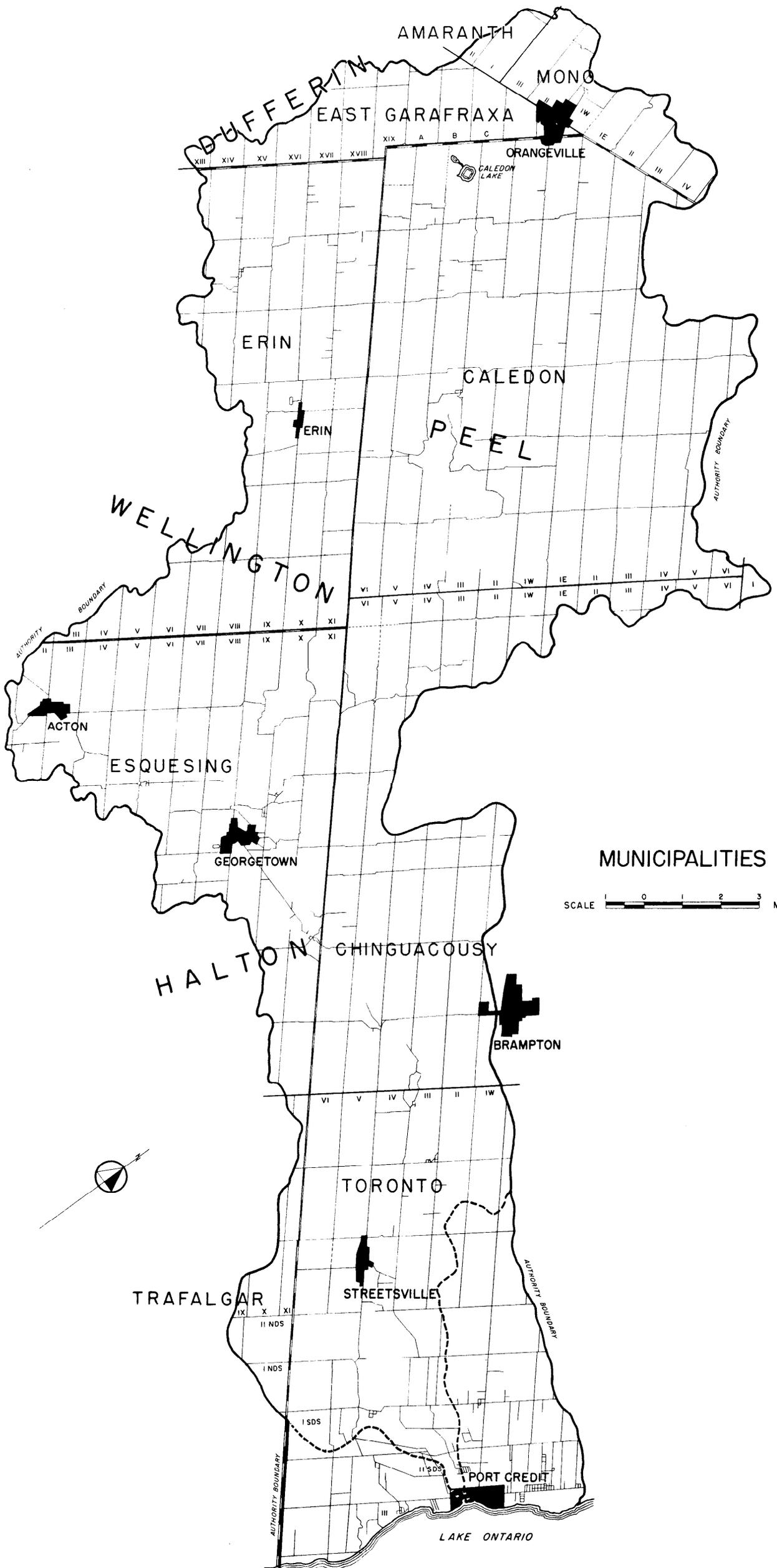
Except for periodic restorations of the dirt surface little was done to Dundas Street until after 1830. By that time the standard of road building was much higher than in 1814. New methods of surfacing had long been in use in Europe and people were beginning to expect something more than a good dirt track on a highway through a settled area. There were now some good roads in the United States, though those in recently settled areas were often as incredibly bad as most roads in Canada. The inhabitants were as ready as ever to demand better roads, though they showed little readiness to pay for them through taxes. The Government began a program of road improvement and after 1830 some main roads were macadamized. Dundas Street was surfaced in this way in 1836, from Toronto to the intersection of the Port Credit-Streetsville Road. This remained the extent of the "stone" road till about 1860. The surfacing was a great improvement and the road is described as excellent in the late thirties,

This may have been an optimistic view, for macadam roads became almost impassable during the break-up each spring. Besides, the stone was broken by hand and, since labour for this was scarce in Upper Canada, the stone used was extremely coarse. It took a long time for the wheels to wear it down; no binding was used except water and rollers only came into use much later in the century, There are stories of people riding in farm wagons on macadamed roads who preferred to get out and walk, and still arrived before the wagon. A writer who praised this stretch of Dundas Street in **1836**, had a light spring wagon broken by the macadam between Dundas and Hamilton in 1841 and was forced to abandon it. Good gravel was cheaper in some areas than true macadam and in the fifties it was used a good deal on the more travelled county and township roads. W. H. Smith calls Dundas Street a "gravelled" road in one reference of 1851; in 1853 it is called "a pretty good stone road"; later references call it macadam, As gravelled roads became more common the distinction between gravel and true macadam became vague; both were often called "stone" roads.

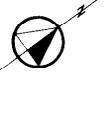
Dundas Street was one of the roads on which tolls were set up as an experiment in 1836. They were managed at first by special "trustees", but in **1845** the Government took them into its own hands. During the late 1840's these roads were quite profitable, but the public thought that they had been better managed by the Commissioners, When they were sold to a private company in 1850 W. H. Smith remarked that

"They were certainly very badly managed, and whoever loses by the present transfer,, the public are likely to be the gainers, as they will never submit to pay tolls to private parties for travelling such bad roads as they have been condemned to use for the last year or two".

The company had a bad bargain; in a few years the railway had reduced the traffic along Dundas Street and when they sold the roads to the counties in **1865** they got a much lower price than they had paid in 1850.



MUNICIPALITIES



2. The Lakeshore Road

It was intended that the Lakeshore Road should also be straightened to conform to the survey and this was evidently under discussion in 1808. The inquiry as to land-owners in the Second Concession South may have been made in this connection, and the project may have been responsible for the decision to grant the masting reserves to settlers. In Trafalgar settlers were allowed to do their settlement duties on Old Dundas Street, which now formed part of the Lakeshore Road, and this may have been the case in Toronto also. A long letter in the Gazette of September 17, 1808 makes it clear that some people were opposed to the abandonment of the old road along the shore to the Credit.

The "Commissioners Road leading to the head of the Lake" that was to be "amended" in 1810, was most probably the Lakeshore Road. The Gazette of May 18, 1811 carried another notice from the Commissioners asking for proposals

".....for erecting Bridges over the Rivers Humber and Credit, near the mouth of each River, on the Line of the Middle Road from York to the Head of Lake Ontario; also for opening and amending the Road from Captain Given's Lot near the Garrison of York to the River Credit, either for the whole or by the mile, to be opened sixty feet wide, and making good and sufficient Causeways eighteen feet wide where requisite.,.,."

This was the response to a petition in March saying that the ferries on these rivers were useless at certain seasons when the ice was too thick for boats and not safe for horses, The expression "Middle Road" might be supposed to mean the Second Concession South, which was called by this name until most of it became the Queen Elizabeth Way; but the fact that the bridges were to be near the mouths of the rivers (taken with other evidence) shows that the two roads mentioned were really the same, and that they followed the present line of the Lakeshore Road. The old road remained in use for some time, so that the new one was in effect a "Middle Road" between it and Dundas Street.

It was the old Lakeshore Road that Robert Gourlay found so "miserable" in 1817, with no houses from the Credit to Col. Samuel Smith's beyond the Etobicoke. Gourlay's account of this journey to York was written in England some years later and cannot be relied on, He thought he was following the main road and did not know that the few settlers in that section had their houses farther inland, He crossed the Etobicoke without being aware of it, His temper was made even worse than usual by a balky pony. The new Lakeshore Road was "opened" once more in 1820. This time the work was more thorough and the road seems to have become practically one long stretch of corduroy. Captain Basil Hall found this very rough in 1829 and most of it seems to have been got rid of in the 1830's. After the founding of Port Credit the road was more used, especially in winter and in wet seasons, It shortened the journey from Toronto to Hamilton, By 1850 there was a regular stage on the Lakeshore Road when the steamers were not running, but none in summer;

"and being more sandy than Dundas Street, as also from its being less cumbered with hills..... it is much travelled during the spring and fall".

As the road was not surfaced, it did not become a toll road until it was sold in 1850.

3. The Centre Road or Hurontario Street

A "Street of Communication" through the centre of the New Survey of Toronto Township and through Chinguacousy and Caledon, was part of the surveys of 1819-20. It began at once to be called the "Centre Road". The idea of extending it to Lake Huron came later, for the letters "W.H.S." and "E.H.S." are not used in descriptions of lots until after 1821. The road is said to have been "opened" or "cutⁱ" by government, but this can only have produced a very rough sleigh track. After that it appears to have been left to the inhabitants to improve and maintain. It was probably as good as the other

travelled concessions in the twenties and thirties but little better. As far as Silverdale the route was a comparatively easy one and there was little need to depart from the straight survey line. Farther north there are steep hills and until these were cut down to some extent settlers seem to have preferred the concessions to east and west, After the road was planked to "Edmonton", the section through Caledon was improved. It is shown as the travelled road on all the maps from 1850. Smith speaks of this part of the road as if it were still bad in 1850-51. At that time it was expected that the planking would be continued through Caledon. This was never done, but the road had been effectively improved before 1857 and there was a stage line along it from Brampton to Orangeville.

The Government is also reported to have opened the "Sixth Line Road", so called because it ran at the back of the Sixth Concession E.C.R. This road was certainly open to Mono Mills by 1824. The Graham brothers were responsible for the making of the lower part, which at first connected with a rough trail to Summerville but was soon given a better connection with Dundas Street by Islington. This road is wholly outside the Credit Watershed; but it served as the chief means of access to the eastern part of Caledon and one means of reaching Orangeville.

4. Concession Roads, Sideroads and "Given" Roads

The surveyed concession roads were supposed to be opened by settlement duty, but whether they became travelled roads depended on the difficulties encountered, as well as the amount of work carried out by settlers. A few concession roads became travelled routes for considerable distances, passable for wagons and sleighs. The rest were opened only where there were settlers. The inspections of Clergy lots in 1829 often note that the road in front or behind a reserve was not open; in 1835 such a notation is rare in Toronto and Chinguacousy and not very frequent in Caledon.

In 1822 some Presbyterian missionaries from the United States travelled on foot from Dundas Street to the neighbourhood of Scotch Block in Esquesing and have left a description of a newly "opened" concession.

".....Where they were in the best condition, we had to be continually making a zigzag track to get around the fallen timber, In many places we had to turn aside into the woods, and sometimes to turn back to avoid the marshes and impassable places. We entered the concession line early in the morning, and having travelled diligently till late in the afternoon, we arrived at the house of Mr. Laidlaw, sixteen miles from the main road."

Five years later this Third Concession Road was one of the travelled roads across Esquesing and probably passable for wagons and reasonably easy for foot passengers, The other travelled road across that township was the Eighth from Hornby to Ballinafad. In Toronto New Survey the Third and Fifth Concessions West appear to have been travelled as far as the Snelgrove Sideroad in Chinguacousy. The Fourth and Sixth were well travelled for about the same distance above the Derry West Sideroad, but were interrupted below it,

This sideroad, between Lots 10 and 11 in the New Survey and the one between Lots 10 and 11 in Chinguacousy were the only ones opened straight along the surveyed line in 1824 through their whole length, They both connected with roads leading to the Humber mills. The boundary of the Old Survey was open, but just before the Second Concession West a road led across lots directly to the bridge above Street's mills and on, by what became Main Street in Streetsville, to the Townline. This bridge was built about 1823 and was probably the first one above Dundas Street. Such roads across private property (called "given roads" in Eastern Ontario) were very common, especially where there was a mill. Some of them continued for several miles without using a surveyed road allowance, like a road in Esquesing which formed a connection between MacCallum's mill near Limehouse, Charles Kennedy's sawmill and the Williams mills at Glen Williams, This seems

likely to have continued up the Credit into Chinguacousy, to give the settlers near Cheltenham and Boston Mills a route to Williams' mill before the Haines grist mill was built, To a great extent these roads took the place of sideroads, connecting the opened stretches of concessions, and when a travelled concession encountered a serious obstacle, the settlers made a similar given road around it.

The disadvantage of these roads was that the owner of the land could close them or alter their line to suit his convenience. To prevent this the inhabitants would petition Quarter Sessions to have a line surveyed and established as a public road by the Road Commissioners. Reports on a number of these surveys in the Home District have survived though many are lost. They include half a dozen in Toronto and Chinguacousy Townships between 1829 and 1840. The most important is the road connecting the Fifth Concession West with Dundas Street through the Mississauga Reserve,

".....being a line of road much travelled and much labor needed to be done thereon, and being liable to be closed up by the proprietors of the land through which it passes".

This survey by John Embleton in 1836 established the road very much on its present line. Another deals with the old road down the left bank of the Credit, where it passed through the village of Springfield; but in this case the surveyor said he could not adjust the disputes of the inhabitants and this road was closed below the village in the 1850's At Churchville the road between the Third and Fourth Concessions W.C.R. had been deflected to pass Church's mill. It recrossed the river on a bridge shown by Goessman in 1827 and ran up the right bank to another bridge near the head of the existing pond at Eldorado Mills. Only the lower end of this road was retained in 1837 and the new road on the other bank was established much as at present.

The fourth map illustrating this chapter shows many of these given roads as they were established and

straightened. In some cases further changes had been made by **1859**. Some had already disappeared. Goessman mentions a road in Caledon in 1827 that seems to have been opened to connect Matthew Crooks' holdings in Erin with those near the Falls and another leading from the Sixth Line Road between Lots 10 and 11 to the Centre Road at Caledon. These were probably connected along the sideroad and had a connection with the Forks and the given road from Belfountain to the Centre Road.

5. The Guelph Road

On August 11, 1827 the Gazette carried the following item:

"Canada Company - The proposed road between Guelph and York will reduce the distance to about **47** miles - it will pass diagonally through the township (sic) of Nassagaweya, Esquesing, and Toronto, striking the point where the two latter townships and those of Cinguacousy and Trafalgar, 'corner on' each other....."

The notice goes on to describe the advantages of the road to the townships through which it passed, On November 12th John Goessman, D.P.S., was at "James McNabb's Village in Esquesing - called Ville du Galt". He was engaged in surveying lines for the proposed road and the plan he produced for "Mr. John Scarlett of the Township of York" forms the basis for the third map illustrating this chapter. John Galt had already visited Norval in connection with the road, and it was in his honour that McNabb had given it this curious name,

Most of the features on the map are reproduced as Goessman drew them including his incorrect sketching of the rivers, The "Road.....at present practicable for Waggon's" is a good example of how the settlers travelled across lots from one stretch of opened survey-road to the next. It must have been originally opened only to Eramosa Township, for Galt had cut the first tree on the site of Guelph on April 23, 1827. "A Meeting of the Committee appointed to devise measures for establishing a Road from Guelph to York....." was held at Streetsville on December 4th and it was decided to apply to

Parliament at the next Session, In the end none of the direct lines proposed was adopted. Some slight adjustments were made in the existing wagon road and the section of King's. Highway No. 7 from Norval to Georgetown was established as a public road. Beyond Georgetown travellers had a choice of routes. Even in 1851 it was still expected that a more direct road would be laid out beyond Georgetown, By that time the road through Streetsville had been planked as the "Georgetown and Guelph Road". In a few years the completion of the Grand Trunk Railway put an end to these schemes and Highway No, 7 was eventually established as the Guelph Road.

6. Plank Roads

The idea of making a road of planks, like an oversized boardwalk, seems first to have been tried by the Canada Company in the Huron Tract just before 1840. When the British Government made a large loan to the Government of Canada in 1841, a part of the money was used to plank sections of the Provincial highways, This was not done in the Credit area; but it suggested the formation of road companies to improve certain roads, in return for a franchise to charge tolls. Meetings were held at Brampton in 1846 and 1847 to discuss the planking of Hurontario Street. In 1849 Parliament passed a Road Companies Act, and companies were immediately formed to plank the "Sixth Line and Mono Road", the "Port Credit and Hurontario Road", the "Port Credit, Streetsville, Georgetown and Guelph Road" and the road from Oakville to Erin, which, in 1837, had been established as the lower part of the Garafraxa Road. By 1851 the Sixth Line Road had been planked to Grahamsvilie, Hurontario Street to Edmondton (Snelgrove), the Guelph Road to Georgetown and the Garafraxa Road to Stewartown. The planking on this last road was extended to Georgetown, but the others were not carried farther, Planking proved expensive to maintain and gravel or macadam was substituted in the sixties and this type of surface was extended to most of the main roads by 1870.

Tolls continued to be charged after the roads were acquired by the Counties. There had been a great improvement in all the roads by 1870. The Eramosa Road across Erin Township had been a new and very bad road in 1851; it was gravelled before **1860** and in **1869** is reported as very good. By 1900 all the travelled roads were good except in the spring or in very wet weather and there had been a great improvement in the dirt roads. However, these roads were not designed for motor traffic and for a time after 1918 there was difficulty in keeping them in condition, This was overcome by a steadily extended program of paving Provincial highways and the more important county roads, and of improving others. The Lakeshore Road was paved before the First World War and the area is now well served by a network of highways.

7. Railways

Proposal for railways had begun in Upper Canada in the 1830's but until the Railway Act was passed in 1849 it was not found possible to finance any line. Work on two lines across the watershed was underway in 1851. Both the Hamilton and Toronto through Port Credit and the Grand Trunk line to Guelph were finished in **1856**. The Grand Trunk passed through Brampton, Norval and Acton, so that a large part of the area was served by the two lines. It was more than ten years before another railway was finished. The Credit Valley Railroad was built to Orangeville in 1871, and the Toronto, Grey and Bruce from Toronto, by Caledon East and Caledon, to Orangeville in **1873**. Six years later the Credit Valley Railroad had a branch passing through Erin and Hillsburgh, and the Hamilton and Northwestern was being built through Stewartown and Georgetown and across the south-eastern part of Caledon. These lines made a network across the upper part of the watershed so that almost every village was close to a station,

The Hamilton and Toronto and the Hamilton and Northwestern were amalgamated with the Grand Trunk, and are now

part of the Canadian National Railways. The Toronto, Grey and Bruce and the Credit Valley Railroad were acquired by the Canadian Pacific Railway in the early 1880's. The section of the Toronto, Grey and Bruce through Caledon has been abandoned.

THE RAILWAY AGE1. The Completion of Settlement

The first twenty years of settlement in the New Purchase had been a time of promise, but they had been marked by setbacks and clouded at the end by economic depression, political bitterness and the threat of civil war. Much of the promise was fulfilled in the next thirty years, The 1840's and 1850's were by no means free from the kind of troubles that had disturbed the previous decade. The main political problem was not settled until 1849, but after 1841 there was a distinct easing of tensions, a growing optimism, justified by a more rapid pace of economic development, of the growth of wealth and population and of the application of reforms.

This change of pace is very marked in the Credit area. In 1840 the lower part of the watershed was still being settled, though settlement was already well advanced. It was still to some extent in the backwoods phase of development, The upper parts were just beginning to emerge from the pioneer stage and near the headwaters, in Garafraxa and Mono, settlement was only begun. Six years later, Toronto and Chinguacousy were considered as two of "the best-settled townships in the Home District", Toronto, with 5,377 people in 1842, was one of the most populous townships in the District and Chinguacousy, with a population of 3,965, fairly high in the list. There appear to have been no Crown lands still for sale in these townships. Most of the Clergy Reserves had been leased and a considerable proportion had been sold by 1846. There was still room for more settlers and much land to be cleared. The great immigration of 1848-51 completed the process of filling up. The populations returned for these townships in the Census of 1851-52 is the highest recorded in that century. The population of Chinguacousy, exclusive of Brampton, was almost the same in 1861 as it had been ten years before. In the same

period the population of Toronto Township outside Streetsville seems to have declined slightly and Streetsville may also have lost some inhabitants.

The area in Esquesing around Georgetown and Norval had, by 1846, reached much the same stage of development as Chinguacousy. The countryside was well settled and well cultivated and the villages were growing rapidly. There had been progress in the more remote areas of the township to the north-west. The township as a whole was less populous, and there were still 900 acres of Crown land unsold in 1846. It was not until after the railway was built that settlement began to be complete.

The population of Caledon increased by about a third between 1835 and 1842. Only 500 acres of Crown land remained unsold in 1846, but the township was still sparsely settled and was "looked upon as beyond the verge of civilization, or habitable country by emigrants or land seekers".

"It was originally peopled by a rough and hardy set, a large number of whom still remain, and retaining their old backwoods, divil-me-care manners, seem to think, when they descend to an older settled or more civilized township, that it is necessary to give themselves airs, to show their independence. It is amusing to see some of these gentry at a tavern..... Nothing pleases them; nothing is so good as they get in Caledon! There are no potatoes on the table; they can get potatoes for supper in Caledon. They do not like bread; they get hot cakes for supper in Caledon..
..... Even the salt is not as salt, the sugar as sweet, nor is the mustard, (even when it brings tears into their eyes) as strong as they get in Caledon! And should anyone at table.....attempt good naturedly to check their grumbling they will probably become sulky, and exclaim loudly that they can talk as much as they like in Caledon."

The people of Caledon were not the only ones to whom W. H. Smith gives this kind of character in 1851. The paragraph should, perhaps, be taken with some of the special Caledon salt. When he wrote, a change was already beginning. A large proportion of rough land was still affecting the development of the township, but Caledon was probably more populous in 1851 than Smith supposed. The Census of 1851-52

gives an advance of nearly 1,000 over the assessment rolls of 1850, Smith was right in attributing most of the backwardness to lack of good roads through the township.

"This state of things has been perpetuated in a great measure by the remoteness of the situation, and the extent of bad road that for a great portion of the year cut them off from mixing or associating with the inhabitants of older settled portions of the country. In the meantime, however, they have been clearing their farms, and many of them must now be in good **Circumstances**. Of late years settlers of a different class have been moving in, and as soon the plank road from Brampton is extended-through the township (which is in contemplation), it will improve much more rapidly."

The southern part of Caledon was already little behind the better settled parts of the watershed in 1851. The northern section was already filling up, The plank road was not continued into Caledon, but other improvements were made to the roads in the fifties. Caledon was a reasonably well settled township by 1867, but it was not until after railways had been built through the township that it reached its full development.

Erin Township was geographically as remote from the lake as Caledon and it contained as much or more land of inferior quality. The township as a whole was still sparsely settled in 1846; there were more than 1,500 acres of Crown land unsold, many of the Clergy Reserves were unoccupied and the Canada Company had had trouble in disposing of some of its lots, Settlement was concentrated in the south section of the township, much of it within the watershed, This settlement was, in the 1840's, already further developed in some ways than Caledon. It had almost from the first the advantage of an easier road to the lake, This had been extended through the township and in 1837 became officially the first section of the Garafraxa Road. The Eramosa Road was opened before 1851 as a direct highway from Erin Village to Guelph. With settlers moving into the Queen's Bush. Erin Township developed rapidly, The township contained more people than Caledon in 1861 and by 1867 was nearing its highest **population**. There was, however,

rather less possibility of industrial development and consequently fewer villages.

The settlement of the small section of the watershed in Garafraxa East falls largely in this period. In 1842 the whole township of Garafraxa contained only 322 **people**. Some part of these were certainly living in the vicinity of Orangeville, where there had been mills for several years. The undivided township had 2,083 inhabitants in 1851 and in 1861, 4,866. These figures include the village of Orangeville, which had about 500 inhabitants in 1857.

In the Credit Watershed the period of settlement may be said to have ended before 1867. There was to be much further development in the towns and villages and some increase of population in the upper part of the watershed in the next twenty years. But by 1865 every part of the watershed had been occupied by settlers. The rural population in 1871 was greater than at any time before 1945, when urban expansion was already affecting Toronto Township. It seems probable that there was already a movement of families and individuals from the area which more than balanced any immigration from outside **it**.

A decline in the population of the townships took place in most areas of Southern Ontario before 1900. It was usually apparent by 1881 and was followed ten to fifteen years later by a decline in the population of villages and smaller towns. This decline began a little earlier than usual in Toronto Township and at about the usual date in Esquesing and Chinguacousy. In none of these townships was it very rapid or very great. All three remained fairly populous. In Erin and Caledon it was delayed until after 1890, but when it began the decline was more rapid and has lasted almost to the **present**. In these townships there had been still much untouched woodland in 1850 and lumbering went on there for another thirty **years**. After 1860 there was a very rapid development of industry in Caledon. It was widely dispersed through a number of small

villages and certainly drew people from the farms, but since there were practically no incorporated villages in the township this movement did not affect the township population. This development was accelerated by the building of the railways in the seventies, but by 1890 the tendency to concentrate industry in large plants and the depletion of the woodlands was having some effect. The loss of population in Caledon between 1891 and 1901 was about 27%.

Much of this loss was undoubtedly from the farm population and this has continued to decline to some extent, However, this movement had begun earlier, as it had in Erin where there was less industrialization, The decline of the villages in Caledon is plainly evident to a traveller who knows something of the history of the area. One or two appear reasonably prosperous, but the rest either show plainly that they have been larger and more flourishing in a not very remote past or have practically disappeared. The areas of abandoned farmland, on the other hand, are not so large and striking as in some other watersheds, perhaps because they are partly wooded and some farms are used for recreation, Nor do these areas seem to have ever been as fully developed as the rest.

There are some sections of this kind in Esquesing which seem to be fast going back to bush and which contrast with the areas of good farms. Here also it may be questioned whether these were not rather backward to begin with. In the lower part of the watershed the loss of population was never serious, The land was mostly too good to be abandoned and though some of the unincorporated villages declined at an early period, few have disappeared completely. The concentration of population in the Toronto region began to affect Toronto Township by 1911 and the southern part is now largely suburbanized. The other townships are all increasing their population, Chinguacousy and Esquesing fairly quickly, Erin and Caledon more slowly.

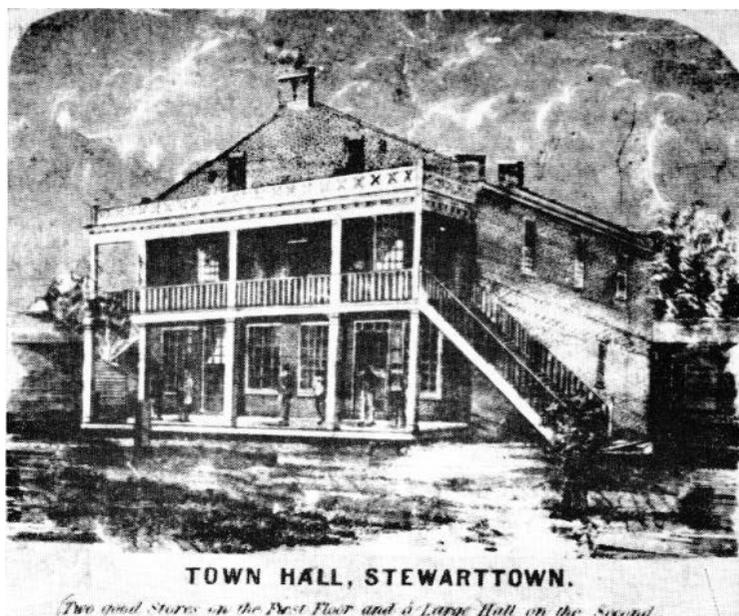
The impression of the Credit area between 1896 and 1911, gained by studying census data and other evidence, suggests that it was suffering from some degree of depression. The lumber trade was dwindling, later some quarries were closed down, the village industries were suffering competition that put the smaller firms out of business and merchants were feeling the same competition from large city firms, Farmers also were having troubles with markets and shortage of help, though on the whole their market was improving as the cities grew steadily larger, This slackening of business was not acute and it did not last, On the whole most of the rural part of the watershed was in a sound condition. It was, however, in this period that many mills were closed and that smaller villages practically vanished, while larger ones became quiet hamlets with little trace of the busier times of twenty years before.

Before long new industries were found to bring some revival to the towns and larger villages, The motor car brought traffic back to the roads and increased the recreational use of the area that had already been developed from before 1870. The motor vehicles also solved some of the difficulties of industry located in rather remote places, making it easier to ship the products and also to keep up the supply of labour in the vicinity. Motor power and electric power were also an advantage in some cases. In this connection there were some interesting developments on the Credit in these years,

2. Hydro-Electric Power

It was not uncommon in the late eighties and nineties and around 1900 for towns and large villages to install generators on one of their milldams and generate power to light the houses and streets. Usually this was done by private companies, but occasionally by the municipalities themselves. The dam of the Ontario Mills at Streetsville was put to this use. A municipal plant was built and was retained by the Ontario Hydro-Electric Power Commission at the desire of the

From Tremain's map of Halton County, 1858, Esquesing Township's Hall, "a commodious, brick building" had recently been built in 1851. The brick township hall which now occupies the site has little resemblance to the one of 1858.



Caledon Township - Polygonal barns were often built from about 1880 well into this century. They were considered by some builders and farmers to give more space for the material used. Though there are a number scattered over the Province it is rare to find more than one or two in one neighbourhood.



The Erindale Dam in 1954. Built in 1910 by the Erindale Power Company, this dam had no connection with the early mills. These were powered by the mill-race from the bank of which the photograph was taken. In 1859 the grist mill stood a little to the right and the sawmill below Dundas Street. The power dam was blown up as a "safety" measure in 1922, after being bought by the Ontario Hydro-Electric Power Commission.



citizens. It is still used to reduce peak loads, The earliest of these plants was built by John M. Deagle at Cataract, it is said before 1890. Deagle is said to have built the first revolving generator in Canada with his own hands and to have bargained with David Smith for a right-of-way across Lot 15, Con. V, Caledon Township, undertaking to supply him with the first electricity ever used to light farm buildings in Ontario. In 1896 the Cataract Light and Power Company was formed with John Deagle and after 1900 electricity was supplied to Erin and Hillsubrgh, to Alton, Caledon and Caledon East, and to the brickworks above the Forks and Cheltenham. The Company had a contract to supply electricity to light some streets in Orangeville and part of the town. In 1905 a five-year contract was granted, but was terminated after a dispute, The plant was sold to the Hydro Commission and went out of use. The dam was blown up in 1944.

The Erindale Power Company supplied light to a large part of Toronto township. Its large concrete dam at Erindale was built in 1910. After the company had been sold to the Power Commission, this dam was also blown up in **1922**.

3. The Growth of the Villages

An outstanding feature of this period is the growth of the village population. This began early on the Credit. Streetsville, Springfield, Norval and Churchville were all villages of some size by 1835. Georgetown may be said to date from the late thirties. It was well established by 1848 and Glen Williams, Cheltenham, Stewartown and Limehouse had been added to the list before 1850. Orangeville was founded in the thirties, but there had been little progress when Orange Lawrence moved there in 1842 and in 1951 it is called a small village. Belfountain and Charleston or Caledon Post Office were old settlements of the 1820's that did not receive recognition until after **1855**. The same may be said of Limehouse where a definite village was in existence by 1850. "McMullan's Mills" had developed into "Erinsville" or Erin Post Office

between 1846 and 1851, and "Hillsborough" had come into existence in the same period. The beginnings of Acton date from about 1842; it was already of some size ten years later. Alton and Melville are first listed in 1857, when their mills were five or six years old. Meadowvale, which also is first mentioned in that year, was at least thirty years old and a place of more importance,

These were the larger places in 1859; in addition there were small mill villages like Sligo and the two Silver Creeks and crossroads villages like Derry West and Claude and a number of smaller crossroads hamlets. Salmonville or Terracotta, Huttonsville and Cataract were mill hamlets at this time known by the names of the millowners with the addition of "Mills" or "Falls". They acquired names 2nd post offices after 1860. There were few additions after 1870. Inglewood grew up near a station on the Credit Valley Railroad, a short distance from its woollen mills and Boston Mills got its name and post office with its station. But the railways in this area did not produce new villages to the extent that they did elsewhere.

To deal separately with each of 25-30 settlements is hardly possible, To do so adequately would fill a volume for there is much interesting material in the majority of cases. A good deal of this has already been touched on in the previous chapters, particularly under mills and industries. The most that can be attempted is to give brief notes on the three towns and the three incorporated villages. The incorporated places are taken in order of the date of foundation, not of the first settlement of the locality or of incorporation.

Streetsville

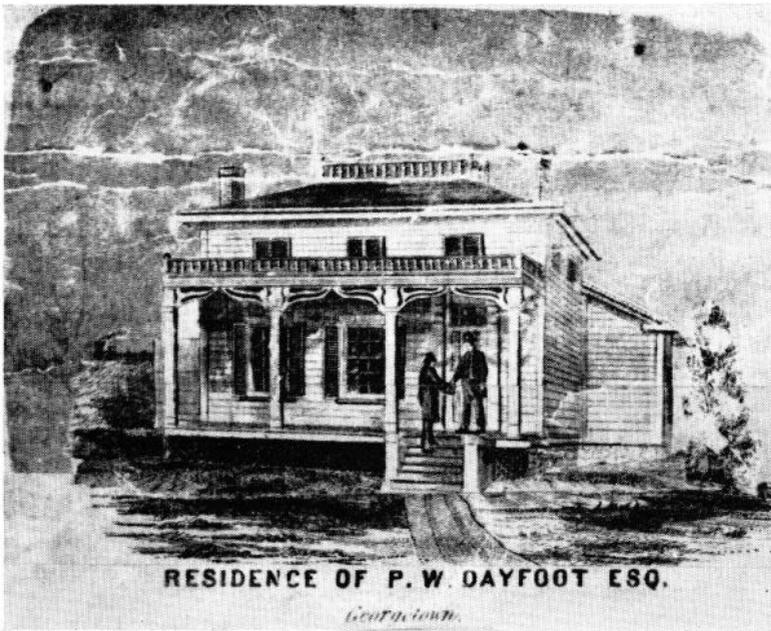
The beginnings of the village were John Barnhart's store and trading post of 1821, Timothy Street's dam and saw-mill of 1822 and Israel Ransom's store opened about the same time, Neither Street nor Ransom refer to the place as a

village in 1825, though there must have been a considerable group of buildings. Barnhart is said to have been shipping lumber and furs and Ransom says he shipped "much potash and other articles" by land. The name "Streetsville" is used by Goessman in 1827 and the work he mentions having done for Street may have been the survey of a village plot. A post office was opened in 1828, with a bi-weekly mail carried on horse-back, Street had probably added a tannery to his mills, a broom factory and a cooperage or "tub-and-pail factory". A hatter, a blacksmith, chairmaker and Cornford Smith's large cabinet shop are mentioned as operating in the 1820's. The trade in lumber and grain was extended about 1830 when W. H. Patterson opened a store and began shipping to Montreal. At this time gangs of French-Canadian lumber hands were brought to the vicinity each season.

Streetsville must have been an unusually large village for 1830. It already had some good frame houses and the first brick one in the township. In 1837 Walton gives the village about 500 inhabitants "including women and children". There were few villages of this size in 1837 and Streetsville was a very busy place. There were at least six merchants' stores, some other shops, two doctors (Barnhart and Crumbie), and a surveyor (John Embleton). These had been expanded by the opening of new workshops and wagon making and wool dressing had been added to the list. There had been some kind of stage to Springfield for some time (probably four times a week) and the two inns (Hyde's and Ballinger's) probably dated back to 1830 or earlier. The "Scotch" Church seems to have been the only one in Streetsville.

Some people certainly left the village in 1837-39 and this may account for an estimate of only 550 people in 1846. There were now Anglican and Methodist Churches and a hall where courts were held. A daily stage to Toronto had "lately" been started. Carriage making, weaving and iron

Main Street, Georgetown, 1954.



From Tremaine's Map of Halton County, 1858 - P. W. Dayfoot's property at this date fronted on John Street near Guelph Street. The house is a type common in upstate New York about 1840 but the "Gothic" porch is more unusual. It has been destroyed or greatly altered.

Georgetown - The former Town Hall - now a pottery. Although conceived in the elaborate style of the early 1870's, this compares favourably with some others of the period.



founding were the new industries, but there had been a marked increase in the number of trades connected with travel. The village now had a newspaper, the "Streetsville Review". This expansion continued in the late forties aided by the planking of the highway. If estimates of 700-1,000 in 1850-51 and 2,500 in 1857 are not much too high, the population fell sharply before 1861, when the Census return was 730. It is very probable that the building of the first railways had that effect, for the decline of Streetsville was obvious by the seventies, There had not been much change in the larger industries. In 1857 Streetsville had "an exstensive trade in woolens of all descriptions, flour, pot and pearl barley, lumber and carriages", as well as grain. If brick, pottery and brewing are added this would serve until after 1880.

It had been hoped that the Credit Valley Railroad would produce an improvement, The population had fallen to 617 by 1871. It rose slightly in the 1870's, but fell again to 522 in 1891. Until after 1941 there was a very slow increase but from 1949 the gain has been rapid and Streetsville, by the last return, has a population of over 2,000. The village had been incorporated in 1858, just before it began to lose its predominance in the area.

Georgetown

George Kennedy, who is described as "founder" of Georgetown, was living on the site by 1820 and there may have been mills there seven or eight years later. A writer in the "Christian Advocate" in 1848 says "About ten years since it was quite a small place, having only a few houses...." and a list of industries that has already been quoted, Such a village would hardly have developed since 1837, when Barber Brothers built the carding-and-fulling mill, The description this writer gives of Georgetown in 1848 shows some progress since 1846, when the Canadian Gazetteer gives too high an estimate of population (700). The Barbers had built a sawmill

and by 1850 they had built a large foundry. Dolson's foundry had been sold to George Kennedy, Georgetown had benefited from the plank road. Stages were running to Hamilton and Toronto. However, apart from the trade in woollens, leather, boots and shoes and lumber, Georgetown had less business than Streetsville and less diversified industry. The population in 1850-51 is estimated at 600-650. The railway brought a boom which led to speculation in real estate and some subdivisions laid out in 1857-58 are still only partly occupied. It also brought a better outlet for goods and a great increase of business. The village was incorporated and the Census of 1861 returned 1,158 inhabitants. In the sixties Georgetown had as diversified a list of industries as the other villages in the area, but lumber, leather and boots and shoes remained important products until the eighties, In the nineties with distress among the farmers and a declining trade in lumber, the population fell from 1,509 to 1,313, but in this century it has risen steadily and Georgetown is now a town of more than 5,000.

Orangeville

Some mills had been built at Orangeville before 1840 and an effort made to start a village. The situation was too remote and the country around too little settled. There seems to have been little progress when Orange Lawrence bought some land and an "old sawmill from Robert Huston in 1846. The village is called a small place in 1851, but improvement of the roads brought a change. With two daily stages to Brampton, a daily mail from Toronto, and the country to the north-west rapidly settling, Orangeville soon became a village of 500 people (1857). The waterpower was especially good and there were six or seven mills along the Credit in less than a mile. Four of these were sawmills and lumbering was one of the leading industries. Innkeeping seems to have been another for there were six inns in 1857 and others were built after 1860. The village was incorporated in 1864 with a population

of 1,000. This had become 1,200 three years later and 1,458 by 1871. The village had become a market town with many stores as well as hotels and after Orangeville became a town a spacious townhall and market house was built in 1876. The town grew quickly; it had nearly 3,000 people in 1891, but like Georgetown, Orangeville suffered a setback in the nineties. By 1921 the population had dropped to 2,187. Since then growth has been steady; the latest returns give a population of about 4,000. The water mills were mostly gone by the turn of the century, but some large factories replaced them. Some of these are still in operation and Orangeville's remote position is now an advantage. It has maintained the town's importance as a market and shopping centre. There are more stores than ever, but only one hotel.

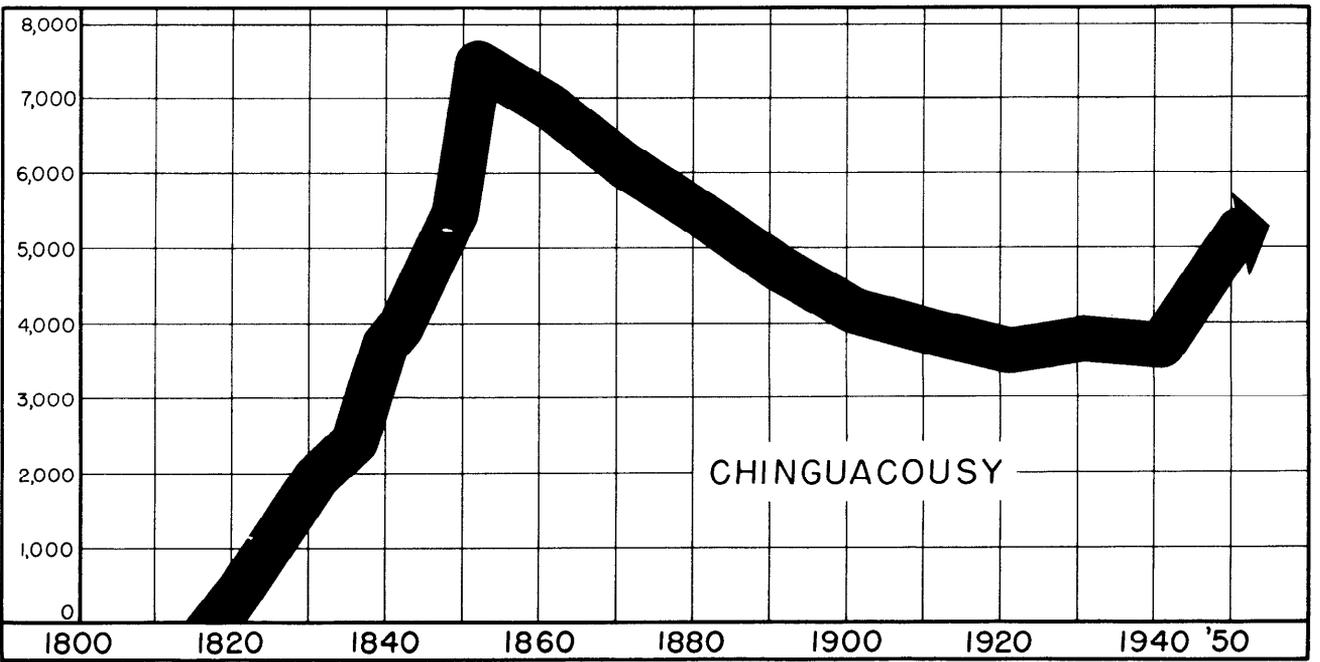
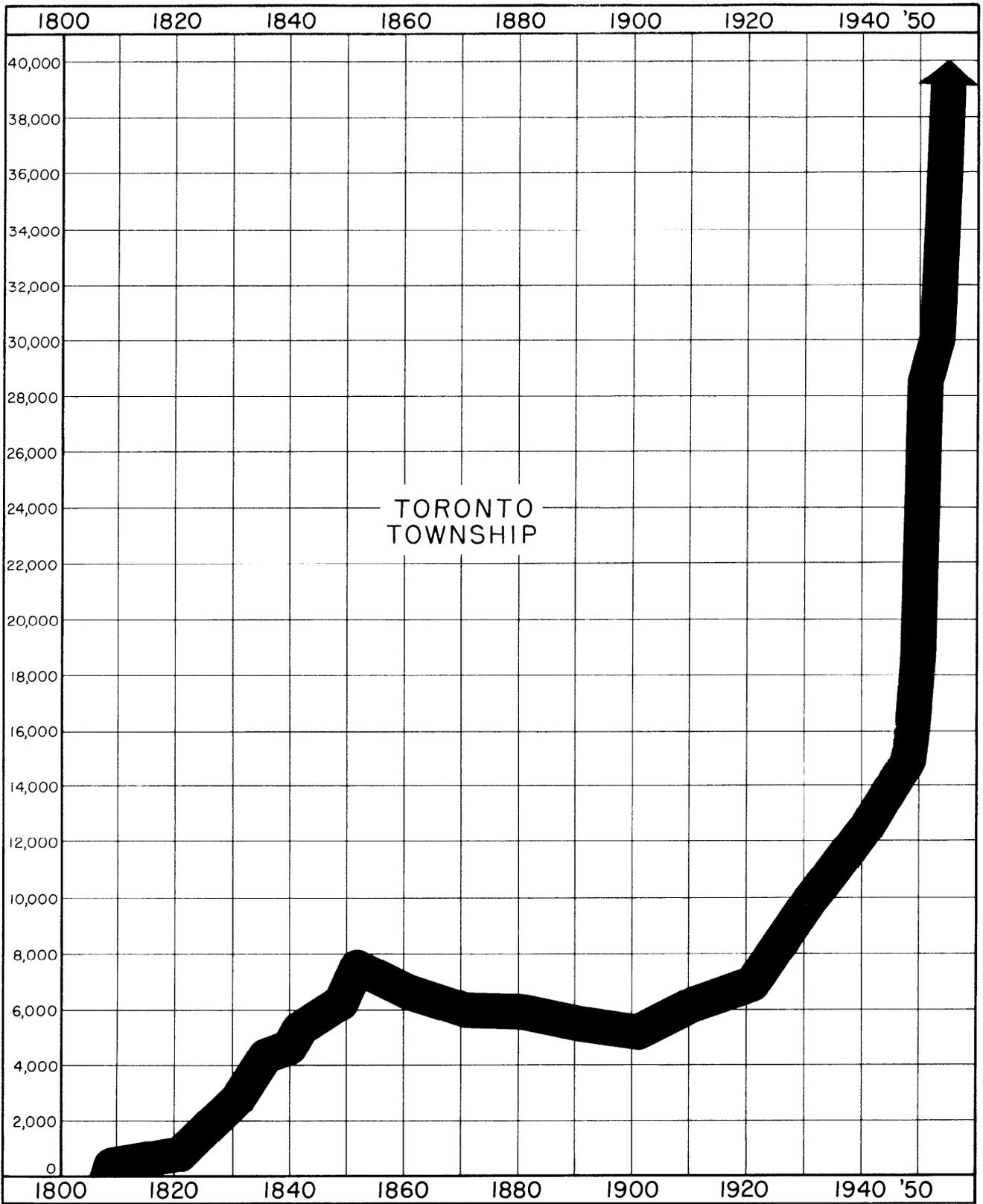
Acton

Acton was first called "Davisville" after a clerk in Wheeler Green's store. This must have been about 1840 and Nicklin's saw and grist mill was probably built about that time. The name was changed to "Adamsville" and became Acton in 1844. Knox Church was built in 1846 and soon after a post office was opened and a woollen mill built. The story of the tanneries has already been told. Speight's carriage factory was founded about 1851-52 and Ryder's in 1854. These, with the shingle mills, cooperages and stave mill, were as important as the tanneries in the 1860's. The population in 1869 is estimated at 700; by 1881 this had grown to 848 and since then the Census Returns have shown no decline and since 1921 a steady growth, though the municipal returns have fluctuated considerably of late years. The most recent (1956) is over 3,300 - some three hundred more than the 1951 Census Return. Acton became a town in 1950.

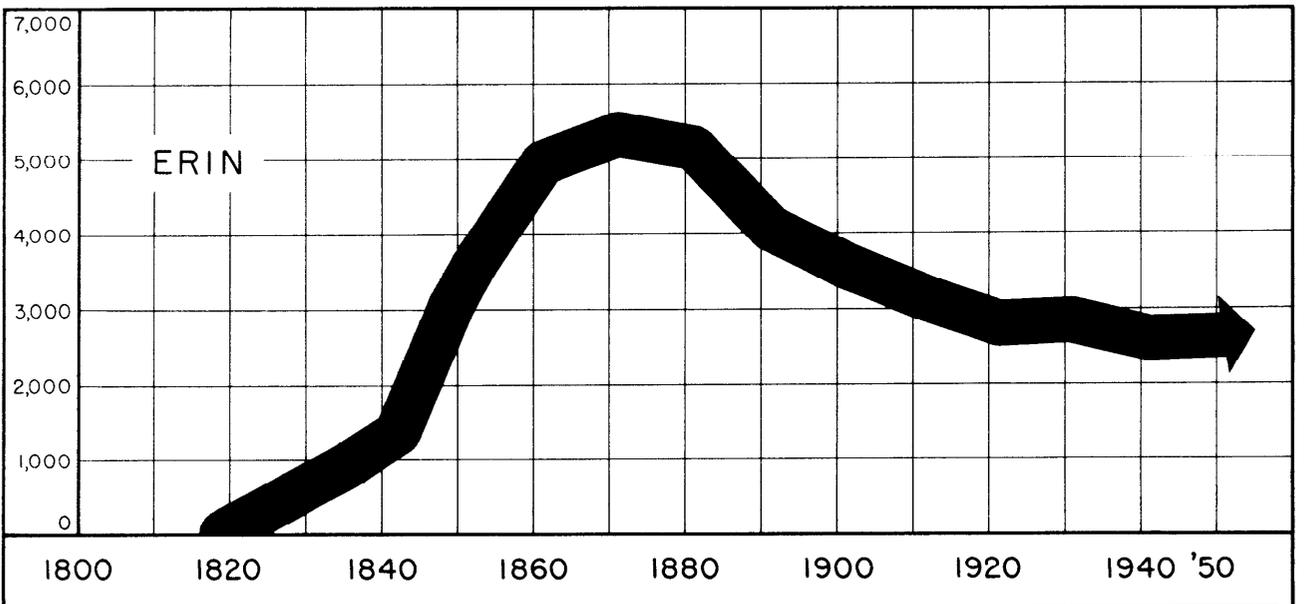
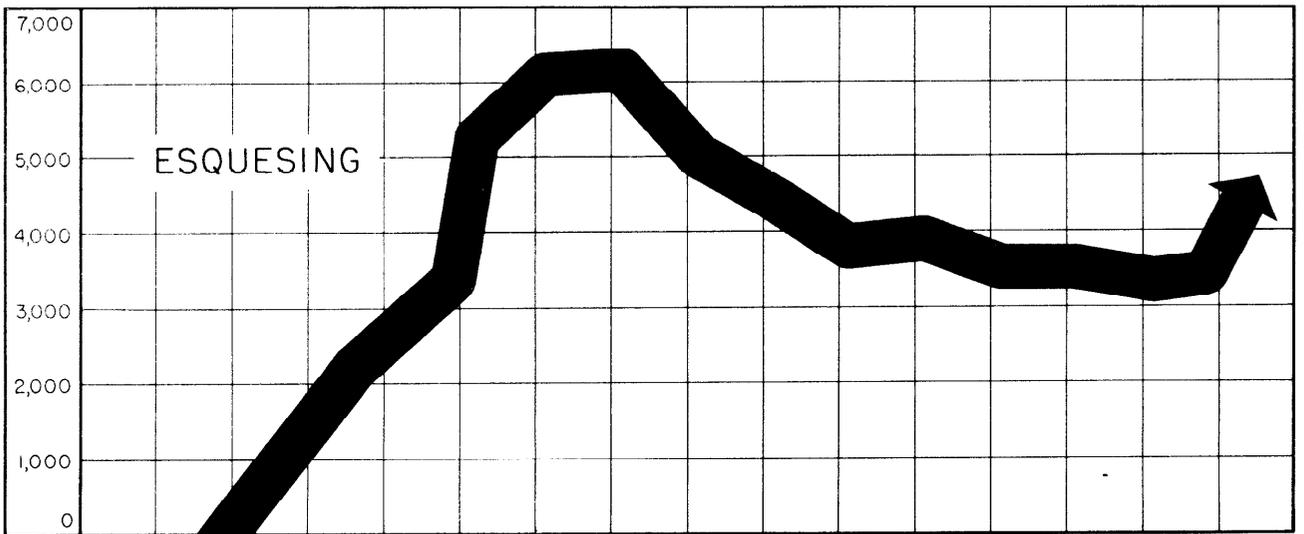
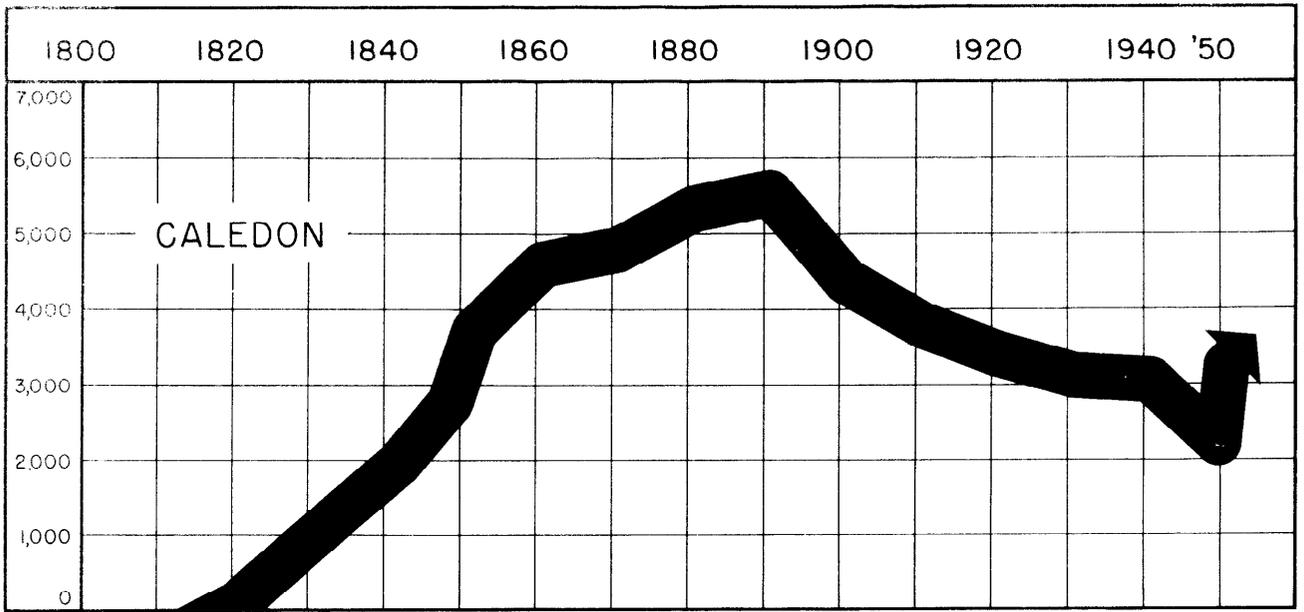
Port Credit

Port Credit was laid out by the Government on the south bank of the river in 1834. A harbour and wharves were

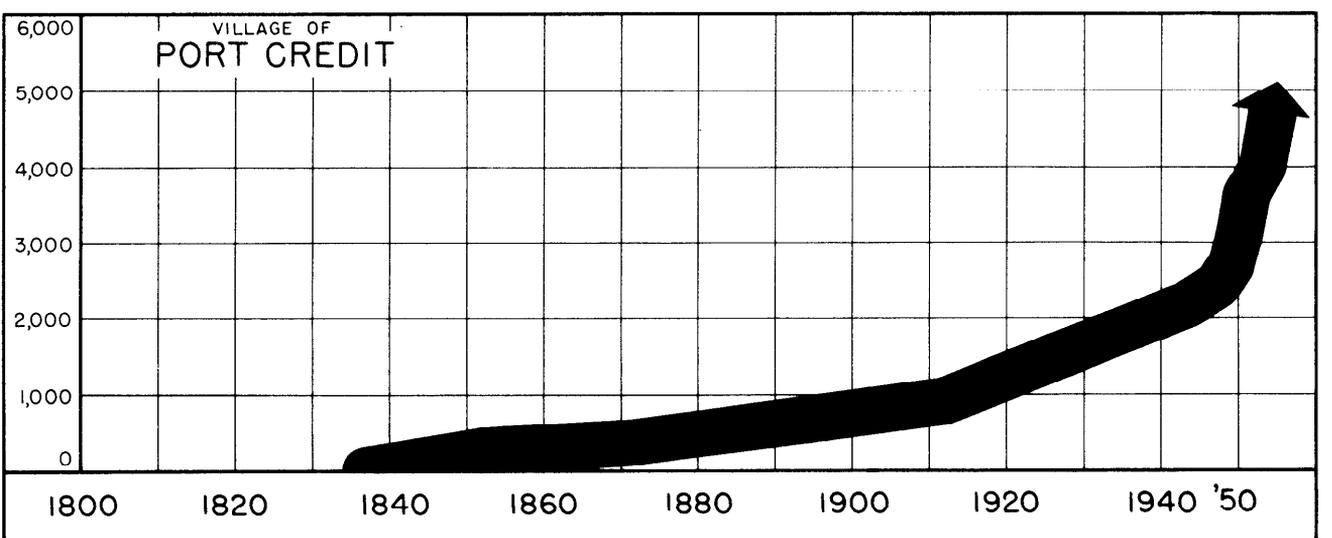
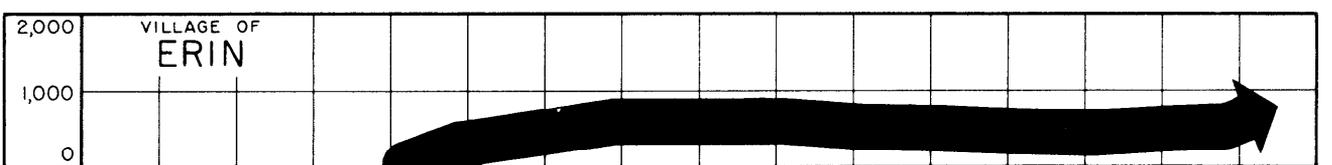
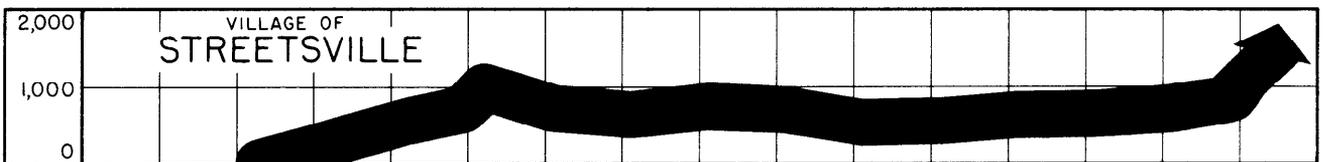
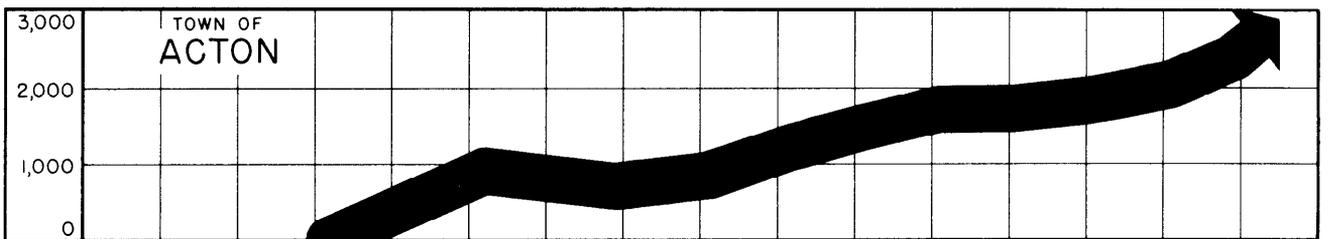
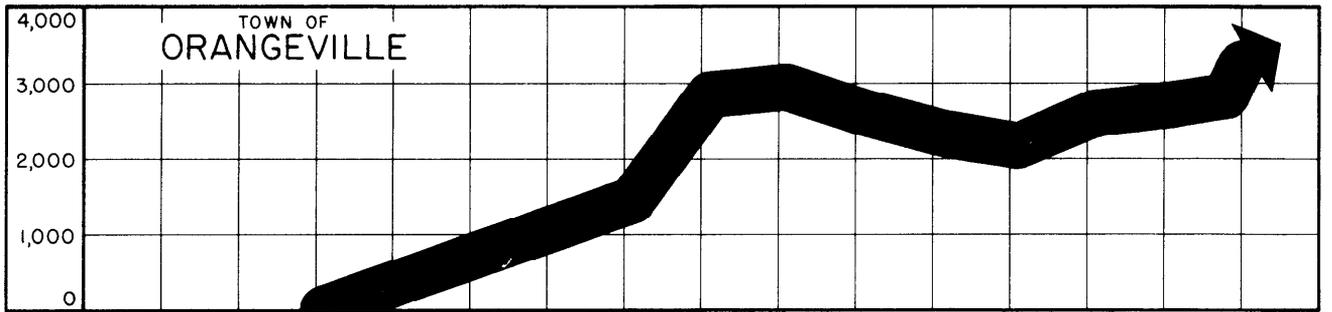
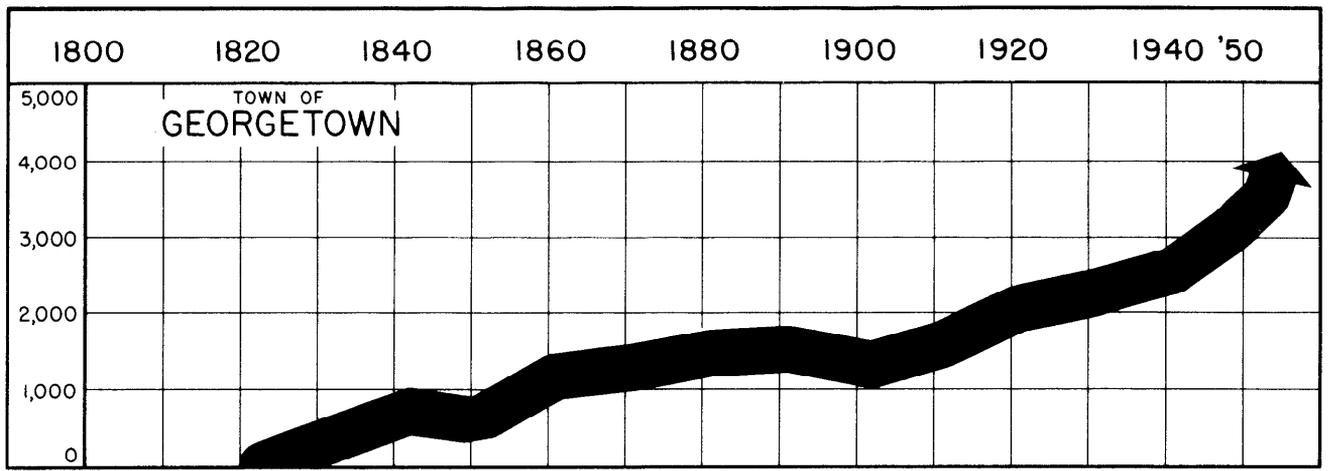
begun but the work had been interrupted when Mrs. Jameson visited the village in 1837. She says there were only a few cottages and this agrees with Walton's Directory, which lists only about five heads of families, and with the plan of the new plot on the north bank, laid out in the forties. This shows only about eight or nine buildings that might be dwellings, in addition to the warehouses near the harbour. The village must have grown by **1846**, for it is credited with 150 inhabitants. There was a Methodist Chapel (1835) and seven businesses. The trade of the port was not large at that time but the planking of the Credit and Guelph Road brought an improvement and in 1851 there were about 250 people in the village. There were some ambitious plans for Port Credit in the early fifties and the lots were mostly taken up, but not many occupied. Ship building was going on in 1857 and the population was about 400. It was believed to be slightly less in 1869, when a sawmill was the chief industry. There was some revival of shipping in the eighties and nineties, but the village grew very little. In the early 1900's it was a small and decayed village and the harbour was chiefly used by yachtsmen as it is today. There was already some tendency for Port Credit to become a residential village. The only starch factory in the watershed was already located there, but was almost the only business of importance. The residential population began to grow after the first world war. The village was incorporated and in 1931 had 1,123 people. There are now nearly six thousand.



TOWNSHIP POPULATION



TOWNSHIP POPULATION



POPULATION-TOWNS & VILLAGES

CHAPTER 1

THE PURPOSE AND METHODS OF THE SURVEY

1. The Purpose of the Survey

A soil conservation survey is made to compile an inventory of soil resources and present use and to appraise the capabilities of the land. From this inventory and appraisal there can be derived a pattern of land use which, if carried out, would adjust the land more nearly to its capabilities. In this report a map of recommended land use has been prepared. This is based on the observations made in the field survey.

2. Source Material

While carrying out the survey, reference was made to all maps and other information available. Geologic maps, prepared by the former Department of Mines and Resources, of Southern Ontario were used. Reference was made to maps of the glacial geology of the area published by the Ontario Research Foundation. The soil map and report of Peel County were used, together with the soil map of Halton County kindly made available by the Ontario Soil Survey. Knowledge gained of soil capabilities in adjacent areas was applied,

3. Personnel and Equipment

The field work of the soil conservation survey was done by students and graduates of agriculture and geography from Ontario universities. The survey was done by jeep and on foot. The fieldmen carried equipment for estimating soil erosion, measuring slopes, and taking soil samples. Soil maps were also carried. Findings were recorded on air photographs.

4. Field Methods

Mapping of the present and recommended land uses of the watershed was done on a "reconnaissance" scale. The land was surveyed from vehicles traversing all roads and

accessible lanes, and on foot where necessary. The present land use was mapped field by field. In mapping the recommended land use, soil maps were correlated with percentage of slope, degree of erosion, and other physical characteristics of the land, and the land assigned to its proper class. The mapping was done on air photographs which were also used in interpreting the physical characteristics of the land.

5. Preparation of Maps

Field observations were transferred from air photographs to large sheets from which photostated copies were made. The map of recommended land use gives the information in the same detail as it was mapped in the field. On the map showing factors limiting land use, areas have been grouped into a pattern, showing the dominant factor in each area.

6. Aim of This Report

The principal aim of this report is to recommend a program of soil and water conservation. It is felt, however, that a description of the physical geography and soils of the Credit Valley is helpful in understanding more fully the needs for conservation and the measures required. The watershed has been divided into several natural regions and these are discussed. The various types of land use in the watershed and forms of agriculture are described in Chapter 4.

The conservation measures reviewed in Chapter 6 are measures applicable within the watershed. A folded map of the Credit Valley accompanies this report and on it is shown the recommended land use. The recommended land use map indicates the use capabilities of the land and it is a guide to follow in adjusting land use to capability. The classes of recommended land use and their definitions are given in Chapter 7.

In Chapter 8 specific recommendations are made for action by the Authority. The recommendations embody the findings of the survey carried out in the summer of 1954. It is recommended that the Farm Planning and Land Use Advisory

Board set up demonstrations in several parts of the watershed. These demonstrations, or pilot farms, would serve to spread knowledge of soil and water conservation measures and show the advantages of farm planning. The aim of the Advisory Board should be to have a plan for every farm in the watershed, Certain problem areas are also discussed.

CHAPTER 2

THE PHYSICAL GEOGRAPHY

1. Introduction

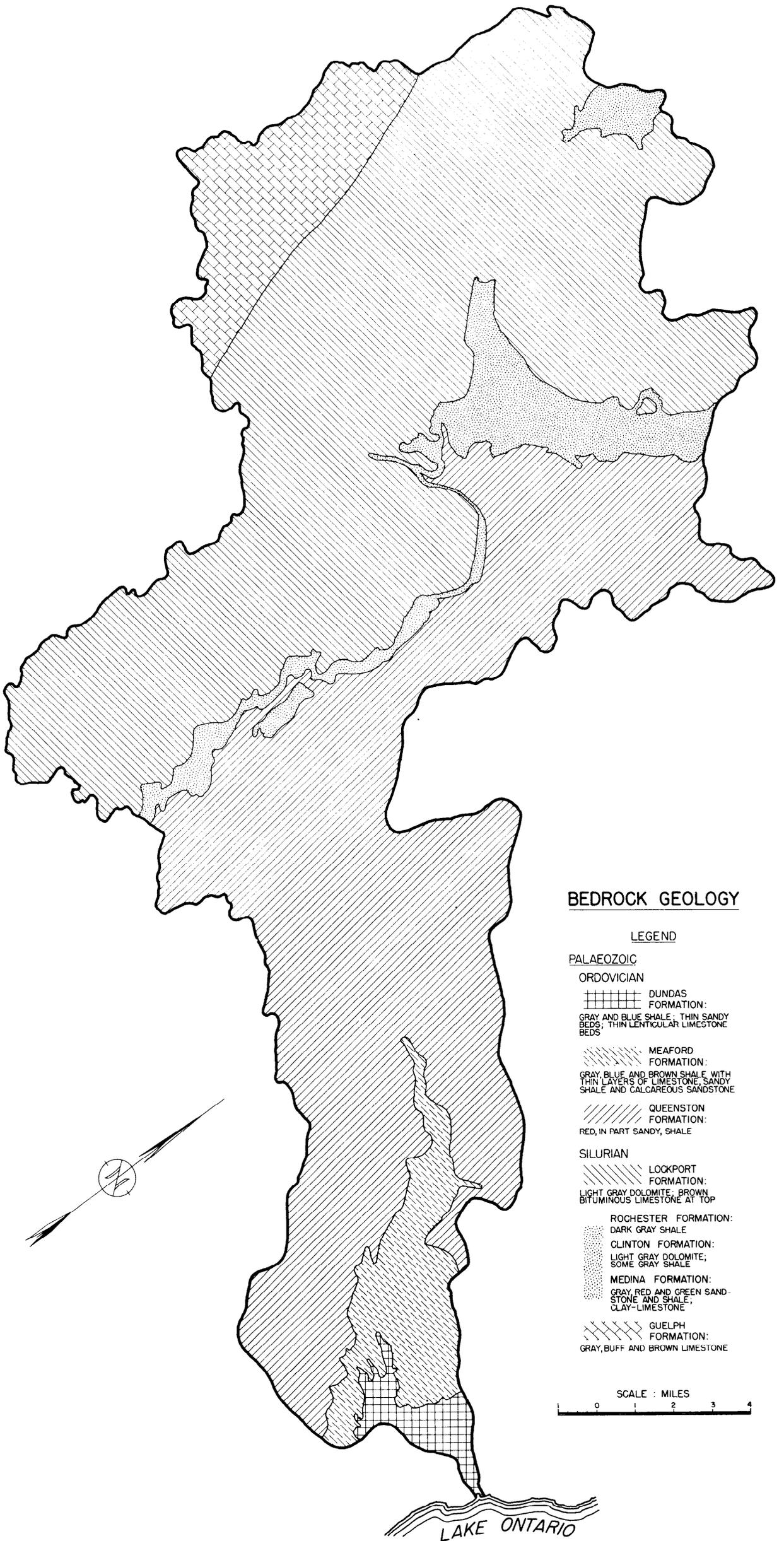
Included in the study of the physical geography is the bedrock geology, the glacial geology, the climate, and the drainage pattern. The Credit Watershed has been divided into several physiographic regions which are characterized by similar landscape features. The soils developing in each of these physiographic regions are similar, taking their characteristics from the parent materials common to each. It follows that the land use pattern within each section of a physiographic type will be similar and that the problems of conservation will be the same.

A knowledge of the physical geography is a prerequisite for the understanding of the land use pattern, The land use of a region is determined primarily by the physical environment, Overriding economic and social factors may distort the picture and the actual land use may not be in full accord with the physical limitations of the soil, The aim of the farmer, however, is to bring the use of his land into as close a harmony as possible with the natural environment, The soils should be used according to their capabilities

2. Bedrock Geology

Geology is the science which has to do with the origin, composition, structure and history of the earth's crust The structure, formation and composition of the rocks which underlie the Credit Watershed are here described.

The bedrocks of the Credit Watershed are sedimentary; that is, they are composed of fine materials eroded from an ancient land surface and laid down in water. Through processes of cementation and compression the sediments became rock, The sedimentary rocks in Southern Ontario were deposited in shallow seas which once covered much of central North America. These sediments were carried from continents



BEDROCK GEOLOGY

LEGEND

PALAEOZOIC

ORDOVICIAN


 DUNDAS FORMATION:

GRAY AND BLUE SHALE; THIN SANDY BEDS; THIN LENTICULAR LIMESTONE BEDS


 MEAFORD FORMATION:

GRAY, BLUE AND BROWN SHALE WITH THIN LAYERS OF LIMESTONE, SANDY SHALE AND CALCAREOUS SANDSTONE


 QUEENSTON FORMATION:

RED, IN PART SANDY, SHALE

SILURIAN


 LOCKPORT FORMATION:

LIGHT GRAY DOLOMITE; BROWN BITUMINOUS LIMESTONE AT TOP


 ROCHESTER FORMATION:

DARK GRAY SHALE


 CLINTON FORMATION:

LIGHT GRAY DOLOMITE; SOME GRAY SHALE


 MEDINA FORMATION:

GRAY, RED AND GREEN SANDSTONE AND SHALE; CLAY-LIMESTONE


 GUELPH FORMATION:

GRAY, BUFF AND BROWN LIMESTONE

SCALE : MILES



LAKE ONTARIO

which lay to the north and east. Sedimentary rocks contain fossils or skeletons of animals, the structures of which have been preserved, and these are used to date the age of the rocks.

Sedimentary rocks are divided into shales, sandstones and conglomerates and were formed from clays, sands and gravels, respectively. Limestone and dolomite were formed from the bodies of animals which dropped to the floor of the sea. They are composed largely of magnesium and calcium carbonates.

Sedimentary rocks are stratified as they are deposited in water. The rocks are classified according to eras, formations and smaller units in the time scale. In the Credit Valley region the rocks belong to the Ordovician and Silurian eras, and were laid down almost 500,000,000 years ago,

The earlier Ordovician rocks in the east include the Dundas, Meaford and Queenston formations. These rocks are composed largely of shale, and are rather impervious to water percolation. The grayish-blue Dundas shales underlie part of the south-east section of the watershed and are exposed along the lower Credit River. The Meaford shales reach the surface at Streetsville and are of much the same colour as the Dundas shales, The Queenston formation is composed of brick-red shale with greenish bands of weathered material; it appears as a bench below the Niagara Escarpment where the Credit River has cut into it and exposed it.

The Silurian rocks overlie the earlier Ordovician formations, and consist of the Medina, Clinton, Rochester, Lockport and Guelph formations. The first three formations form only a narrow band along the escarpment. The Lockport formation is important since, because of its high resistance to erosion, it is the cliff-forming member of the Niagara Escarpment. It is a light gray dolomite pervious to water and occurs as a continuous exposure through part of the Credit Valley, The softer gray dolomite of the Guelph formation appears further to the west.

The parent materials, out of which the soils of the watershed have been built, were derived from the bedrock. Only in small areas, however, do the soils actually develop from the exposed bedrock itself. The bedrock was eroded, ground up and re-deposited by the action of continental glaciers which will be discussed in the next section. The soil materials in the west have a high lime content while those in the east have less. Where the soils have a high lime content the profiles are shallower because leaching of the lime by water has been inhibited.

Limestone bedrock is porous and allows water to seep through readily; therefore, areas where limestone is close to the surface are droughty. Shales, conversely, are impervious to water and inadequate drainage characterizes those areas in which the shale formations are at, or are close to, the surface.

The bedrock formations were laid down as horizontal strata. Because of a warping movement which raised Western Ontario into a broad dome, called a geanticline, the rock formations dip towards the west. The Credit Valley is on the eastern slope of this broad dome or arch so that there is a general rise in altitude to the west. The Niagara Escarpment is the most outstanding feature. It separates the Western Ontario uplands from the St. Lawrence lowlands to the east. The escarpment is an erosional feature capped by resistant rocks which help to maintain a perpendicular escarpment face as the cuesta is eroded westward through long periods of time.

3. Glacial Geology

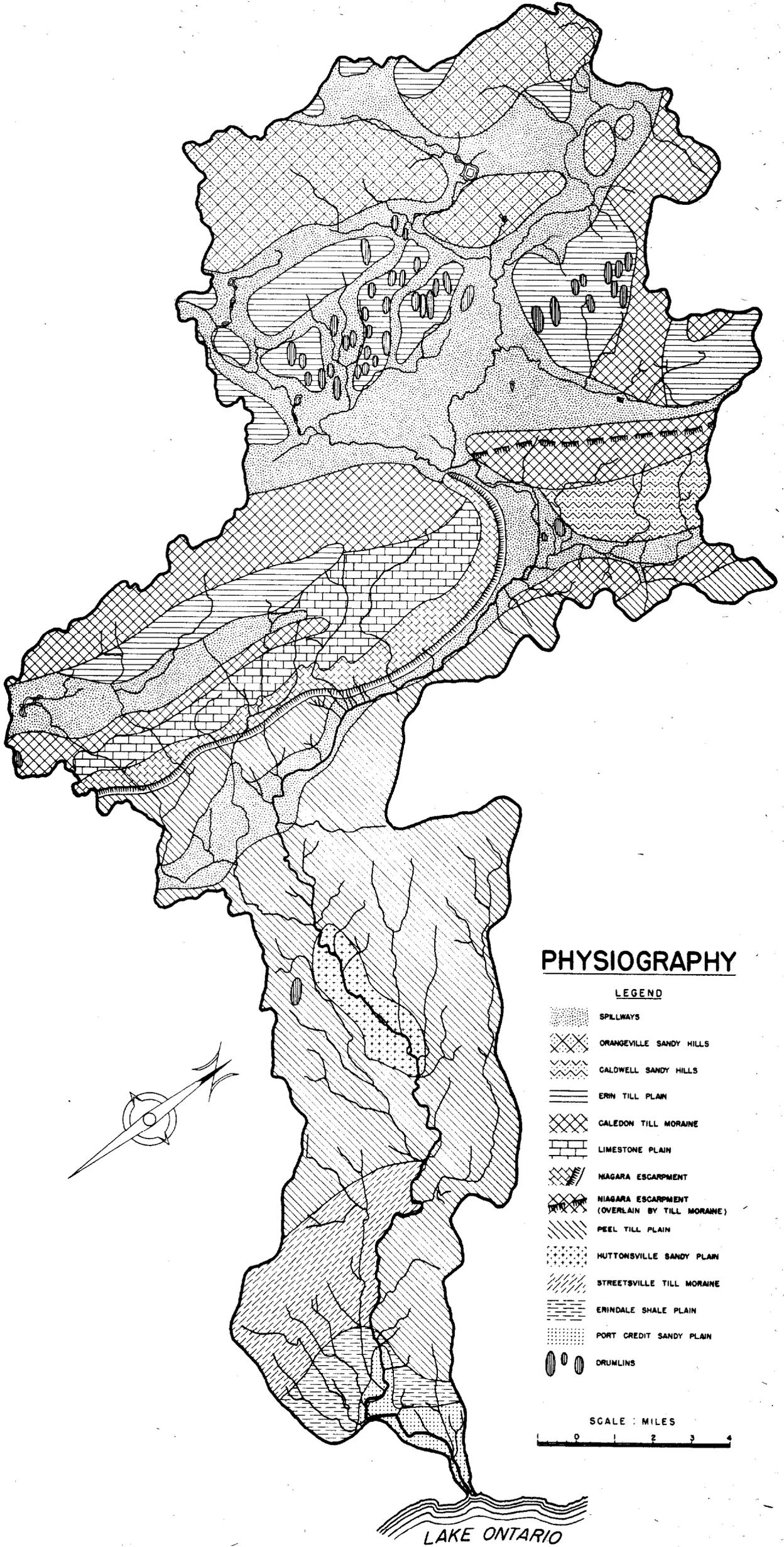
During the recent geological past, in the age called the Pleistocene, Canada was covered by a great continental ice sheet. As a result of falling temperatures snow accumulated, changed to ice and advanced as numerous glaciers from the north to cover all of Southern Ontario to a

depth of several thousand feet. This ice deepened the pre-existing valleys, eroded the land surface and distributed the masses of pulverized rock which it picked up as it moved.

Through this ice action the surface of the land was moulded into the forms of the present landscape, The ice sheet advanced and retreated several times,

"Till" is the name given to the material laid down under the ice sheet during its advance phase and varies in texture according to the materials present. Angular stones occur throughout the mass of the till, and clay is an important constituent when the till is heavy, whereas sandy or gravelly till is light, Till plains are widespread in Southern Ontario and the surface is usually undulating as in Chinguacousy Township, "Drumlins" are long, oval-shaped hills formed under the ice, Often called whale-back hills, they have one steep end and a long tapering tail pointing in the direction of the ice movement, These landforms are found on the till plains in the upper part of the watershed. Where the glaciers halted for a length of time, ridges of till were built up called till or end moraines, These ridges are characterized by a rough, hilly topography and are often excessively stony,

When temperatures rose sufficiently to melt the ice and restrict its advance, another series of landforms was created, Meltwaters issued from the face of the ice carrying sands, gravels and silts which built up delta-like fans. When the ice disappeared these formations slumped to form conical hills called kames. Coalescence of a number of individual kames results in a landform known as moraine. Kame moraines are found in the upper watershed, and can be identified by the stratified gravelly and sandy materials and the water-smoothed stones, Further away from the ice, sandy materials were deposited to form plains pitted with depressions called kettles, These are called outwash plains.



PHYSIOGRAPHY

LEGEND

-  SPILLWAYS
-  ORANGEVILLE SANDY HILLS
-  CALDWELL SANDY HILLS
-  ERIN TILL PLAIN
-  CALEDON TILL MORAINE
-  LIMESTONE PLAIN
-  NIAGARA ESCARPMENT
-  NIAGARA ESCARPMENT (OVERLAIN BY TILL MORAINE)
-  PEEL TILL PLAIN
-  HUTTONSVILLE SANDY PLAIN
-  STREETSVILLE TILL MORAINE
-  ERINDALE SHALE PLAIN
-  PORT CREDIT SANDY PLAIN
-  DRUMLINS

SCALE : MILES



LAKE ONTARIO

The voluminous meltwaters flowing away from the ice created valleys distinctive in form. These features have been named spillways. They are broad channels, usually flat-floored and steep-sided, and possess small streams too small to have cut the valley. Such streams are called misfit streams. Part of the course of the Credit River is determined by the direction of spillways. Where the meltwaters entered pondings created by the damming action of the ice or ice-deposited materials, deltas of sandy materials were built up. The sandy plain around Huttonsville is such a delta. On the lake bottoms a clay veneer was deposited over the underlying till. Parts of Chinguacousy and Toronto Townships are covered by a veneer of clay as a result of a ponding along the front of the ice.

4. Landscape Types

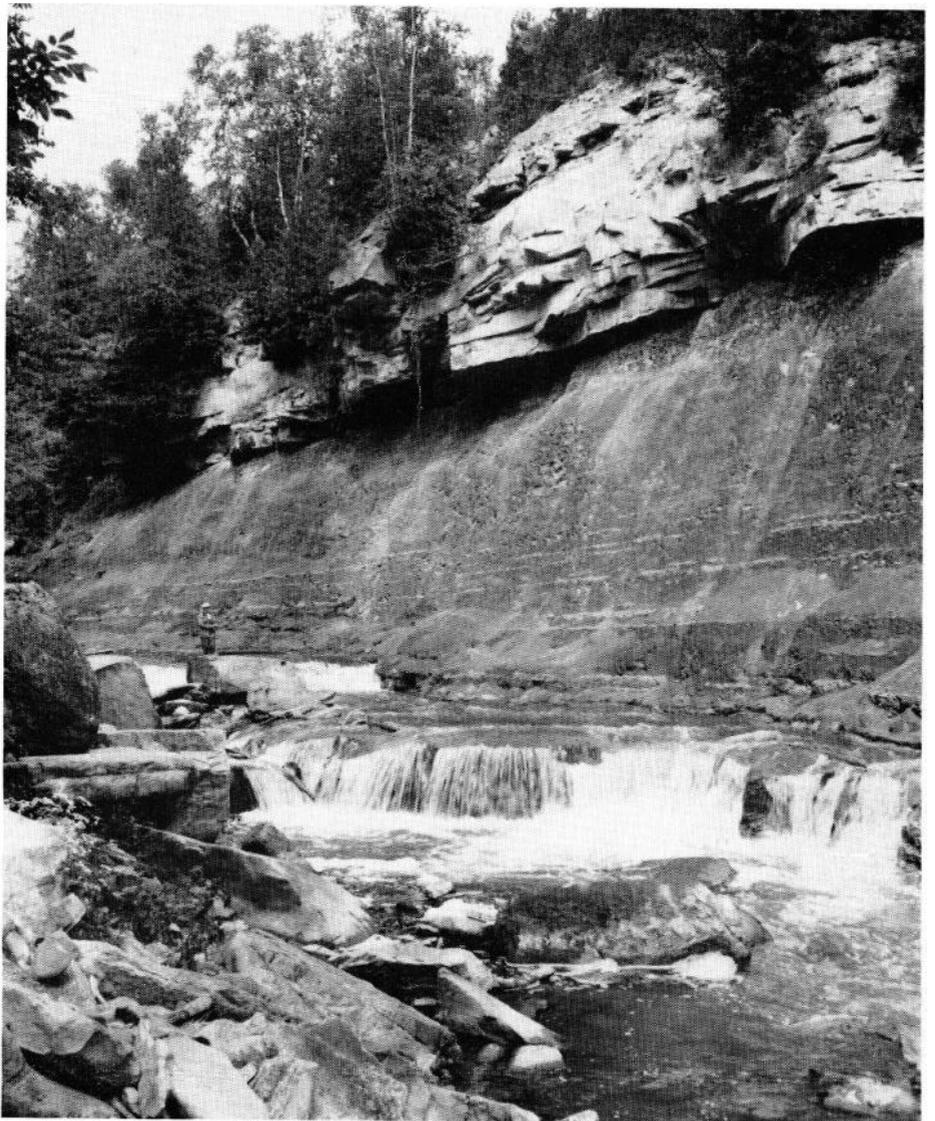
The Credit Watershed may be divided into a number of landscape types on the basis of topography, materials and manner of formation. The landscape types are not always continuous and each may contain inclusions of other types.

The Spillways are the abandoned channels of former glacial meltwater streams. They are broad troughs paralleled with gravel terraces, and small streams may flow along the bottoms. The coarse, poorly drained soils within the valley often support only a cedar swamp. Pasture and forest are the principal forms of land use. On the watershed small spillways of the interconnecting type are found between drumlins and the sandy hills of the moraines. The main branch of the Credit River occupies a connected spillway system as far down as Glen Williams and the west branch of the river also follows a spillway channel,

The Orangeville Sandy Hills are kame moraines where glacial meltwaters deposited poorly sorted materials. The headwaters of the main branch of the Credit River rise in these hills in the north-west corner of the watershed. Rough



The Niagara Escarpment as seen from the Canadian Pacific Railway station at Forks of the Credit. The Credit River flows along a spillway below the escarpment.



The east wall of the gorge below Cataract shows the soft Queenston shale overlain by the more resistant Medina sandstones and dolomites.

topography, sandy materials and flat-bottomed swampy valleys are characteristic of these regions. The Caldwell Sandy Hills in Caledon Township are characterized by the same rough topography and poorly sorted sandy materials.

The Erin Till Plain and Drumlin Field occupies much of the land between the Orangeville Sandy Hills and the Niagara Escarpment. On the rolling till plain in the vicinity of Erin, drumlins or whaleback hills are common and the area is divided by numerous interconnecting cross-valleys. The till is medium-textured,

The Caledon Moraine runs diagonally across the northern part of the watershed in several strands. This landscape type is typically hilly and possesses many swampy depressions. The till is coarse and stony, and often contains boulders of considerable size.

The Niagara Escarpment is the most outstanding feature of the landscape. South of Credit Forks the escarpment stands out prominently and is marked by vertical cliffs of dolomite, while the red shales of the Queenston formation appear as a sloping platform below the crest. Hummocky and bouldery hills of moraine obscure the escarpment north-east of Credit Forks. Where the different branches of the Credit River cross the escarpment they have cut deep notches into the rock. The Limestone Plain with a thin covering of till in some areas lies above the escarpment.

The gently sloping Peel Till Plain, lying to the south and east of the Niagara Escarpment, is the largest physiographic region in the watershed. The undulating surface is broken only by steep-sided valleys. The basal layer of fine till is covered by a clay veneer which was deposited in a glacial lake once covering parts of the plain. The small sandy plain around Huttonsville was a delta in this glacial lake,

The Streetsville Moraine has a subdued morainic topography. Between the low hills are swampy depressions.

The Shale Plain which is partly covered with a shallow mantle of till lies further east.

The Port Credit Sandy Plain was once covered by the larger glacial Lake Iroquois which occupied the Lake Ontario basin. Along the edge of the sandy plain are ancient beaches. The sandy ridge which obstructs the Credit River was once a bar thrown up by lake waves.

5. The Climate

Southern Ontario has a cool temperate climate, Precipitation is distributed evenly throughout the year, although there is a moisture deficiency in late summer. The temperature is high enough to permit the growth of a wide range of crops and various kinds of fruits, Within the watershed there are climatic differences and three climatic regions have been distinguished: the Lake Shore, the Peel Plain and the Upland. The Upland region is cooler, has more rain, but has shorter summers and longer winters than the other regions, Winds blowing off Lake Ontario over the Lake Shore region modify the winter temperatures of this area.

The Lake Shore region is confined to the Port Credit Sandy Plain. The mean annual temperature is 44 degrees. Summers have a mean temperature of 66 degrees and winters have a mean temperature of 21 degrees. The extreme low temperatures are not low enough to prevent the growth of many varieties of tender perennial food plants. The last frost of spring comes about the eleventh of May and the first frost of autumn comes about the third of October. The growing season, which includes all the days above 42 degrees, averages 197 days. Annual precipitation is 33 inches, with 8 inches falling during the three summer months. Droughts are more frequent than in the other regions, but there is more sunshine.

The climate of the Peel Plain is not modified by winds from Lake Ontario, but the area does have a southern

exposure. The mean annual temperature is between 42 and 44 degrees, The mean seasonal temperatures are: winter 21 degrees, spring 41 degrees, summer 66 degrees, and fall 47 degrees, The last spring frost comes about May 15 and the first fall frost about September 28. The average growing season is 196 days. Precipitation is about 33 inches, 8.7 inches falling in the three summer months. Droughts are less frequent than on the lake shore.

The Upland region includes all the land above the Niagara Escarpment. The mean annual temperature is 42 degrees, which is about 2 degrees below that on the Peel Plain. The seasonal mean temperatures are as follows: winter 16 degrees, spring 41 degrees, summer 66 degrees, and fall 46 degrees, There is a wide temperature range of 145 degrees. The growing season averages 189 days and is shorter by a week than in regions to the south. The last frost of spring comes about April 19 and the first frost of fall comes about September 25. The low winter temperatures preclude the growing of many tender perennial plants, The annual precipitation is 36 inches and is 3 inches higher than on the Peel Plain. The average rainfall for June, July and August is 8.9 inches.

6. The Drainage Pattern

Water is an important natural resource and conservation of water must be a part of any soil conservation program, All the water which is available to the crops falls as rain or snow and is disposed of by surface run-off, evaporation, transpiration or deep seepage. Since there is a moisture deficiency in the latter half of the summer in the Credit area, water losses should be a serious consideration of the farmer.

The two main branches of the Credit River rise in regions of sandy hills, In these sandy soils surface run-off is low and the precipitation percolates rapidly down through the soil to recharge the ground water by deep seepage. Throughout the year springs give a constant flow to the upper river,

The flow of water at Cataract in the middle of summer, July 13-30, 1954, was 14 cubic feet per second. The normal minimum flow is between 11 and 18 cubic feet per second. The location of the headwaters of the Credit River in regions which catch and preserve the water means a good flow further down the river. The cold clear water of the upper river benefits recreation, fishing, domestic supply and industrial use.,

When the Credit River crosses the Niagara Escarpment it enters the Peel Plain region of clay soils, Surface water losses from clay soils are much higher than from sandy soils, the amount of percolation is much reduced because of the compact nature of the clay and consequently streams are often dry during the summer in this area. This condition precludes the use of these streams for fishing, but some recreational use would be possible if dams were built. Conservation of surface water by impounding it can also serve the purposes of stock watering and irrigation.

For certain purposes a good stream flow throughout the year is necessary. A flow of only from 3 to 4 cubic feet per second has been recorded at Erindale. Although the yearly minimum flow in the main stream rarely reaches such a low figure, nevertheless with increasing use of the river water for recreation, domestic purposes, industry and irrigation, such a flow is cause for concern. The regulation of run-off is important in the water relations of a river and should be a factor of some concern to the farmer.

CHAPTER 3

THE SOILS OF THE WATERSHED

1. Definition of the Soil

The soil is a thin mantle covering the earth. The soil develops and takes its character from the climate, vegetation and parent material from which it is formed. It is composed of mineral material, micro-organisms and the remains of plants and animals. In the soil the plants germinate, and from it take in moisture and necessary elements in solution for growth and maturation. The quality of a soil is measured in terms of the vegetation it supports, and its economic importance to man.

2. The Gray-Brown Podzolic Soils

The character of a soil is determined essentially by the climate and the natural vegetation. The soils of the watershed, like most soils of Southern Ontario, were formed under a moist, cool temperate climate and a covering of hardwood or mixedwood forest. Soils formed in this environment exhibit the same characteristics, and are called gray-brown podzolic soils.

The process of podzolization is as follows. Leaves, dead wood and grass litter the surface of the ground, and are at once attacked by micro-organisms. The organic matter decays, and organic acids move downwards through the soil with water from the surface of the ground. Organic matter is mixed with the parent mineral material to form a dark-coloured upper layer. As the acids and water move downward, lime and magnesium, salts of iron and aluminum, and the very finest clay particles, the colloids, are carried down to a lower horizon or zone. A zone of leached mineral matter is left with a high silicon content. Some of the material from above is redeposited in a lower zone. Here the lime neutralizes the acids, and the colloids accumulate to form a sticky horizon marked by a definite structure.

3. The Soil Profile

The soil profile is a cross-section of the soil, revealing the different levels or horizons described above. An ideal soil profile is given here which develops under normal forest conditions in Southern Ontario.

<u>Horizon Name</u>	<u>Description</u>
Aoo Litter	Loose, newly fallen leaves and branches
Ao Humus	Layer of partially decomposed organic debris
A1 Topsoil	Dark grayish-brown to black in colour, loose and friable, mineralized humus layer
A2 Layer of leaching	Light-coloured mineral layer resulting from a leaching and bleaching action. Often mixed with A1 to form an Ac horizon, i.e. cultivated
B Subsoil or zone of accumulation	Dark brown, exhibiting a definite blocky or cloddy structure, often sticky
C Parent material	Unweathered mineral matter, may be gravel, sand, loam or clay; lime or magnesium carbonate may be found free
D Bedrock	May be shale, sandstone or limestone

The dark gray gleizolic soils develop under poorly drained conditions. The following is a generalized description of a gleizolic soil in Southern Ontario,

<u>Horizon Name</u>	<u>Description</u>
Ao Humus	Accumulated layer of partially decomposed litter from deciduous trees
A1 Topsoil	Dark gray to very dark gray mineralized layer
G Glei	Brownish-gray mottled mineralized layer
C Parent material	Grayish-brown calcareous parent material

Soils differ within a region because of parent material, and topography. Soils developing on material with a coarse texture such as sand or gravel have deep profiles,

Leaching of plant nutrients may be a major problem in such soils because as the water moves rapidly downward it carries away soluble minerals to depths which cannot be reached by the plant roots. Because of the rapid drainage these soils tend to be droughty. The continuous movement of air through the soil leads to rapid oxidation of the soil organic matter. Conversely, poorly drained soils accumulate organic matter in the upper layers, and develop a sticky gray clay level below called the glei horizon.

Soil formation is continuous. Under a forest or grassland the soil-building processes and soil erosion are in equilibrium. When the cover of vegetation is removed the soil is more exposed, accelerated erosion may result, and soil can be carried away faster than it can be built up. The mature soil is the best medium in which to grow crops and consequently this type of erosion is of much concern to the conservationist and should be to all others who use the land. This erosion can be prevented by proper tillage methods worked out by conservation engineers. Where drainage is poor the land must be drained in order that the plant roots can develop properly.

When the soil is inadequately drained, or there is a fluctuating water table near the surface, the soil-building process which is due mainly to the downward movement of water and aeration is restricted. Where the water table fluctuates the lower horizons of the soil are mottled. Red, yellow and brown streaks or spots are indicative of the oxidized forms of iron and manganese. Mixed with these are blue and gray colours which are characteristic of reduced compounds. Imperfectly drained soils exhibit a yellowish-brown or brown subsoil with mottling appearing to a greater or lesser degree. Poorly drained soils have a glei horizon with red, yellow and brown streaks,

4. Soil Classification

Soils are grouped into categories called catenas which can be described and readily recognized. The soil catena includes soil series developed on similar parent material, but differing in profile characteristics because of natural interior drainage. The soil series is a group of soils with genetic horizons similar as to differentiating characteristics and arrangement in the soil, profile, and developed from a particular type of parent material. The characteristics include colour, structure, organic matter content, chemical reaction and texture.

The soil type is the principal unit of mapping, and is more specific in character. The soil type name consists of a series name plus the textural class. As an example, in the Dumfries catena two soil series are recognized: Dumfries series which has good drainage, and Lily series which is poorly drained. Dumfries is a soil series, and may be divided into two types: Dumfries loam and Dumfries sandy loam.

5. Major Catenas on the Watershed

On the Peel Plain the most important agricultural soils were developed over fine-textured shale and limestone till, and on lake clays underlain by clay till. The Oneida catena, developed over fine-textured till, covers a broad zone from the escarpment to Streetsville. South of Brampton is the Cashel catena developed over heavy clays of lacustrine origin. The Harriston catena in the north-west was developed on medium-textured till, as was the Guelph catena further west. Also in the north-west is the Dumfries catena developed over coarse till. The Bookton, Hillsburgh, Brighton, Fox and Pontypool catenas were all developed on sands of different textures, and are in morainic deltaic or outwash regions. The Caledon catena occurs on well-sorted outwash gravels. Where the bedrock is exposed three catenas are recognized: the Lockport formed over red shale; the Brockport formed over gray

shale; and the Farmington formed over limestone.

6. The Dumfries Catena

The Dumfries **catena** is found in the Credit Forks moraine. The topography is rough and hummocky, and the materials are coarse and stony. External and internal drainage is good, though numerous kettles occur which are poorly drained. Stones occur throughout the profile to make cultivation difficult. The soil is susceptible to sheet erosion which may be severe.

Dumfries loam is the well drained member of the catena, and a description of the soil profile follows, The A1 horizon is about 4 inches deep, and is a dark brown loam with a very fine granular structure, There are usually two lower A horizons: the upper one (A2) with 5 inches of yellowish-brown loam, granular and friable, and the lower (A3) with 2 inches of pale brown sandy loam slightly cemented. The B horizon consists of 7 inches of yellowish-brown loam with a medium nut structure,

The soil has a medium to low fertility, being low in organic matter and important plant nutrients. When the Dumfries soils are cultivated, fertility maintenance and erosion control are the two most important management problems. Dumfries loam supports a general farming economy. Cereals, legumes, hay and pastures are fairly well adapted to this soil. Lily loam, the poorly drained associate, is a late soil, and unless drained is better left in pasture or woodland.

7. The Harriston and Guelph Catenas

The Harriston catena developed over loamy limestone and shale till. The soils occur in the Orangeville moraine and Erin drumlin field where the topography is moderately sloping. The stoniness of the Dumfries is lacking and the soils are well supplied with lime and plant nutrients. Harristor loam, the well drained member of the catena, has the widest

The A1 horizon, about 5 inches deep, is dark grayish-brown in **colour** and has a fine granular structure. The A2 horizon is about a foot deep, is yellowish-brown in colour and has a weak platy structure. The subsoil, about ten inches thick, is dark brown, and has a weak nut-like structure. Stones increase in number from top to bottom. Listowel loam is the imperfectly drained member and the lower horizons in this type are mottled. There is little erosion, but drainage is necessary. Parkhill loam, the poorly drained member, has a glei horizon of a grayish-brown colour. Most of this soil is under woodland. The soils of the Harriston catena are suited to dairy, beef or general farming, Most farm crops grown in the region are produced with reasonably good success, but soil fertility levels need to be maintained and conservation measures are required.

The Guelph catena was also developed on loamy limestone and shale till. The soils are found on the Alton drumlins towards the west. The A2 horizon is light brown to yellow-brown in colour, and the B horizon is brown in colour. In all other respects it resembles Harriston loam. The parent material has a high lime content. The catena includes the well drained Guelph loam, the imperfectly drained London loam and the poorly drained Parkhill loam. While the natural fertility of Guelph loam is high it requires rotations which include legumes, and manure and artificial fertilizers to maintain a high productivity. On the slopes, because of erosion, contour tillage and strip-cropping are necessary.

8. The Oneida Catena

The Oneida catena developed over clay till derived largely from shale. The soil colour changes from gray to red from north to south, due to the colour of the shale from which the till was derived. Three soil types are recognized: Oneida clay loam, the well drained associate; the imperfectly drained Chinguacousy **clay loam** and the poorly drained Jeddo



Rough topography and stony soils are typical of the Caledon Moraine. This land is suitable for use as pasture for beef cattle.



Fine herds of Holstein-Friesian cattle and well-kept farm buildings are characteristics of the dairy belt around Norval.

Oneida clay loam is the most productive soil type found in the watershed. The gray, leached (A,) horizon can be clearly seen overlain by the dark topsoil.



clay loam. Chinguacousy soil is the most extensive in area on the watershed.

Oneida clay loam developed on smooth, moderately sloping topography, and a profile description follows, The A1 horizon is 5 inches deep, is very dark grayish-brown, and has a fine granular structure. The leached X2 horizon is 10 inches deep, is yellow-brown in colour, and has a weak plenty structure. The 14 inches of dark brown subsoil has a coarse blocky structure, and a hard consistency. Mottling due to restricted internal drainage is characteristic of the lower horizons of Chinguacousy soil. The poorly drained member of the catena, Jeddo clay loam, has a gray-brown to yellow-brown mottled glei horizon about 30 inches deep.

Most of the Oneida and Chinguacousy soils are cleared. On the slopes contour tillage and strip-cropping are necessary to prevent erosion. The two soils are used chiefly for dairying although a certain amount of general farming is also practised. The soils are well suited to the production of cereal grains and forage crops, but the growth of alfalfa may be limited by inadequate drainage and acid reaction, Dairy farming and cash crops, such as wheat, corn, beans and tomatoes, can be grown where climate permits. The soils of the catena are low in organic matter. The addition of manure, liming and applications of mineral fertilizer are needed to maintain a high productivity. The installation of tile drains would permit the production of a wider range of crops and earlier spring cultivation. Jeddo clay loam in its natural state is best used for hay and pasture.

9. The Cashel Catena

The parent material of these soils was deposited in still water as a clay veneer over the underlying clay till. The soil profile is stonefree, but usually contains small bits of shale. Internal drainage is slow because of the high clay content. Three members of the catena are recognized: the well

drained Cashel series, the imperfectly drained Peel series, and the poorly drained Malton series. The imperfectly drained member of the catena occupies the largest area.

The soil profile of Peel clay is here described, The A1 horizon is 5 inches deep, is dark grayish-brown in colour, and has a medium granular structure. The A2 horizon is 2 inches deep, is light yellowish-brown in colour, and has a medium granular structure. The dark brown clay B horizon is 10 inches deep, and has a coarse nuciform structure. The parent material is grayish-brown clay with a medium nuciform structure and a plastic consistency. The lower horizons are mottled. Cashel clay is much the same as Peel clay in profile characteristics. Malton clay, the poorly drained member of the catena, has about 15 inches of a gray-brown mottled glei horizon with a blocky structure.

General farming and dairying characterize the land use, Cereal grains, legumes, hay and pasture are the usual crops, Legumes are suitable only where drainage is good. Though sheet erosion occurs on sloping land, tile drainage is the chief conservation need, The soils are fertile, and productivity is high when they are maintained by good farming practices,

10. Pontypool Sandy Loam

Pontypool sandy loam developed over poorly sorted sands, The materials were deposited by glacio-fluvial action. The soil is found on the Orangeville and Caldwell moraines. Pontypool sandy loam is the only catenary member recognized. It has an A1 horizon 4 inches deep of sandy loam, dark grayish-brown in colour, with a fine crumb structure. The A2 horizon is 20 inches deep, is yellowish-brown in colour, and exhibits a platy structure giving way to a single grain structure. The B2 horizon is 10 inches deep. It is a dark brown sandy loam with a medium nuciform structure. Few stones appear in the soil material. The soils are coarse-textured,

and well to excessively drained. The topography is usually steeply sloping and irregular,

Pontypool sandy loam is an (early soil, and can be cultivated with ease. It is used for general farming and dairying, and some cash crops are grown. A large part of the area mapped as Pontypool sandy loam is used for pasture, Crop production is limited by low fertility, droughtiness and susceptibility to wind erosion, The soil should be kept under cover as much as possible because of the danger of excessive loss of valuable topsoil,

11. The Brighton and Fox Catenas

Both the Brighton and Fox sandy soils developed on well sorted outwash sands. Brighton sandy loam has a high lime content while the Fox catena has a medium lime content, Brighton sandy loam was mapped along the southern flank of the Caldwell moraine. The Fox catena was mapped on the Huttonsville and Port Credit sand plains. Brighton sandy loam is the only member of the Brighton recognized. In the Fox catena the well drained Fox series and the imperfectly drained Brady series have been mapped,

The soil profiles of both catenas are very much the same so that the description of the Brighton sandy profile is given here alone. The A1 horizon consists of 4 inches of dark grayish-brown sandy loam with a fine crumb structure, The A2 horizon consists of 15 inches of sand with a single grain structure, The horizon changes from a brownish-yellow colour to a very pale brown. The B horizon consists of 3 inches of sand, yellowish-brown in colour, with a weak nuciform structure. The parent material is a light brownish-gray sand with a single grain structure. The subsoil of the Fox series has a medium nuciform structure. Brady sandy loam has a mottled, dark brown subsoil,

Brighton sandy loam is marked by low fertility, droughtiness and erodibility. Permanent pasture, cereal grains

and hay are recommended, and cash crops if well supplied with manure and fertilizers. The Fox series has the same limitations as the Brighton series, but high value crops can be grown with heavy applications of fertilizer and organic matter. Specialized crops such as tree fruits, vegetables and small fruits are grown. The imperfectly drained Brady sandy loam occurs only in limited areas within the area covered by the well drained associate, and does not present a separate management problem. The range of crops that can be grown is somewhat restricted unless the soil is drained,

12. The Hillsburgh Catena

Hillsburgh sandy loam predominates in the west end of the Orangeville moraine. The parent material is mostly fine gray sand and fine gravel, and is almost stonefree. The soil has an A1 horizon consisting of 5 inches of light brown sandy loam with a coarse crumb structure. It is underlaid by an A2 horizon of yellowish-brown sandy loam 14 inches deep. The B horizon has 6 inches of brown sand which may be somewhat compacted and encrusted with iron. General farming is practised, with potatoes as a special crop. Erosion by wind and water is common. Organic matter must be maintained at a high level or else the topsoil becomes loose and blows readily. Under proper management good yields of grain, hay and pasture are produced. The steep phase of this soil is better placed in pasture or forest

13. The Bookton Catena

Soils developed on sands underlain by clay till occupy 3 small areas, and occur in various places on the Peeland lake plains. The sandy materials on the surface resemble the Brighton catena while the clay till resembles the Oneida catena. The depth of the sand ranges from a thin veneer up to three feet. The topography is smooth and moderately to gently sloping. Two series were mapped, the Bookton occurring on well drained sites and the Berrien on the imperfectly

drained areas.

The average profile exhibits the following characteristics. The lower horizons of Berrien sandy loam are mottled. The A1 horizon consists of 3 inches of dark grayish-brown, crumb-structured sandy loam, The A2 horizon consists of 5 inches of yellowish-brown sand with a single grain structure. The B horizon is about 14 inches deep, dark gray to brown in colour, and has a single grain structure. The C horizon, if sand, is grayish-brown, with a single grain structure. The clay till beneath is brown, calcareous and prismatic in structure,

The soils are used for general farming and dairying. Vegetables, tree fruits and small fruits do well where the climate is satisfactory, Fertility and organic maintenance are the main requirements. Drainage is necessary to bring Berrien sandy loam into satisfactory production,

14. The Caledon Catena

Caledon and Gilford loams were developed on well sorted gravels. The parent material was deposited in slowly moving water, and occurs on outwash plains, There are extensive areas of these soils in the Orangeville moraine, The topography is smooth, and moderately sloping in areas of Caledon loam.

Caledon loam has a dark grayish-brown A1 horizon about 4 inches in depth. It exhibits a fine granular structure. The A2 horizon is a yellowish-brown sandy loam, 17 inches in depth, with a weak platy structure. The dark brown clay loam subsoil is stony, has a coarse nuciform structure and is 14 inches deep, The parent material is brown well-sorted gravel with a single grain structure. It is derived largely from shale.

Caledon loam is used chiefly for dairying and general farming. Though the soil is suitable for cereal grains, hay and pasture, yields are limited by low fertility. Erosion

is moderate, and can be controlled by a long rotation and strip-cropping. Gilford loam, the poorly drained member of the Caledon catena, exhibits the characteristics of gleizolic soils. Pastures and woodlots are the commonest land uses.

15. The Brockport Catena

Soils developed over gray shale occur in the Erindale area. Because of the nature of the bedrock most soils have inadequate drainage. Cooksville clay loam, described here, is imperfectly drained; Brockport clay loam is the well drained member of the catena and Mississauga clay loam is the poorly drained member. Bedrock is usually at depths of 2 feet or less. The topography is smooth and gently sloping. The very dark gray clay loam of the A1 horizon has a medium granular structure and is about 5 inches deep. The yellowish-brown clay loam of the A2 horizon is 4 inches deep and has a medium nuciform structure. The 10 inches of the clay B horizon is mottled and has a blocky structure. The shale below is of the Dundas or Meaford formations.

The soil is best suited for grazing or forestry. Crop production is limited by low fertility, shallowness and droughtiness. Some general farming and dairying is practised where fertility levels are increased and maintained. The well drained associate. Brockport clay loam, is limited by rapid run-off and resulting erosion. With liming and other forms of soil management fair yields of cereal grains, hay and pasture can be obtained. Most of the poorly drained associate, Mississauga clay loam, is under woodlot. It is limited by poor drainage, and the presence of bedrock so close to the surface makes artificial drainage difficult.

16. The Lockport-Catena

Lockport clay, the well drained member of the catena, is found in Chinguacousy Township between Terra Cotta and Inglewood on steeply sloping and often severely eroded

slopes. The brown clay A1 horizon is 4 inches deep, and has a medium granular structure, The yellowish-brown A2 horizon is 8 inches deep, and has a medium nuciform structure. The B2 horizon consists of 14 inches of reddish-brown plastic clay with a blocky structure. The parent material is a dark red, fragmental clay overlying the dark red shale.

A permanent cover of grass or forest is required to prevent rapid run-off. Pasture and forest are the best land uses. Trafalgar clay, the imperfectly drained associate, is better for agriculture because the slopes are gentler and not as open to erosion.

17. Farmington Loam

Farmington loam developed in thin drift over Lockport dolomite. The soil is often less than a foot deep and exhibits no profile development because of rapid water loss downward through the bedrock. Forestry and grazing are, and should be, the chief endeavours on this soil. Fair pasture is produced after the spring and fall rains.

18. Muck and Bottomland Soils

In areas of poor drainage, in depressions, in the bottoms of spillways and in inter-drumlin areas, the excess moisture slows down decomposition of plant matter so that there is considerable accumulation of muck. Since muck soils are poorly drained, they are used mainly for summer pasture and for woodland.

Where the main streams and some of their tributaries flow through broad valleys, the valley bottoms are subject to floods, especially in the spring. The soils of such areas are silty and covered with recent deposits of sediment, so that there is little or no profile development; they therefore cannot be assigned to any particular soil zone. Because of the poor drainage and periodic flooding, these soils are unfit for regular cultivation and are usually covered by pasture or woodland. They are lumped together under the general

term of bottomland.

19. Evidence of Soil Erosion

The soils in the Credit Watershed have been denuded of their forest cover and exposed by cultivation for about a century and a half. Rain beating against the soil and running off down the slope carries away the tiny particles that make up the soil. The most common form of erosion, sheet erosion or "wash", is insidious for it cannot be easily detected. After the humus-rich absorbent upper horizons of the soil are removed the compact subsoil is exposed. Gullies develop as run-off water is channelled down the slope.

The most obvious evidence of erosion is the gully. Gullies and blowouts (which bear the same relationship to gullying except that the agent is wind, not water) are advanced forms of soil erosion. Sheet erosion must have continued for some time before gully erosion becomes apparent. In the spring and summer, rills are easily discernible on slopes of fallow fields or fields with intertilled crops. Often after a heavy rain fans of coarse sandy material will be formed at the bottom of a slope where the rills terminate. Rills are easily obscured by implements, but they are positive indicators of erosion. The wind blowing over fields also picks up fine loose material. Blowouts are a hazard on all droughty, sandy soils of the watershed.

Erosion may be seen by poor crop response on slopes and knolls. If sheet erosion has carried off the soil the parent material may be exposed. This can be seen on hill-tops where the light soil is contrasted sharply with the dark soil on the lower slopes. Along fence lines differences in the level of cropped and forested land or between well managed and mismanaged land may be apparent.

In the field, soil is recognized by colour, texture and structure. The degree of erosion can be assessed quite accurately if a profile of a virgin or relatively

undisturbed soil can be examined. Such soils can be found along old fence lines and in woods. Roadcuts offer a ready-made cross-section of the soil. The characteristics of the different horizons are noted, and when a similar soil in a field is examined the degree of erosion is known. For example, if the subsoil is recognized within 6 inches of the surface, and it is known that the subsoil in a virgin soil is 2 feet in depth, then it can be assumed that erosion has removed 1.5 feet of topsoil.

Lime carbonates when in contact with a dilute solution of hydrochloric acid will effervesce. Free carbonates do not occur within the soil profile, but are commonly found within the parent material, The depth at which effervescence is noted is the bottom of the soil profile. The degree of erosion can thus be readily ascertained. Where erosion has completely removed the soil on steep slopes, a few drops of acid on the surface of the ground will produce an immediate reaction.

CHAPTER 4

PRESENT LAND USE

1. Introduction

The land use of the Credit Watershed was mapped in the summer of 1954. The survey gave special attention to the cultivated land, The diversity of soils and climate within the watershed is reflected by the variation in agricultural practices. Agriculture consists chiefly of mixed farming, beef farming, dairying, and vegetable and fruit growing.

An inventory of present land use is made for two reasons, First, to estimate the capability of the land, taking the present use as an indication of the experience of those who have been using the land for generations, Second, to estimate the degree to which use is adjusted to capability and the extent to which changes in use or management are required to bring all the land into its wisest use,

2. Dairy Farming

Dairy farming is the principal type of farming in the lower part of the Credit Watershed. This area includes all the land below the Niagara Escarpment, excepting the small sandy plains, and forms a part of the Metropolitan Toronto milkshed. It includes Chinguacousy, Toronto and part of Esquesing Townships. The physiographic regions in which dairying is dominant are the Peel Till Plain, the Streetsville Till Floraine and the Erindale Shale Plain. Dairying is also carried on outside these regions, Communities such as Orangeville and Acton possess their own smaller milksheds.

The principal soil catenas on which dairy farming is practised are the Oneida, Cashel and Bookton. Outside the main milk-producing section, dairy farms are located on the areas of better soils such as Harriston loam.

Throughout this region Holstein-Friesian cattle are dominant, but other dairy breeds such as Jersey and

Ayrshire are kept. Swine and chickens are important in supplementing farm income and are common to all types of farms. In general, however, farm operations are geared to the production of milk.

Field crops grown for dairy purposes include cereal grains, corn and hay. Of the grains, fall wheat, oats and mixed grains occupy the largest acreages. Although the acreage is small in comparison to some other crops, the growing of corn for fodder is an important part of farm operation: the number of silos throughout the region attests to this. Corn occupies about 2 per cent of the total area. Clovers, alfalfa and other grasses are grown for hay. Barley, rye and field roots are of less significance, Spring grain (mostly oats and mixed grain) occupies about 20 per cent of the area, while winter grain (mostly fall wheat) occupies 7 per cent of the land, Hay and clovers occupy 25 per cent of the area, Dairy farming cash crops include wheat, rye, beans, potatoes, flax, vegetables and tree and small fruits. Pasture, which includes bottom lands and the poorly drained soils, occupies about 25 per cent of the area.

3. Horticulture

Specialized farming is found mostly south of No. 5 Highway in the region of Huttonsville (Huttonsville Sandy Plain) and on the lake plain (Port Credit Sandy Plain). Throughout the balance of the watershed generally, smaller-scale production is confined to suitable sites. On the lake plain and in the Huttonsville area, apples, strawberries, raspberries, sweet corn, tomatoes and a variety of other vegetables and fruits are grown.

The growing of vegetables, tree and small fruits often requires the investment of large amounts of capital, This specialized form of agriculture requires many hands for cultivation and harvesting and is usually accompanied by intensive mechanization. Irrigation in the area is becoming more and more important in the production of flowers and

vegetables and requires considerable capital investment for equipment. Most of the irrigation systems in operation in the summer of 1954 were on the Huttonsville Sandy Plain, and the source of water was the Credit River.

In the Credit area such specialized crops are grown on light sandy soils or muck soils, The former require liberal applications of fertilizer and organic matter, while the latter need to be fertilized and drained, Sandy soils support the largest acreage of vegetables and small fruits, and Fox sandy loam is a representative soil used for this purpose, It permits early spring cultivation, is well drained, and heavy applications of fertilizer are profitable, Soil catenas used for horticulture, except where limited by local climatic factors such as frosty pockets, are the Fox, Brighton, Lockport, Bookton, Pontypool and muck.

4. Beef Farming

On beef farms the sale of cattle for beef purposes constitutes the major source of income, but this often is supplemented by the sale of other farm products. In the dairy belt the number of beef cattle is small in proportion to the number of dairy cattle, and the few farmers who do raise beef devote themselves to the production of breeding stock for sale. In contrast, beef raising becomes a significant industry above the Niagara Escarpment. In a 1,000-acre block as many as half the farms may be devoted to beef raising. This type of farming becomes more common on the poorer soils where more intensive uses than pasture do not give sufficient returns and may lead to serious soil and water problems.

Pasture and hay provide the major portion of the beef cattle feed ration. In the summer the cattle are pastured, but in the winter hay and silage are fed. In areas devoted to beef cattle a large proportion of the land is devoted to the production of hay and pasture, Little grain is grown, and even less is grown as farmers turn more and more to grassland farming. Land formerly cultivated is being planted

to grasses and legumes for hay and pasture, Beef farming is an extensive form of land use, and this is reflected by the number of abandoned farm buildings. Supplementary income is obtained by the raising of chickens and sheep and the growing of potatoes, rye and flax.

5. Mixed Farming with Livestock and Cash Crops

Most of the farms of the watershed have a dairy herd, and the whole milk is sold to dairies and creameries while the skim is fed to hogs, The sale of surplus dairy stock off the farm is also important in providing income, Another source of income comes from the raising of hogs, sheep and poultry, The livestock economy is supplemented by growing potatoes, rye, small fruits and flax for seed.

Mixed farming is the principal type in Caledon, Erin, Albion, East Garafraxa, western Esquesing, Mono and Amaranth Townships. Caledon Township, since it is almost entirely within the watershed, serves to indicate the crop acreages. The principal field crop in 1951 was cultivated hay, amounting to 10,068 acres. Of the grains, the acreage of mixed grains was the largest (6,666 acres), and 4,061 acres were in oats, followed by 1,429 acres in wheat. Only minor acreages of barley (288) and rye (55) were grown. Potatoes were important, 404 acres being planted. The total acreage of field crops in 1951 was 23,653. Cash crops outside of potatoes and cereals accounted for a negligible acreage. About 35 per cent of the land is in pasture, and this high proportion is due to the large number of beef farms within the township.

As Metropolitan Toronto grows, the need for whole milk will cause the milkshed to expand. More and more farms are turning to dairying. Mixed farming may be found in all regions and on all soils above the Niagara Escarpment, This is the traditional form of agriculture. Because of less fertile soils, distance from markets and lack of capital,

mixed farming has been and will probably be dominant for some time. However, there is a noticeable trend towards specialization.

6. Forestry

Forest covers 35,030 acres or 16.3 per cent of the drainage basin of the Credit River. This is a considerable amount of land, but ever 10,000 additional acres have such poor soil and other severe limiting factors for use that an extensive program of tree planting should be inaugurated. At present, tree plantations cover only about 493 acres.

Most farms have woodlots, and these often serve a multiple use as poor pasture. This is not their best use. Properly managed, the woodlot can provide important revenue from the sale of logs, posts, maple sugar and fuel-wood. Much land on the watershed is well suited to tree farming,

7. Residential, Industrial and Other Land Uses

Reference to the table of land use shows that 3 per cent (6,142 acres) of the land of the watershed is taken up by urban uses. This does not include road allowances, some recreational lands, hobby farms, gravel pits, limestone quarries or other such uses. Farmsteads, surprisingly, take up 3,480 acres, or 1.7 per cent of the watershed. They include house, barn, kitchen garden and various out-buildings. With increasing urbanization, more and more farmland will be taken out of production. Because of its location with respect to Metropolitan Toronto and general lakeshore development, this is a significant problem to the Credit Valley. Much of the land undergoing subdivision has been used for vegetable and tree and small fruit farming. This land is well suited for such use by soil and climate. Gravel pits and limestone quarries are in poor soil areas and do not normally interfere with other uses. The high proportion of

wasteland in the watershed is partly due to the "institutional deserts" created along the rural-urban fringe. The high tax load on such lands prohibits most forms of agriculture. Many have been subdivided and await the builder.

8. Summary of Land Use

The trend of agriculture in the Credit Watershed appears to be towards greater specialization. The old self-sufficing farm has almost disappeared, except in a few isolated cases. The mixed farm has for long been the common type, but with growing urban markets, higher prices and better transportation facilities, the mixed farm is changing as well. With the growth of nearby Toronto, the demand for fluid milk has been felt farther and farther afield, The demand for fruit and vegetables has also increased and appears likely to continue to do so. The net result will be more land devoted to specialized vegetable production. Cash crops are being widely grown and livestock raising is replacing mixed farming. To meet these changing demands on the land, a gradual readjustment in land use is taking place. It is a function of the Authority to direct this change into the most suitable pattern.

The following table shows the acreage and proportion of each of the present land uses.

TABLE OF PRESENT LAND USE SHOWING ACREAGES AND PROPORTION OF EACH USE TO THE TOTAL AREA

Land Use	Acreage	Per Cent
Tilled for crop	2,054	0.9
Fallow	1,440	0.7
Row crop	4,613	2.2
Vegetables and small fruits	888	0.4
Orchard	2,311	1.1
Spring grain	36,164	16.9
Winter grain	7,302	3.4
Hay	40,377	1.8
Farmstead	3,580	1.7
Waste land	9,880	4.6
Pasture	63,587	29.7
Tree plantation	493	0.2
Forest	34,537	16.1
Urban and other non-agricultural uses	6,142	3.0
Water	761	0.3
T o t a l	214,362	100.0

To summarize , present use is in the following proportions:

Forested	16.3 %
Pastured	29.7 %
Cultivated	44.4 %
Other uses	9.6 %
Total	<hr/> 100.0 %

Along with the growth of Toronto has gone the growth of neighbouring towns and villages. The lower part of Toronto Township is being rapidly urbanized, although this land is excellent for growing fruit and vegetables. The acreage of land given over to market gardening and orchard is becoming larger in the Huttonsville area and will probably expand into the upper part of the watershed.

The Toronto Milkshed, or milk supply area, extends across the Credit Watershed as far as the Niagara Escarpment. On the Peel Plain dairying is the dominant agricultural industry. Dairying will never become as important on the land above the Escarpment, but fluid milk sales will grow and the number of dairy cattle will increase. The acreage of cultivated land in the dairy belt has remained much the same over the years. About 60 per cent of the land in the dairy belt is cultivated, and any conservation program must take into consideration the demonstrated demand for regular cultivation.

In the region above the Niagara Escarpment about 40 per cent of the land is under cultivation, and the amount seems to be decreasing. Beef and mixed farming with cash crops are the most common types, The number of beef cattle kept on the farms has increased about two and one-half times during the last fifteen years. Increasing acreages of land with infertile soil are being devoted to pasture as a better use, This trend to grass farming is a good one from the point of view of soil conservation. Cash crops are likely to increase in importance. The number of swine and sheep kept has decreased over the years.

The use of the land is determined by physical, social and economic factors. Because land use is partly determined by other than physical factors, the use of the soil cannot fully be brought into accord with its physical limitations. Nevertheless, this is no excuse for lack of appreciation of good land management, and it is recommended in this report that land use be adjusted as closely to the capability of the land as possible.

CHAPTER 5
FACTORS LIMITING LAND USE

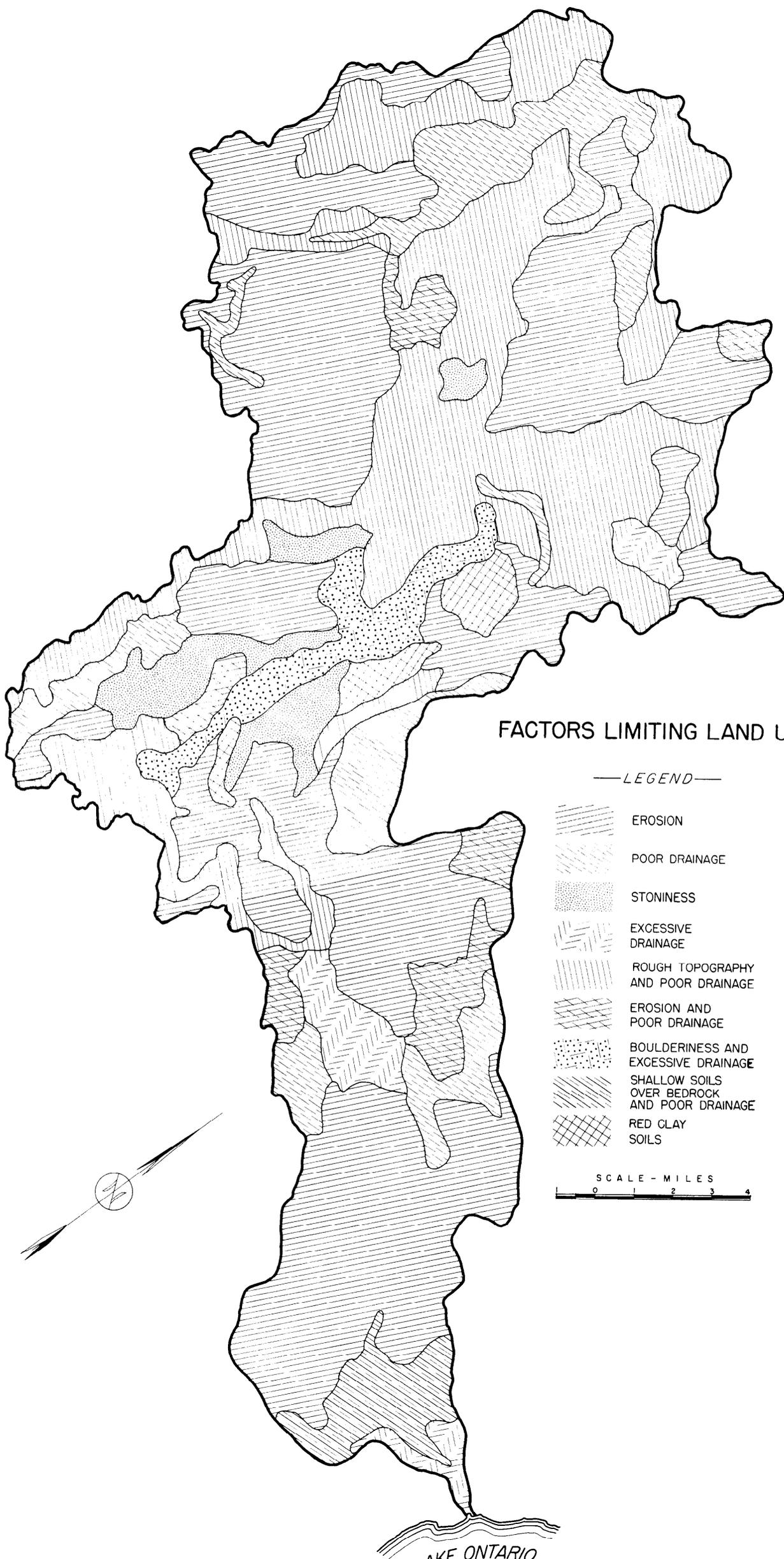
1. Introduction

Only a small proportion of the land of the Credit Watershed can be considered to have no problems or hazards which would restrict the use of the soil. The map enclosed with this report (Factors Limiting Land Use) indentifies those areas where some physical restriction is placed on the use of the soil. Although more than one restriction may be applicable to a particular area, only the most outstanding factor(s) for any particular area is shown on the map.

The major problems restricting land use in the watershed are as follows: water erosion, aridity or droughtiness, topography, massive clay soils, poor drainage, boulderiness, stoniness and shallowness over bedrock. In this report all of these factors are discussed with reference to their origin, the restrictions they place on land use, and the remedial measures required to correct them if such are possible.

FACTORS LIMITING LAND USE

Limiting Factor	Acreage	Per Cent of Total
Unrestricted	7,206	3.4
Erosion	76,282	35.6
Excessive drainage	1,325	0.6
Topography	47,273	22.0
Massive clay	708	0.3
Inadequate drainage	25,465	11.9
Boulderiness	3,953	1.9
Stoniness	4,954	2.3
Shallow soils over bedrock	158	0.1
Forest	35,030	16.3
Non-agricultural use	12,033	5.6
Total	214,387	100.0

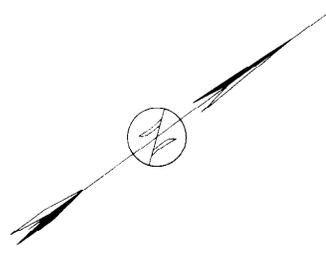


FACTORS LIMITING LAND USE

— *LEGEND* —

-  EROSION
-  POOR DRAINAGE
-  STONINESS
-  EXCESSIVE DRAINAGE
-  ROUGH TOPOGRAPHY AND POOR DRAINAGE
-  EROSION AND POOR DRAINAGE
-  BOULDERINESS AND EXCESSIVE DRAINAGE
-  SHALLOW SOILS OVER BEDROCK AND POOR DRAINAGE
-  RED CLAY SOILS

SCALE - MILES



LAKE ONTARIO

2. Soil Erosion and Run-off

The moisture received by the land, whether from rainfall or melting snow, is partly absorbed by the soil and some is held for plant use. The remainder is lost. Two types of water losses are recognized: (1) the downward movement of gravitational water by percolation, and (2) the run-off of excess water over the soil surface. Percolation of water will be dealt with in the next section.

Run-off means the loss to streams of water which might have been of use to plants, and erosion means the loss of the valuable soil itself. Under a forest cover run-off is small, permitting much of the moisture received to enter into the soil and reducing erosion to a bare minimum. Some geologic erosion, as contrasted to induced accelerated erosion, will take place but the soil-building processes are able to replace this loss. However, when the land is cleared there is no protection from the elements, and accelerated erosion results. Unless steps are taken to reduce run-off, soil erosion will impoverish the productive capacity of the land. Moisture loss by run-off may run as high as 50 or 60 per cent of the annual precipitation. It is thus in the interest of all land users that run-off be reduced and soil losses kept to an absolute minimum.

When the land is cleared the soil is easily carried away by moving water. There are several distinct types of water erosion: sheet, rill and gully erosion. Sheet erosion or "wash" removes the soil more or less uniformly from every part of the slope. This type of erosion is insidious because it removes only a thin layer of soil at a time, and dangerous because most people fail to realize that it is taking place. As the soil is removed the profile becomes progressively shallower and the lower horizons eventually exposed. The colour of the soil changes due to loss of organic matter and soil productivity falls. Tiny gullies, or rills, often appear after rainstorms. The rills, easily obliterated by cultivation, are soon forgotten but appear with the next rainstorm.

The most obvious type of erosion is gully erosion. Gullies form where run-off is concentrated. When large gullies are not repaired and if they are allowed to continue growing, they may put the land out of use altogether unless measures are taken to stop their development. Sheet and rill erosion are more widespread, and the most important from the standpoint of general soil depletion.

The mature soil is the best medium for plant growth. The removal of any part of the soil may have an adverse effect on plant development. Since the topsoil is the major zone of root development, carries most of the nutrients available to plants and supplies a large share of water used by crops, its removal at once reduces productivity. The subsoil, though potentially fertile, does not have the same water-holding capacity. In those cases where the topsoil has been removed and the subsoil appears at the surface, the compact nature of the latter allows greater run-off and consequently the increased probability of gullying. Because less water is available, crop response is greatly lowered. Poor crop response on a slope in an otherwise good field as often as not reflects water deficiency due to destruction of the moisture-holding topsoil.

Forests and grasslands are the best natural soil protectors. Field crops vary in their influence. Intertilled crops, such as corn, tend to encourage erosion. Fallow or tilled fields are most open to erosion as there is no cover to break the run-off over the slope. Wheat and oats offer considerable obstruction to wash, while close-growing hay and pasture are able to break the force of the rain drops and slow run-off to a point where little erosion occurs. On shallow slopes where intertilled crops such as corn and potatoes are grown, contour tillage should be practised to reduce run-off. Strip-cropping (alternating strips of intertilled crops with hay or grain) checks the flow of water. Each furrow along the contour acts as a miniature dam holding back the water so that more may enter the soil. Diversion ditches and grassed waterways

are recommended to carry off the excess water harmlessly, On droughty slopes contour furrowing may help permanent pastures and young plantations. On steep slopes terraces constructed across the slope catch the water and conduct it away at a gentle grade. The use of green and barn manures builds up the organic matter in the soil, reducing run-off by increasing the absorptive qualities of the soil.

Erosion is widespread in the watershed; it occurs on most slopes, but the finer soils and steeper slopes are affected more severely,

3. Excessive Drainage

Aridity is a problem over wide areas of the watershed. Sandy and gravelly soils are easily cultivated in the spring, and as a result are called "warm" soils, but later in the season they become droughty. This is because of their coarse texture and loose structure which allows water to percolate rapidly down through the soil to lower levels out of reach of plant roots, This gravitational water dissolves and carries away plant nutrients in solution, Since these soils have a low inherent fertility, cultivation soon lowers their productivity.

The water-holding capacity of the so-called light soils can be increased by building up the organic content of the soil. Organic matter when incorporated with the soil acts as a binding agent for the particles, increasing their water-holding capacity, The maintenance of the soil in sod is the most effective means of building up the structure and organic content. If cultivated, barn and green manure encourage more favourable soil-water relations. Maintenance of a high organic content leads to a good soil structure and helps to reduce the hazard of wind erosion.

Light sandy soils such as Pontypool sandy loam or Brighton sandy loam are best suited to a pasture economy, Where cropped, these soils require heavy applications of

commercial fertilizer and plenty of manure in order to maintain productivity and good water relations. Other light sandy soils such as Fox sandy loam are used for market gardening and fruit growing and heavy applications of fertilizer are profitable and desirable.

When the till covering the limestone bedrock is thin the soils tend to be droughty. On the watershed Farmington loam is the worst in this respect. Water loss is so rapid that crop production is prohibited, Forestry and grazing are the best land uses. Where the soil cover is thicker, pasture is recommended. During the spring season, and again after the fall rains, fair pasture is provided. The cattle should be moved to better pastures during the summer. The thinner soils are better forested, their value as pasture being very low.

4. Topography

Indiscriminate clearing of steeply sloping land has led to widespread erosion. After 10 to 50 years of cropping, much of this land has lost most, if not all, of its soil, Excessively steep land and irregular landforms are also impractical for tillage by regular power machinery. Today, steep slopes are tilled in marginal areas only. Elsewhere such land has been allowed to revert to scrub forest or marginal pasture. Land restricted to agricultural use by topography is found along the escarpment in the morainic regions and along the spillways.

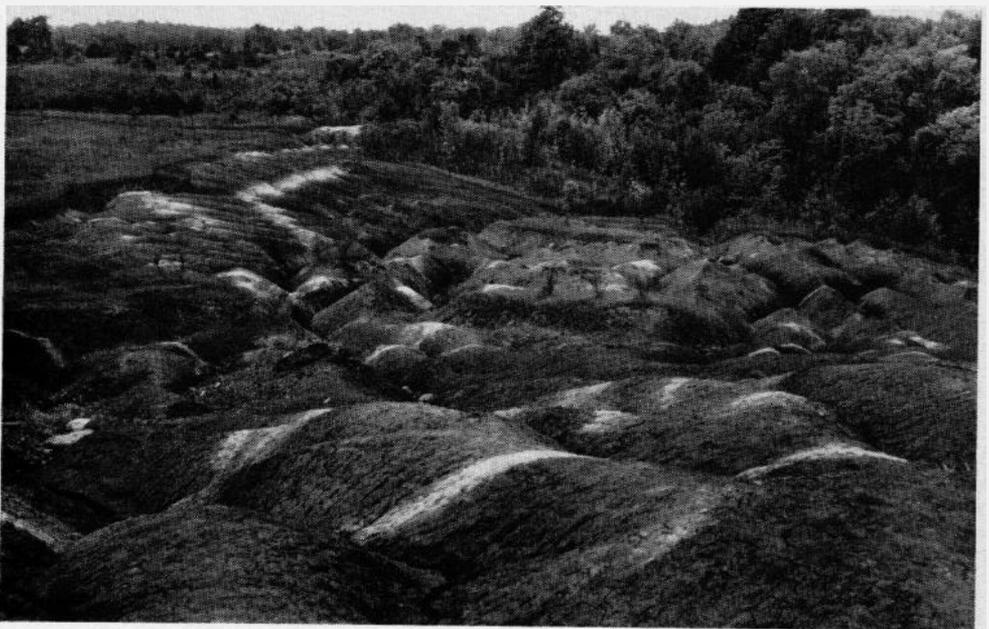
Steep hillsides are droughty because of the rapid run-off and the soil profile is shallow because of erosion. These lands are better in pasture and forest. Where feasible, contour furrowing may be used to decrease run-off and so add to the soil moisture,

5. Massive Clay Soils

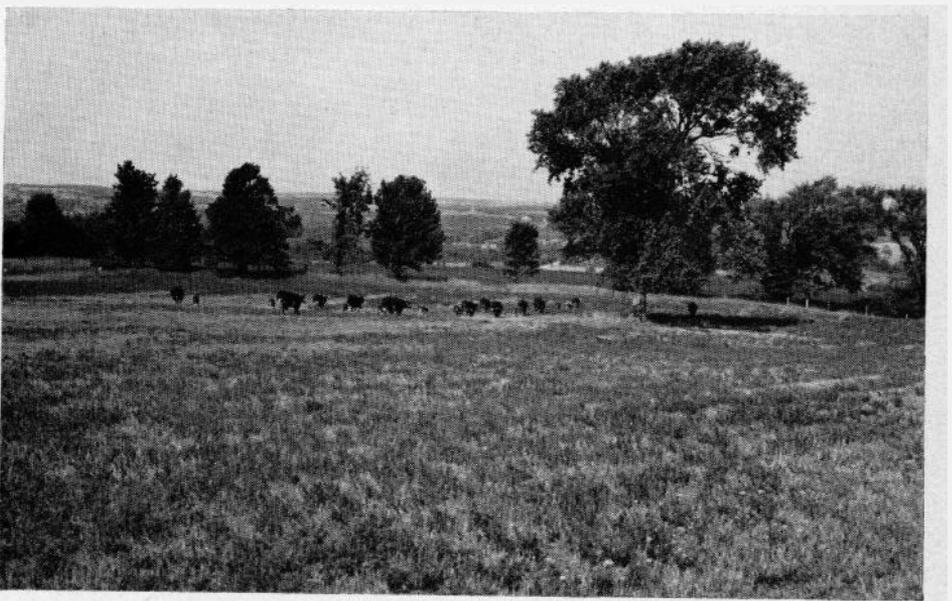
Massive clay soils have developed over shales and lacustrine clays. The parent materials are fine-textured and contain a high proportion of clay and silt, On the accompanying



Fields in the moraines have been cleared of stones only at the cost of much labor. Stone piles and stone fence rows obstruct cultivation and harbour noxious weeds.



The severely eroded and gullied red clay soils constitute one of the chief problem areas in the watershed.



Pasture improvement pays in increased milk or beef production.

map only the Lockport catena is mapped under this category, but large areas elsewhere exhibit similar characteristics. The clay soils developed over shales have a low fertility and a low permeability. The Cashel catena, which developed over lacustrine clay, also has a slow internal drainage but is fairly well supplied with soil nutrients.

Massive clay soils suffer greatly from sheet and gully erosion and the red clays above Cheltenham have been deeply carved by water action. The nature of the material permits rapid run-off. Heavy soils are also prone to cloddiness or "puddling" if cultivated when wet. A clay soil of high plasticity becomes hard and cloddy due to the cohesive tendencies of the clay particles. These soils are droughty in late summer, especially those on slopes, If the water table is high in the spring, root development is restricted. Later in the Summer the water table falls, and the plants suffer from lack of water.

The Cashel catena is a productive soil association and is generally well suited to the production of general crops. It is quite susceptible to erosion; and to prevent this, forage crops in rotation, and the maintenance of a good structure by liberal additions of manure to keep a high organic content, are required. The Brockport catena likewise, with fertilizers, lime and barnyard manure, may be kept in fair productivity. The permeability of the Lockport catena is low and since most of these soils are on slopes they are highly susceptible to erosion. A permanent grass cover or plantation where there is danger of erosion is called for.

6. Inadequate Drainage

Large areas of the watershed are imperfectly drained. Inadequate internal soil drainage is found (1) in depressed areas in permeable soils or (2) in level and undulating impermeable soils. Lily loam, Parkhill loam and Gilford loam are poorly drained soil types and are common to low-lying areas. These types may be found in kame and till moraines and outwash

plains. On the Peel Plain, Peel clay, Malton clay, Chinguacousy clay loam and Jeddo clay loam are soil types with inadequate drainage.

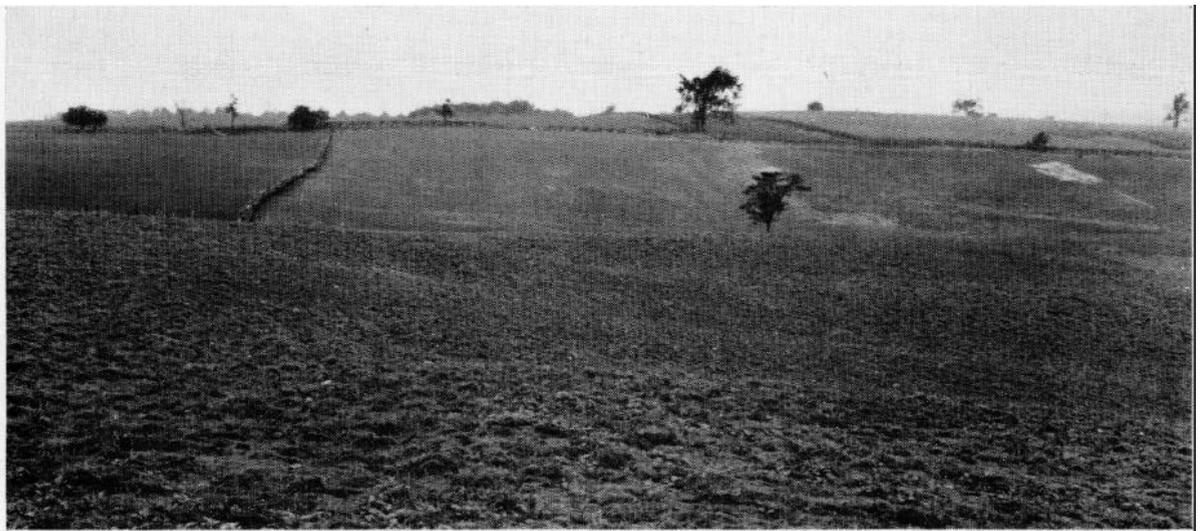
Inadequate drainage is caused by a high water table. Drainage is necessary to make inadequately drained land more productive. Drainage promotes granulation which creates a better soil structure and consequently a better tilth. The draining of wet land also permits earlier spring cultivation and helps to maintain a sufficiently deep and effective root zone. Soil temperatures are higher in drained land and evaporation may be reduced. The greatest benefit perhaps comes from an increased aeration of the soil. The decay of organic matter takes place more rapidly as the oxygen content rises, and nitrification is increased. By lowering the water table more water enters the ground during rain storms, controlling run-off so that erosion is reduced.

Drainage may be effected by either open or closed drains. Tile drains are the most reliable means of under-drainage in the majority of cases. Ditches have a larger capacity, and can carry water at a lower grade. The type of drainage system suitable varies with the soil and situation, Since drainage is expensive, many small poorly drained locations are better left in forest or pasture. Often seepage from surrounding high land may be at fault, and diversion ditches may be employed.

7. Boulderiness

Land on which large numbers of boulders are found is often limited to cultivation by topography as well. The large boulders in the Credit Forks morainic system were deposited by glaciers. The limestone plains above the escarpment are also strewn with large limestone boulders broken off from the face of the limestone cliffs by the ice. Where boulders are numerous, cultivation is made difficult and often impossible. The expense of their removal outweighs the

A large proportion of the inadequately drained soils of the Peel Plain are drainable. Drainage increases crop yields and improves pasture.



Much of the hilly land of the moraines is in unimproved pasture. Overgrazing has resulted in soil erosion and a lowered carrying capacity of the pasture.

Reforestation of much of the droughty, over-grazed pasture land in Caledon Township is recommended. The carrying capacity of the sandy soils is very low and pasture improvement is uneconomical.



advantage gained. Such land may have some value for pasture, but forest is often the best land use.

8. Stoniness

The rugged moraines which run south and west of Credit Forks are composed of coarse till which is particularly stony. The Dumfries and Lily loams are characterized by the large number of stones throughout the soil profile, especially in the lower horizons, Excessive stoniness interferes with machinery and dulls the blades. It is a slow and laborious task to clear fields of stones by carrying them to the fencerows. It may often be worth while to clear the fields if the soils are fertile. The removal of stones larger than two inches may result in a greater loss of soil through erosion. Stony soils such as Dumfries loam are often light, and easily worked in the spring. The steeper slopes should, however, be left in pasture or forest as the clearing of stones may do more harm than good.

9. Shallowness over Bedrock

Shallowness becomes a problem when there is less than three feet of soil over the underlying bedrock. There are two areas in the watershed where this situation prevails:

(1) the Erindale shale plain and (2) the limestone plain which runs from Credit Forks southward along the top of the escarpment. Soils developed over shale may be limited by either droughtiness or poor drainage. Farmington loam which developed over limestone is limited by droughtiness. In both areas cultivation is hampered by bedrock outcrops and the limestone plain is bouldery as well.

CHAPTER 6

SOIL AND WATER CONSERVATION MEASURES

1. Soil Conservation

It is the aim of soil conservation to use every acre of land according to its capability, If the best land is intensively used, that of lower capability is relieved from the intensive use which might deplete its fertility or expose it to soil losses through erosion. Each body of land may be classified with respect to its inherent physical characteristic; and a use designated which matches its capability. A description of the classification used for the Credit Valley is found in Chapter 7.

Proper soil management is necessary to keep the soil at its initial productive level, or to raise it. By proper management crop yields are maintained or increased, The aim of conservation is to make possible a sustained yield of crop production from the land. Not all the conservation practices here described are applicable to any one body of land, but one or more will be applicable to each farm. It may be that major changes will be necessary on some farms but many will require only the adoption of special practices on some of the land.

2. Good Soil Management

Good soil management is needed on all cultivated land, This means the maintenance of a good soil structure and satisfactory soil moisture conditions. Soil granulation is encouraged by proper maintenance of soil humus. Crop rotation is a necessary part of soil management and influences the soil structure, chemistry and biology. It helps to improve soil structure, conserves soil nutrients and increases humus content. All these improvements in the soil's condition produce better moisture relationships and aid in reducing erosion,

3. Cover Crops - Mulches - Crop Rotations

Exposure of the soil for any length of time leaves the land unprotected against soil erosion and water losses. It is common practice to leave some of the land bare in the spring and fall when heavy rains can result in a great deal of erosion. Fields are also left fallow during the summer and winter. To protect the land the provision of a cover crop as long as possible is recommended, If the land must be left bare, then a rough surface decreases run-off.

A mulch cover such as wheat stubble reduces the impact of rain on the soil and slows up run-off, Water evaporation is also reduced, and more rainfall is absorbed into the soil. The humus content of the soil is maintained and bacterial activity increased. Suitable crop residues include corn stalks, grain stubble, refuse from potato plants and rotten hay or straw not needed for other purposes. A stubble mulch also reduces wind erosion on light soils,

A major soil conservation measure is the well planned crop rotation. A crop rotation should be designed to return organic matter to the soil, either as green manure or in crop residue. A crop rotation may include a cultivated crop, a small grain, and a grass and/or a legume, The cultivated crop exposes the soil to maximum erosion, small grains allow less erosion, and the grass or legume provides cover enough to largely control erosion and aids in maintaining soil structure and fertility.

4. Pasture Improvement

Marginal land lacking in soil fertility or land too rough to be economically cultivated is better kept in permanent pasture. This applies especially to light soils which quickly lose their fertility, or wet soils with a high water table making for late seeding and poor root development. A thick grass cover protects the soil from erosion and slows up

the surface run-off of water, allowing its absorption into the ground. Grasses are soil-builders and their extensive root systems remain in the soil to add to the organic matter. Improved pasture is nutritious and beef and milk production is higher from those cattle using it. Pasture improvement is further discussed in Chapter 8.

5. Drainage

Many soils are inadequately drained. Soils may be described as either imperfectly drained or as poorly drained. Imperfectly drained soils have a fluctuating water table which is high in the spring but which falls during the summer. Poorly drained soils have a constantly high water table throughout the year. The former soils usually require simple tile drainage to lower the water table. The latter soils require more extensive drainage systems, including ditches.

A wet soil is a cold soil and it warms up slowly in the spring, The poor drainage results in late seeding, the plant root systems develop late, and they are shallow, Later in the season, when the water table drops, the plants actually suffer from drought because of retarded root development. The presence of water also reduces the amount of oxygen available to the roots and slows up the plant processes, Granulation of the soil is reduced, and the cultivation of the heavier types when wet entails the risk of puddling the soil into a hard, cloddy mass.

Wet land may be drained by either tile systems or open drains. Ditches can carry away more water, and at a lower grade, but are inconvenient. They need to be cleaned periodically, weeds are difficult to control, they occupy valuable land, and may, at times, prove a hazard to stock. Tile drainage is generally a better method, but may prove more expensive. The tiles are so arranged that the water is led rapidly to an outlet, usually a grassed waterway or ditch. It

is essential that the outlet be protected or gullying may result. If no outlet is available then the land may be better left in pasture or woodlot.

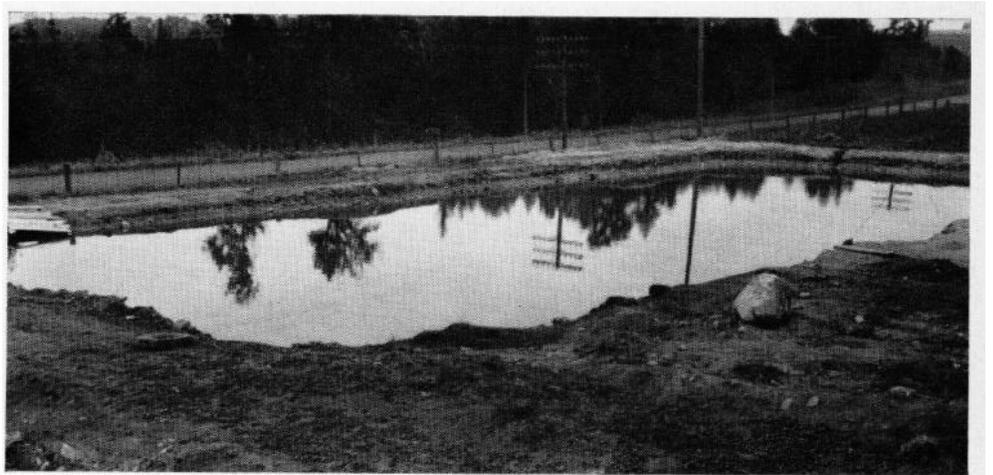
6. Farm Ponds and Irrigation

There are many sites on the Credit Watershed which are suitable for farm ponds. Ponds may be constructed along streams, spring lines, or watercourses. There are six types: dug-out, spring-fed,, by-pass, run-off, permanent stream, and the temporary type on permanent streams, A bulletin on farm ponds is available from the Ontario Department of Agriculture but anyone interested in their construction would be well advised to seek the advice of the County Agricultural Representative. Farm ponds are generally used for stock watering, but they may also be used for irrigation, recreation, barn or domestic supply; or fire protection.

The base for a farm pond should be an impermeable material which does not allow excessive water wastage through seepage, Some seepage will take place, however, and if many ponds were built in an area the effect on the ground water supply would be beneficial. At the same time the farm ponds are reservoirs which can hold back much water from flowing downstream in the spring or during heavy rains and thus reduce the severity of floods. Farm pond construction should not be entered into without an appreciation of the factors involved, The remnants of a multitude of former dams throughout the country indicate that in many cases faulty construction has been made in the past.

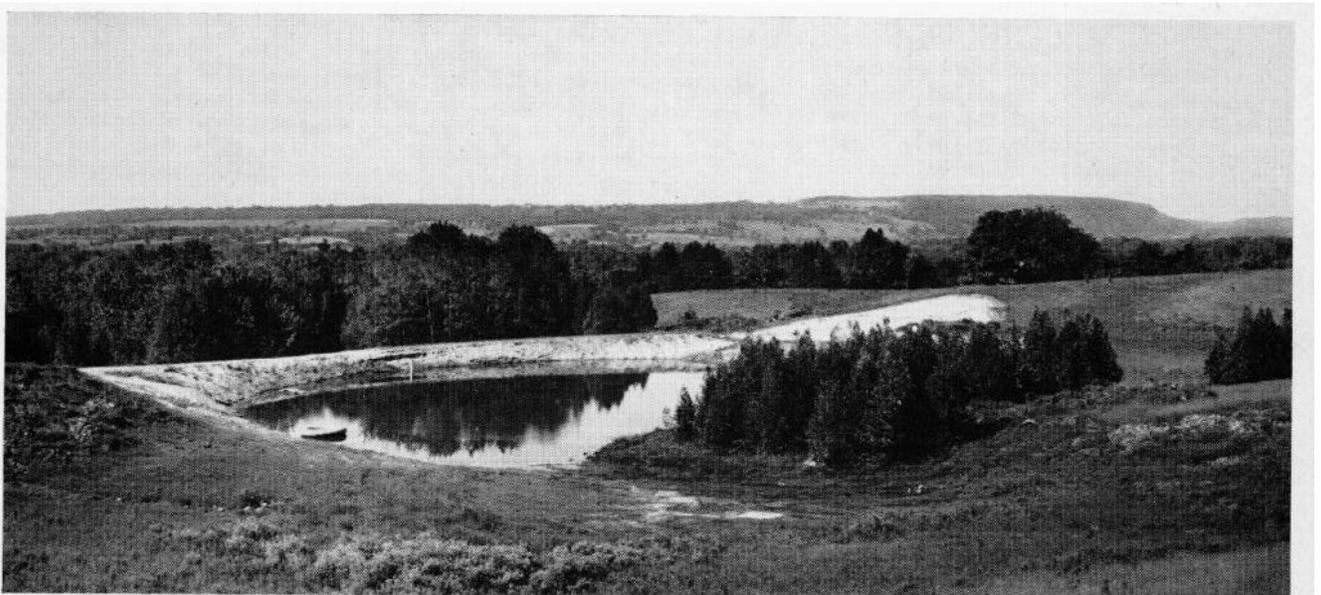
Irrigation as a means of supplying water in the growing season has been adopted by a number of farmers. This method is most used in the Huttonsville area, where the growing of vegetables and small fruits on the sandy soils has led to great demands for water. The water is taken from the Credit

*A grassed waterway through
a field of oats.*



A spring-fed pond two miles east of Hillsburgh constructed for fire protection

An excellent run-off pond constructed in a hollow of the hills near Inglewood provides water throughout the summer



River and at the present time there is no deficiency. There is only so much water in the ground and in the streams, however, and a water shortage could develop. In such an event it might be necessary to regulate the use of water to ensure a fair and equitable distribution for everyone.

7. Contour Cultivation and Strip-Cropping

When land is cultivated by contour the furrows and drill rows run across the slope or on the level, This contrasts with the general practice of cultivating parallel to the field boundaries regardless of slope. Contouring reduces soil loss by water erosion because more of the water is absorbed by the soil. The furrows and drill rows at right angles to the slope act as tiny dams which catch and hold the water. Contour cultivation also saves power, time and wear on the machinery.

Simple contouring may be sufficient on very gentle slopes, On steeper slopes contour cultivation must be combined with strip-cropping. Strip-cropping means alternating bands of cultivated crops with bands of close-growing grasses or legumes. Grass strips act as buffers to break the force of the water and to catch the soil eroded from the cultivated strips above, Sod also improves soil fertility and increases the organic content of the soil, Crop rotations which include two years of sod cover on one strip may be necessary. Such a crop rotation may be as follows: corn, oats, hay. On even steeper slopes terracing can provide greater protection. Grassed runways and diversion ditches, as described in the next section, should be used to carry off surplus water.

8. Grassed Waterways and Diversion Ditches

A grassed waterway is a means of carrying harmlessly away excess surface water from a slope. It should be constructed along a natural run-off channel if possible. If no natural channel is available then one may have to be

constructed. To be effective and safe a thick sod must be maintained along the waterway. The sod prevents the gullying which would occur if the water ran over bare soil. The same principle applies to diversion ditches around pond dams. The sod also catches and holds topsoil which is being carried away. The grassed waterway should be wide enough and have sufficient capacity or gullies may form along the cultivated soil parallel to the sod strip,

To divert water harmlessly from a slope to a grassed waterway or other channel diversion, terraces may be constructed. These are broad troughs with gently sloping sides and they run slightly off contour to a suitable outlet. This device is particularly useful on slopes that are ordinarily not suitable for contour cultivation.

9. The Removal of Stone Fences, Stone Piles, and Boulders

Boulders and stones located within the soil profile and on the surface are factors limiting cultivation in several regions. Boulders and stones are scattered haphazardly about the surface of the Limestone Plain. Boulders are also found in small areas within the sandy hills and the moraines. Stony soils are common in the northern half of the watershed,

In the past much labour has been expended in the clearing of stone, and many piles are to be seen along fencerows and in fields. The stone pile or fencerow may be a major obstruction to conservation farming. Fences were usually laid out to form rectangular fields irrespective of the lay of the land and for conservation measures such as strip-cropping it is often necessary to remove them. Where the fence or much of the fenceline is stone the problem of removal is increased,

Large boulders can be removed by a bulldozer or they can be buried deeply enough in the ground to permit cultivation. Stone piles and stone fences can be buried in

trenches constructed for the purpose. Stones may be used to construct underground drains if laid out in a ditch and covered over. Where conservation farming is to be carried on and stone fences and piles would obstruct the program their removal should have a priority of interest. For the individual, however, the cost of such a program might prove prohibitive. The Authority could make machinery available, or offer financial assistance to farmers who are planning a conservation program in which it is necessary to remove such obstacles.

10. Woodlot Management and Reforestation

Proper woodland management and private reforestation on farms is an integral part of the watershed conservation program. Under present conditions woodlots are widely used as supplementary pastures for cattle. Such use is not advisable, for tree roots get trampled, the soil is unduly compacted, and forest regeneration is made difficult or impossible because of browsing. Woodlots should be fenced and existing pasture made more productive by improvement. Shade trees may be planted along fence lines and in groves for cattle,

CHAPTER 7

RECOMMENDED LAND USE

1. Introduction

The Credit Watershed was surveyed on a reconnaissance scale in the summer of 1954 and the land was classified in terms of recommended use. Prerequisite to planning a soil and water conservation program in any area, it is necessary to make an inventory of land capability. The capability of the land is assessed, using the present land use as a practical guide. The recommended use involves a consideration of the capabilities and physical characteristics of each parcel of land and in this report it is presented in map form.

2. The Classification

The lands of the watershed were classified in terms of recommended use. This classification involves a consideration of the inherent characteristics of each body of land, its present use and its use capability, i.e., the use to which it is ideally suited. The recommended land use map provides a frame of reference for the conservation-minded and a guide to the Farm Planning and Land Use Advisory Board. It should not be used in the same way that a farm plan is used. The farm plan is especially made to fulfil the needs of the individual farmer.

It will not be possible to use all the land according to its capability because of many disrupting economic and social factors. Also, the land-holding pattern makes difficult the use of each type of land according to its capability. However, major disruption of the existing landscape is not necessary to carry out a soil and water conservation program. In many cases only slight changes are needed in the present farm program to bring it into accord with conservation principles.

Two broad classes are recognized on the watershed: land suitable for permanent vegetation and land suitable

for cultivation. Cultivable land is that which, with good agricultural practices can, and should, remain in crop production because of its capability. Depending on conditions; the poorer land may be capable of producing good quality pasture or be more suited to forestry. The classification used is explained in detail in the following sections. The map should be used when reading this chapter.

3. Recommended Land Use Classes

Six classes of recommended use are used in this report. Agricultural land may be used as cropland, pasture or woodlot. Cropland may be classed according to the need for special conservation practices such as strip-cropping or drainage. The six land classes are defined here:

L - Cultivable Land, Not Restricted in Use
(Medium Yellow)

This type includes fertile flat land with no drainage or erosion problems. There are no restrictions on use and no special management is required beyond good farming practices.

LD - Cultivable Land, Drainage Required
(Pale Blue)

Normally rather level land which suffers mainly from impeded internal soil drainage. Drainage outlet is available and the cost of drainage would not be prohibitive.

CF - Cultivable Land, Contour Tillage Required
Light Brown

The lands of this class possess mild to moderate smooth slopes suitable for contour methods of cultivation. These methods would help to eliminate erosion and retain water in the soil.

LR - Cultivable Land, Restricted in Use
(Light Yellow)

It includes land of mild to moderate, irregular or hummocky, slope and eroded soils. Small, low-lying spots may be poorly drained, as well as larger areas which are considered undrainable.

P - Pasture Land (Pale Green)

Limitations such as steepness of slope, roughness of topography, poor drainage and low natural soil fertility restrict this land from continuous cultivation. Such land may be suitably and desirably used for planned pasture. Cultivation, if carried on at all, should be done infrequently.

F - Forest Land (Tree Symbol)

Land which is limited by low inherent fertility, poor drainage, steepness of slope, or other severe physical disability is better planted to forest. Land classified under this use will often be found near existing woodlots, which are also shown (but in a different colour) on the map.

TABLE SHOWING THE PROPORTION OF LAND
IN EACH RECOMMENDED CLASS

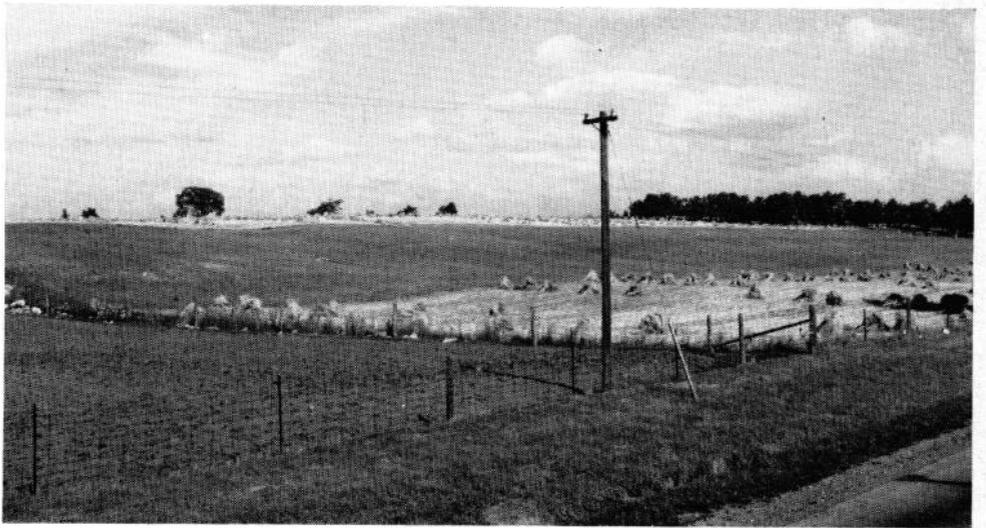
Class	Acres	Per Cent
L	7, 206	3.4
LD	10,511	4.9
CF	9,844	4.6
LR	90,391	42.2
P	38,678	18.0
F	10,674	5.0
Existing forest	35,030	16.3
Other uses	12,033	5.6
Total	214,387	100.0

4. Cultivable Land, Not Restricted in Use

Land classified as having no restrictions in use is adequately drained, and has no erosion problems. This type is also free from other cultivation problems such as excessive stoniness, boulderiness, droughtiness or acidity. The land is either level or has a slope of less than three per cent. The soils are loamy and have a good structure. Internal drainage is good and the soil profile is relatively



Cultivable land which is not restricted in use is level, well-drained and uneroded. There are no restrictions as to use and a high crop production results from good soil management. Oats is a widely grown crop in the watershed.



Long, smooth slopes lend themselves to contour tillage practices. Cultivation across the slope prevents soil and water losses and excess surface water should be carried away safely by grassed waterways.

Contour tillage prevents soil and water losses.



deep. Regular three- or four-year crop rotations, with applications of manure and commercial fertilizers, are sufficient to keep the soils productive.

Surprisingly enough only 3.33 per cent of the watershed is classified as cultivable without restrictions and much of this is found on the Peel Till Plain. This small percentage points up the widespread need for conservation measures. Most of this land is found on the till plains.

5. LD - Cultivable Land, Drainage Required

Only a small proportion of the poorly drained land in the watershed is considered drainable. About 5 per cent of the watershed is so classified. Tile drains and ditches can normally take care of the excess water in this type. The other lands requiring drainage, but possessing no outlet or requiring costly drainage installations, have been placed under either class LR or P. The class to which they are assigned depends on the severity of conditions and the acreage involved.

The largest acreage of poorly drained land which may be drained is in the Feel Plain where many of the flat inter-stream areas are so affected. There is also a large acreage of this type in the inter-stream areas in the Erin Till Plain. On the Peel Plain much of this land is at present in pasture and is likely to remain so because of the need for pasture,, However, grass grows better on well-drained soils and the drainage of these lands may be considered desirable.

6. CF - Cultivable Land, Contour Tillage Required

In this class are areas with smooth slopes suitable for contour methods of cultivation. The necessity for contour tillage arises because of the rapid run-off and the need to conserve soil and water. Within the watershed about 4.5 per cent of the land is suitable for contour cultivation. Unfortunately, many otherwise suitable slopes cannot

be protected by contouring because of cultural obstructions, such as buildings, roads or fencerows. Contourable land is found generally in the Peel Till Plain and in the Erin Till Plain. The drumlins in the Erin Till Plain have their axes pointing in the same direction as the road network so that it is possible to contour many of these without obstruction. The soils found on the steeper slopes are not deep. Almost any soil type may be found, but soils developing over fine or medium tills are most common in this land class.

The special practices recommended on this type of land are contour tillage, strip-cropping, diversion terraces and grassed waterways. These special practices are described in the chapter devoted to soil and water conservation measures. Strip-cropping can be applied to many slopes on the Peel Till Plain, especially on the low ridges which run in a north-south direction. In the drumlin field the slopes are often somewhat steeper and all of the special practices may be needed to do an effective job.

7. LR- Cultivable Land, Restricted in Use

Much land is cultivable, but is restricted because it is highly susceptible to erosion, is irregularly sloping, stony, bouldery, acidic, inadequately drained or droughty. Conservation practices such as drainage or contour tillage are impracticable because of lack of drainage outlets or irregular slopes. These soils should be protected by extended crop rotations in which the land is broken only once or twice every five years. A grass or legume cover should be kept as long as possible to conserve the soil and to build up the organic content. Every possible method of soil rebuilding should be practised, including winter cover crops, green manure and applications of barn manure. Intertilled crops such as corn, potatoes, or roots should be restricted to gentler slopes. In some places strip-cropping may be practised even though the slope is irregular. Grassed waterways may also be used.

This type of land is widely distributed; it occurs in every physiographic region. In the morainic regions where almost all the land is rolling or hilly it represents the cultivable portion. In the Peel Till Plain it represents the poorly drained land which is very difficult to drain. This land is also found along the spillways above the swamps and in the areas of sandy soils.

8. P - Land Recommended as Pasture

Land recommended to pasture is not desirable for crops. The productivity of such land is generally low and much of it is limited as to use by topography. The steep slopes make the use of machinery difficult, and the problem of erosion is extreme. Cultivation may also be precluded by stoniness, boulderiness, or the occurrence of bedrock outcrops, Low wet areas in a field may make cultivation difficult, Under cultivation sandy soils are exposed to wind erosion and a permanent cover of vegetation is desirable. Bottomlands make excellent pasture, but flooding rules out cultivation. Massive clay soils or droughty soils are better under grass because of their low productivity. The establishment of rich, nutritious planned pasture will be reflected in the greater production of beef and milk.

Much land in the Orangeville, Caldwell and Caledon Moraines is classified as recommended pasture because erosion and droughtiness make normal cultivation uneconomical. Parts of the limestone plain are suitable for pasture where the soils are not too droughty. Interdrumlin areas and low parts of the Peel Plain are also recommended to this use because of poor drainage. The wet lands along the spillways also lend themselves to the production of hay and pasture.

9. F - Land Recommended as Forest

Extensive areas of soil of proven low capability have been designated as forest land for acquisition by the Authority. By and large they are included in those areas

designated as present forest or as recommended forest on the Recommended Land Use map. It should be made clear that land recommended to forest by the Forestry Section follows lot lines, for purposes of acquisition, while land so recommended by the Land Use Section follows the "lay of the land" and is based on land capability. It is recommended that 10,674 acres of present pasture and cropland be planted in forest by the Authority and by private owners.

The woodlots on better classes of soils should be retained as far as possible. Any woodlot which is cleared should be replaced by a woodlot elsewhere on available land of low capability. The maintenance of the woodlot is the responsibility of the farmer or owner of the land. Most of the reforestation will be of a private nature, and individual enterprise should be fostered,

CHAPTER 8

A RECOMMENDED CONSERVATION PROGRAM

1. The Authority and Advisory Agencies

An aim of the Credit Valley Conservation Authority is to improve and sustain the productivity of the agricultural land. To do this, it is necessary to initiate a soil and water conservation program. The Authority at its first meeting appointed a Farm Planning and Land Use Board to supervise a co-ordinated soil and water conservation program.

In order to carry out its task the Advisory Board must call upon various government and private bodies to assist it in the carrying out of its program. The Department of Agriculture is the most important agency which the Advisory Board can call upon. The Agricultural Representatives of Dufferin, Halton, Peel and Wellington Counties are the normal channels to use when technical assistance is required. The Soil Advisory Service of the Department of Soils, Ontario Agricultural College, provides specialists in farm planning. Other departments which may be called upon to render help and advice are the Agricultural Engineering, Field Husbandry, Animal Husbandry, and Agricultural Economics Departments.

Various non-governmental organizations are dealing with agricultural and conservation matters. The Soil and Crop Improvement Association takes an active part in encouraging a soil and water conservation program,

2. Demonstrations

A demonstration of conservation practices may be carried out either on private land in conjunction with the owner or on land acquired by the Authority. It can be shown how good cropping practices and correct agricultural engineering on farmland reduce soil erosion and increase production,

To show that soil and water conservation measures are both desirable and practical. should be the aim of any demonstration. Conservation practices properly carried out will pay in increased crop and pasture yields. Demonstrations, whether of improved cropping practices or pasture improvement, are best located on a soil type and topography which is typical of the area in question. Not all lands within the watershed will necessarily require the same management. A useful demonstration project would show contour ploughing in areas with long smooth slopes, or pasture improvement where pasture is intensively used. From the table of Recommended Land Use it can be seen that 4.6 per cent (9,844 acres) of the watershed area has slopes which are contourable, and 4.9 per cent (10,511 acres) can be drained. It would be desirable to carry out a demonstration on some of this land.

It is better if the demonstration is carried out on private land, for then it provides an example of the co-operation between Authority and farm owner. Also it is often felt that projects on public land are not necessarily typical of conditions because of the unlimited financial backing and close supervision by government specialists. If such a demonstration cannot be arranged then it may be necessary for the Authority to acquire land for such a purpose. This would fill the same role as does a demonstration farm,

Demonstrations of soil and water conservation on farm land, whether of pasture improvement, drainage, or contour tillage, have a great educational value. The farmer is able to examine, at first hand, contour ploughing, grassed waterways, diversion ditches, farm ponds and other conservation measures. School children taking agricultural courses can see in practice on demonstration farms, the lessons they learn in the classroom, Agricultural societies, such as Junior Farmers, should use demonstrations as a practical side

of their educational program. Any conservation project should be well advertised by roadside signs, so that the public may be made conscious of the work being done by the Authority.

3. Pasture and Pasture Improvement

Land recommended as suitable for pasture includes land restricted to cultivation by physical limitations and also land which may be cultivated but which is restricted in use by such physical limitations as stoniness, poor drainage or erodibility. The productivity of much land is low because of soil depletion or inherent low fertility, and this is reflected in its general use as pasture. Much of the land suitable for pasture is found in the moraines and along the spillways. Where the soil is inherently infertile or where cultivation is restricted its use as range land is recommended. There is land of medium fertility, however, which can be improved to increase pasture returns. Much of this land is in the dairy belt and along the spillways and creek bottoms.

Pasture is the cheapest feed for cattle or sheep, Grass is cheaper than alfalfa hay, corn silage or grain, and this is reflected in the higher proportion of land devoted to pasture than to any other crop on the agricultural land of the watershed. Almost 30 per cent of the total area of the watershed is in pasture. As the demand for animal products increases pasture land will be utilized more intensively. It has been shown in studies elsewhere that livestock gain weight more rapidly and produce more milk when raised on improved pasture, The pasture yield on soils of medium fertility may be increased up to four times. Pasture improvement also provides partial insurance against high feed prices.

A grass cover is the best method of protecting agricultural land from soil erosion. Grass adds organic matter to the soil, and if legumes are present in the pasture mixture,

nitrogen is also added, Under a sod cover, soil-building keeps pace with soil losses, and depleted and eroded soils are rejuvenated.

Pasture improvement schemes may be undertaken when sufficient land of fair fertility is available. At present, improvement of pasture gives worthwhile returns on dairy farms where pasture is used intensively. Dairy cattle should have continuous access to good pasture throughout the day and night, Shortage of good pasture means feeding expensive substitutes to maintain a high milk production. Dairy cattle also need shade, water and shelter. A pasture improvement program may be accompanied by the construction of farm ponds and the planting of trees for shade.

If a field or farm is to be set aside as a permanent improved pasture, the farmer is advised to call upon the Agricultural Representative for advice as to whether or not the pasture is worth improving. Long-term pasture requires grass and legume mixtures which are adaptable to the local climate, topography, soil and drainage. Pasture mixtures may be expected to last from four to seven years. The mixture is different if both hay and pasture crops are to be taken from the field,

Pasture improvement land must be fenced if rotation of pasture use is desired so that over-grazing does not take place. Slopes can be terraced or contour-furrowed to provide added control of water run-off, and inadequately drained land may be ditched or tilled. The land must be prepared and fertilized for seeding. In order to allow a thick sod to develop, cattle should be kept off until one is built up, and then it should only be lightly grazed the first year. Management of a pasture entails maintenance of a high level of soil fertility, clipping to destroy weeds, harrowing to spread the droppings, and avoidance of over- or under-grazing so that the grass will not, be trampled and the legumes crowded out.

The forage requirements of beef cattle are not as exacting as are those of dairy cattle. Beef animals may get adequate forage from poorer pasture lands during the growing season. Pasture management entails keeping the cattle population at a number which the pasture can support. Over-grazing the pasture keeps down the growth of beef cattle just as it decreases the supply of milk from dairy cattle. It may be economical to improve pasture for beef cattle by the addition of lime, where this amendment is indicated, and by the clipping of weeds, Rotation of livestock during the summer helps maintain a good growth of grass, The time and money spent on pasture for beef cattle should be in proportion to the value of the livestock and the need for feed.

In order to further pasture improvement, a program of education should be considered. The literature published by the Department of Agriculture, and made available through the Agricultural Representative, should be distributed to all interested farmers. Several film releases have been made available, such as the O.A.C. production, "More Beef per Acre". These films could be used at meetings of farmers to show the benefits of pasture improvement.

4. Pasture Improvement on Parts of Land Acquired for Other Purposes

The Authority will find it necessary to acquire private land when it proceeds to carry out various recommended projects connected with reforestation, flood protection, or recreation. Property is usually purchased in blocks, often containing within its boundaries various classes of land. Land of high capability may easily be included with low capability land which is not productive from an agricultural point of view. Such high capability land, if the acreage is large enough, may lend itself to demonstrations of soil and water conservation. Other Authorities have found by experience that multi-purpose

projects are workable and suitable. Such a project in the Saugeen Watershed combines reforestation, recreation and a pasture improvement demonstration. The Credit Valley Authority might well give serious thought to such a project.

Above the Niagara Escarpment there is much low capability land in the sandy and hilly areas which is well suited to combined use as forest and pasture. The pasture would, of course, be restricted to the better sites, Most of this land is at present used by farmers engaged in raising beef cattle and in mixed farming with livestock. A pasture demonstration could be quite useful in these areas. Pasture demonstrations at present should, however, be confined to land which has a high pasture capability. At the present state of economic development it is not reasonable to attempt to renovate pasture on very poor soils, but rather to renovate pasture on soils with medium or better fertility.

5 .The Farm Plan

The purpose of the farm plan is to lay out a farm so that each section of the land is used and managed according to its capabilities. The plan embodies the conservation principles which have been discussed in this report. Conservation practices are recommended which are applicable to the farm for which the plan is made. In Ontario, responsibility for farm planning has been delegated to the Soil Advisory Service of the Soils Department, Ontario Agricultural College at Guelph.

A farm planner surveys the farm, field by field, and maps his findings on an aerial photograph. The soil series and types are identified, and their boundaries are delineated. The degree of erosion is estimated by examination of the soil profile. The slope of the land is measured and the soil-limiting factors described. Watercourses, either permanent or

intermittent, are mapped, Gullies and over-deepened water-courses are also noted and mapped. From all of this information a map of use capability is made.

The plan of the farm is then worked out so that each piece of land is used as closely as possible according to its capability. Where necessary, changes are made in tillage and cropping practices to prevent soil erosion. Basic to good farming is soil management, and the plan attempts to arrange the cultivation practices so that this can be achieved, In many cases a well planned crop rotation is sufficient to keep the soil in a good condition. On sloping land strip-cropping or contour cultivation may be recommended. The installation of grassed waterways and tile under-drainage may be recommended to take care of intermittent run-off. Where land is inadequately drained, plans for ditching and for tiling may be made, Farm ponds, reforestation and pasture improvement schemes may also be recommended.

A system of crop rotation will be worked out to conform with the needs of the farmer, It would include the correct balance of pasture, hay, grain and other crops necessary to meet the requirements of the herd which the land must carry. The rotation system would be so designed to take care of changing needs. Where special practices such as contour tillage are required a transition period is arranged so that a year of cropping is not lost. Special devices such as grassed waterways or terraces may take more than one year to get into working shape. For work such as this the services of an agricultural engineer may be required, and this specialist is available through the Agricultural Representative.

Most changes which have to be made to carry out the farm plan can be done with the farmer's own equipment, but there are some things, such as the construction of farm ponds, drainage ditches, or diversion terraces, which require heavy earth-moving or grading equipment. The Authority might well

make equipment available to the farmer who is carrying out a farm plan. In regard to farm ponds a grant is made toward construction, and application for this should be made through the Authority.

By the summer of 1954 seven farm plans had been completed in that part of Chinguacousy Township within the watershed. Farm plans had been drawn up for farms in other townships as well, and several farmers had applied to the Department of Agriculture for farm plans. This shows an increasing desire for farm plans by many farmers, and the Authority should provide further information so that more farmers will take advantage of the services offered. Farm plans have been or will be prepared for dairy, mixed and beef farms. The adoption of a farm plan for every farm in the Credit Watershed should be the aim of the Authority.

6. The Red Clay Soils: An Erosion Problem

A problem of immediate concern to the Land Use Advisory Board is the red clay in the Terra Cotta - Inglewood area (see map of Limiting Factors). These soils are severely eroded and gullyng is common on the steeper slopes. The red Queenston shale weathers into a massive and unabsorptive soil, the Lockport clay. Lockport clay, eroded phase, occurs as a band along the face of the Niagara Escarpment and is about 700 acres in extent. It is low in organic matter, phosphorus, potassium and calcium and gives an acid reaction. Since crop production on this soil is limited by low fertility, its use either as pasture or as forest is recommended.

Severe sheet erosion and gullyng over large areas occurs above Cheltenham and Terra Cotta. To prevent continued erosion a grass or tree cover is required and over-grazing must be stopped. A program of reclamation of the severely eroded red clay is recommended. Reclamation may be undertaken either as a pasture improvement scheme, as a reforestation project, or both.

The red Lockport clay is suitable for the production of pasture, but only where a permanent grass cover can be established. A pasture project might be initiated by the Authority on a suitable tract of land, and it would act as a demonstration of what can be done. Since such a project would be in the nature of an experiment, the co-operation of the Ontario Agricultural College would be desirable. It is recommended, therefore, that a joint project be considered in which both the Authority and the Ontario College of Agriculture co-operate.

Those farmers whose land includes Lockport clay should be interested by the Authority in its reclamation. Pasture improvement and reforestation are necessary in most areas, The necessity of limiting the number of cattle grazing on this type of soil should be emphasized. The Authority could subsidize fencing of land to prevent cattle from grazing where erosion and gullying are severe and gully control should be carried out,

Although gullies may be controlled by a permanent vegetation cover or by check dams, these control measures may be nullified if there is a heavy run-off while control is being established, A concentration of water in such a gully damages or washes out plantings or check dams, Diversion of excess surface water from the head of the gully will prevent run-off from entering and causing more damage, If diversion is impossible while attempts are being made at control, the water should be channelled through the gully as safely as possible by the use of flumes, check dams and so on. Whatever is done it should be remembered that half-measures may be worse than none and only serve to aggravate the situation.

By terracing the drainage area above the gully head, much or all of the run-off can be diverted elsewhere, where it can be safely disposed of, Diversion ditches, described in Chapter 6, to be effective must be constructed to

carry off the maximum amount of rainfall. They must also be constructed so that erosion does not begin along the water channel, Construction of diversion channels should be left to an agricultural engineer to plan. The Authority could make machinery available in schemes of this nature.

Reforestation is the best use of the more severely eroded portions of this soil and some of the land is so severely eroded that ultimate reclamation by any means other than reforestation is out of the question.

7. The Problem of Wind Erosion on the Credit Watershed

Wind erosion is something of a problem on the light and excessively drained sandy soils of the Credit Watershed. Extensive areas of such land are found in the Orangeville and Caldwell sandy hills. In these regions soils have suffered erosion by both wind and water and in some cases it has been severe. Whereas water erosion is usually more severe on steep slopes, soil blowing may become an acute problem on either level or sloping land. Pontypool sandy loam, a soil type common to both above-mentioned regions, is susceptible to wind erosion and in addition suffers from excessive drainage and low fertility. Other soil types with the same problems are Hillsburgh and Brighton sandy loams.

Under natural conditions significant wind erosion never occurred in Southern Ontario. With the removal of the permanent vegetation cover and with the cultivation of the soil, conditions favourable to wind erosion were created. Depending on texture and organic matter content, soils vary in their resistance to wind erosion. Coarse sands are more likely to blow than fine sands. Organic matter in the soil binds the soil particles together and retains moisture and thus reduces the hazard of wind erosion.

This hazard is low if the soil is protected by a cover of permanent vegetation. Either forest or pasture

protect the soil adequately, and where the hazard of wind erosion is great, permanent vegetation is recommended. A permanent vegetation cover protects the soil by shielding it from the wind, by binding the soil particles together, and by keeping the soil moist. On cultivated land soil management is necessary to prevent the soil from blowing. Planned crop rotations and applications of manure are necessary to maintain a good soil structure and a high organic content. Cover crops protect the soil and prevent rapid loss of water by run-off. Stubble on a field protects the soil from the wind and as mulch ploughed into the soil helps maintain the organic content.

Windbreaks or shelterbelts may be used to advantage. Windbreaks are rows or belts of trees planted around cultivated fields to check the velocity of the wind. By slowing up and deflecting the wind near the ground, the hazard of wind erosion is reduced. Windbreaks reduce the evaporation of moisture from the soil, thus saving water for the production of crops; and keep the snow on the ground so that it is available in the spring. The greatest danger from erosion is in large fields where the wind can sweep unobstructed.

Although the planting of trees is part of the forestry program, nevertheless, because of the problem of wind erosion on sandy soils, the Land Use Advisory Board should take an active interest in the planting of windbreaks. It is recommended that the Authority should promote and assist private owners to establish windbreaks and shelterbelts in those areas where wind erosion is a problem.

8. The Problem of Drainage

Large areas of the Credit Watershed are inadequately drained. It was found that agricultural production on 10 per cent of the land in the watershed was so limited. Inadequately or poorly drained land is not confined

to any one region. The largest continuous area is that around Caledon Lake and along the valley towards Orangeville. In this area about 6,761 acres, or one-quarter of the land, is inadequately drained, but only one-sixth is considered drainable. The imperfectly drained areas in Caledon, Erin, and upper Esquesing Townships are also difficult to reclaim; less than half has been mapped as being drainable. On the Peel Plain several large areas are so limited, but a fair proportion of this land, about three-fifths, may be feasibly drained by artificial means. Some has already been so treated.

Drainage is imperfect in many of the inter-stream areas, especially in north-western Chinguacousy Township, Pockets of poorly drained or gleizolic soils occur along some of the shallow stream valleys. North of Georgetown there are many small poorly drained depressions covered by willow scrub.

A high or fluctuating water table limits the growth of crops. Wet soils cannot be ploughed until the surplus surface and subsurface water has been drained away, Late plantings mean a shorter growing season. Well drained soils permit easier use of implements. Poor drainage limits root development so that crops may suffer drought in the summer. Wet soils are "cold" soils, while drainage allows higher average temperatures. Drainage also allows more water to percolate downwards through the soil so that there is less chance of erosion on sloping land,

It is advisable that a survey be made of any area which is to be drained. Such a survey will show the type and size of drains required, where the drains should be located, the best outlet, and any land use changes which are necessary. Any farmer who wishes to drain his land should apply to the office of the County Agricultural Representative for a drainage survey, Agricultural Engineering Fieldmen are made available by the Department of Agriculture for surveying land for which drainage is proposed.

The two most common types of drains used are tile and open ditch. Other types include stone, brush, box and mole drains, which are either temporary or fulfil special functions. Tile drainage, in most instances, is the best method of drainage because of its permanent nature and because tile does not need constant maintenance. Tile drains effectively carry off surface as well as subsurface water, Ditches are the most effective instruments for the removal of excess surface water, but maintenance is a problem.

Financial assistance is available from the Province of Ontario under the several drainage Acts in force. The Tile Drainage Act makes it possible for a loan to be obtained by the individual through the municipal council for 75 per cent of the cost of installing a drainage system. up to \$3,000 per 100 acres or fraction thereof may be borrowed. Open ditches constructed under the terms of The Municipal Drainage Act may be partly financed through funds made available by The Provincial Aid to Drainage Act, Under this Act individual owners are required to pay only two thirds of the cost of construction.

It is recommended that the Credit Valley Conservation Authority and the municipalities concerned co-operate in furthering drainage on individual farms and over broader areas if necessary. Since drainage of inadequately drained areas on the Peel Plain is more profitable and practical than elsewhere, it is recommended that a drainage program be furthered in that region.

Chapter 1

THE FOREST IN THE PAST

1. At the Time of Settlement

Good early descriptions of the forests of Southern Ontario are rare, for the early settler regarded the forest more as an obstacle to cultivation than as a positive asset worthy of recording. However, a fairly good picture may be obtained by piecing together the scattered information which does exist. Such early concern as there was with timber resources centred around pine and oak for the British navy and the easily cut softwoods for building purposes. Fuelwood was important, but was everywhere abundant and not worthy of special note. In addition the type of timber was of indirect interest as an indication of the quality of the land; pine - oak forests indicating light, easily worked soil, and maple - beech stands suggesting richer but heavier soils.

In order to record this information prior to settlement, the early surveyors were instructed as follows:

"Your field book is to be kept in the accompanying form, comprising the kind and quality of the soil and timber, enter ins each kind of timber in the order of its relative abundance."

In accordance with these instructions, the surveyors' notebooks included a running account of the composition of the forest cover along every line they ran, and thus they provide a reasonably accurate picture of the original bush in each township surveyed.

The townships comprising the Credit Watershed were all surveyed between 1806 and 1822. From the surveyors' field notes it is clear that they worked through a primeval forest almost unbroken except for an occasional "beaver meadow" or patch of windfall. In the valleys they found cedar, tamarack or "aulder" swamps and black ash "swails". On the valley slopes hemlock was common. Over most of the watershed the uplands were covered with stands of hard maple and beech, with a mixture of basswood, oak, ash and elm. In the central part of the

watershed pine was sparsely scattered through the hardwood forest. In the north pine was more abundant, but only near the lake did the surveyors record the timber as being principally pine and oak. This is confirmed by Smith's Canadian Gazetteer of 1846 which contains the following notes:

Caledon Township:

"The north of the township is hilly and broken, with a considerable quantity of pine; in the south the land is much better, and the timber principally hardwood. "

Toronto Township:

"For from two to three miles from the lake the land is light and sandy, and the timber principally pine; afterwards it becomes rolling, and the timber the best kinds of hardwood?"

The modifying influence of Lake Ontario is reflected in the presence of walnut, noted by Wilmot in the Toronto Township survey of 1806.

Little note was made of the quality of timber, but just south of Georgetown in the Esquesing survey of 1819 Bristol was sufficiently impressed to note "Beech baswood Maple Oak timber very large." The same year at Concession VI, on the north boundary of Chinguacousy he recorded "timber chiefly beautiful sugar maple." To so impress a surveyor of this period these must have been fine stands indeed.

Ryckman's survey of the west part of Caledon Township was finished in May 1820. The refreshing sight of early spring bloom may have been the cause of his record of "a few Plumb trees"* at Lot 15 on the line between the 4th and 5th concessions.

2. Clearing the Land

The attitude of the early settler to the forest was completely hostile, Although the forest supplied his meagre needs for construction material and fuel, this was but a drop

* This would be the wild Canada Plum (Prunus nigra Ait.), one of the earliest blooming of our native fruit trees.

REMAINING WOODLAND IN PERCENT

ESTIMATED FROM CENSUS OF CANADA FIGURES

Township	1851	1861	1891	1911	1921	1931	1941	1951	1954 Survey *
Amaranth	97.2	89.6	40.4	11.6	6.6	5.4	4.9	6.4	2.6
Mono	87.9	64.8	29.4	13.1	16.2	16.1	14.6	12.3	17.6
Garafraxa East	95.0	73.2	17.9	7.0	7.4	7.5	7.7	7.0	11.6
Erin	72.6	55.1	20.1	11.8	16.5	14.8	14.6	13.5	20.8
Albion	70.4	47.8	19.7	8.1	8.9	9.1	10.0	9.1	16.6
Caledon	69.3	55.8	23.7	10.1	10.8	15.3	13.5	14.3	22.6
Chinguacousy	49.2	34.4	10.0	5.8	6.1	5.5	4.9	5.0	9.8
Esquesing	56.8	48.4	19.7	13.4	13.3	13.5	12.0	11.5	17.8
Trafalgar	41.6	30.7	16.8	5.0	6.8	8.4	5.2	5.6	4.6
Toronto	47.4	37.9	17.1	8.7	5.9	5.0	5.1	4.8	6.6
Total	67.3	52.6	21.7	9.5	10.0	9.8	9.5	9.0	16.3

* Survey figures refer only to that part of the townships within the Credit Watershed.

in a seemingly limitless sea of supply. Transportation was poor, and markets for his woodland produce extremely limited. For agriculture to develop the forest must go, and much of it was simply piled and burned. Settlement duties required a certain amount of land to be cleared before a patent could be obtained. After January, 1820, this obligation included the cutting of all trees on a strip 165 feet deep across the entire front of each lot.

When a new area was opened for settlement the best land was naturally taken first and the rough and swampy areas were avoided, Land was cleared first along the fronts of the farms and the woodland cut farther and farther back toward the end of the farm which lay farthest from the road. This was done, in many cases, without reference to the quality of the soil except where it was swampy.

The accompanying table gives an estimate of the remaining woodland at various dates in the townships making up the Credit Watershed. Although slight irregularities appear in the table, due to incomplete information: the general trend of events is obvious. Until about 1910, the decrease in woodland was rapid. After that the small remaining area of woodland was at least tolerated, and in some cases has probably shown a slight increase. There is not as yet any evidence of a sharp increase in woodland cover such as might be brought about, by a real enthusiasm for reforestation of submarginal lands.

The figures from actual measurements made in the 1954 survey, given in the last column for comparison, refer only to that part of the township within the watershed. Due to varying topography this part may be more heavily or less heavily wooded than the township as a whole,, In part, however, these differences may simply reflect different opinions as to what should be classified as woodland. The condition of the remaining woodland is described in the following chapter,

3. Forest Products

The earliest interest in timber in Ontario was the reservation of pine and oak either by specified areas or by individual marked trees for the use of the British navy, This system was already weakening when settlement in the Credit area began, and although we find a few lots marked for "Masting" in the original survey of Toronto Township, these apparently were soon released for settlement. The masting records from the 1806 survey of the Mississauga tract in Toronto Township list seven lots south of Dundas Street as containing "a great many" pine 7 to 11 feet in circumference and 60 to 70 feet high. Three lots are said to contain "a great many" oaks 8 to 11 feet in circumference and 40 to 45 feet high, with two other lots having "a few Trees of this Description". The supply of material to meet the high standards of the Royal Navy was apparently quite limited.

The square timber trade commenced, no doubt, somewhat later than the mast trade and was carried on simultaneously with it from the thirties.

Square timber was obtained by selecting large trees, mostly white pine, and squaring the best part into one long stick. In the earliest days of the industry the timbers were squared on all four sides to a fine "proud edge", but later, when the best timber had been cut, they were squared with a rounded shoulder or "wane" and were known as "waney timber". Such methods, of course, were wasteful since the finest grained wood was sacrificed in the operation, but this was the type of material called for, by the British market,

Often only one tree in a thousand would yield a finished 'stick' (so was the heavy square timber nonchalantly called in the trade) fit for export. A good stand might yield thirty or forty trees an acre for over the whole area allowances had to be made for 'wants' - the non-bearing patches of swamp, burn, etc. Today a whole township or limit (in Northern Ontario) may not have one good square stick of the quality of the square timber of another day."*

Until 1890 the Census of Canada lists all pine and oak not sawn into lumber as "square timber", and even as late as 1910 most species are listed as "square, waney or flattened".

As settlement and trade grew, sawmilling became important. It is uncertain when the peak was reached in this industry. Actually it would not be the same in all parts of the watershed. W. H. Smith reports the following shipments from Port Credit:

1844

Square Timber, Oak and Pine	278,000 feet*
Lumber	1,433,369 feet*

1850

Lumber (No square timber listed)	2,430,751 feet*
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At the latter date Smith† remarks of Toronto Township:

"The saw mills have decreased in number, but the grist mills have increased; a favourable sign, as it may be presumed that the timber is becoming scarcer, and more land is being brought under cultivation".

However, this decline was not yet a general or settled trend for the watershed. As trade conditions improved, sawmilling flourished. In 1859 there seem to have been 58 water-powered mills and 4 steam mills operating on the watershed, Not only good export conditions, but also a vigorous local demand stimulated forest production. From 1840 to 1870 a large amount of lumber and squared timber was used for local construction, and particular species were in demand for the manufacture of vehicles, furniture, barrels and woodenware. Local building had slacked off by 1875. The making of vehicles continued until about 1890.

A study of the accompanying tables of forest

* Presumably the square timber is recorded in cubic feet and the lumber in board feet,

† Smith, W. H. Canada: Past, Present and Future.

FOREST PRODUCTS - ESTIMATED FROM CENSUS OF CANADA FIGURES
CREDIT WATERSHED AND SURROUNDING AREAS
Including the Counties of Dufferin, Halton, Peel & Wellington

Products	Species	Unit	1870	1880	1890	1900	1910 *	1920	1930	1940	1950
Pulpwood		Cords			2,703	113		113	93	47	36
Tanbark		"	1,341	1,575	2,058	528	79				
Lathwood		"	53	2,193	1,521						
Masts & Spars		Number	200	4	40	4					
Staves		"	2,140M	2,160M	1,698M	\$852	\$675				
Fence Rails		"						11,685	13,723		
Fence Posts		"			135,801	49,906	32,036	27,160	54,048		28,265
Poles		"			3,339	1,368	2,575	389	1,819		752
Railway Ties		"			583,335	4,123	3,930	100			
Shingles		"			15,963M						
Piling		"				99	340				
Fuel Wood		Cords	265,642	294,756	255,899	160,855	148,832	145,216	118,742	84,728	32,642
Square Timber & Logs	Ash	Cu.Ft.				6,579	12,260				
	Birch & Maple	"	7,145	21,550	117,700	16,355	22,280				
	Black Walnut	"			1,200						
	Butternut	"	8,000	20	800						
	Elm	"	160,573	232,593	249,081	82,516	72,935				
	Hickory	"	216	2,577	7,320						
	Oak	"	9,163	33,841	36,535	3,406	2,420				
	Pine	"	32,873	384,855	134,679	8,331	9,310				
	Tamarack	"	133,803	90,651	168,469						
	Others	"	509,725	686,575	186,421	56,809	147,471				
Lumber	Pine	M bd. ft	16,275	29,952	10,462	1,004	598				
	Others	"	9,274	118,868	72,294	8,722	8,373	2,900	2,849		1,568
Other Products		\$				84	7	689	1,421	33,960†	5,709

* From 1910 on the figures include the Townships of Melancthon, Mulmur and Mono, formerly in other counties.

† Includes lumber, posts and poles.

M = Thousand (1,000)

products reveals many changes. While the varying basis used for Census of Canada returns at different periods makes comparisons difficult, some general trends are quite clear. The peak production shown for most products is in 1880 or 1890. Soon after 1900 such products as tanbark, lathwood, masts, staves, shingles and piling drop from the list, and production of other products shows a sharp decline. The one product which has persisted throughout the record is fuelwood, which has dropped from a peak of 294,756 cords in 1880 to a low of **32,642** cords in **1950**. This decline reflects both the decrease in available supply and the increasing competition of other fuels.

The addition in 1890 of fence posts, poles and railway ties reflects the development of the area. The introduction of wire fencing, the development of the telephone and the expansion of telegraph service all stimulated forest production at this period. The subsequent sharp decline in these products shows the rapid depletion of supplies.

Tamarack was an important timber until 1890 when the species was almost wiped out by the depredations of the larch saw-fly. The amount of walnut, butternut and hickory cut was never large, and after 1890 these species disappear from the record.

In 1920 no square timber is shown, and from this time on lumber production is small and is no longer separated by species.

Potash, shipped to Britain for use in soap making and the dyeing industry, was a source of some revenue while land was being cleared. It was extracted from the ashes of hardwood trees, 60 large maple trees producing one barrel of 650 pounds. W. H. Smith reports shipments from Port Credit of **32** barrels in 1844 and 26 barrels in 1850.

Maple sugar was almost the only sugar available to the pioneers. In 1910 census records begin to list maple syrup as well, indicating the change from a pioneer necessity

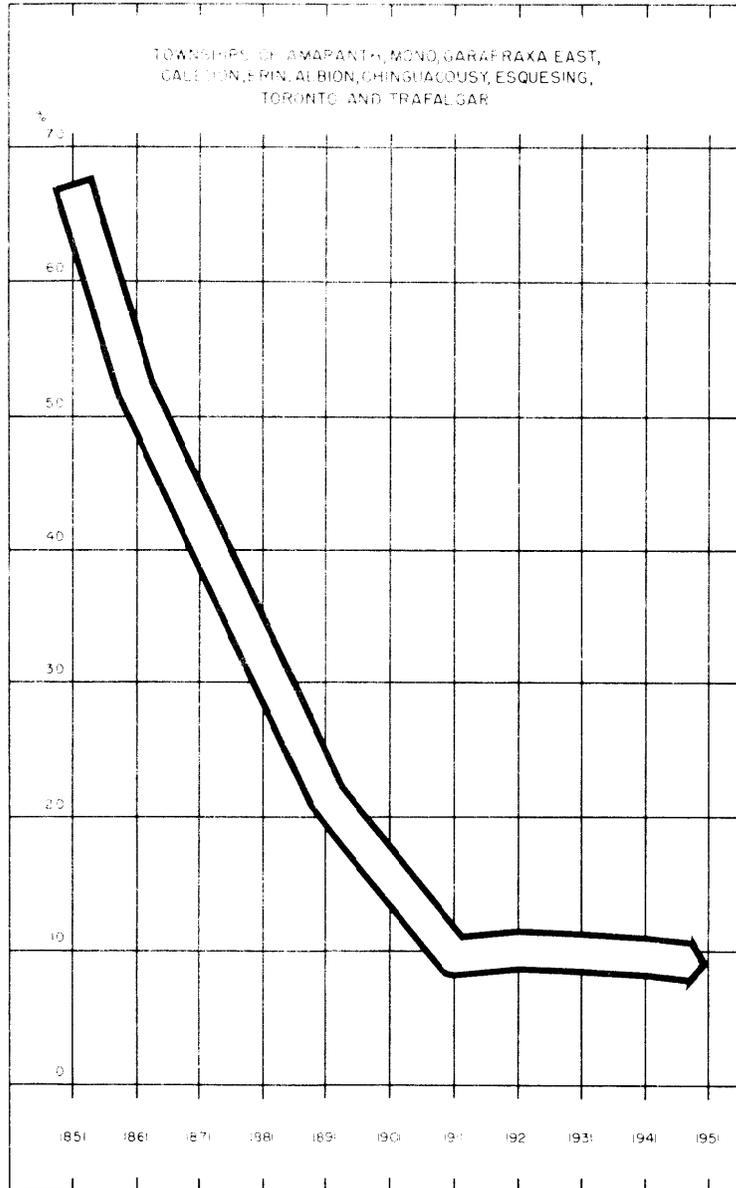
MAPLE PRODUCTS CALCULATED AS SYRUP
FROM CENSUS OF CANADA FIGURES

County	1851 Gals.	1861 Gals.	1871 Gals.	1881 Gals.	1891 Gals.	1901 Gals.	1911 Gals.	1921 Gals.	1931 Gals.	1941 Gals.	1951 Gals.
Dufferin							5,045	2,618	4,486	842	1,029
Peel	4,282	5,200	38	55	434	198	2,656	1,770	2,056	766	151
Wellington	14,622	31,721	14,641	3,195	8,861	6,564	11,716	7,554	12,351	6,103	4,127
Halton	4,856	5,472	710	105	1,171	1,252	1,791	1,165	1,932	830	423
Total	23,760	42,393	15,389	3,355	10,466	8,014	21,208*	13,107	20,825	8,541	5,730

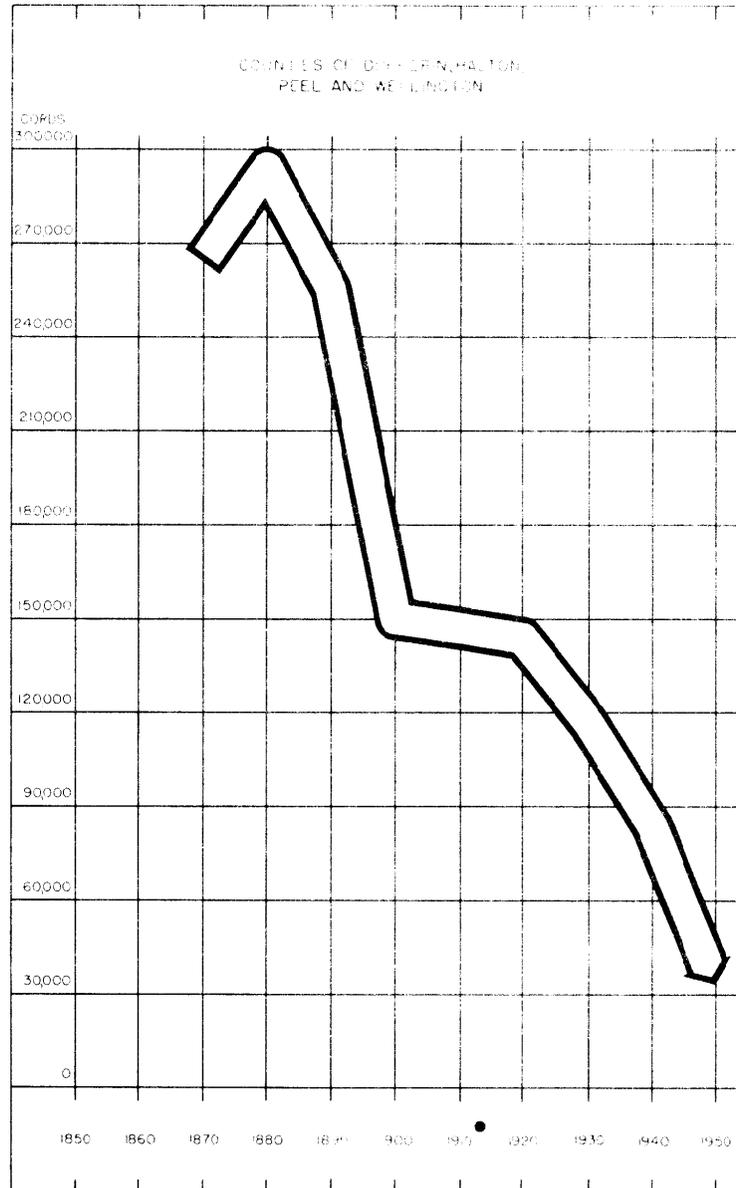
* From 1910 on the figures include the Townships of Melancthon, Mulmur and Mono which were transferred to Dufferin from Grey and Simcoe Counties.

to a modern luxury. For ~~stake~~ sake of comparison the accompanying table shows these products expressed as an equivalent amount of syrup. Production in 1950 was less than 14 per cent of that for the peak year of 1860.

PER CENT WOODLAND

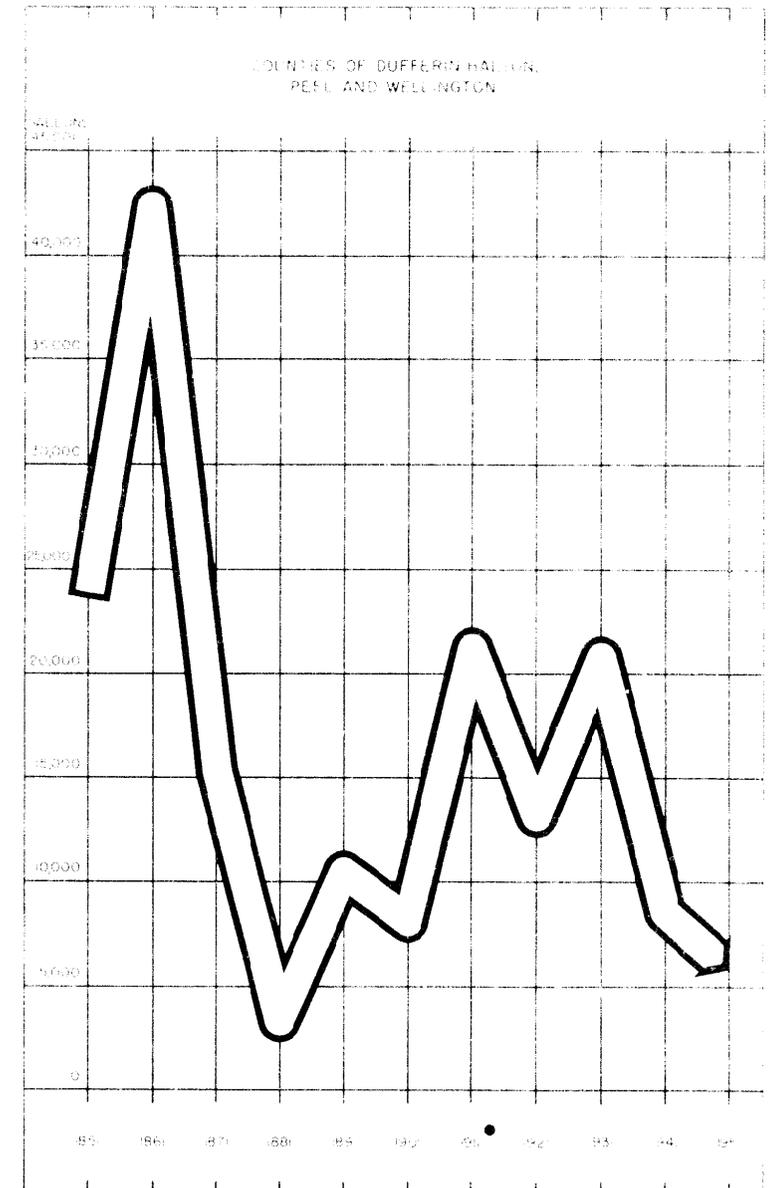


FUELWOOD PRODUCTION



MAPLE PRODUCTS

(EXPRESSED AS GALLONS OF SYRUP)



CHAPTER 2

SURVEY OF PRESENT WOODLAND

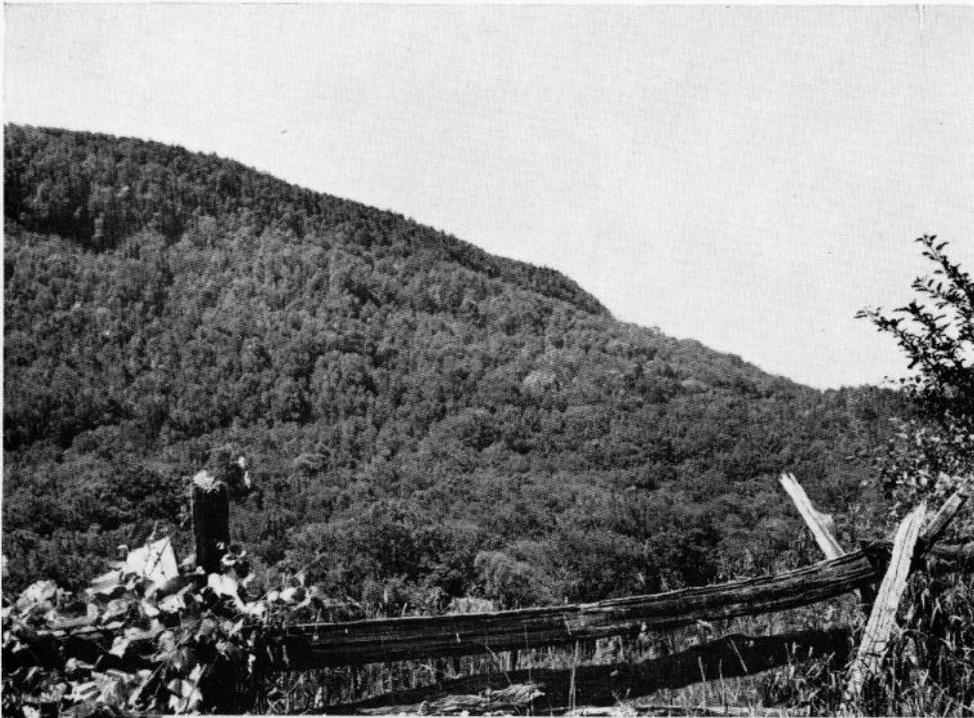
An accurate inventory of the existing woodland in the watershed and an estimate of its present condition is a basic necessity in establishing a woodland conservation program. A detailed study was consequently made of all woodlands, scrubland, plantations and land which is suitable for reforestation,

Almost the entire Credit Watershed lies within the Huron-Ontario Section of the Great Lakes-St. Lawrence Forest Region.* In this forest section, as a whole, the prevailing association of forest trees is dominated by sugar maple and beech and this association is described as the climax typed for the area. Occurring in this climax type are other associated species such as basswood, white elm, yellow birch, white ash, hemlock and white pine. After disturbances such as cutting or fire this climax type may be replaced for a time by poplar and white birch. On local or specialized sites such as river bottoms and swamps there occur other aggregations of trees which may bear no relation to the typical or climax forest of the area; for example, an association where white cedar is the dominant species. These distinctive local combinations of tree species are in response to very local climatic, soil, topographic and drainage features.

The Deciduous Forest Region", which occupies much of the eastern half of the United States, includes only a small part of Southern Ontario. In the Credit Watershed it extends only a few miles from the river mouth. Here the

* W. E. D. Halliday. A Forest Classification for Canada, 1937.

† The climax type is the one best suited to maintain itself permanently under the climatic conditions of a given area. Unless disturbed by fire, axe, or other agents it will eventually take possession and hold most of the area against the competition of other trees.



The wooded slopes of the escarpment not only add to the beauty of the Credit Valley but make this rough terrain productive in terms of wood for industry and clear spring water for the river.

modifying influence of Lake Ontario makes possible a characteristic association containing black and white oaks, sassafras and shagbark hickory,

1 . Survey Methods

Aerial photographs, each covering about 1,000 acres, were provided to the forestry party, and mapping in the field was done directly on the photographs. Each area of woodland, scrubland, swamp and rough land was visited and described as to acreage, cover type, presence of grazing, reproduction, and average diameter at breast height.

Each woodlot was classified as hardwood, coniferous or mixed. The term "hardwood" is used to denote all broad-leaved trees regardless of their physical hardness. A woodlot in which 80 per cent or more of the trees are hardwoods is called a hardwood stand: one in which 80 per cent or more of the trees are conifers is called a coniferous stand; and all other stands are classed as mixedwood.

Plantations were likewise examined and records made of method of planting, approximate age, care, damage and survival .

Land suitable for reforestation was mapped, and descriptions prepared in some detail for the larger areas,

2 . Forest Cover Types

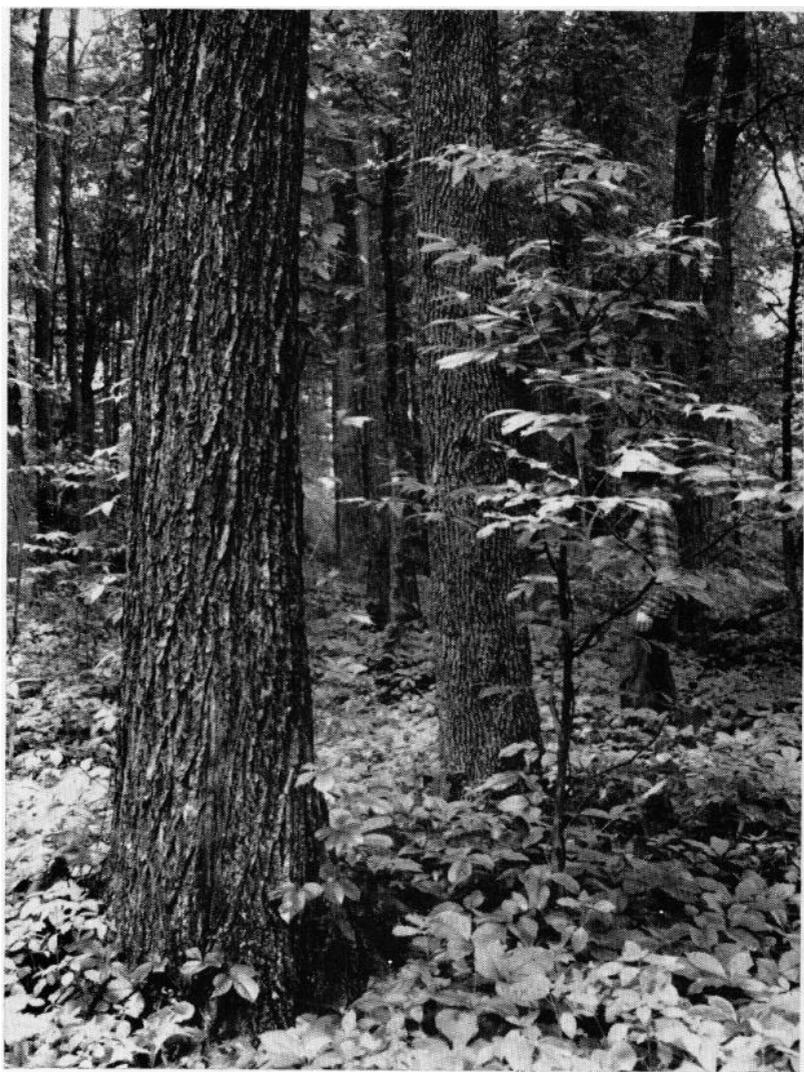
The term "forest cover type" refers to those combinations of tree species non occupying the ground, with no implication as to whether these types are temporary or permanent,, A slightly modified form of the system drawn up by the Society of American Foresters has been used on this survey so that the system will adequately describe the cover types common to the watershed. The gaps in the numerical system are due to certain cover types common to the eastern United States which do not enter Canada.

The following cover types were encountered on the Credit Watershed:

Aspen, a tree of low value, is often the first species to come in after clear-cutting fire or over-grazing. It should be replaced as rapidly as possible with more valuable species.



The black ash-white elm-red maple type occupies the wetter areas, in many hardwood swamps.



<u>Type Number</u>	<u>Name</u>
4	Aspen
5	Pin cherry
6	Paper birch
8	White pine - red oak - white ash
9	White pine
10	White pine - hemlock
11	Hemlock
12	Sugar maple - beech - yellow birch
13	Sugar maple - basswood
14	Sugar maple
14a	Black cherry
15	Yellow birch
21	Paper birch - white spruce - balsam fir
22	Balsam fir
23	Black spruce
24	White cedar
25	Tamarack
26	Black ash - white elm - red maple
47	Black locust
50	White oak
51	Red oak - basswood - white ash
52	Red oak
57	Beech - sugar maple
58	Beech
59	Ash - hickory
60	Silver maple - white elm
60a	White elm
88	Willow

Although twenty-eight cover types were identified in the watershed, over 90 per cent of the woodland acreage is contained within six cover types. In order of the area which they occupy these types are as follows:

Type 4 - Aspen, which occupies 8,254 acres or 23.6 per cent of the woodland acreage. Aspen is a pioneer type coming in after clear-cut operations, overgrazing or fire. It quite frequently is the invasion species on abandoned fields and pastures. Though it avoids the wettest swamps it does grow on soils that are wet throughout a good part of the year, and occurs as well on the droughty soils. Its associates may be large-toothed aspen, balsam poplar, red cherry, white elm and paper birch. An understory of dogwood or of spruce and balsam fir on the wet sites, or of tolerant hardwoods on the drier sites, is frequently present.



Stands of sugar maple and beech-sugar maple originally covered a large percentage of the upland areas of the watershed. As they occurred on the best agricultural soils, a large proportion of the original forest has been cleared. However, these are still among the most abundant and most valuable cover types on the Credit Watershed.

Type 24 - White cedar, which occupies 6,396 acres or 18.3 per cent of the woodland acreage. This type occurs most commonly on the muck soils of the swamps where it has such associates as black ash, white elm, tamarack, red maple, black spruce, yellow birch, hemlock, white pine and white birch. Where lime is plentiful white cedar may extend even to the droughty upland slopes where it tends to form pure stands.

Type 14 - Sugar maple, which occupies 16.2 per cent of the woodland acreage. This type and the closely related Type 57 (beech - sugar maple) originally covered most of the upland or better drained areas of the watershed, but since it occupied land which was considered fertile and with good moisture conditions much of it was cleared to make way for agriculture.

Calcareous soils are considered desirable for the vigorous growth of high-quality hard maple timber, and the upland soils of the area seem to satisfy this requirement well. Common associates of the type are white elm, white ash, basswood, black cherry and hemlock, with butter-nut, yellow birch and rock elm typically occurring in the lowland locations of the type.

Type 57 - Beech - sugar maple, which occupies 15.5 per cent of the woodland acreage. This is regarded as the typical association forming the climax type for the uplands of the region. Its associates are hemlock, white elm, basswood, white ash and black cherry, with hornbeam an important subordinate. The type, like Type 14 (sugar maple), was formerly very extensive in the area but, because it occupied the best land, its area has been tremendously depleted,

Type 60a - White elm, which occupies 12.6 per cent of the woodland acreage. Type 60a is very similar to the silver maple - white elm swamp type, but often occurs on somewhat drier sites.

Type 26 - Black ash - white elm - red maple, which occupies 4.7 per cent of the woodland acreage. This type occupies moist to wet muck or peat soils in swamps, depressions of slow drainage, elongated areas along small sluggish streams, and often covers extensive swamps. Its associates are balsam fir, balsam poplar, yellow birch, white cedar and sometimes tamarack, white pine, basswood and hard maple.

The remaining 22 cover types are present in amounts which vary from 1 per cent of the woodland within the watershed to trace amounts of four or five acres. Briefly these cover types may be described as follows:

Type 5 - Pin cherry is a pioneer cover type after cutting or fire.

Type 6 - Paper birch is another pioneer species.

Type 8 - White pine - red oak - white ash occurs on moist but well-drained soils, mostly on steep slopes overlooking the river in Esquesing Township.

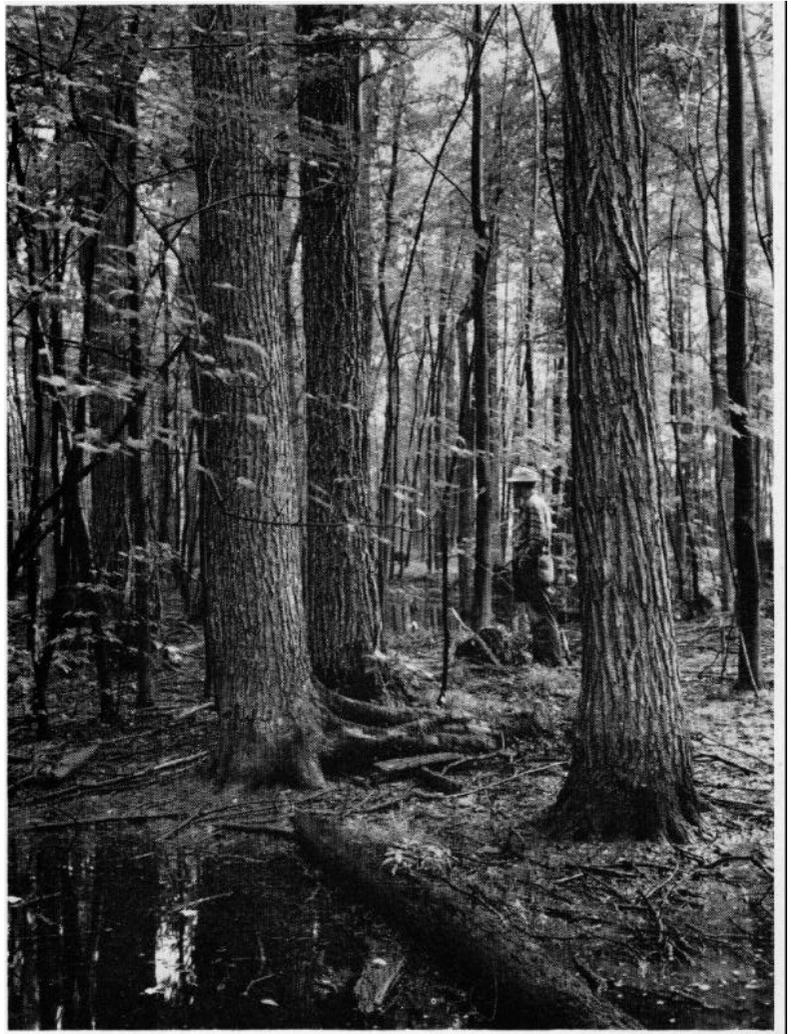
Type 9 - White pine, most common on light sandy soils.

Type 10 - White pine - hemlock, favours moister, cooler sites, ravines and north slopes,

Type 11 - Hemlock, similar to above type, but with hemlock predominant over any single associate,

Type 12 - Sugar maple - beech - yellow birch is a cover type which is close to its southern range (latitude and altitude) within this watershed, consequently it has a limited distribution.

The white elm type is common on sites which are seasonally wet but become dry in midsummer.



On drier sites hawthorn takes over abandoned fields. Unless these areas are reforested they will produce nothing of value for many years to come.

Poorly drained pasture may become covered with willow scrub. Unless drainage and pasture improvement are feasible these areas should be fenced and returned to forest cover.



- Type 13 - Sugar maple - basswood is another cover type in which hard maple is an important component of the stand. This type is important due to the demand for basswood logs.
- Type 14a - Black cherry, occurs in small patches on fertile well-drained soils; a temporary type following clear-cutting.
- Type 15 - Yellow birch, usually occurs on moist sites in small patches following cutting or other opening up of the forest.
- Type 21 - White spruce - balsam fir - paper birch is a type which is mainly confined to the fringe of swamps,
- Type 22 - Balsam fir occurs on imperfectly drained sites in valley bottoms and shallow depressions in rolling plains areas,
- Type 23 - Black spruce is an intrusion from the forest of Northern Ontario. It occurs on cold, poorly drained swamp land.
- Type 25 - Tamarack occurs on muck swamp with little or no drainage.
- Type 47 - Black locust, not native but may escape from plantations. Prefers dry, limey soils.
- Type 50 - White oak, occurs on well-drained soils in the extreme south end of the watershed.
- Type 51 - Red oak - basswood - white ash, contains a greater variety of species and extends a little farther north than the above type.
- Type 52 - Red oak, occurs as one small patch among the southern oak types.
- Type 58 - Beech, as a pure type is scattered in small areas through the watershed.
- Type 59 - Ash - hickory is a residual type which often occurs after logging and grazing of Type 60 stands,

FOREST COVER TYPES

Township	Acres	4	6	8	9	10	11	12	13	14	15	21	22	24	25	26	47	50	51	57	58	59	60	60a	88
Amaranth	31				3									5						23					
Mono	1,125	390	13				14	6		95				437	72	21				41					36
E. Garafraxa	1,075	217	19							170		17		304	23					166	16				143
Caledon	14,235	4,535	242			28	124	72	75	2,272	71	15	12	2,499	36	806				2,010	40				1,388
Erin	7,007	1,599	9				30	10		807		17	108	1,900	28	217	87			1,238	34		28		751
Albion	48	42																							4 2
Chinguacousy	3,376	244	117		4	24	39		297	678	12			393		172			37	481	16	127	118	592	25
Esquesing	6,229	1,093	172	75	9	81	22			1,356				854	31	346	4			942	36		11		1,191
Toronto	1,725		55		24		11	23		277				4		93	3	441	41	430	16	24			263 16
Trafalgar	179				8					34						4		14	8	85					26
Total	35,030	8,254	627	75	48	133	240	111	372	5,689	83	49	120	6,396	190	1,659	94	455	86	5,416	158	151	157	4,394	43
Per Cent	100	23.6	1.8	0.2	0.1	0.4	0.7	0.3	1.1	16.2	0.2	0.1	0.4	18.3	0.5	4.7	0.3	1.3	0.2	15.5	0.5	0.4	0.5	12.6	0.1

Four other types occur as traces each constituting less than 0.1 per cent of the woodland. These are:-

Type 5 = 5 Acres Type 23 = 10 Acres
 " 14a = 11 " " 52 = 4 "

Type 60 - White elm - silver maple, occurs in river bottoms and on swampy depressions in rolling plains.

Type 88 - Willow, occurs on wet sites along stream banks.

Summary of Cover Types

(a) The upland areas of most of the Credit Watershed are characterized by sugar maple and beech - sugar maple stands which are the common climax type for the Great Lakes - St. Lawrence Forest Region. These types make up 31.7 per cent of the total woodland of the watershed. These cover types once extended over most of the upland areas. As they occupied the most desirable agricultural land, a large proportion of these stands were cleared.

(b) The presence of oak types near the mouth of the river indicate that a small area along Lake Ontario may be included in the more southern Deciduous Forest Region.

(c) Aspen, which is a temporary type of low commercial value, now occupies 23.6 per cent of the woodland due to clear-cutting or other opening up of the forest. Much of this area could be occupied by more valuable forest species.

(d) The other common types are characteristic of swamp areas. White cedar, elm, and black ash - white elm swamps produce a forest crop on lands not suited for other use, and at the same time form valuable water storage areas.

(e) The twenty-two cover types making up the remaining 9 per cent of the forest cover indicate the great variety of local climatic, topographic and soil conditions found in the Credit Watershed.

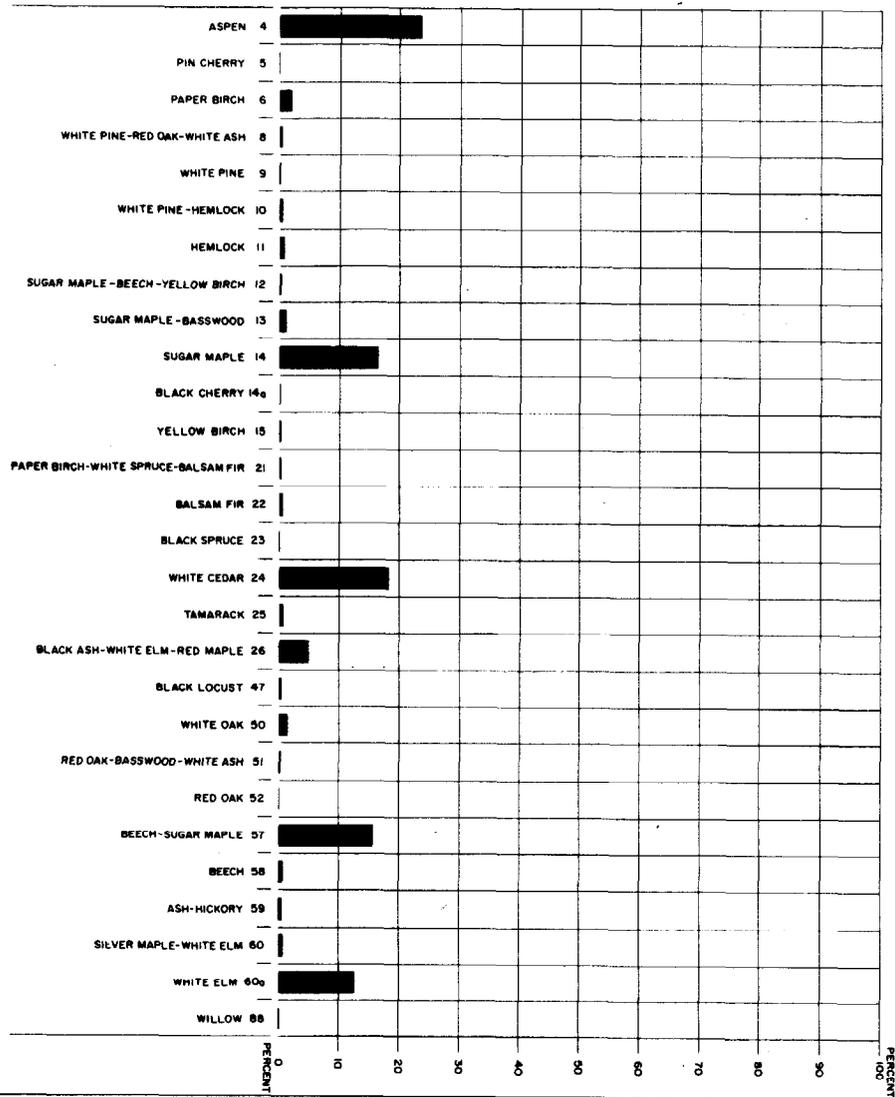
3. Condition of Woodlands

Conditions revealed by the survey are shown in some detail in the accompanying tables and graphs.

Woodland within the watershed comprises 35,030 acres, which is 16.3 per cent of the total area of 214,387

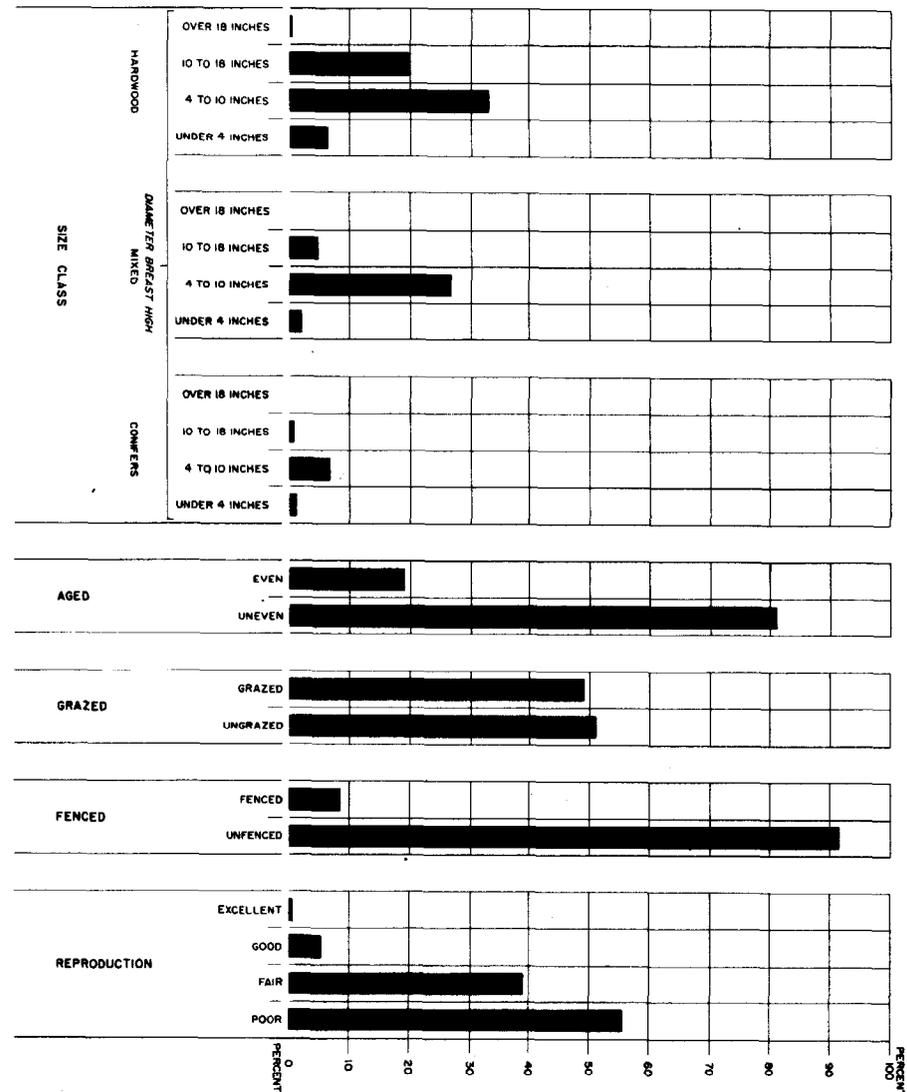
FOREST COVER TYPES CREDIT RIVER WATERSHED

PERCENTAGE OF TOTAL WOODLAND
1954



WOODLAND CONDITIONS CREDIT RIVER WATERSHED

PERCENTAGE OF TOTAL WOODLAND
1954



acres. Of this woodland, 59.3 per cent is classed as hardwood stands, 32.7 per cent as mixedwood, and only 8.0 per cent as coniferous. This indicates that even the cedar type has a considerable admixture of swamp hardwoods. As upland conifers and mixedwood types are relatively limited, the supply of softwood sawlogs from the area is very small.

Very little of the present woodland is mature and merchantable. Only 0.3 per cent, practically all hardwood, is classed as over 18 inches diameter breast height. Coniferous stands between 10 and 18 inches, the size desired for posts and poles, make up only 0.6 per cent. The 9.0 per cent of young stands, under 4 inches diameter breast height, and the 32.8 per cent of hardwoods between 4 and 10 inches will require some time to grow to merchantable size. This time may be shortened by thinning the stands where necessary. The remaining hardwoods between 10 and 18 inches diameter (19.9 per cent), mixedwood from 4 to 18 inches (31.0 per cent) and conifers 4 to 10 inches (6.4 per cent) will soon reach maturity and should pay for proper management in a relatively short time.

The survey indicates that 81.0 per cent of the woodland is uneven-aged, and therefore might readily become a source of continuous revenue to the owner. However, this continuous production will not last for long unless there is an improvement in natural regeneration in the woodlots. Over half the woodland area shows virtually no regeneration. Less than six per cent showed regeneration which could be classed as "good" to "excellent". One obvious reason for this condition is the fact that approximately half the woodlots are grazed.

4. Scrublands

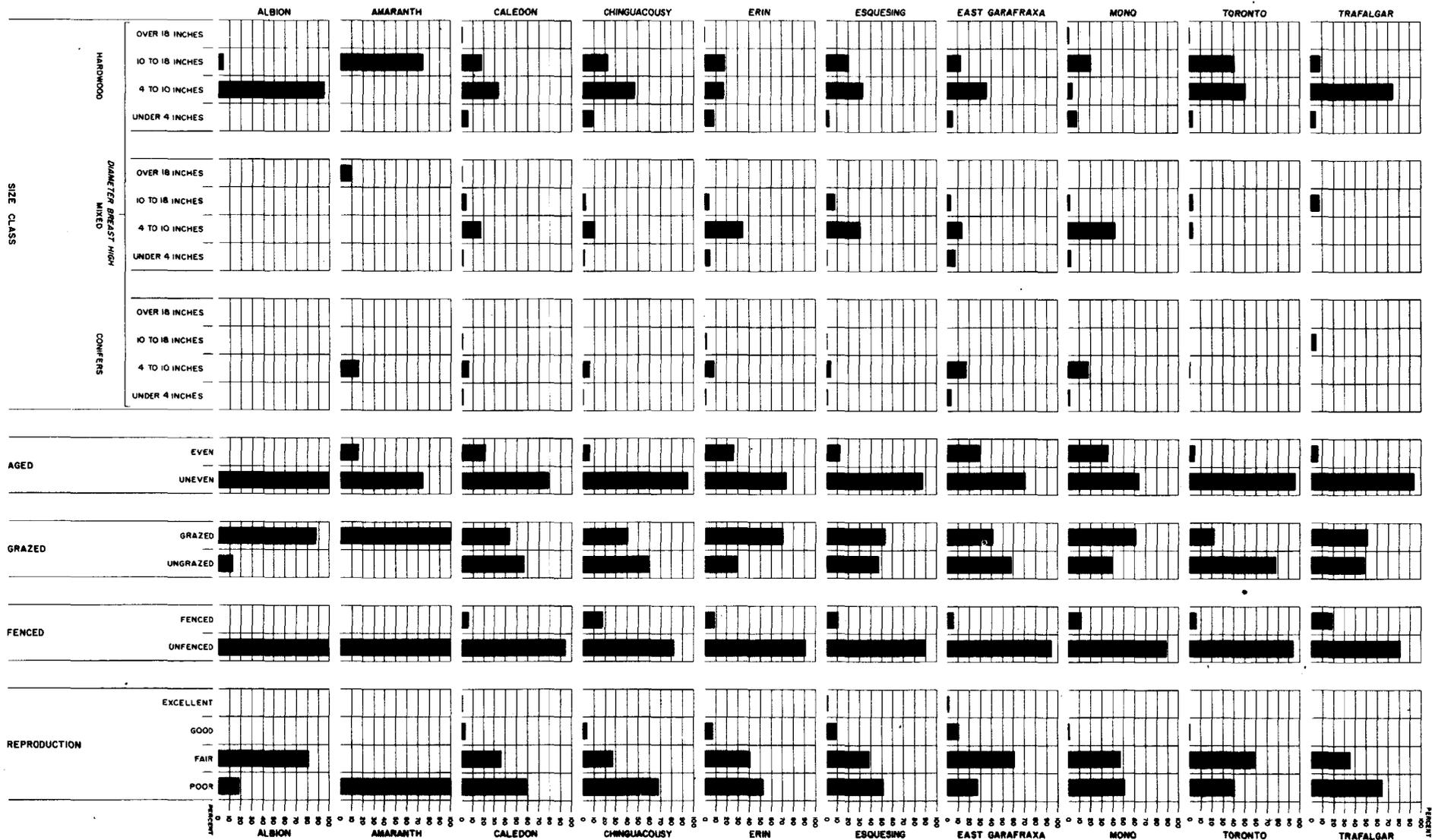
In all 5,033 acres in the watershed are covered with tree species which never attain commercial size. The

WOODLAND CONDITIONS BY TOWNSHIPS

CREDIT RIVER

PERCENTAGE BY TOWNSHIP

1954

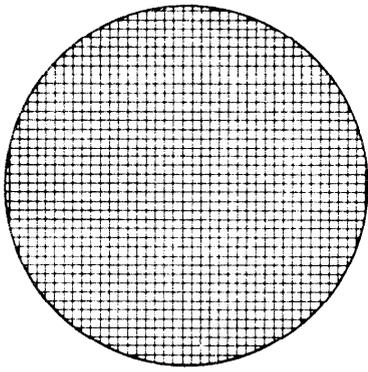


most common species are scrub willow and dogwood on poorly drained sites and hawthorn and sumach on dry sites. Much of this area is located on abandoned farmland or neglected pasture.

In some cases this land can be restored through drainage or through eradication of dry scrub. However, where such restoration does not seem economically feasible, the area should be returned to tree cover through systematic replacement of the scrub species with more valuable species.

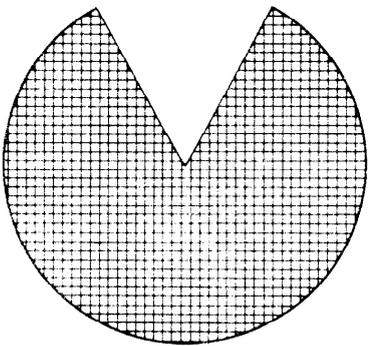
SCRUBLANDS

Township	Area in Watershed (Acres)	Scrub			
		Dry (Acres)	Wet (Acres)	Total Acres)	Total % of Twp. Area
Amaranth	1,210	-	-	-	0.0
Mono	6,394	-	184	184	2.9
E. Garafraxa	9,293	69	159	228	2.5
Caledon	63,110	539	1,079	1,618	2.6
Erin	34,157	742	339	1,081	3.2
Albion	288		11	11	3.8
Chinguacousy	34,598	421	84	505	1.5
Esquesing	35,117	897	384	1,281	3.6
Toronto	26,323	113	12	125	0.5
Trafalgar	3,898	-		-	0.0
Total	214,386	2,781	2,252	5,033	2.3



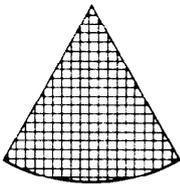
TOTAL AREA OF WATERSHED

214,387 Acres
(100%)



OPEN LAND

174,324 Acres
(81.3%)



WOODLAND

35,030 Acres
(16.3%)



WET SCRUB

2,252 Acres
(1.1%)



DRY SCRUB

2,781 Acres
(1.3%)

WJC

CHAPTER 3

SURVEY OF WOOD-USING INDUSTRIES

The present condition of wood-using industries in the Credit Watershed largely determines the local outlet for woodland products . At the same time the lack of assured local supplies limits the possibilities of expansion or even maintenance of this industry. The present survey covers sawmills, lumber yards, fuelwood and posts, maple syrup, and wood product manufacturers in or very close to the Credit Watershed.

1. Sawmilling

At one time many mills were powered by the waters of the Credit River. None of these are now in operation. At the time of the survey there were 6 mills operating on the watershed and 4 others within four miles of the watershed boundary , one powered by an old-time steam engine and the rest by gasoline or diesel engines.

All mills are small. One has a daily output capacity of 7,000 board feet; the others having capacities from 3,000 board feet down. Only one mill operates all year, producing 500,000 board feet of lumber. The others operate from a few days to a few weeks, as logs come in; their total annual output of 1,185,000 board feet representing only 62 days operation at full capacity.

Approximately half the present cut is custom sawing for local farmers to provide lumber for their own use or local sale. Sawing rates varied from \$10.00 to \$25.00 per thousand board feet, the lower rates being for softwoods which make up nearly half the total cut. Most of the millowners ' lumber is also sold locally, although one mill ships a small amount to the U.S.A.

All mills but one are permanently installed. The development of good roads and the ease of trucking logs from many small woodlots have encouraged this trend. Portable mills have been discouraged further by the lack of sufficiently

good stands of timber to pay for moving the mill to cut a single woodlot. As many of the old portable mills were inefficient and created a fire hazard near the woodlot, this trend need cause no regrets.

The following is a list of the sawmills investigated:

Reference No.	Township	Location
1	Toronto	Lot 3, Con.II E
2	Toronto	Lot 2, Con. I E
3	Toronto	Lot 12, Con. I W
4	Toronto	
5	Esquesing	Lot 20, Con. IV
4	Esquesing	Lot 12, Con. VIII
7	Er in	Lot 19, Con. VII
8	Caledon	Lot 31, Con. IV W
9	Chinguacousy	Lot 14, Con. IV
10	Mono	Lot 1, Con. III W

As there are no growth rate, yield or inventory data for Southern Ontario woodlots, it is extremely difficult to determine how the current annual cutting rate compares with the annual growth. With the present lack of management, it is likely that the woodland of the watershed is not producing more than the present meagre annual cut. With proper management it seems certain that the present woodland and submarginal land on the Credit Watershed could produce sufficient timber not only for full year-round employment of all present milling equipment but also for a considerable expansion in the industry. This would ensure more efficient use of equipment, better employment for mill workers and a better outlet for woodland products.

2. Lumber Yards

Seventeen firms selling dressed lumber and builders' supplies are located in the Credit area, the main concentration being in the south where post-war housing



Sawmilling in the Credit Watershed is mainly a part-time occupation for farmers and others who run their mills a few days to a few weeks each year.



Although diameter limit regulations restrict the slashing of woodlots for fuelwood, there is still much material available from tops and branches, and from defective trees which should be removed in woodlot improvement.

developments provide a ready market. Few of these companies were in business in the area before the war. Their market is almost entirely local but practically none of their supplies are from local sources. Their lumber, plywood and veneers come mainly from Northern Ontario, Quebec and British Columbia, with smaller amounts from other parts of Canada or imported from other countries.

3 . Fuelwood and Posts

The total volume of this material cut on the watershed cannot be readily estimated since most of it is used by the woodlot owner or his neighbours and does not appear on the market. Much of the fuelwood is produced incidentally from tops left in sawlog cutting and not as a separate operation. In the southern part of the watershed, where woodlots are scarce, the majority of the residents now burn coal or oil.

Diameter limits now prevent the wholesale commercial slashing of woodlots for fuelwood. There is, however, an abundance of low-grade material which should be taken out in improvement cuttings and thinnings and which could readily supply any fuelwood market. In fact, the development of all possible markets for low-grade wood products is a major requirement in encouraging woodlot owners to undertake such improvements. The main factor in the change from wood to coal or oil is not a saving in cost but the greater convenience of these latter fuels. Unfortunately this contrast in convenience has been unnecessarily exaggerated by the failure of manufacturers to develop and press the sale of improved wood-burning equipment. Such improved designs as have been developed are practically unknown in this area.

Because of the convenience of carload purchases and lack of an assured local supply, dealers in Cooksville and Clarkson bring in slabs and cordwood from Haliburton and Luskoka. Similarly, a Cooksville dealer purchases his cedar posts in Meaford.

4. Maple Products

The production of maple syrup on the Credit Watershed has dwindled in recent years until only the occasional sugar house remains. Syrup production is time-consuming work and present high labor costs are undoubtedly a major factor in the abandonment of this industry by many farmers. Only under conditions of lower labour costs or development of more efficient production methods can the many potential sugar bushes on the Credit Watershed be brought into production.

5. Local Wood- Using Industries

Twenty-four wood-using plants in or near the Credit Watershed were studied during the survey. These may be grouped as follows:

- (a) Furniture factories - 8
- (b) Sash and door 11
- (c) Miscellaneous
wood manufacturing 5

(a) Furniture Factories

These eight establishments, all in the southern part of the area close to markets and transportation facilities, produce household furniture, children's furniture, school desks, and also cupboards, show cases and counters. Some species such as oak, walnut, western white pine and parana pine are imported, but the bulk of the lumber used is of Canadian origin. The Canadian woods used are white pine, B.C. fir, poplar, white and yellow birch, basswood, hard maple, black ash. Most of these species are found in the Credit Watershed but none of the factories reported any purchases of local lumber. Since this industry can use small pieces and does not require high quality in parts to be covered by upholstery, it **should provide** a useful market even in the early stages of improvement of the woodlots of the Credit Water shed.

(b) Sash and Door

Most of the eleven companies producing these products are close to the rapidly developing building projects

along Lake Ontario, and many of these companies have started business since the war. Although a variety of woods are used to some extent, their main materials are the native or imported pines. Very little of this lumber is from local woodlots.

(c) Miscellaneous Wood Manufacturing

The five plants studied produce such varied products as boat seats, wooden heels, baskets, air registers and wooden tanks. Only one firm reports using any appreciable quantity of local wood, although all but one use some species which grow or could be grown in the area.

CHAPTER 4

FOREST CONSERVATION MEASURES IN PROGRESS

Present forest conservation measures in the Credit Watershed are almost entirely confined to areas north of Highway No. 7. Here the steep slopes of the escarpment, the poorly drained soils of the glacial spillways, and the rough hills around Orangeville all provide sites more suitable for trees than for agricultural use.

Nearer the lake increasing urbanization, and the mild topography suitable for intensive agriculture, prevent any extensive areas remaining in forest,

1. Demonstration Woodlots

The most important measure which could be taken for forest conservation would be the improved management of present woodlots. An early effort in this direction was the establishment by the Department of Lands and Forests of demonstration woodlots. These are areas of private woodland on which the owners have agreed to follow prescribed methods of woodlot management and to permit access to the area by interested persons.

Fourteen demonstration woodlots have been established in the Credit Watershed, distributed as follows:

Toronto Township	3
Esquesing Township	3
Chinguacousy Township	2
Caledon Township	6

Well conducted demonstrations could exert an influence for proper management in the surrounding area. Unfortunately, some of these demonstration woodlots have been cut over when the property changed hands, and others have been neglected so that they no longer serve their original purpose.

2. Tree Farms

In the past few years a movement has been under way to recognize well-managed forest properties as Certified Tree Farms. With the sponsorship of several organizations

interested in Setter forestry, the Canadian Forestry Association in 1953 formed a National Tree Farm Committee to recognize with a suitable sign and certificate those owners who agree to maintain their land for growing forest crops, protect the land adequately, agree that cutting practices will be satisfactory to ensure future forest crops, and permit inspection by Committee foresters. The first private Tree Farm to be certified in Ontario was the 325-acre property of Mr. E. R. Grange at Alton on the Credit River.

Several Conservation Authorities have become co-sponsors of the Tree Farm movement in their areas, and it is recommended that the Credit Valley Conservation Authority give its support to this movement.

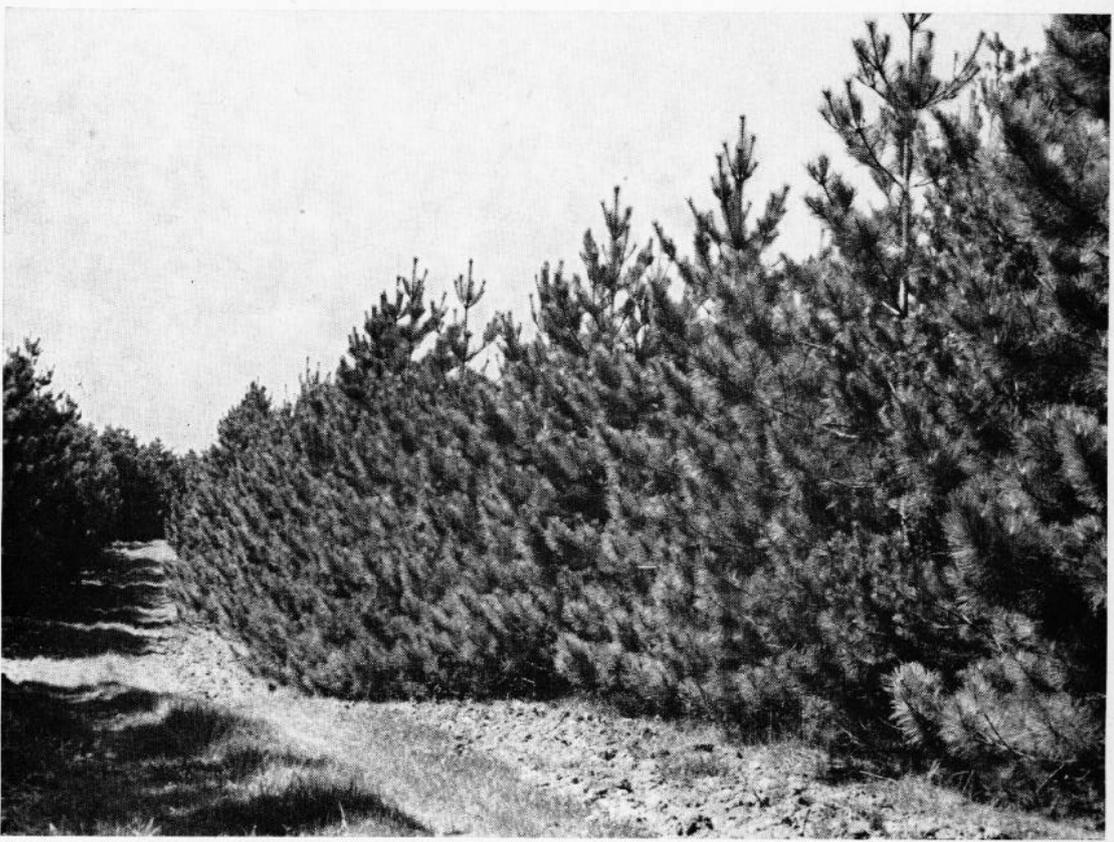
3. Private Planting

In the Credit Watershed there are 120 private plantations, covering 703 acres. Considering that this watershed does not contain large, easily planted sandy areas such as those which have stimulated planting in other parts of the province, this represents a worthwhile start in reforestation,

The distribution of these plantations by townships is shown below.

Township	No. of Plantations	Total Area in Acres
Amaranth	1	7
Caledon	79	571
Chinguacousy	7	17
Erin	8	17
Esquesing	15	45
E. Garafraxa	4	15
Mono	6	31
Total	120	703

At the common six by six foot spacing, about 850,000 seedlings



Private plantations such as this are already furnishing effective cover on some of the sandy hills.



The first private tree farm to be certified in Ontario was that of Mr. E. R. Grange at Alton.

would be required to plant this area.

Private individuals and municipalities may obtain advice and assistance in reforestation and woodlot management through the Department of Lands and Forests' Zone Foresters at Maple for Peel County, at Angus for Dufferin County, and at Hespeler for Halton and Wellington Counties, The Zone Forester also assists in the establishment of Authority forests, County forests, demonstration and school plots and demonstration woodlots.

The forest tree nurseries at St. Williams and Midhurst are the chief sources of planting stock for this area.

Survival and growth of seedlings have been good, but recent insect damage has caused some concern.

Few owners are interested solely in production of Christmas trees. However, in many plantations intended to produce a more permanent forest cover some Christmas trees are grown. These give an early return and help to defray the planting cost,

4. County Forests

The only county plantation within the watershed is a corner of the Peacock Tract of the Wellington County Forest.

The Peacock Tract, which contains 70 acres, was acquired by the County in 1944. A small portion of the tract is in natural cover; the remaining 68 acres of open land was planted with red, jack and Scotch pine, white elm, rock elm, silver maple and red oak. The planting was completed in 1945 by school children.

The first county forest in Ontario was established in 1922. The agreements which are in force at the present time run for a period of 30 years, during which time the Ontario Government agrees to establish the forest and pay the cost of such items as fencing, buildings, equipment, labour, maintenance, trees, etc. - in short, everything connected with the management of the forest.

At the end of the 30-year period the county has the privilege of exercising one of three options: First, to take the forest over from the Government and pay back the cost of establishment and maintenance without interest; second, to relinquish all claim to the forest, whereupon the Government will pay to the county the cost of the land without interest; third, the forest may be carried on as a joint undertaking by the Province and the county, each sharing half of the cost and half of the profits.

5. Tree-Cutting By-Laws

Under The Trees Conservation Act of 1946 and its successor The Trees Act (R.S.O. 1950, c. 399) twenty-one counties have passed by-laws to restrict and regulate the cutting of trees. These by-laws do not interfere with the right of the owner to cut material for his own domestic use, but specify certain diameters below which trees may not be cut for sale.

The limits provided by the counties covering the Credit Watershed are given below:

County	Diameter Limits in Inches						
	5	6	7	8	10	12	14
Dufferin	Cedar				Basswood	Others	
Halton			Cedar				Others
Peel		Cedar		Poplar Wh. Birch		Others	
Wellington	Cedar				Balsam Fir Poplar Ironwood Wh. Birch	Others	

All measurements are taken at 18 inches above ground. In general these limits are too low, and greater uniformity between counties would be desirable.

Such diameter limits are only an elementary step to prevent indiscriminate slashing of woodlands. Where these by-laws have been enforced rigidly they have proved of considerable benefit. There will, however, usually be fast-growing trees above the diameter limit which are increasing rapidly in value, and should be left for future cutting. There will also be poorly formed or diseased trees below the diameter limit which should be removed.

Better than a rigid diameter limit is the marking of trees for cutting according to their condition. Professional advice on such marking is available through the Zone Forester. Many tree cutting by-laws provide for the necessary variations from a strict diameter limit where the cutting is done under such supervision and in accordance with good forestry practice.

6. 4-H Clubs

These clubs are organized by the Ontario Department of Agriculture assisted by the Department of Lands and Forests and must be sponsored by an organization interested in the improvement of woodland and reforestation.

Members must be between 12 and 21 years of age and each member undertakes a project such as marking a half-acre plot of woodland for thinning or reforesting a quarter-acre of land. Projects are judged annually on Achievement Day and prizes awarded; for this purpose the Department of Agriculture furnishes \$3.00 per member and the sponsoring organization \$1.50. Winners may enter the Provincial Inter-Forestry Club Competition. Clubs open to students of the Credit Watershed have already been organized at Orangeville, Brampton and Georgetown.

Sponsorship of these clubs in the Credit Watershed would be a worthwhile project for the Authority,

7. Forest Conservation Measures in Other Areas

(a) Authority Forests

The agreements for establishment and management

of Authority forests, which have been drawn up between ten Conservation Authorities and the Ontario Government, are substantially the same as those made with the counties, except that the Government will provide half the land cost as an interest-free loan during the period of management. Authority lands are subject to municipal taxes. Under these agreements 18,600 acres had been acquired for reforestation and management up to December 15, 1954.

(b) Municipal Forests

Several municipalities other than counties have established forests, which are eligible for assistance from the Department of Lands and Forests. Some of these forests protect town water supplies, and all will eventually add to municipal revenues.

CHAPTER 5
A CREDIT AUTHORITY FOREST CONSERVATION PROGRAM

The activities through which the Authority may further forest conservation fall into three broad categories, In woodlot improvement demonstrations or private planting the Authority may co-operate with private landowners. In larger areas needing reforestation or management the Authority may acquire land and manage it directly. Through public meetings, field days and publications the Authority may educate and encourage residents of the Credit Watershed to practise conservation on their own lands.

Areas recommended in this chapter as suitable for private reforestation or public forest conservation measures are shown on the folded map in the back of the report.

1. Woodlot Improvement Projects

For most persons the best lesson in conservation is field observation of specific examples of the present abuses and efforts to remedy them. Woodlots chosen as illustrations must be near good roads and should be marked with large signs giving considerable detail of conditions and improvement measures in progress. Roadside or other parking facilities would have to be provided so that visitors could take the full time necessary for inspection without interfering with other traffic.

Some of the proposed improvements are experimental in nature. From the owner's point of view the whole program may seem to be of unproved value. On these sample areas the Conservation Authority is therefore fully justified in assuming part of the actual woodlot improvement cost as well as the cost of signs and parking facilities.

To use a private woodlot in this way for educational purposes would require a definite agreement with the owner to ensure that the proposed improvements were carried out, and that the benefits of this work would not be lost by a change of ownership or of attitude on the owner's part. In addition a detailed record of costs and returns would be necessary to

show other owners that it would pay for them to adopt similar practices in their own woodlots .

Some owners may be willing to see their woodlots used for such demonstrations, but wish to be relieved of any personal participation in the project . In such cases the Authority might lease the woodlot or purchase it outright.

Below are listed several examples of well-located woodlots suitable for Authority woodlot improvement projects. The Conservation Authority should decide on suitable forms of agreements leases, etc., explain the purpose of these projects to the owners and try to enlist them as co-operators, This list is by no means exhaustive, but serves to illustrate the type of woodlot suitable for such projects. (Map follow p. 33)

- (1) Lot 28, Con, VII, Erin Township
1 mile north of Hillsburgh

Mainly beech - hard maple, some over-mature, contains some ironwood, near road is too open and weedy, open to cattle, reproduction poor. This is a fairly good stand, but would show improvement from exclusion of cattle, planting of open patches, and removal of ironwood and some poor quality large trees which would give a return on the cost of improvement.

- (2) Lot 21, Con. X. Erin Township
2 miles north of Erin

Hard maple type, some poor quality hemlock and cedar, reproduction fair to poor, some grazing. Fencing from cattle and removing poor trees are the main needs. Here there is no sawlog material to cover costs.

- (3) Lot 29, Con, IIW, Caledon Township
1 mile south of Orangeville

Part beech - hard maple, some over-mature, part better quality hemlock, grazing has caused complete lack of reproduction. Fencing would involve an access lane to the watering pond , some old trees need removal after natural regeneration becomes established, and small open areas would need planting.

- (4) Lot 18 Con. VW, Caledon Township
3 miles south-west of Alton

Beech - hard maple type in poor condition from logging and grazing; remaining trees spreading, poor form; stand open, weedy. Needs fencing and probably tearing up of around surface (scarification) before regeneration would become established. Most of old trees would be better removed after reproduction is established.

- (5) Lot 15, Con VW, Caledon Township
5 miles west of Caledon

A former demonstration woodlot, hard maple with a small pine plantation. Fences have been neglected and cattle allowed in. Fence repairs, removal of poor trees, thinning of young stands, and pruning of the plantation are all required.

- (6) Lot 10, Con, VW, Caledon Township
half-mile east of Belfountain

Beech - hard maple, grazed and logged until it consist's of scattered spreading over-mature trees with no reproduction. Needs fencing to encourage natural regeneration, and later removal of old trees.

- (7) Lot 10, Con. IIIW, Toronto Township
At Meadowvale Station

A demonstration woodlot in beech - hard maple type, has been well treated. Needs some fencing and would be good example of results already obtained.

- (8) Lot 12, con, IW, Toronto Township
1 mile west of Highway No, 10

Elm type, open, with grass, weeds and hawthorn, has been grazed heavily, no reproduction. Requires fencing and scarification at seed time to get regeneration; would demonstrate what can be done with a badly abused woodlot.

- (9) Lot 12. Con. IINDS, Trafalgar Township
5 miles north-west of Erindale

White pine, poor for 5 because too open grown, heavily grazed, grassy. Fencing would need access lane to pond. Needs underplanting with white pine or ground scarification to secure natural regeneration.

2. Private Reforestation

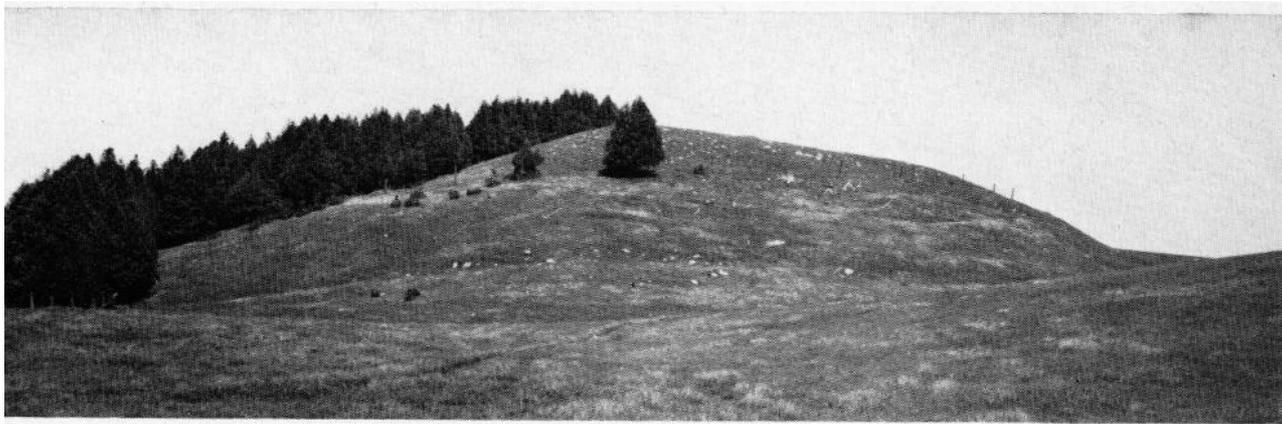
On many farms, even in the better farming areas, there are small tracts which; because of steep slopes, stoniness or poor drainage, would be better in tree cover. A total of 5,327 acres of such land requiring private reforestation were mapped in the recent survey. These tracts are not suitable for public acquisition and management, but the effect of reforestation control of run-off, improved summer stream flow and stabilization of wood-using industry justifies public assistance in such work. These areas have not been privately reforested heretofore because the owner has some other minor use for the area, because he is discouraged by the long period between planting and harvest of a forest crop or more commonly simply because of inertia on his part,

The interest of private owners in reforestation may be fostered in several ways. Public education! such as that now carried out by the Zone Forester in the district, can be furthered by the Authority. In addition, direct assistance to private planting can be given.

Several other Conservation Authorities have purchased tree-planters which supply a planting service to private owners at a nominal cost. Where rough ground makes hand planting necessary, some Authorities refund \$10 per acre if inspection shows that planting has been done carefully and the plantation is adequately protected from livestock.

It is the policy of the Department of Lands and Forests to charge \$14 per thousand for Scotch pine and \$10 per thousand for other planting stock. For some years trees were distributed free. Following the end of the war in 1945, the nurseries were unable to meet the greatly increased demand, and it was felt that a charge for trees would ensure more care in ordering the required amount and in planting the trees received.

The assistance schemes carried out by other Authorities have stimulated interest in private reforestation while still ensuring the good use of the planting stock. It is



Steep slopes and stony land unsuited to agriculture can be used profitably to grow trees.

Farms abandoned because the soil is too stony could again grow good crops of trees.



Lack of cover results in serious erosion. Reforestation of this land will induce rain and melt-water to enter the soil and feed headwater springs instead of running off as destructive surface flow.



recommended that the Credit Valley Conservation Authority adopt some similar policy of assistance to private reforestation.

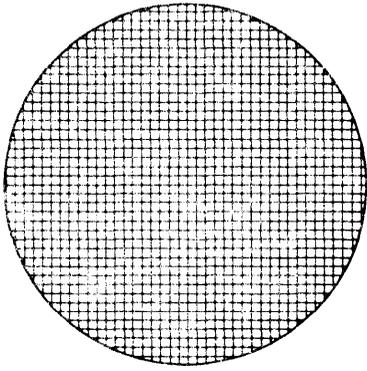
3. Credit Authority Forest (see map following p.33)

When large areas (100 acres or more) require reforestation or woodland management, the task is frequently too great for private initiative. In such cases acquisition by the Authority is recommended.. This is particularly desirable where these forests form natural water-storage areas which decrease the severity of floods and maintain the summer flow of streams. Other tracts which at present lie idle or produce only sparse, droughty pasture can again be made to add to the economy of the area through reforestation.

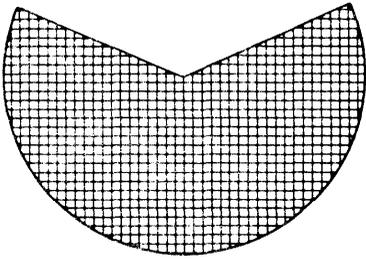
In all 4,743 acres are recommended for acquisition by the Credit Valley Conservation Authority. Of this total, 3,000 acres are open lands, 1,632 acres have some form of tree cover, 108 acres are scrub, and 3 acres are water. A minimum of land in better land classes has been recommended for reforestation. However, it was impossible to omit such land entirely when it formed a small part of a lot which was composed mainly of a poorer type of soil.

Because of the rougher topography in the northern part of the watershed, the recommended areas are concentrated in the townships of Mono, East Garafraxa, Erin and Caledon. As most of the streams in the watershed rise in these townships, this is also the area in which reforestation will have most effect on stream flow.

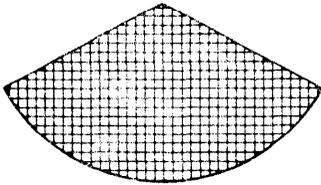
The problem of land acquisition should be approached carefully. In most cases purchase will be arranged by direct negotiation. The Authority should also be alert to acquire tax-delinquent lands. The Authority has the power to expropriate land and is justified in doing so when an unreasonable attitude on the part of the owner stands in the way of works urgently required for the general good. However, a favourable public attitude is essential to the furtherance of conservation and such powers must be used with discretion.



TOTAL AREA
OF
RECOMMENDED AUTHORITY FOREST
4,743 **Acres**
(100 %)



REFORESTATION LAND
3,000 Acres
(63.2 %)



WOODLAND
1,632 Acres
(34.4 %)



SCRUBLAND
108 Acres
(2.3 %)



WATER
3 Acres
(0.1 %)

LAND CLASSIFICATION
RECOMMENDED AUTHORITY FOREST

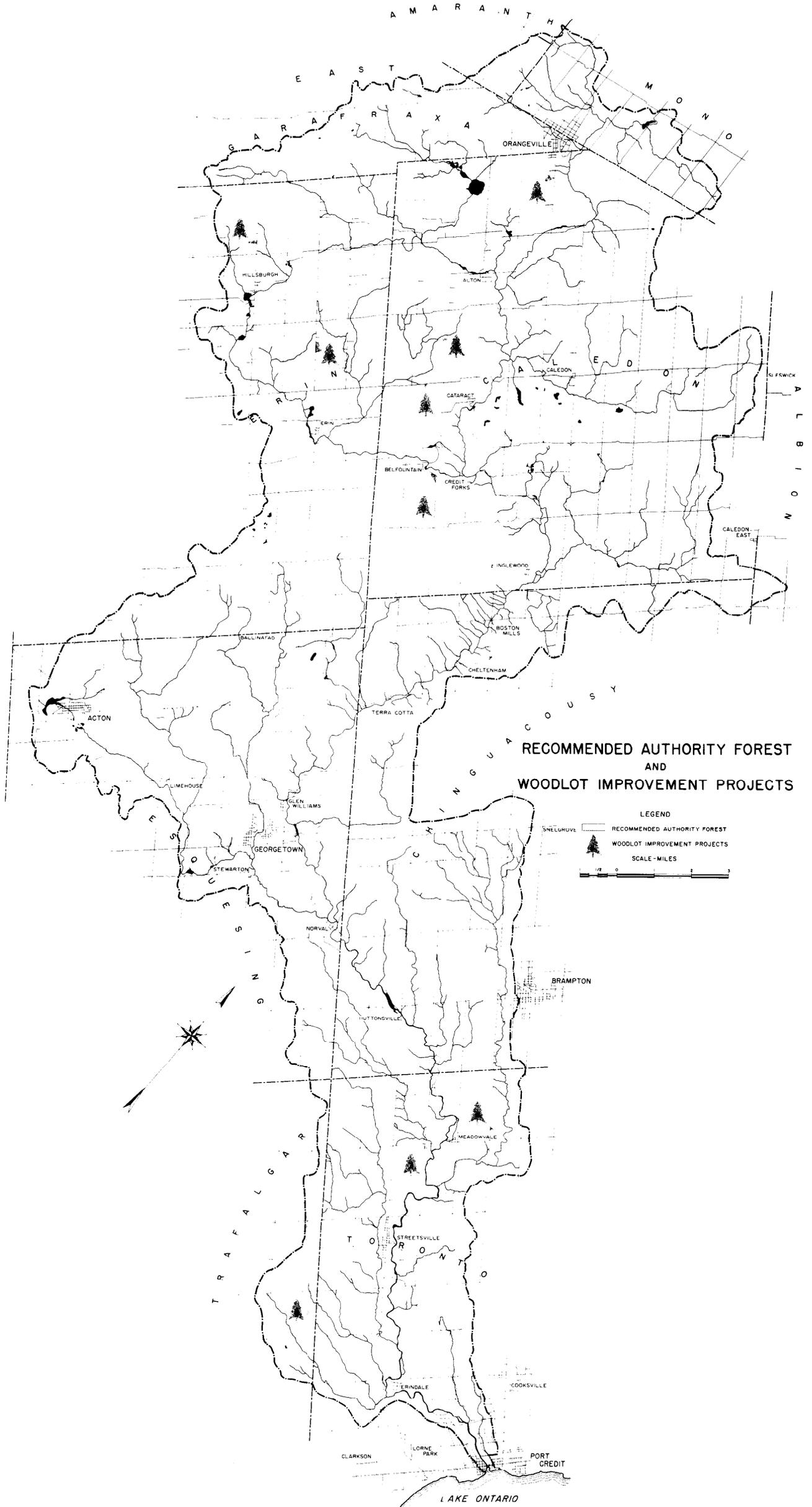
Very few of the recommended properties are occupied. In an exceptional case, if a hardship would be entailed by asking an old resident to move, **some special provision such as a life tenancy** of the house might be arranged.

Land prices paid by different Conservation Authorities and even within the individual Authority have varied greatly. The Grand Valley Conservation Authority, on purchases of 1,615 acres, has paid an average of slightly less than \$12 per acre. The Humber Valley Conservation Authority, nearer the Toronto metropolitan area and more influenced by suburban price, has had to pay nearly \$32 per acre for the 708 acres it has purchased for reforestation.

4. The Authority and Conservation Education

Many agencies at present do, or can, engage in conservation education. The Authority can supply opportunity ties and materials to encourage and enlarge these activities. **Wall maps**, literature, conservation pictures and conservation lectures supplied to the schools will help to give geography, history and conservation practices a local significance. Building up a library of slides on local conservation problems and accomplishments would be of great assistance to speakers. Organization of public meetings and contact with individuals and groups such as farm forums will gain support for both private and public conservation efforts. Landowners should be encouraged to make greater use of the services available from the Conservation Authority and from officers of the Department of Lands and Forests and the Department of Agriculture.

The most effective educational activity is actual participation in or field observation of conservation activities. Tree planting days, group visits to woodlot improvement projects and conducted tours **over** a well organized **conservation trail** could all be sponsored by the Conservation Authority. These activities would all stimulate individual action on forest conservation measures, such as those described in the following chapter, which cannot be carried out directly by the Authority.



CHAPTER 6

FURTHER FOREST CONSERVATION MEASURES REQUIRED

1. Woodland Management

The woodlot inventory shows that there are 35,030 acres of woodland on the Credit Watershed. Practically all of this area requires better management. While experimentation is desirable to determine the best method of handling certain problems, the general principles of woodlot management have been known for years but have not been applied. A free advisory service is available from the Zone Foresters, but is not sufficiently used, and a readily understood pamphlet on "The Farm Woodlot" can be obtained from the Department of Lands and Forests.

One of the most difficult problems confronting the private owner in the management of his woodland is the utilization of the small woodland products which can be readily made and handled by the owner. These products such as fuelwood, pulpwood, bolts, posts and poles, if properly harvested, increase the productivity of the woodlot and the gross returns per acre. The volume of these small products has been reduced by diameter limit regulations which have restricted the wholesale commercial slashing of woodlots. Nevertheless, much material of this type could still be produced from thinnings and improvement cuttings and from limbs and tops of trees. The difficulty of marketing such low-grade material has seriously hampered owners in carrying out the needed improvement work in their woodlots. Any means which can be discovered for using small and poor-grade wood should be developed to the fullest extent. At the present time interest is increasing in the possibility of manufacturing wood chips in the woodlot by means of a portable chipper. Such chips can be used for the manufacture of pulp for paper, and as cattle bedding and chicken litter, which can subsequently be spread on fields to increase the humus content of



Unmanaged stands contain poorly spaced, diseased or poorly shaped trees and often lack regeneration.



Spreading wolf-trees take up room which should be available for profitable well-formed, vigorous trees.



Thinning of this young maple stand has improved the spacing and given each tree room for more vigorous growth.

the soil. They can be made from any species of wood, and tops and branches can be utilized. The number of pulp companies which can use hardwoods is limited at the present time and only those making kraft paper can use chips containing bark, but the demand for hardwood chips will increase and portable barkers are being developed. Every woodlot owner should consider the possibility of improving the quality of his woodlot by utilizing the low-grade material as chips or otherwise.

Owners of large woodlots might be encouraged to undertake thinnings and improvement cutting if equipment or trained crews were available at reasonable cost. The Authority should consider offering such a service. As an alternative, the Authority might offer a subsidy for each acre improved to its specifications and found satisfactory on inspection by the Authority's officers.

2. Elimination of Woodland Grazing

The Report of the Ontario Royal Commission on Forestry, 1947, contains the following statement:

"The most widespread abuse of forests is that of utilizing them as pasturage for animals. If this practice alone could be eliminated more than half the battle to save Ontario woodlots would be won. Forestry and pasturage cannot succeed on the same piece of ground, as diametrically opposite conditions are necessary for each.

"It is foolish to consider replanting millions of acres to forests unless the owners of millions of acres already under forest are convinced of the necessity and economy of caring for them in such a manner that they will be perpetuated and improved."

This is not a new theme. As early as 1908 the Ontario Legislature, in providing an exemption of one acre in ten used for forestry purposes, included a "no grazing" clause. There are a number of reasons for the widespread practice of allowing woodland grazing. The woodlot has always been considered a pasture field even though the value of woodland pasture is low compared to cleared land. The reason for its low carrying capacity is partly because grass grown in the



Heavy grazing has removed all regeneration as well as the natural covering of the forest floor. If woodlot pasturing were eliminated the most destructive factor in farm woodlands would be removed.

shade is not nearly as high in food value as that grown in full sunlight. The following statement in respect to woodland pasture has been made by leaders in agriculture: "On the whole, the opinion of the Agronomists is that, on the average, woodland pasture will produce about one-sixth the quantity of pasturage, and the quality will be about one-half as good as that of the improved pasture". Weeds are usually prolific in wooded pastures, often smothering most of the grass.

If shade is required for stock, it may be desirable to leave a portion of the woodlot in the pasture when fencing the woodlot. Another solution is to establish small groves of fast-growing hardwoods which can be fenced temporarily until the trees are sufficiently tall that browsing will not damage crown growth. Where springs or streams that supply water for the stock are situated in the woodlot access may be trade to a trough near the spring and the area should be fenced to prevent trampling.

The economic fallacy of grazing woodlands is illustrated by the following examples:

(a) *The Wisconsin Agriculture Experiment Station measured the total yield per acre of dry matter from three types of pasture over a five--year period in Richland County:

Improved pasture (grass and legume)	3,210 lbs.
Unimproved open pasture	1,453 lbs.
Woodland pasture	276 lbs.

Here the improvement of one acre of open pasture provided a gain of 1,757 pounds of feed, which is equivalent to the forage from 6.4 acres of woodland producing at the rate of 276 pounds per acre. In this case the improvement of about **6.5** acres of existing open pasture would provide all the additional roughage that could be obtained from 40 acres of woodland.

* The Case Against Cows. Wisconsin Conservation Bulletin, December 1951.

(b) *The U.S. Soil Conservation Service co-operating with the Wisconsin Agriculture Experiment Station conducted studies which showed that the daily pasture cost per cow was greater in woodland pastures. Taxes and other charges against the land, fencing, costs of establishment and acres required per cow were all considered. The study showed the relative daily pasture costs per cow on different classes of pasture to be approximately as follows.

Rotation pasture	5¢
Open permanent pasture	6¢
Improved pasture	5¢
Wooded pasture	17¢

At this rate, for a 180-day grazing season, woodland pasture cost \$30.60 per cow, whereas on improved pasture the cost was \$9.00. In other words, wooded pasture cost over three times as much as improved pasture.

(c) A fully timbered average maple stand, 60 years old, may yield about 4,000 board feet of saw timber per acre, net scale, in the Credit area. Such a woodlot is virtually ruined by 29 years of heavy grazing, whereas 20 years of protection and no logging may increase the net volume to approximately 8,500 board feet per acre. The gain of 4,500 board feet is equivalent to an annual increase of 225 board feet per acre. At \$28 per thousand on the stump this amounts to a mean annual gross income of \$6.30 per acre over the period of utilizing only the increase in volume.

Basically the problem in grazing, as in all woodlot forestry, is the fact that a tree takes not one or two seasons but often more than the lifespan of a man before it is ready for harvest. This makes it difficult for many owners to

* Soil Conservation Service, U.S. Department of Agriculture, Forestry Handbook (Fourth Edition). 1948. Upper Mississippi Region. Compiled and Edited by S.S. Locke, Chief Regional Forestry Division.

understand the advantages of proper care for their woodlots or submarginal land. Examples such as those given show that good forestry practice in the woodlot will return more dollars than the scant forage value which it may produce for Livestock. The Authority will find very little local or regional data on woodlands to prove these arguments on economic return, and should recommend that the appropriate agencies extend their studies in this field.

The number of cattle permitted to graze and the size of the woodlot have a direct relationship to the damage which is done. A large woodlot, of course, is not as seriously damaged by a few head of cattle as a small one. However, in most cases where grazing is permitted over a number of seasons the damage is serious.

Livestock admitted to woodland browse on the leaves and shoots of small trees and ride them down, and by scuffing the surface roots of larger trees injure them and permit entry of fungus diseases.

Field observations indicate that cattle have preference habits in grazing woodlands. Unfortunately this preference is for the more economically desirable species such as maple, basswood, elm and beech, whereas undesirable species such as hornbeam, blue beech, dogwood and hawthorn are grazed only when cattle are seriously underfed. This combination of factors, under continued grazing, changes not only the quantity but the quality of the reproduction and so the succeeding stand. The poorer hardwood species, and conifers where these occur, are favoured. The invasion of pastures by cedar and hawthorn is an illustration of this grazing preference.

Continued overgrazing affects natural reproduction both directly and indirectly; directly in so far as it affects the reproduction itself and indirectly through its effect on the soil. Livestock trampling compacts the soil, breaks up the protective layer of litter, exposing the mineral soil to drying, and

the cattle, by consuming the vegetation within reach, reduce the volume of litter naturally returned to the soil. It is this litter which keeps the soil open or porous and in a highly absorptive state. Thus water relations are changed, which adversely affects the rate of tree growth and may early eliminate seedlings which manage to make a start in the compacted soil.

A woodland is doomed where conditions persist which will not permit natural regeneration. After a time with no new growth to replace larger trees which die of natural causes, the canopy begins to open up, and sunlight let in further dries out the soil. Weeds and later grasses which require plenty of light gain a foothold and a sod begins to form. In general, tree seeds which germinate cannot compete with an established grass cover, As these effects of grazing progress the stand becomes open or park-like and eventually all the trees disappear.

Livestock grazing affects more than the growth of trees on the owner's land. Soil erosion in the woodland increases as the absorptive capacity and mechanical protection afforded the soil by the litter is reduced. The open canopy exposes the soil to the erosive force of rain impact and a compacted soil forces overland movement of water. Livestock tend to follow trails in the woodland and these often become centres of serious erosion. Thus continued grazing increases surface run-off and soil erosion.

Soil losses and the amount of water which ran off the land were measured at the Soil Conservation Experiment Station, La Crosse, Wisconsin. The following table-2 shows the results of measurements of four heavy rains recorded during the 1935 growing season on three separate watersheds having the same soil type.

* Technical Bulletin No. 973. U.S. Department of Agriculture, Soil Conservation Service. 1949.

	<u>Run-Off</u>		<u>Soil Loss</u>
	Inches	<u>% of Total Precipitation</u>	(Lbs. per Acre)
Watershed A (Grazed Woods)	1.01	12.61	1,560
Watershed B (Protected Woods)	.02	.25	20
Watershed C (Open Pasture)	.34	4.24	560

Watershed A: 2.67 acres of second growth hardwoods.
Slope 15 - 18 per cent.
Grazed to optimum carrying capacity.

Watershed B: 11.5 acres of second growth hardwoods.
Slope 25 - 50 per cent.
Neither grazed nor burned.

Watershed C: 5.85 acres cleared of second growth timber
in 1932.
Slope 25 - 35 per cent.
Grazed to optimum carrying capacity.

Obviously continued woodland grazing is more than the private affair of the property owner. Anything which contributes to soil loss and to increased surface run-off lowers the yield capacity of the land on the one hand and adds to the flood hazard on the other. The lessened value of wood products reaching the market and the increased cost per cow on poor pasture are economic losses to the community as well as to the individual. The Authority is therefore justified, not only in carrying out a vigorous campaign of education in woodland improvement, but also in offering direct assistance to woodlot owners. The County of Halton has already adopted a program of assistance for fencing of woodlots, although to date this program has not had a very marked success. It is recommended that the Credit Valley Conservation Authority through discussions with woodlot owners should formulate some modification of -this program which will stimulate action toward the elimination of woodland grazing and the improvement of private woodlands.

In spite of the studies and publicity to date, the seriousness of the grazing problem has not yet been brought home to the person most concerned, the farm woodlot owner. It is recommended as a step in this direction that the Authority publish a simple, attractive bulletin on woodlot grazing.

3. Forest Fire Protection

In spite of the publicity given to the damage caused by fire the average person does not realize how serious this is, Though he may know that young growth and small trees are burned by surface fires he does not realize the extent of the less obvious damage such as the destruction of humus which itself preserves the condition and water-retaining capacity of the soil. When the humus and ground cover are destroyed the sun and dry winds remove the moisture required for tree growth and plant nutrients are destroyed. The heat of the fire also injures the growing tissue inside the bark of older trees which are not actually burned, exposing the wood to attack by insects and fungi. Even though through time the wounds may be completely healed, the damage shows up as defects when the tree is cut for lumber.

Many landowners in Southern Ontario are so completely unaware of, or indifferent to, the damaging effects of fire that they deliberately set fire in peat land to burn off the peat, starting fires which it is next to impossible to extinguish. Such fires burn for months, even under the snow, destroying many acres of woodland every year, not only on the land of the person setting the fire but frequently spreading over land adjacent to it.

The first step in fire control is fire prevention, and the best assurance of prevention is an enlightened public opinion which will make every member of the rural community conscious of the seriousness of the fire damage and of his duty as a citizen to do all he can to prevent it. The farmer can prevent most fires in farm woodlots if he exercises

the same care the he does around his home and buildings. It is particularly necessary to exercise such care in areas which have been cut recently, since the accumulation of slash **creates** a serious fire hazard. Close utilization of tops and the scattering of slash so that it lies close to the moist ground and rots faster will help to reduce this danger.

From the evidence collected in the northern states of the United States, where conditions most nearly approximate those of rural Southern Ontario, it is apparent that the most effective fire protective systems are those set up under the following conditions:

- (a) Where the system is organized under the direction and control of the state forester and the wardens in each town are appointed by him on the recommendation of the local council.
- (b) Where wardens paid an annual retainer are actual residents in the locality. Usually they are farmers who have had practical instruction in fighting fire, They have the power to call out other local residents to help in fire-fighting and maintain a store of fire-fighting tools on their premises,
- (c) Where the warden is assisted in his work by all members of the community. That is, his address and telephone number are known to everyone and fires are reported to him immediately.
- (d) Where designated members of the community know that they are likely to be called on to fight fire and are paid so much per hour for the time they are so employed.
- (e) Where every resident is thoroughly fire-conscious and realizes that loss of timber by fire is a loss to the whole community, and considers it his duty to prevent, report and fight fire.

(f) Where fires for burning brush and rubbish may be set only after a permit has been obtained from the local firewarden.

It is therefore recommended that the Authority set up a committee to determine the best method of providing fire protection for public and private lands, through the co-operation of the Department of Lands and Forests, for the protection of woodlands in the Credit Watershed.

If opinion in favour of such a move were sufficiently widespread, it is possible that all of Southern Ontario could be declared to be a "fire district" under The Forest Fires Prevention Act. This would place organization and administration under the experienced staff of the Department of Lands and Forests. The Select Committee on Conservation, 1950, recommended that:

"On application to the Minister of Lands and Forests, the boundaries of the fire district should be extended to include those municipalities or areas that have 25 per cent or more of their area classified as woodland, slash, waste or swamp lands; and

In all other municipalities the Minister of Lands and Forests should be empowered to enter into agreements to provide forest fire protection and to charge a portion of the cost back to the said municipalities."

In the meantime powers already exist for counties, under The Fire Extinguishment Act (R.S.O. 1950, Chapter 142), and for townships, under The Municipal Act (R.S.O. 1950, Chapter 243, Section 388) and The Fire Guardians Act (R.S.O. 1950, Chapter 139) to appoint officers and make regulations for the prevention and suppression of fires in their areas,

4. Protection from Insects and Diseases

In projects such as the public and private reforestation recommended for the Credit Watershed, careful consideration should be given to the prevention of outbreaks of insects or tree diseases and adequate arrangements made for the immediate application of control measures when these become necessary. While it is not possible to predict accurately the

course insects or disease may take under the ever-changing conditions of a newly forested area, there are a number of fundamental principles which, if applied, will greatly lessen their destructiveness.

Large areas of one kind of tree present ideal conditions for an outbreak of insects or fungus disease. Mixing species in the plantation or separating the species in small blocks tends to slow the spread of outbreaks until natural agencies bring them under control or direct control measures can be applied.

It is important to plant only the species of trees suitable to the site and existing growing conditions. Healthy, vigorous trees are certainly more resistant to attack than weak, struggling ones.

Over-mature and dead trees should be removed from the existing stands as these harbour bark-beetles and wood-boring insects which may become excessively abundant and attack healthy adjacent trees. Fungus infections may likewise spread from such sources.

Care should be exercised to prevent ground fires. Even light ground fires are frequently followed by severe outbreaks of bark-beetles and wood-boring insects and fungus infection at the base of the trees.

Woodcutting operations, sawmill sites and wood storage yards should be carefully supervised or they may become reservoirs of infestation.

It is essential that an inspection be made each year so that any abnormal increase in insects or disease may be noted and control measures initiated before the outbreak becomes serious. Prompt action may reduce control measures to a comparatively easy task and confine damage to a small area.

(a) Some Important Insect Pests

The White Pine Weevil has caused serious damage to plantations by attacking the leading shoots of young white

pine. As this insect prefers to work in full sunshine, white pine should be grown in mixture with some other species which will shade the pine in its early years.

In recent years the European Pine Shoot Moth has increased to epidemic proportions in red and Scotch pines. Investigations are under way but no simple and effective control measures have yet been discovered. Another enemy of these species, the Root-collar Weevil, has recently been reported near Angus in Simcoe County. This insect kills young trees by girdling them below the ground. In the U.S.A., where this insect is better known, certain emulsions applied around the base of infested trees are said to give good control.

Leaf-feeding insects may kill conifers by one complete defoliation and hardwoods by defoliation for three years in succession. However, even partial defoliation may so weaken trees that they will be attacked by other enemies. Protection from leaf-feeding insects is therefore desirable. This is the kind of attack against which spraying is most successful.

Since investigations of forest insects are constantly under way, the owner considering insect control should always check with the Zone Forester to find the most effective methods now in use.

(b) Tree Diseases

The chief diseases of the hardwoods are the various trunk, butt and root rots, and chronic stem cankers, which are all endemic and may cause serious damage under aggravating conditions. Woodlots on the Credit Watershed present very diverse conditions with respect to the incidence of these diseases, a circumstance which is usually related to their past history. Thus many containing old timber are in need of heavy preliminary salvage and sanitation cuttings as a result of mismanagement or neglect. Such cuttings should precede or be combined with cleanings and improvement cuttings, designed to improve the composition and structure of the stands, Having

Ordinary care and simple measures such as this ploughed fire-guard greatly reduce the danger of fire in plantations and woodlots.



This attractive pond developed from spring source provides a water supply in case of fire in the adjoining plantation.



Well placed windbreaks protect crops and control wind erosion and snow drifting



established a sanitary condition, normal care should maintain it and obviate loss on account of decay.

The wood rots are commonly thought of as diseases of mature and over-mature timber, but experience has shown that infection may occur at a very early age. In hardwood sprouts the stem may be infected from the parent stump, In older trees infection is chiefly through wounds, either of the root or trunk, which may be caused by fire, trampling by animals, insects, meteorological agencies, or by carelessness or accident in felling and other woods operations.

For many reasons "cleanings" in the reproduction are desirable, especially where the woods have been heavily cut, Besides favouring the valuable species, those stems which are of seedling origin should be favoured over stump sprouts which are more liable to decay.

In harvest cuttings, which should recur at frequent intervals, the permissible volume allotted should include trees in which incipient decay is discovered and so far as possible those which have become a poor risk through injury or other circumstances.

The white pine blister rust is a serious enemy of that important species, .It can be controlled by elimination of the currant and gooseberry bushes which spread the disease. This is economically feasible where white pine is growing on good sites, and where a considerable concentration of white pine on a small area reduces the labour involved.

5. Windbreaks and Shelterbelts

In the process of clearing land for agriculture woodlots and belts of trees along fence lines have been removed which had served as natural shelterbelts. The restoration of these in the form of windbreaks is essential to a complete conservation program in many parts of Southern Ontario,

When proper species are used and windbreaks are correctly placed the effects are almost entirely beneficial. The effects may be direct or indirect, but in either case are the result of reduction in wind velocity. The effects of windbreaks on crops and cultivated fields may be listed as follows:

(a) Direct Effects

- (1) Wind damage and lodging in small grains and corn is reduced or eliminated-
- (2) Snow and the resultant moisture are more evenly distributed over fields, particularly on the higher spots where they are required most.
- (3) Wind erosion of the soil is minimized.

(b) Indirect Effects

- (1) Moisture loss by evaporation is reduced.
- (2) Temperatures in the fields are raised, which may prevent frost damage, accelerate growth and even lengthen the growing season slightly.
- (3) Erosion of the soil by water may be reduced by its more even distribution when released from snow.

The benefits of windbreaks to buildings in reducing heat loss in winter have been shown to be considerable. Experiments conducted in the United States proved that more than twice as much heat is lost from a house, per day or per hour, with a wind of 20 m.p.h. as with one of 5 m.p.h., and a windbreak can easily reduce wind velocities in this proportion. Used in this way they can often be made to form an effective background for the house and a protection for farm buildings. Another advantage of windbreaks is that they provide shelter and runways for insectivorous birds and small animals,

Belts of trees comprising one or two rows are usually called windbreaks, and with more than two rows, shelterbelts. In Southern Ontario windbreaks as a rule give sufficient protection except where wind erosion of soil on rolling land is severe, when shelterbelts may be required. On level land windbreaks may nearly always be established along existing fence

lines, but on rolling land consideration should be given to the contour of the land. The prevailing winds in Southern Ontario are generally from the west, so that the greatest protection will be derived from windbreaks on the west side, but the placement of windbreaks on the other three sides as well should be considered.

Both the height of the trees and the wind velocity influence the effective range of a windbreak. An average windbreak will reduce the ground velocity of a 20-mile wind 10 per cent or more for a distance of about 30 times the height of the trees. About one-fourth of this effect will be felt on the windward side of the windbreak and three-fourths on the leeward side. For example, if the trees are 40 feet high the total effective range with a 20-mile wind will be 30×40 or 1,200 feet, 300 feet of which will be on the windward side and 900 feet on the leeward side. Generally speaking, the reduction in velocity is greatest close to the windbreak and tapers out to zero further away. With higher wind velocities and/or higher trees the proportionate reduction and the effective range will be greater,

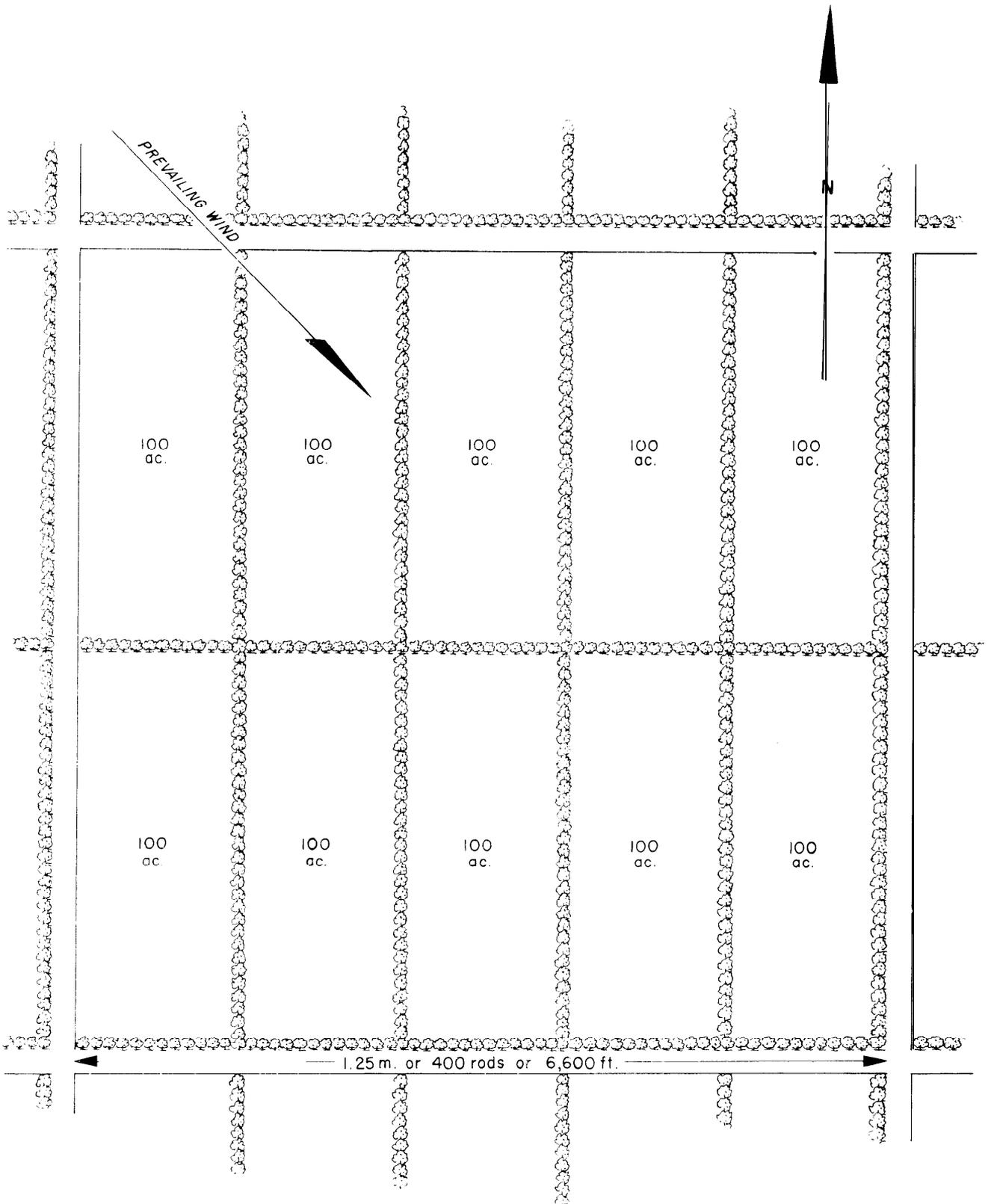
European alder is gaining great popularity as a windbreak tree because it is a nitrogen-fixer like the legumes and does not rob the soil to the same extent as non-nitrogen-fixing species.

One consideration that should be kept in mind is that under certain circumstances windbreaks may cause air stagnation, which may increase temperature and moisture conditions to a dangerous degree in summer or increase frost damage in spring and fall on small areas, particularly in hollows. Where this is likely to occur, windbreaks should be planted so as to guide the flow of air past such spots, Where these conditions develop after the windbreaks are established they may be relieved by judicious opening up of the windbreaks.

WINDBREAK PLAN

for

1,000 ACRE BLOCK



This plan shows the minimum windbreak requirements for a 1,000 acre block on level land. Woodlots and plantations will replace some of this and placement will have to be adjusted according to topography and soil on rolling land.

Experience has shown that windbreaks are an asset to any farm, that their adverse effects, if any, are local and easily remedied, and that in many areas they are essential to the control of soil erosion by wind. It is therefore recommended that the Authority encourage the establishment of windbreaks by private owners in every way.

6. Snow-Fences

In the climate of Southern Ontario snow drifting may cause much inconvenience and sometimes hardship. Control can be readily effected by means of windbreaks and is dependent on proper placing with reference to lanes of travel and topographic features,

Where space is limited or land valuable lath or board fences are frequently used, but the cost of erection, removal or maintenance of these can be materially reduced by using trees as permanent windbreaks or shelterbelts.

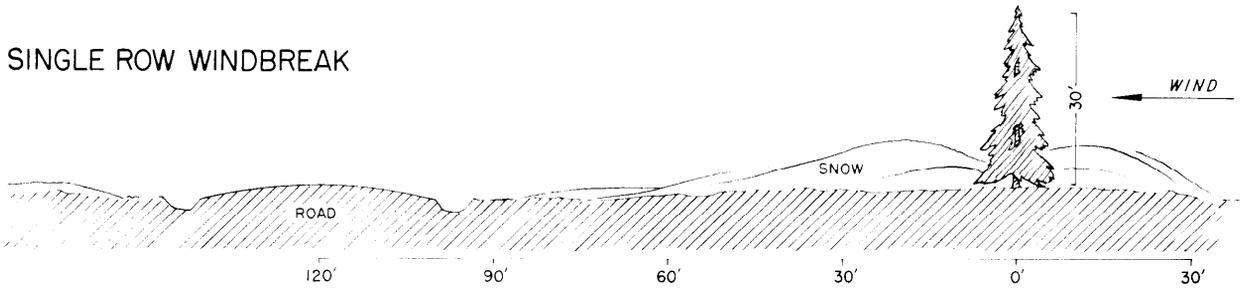
The object of a snow fence is to mechanically reduce wind velocity near the ground in such a manner as to cause a drift to form where it will be least harmful. The reduction in velocity creates two pools of relatively calm air. a small one on the windward side and a much larger one on the leeward side, and it is here that drifts form, leaving the area farther to the leeward free of drifts and comparatively free of snow. As winds become stronger the wind reduction and the width of the calm pool on the leeward side will increase and the centre will tend to move farther away from the windbreak.

A wide belt of trees which will accumulate a large drift of snow on its windward side may be planted right to the edge of the road, the windward edge extending back a distance equal to three or four times the height of the trees and generally at least 100 feet.

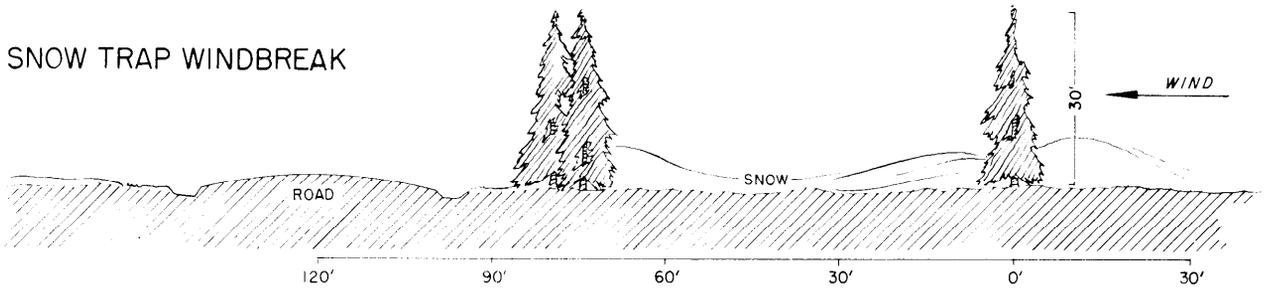
In some places the snow trap type of windbreak is effectively used. It is composed of one or more rows of

SNOW FENCES

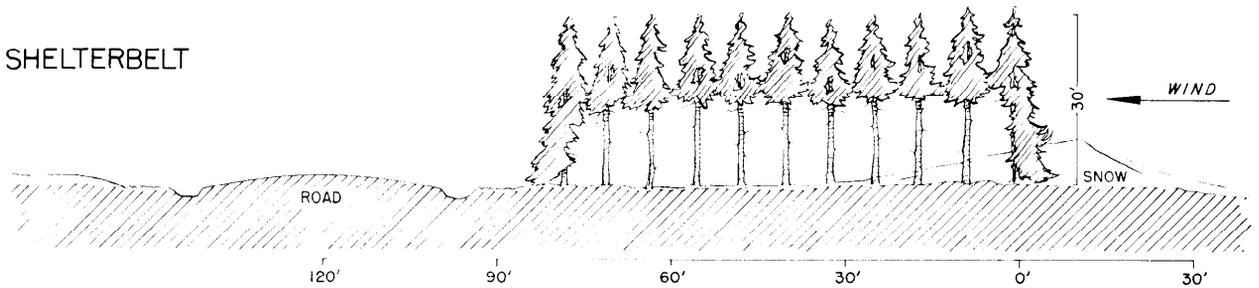
SINGLE ROW WINDBREAK



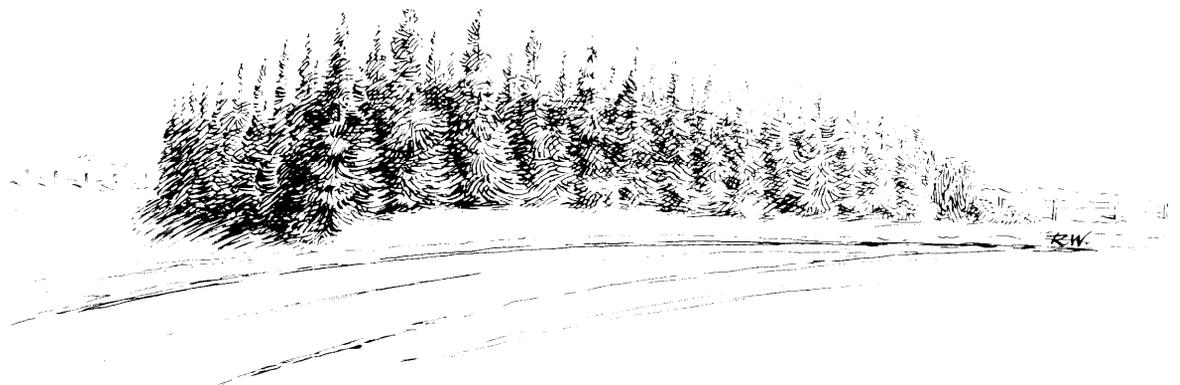
SNOW TRAP WINDBREAK



SHELTERBELT



CROSS SECTIONS OF ROAD AND SNOW FENCES



Two methods of preventing drifts at the ends- left end of shelterbelt terminates at a hollow, right end is tapered down to the ground

trees close to the road with a wide opening to windward and then a single row of trees. The single row arrests the first force of the wind and the snow is deposited in the opening. This has the advantage of requiring fewer trees than the shelterbelt and leaving the ground between open for cultivation in summer.

Poor placement of windbreaks may accentuate drifting conditions. A single row of trees, unless it is a dense coniferous type, is seldom dense enough to completely stop winter wind, and may likewise create drifts.

Any prejudice which may exist against windbreaks for protection against drifting snow on roads arises from such poor or poorly placed windbreaks. If a windbreak has openings in it or if it ends abruptly streamer drifts will form. Windbreaks should be kept dense and tapered down at the ends by using progressively smaller species of trees and shrubs to prevent the formation of streamer drifts.

Trees are being used successfully as snow fences in Ontario by the Department of Highways, by railways and by a number of counties. Every encouragement should be given to the establishment of such snow fences in place of the removable type of lath fence now in use,

CHAPTER 7

THE HARVEST AND MARKETING OF THE WOODLAND PRODUCT

Conservation means the wise use of our resources. Forest conservation therefore implies the harvesting of a crop when it is mature. This concept is equally opposed to the liquidation of forest capital by the slashing of woodlots, and the equally wasteful idea that no tree should be cut until it rots and dies. When the farm woodlot is managed according to good forestry practice, cutting at intervals removes only the annual or periodic growth and leaves the forest capital and the secondary influences of the forest unimpaired.

Many farmers strive for a high yield per acre in agriculture, but few give comparable attention to the productivity of their woodland,. In part this lack of interest has been caused by the fact that under a clear cutting system the harvest has been so infrequent, perhaps only once in a man's lifetime. As a consequence the owner has little experience in timber sales, is ill-equipped to estimate either the quantity or quality of his product, is at a disadvantage in bargaining with a timber buyer and feels, sometimes unjustifiably, that he is being treated unfairly. This chapter points out some of the things that the owner needs to know in order to realize that conservation is a worthwhile business,

1. The Timber Harvest

Harvesting of timber involves four distinct operations; estimation of volume, cutting, skidding and hauling. The owner may perform all operations, selling his logs at the mill; he may cut and skid the logs, selling them at the roadside; or he may sell his timber on the stump.

(a) Estimating

Estimation of timber may be done either in the tree (cruising) or in the log after cutting (scaling) .

Some operators cruise timber by rough ocular estimate; that is, by walking through the bush and estimating, on the basis of past experience, the number of board feet in the stand. The most accurate method would be to measure each tree, consider taper and defect, estimate and tally its volume. In large wooded tracts only a representative sample, say 10 per cent or 20 per cent, may be measured, and the total estimated from this sample.

One example may illustrate the value of a tallied cruise. Some years ago in competitive bidding for 87 acres of woodland one operator estimated a stand, by tallying every merchantable tree, to be 700,000 board feet; the chief log buyer for a large furniture manufacturer estimated 350,000 board feet; another operator estimated 100,000 board feet. The actual cut from the stand was 746,000 board feet. Obviously such discrepancies are of concern to the seller as well as to the bidder who tries to maintain his place in competitive buying. Before selling standing timber it would pay the owner to make a tallied cruise or, if necessary, to hire professional assistance for this purpose.

Similarly when selling logs the owner or his agent should assist in their measurement, try to understand the allowance which must be made for defects, and assure himself that he is being fairly treated.

(b) Cutting and Skidding

In large-dimension hardwood timber in reasonably dry level bush an experienced two-man crosscut crew can make from 3,000 board feet to 4,000 board feet of logs per day. Under poorer conditions, with heavier underbrush in softwood swamps, the figure might be nearer to 1,500 board feet.

With recent improvements, power saws have become more popular where there is any large quantity of timber to be cut. Power saws require a considerable capital outlay, but with proper maintenance production is almost trebled.

The horse is still the most adaptable medium of power for transporting logs from the tree to the roadway. Where conditions are not too difficult a caterpillar tractor or winch is often used.

In a typical hardwood operation the value of logs at the roadside may be half as much again as that of logs in the standing tree. The difference is mainly labour cost. By performing the operations of cutting and skidding the farmer increases his return by selling his labour and use of his equipment instead of just his stumpage. The flexibility of woods work in fitting into otherwise slack seasons on the farm should make this increased return particularly attractive. In addition, the farmer doing his own cutting is best able to determine that the right trees are removed and damage to the remaining stand kept as low as possible.

(c) Hauling

Truck hauling has increased the distance from which mills can secure their logs. Cost per thousand board feet hauled depends largely on distance. Thus, while grade 1 logs might be hauled up to 50 miles, the lower value of other logs might limit practical hauling distance to 15 or 20 miles.

While actual figures will vary greatly, the example below will suggest the change in log value at various stages.

Value of logs in the tree (stumpage)	\$28.00	per	M	bd.	ft.
Making logs from tree	8.00	"	"	"	"
Skidding logs to road	6.00	"	"	"	"
Hauling logs to mill	8.00	"	"	"	"
	<hr/>				
Value of logs in millyard	\$50.00	per	M	bd.	ft.

2. Timber Sales

(a) Outright Sale of Woodlot

Frequently a saw-miller finds the simplest procedure is to buy the woodlot or farm outright. In this case the former owner has no further interest in the land. The

practice of slashing such woodlots and leaving them to become tax-delinquent was a legitimate cause for community concern. Where tree cutting by-laws are rigidly enforced this abuse should be kept under control.

(b) Sale of Cutting Rights

Under this method the owner sells the right to cut all timber of certain species down to a certain diameter; or the trees to be cut may be marked in advance and the sale made on this basis. Often only a very vague word-of-mouth agreement is made and misunderstandings are common. A simple written agreement such as suggested later in this chapter would avoid this confusion.

A lump sum method of payment is often used on such sales, based upon a volume estimate by the buyer. As mentioned in the section on cruising, the volume estimates of different bidders may vary considerably. The seller is therefore advised to consult the list of buyers of woodland products in the hands of the Zone Foresters and to obtain competitive bids from as many buyers as possible. On lump sum purchases the buyer takes all the risk as to accuracy of estimate and quality of timber.

Selling the standing timber at a rate per thousand feet removes the uncertainty of volume estimates and requires measurement of the logs after cutting. Two uncertainties remain, the log rule to be used in measurement and the assignment of logs to different grades which differ in prices per thousand board feet. For provincial government transactions the new Ontario log rule is now required; but for private sales there is no set standard, the Doyle rule being most commonly used. The woodlot owner seldom knows the problems of processing logs into lumber sufficiently well to understand fully why the buyer assigns some logs to lower grades. (See later discussion of log grades.) Possible arguments and ill-feeling on this account are factors in making

some buyers prefer lump-sum purchase. The woodlot owner must decide whether to accept volume and grade risks in the hope of getting a better price by selling on a log measurement basis.

In the event that he chooses to be paid on a volume removed basis, just what the buyer intends to cut and pay for should be absolutely clear. Only the best trees might be removed and it is possible that only the best logs from these trees might be taken. This leaves the owner with many poor quality logs which he cannot readily sell and with some poor trees standing which he wanted cut. The volume actually paid for might be small and the woodlot owner's total realization on the transaction might be less than he would have received had he accepted payment in a lump sum.

No matter which of these two methods is chosen, a written Timber Sales Contract should cover the transaction. It should set forth all the details necessary as to prices, species, sizes, rights granted to the buyers, limiting dates, times of payment, and so on.

(c) Owner-made Logs

The woodlot owner who has decided to realize not only the value of his woodland product but also the additional labour income derived from its harvest prefers to take payment at a price per thousand board feet for logs placed on skids at the roadway or logs delivered to the mill, Here again the securing of competitive bids and a clear understanding with the buyer regarding log grade will avoid any feeling of unfairness in the deal, An owner who simply arrives at the mill with a load of logs may feel that he has to accept the offered price even though he is dissatisfied.

3. Log Price and Grades

A woodlot owner may wonder when the sale price at the mill for "select grade " hard maple in two-inch stock

is \$200 per thousand board feet and at the same time the price he receives for standing maple may average only \$60 per thousand for good trees. But he should also note that No. 3 Common is selling for about the same price as he is paid for his standing timber and this grade is not paying the mill its costs. Also select grades represent only a small percentage of the mill run, generally less than 15 per cent in hardwoods, The operator has to handle, manufacture and market large quantities of timber of marginal and submarginal sale value in order to offer to the market the small percentage of high-grade stock which puts the economic picture of the operation in a better light; higher grades must carry the burden of lower grades.

The amount of lumber which can be sawn from a log depends upon the skill of the sawyer, number of defects present, shape of the log, thickness of the boards or timbers sawn and the amount of saw kerf. The defects may be either visible or hidden. Logs are graded on the visible defects, allowance for hidden defects such as those caused by old maple syrup spiles or overgrown limb stubs proving a problem. The effects of the various defects or combination of defects on the grade-volume outrun of the lumber at the mill is not easy to appraise, and only those with considerable experience at the headsaw and at grading lumber can attempt it. Since probable grade output per log is important the buyer considers this when buying stumpage or logs. Generally operators classify logs in at least three grades, and sometimes four, and pay for logs according to these grades.

Sometimes the grading rules are rigid, but in most cases they vary from flexible to vague. In fact some buyers do not grade at all but buy at a set price per thousand board feet bush run. However, even with those buyers who have reasonably well defined log grading specifications, the specifications are rarely available in a tabulated form to a log

seller. The log buyer simply keeps in mind certain basic principles and grades on his knowledge of what can be sawn from each log. Log grading rules therefore are not only indefinite but also vary from one operator to the next. This lack of standardization, lack of publication and the obscurity of log-grading rules increases the general confusion regarding them to the extent that it becomes extremely difficult, if not actually impossible, for the woodlot owner to compare the log price-grades of different buyers - and a quoted price per thousand board feet actually means very little to the man selling logs. Tables showing a comparison of grades and prices paid for these grades, by two hardwood operators and two softwood operators, are found on the following pages. Consulting the price lists in the table for operators "A" and "B", it appears that operator "A" pays by far the best price for hardwood logs and that selling to him would bring the maximum dollar return. However, upon examination of the grading rules it is found that there are other very important factors which will affect the transaction and that price must be correlated with grade. Although operator "A" offers \$90 per thousand board feet hard maple of grade 1 quality, the log must be over 16-inch top diameter and have no defects at all. Of all the logs sawn in the district only a small percentage would possess the qualifications necessary to admit them to this grade category. Therefore the best price that will be obtained from operator "A" for the majority of the logs sold to him will be that of grade 2, \$60 per thousand. If the logs were sold to operator "B", more of the logs would be in the grade 1 category because his specifications for top grade are not as exacting, some knots, shake and heart rot being allowed. To illustrate these price-grade variations more clearly, five hypothetical 12-foot logs with different defects are listed below in table form and the price they would command from the two operators are shown.

LOG PRICE LISTS FOR TWO HARDWOOD OPERATORS
WITH GENERAL LOG GRADE SPECIFICATIONS

Prices quoted are those paid per M bd. ft. by Operators A and B for logs delivered to the mill. Roadside logs bring \$5 to \$10 less than these prices.

Species	Grade 1		Grade 2		Grade 3	
	A	B	A	B	A	B
Hard maple	\$90	\$70	\$60	\$50	\$35	\$30
Beech	70	50	45	35	25	20
Elm	75	55	50	40	30	25
Basswood	85	70	55	50	35	30
Birch	75	55	50	40	30	25
Ash	75	55	50	40	30	25
Hickory		70		50		30
Cherry		70		50		30
Hemlock	65	50	40	40	20	25

LOG GRADE SPECIFICATIONS

Grade	Minimum Diameter (Inches)		Minimum Length (Feet)		Knots Permissible	
	A	B	A	B	A	B
1	16	14	12	12	None	Up to 3 small tight
2	12	10	12	8	1 to 2 small tight	No loose
3	8	8	8	8	Several small tight, 2 or 3 loose	Several small tight., 1 to 2 loose
	Diameter of Centre Shake Permitted in a 10-inch Log (Inches)			Diameter of Heartrot Permitted (Inches)		
	A	B	A	B	A	B
1	None		1		None	1
2	1		2		1	2
3	3		4		3	4
	Seam Permitted			Crook Permitted		
	A	B	A	B	A	B
1	None	None	None	None	None	None
2	None	Small straight	None	None	None	up to 10% volume reduction
3	Straight only	Half spiral	None	None	up to 30% volume reduction	up to 30% volume reduction

LOG PRICE LISTS FOR TWO SOFTWOOD OPERATORS
WITH GENERAL LOG GRADE SPECIFICATIONS

Prices are those paid by Operators C and D per
M bd. ft. delivered to the mill

Species	Grade 1		Grade 2		Grade 3	
	C	D	C	D	C	D
Spruce	\$70	\$70	\$60	\$50	\$50	\$30
Balsam	70	70	60	50	50	30
Hemlock	60	70	50	50	40	30
Cedar	60	70	45	50	35	30
Pine	110	90	85	70	60	50

LOG GRADE SPECIFICATIONS

Grade	Minimum Diameter (Inches)		Minimum Length (Feet)		Knots Permissible	
	C	D	C	D	C	D
1	14	16	12	12	3 to 4 small tight	1 small tight
2	12	14	12	10	6 to 8 small tight	3 to 4 small tight
3	7	8	8	8	Over 8 small tight All logs with loose knots	Not more than 6 small tight nor 2 loose
	Shake Permitted				Heartrot Permitted	
	C		D		C	D
1	None		None		None	None
2	20" for 10" log		None		2" for 10" log	2" in 10"
3	If log volume reduced 30% or more		2" to 3" in 10" log		If log volume reduced 30% or more *	3" in 10"
	Seam Permitted				Crook Permitted	
	C		D		C	D
1	None		None		None	None
2	None		None		None	None
3	No more than half spiral		One straight seam only		30% volume reduction	Slight only

* Although the sawmillers whose grades are listed do not want to accept logs with more defect than is shown by Grade 3, they sometimes feel compelled to do so, particularly Operator D, whose grades are more exacting, Operator C has turned logs away that would not reach his lowest specifications.

<u>Diameter</u> <u>Small End</u>	Defects	<u>Price Paid per M Board Feet</u>	
		Operator "A"	Operator "B"
18"	Clear	\$90	\$70
16"	3 knots, other- wise sound	\$60	\$70
14"	Clear	\$60	\$70
12"	2 tight knots 1.5 heart rot	\$35	\$50
10"	crook (30% volume deduction)	\$35	\$30

It can be seen therefore that the log seller must, to realize his greatest profit, examine the grading rules and prices of the different buyers and consider which will best suit his particular type of timber - despite the difficulty of following such a practice.

Buyers' needs for timber are different and fluctuate and so the amounts they will pay also vary. There may be special orders or contracts beyond general sales. Such orders might call for concentration on elm of hockey-stick grade, maple of heel-stock grade and so on. In some cases buyers will pay premium prices for special logs that will satisfy good contracts. In other contracts an order may allow certain defects such as dark heart or sound knots which may not generally be allowed in the sale of the species, and a heavy run of rough legs may be allowed at good prices to satisfy a contract. At another time such rough logs would be of no interest to the buyer. Special prices of this nature should be made known.

A good buyer, in making a stumpage purchase on a per thousand basis by log grade, will walk the woodlot with the owner and try to illustrate the various log grades according to external appearance. In this way the owner is more likely to receive an idea of the probable log-grade run in the sale.

Much of the scepticism in the minds of the woodlot owners toward dealings with log buyers would disappear if there was less obscuring of the grading standards. Some buyers feel that they must say that they operate with open books. Generally this is true. A good way to show this is to make available price lists and general log grade specifications together.

It is evident, however, that the grading rules must also be standardized if the woodlot owner is to achieve an understanding of the rules comprehensive enough to enable him to compare effectively the prices offered by different buyers and thereby choose and receive the maximum market price for his logs.

To arrive at a set of volume-grade rules which will be of acceptable accuracy, fairness and clarity presents several problems. The first step, to evolve a system of scaling which will give consistent log volume content, is not too difficult. Such a system has been devised and practised by the Division of Timber Management, Department of Lands and Forests, for some time and is laid out in the Manual of Scaling Instructions. The greatest difficulty lies in creating a system which will give consistent log grade in which allowance must be made for downgrading due to external (e.g. knots, burls, scars) and internal (e.g. spiral grain, discolouration, mineral stain) defects. The solution to this problem is not at once apparent. One approach to downgrading might be to make an allowance on a percentage basis as is done in reducing log volume for crook. Another might be to reduce grade on a point system based on the visible defects of the ends and sides of the log. Whatever plan is eventually adopted, its evolution will be complex and require a great deal of study. It is therefore recommended that the Authority request the Department of Lands and Forests to conduct a program with the object in view of standardizing hardwood log grades based on defects and how they limit the use to which the log can be put.

4. Timber Sale Contracts

As an aid to people who are unfamiliar with timber sale agreements, a sample contract is given here. It shows the more important provisions that should be included in a contract for the sale of marked trees to be scaled in the log. Substitute clauses are given for use in other kinds of sales. No single form of contract will suit all classes of sales, but owners of woodland timber should have no difficulty in adapting this contract to their use.

SAMPLE TIMBER SALE CONTRACT

Agreement entered into on this.....day of between..of hereinafter called the seller, andofhereinafter called the purchaser.

Witnesseth:

ARTICLE I. The seller agrees to sell the purchaser, upon the terms and conditions hereinafter stated, all the living timber marked or designated by the seller and all the merchantable dead timber, standing or down, estimated to be board feet, more or less, on Lot.....Con.....in the Township of County of.....and located on a farm owned by the seller and about.....miles from.....

ARTICLE II. The purchaser agrees to pay the seller the sum of **more** or less, as may be determined by the actual scale, at the rate of..... per thousand feet..... payable prior to the date of removal of material, in instalments of.....each.

ARTICLE III. The purchaser further agrees to cut and remove said timber in strict accordance with the following conditions:

1. Unless an extension of time is granted, all timber shall be cut, paid for, and removed on or before.....
.....

2. Saw timber shall be scaled by the.....
.....log rule, and measured at the.....
.....

3. The maximum scaling lengths of logs shall be 16 feet; greater lengths shall be scaled as two or more logs. Upon all logs an additional length of 4 inches shall be allowed for trimming. Logs overrunning this allowance shall be scaled not to exceed the next foot in length,

4. No unmarked timber of any kind shall be cut, except
.....

5. Stumps shall be cut so as to cause the least possible waste - stumps of trees up to 16 inches in diameter, not higher than 12 inches above the ground, and those of trees above this size at a distance above the ground not greater than three-fourths of their diameter.

6. All trees shall be utilized in their tops to the lowest possible diameter, for commercially saleable material.

7. Young trees shall be protected against unnecessary injury; only dead trees and less valuable kinds may be used for construction purposes in connection with lumbering operations.

8. Care shall be exercised at all times by the purchaser and his employees against starting and spreading of fire.

ARTICLE IV. It is mutually understood and agreed by and between the parties heretofore mentioned as follows:

1. All timber included in this agreement shall remain the property of the seller until paid for in full.

2. In case of dispute over the terms of this contract, final decision shall rest with a reputable person to be mutually agreed upon by parties to this contract, and in case of further disagreement, with an arbitration board of three persons, one to be selected by each party to this contract, and a third to be the Zone Forester or his chosen representative,

In witness whereof the parties hereto have hereunto set their hands and seal this..... day of....., 19.....

Witnesses:

.....
.....

The following are sample clauses that should be substituted in the contract when other methods of sale are used. In lump sum sales, substitute in Article I, a descriptive clause, modelled on this one:

All merchantable living trees, except..... which measure 12 inches or less in diameter at breast height (a height of 4-1/2 feet above the ground).

Such provision will reserve the basis of a second crop consisting of the more valuable and rapid-growing kinds of trees and remove all the inferior and slower-growing trees,

The payment clause in lump sum sales should be varied to read somewhat like this:

The sum of.....dollarsfor said timber, payable prior to the cutting of the material, in instalments of.....dollarseach, payable on or before.....respectively.

5. Attempts at a Solution of the Marketing Problem

Orderly marketing of woodland products is to the advantage of the woodlot owner, the sawmill operator, and

the ultimate industrial consumer who requires definite quantities of certain species in certain grades to carry on his manufacturing business. It has already been remarked that the farmer feels at a disadvantage in marketing logs, and his real or imagined grievances are a detriment to good relations between the buyer and seller of logs and a steady flow of logs to the market. The following attempts at improved marketing may suggest methods which could be applied in the Credit Watershed.

(a) A Marketing Experiment Near Coon

During the winter season of 1948 and 1949 the Department of Lands and Forests in the Galt Zone carried out an experiment in the marking and marketing of timber in an 18-acre woodlot near Doon. The project was initiated by Mr. I. C. Marritt, the District Forester, and the field work was done by Mr. L. S. Hamilton, Zone Forester. The scheme is patterned after a marketing assistance method meeting good success in the State of New Jersey.

The mixed uneven-aged woodlot contained considerable large white pine and red oak. Initial investigations by the Department showed growth stagnation due to over-stocking and recommended the removal of certain trees representing the accumulation of growth over a number of years. Under this condition, removal of selected trees reduces the growth stagnation factor and the remaining trees grow at an increased rate. As growth again slows down, another cropping should take place. This is the simple principle of selective logging - the removal of accumulated growth periodically to keep the stand at a healthy productive growth rate.

Upon explanation of the proposed marketing assistance, the woodlot owner entered into a signed agreement with the Department as a co-operator, agreeing not to sell or allow to be cut any trees except those marked, upon penalty of a nominal fine per thousand for the estimating and marking service of the Department.

The trees were marked with a view to a second marking which would be necessary afterwards to remove weed trees and trees of low value in order to give good growing conditions. Each tree marked for removal was blazed at breast height and below stump height, the stump blaze being branded to detect any unauthorized cutting. The total log scale estimated for the 223 trees marked was 47,600 board feet Doyle Rule. The trees were listed as to species and diameter on a mimeographed form.

All the estimation data were turned over to a timber agent chosen by the Department. The timber agent entered into written agreement with the owner to

- (1) solicit tenders from buyers;
- (2) draw up a timber sale contract protecting the owner;
- (3) check on cutting operations; and
- (4) measure and collect payment for all wood cut before its removal from the property,

The agent was to receive a percentage commission of the gross sale value.

The timber agent mailed the volume estimate sheets to all local log buyers, giving location of the woodlot and inviting inspection of the bush.

The timber sale contract set forth the prices agreed upon for the different species, required that tops be worked into 4-foot wood to be paid for at an agreed price per standard cord, provided penalties for the cutting of unmarked trees, and required that the woods operation be conducted with a minimum of damage to the woodlot.

Prices realized by the owner were much better than the average paid in the area. Prices per thousand board feet Doyle Rule for the standing timber were:

White and red oak.....	\$62
White ash, soft maple, hard maple, basswood and cherry.....	\$60
White Pine	\$55
Hemlock.....	\$45
Beech.....	\$30
Fuelwood.....	\$4 per standard cord

The experiment was considered very successful by all the parties concerned, yielding about 2,000 board feet more than estimated, and the woodlot has been left in fine growing condition with an expected second cut in fifteen or twenty years of 25,000 board feet.

(b) Forest Products Co-operative in New York State

in Otsego County in New York State local interest in forestry, stimulated by critical needs arising from the depression, resulted in the organization of the Otsego Forest Products Co-operative Association at Phoenix near Cooperstown in 1935 as a farmer co-operative under the cooperative corporation laws of New York State. In its certificate of incorporation the objectives of the Association are stated:

"To promote, foster, and encourage the better care and increased productivity of woodlands, the orderly and efficient marketing of forest products through co-operation to eliminate speculation and waste and to stabilize the marketing of forest products."

A survey covering a radius of 35 miles from Cooperstown indicated about 2 billion feet of merchantable timber, a fair portion of which could be available to the Co-operative. In 1937 a loan was arranged with the Farm Security Administration to construct and operate a farmer-owned processing plant. Since that time this Association has afforded farmers within an increasing radius (now about 50 miles and occasionally up to 90 miles) an opportunity to practise forestry in conjunction with their usual farming enterprises on a basis that assures equitable return from any

species and grade of product in whatever quantity offered. The program requires change from the common stripping of woodland and of utilizing only the best trees of a few species, to selective logging and diversified utilization, whereby the forests will be managed for a continuous high-value yield.

Ctsego County, in which the centre of the mill-servicing area is located, is not unlike much of Southern Ontario. The county is dominated by dairying; about 62 per cent of the land is used for crops and pasture; 28 per cent is in forest; the remaining 10 per cent is abandoned farmland (reverted to brush), water, roads, marsh, building sites, and so on.

The Association is composed of members and operated by a Board of nine Directors elected by members at an annual meeting. The manager is appointed by the Board and is assisted by an office manager, a complete mill crew, and fieldmen who handle member contracts and all phases of the field activities.

To become a member a person must be a woodlot owner, must purchase five shares of common stock at \$1 per share and must sign the Association's Marketing Agreement. The member thereby agrees to manage his woodlot according to good forestry practices and to sell any sawlogs cut by him for sale to the Co-operative and to accept 5 per cent of the value of his logs in common stock. Members receive patronage dividends. The Association agrees to assist the owner in applying good forest practices to his woodlot and to publish prices and grading specifications for logs on a delivered-to-the-mill basis and, should it be unable to handle the member's forest products advantageously, to give permission to sell them elsewhere. Lumber needs of members are met at wholesale prices at the mill. By 1941 the Association had a membership of over 600; this had increased to almost 1,100 by the spring of 1950.

The Association's fieldmen will, on request and without charge, cruise a member's woodlot and mark for cutting, telling him the number and volume by species of trees in his woodlot and the physical condition of the stand. The marking viewpoint is to improve the woodlot by removal of mature trees and leave the young and medium-sized trees of commercial species to grow.

The plant of the Association is modern and equipped to get the most out of the log at a minimum of cost and waste. It has a hot log-pond, a modern band mill, a small circular mill, edgers, trimmers, slabsaws, planing mill, small resaw, and mechanical conveyors to the sorting and grading deck. The equipment is powered by electricity and steam. A very important feature of the plant is its battery of dry kilns. There is rail service into the mill-yard.

The mill annually cuts between 2.5 and 3 million board feet of lumber, which holds consistently to 66 per cent hardwood and 34 per cent softwood. Mill operation is on a three-day week basis, it being established that full-time operation would too rapidly deplete the timber resources of the area which can be economically serviced. The 12-man crew works the remainder of the week on lumber handling. The daily cutting rate is 20,000 board feet of softwood or 15,000 to 16,000 board feet of hardwood.

The Association publishes a leaflet every two months which is sent to each member. It describes activities and facts about the Association, and farm forestry practices in general which are of interest to the members. Through it the members are posted on current log prices at the mill by species and log grades and the standard logs grades of the mill are set forth in detail.

Demonstrating in many ways the economic advantages of co-operative action, the Association has largely overcome many of the obstacles that make intensive forest

management on a continuous yield basis impractical without a market that will absorb all classes of products, pay fair prices and accept delivery in small quantities from widely dispersed farm forestry enterprises.

(c) The Lanark County Co-operative

This Co-operative was set up by a group of woodland owners in the County of Lanark in March **1950**. Its objectives are the better management of privately owned woodland to ensure a continuous yield of the best material possible from the forested land of the members through profitable marketing of all the woodland products.

To put the woodland enterprise on a paying basis to the individual it is necessary to market not only the material suitable for lumber manufacture and special products such as veneer, but also the inferior products such as the poorer hardwood species, low-grade hardwood logs of the better species, small softwood products such as cedar posts and poles, and that material removed in improving a woodlot during what may be called sanitation cutting. It was felt that the advantages of co-operative action by woodland owners in the field of marketing would best solve the problems of the individual, particularly in respect to inferior or small products. Acting as a group rather than individually and through a member active in contacting prospective buyers, they can hope for recognition by the buyers in the area as a stable source of the various woodland products,

The establishment of the Co-operative followed an extensive educational campaign carried on by fieldmen of the Federation of Agriculture, the Department of Lands and Forests, and the local Farm Forum leader. Interest was aroused through moving-pictures, talks at schools, local evening meetings, press releases, radio programs and public speaking competitions on woodlot management. Meetings held at Lanark were attended by officers of the Department of Lands

and Forests, representatives of pulp and paper companies, sawmills, and other wood-using industries, and members of agricultural organizations. Gradually a workable plan was evolved and the Lanark Forest Co-operative was set up under a number of directors with Mr. Herb Paul as manager.

Mr. Paul of Lavant, the main force behind the formation of the Co-operative, is an energetic leader of the local Farm Forum, caretaker of the Lanark County Forest, a farmer and owner of several hundred acres of woodland in Lavant Township. As manager of the Co-operative his duties entail the location of markets for the woodland products of the members, arriving at satisfactory price schedules, collection of payment for products, ensuring that products are ready or delivered at the time promised, and advising members on cutting their woodland according to best forestry practices.

By the fall of 1950 membership in the Co-operative was approximately 60, with an increasing interest in its operations prevalent. The membership fee is \$5 and in addition the Co-operative takes 5 per cent of the sale proceeds of products handled. The member pledges to supply the quantity of material at the time and place agreed and to practise wood-lot management according to conservation principles.

At present the Co-operative has no intention of undertaking a manufacturing endeavour such as a sawmill for lumber or railway ties. Logs are not accumulated at a central point and sorted as to species and a grading standard, but are handled direct from woodland to buyer, The purchaser's measure of the volume, by grade where it might apply, is accepted as the basis for payment on transactions.

An objective of the Co-operative, stated as the better management of privately owned woodland to ensure a continuous yield of the best material possible, is a highly commendable aim. However, the statement entails a tremendous amount of field work on the part of those capable of advising

on the subject of woodlot management. This is a job requiring experienced field personnel. At present, although the Department of Lands and Forests is following this development in marketing with interest and co-operation, it has not the staff of extension foresters to provide the many owners of farm woodland with the guidance that is necessary. If the farm woodlot is to assume its place in the economics of the farming enterprise it must be shown that it pays in dollars and cents to the owner. The average woodlot owner cannot afford to carry on practices at a financial loss in the interest of the region or posterity. If, in its infancy, the Co-operative manages to make dollars and cents for its members by the sale of those products generally difficult to market as well as those relatively easy to market, and does the best it can toward field guidance on woodlot management for perpetual yield, then it will have done a lot toward good forestry in its area,

NATIVE SHRUBS

Shrubs have a definite place in conservation. Certain species have been used successfully for controlling steep slopes and for preventing erosion of stream banks, With the growing interest in farm ponds and the accepted practice of fencing these from livestock, shrubs can serve many useful purposes along the boundaries or interspersed with trees.

While thrifty farmers like to keep their fencerows clean, especially where woven wire is used, there are still many landowners who retain their stone or rail fences overgrown with shrubs and vines for the protection of small animals or food for birds during winter. Song birds, too, in the fall before flying south, find supplementary food from this source. Also, some of our shrubs produce fruit which is prized by man for winter preserves and jelly, and in certain rural areas more than one delectable drink is made from this source.

Shrubs also have a definite horticultural appeal. Their flowers appear in many forms and a variety of colours. Their leaves, too, are often attractive during the summer and definitely so in the early autumn when the bright scarlet, purple and dark green brighten up the landscape. The fruit of many species, after the leaves have fallen, stand out in sharp contrast from the dull branches, while on some the branches themselves of yellow, green and dark red add warmth to the countryside.

A knowledge of shrubs as well as trees is an asset to one interested in conservation. For this reason, it has been considered necessary that more attention be given to this form of plant life in the surveys undertaken for the Authorities. There is no manual of shrubs for Ontario at the present time; therefore, realizing the

need for such a volume, the Department of Planning and Development is publishing, in this section of the report, a selected list of twenty-five native shrubs which it is planned to increase from year to year until all the shrubs and ligneous plants of the province have been included.

While many of the shrubs described in this chapter are found on the Credit Watershed, some are not indigenous to it and many others found thereon are not included in this first list. However, when the study is completed and published in a separate volume, this will be corrected, and by the use of the maps one may determine by counties those shrubs which are found on any particular watershed in the Province,

TWENTY-FIVE SHRUBS OF SOUTHERN ONTARIO

by

James H. Soper, Ph.D.
Margaret L. Heimbürger, Ph.D.
Leslie A. Garay

The shrubs constitute a rather prominent and interesting but little known element of our flora. Several books are available describing the trees of Ontario but no comparable treatment for shrubs has been published. For this reason a study of the native and naturalized shrubs of our province was begun a few years ago with the ultimate objective the preparation of an illustrated manual. This project has involved both field work and herbarium studies. Field observations and collections of living plants and of pressed specimens have been made in various parts of southern Ontario. Additional information for other parts of the province has been obtained from a study of specimens preserved in both institutional and private herbaria. These include the herbaria at the Universities of Toronto, Western, McMaster, and Queen's, the Ontario Agricultural College at Guelph, the National Herbarium of Canada and the Department of Agriculture, Science Service, at Ottawa.

This publication is the first in a series and covers the shrubby representatives of fourteen families which have been studied and illustrated. The plan is to continue publishing on the other groups of shrubs as they are studied and then to issue the complete series with a key for the identification of the species. For each species studied, there is a description, an illustration and a map, which shows the distribution in southern Ontario as far as it is known from the available records.

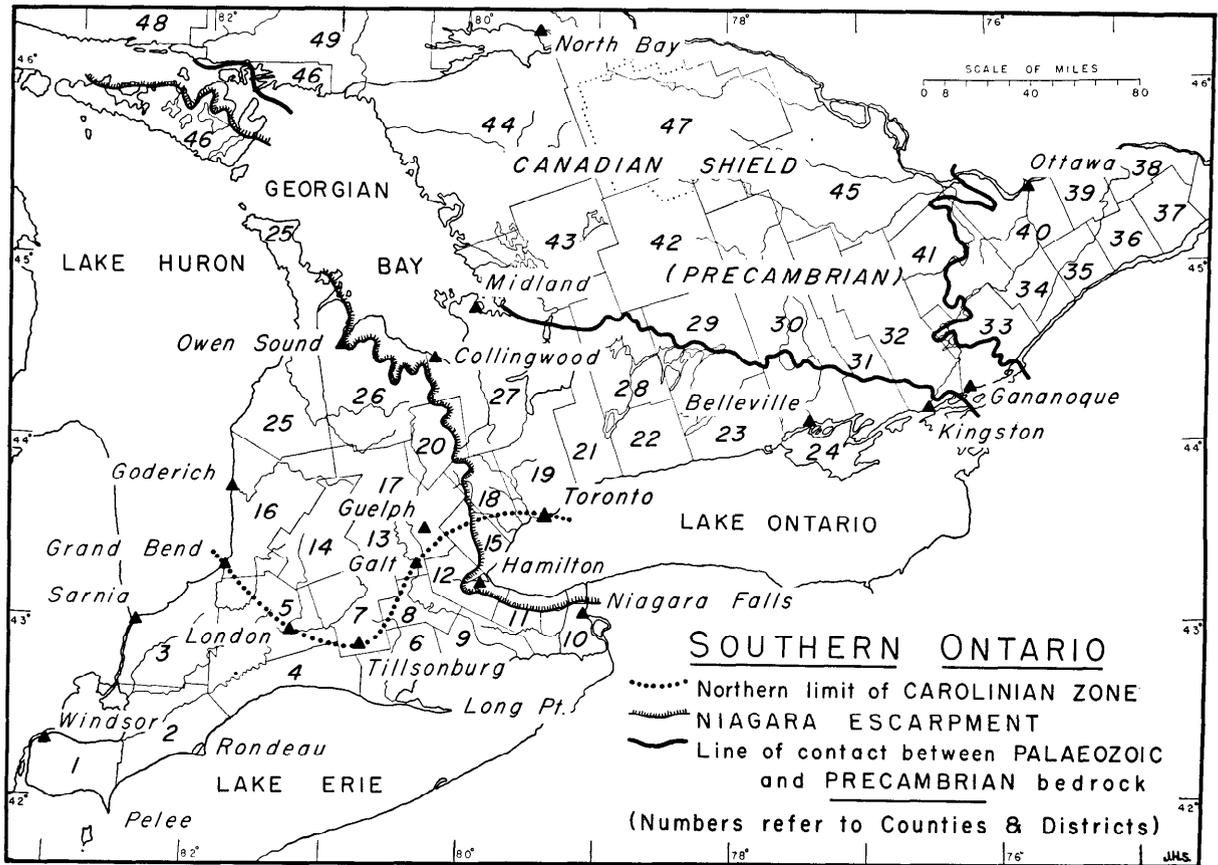
The descriptions have been prepared with a view to emphasizing the vegetative characters of each species, particularly the arrangement and shape of the leaves. At the end

of each description a Field Check is given which calls attention to the more obvious diagnostic characters of that species, Measurements are based on the specimens available in the herbarium of the Department of Botany at the University of Toronto, where this study is being conducted. Nomenclature and the spelling of names follow the 8th edition of Gray's Manual of Botany published by M. L. Fernald in 1950.

The first twenty-five illustrations have been prepared by the junior author working from pressed herbarium specimens. It was felt that line drawings would express more clearly the diagnostic features such as leaf shape, venation, and marginal tothing than either photographs or three-dimensional sketches. The leafy branch which forms the main portion of each illustration is one-half the natural size. The smaller drawings of the details such as flower, fruit, leaf surface and leaf margin are at various magnifications.

The maps have been prepared from information on file in the Catalogue of Vascular Plants of Ontario compiled by the two senior authors. Each dot on the maps represents either a specimen preserved in some herbarium, a field observation, a published report or other acceptable evidence of the occurrence of that particular plant in the locality shown. An introductory map has been included as a reference, giving a key to the names of the counties and districts in southern Ontario as well as one floristic and two geological boundaries which have a significance in relation to the distribution of plants, The numbers of the counties and districts follow the system used by Baillie & Harrington in the Transactions of the Royal Canadian Institute, volume XXI, part I, published in 1937.

The Carolinian Zone is the region along the north shore of Lake Erie north to a sinuous line running approximately from Grand Bend on Lake Huron through London, Tillsonburg and Galt to Toronto on Lake Ontario. It is a well



COUNTIES and DISTRICTS

Counties

- | | |
|--------------------|------------------------|
| 1. ESSEX | 27. SIMCOE |
| 2. KENT | 28. VICTORIA |
| 3. LAMBTON | 29. PETERBOROUGH |
| 4. ELGIN | 30. HASTINGS |
| 5. MIDDLESEX | 31. LENNOX & ADDINGTON |
| 6. NORFOLK | 32. FRONTENAC |
| 7. OXFORD | 33. LEEDS |
| 8. BRANT | 34. GRENVILLE |
| 9. HALDIMAND | 35. DUNDAS |
| 10. WELLAND | 36. STORMONT |
| 11. LINCOLN | 37. GLENGARRY |
| 12. WENTWORTH | 38. PRESCOTT |
| 13. WATERLOO | 39. RUSSELL |
| 14. PERTH | 40. CARLETON |
| 15. HALTON | 41. LANARK |
| 16. HURON | 42. HALIBURTON |
| 17. WELLINGTON | |
| 18. PEEL | |
| 19. YORK | |
| 20. DUFFERIN | |
| 21. ONTARIO | |
| 22. DURHAM | |
| 23. NORTHUMBERLAND | |
| 24. PRINCE EDWARD | |
| 25. BRUCE | |
| 26. GREY | |

Districts

- | |
|-----------------|
| 43. MUSKOKA |
| 44. PARRY SOUND |
| 45. RENFREW |
| 46. MANITOULIN |
| 47. NIPISSING |
| 48. ALGOMA |
| 49. SUDBURY |

known floristic area or forest region in Canada, a northern strip of the Deciduous Forest in which many species of southern trees and shrubs are common and in which numerous other woody and herbaceous species of southern affinity reach their northern limit or have their major Canadian distribution.

One of the geological boundaries shown on the map is the Niagara Escarpment, which is a very prominent topographic feature of our landscape. It is a set of cliffs capped by limestones and dolomites entering Ontario at Queenston on the Niagara River and extending west to Hamilton and then northwest to the Bruce Peninsula and continued on Manitoulin Island. A number of calcicolous plants are found closely associated with the basic soils which accompany this long series of rock exposures and talus slopes. The other geological boundary is that between the two main types of bedrock which underlie the glacial deposits and soils in southern Ontario. The extensive geological formation known as the Precambrian or Canadian Shield, characterized by granites and gneisses, comes down across southern Ontario to the region of the Thousand Islands on the St. Lawrence River, where it passes into the state of New York. The area south and west of the Canadian Shield, including the Bruce Peninsula and Manitoulin Island, is underlain by sedimentary rocks of Palaeozoic age, chiefly limestones and dolomites. A similar but smaller section of the Palaeozoic underlies the eastern counties of Ontario between the St. Lawrence and the Ottawa Rivers. In the case of those plants which seem to have a preference for either acid or basic soils the position of the boundary between the Precambrian and Palaeozoic rocks often shows a relation to the actual distribution of the species concerned.

The authors wish to express their gratitude to Mr. A. H. Richardson, Chief Conservation Engineer of the Department of Planning and Development who suggested and initiated this project and has facilitated its progress in many

ways. Financial support for field work, visits to herbaria and the employment of assistants in the field and in the herbarium have come from several sources. Grateful acknowledgment is hereby made to the Department of Planning and Development, the former Research Council of Ontario, the Ontario Research Foundation and the University of Toronto.

The authors would be very glad to receive information concerning errors, omissions or additional distribution records from anyone using this publication.

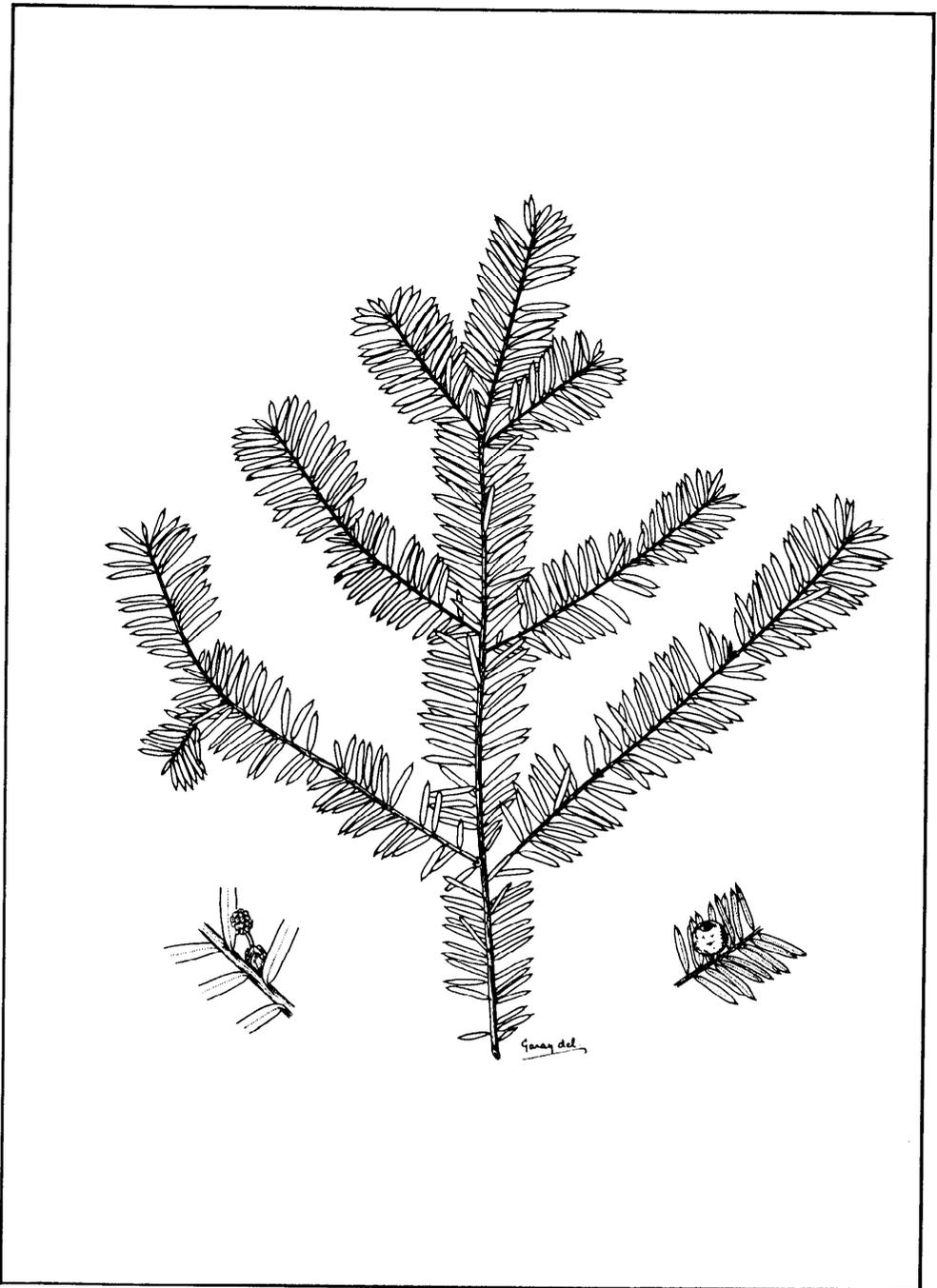
James H. Soper

May 1, 1956.

Department of Botany,
University of Toronto.

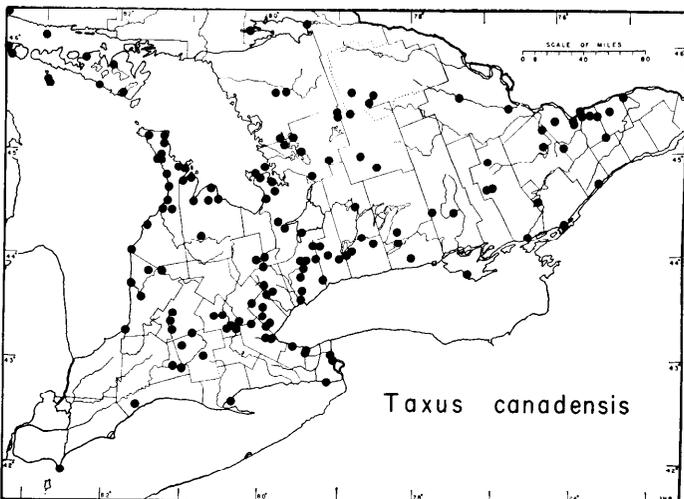
TWENTY-FIVE SHRUBS DESCRIBED

<u>Family</u>	Genus and Species	Common Name
TAXACEAE	<i>Taxus canadensis</i>	American Yew
MYRICACEAE	<i>Myrica Gale</i>	Sweet Gale
	<u><i>Myrica pensylvanica</i></u>	Bayberry
	<i>Comptonia peregrina</i>	Sweet-fern
FAGACEAE	<u><i>Quercus prinoides</i></u>	Chinquapin Oak
ANNONACEAE	<u><i>Asimina triloba</i></u>	Pawpaw
LAURACEAE	<u><i>Sassafras albidum</i></u>	Sassafras
	<i>Lindera Benzoin</i>	Spicebush
HAMAMELIDACEAE	<i>Hamamelis virginiana</i>	Witch-hazel
RUTACEAE	<i>Xanthoxylum americana</i>	Prickly Ash
	<i>Ptelea trifoliata</i>	Hop-tree
AQUIFOLIACEAE	<u><i>Ilex verticillata</i></u>	Black Alder
	<i>Nemopanthus mucronata</i>	Mountain Holly
CELASTRACEAE	<u><i>Euonymus atropurpureus</i></u>	Burning Bush
	<u><i>Euonymus obovatus</i></u>	Running Strawberry-bush
	<u><i>Celastrus scandens</i></u>	Bittersweet
STAPHYLEACEAE	<u><i>Staphylea trifolia</i></u>	Bladdernut
RHAMNACEAE	<u><i>Rhamnus alnifolia</i></u>	Alder-leaved Buckthorn
	<i>Rhamnus cathartica</i>	Common Buckthorn
	<u><i>Rhamnus Frangula</i></u>	Glossy Buckthorn
	<u><i>Ceanothus americanus</i></u>	New Jersey Tea
	<u><i>Ceanothus ovatus</i></u>	Narrow-leaved New Jersey Tea
THYMELAEACEAE	<u><i>Dirca palustris</i></u>	Leatherwood
ELAEAGNACEAE	<u><i>Shepherdia canadensis</i></u>	Soapberry
RUBIACEAE	<u><i>Cephalanthus occidentalis</i></u>	Buttonbush



Taxus canadensis Marshall

AMERICAN YEW



Taxus canadensis Marshall

AMERICAN YEW, GROUND HEMLOCK

Habit - The American Yew is a low spreading shrub of damp or shaded places. It seldom grows over 4 feet in height and although it may have branches 5 or 6 feet long these usually spread out from the base of the plant a foot or two before curving upwards.

Twig - The twigs are slender and green at first but soon become brownish and rather scaly.

Leaf - The leaves (needles) are narrow, flat and ever-green, They are numerous and arise in a close spiral around the stem but with their stalks so twisted that they form a flat spray along each branch, The needles are an inch or less in length and from 1/16 to 1/8 inch in width. Each needle is dark green above, pale green beneath, and has a short sharp point at the tip, This serves to distinguish Yew from low spreading specimens of Hemlock or Balsam Fir, in both of which the needles have silvery lines beneath and are rounded or blunt at the tip.

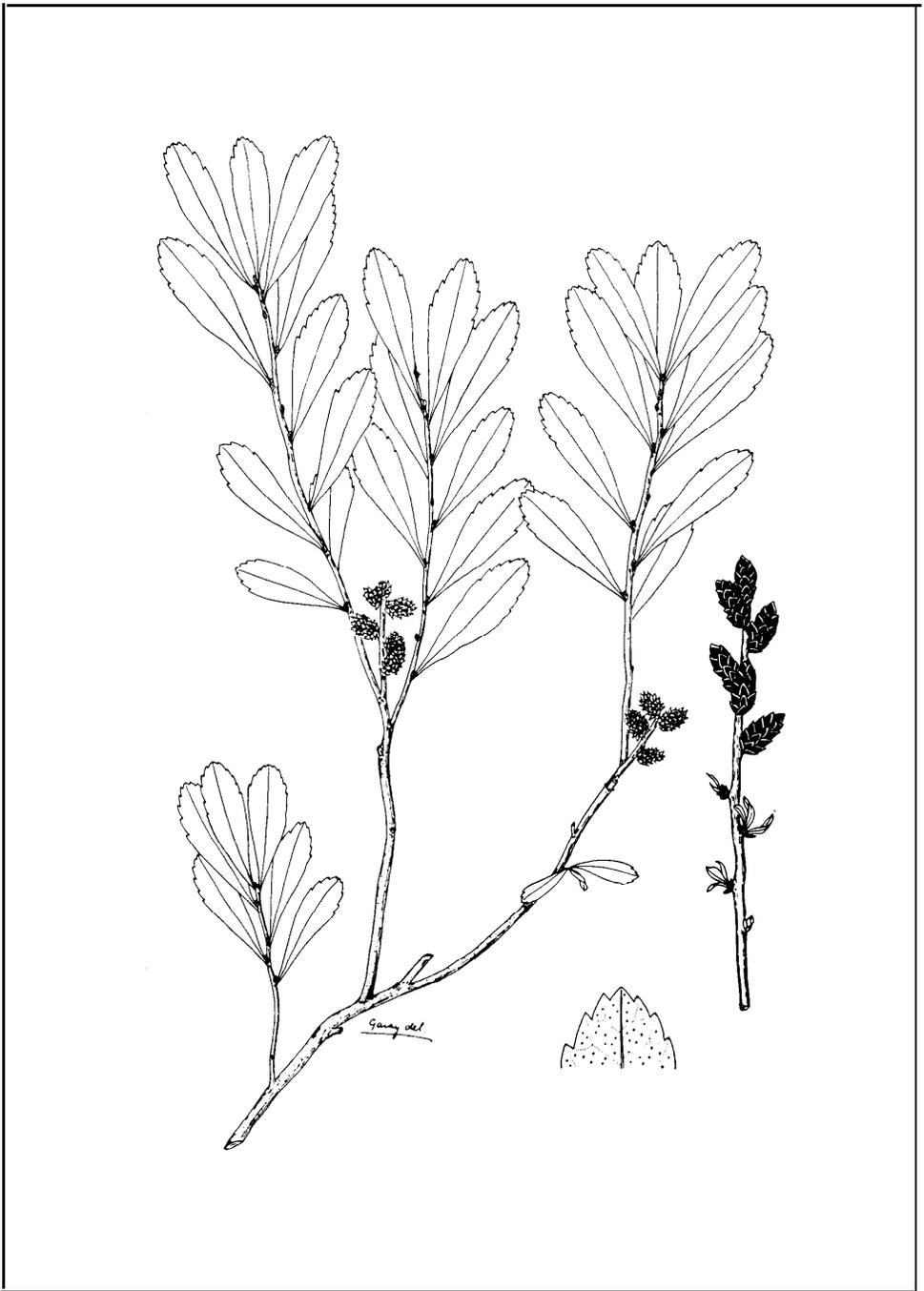
Flower - The Yew has separate male and female flowers which are usually borne on different plants. The male flower (shown enlarged) consists of a small stalked cluster of pollen sacs projecting from a cup-like group of bud scales. The female flower is reduced to a naked ovule (not enclosed in a pistil) on a short stalk surrounded by spirally arranged scales. Both types arise in the axils of the leaves of the previous year's growth and open in early spring before the new leaves appear .

Fruit - The female flower matures into a naked brown bony seed which is surrounded by a bright red pulpy cup (the aril) about 3/8 inch across and open at the tip. The general appearance from a distance is that of a red berry with a hole in the end. The fruits ripen in midsummer and are almost sessile along the lower sides of the branches.

Habitat - Swampy thickets, coniferous or mixed woods, ravine slopes or rocky banks.

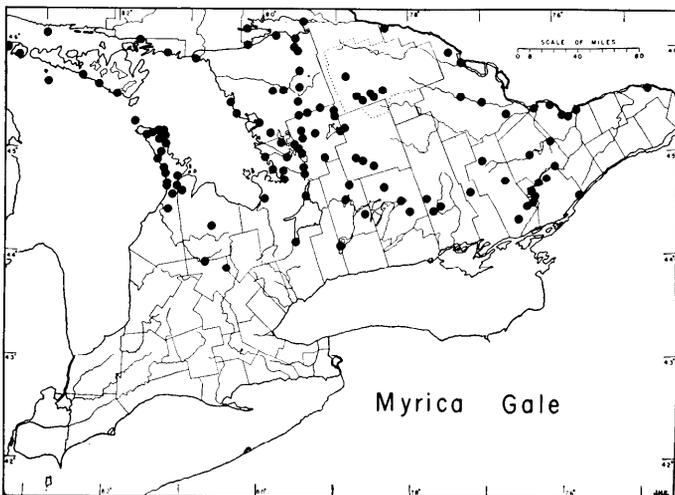
Range Widespread in southern Ontario especially north of the Carolinian Zone, extending to 50° north latitude and beyond; southwards chiefly in cool shaded ravines. (Newfoundland to Manitoba, south to Kentucky and West Virginia.)

FIELD CHECK - Low spreading evergreen with sharp-pointed needles in flat sprays and red berry-like fruits in midsummer.



Myrica Gale Linnaeus

SWEET GALE



Habit - The Sweet Gale is a low upright shrub found in wet places, It grows to a height of 4 or 5 feet and its branches do not spread very widely.

Twig - The young twigs are hairy, gland-dotted and fragrant when bruised. The bark is dark gray to reddish-brown with small pale lenticels.

Leaf - The leaves are alternate and deciduous, rather firm in texture, dark green above and paler beneath. They are gland-dotted and fragrant when crushed. The size varies up to 2.5 inches long and .75 inch wide. Each leaf is narrowly elliptic to oblanceolate, usually broadest above the middle, and the rounded tip is conspicuously toothed. There are no teeth along the margins of the wedge-shape basal portion, which tapers to a distinct petiole about 1/8 inch long.

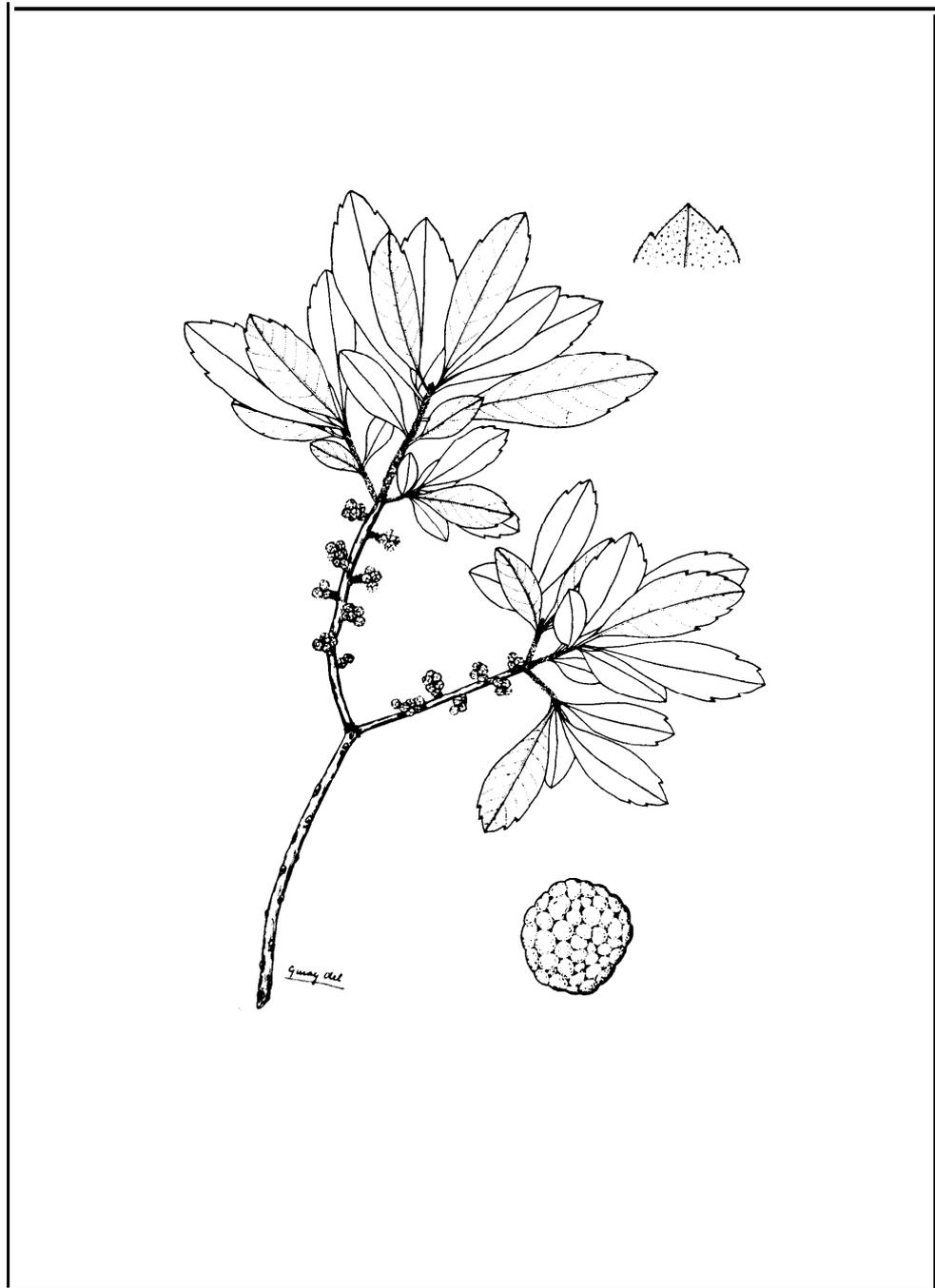
Flower - The male and female flowers which open early are small and usually develop in scaly catkins or cone-like clusters at the tips of the branches of separate plants. The male catkins (shown enlarged) have a number of dark brown shiny triangular scales with pale margins and become loose and open when the pollen is shed.

Fruit - The female flowers, which are rather inconspicuous when young, mature into ovoid to globular brownish clusters of gland-dotted drupe-like nutlets.

Habitat - In damp soil and shallow water along shores of lakes and streams and in swamps.

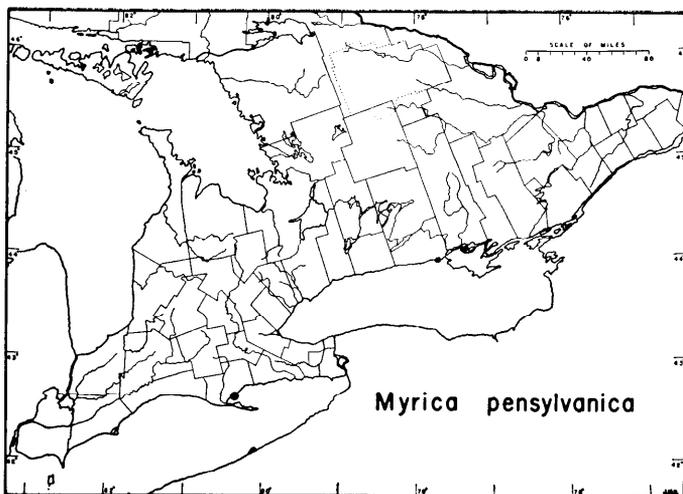
Range Common throughout central and northern Ontario (to 54° north latitude on the west coast of James Bay), Manitoulin Island and the Bruce Peninsula; rare south of the Canadian Shield and absent in the Carolinian Zone. (Newfoundland and Labrador to Alaska and south to Oregon, Wisconsin, Tennessee and North Carolina.)

FIELD CHECK - Gland-dotted leaves and young twigs fragrant when crushed; leaves toothed only near the apex; in wet places north of a line joining Toronto and Goderich.



Myrica pensylvanica Loiseleur

BAYBERRY



Habit - The Bayberry is an erect and rather stiffly-branched shrub reaching a height of 5 - 6 feet or occasionally higher.

Twig The branchlets are brown and hairy, gland-dotted and fragrant when bruised. The bark is dark gray to reddish-brown in colour.

Leaf - The leaves are alternately arranged along the stem but crowded towards the ends of the branches and, although deciduous, they often remain attached to the stems late into the fall. They are rather thin, bright green and sparsely gland-dotted above, paler and copiously gland-dotted beneath, fragrant when crushed. Each leaf is elliptic or oblong-oval in shape, rounded or obtuse at the tip and somewhat wedge-shaped or tapered at the base to a short petiole not more than .25 inch long. They are variable in size, up to 3 inches long and 1 inch wide and mostly broadest at the middle. The smaller ones are often entire but the larger ones are coarsely toothed towards the tip and about half way down each side.

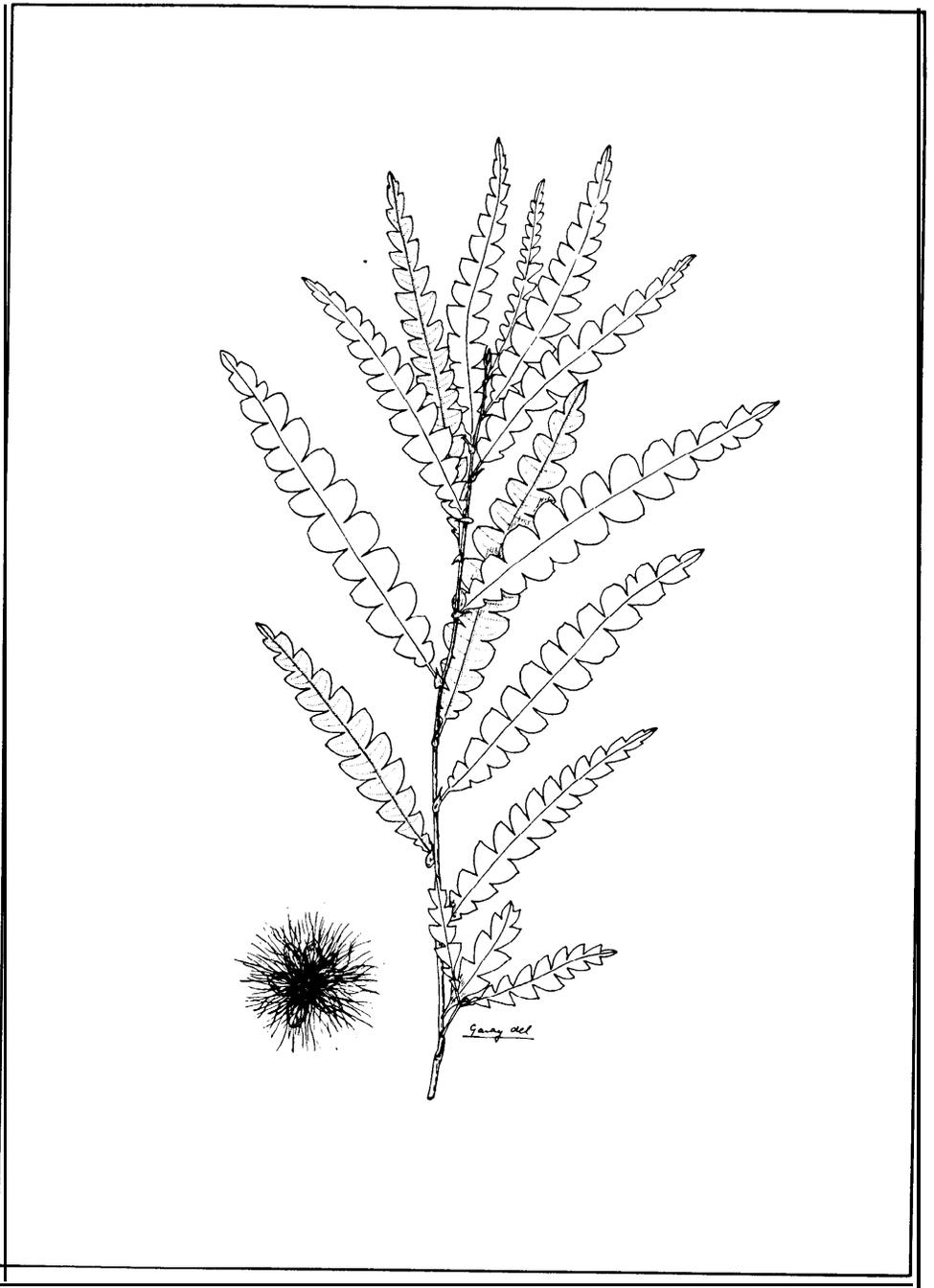
Flower - There are separate male and female flowers, which are small and catkin-like and borne on the old wood below the current leaf-bearing tip of a branch.

Fruit - The female catkins mature into clusters of bony globular nutlets which are encrusted with grayish-white to pale bluish waxy particles.

Habitat - In low open swampy woods and occasionally in dry sandy soil.

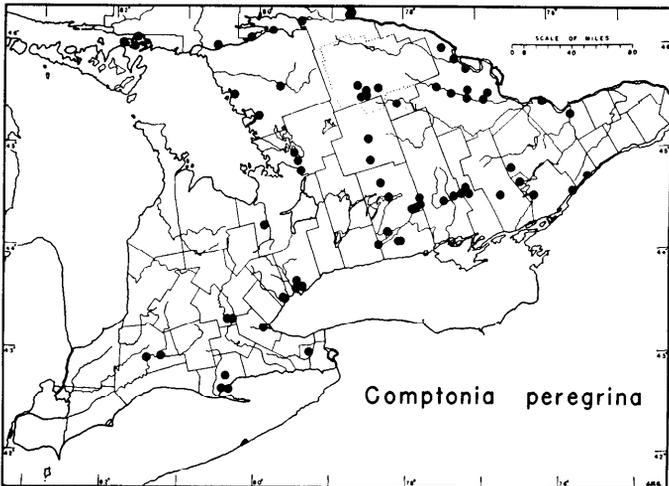
Range The only known Ontario station is at Turkey Point in Charlotteville Township, Norfolk County. (Atlantic coastal plain from southern Newfoundland to North Carolina and locally inland to the Lake Erie region.)

FIELD CHECK - Gland-dotted leaves and young twigs fragrant when crushed; leaves toothed only near the apex; fruit a cluster of small round nutlets encrusted with bluish-white wax; restricted to the Turkey Point region.



Comptonia peregrina (Linnaeus) Coulter

SWEET-FERN



Habit - Sweet-fern is a low and often much-branched erect shrub of dry places. It spreads freely by long underground stems and is usually less than 3 feet high.

Twig - The twigs are hairy and gland-dotted, fragrant when bruised, The bark varies from dark reddish-brown to gray or nearly black.

Leaf The leaves are alternate and deciduous, dark green above and paler beneath. They are long and narrow, tapered at both ends, and lobed in a pinnatifid or fern-like manner. The deep indentations between the rounded or pointed segments reach almost to the midrib. The leaves are gland-dotted, especially above, and very fragrant when crushed. Their size varies up to 4.5 inches long and 1 inch wide including the short petiole, .25 inch or less in length, which has a pair of semi-cordate long-pointed stipules at the base.

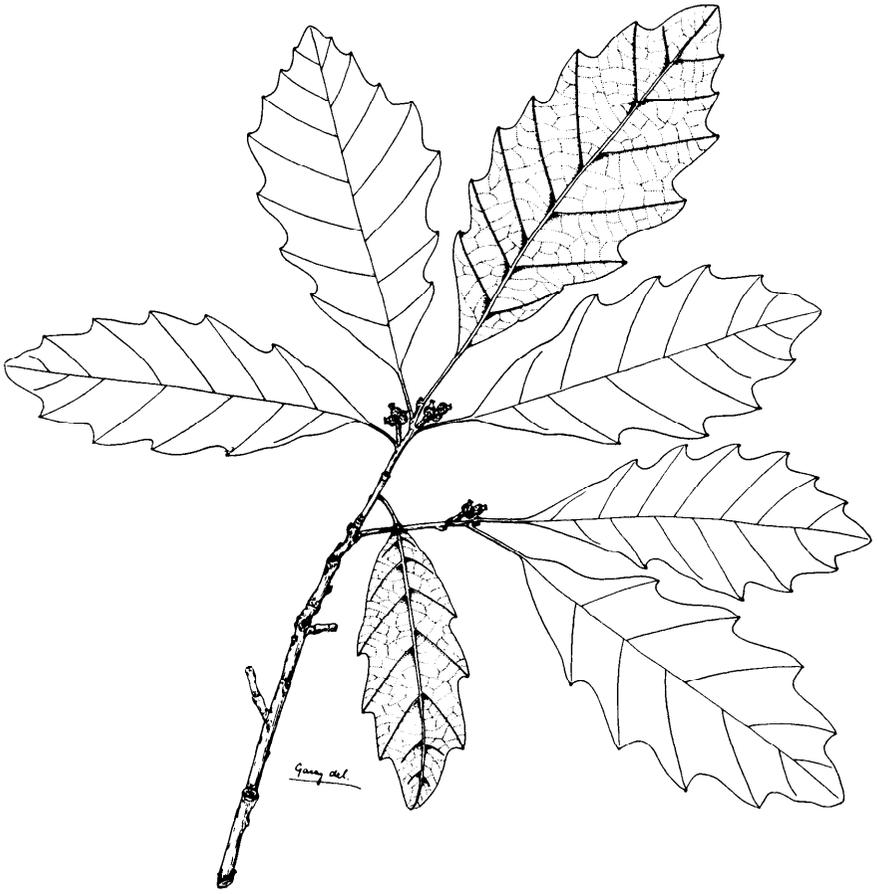
Flower There are separate male and female flowers usually borne on different plants. The male flowers occur in slender flexuous catkins about one inch or more in length and borne in clusters near the ends of the branches. The female flowers occur in small dense bristly bur-like clusters and are usually borne at the ends of short side branches.

F r u i t - The fruit is a bristly bur-like cluster (see enlargement) about one inch or less in diameter. It consists of a number of smooth bony conical or barrel-shaped nutlets surrounded by numerous long slender glandular and ciliate scales.

Habitat - In dry sandy, gravelly or rocky soil.

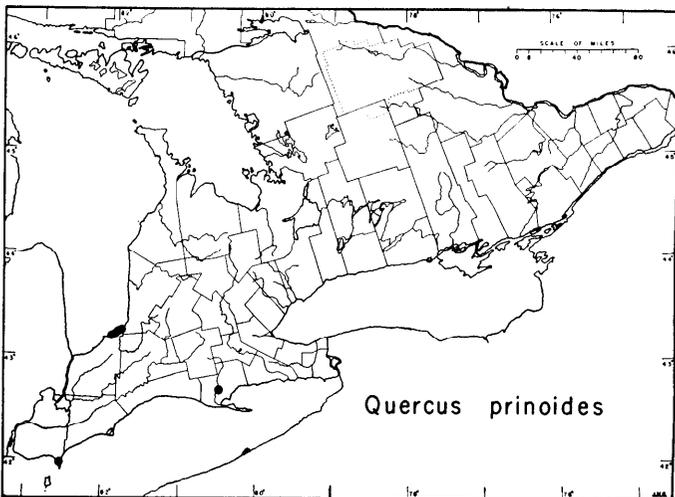
Range - Common on the Canadian Shield and north to Lake Abitibi; also in the southern part of Thunder Bay district adjacent to Minnesota; south of the Canadian Shield in southern Ontario on scattered areas of sandy soil. Apparently absent on limestone or dolomite outcrops. (Cape Breton to Manitoba and south to Minnesota, Illinois, Tennessee and Georgia)

FIELD CHECK - Gland-dotted fern-like leaves and young stems, fragrant when crushed; a low shrub of dry sandy or rocky ground.



Quercus prinoides Willdenow

CHINQUAPIN OAK



Quercus prinoides Willdenow

CHINQUAPIN OAK,
DWARF CHESTNUT-OAK

Habit - The Chinquapin Oak is a medium-sized shrub or small tree usually with several stems from the ground and reaching a height of 10 feet or more.

Twig - The twigs are slender, smooth and brittle and the bark is pale gray to reddish-brown in colour.

Leaf - The leaves are alternate and deciduous, bright green and shiny above and pale beneath with a dense flat coating of white stellate hairs. Their shape is chestnut-like, similar to Castanea dentata, the Sweet Chestnut, varying from elliptic to oblanceolate with an acute or broadly pointed tip and a wedge-shaped base with a petiole .5 inch or less in length. The size varies up to 4 inches in length and 2 inches in width, including the petiole. The margins are wavy-toothed, with 3 - 7 teeth on each side, the teeth blunt but each with a definite dark tip.

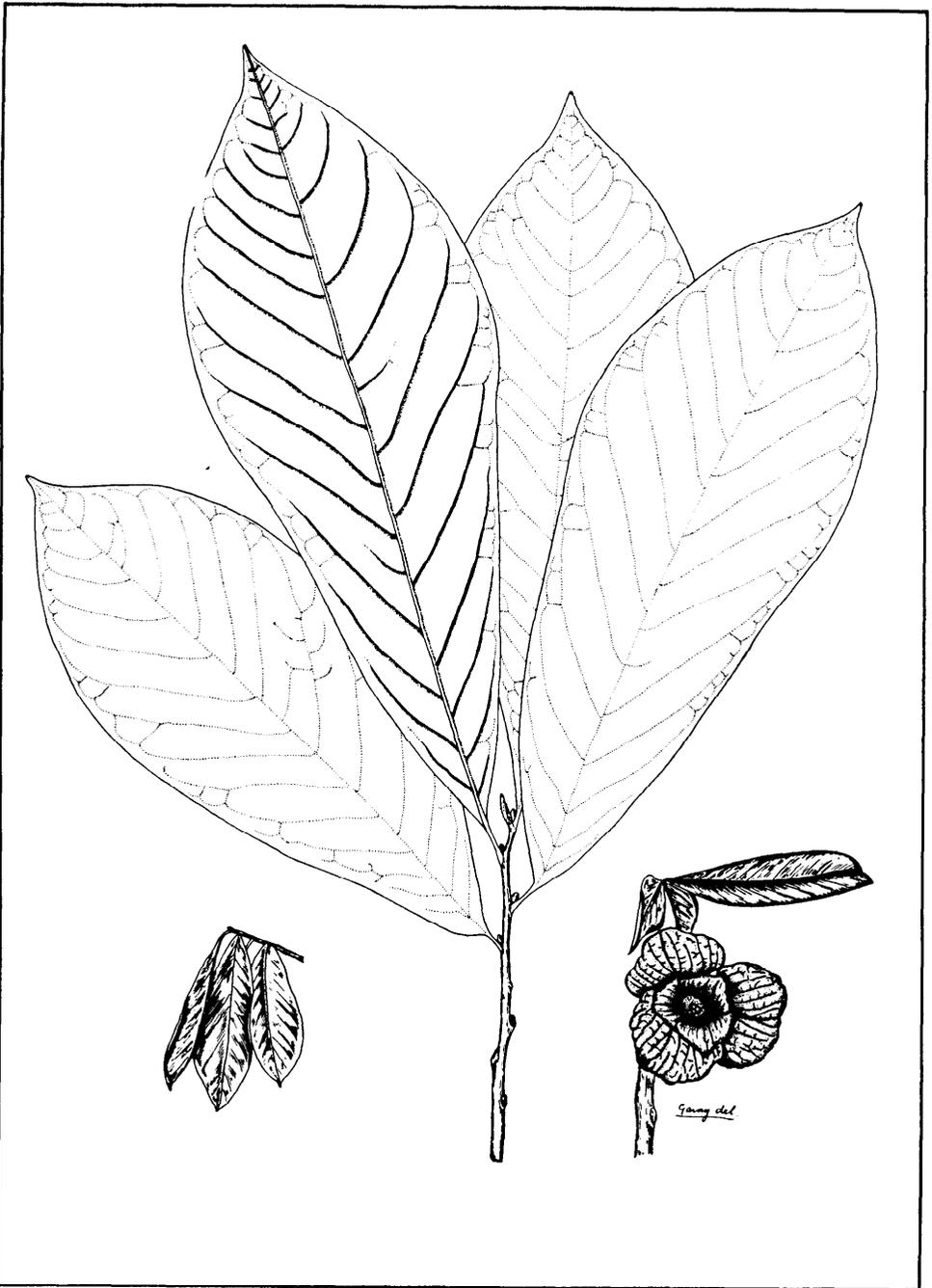
Flower - There are separate male and female flowers which appear about the end of May with the unfolding leaves. The male flowers are borne in slender catkins about an inch long clustered at the ends of the branches. The female flowers are sessile or short-stalked and borne in small clusters in the axils of the developing leaves.

Fruit - The fruit is an acorn about .75 inch long and .5 inch wide, the nut covered for about one-third its length by the hairy cup. The acorns develop singly or in groups of two or three and ripen the same season. This oak is truly a dwarf for it fruits abundantly when as low as three feet in height.

Habitat - In sandy soil; sand-plains, open or wooded sand-dunes.

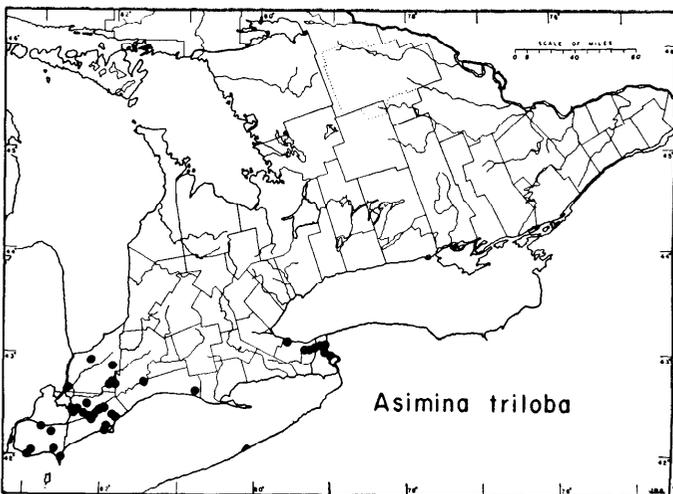
Range - Known only from three general areas in Ontario: the Grand Bend Pinery on Lake Huron; Point Pelee on Lake Erie; and the sand-plains of Walsingham Township in Norfolk County near Lake Erie. (Southern Maine to Minnesota and south to Texas and Alabama.)

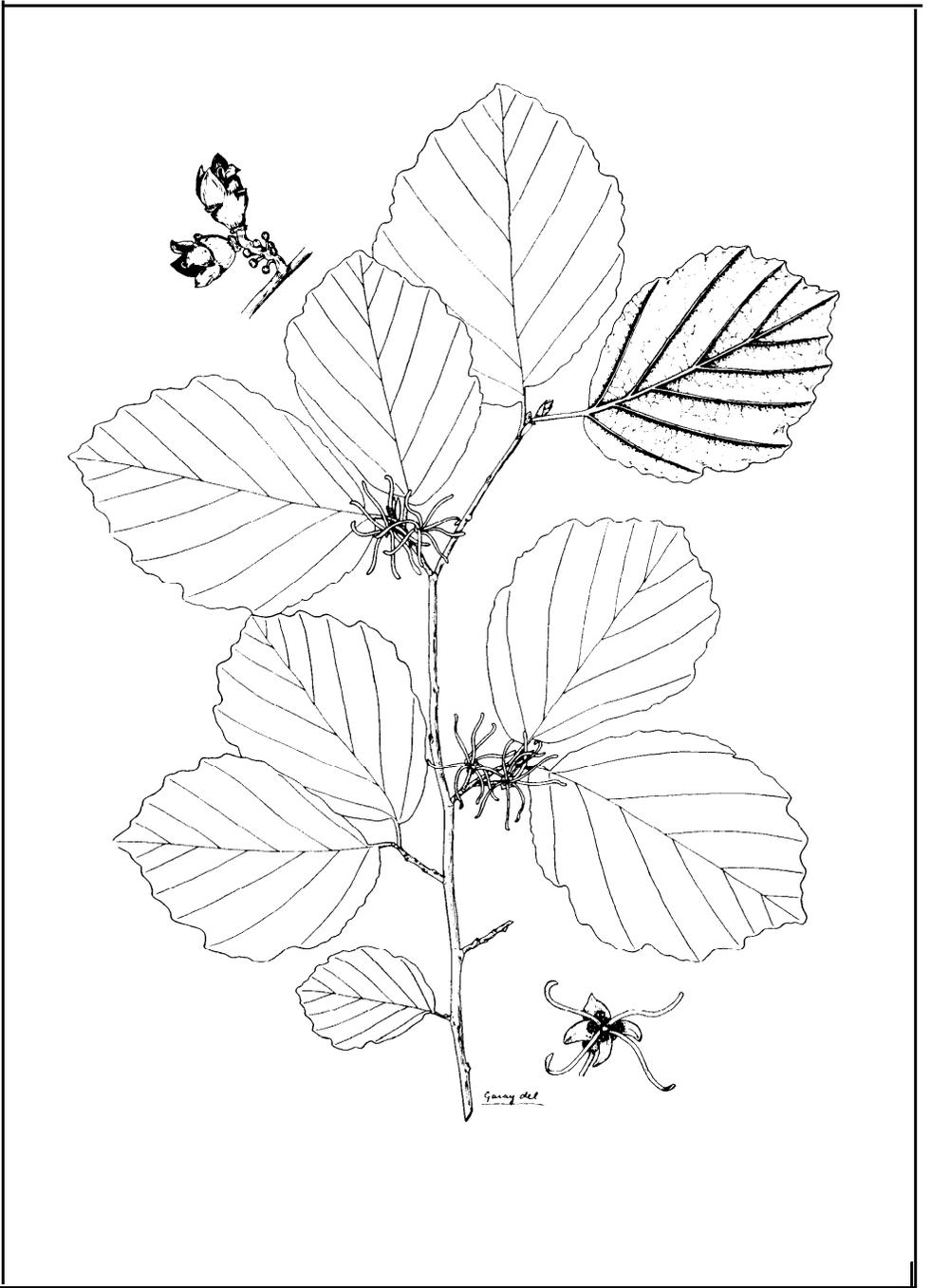
FIELD CHECK - Leaves chestnut-like; producing acorns even when a low shrub. This is the only dwarf oak in Ontario.



Asimina triloba (Linnaeus) Dunal

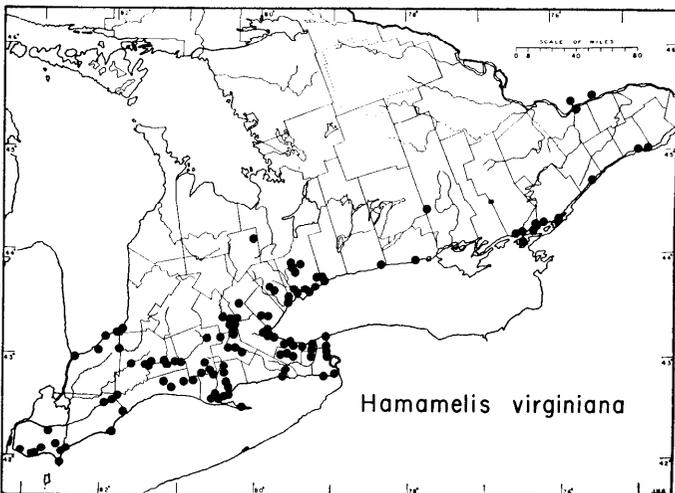
PAWPAW





Hamamelis virginiana Linnaeus

WITCH-HAZEL



Habit - The Witch-hazel is a large spreading shrub or small tree reaching a height of 15 or 20 feet.

Twig - The twigs are slender with more or less rusty stellate pubescence. The buds are naked and stalked, the terminal one flattish, slightly curved and covered with light brown hairs. The bark is gray-brown in colour.

Leaf - The leaves are alternate and deciduous, broad and rounded, oval, or obovate, with an irregularly wavy margin. There is a short but distinct petiole and the base of the leaf is obviously asymmetrical, that is, the leaf tissue joins the petiole farther up on one side than on the other (see illustration). The leaves often turn a clear yellow in the fall. The size varies up to 5 inches in length and 4 inches in width and there are 5-7 pairs of rather straight veins.

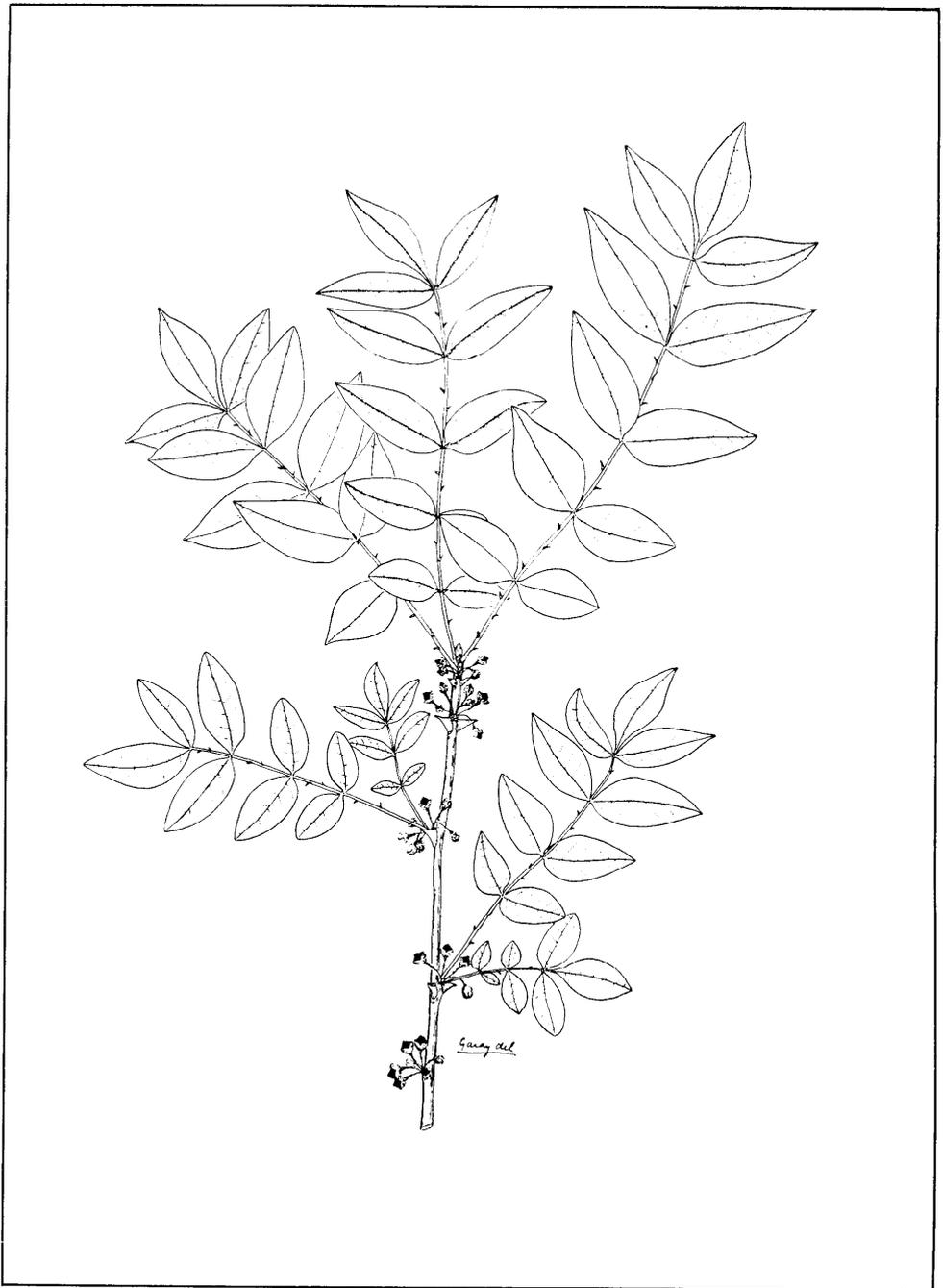
Flower - the flowers are perfect and usually borne in group of three. They open in the autumn about the time the leaves are falling. Each flower has four very narrow pale yellow ribbon-like petals (see illustration) about .5 to .75 inch long which are often crumpled or twisted so that the flowers present a ragged appearance.

Fruit - The fruit is a pale brown capsule which matures a year after fertilization of the flower. It is woody when mature, about .5 inch long, urn-shaped and two-beaked, with a prominent rim around the middle formed by the adherent calyx. When fully ripe the capsule splits open at the top and two shiny black slippery seeds are shot out for some distance, much as a fresh apple seed may be shot from between the finger and thumb, The empty capsules may remain on the plant for another season.

Habitat - Generally found in rather dry or well-drained sandy and gravelly situations; open woods, edges of woods, and slopes of ravines.

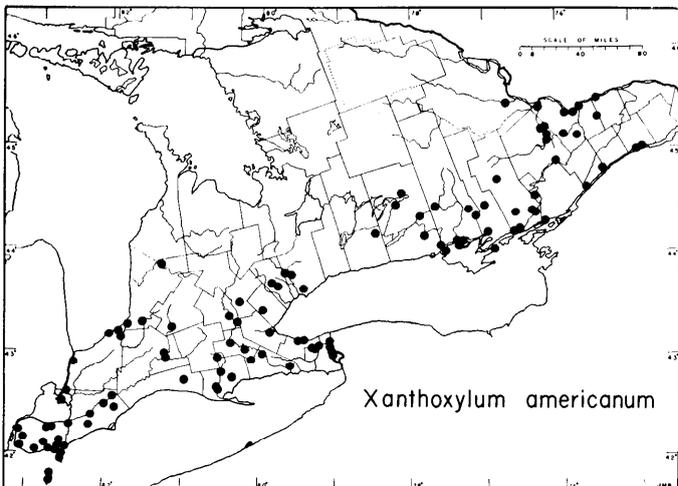
Range Common in the Carolinian Zone from Grand Bend to Toronto ; less frequent eastward along Lake Ontario and abundant again along parts of the St. Lawrence River; north to Mansfield (Dufferin Co.), the vicinity of Marmora (Hastings Co.), and the Quebec side of the Ottawa River in the Ottawa District (not recently seen on the Ontario side). (Southwestern Quebec to Minnesota, south to Missouri, Tennessee and Georgia.)

FIELD CHECK - Alternate leaves with irregularly wavy margins and asymmetrical bases; yellow flowers in the fall; woody persistent capsules.



Xanthoxylum americanum Miller

PRICKLY ASH



Habit - The Pawpaw is a tall shrub or small tree commonly spreading by root suckers to form thickets or groves, less frequently found as individual specimens. It grows to a height of 25 feet or more.

Twig - The twigs are reddish-brown and hairy at first, later becoming smooth. The buds are covered with a coating of rusty-brown hairs, the terminal bud flattened and naked, the laterals smaller and rounded. The bark is gray to brown, becoming somewhat ridged or scaly in age.

Leaf - The leaves are alternate, smooth and deciduous. They are obovate to oblanceolate in shape, usually broadest beyond the middle and often very large, up to 12 inches long and 5 inches wide. It is characteristic for the leaves to hang in a partially or completely drooping position (see small illustration). The **tip** of the **leaf** is acute or sharp-pointed and the base is wedge-shaped, gradually tapered to a grooved petiole .25 to 3/8 inch long. The **leaf** margins are without teeth. The venation is pinnate and rather conspicuous on the lower surface.

Flower - The flowers are borne singly on the wood of the previous year and appear late in May when the leaves are unfolding but still small. At first they are whitish or greenish-yellow but as they expand they turn dark reddish-purple to maroon in colour. They are three-parted, reticulate-veiny and fleshy in texture (see illustration).

Fruit - The fruit is a berry but looks like an irregular-shaped pear and is called a pawpaw. It is roughly oblong-cylindric in shape, fleshy with a green skin which later turns yellow to brown, and with one or two rows of large flat brown bean-like seeds embedded in the rather soft yellow flesh. The pawpaws are borne singly or in drooping clusters of 2-5 (rarely more) and ripen in October. The flesh of the pawpaw is edible, but apparently not as tasty here as in the southern states. Its flavour is distinctive, almost defying definition. It combines such elemental flavours as those of banana, custard, apple, pineapple, eau-de-cologne and turpentine.

Habitat - In damp sandy or clayey soils; chiefly in alluvial flats, on stream banks and on slopes of sheltered ravines.

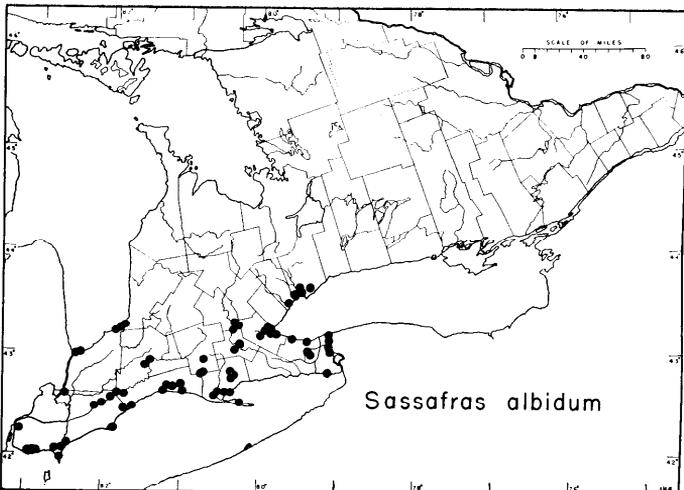
Range Restricted to the Carolinian Zone; most abundant in the counties of Essex, Kent, Lambton and Lincoln. (New Jersey and western New York to southern Michigan, southeastern Nebraska and south to Florida.)

FIELD CHECK - Large drooping entire leaves; reddish-brown flowers, and pear-like fruits with yellow edible flesh and bean-like seeds.



Sassafras albidum (Nuttall) Nees

SASSAFRAS



Habit - The Sassafras is a large shrub which sometimes spreads by root suckers to form thickets but is frequently found as a small or medium-sized tree. It has a characteristic open type of branching, the side branches horizontally wide-spreading with upcurved tips.

Twig - The twigs are green to purplish, smooth, shiny, brittle and spicy-aromatic when bruised. The bark is green at first, soon becoming rough, mottled and reddish-brown with conspicuous flat corky ridges.

Leaf - The leaves are borne alternately along the stem and are deciduous. They are of three different shapes and are fragrant when crushed. The smaller ones are usually simple and elliptic to broadly ovate in outline. Others, often the larger ones, have either a mitten-like shape with one lateral thumb-like lobe or a trilobed symmetrical outline (see illustration). The larger leaves measure up to 8 or 10 inches in length and may be almost as wide as long. There are no teeth on the margins and each leaf has a firm petiole an inch or more in length.

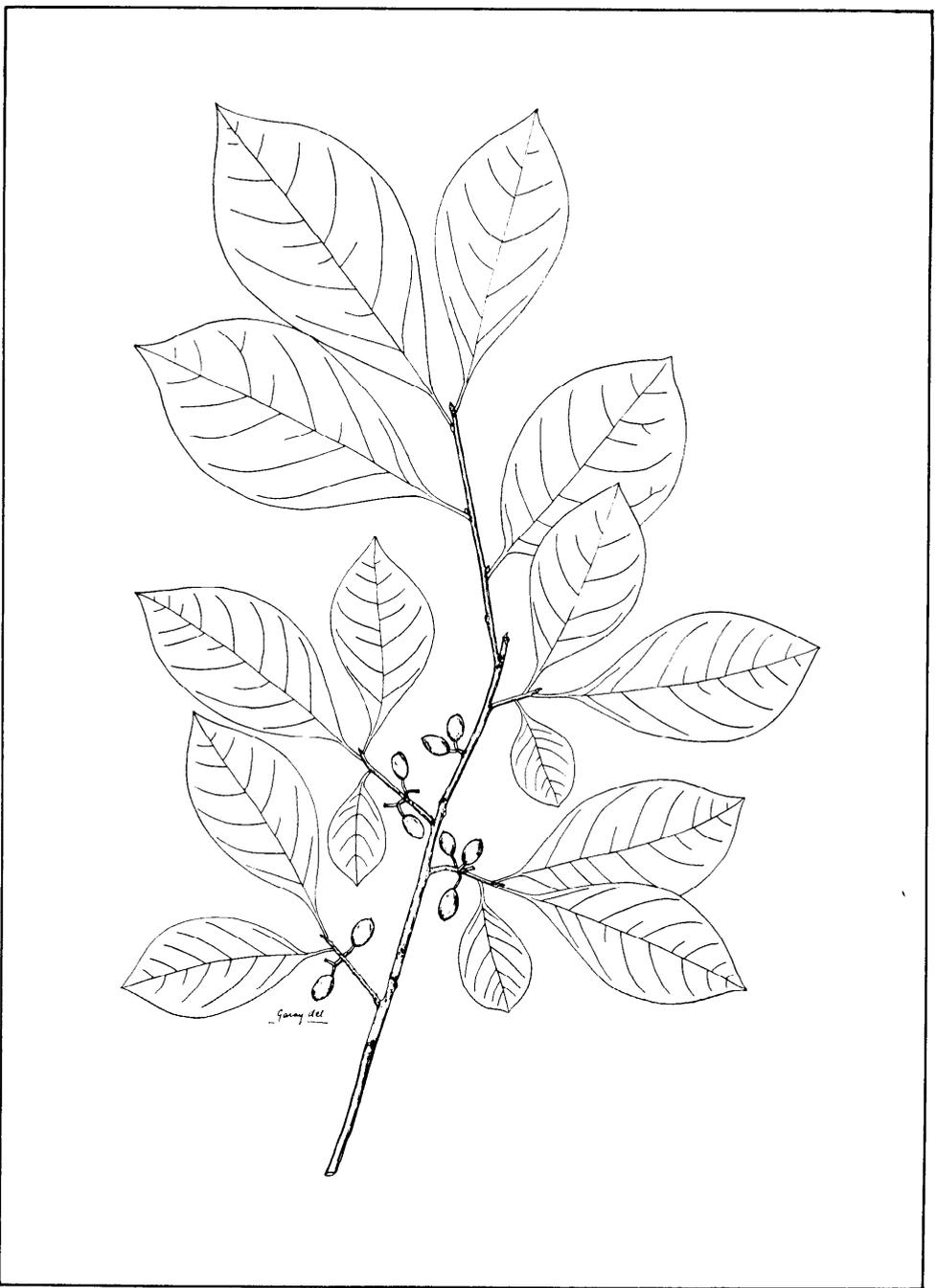
Flower - The flowers are greenish-yellow and are borne in stalked racemose clusters subtended by several scaly bracts, appearing with the developing leaves in late May. Male and female flowers usually occur on separate trees.

Fruit - The fruit is a dark blue ovoid berry-like drupe with a large brown stone, borne on a stout reddish stalk having the end thickened into a club-shaped base or collar below the fruit.

Habitat - Most frequent in sandy soils and rich loam in semi-open deciduous woods.

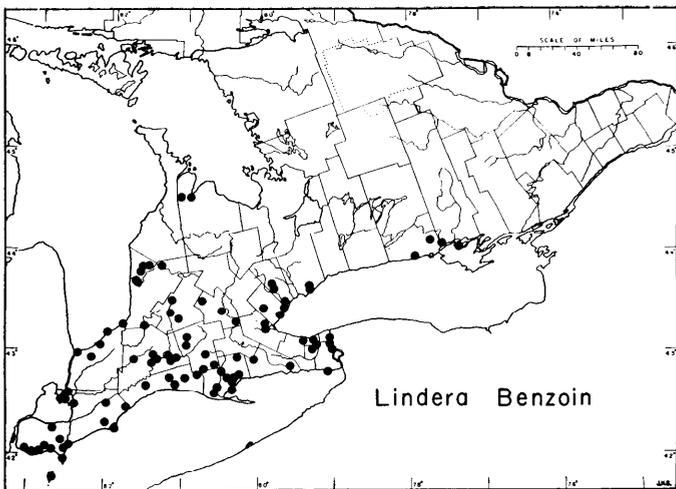
Range - Restricted to the Carolinian Zone and not found north of the Toronto region. (Maine to Michigan and Illinois and south to Texas and Florida.)

FIELD CHECK - Aromatic; leaves simple, mitten-shaped or trilobed, with entire margins; fruit blue and berry-like on a club-shaped stalk.



Lindera benzoin (Linnaeus) Blume

SPICEBUSH



Habit - The Spicebush is a large spreading shrub up to 10 feet or more in height.

Twig - The twigs are slender, spicy-aromatic when bruised and slightly hairy at first, later becoming smooth. The bark is a gray-brown and roughened in age.

Leaf - The leaves are simple, alternate and deciduous, thin and aromatic when crushed. Their shape is elliptic, oval or oblong-ovate and broadest at or beyond the middle. In size they may reach 6 inches in length and 2.5 inches in width. The longer ones are acute or acuminate at the apex, the shorter ones blunt or rounded. Each has a grooved petiole .25 to 3/8 inch long. There are no teeth on the margin.

Flower - Male and female flowers are usually borne on separate plants. They are small, yellow, in dense clusters of 4-6 surrounded by a group of 4 deciduous scales and appear in the early spring before the leaves.

Fruit - the fruit is a smooth bright red glossy berry-like drupe about 3/8 inch long, borne in clusters of 2-6 on short stalks. They are spicy-aromatic when bruised or chewed and each contains a single seed.

Habitat - In low moist thickets or woods along or near watercourses; more rarely on higher, well-drained locations such as riverbanks, open meadows and sand dunes.

Range - Common in the Carolinian Zone, but found also around Owen Sound near Georgian Bay and along the north shore of Lake Ontario in Hastings, Northumberland and Prince Edward counties. (Southern Maine to Iowa, south to Kansas, Missouri, Texas and Florida.)

FIELD CHECK - Aromatic; early yellow flowers in dense clusters; entire leaves; glossy red berry-like fruits.

Habit - The Prickly Ash is an upright much-branched prickly shrub which often spreads to form dense impenetrable thickets, It may grow to a height of 10 feet or more.

Twig - The twigs are stout and soon develop at the base of each leaf a pair of strong sharp-pointed persistent prickles with broad flat bases. The bark is slightly ridged, often reddish or purplish at first, turning brown to gray.

Leaf - The leaves are pinnately compound, alternate and deciduous, They are dark green above, much paler beneath, and fragrant when crushed. Small prickles are present along the leaf stalk, especially in pairs where the leaflets are attached. The complete leaf measures up to 10 inches long and 4 inches wide, the individual leaflets up to 2.5 inches long and 1.5 inches wide. The leaflets are elliptic to ovate-oblong in shape and minutely gland-dotted above. Their margins are entire or shallowly crenulate.

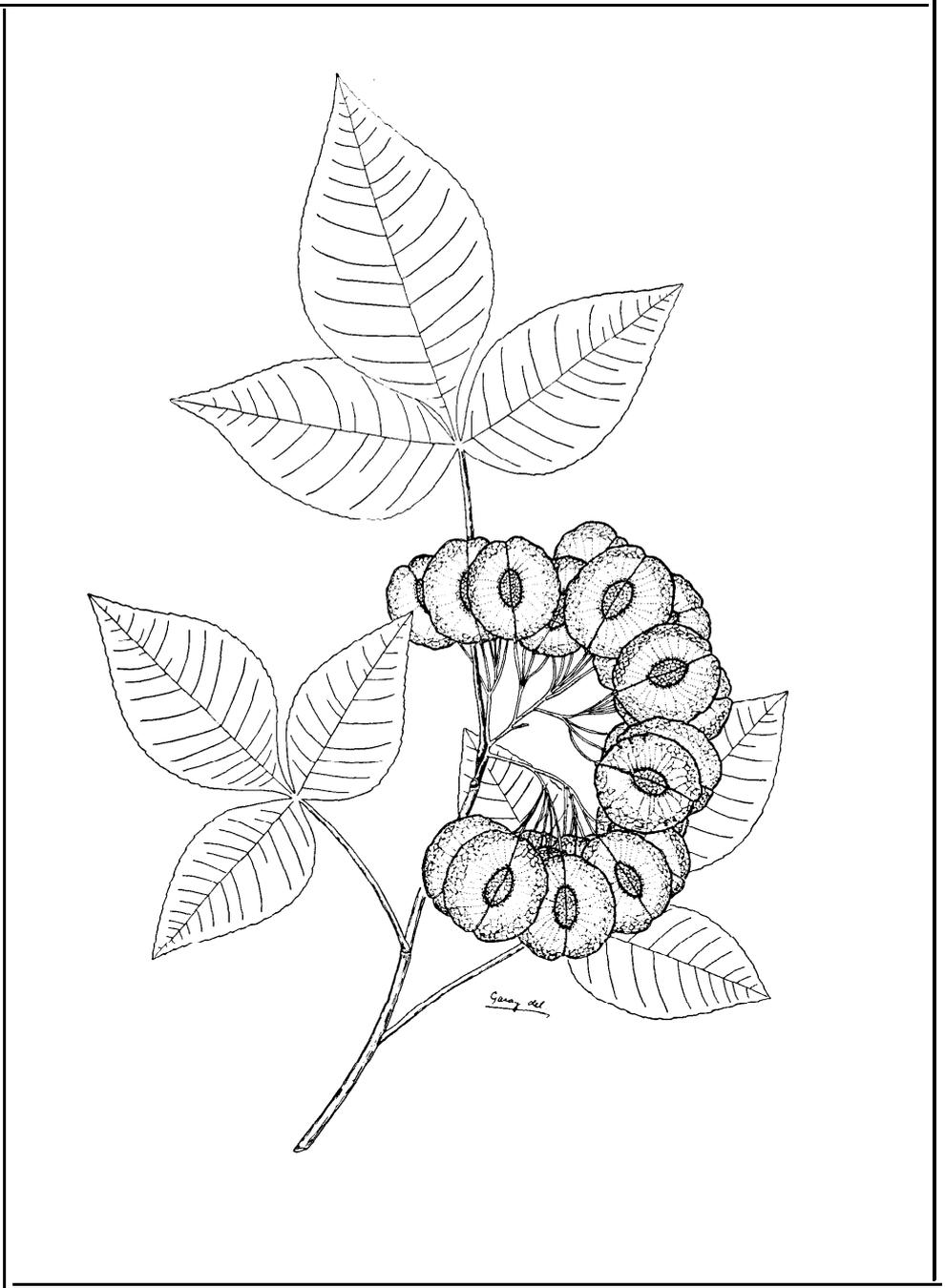
Flower - The flowers are small and greenish in colour, the male and female flowers borne on separate plants. They appear in the early spring, just as the leaves are unfolding, in close clusters along the old wood.

Fruit - The fruit is a reddish-brown round aromatic pod less than .25 inch across, splitting into two sections to expose one or two glossy black seeds.

Habitat - Pastures, open rocky places, edges of woods, thickets, fence-rows and roadsides.

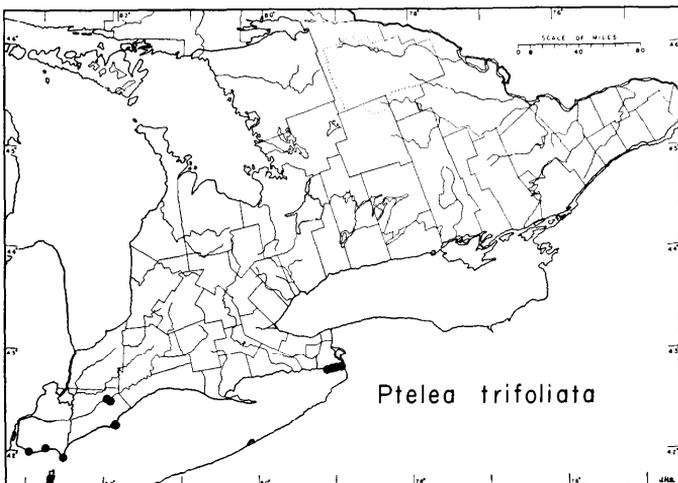
Range Common in the Carolinian Zone and eastward through the counties bordering the north shore of Lake Ontario to the St. Lawrence, Rideau, and Ottawa River districts, (Quebec to North Dakota, south to Oklahoma and Georgia.)

FIELD CHECK - Upright thicket-forming shrub; stems with stout-based prickles in pairs; alternate pinnately-compound aromatic leaves.



Ptelea trifoliata Linnaeus

HOP-TREE



Ptelea trifoliata Linnaeus

HOP-TREE WAFER-ASH,
SHRUBBY TREF0IL

Habit - The Hop-tree is a tall shrub or small tree growing to a height of 15 feet or more.

Twig - The twigs are stout and smooth with a large white pith, The bark is reddish-brown and shiny at first, later turning gray and becoming rough.

Leaf - The leaves are three-parted, alternate and deciduous. They are rather thick in texture, dark green and shiny above, much paler beneath and malodorous when crushed. There are minute black glandular dots on both surfaces but these are more easily seen above. The leaflets are ovate-lanceolate to obovate or elliptic, up to 4 inches long and 2 inches wide, and are sessile at the end of a stout petiole 3 inches or more in length. The margins are entire or shallowly and often remotely serrulate.

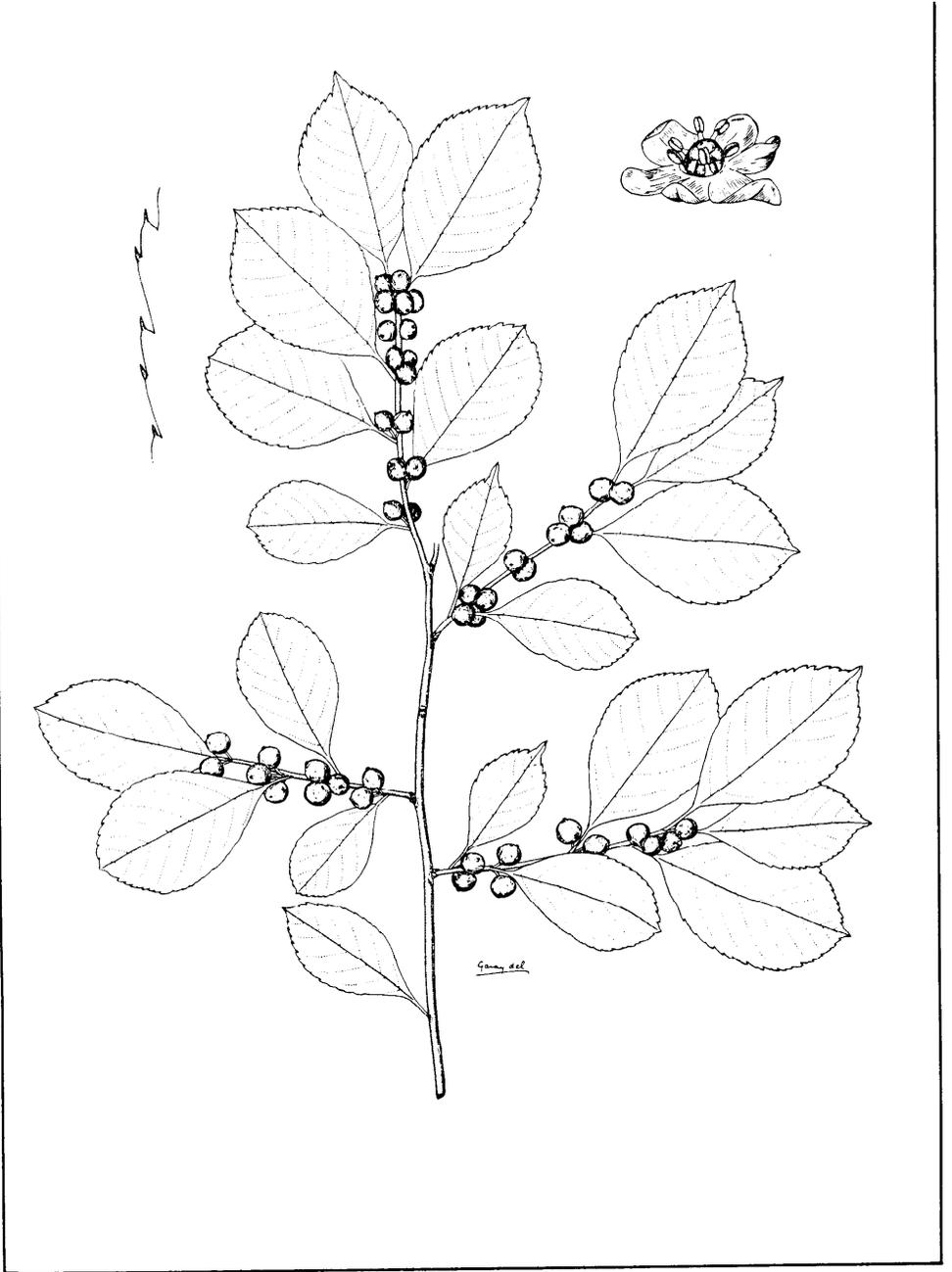
Flower - The flowers are perfect or unisexual, greenish-white, and borne in large terminal cymose clusters. They open about the middle of June.

Fruit - The fruit is a flat wafer-like nearly circular gland-dotted samara with a broad veiny wing all around the central part containing the two seeds. The samaras are .75 to 1 inch across, borne in dense stalked clusters which may remain attached to the plant over winter.

Habitat - Sandy soil: on sand dunes, in thickets or open woods, especially along the shores of lakes and rivers.

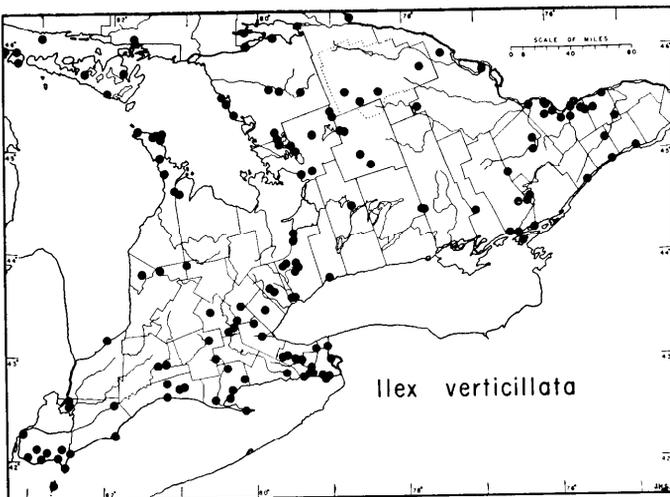
Range Confined chiefly to the sandy shores of Lake Erie and near the Thames River in Kent county. (Quebec and New York to Lake Michigan and Nebraska, south to Mexico and Florida.)

FIELD CHECK - Alternate trifoliate leaves and clusters of wafer-like samaras.



Ilex verticillata (Linnaeus) Gray

BLACK ALDER



Ilex verticillata (Linnaeus) Gray BLACK ALDER, WINTERBERRY

Habit - The Black Alder is an erect shrub up to 10 or 15 feet in height.

Twig - The twigs are stout, smooth and finely ridged. The bark is brownish at first, turning gray to blackish, with warty lenticels, and it is often mottled light and dark gray with small thin pale portions peeling off.

Leaf The leaves are alternate and deciduous, sharply serrate with incurved teeth (see illustration), and acute or abruptly acuminate at the tips. Their texture varies from thick to thin or almost membranaceous. They are a dull dark green above, smooth or downy, and paler beneath, usually hairy along the veins. Each leaf is elliptic, oval, or oblanceolate, up to 4 inches long and 2 inches wide including the grooved hairy petiole .5 inch or less in length. There is a pair of small narrow persistent stipules at the base of each leaf.

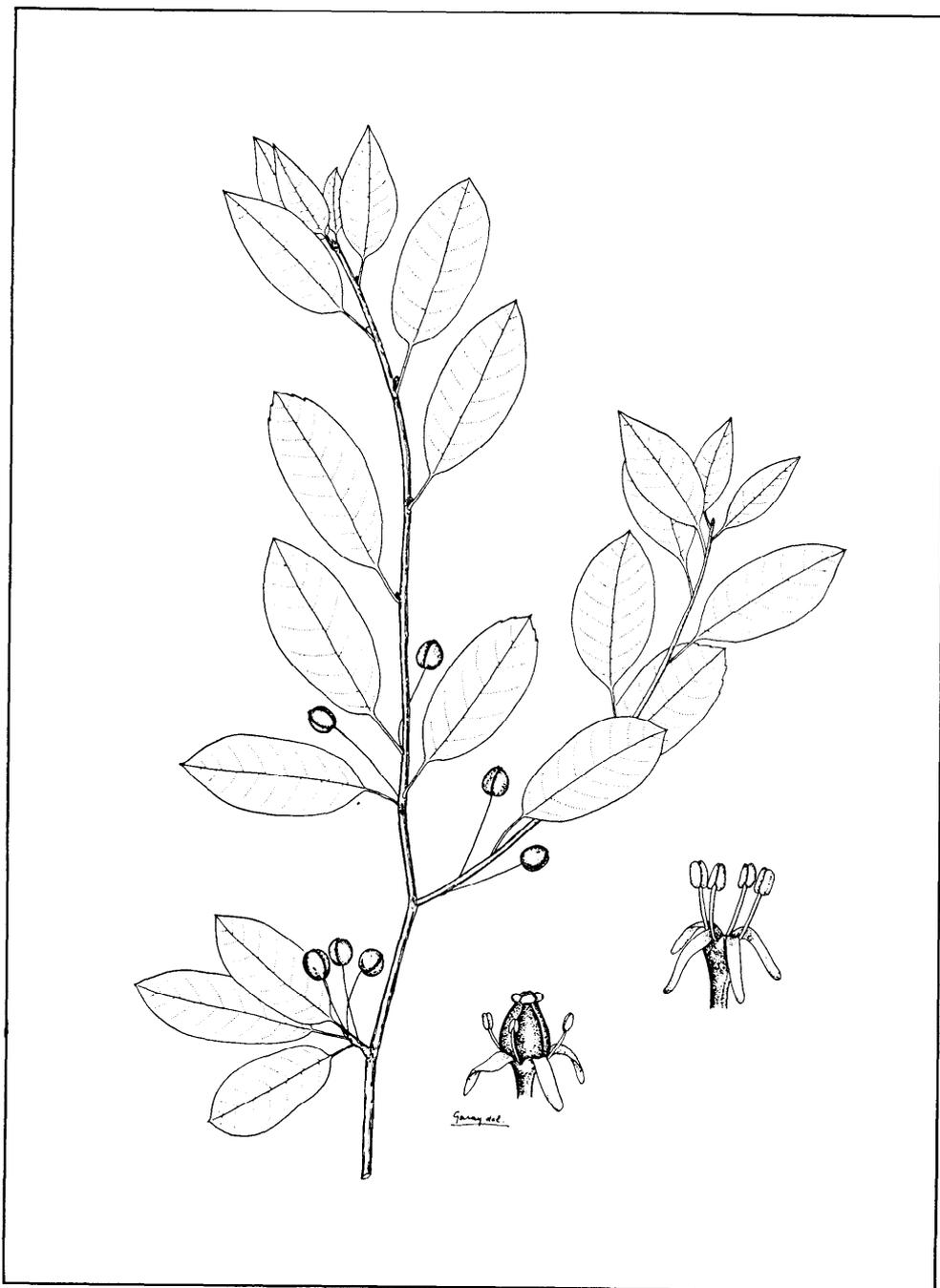
Flower The flowers are small, greenish to yellowish-white, and unisexual or imperfect, They are borne on short stalks in the axils of the leaves, the male flowers in crowded clusters, the female flowers singly or two or three in a cluster.

Fruit - The fruit is a bright orange to red globular berry-like drupe about .25 inch across. These occur singly or in small clusters on short stout stalks in the leaf axils and remain on the plant well into the winter. Each drupe contains 3 - 5 smooth bony nutlets.

Habitat - Moist situations such as swampy woods and thickets, peat bogs) or low land bordering swamps, bogs and roadsides.

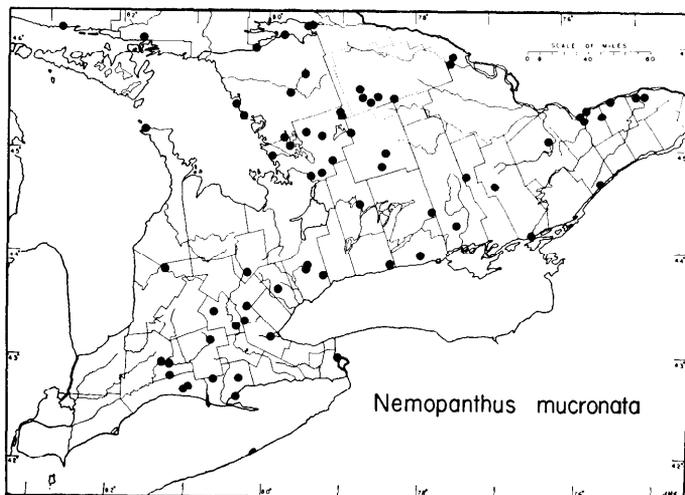
Range Widespread throughout southern Ontario and north to about 48° north latitude. (Newfoundland to Minnesota, south to Tennessee and Georgia,)

FIELD CHECK - Sharply serrate alternate stipulate leaves and conspicuous orange-red persistent berry-like fruits.



Nemopanthus mucronata (Linnaeus) Trelease

MOUNTAIN HOLLY



Nemopanthus mucronata (Linnaeus) Trelease MOUNTAIN HOLLY

Habit - The Mountain Holly is an erect, much-branched shrub of moist places growing to a height of 10 feet or more.

Twig The twigs are of two types, the long shoots slender and purplish with scattered leaves, the short shoots stouter, purplish or gray, and with the leaves more crowded, often appearing whorled. The bark is gray and rather smooth, with many pale lenticels.

Leaf - The leaves are thin and smooth, alternate, and deciduous. They are bright green above, dull and paler beneath, elliptic, oblong-elliptic or ovate in outline and rounded or acute at the tip with a short sharp point (mucronate). The size varies up to 3 inches long and 1 inch wide. The margins are usually entire but may have a few scattered sharp-pointed teeth, The base of the leaf is rounded or narrowed to a slender usually purplish petiole .5 inch or less in length.

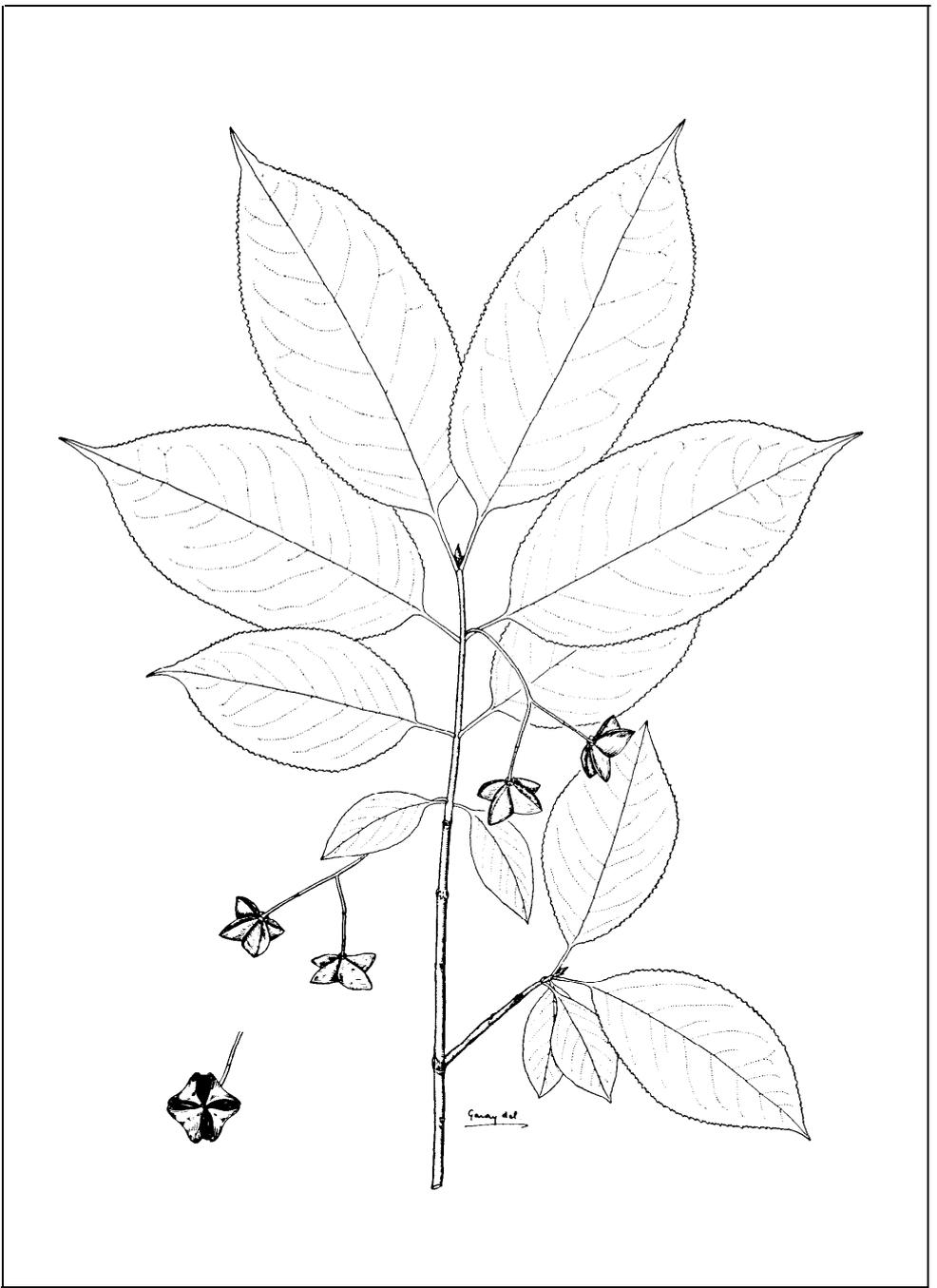
Flower - The flowers are very small, the male and female usually separate, borne singly or in small clusters from the axils of the leaves on thread-like stalks up to an inch or more in length. They open about the end of May before the leaves have fully expanded.

Fruit - The fruit is a purplish-red to crimson berry-like drupe about .25 inch in diameter borne on a slender purplish stalk. Each fruit contains 4 or 5 bony nutlets.

Habitat - Moist situations, low places, swamps and damp woods, especially the edges of sphagnum bogs or tamarack swamps.

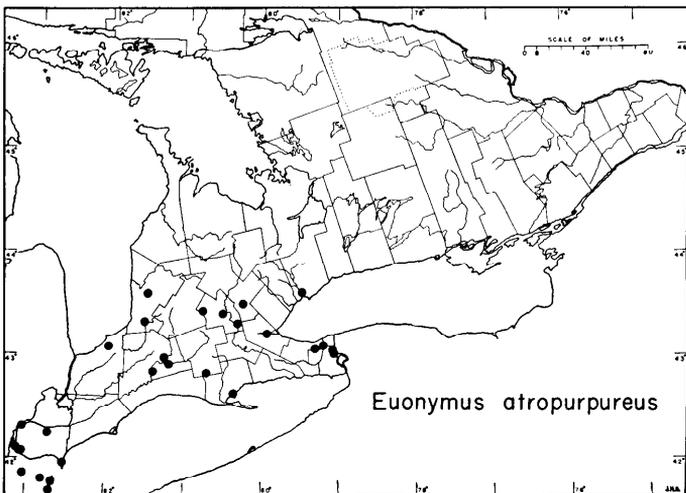
Range - Widespread in southern Ontario but commoner north of the Carolinian Zone to 49° north latitude, (Newfoundland to Minnesota, south to Illinois and West Virginia.)

FIELD CHECK - Alternate mostly entire mucronate-tipped leaves with very slender purplish petioles; fruits purplish-red and berry-like, borne on long slender stalks.



Euonymus atropurpureus Jacquin

BURNING BUSH



Euonymus atropurpureus Jacquin

BURNING BUSH, WAHOO

Habit - The Burning Bush is an erect or spreading shrub, sometimes tree-like and reaching a height of 15 to 20 feet.

Twig - The twigs are smooth, greenish and usually somewhat four-sided, The bark is green to gray, often streaked with reddish-brown.

Leaf - The leaves are opposite, finely serrate, sharp-pointed and deciduous, They vary from narrowly elliptic and tapered at both ends to broadly elliptic, oblong-ovate or obovate, up to 5 inches in length and 2 inches in width including the grooved petiole .5 inch or more in length.

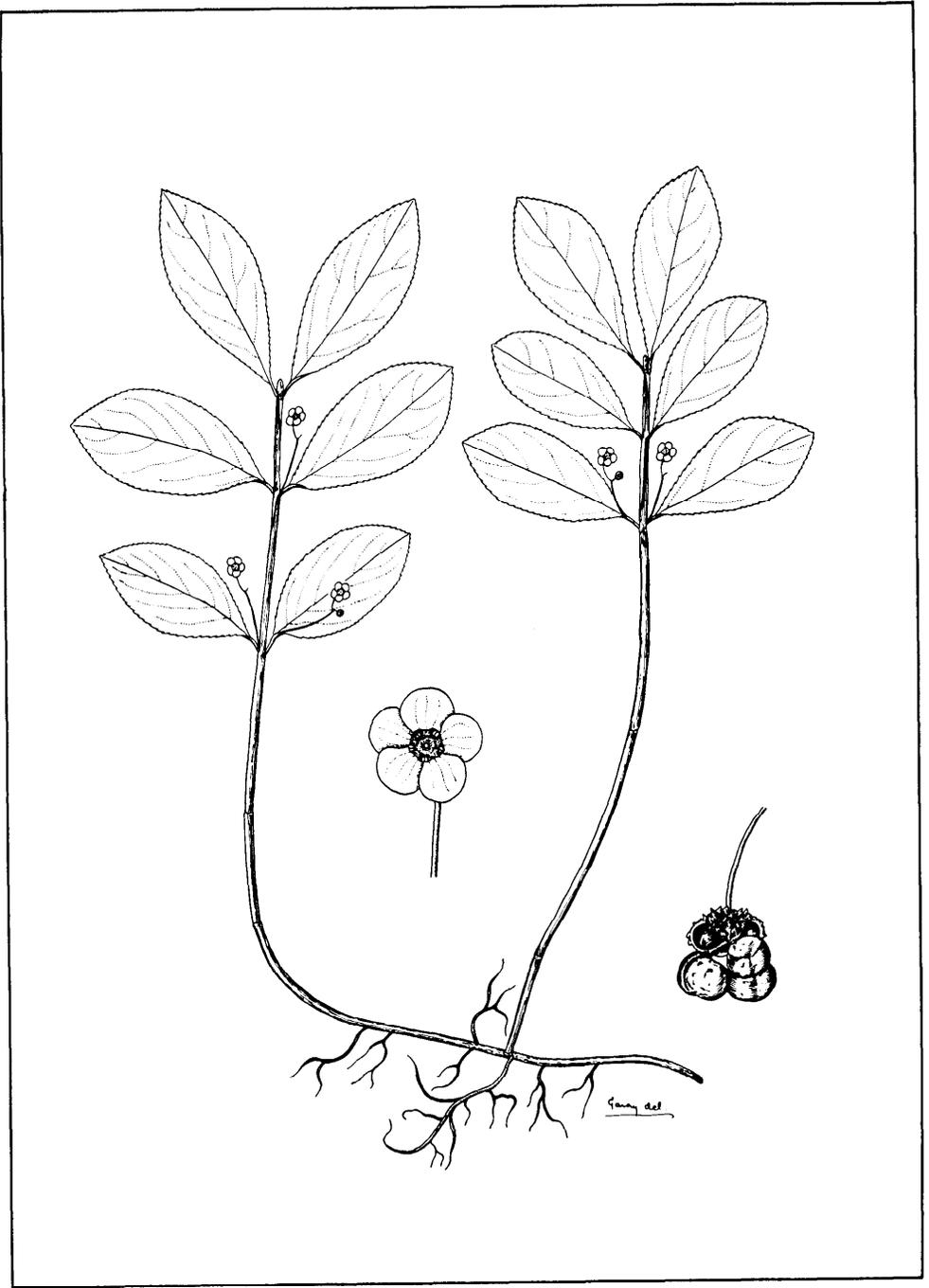
Flower - The flowers are small, purplish-maroon in colour and rather inconspicuous, They are borne in small numbers on slender stalks in cymose clusters from the lower leaf axils. They open in late June or early July.

Fruit - The fruit is a deeply 4-angled capsule, turning pink when ripe (in September) and splitting to expose the scarlet-coated seeds, The fruits remain on the plant after the leaves have fallen,

Habitat - In low places, particularly in thickets, along streams in rich alluvial soil; also in damp sandy or rocky woods,

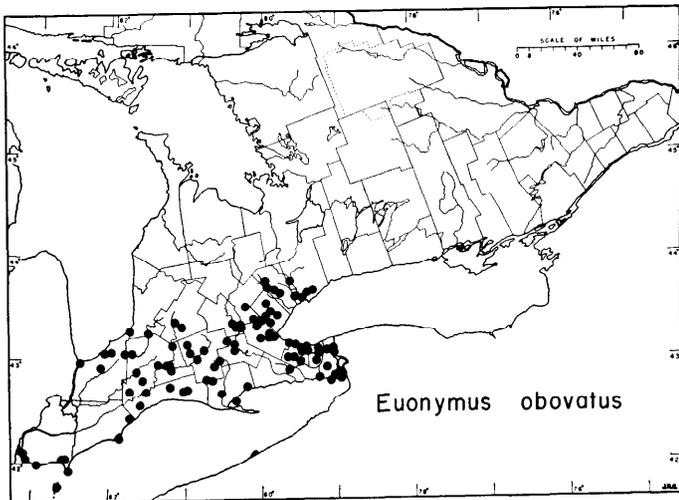
Range - Found native only in the district south of a line from Toronto west to Lake Huron, (Ontario to Montana, south to Oklahoma, Alabama and eastern Virginia).

FIELD CHECK - Somewhat four-angled stems, opposite and finely serrate pointed leaves; persistent pink and red bitter-sweet-like fruits.



Euonymus obovatus Nuttall

RUNNING STRAWBERRY-BUSH



Habit - The Running Strawberry-bush is a low trailing shrub with prostrate freely-rooting stems from which arise short erect or upturned leafy branches. It seldom reaches a height of more than one foot.

Twig - The twigs are smooth, greenish, and often four-sided or conspicuously angled, The bark is gray-green to brownish.

Leaf - The leaves are thin and smooth, with very finely serrate margins. They are borne in 2-5 opposite pairs on each branch and are deciduous, Each leaf is elliptic to oblong or obovate, up to 3 inches long and 1.5 inches wide, the terminal pairs usually the largest. The tip of the leaf is rounded or slightly pointed and the base is tapered gradually to a short grooved petiole about 1/8 inch long.

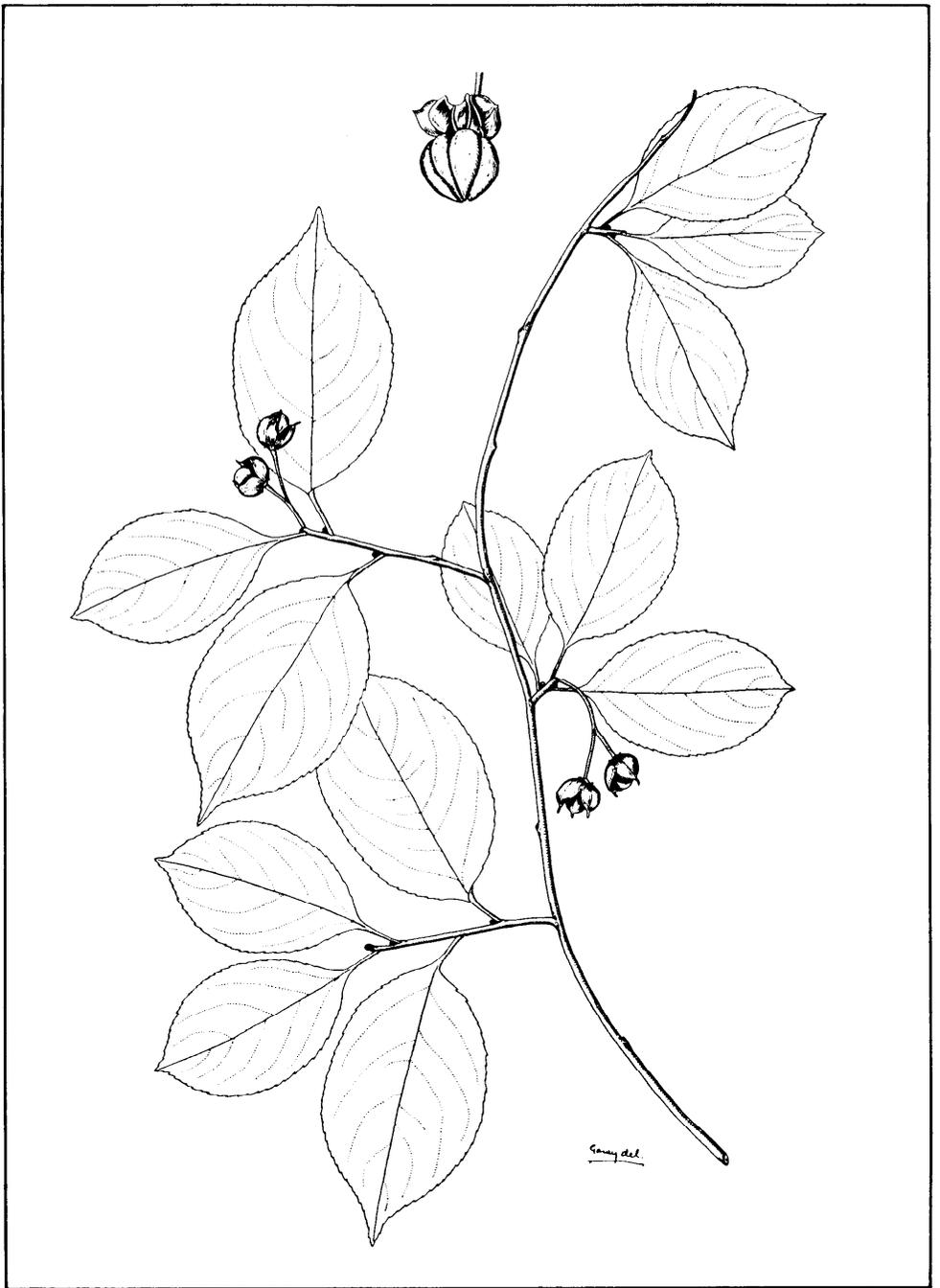
Flower - The flowers are small, greenish-yellow and rather inconspicuous. They are borne singly or in groups of 2 or 3 on long thin stalks from the axils of the leaves. Each flower is about 1/4 inch across with five round overlapping petals and five bright orange-yellow stamens protruding from a translucent green disk (see enlarged drawing).

Fruit - The fruit, similar to that of Bittersweet in appearance, is a 3-lobed spiny or tuberculate-roughened orange-pink to crimson capsule, when ripe (in September) splitting into 3 segments and exposing the orange to scarlet-coated seeds. There are usually three seeds hanging down a short distance from the inner wall of the pendent capsule.

Habitat - In shaded situations, ravine slopes, rocky woods, wooded talus slopes or wooded river banks.

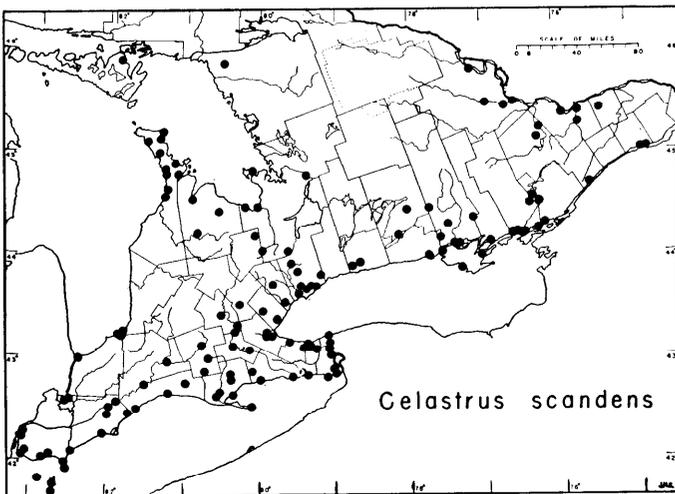
Range - Essentially restricted to the Carolinian Zone; very common along the Niagara Escarpment from the Niagara River through Welland, Lincoln, Wentworth, Halton and Peel counties. (New York to Michigan and Illinois, south to Missouri and Tennessee).

FIELD CHECK - Low trailing habit; ascending or erect branches with opposite leaves; showy bittersweet-like spiny fruits,



Celastrus scandens Linnaeus

BITTERSWEET



Celastrus scandens Linnaeus

BITTERSWEET

Habit - The Bittersweet is a woody vine or twining shrub which forms tangled masses in open ground, or climbs on fences, shrubs or trees to a height of 25 feet or more.

Twig The branchlets are slender, green, smooth, and flexuous. The bark is gray or reddish-brown.

Leaf - The leaves are thin, smooth and light green in colour, alternate and deciduous. Their shape varies from oval to oblong, ovate-lanceolate or obovate, up to 5 inches long and 2 inches wide. They are acute or acuminate at the apex and rounded or tapered at base to a petiole .25 to .75 inch long. The margins are crenulate-serrate.

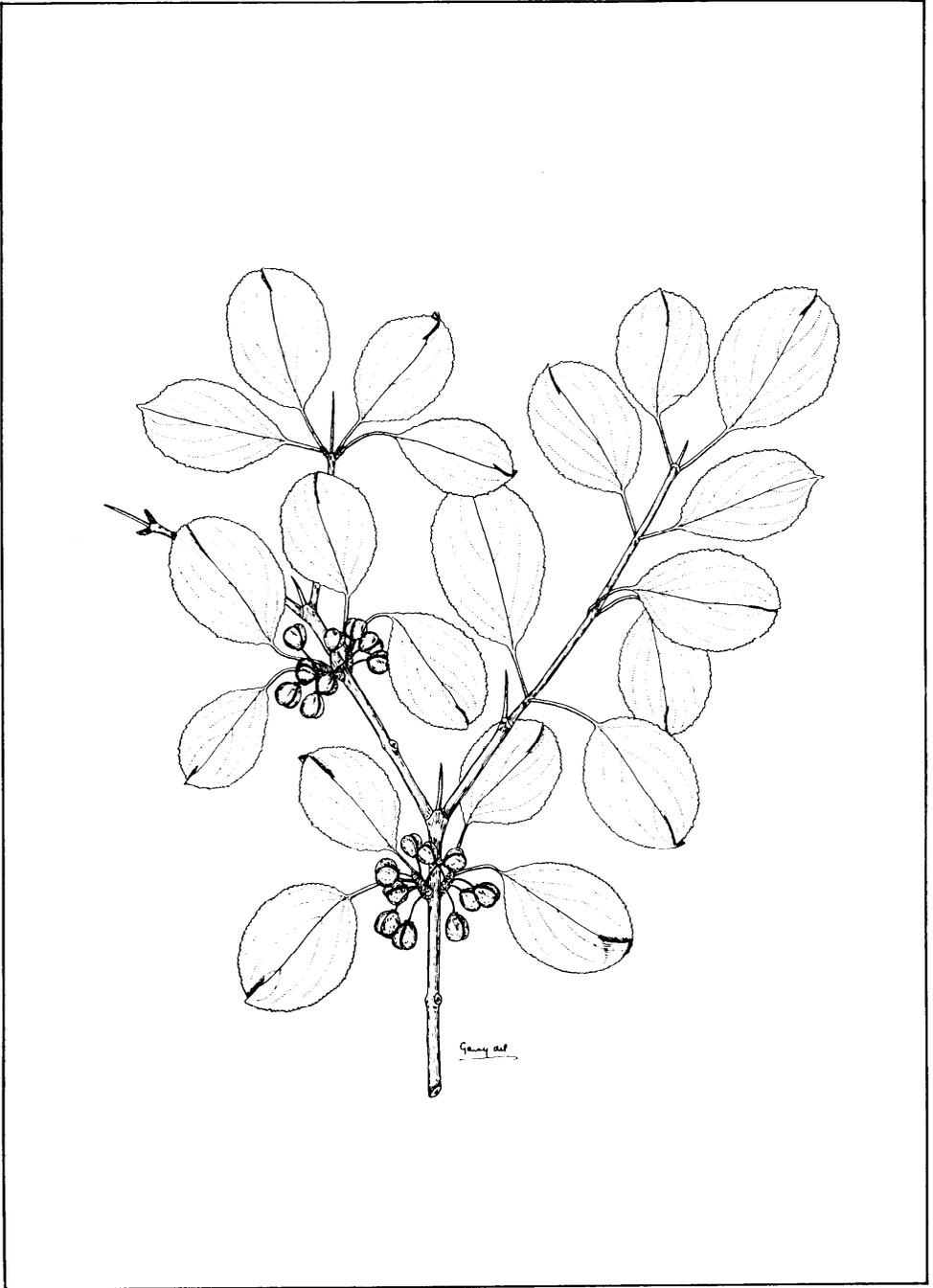
Flower - The flowers are small, greenish-yellow and rather inconspicuous. Male and female flowers are usually borne on separate plants in terminal raceme-like clusters and opening in June.

Fruit - The female flower develops into a globose orange-yellow capsule about .5 inch across, which when ripe splits into three parts to expose the crimson or scarlet-coated seeds. The fruits persist after they split open, thus forming very attractive elongate orange and red clusters.

Habitat - In both dry and moist situations; sandy or rocky woods, swampy thickets, roadsides and fence-rows.

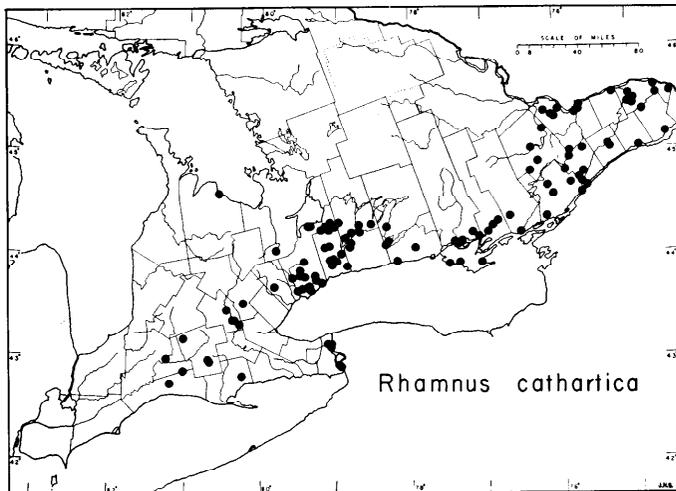
Range - Common in Ontario south of the Canadian Shield, north in the Ottawa valley and the Bruce Peninsula; also near the eastern and western ends of Lake Superior. (Southern Quebec to southern Manitoba, south to Oklahoma, Louisiana and Alabama.)

FIELD CHECK - Twining woody vine with alternate, pointed, finely toothed, light green leaves and attractive clusters of orange and red fruits.



Rhamnus *cathartica* Linnaeus

COMMON BUCKTHORN



Habit - The Alder-leaved Buckthorn is an upright, sparsely branched and thornless shrub usually less than 3 feet in height and sometimes spreading to form low thickets or patches bordering wet places.

Twig - The twigs are stout, at first green and minutely hairy, later purplish-red to gray and finely ridged.

Leaf - The leaves, alternate and deciduous, green above and a somewhat paler gray-green beneath, vary from elliptic to ovate or obovate in shape with crenate-serrate margins. The upper leaves are larger, up to 4 inches long and 2 inches wide, with acute to tapered or pointed tips, the lower ones smaller with more rounded tips, the bases sometimes rounded but more commonly narrowed to a grooved petiole .25 to .5 inch long. There are conspicuous linear stipules .25 to 3/8 inch long on the young growth usually falling off before the fruits mature.

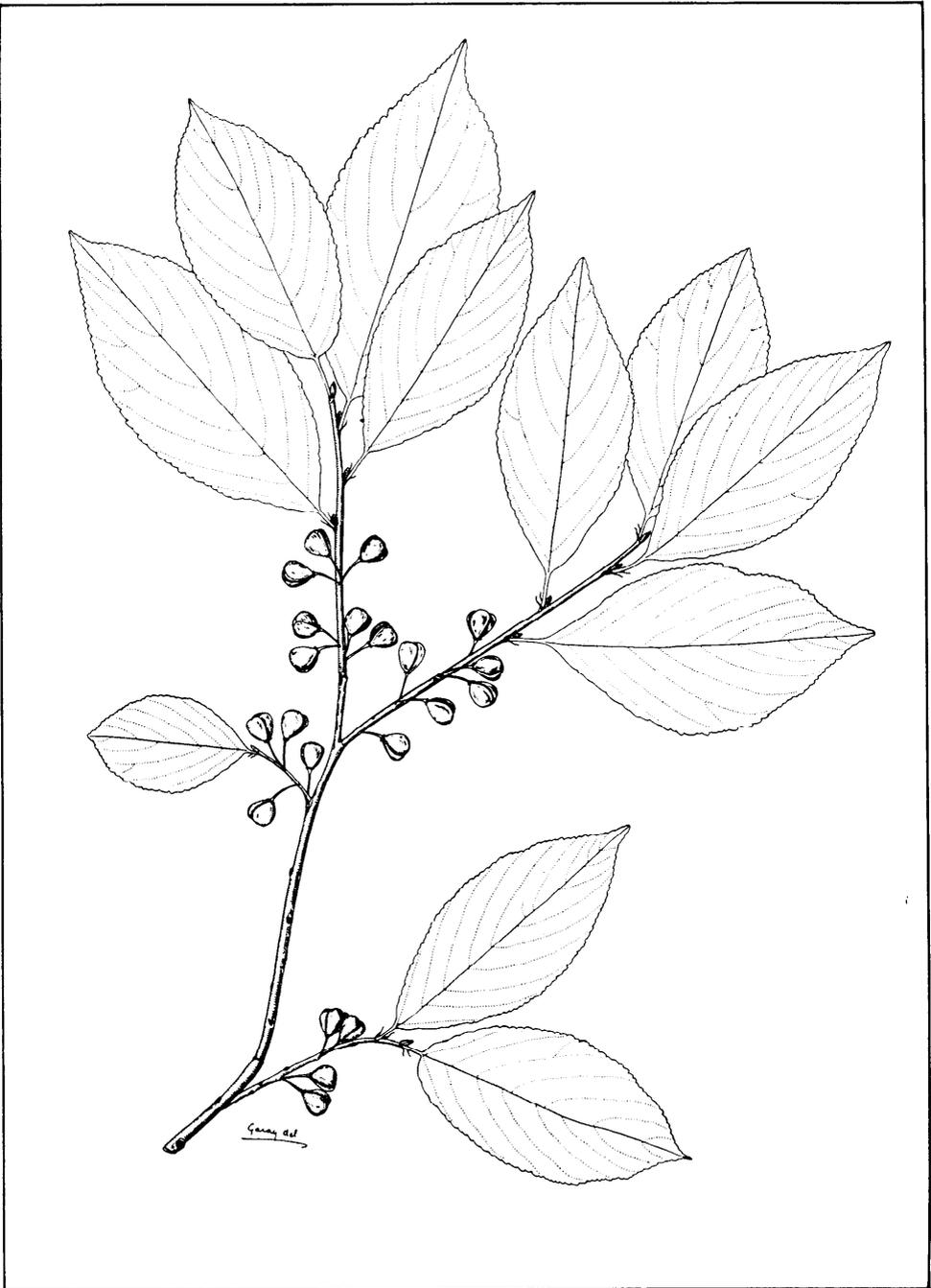
Flower - The flowers are very small, about 1/8 inch across and yellowish-green in colour. They are either perfect, unisexual or dioecious, borne on short stalks in small clusters from the axils of the lower leaves and open in late May or early June.

Fruit - The fruit is a purplish-black globose to ovoid 1-3-seeded berry-like drupe about .25 inch across, slightly longer than wide, These are borne in small clusters and ripen in August or September.

Habitat - Moist situations: low woods and thickets, swampy depressions in woods, shores of small lakes and banks of streams, sphagnum bogs and cedar swamps.

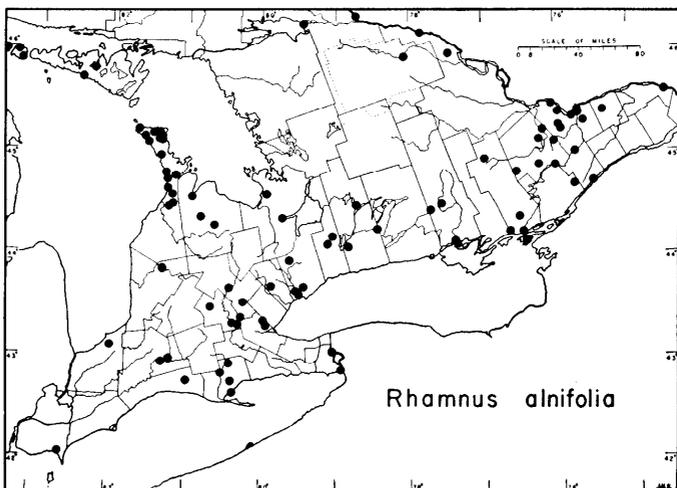
Range Widespread in Southern Ontario but apparently rare on the Canadian Shield; also around Lake Superior and north to James Bay. (Newfoundland to British Columbia and south to California, Nebraska, Indiana and West Virginia.)

FIELD CHECK - Low erect shrub of wet places; alternate veiny leaves and black berry-like fruits.



Rhamnus alnifolia L'Heritier

ALDER-LEAVED BUCKTHORN



Habit - The Bladdernut is an erect rather stiff-branched shrub up to 15 feet in height.

Twig - The twigs are stout and green, mottled with lines or stripes. The bark turns gray or brown and is slightly ridged or warty.

Leaf - The leaves are opposite, three-parted and deciduous, the terminal leaflet usually larger than the two laterals and borne an inch or more beyond them on the leaf stalk. The lateral leaflets are sessile or short-stalked and the complete compound leaf measures up to 10 inches in length, including the petiole which is 4 inches or more in length. The shape of the leaflets is oval to ovate-lanceolate with an obtuse or acute and abruptly sharp-pointed (acuminate) apex and a rounded or tapered base. The blades with closely and sharply serrate margins measure up to 4 inches in length and 2 inches in width. They are dark green and smooth above, much paler and somewhat pubescent beneath at least along the veins. There are prominent stipules on the young growth, linear-filiform and hairy, up to 1 inch long and soon falling off. Similar but smaller stipels occur at the bases of the lateral leaflets.

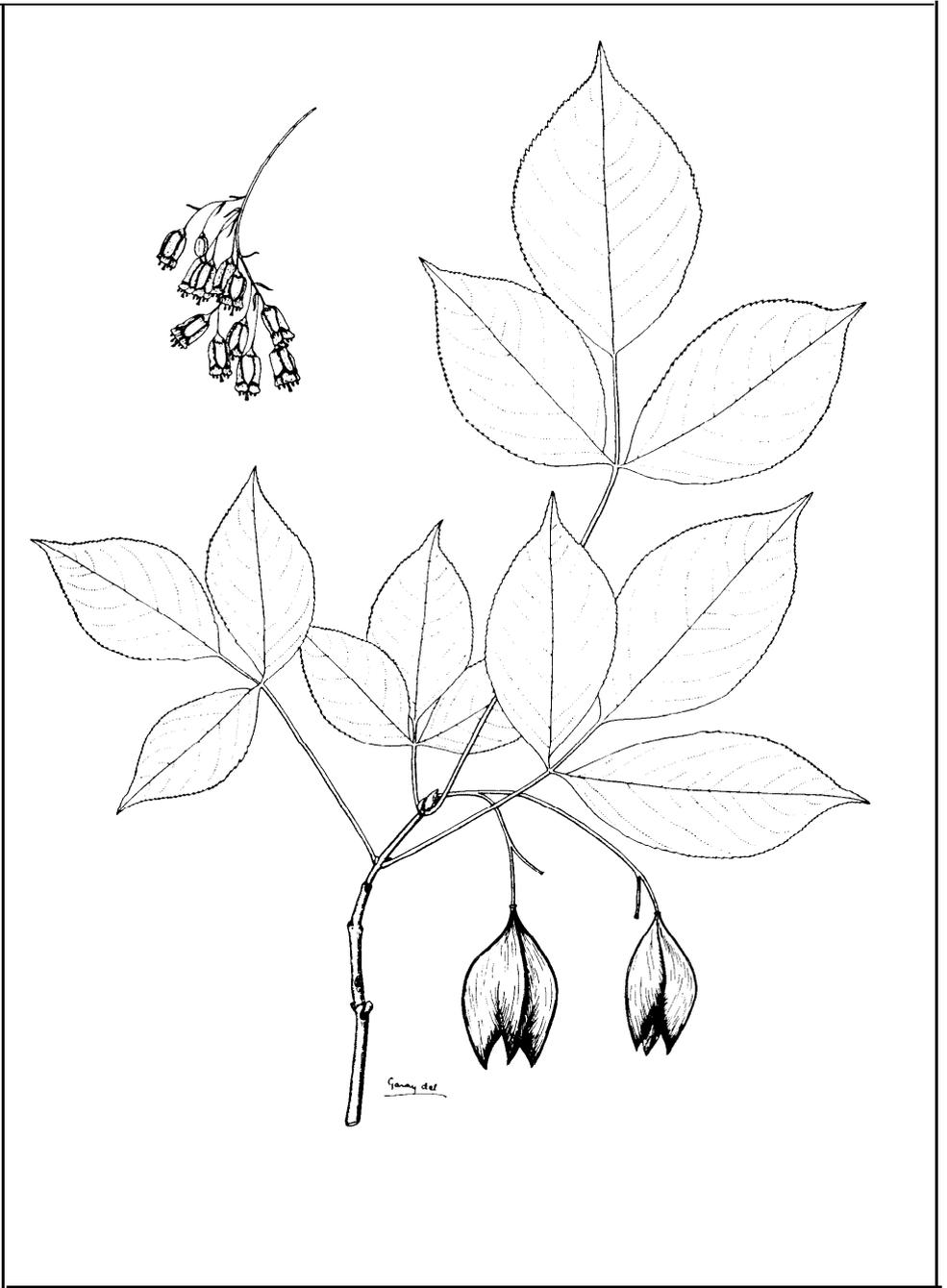
Flower - The flowers are white or cream-coloured, perfect and cylindrical in shape, about 3/8 inch long, borne in terminal drooping raceme-like clusters. They open in May shortly before the leaves have fully expanded.

Fruit - The fruit is a much-inflated and prominently 3-angled veiny brown capsule varying in shape from globular to ellipsoidal. It measures 2 - 3 inches in length and has 3 conspicuous points at the tip, each with a short thread-like tail which is the persistent style. There are three cavities in the capsule, each containing 1 - 4 pale brown seeds which become loose when ripe and rattle around inside. The capsules often remain on the plant throughout the winter.

Habitat - Rocky woods, river banks and alluvial flats, hillsides, talus slopes of the Niagara Escarpment and occasionally wooded sand dunes or ridges.

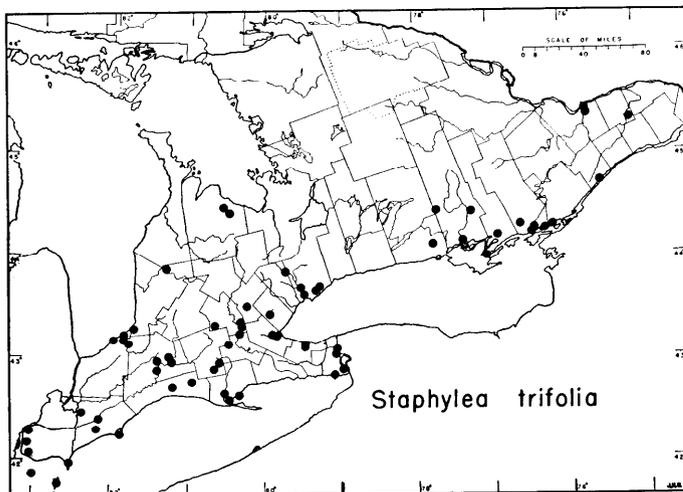
Range Commonest in the Carolinian Zone but also near Georgian Bay in Grey county and along the eastern half of the north shore of Lake Ontario to the St. Lawrence and Ottawa districts. (Southwestern Quebec to Minnesota, south to Oklahoma and Georgia.)

FIELD CHECK - Opposite three-parted finely serrate leaves and inflated S-angled persistent brown capsules.



Staphylea trifolia Linnaeus

BLADDER-NUT



Habit. The Common Buckthorn is a large coarse shrub or small tree up to 20 feet in height with terminal and lateral spine-like or thorn-like short shoots.

Twig The twigs are stout and purplish-red to gray-brown. The long shoots are smooth and somewhat angled, the short shoots rough-warty with crowded leaf scars.

Leaf - The leaves are chiefly opposite, but some are subopposite or alternate. They are smooth and green on both surfaces and deciduous, but they sometimes remain green and do not fall until late in the autumn, The shape varies from elliptic to ovate with an abruptly pointed tip which is slightly folded and recurved in its natural position. The base is subcordate, rounded or tapered, with a grooved pubescent petiole up to 1 inch in length. The size of the whole leaf varies up to 4 inches long and 1.5 inches wide. The margins are minutely crenate-serrate and the lower surface shows 3-5 pairs of strongly curved veins. There is a pair of deciduous linear stipules, 1/8 to .25 inch long at the base of each young leaf.

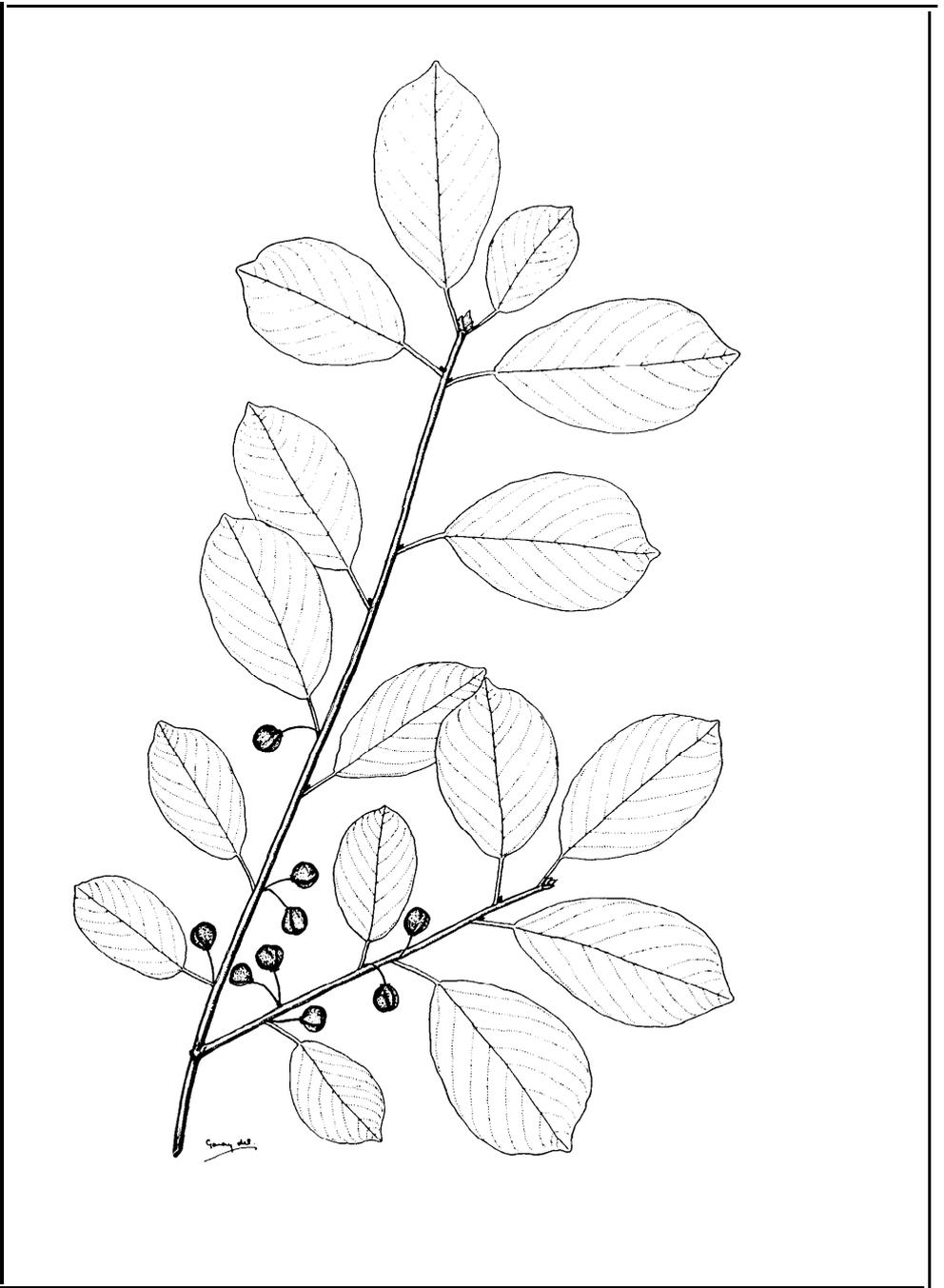
Flower - The flowers are very small, less than .25 inch across, perfect, unisexual or dioecious. They are greenish-yellow in colour and borne on thread-like stalks .25 inch or more in length in rather dense clusters from the axils of the lower leaves and open in early June.

Fruit - The fruit is a purplish-black 3-4-seeded globose berry-like drupe about .25 inch across. These are borne in dense clusters and ripen in August or September.

Habitat - In both dry and moist situations; open pastures, fence-rows, roadsides, clearings; also in low woods, rocky woods and on the slopes of ravines; often appearing as if native.

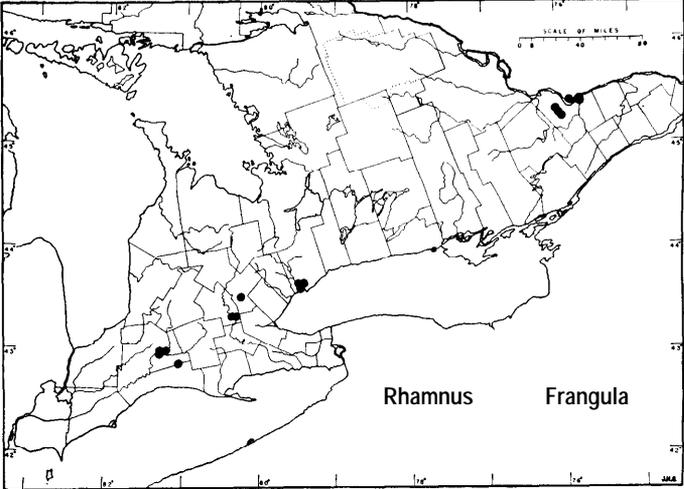
Range Introduced and common in southern Ontario both south and east of the Canadian Shield. (A native of Europe and thoroughly naturalized in many parts of North America from Quebec to Minnesota, south to Missouri and Virginia.)

FIELD CHECK - Coarse shrub or tree with spine-like short shoots; leaves opposite or subopposite with strongly curved veins; black berry-like fruits in dense clusters.



Rhamnus Frangula Linnaeus

GLOSSY BUCKTHORN



Rhamnus Frangula Linnaeus GLOSSY BUCKTHORN, ALDER BUCKTHORN

Habit - The Glossy Buckthorn is a shrub or small tree up to 20 feet in height.

Twig - The twigs are stout, brownish to gray, mottled with conspicuous elongate pale lenticels.

Leaf - The leaves are thin and deciduous, green and smooth on both surfaces and mostly alternate although some are sub-opposite. The shape is oval, elliptic or obovate with a rounded, blunt and usually abruptly pointed apex, a rounded or tapered base and entire, faintly wavy margins. The size varies up to 4 inches long and 2 inches wide including a stout petiole up to 2 inch long. There are 5-10 pairs of rather straight veins which are finely pubescent beneath. Very small and slender deciduous stipules occur on the young growth.

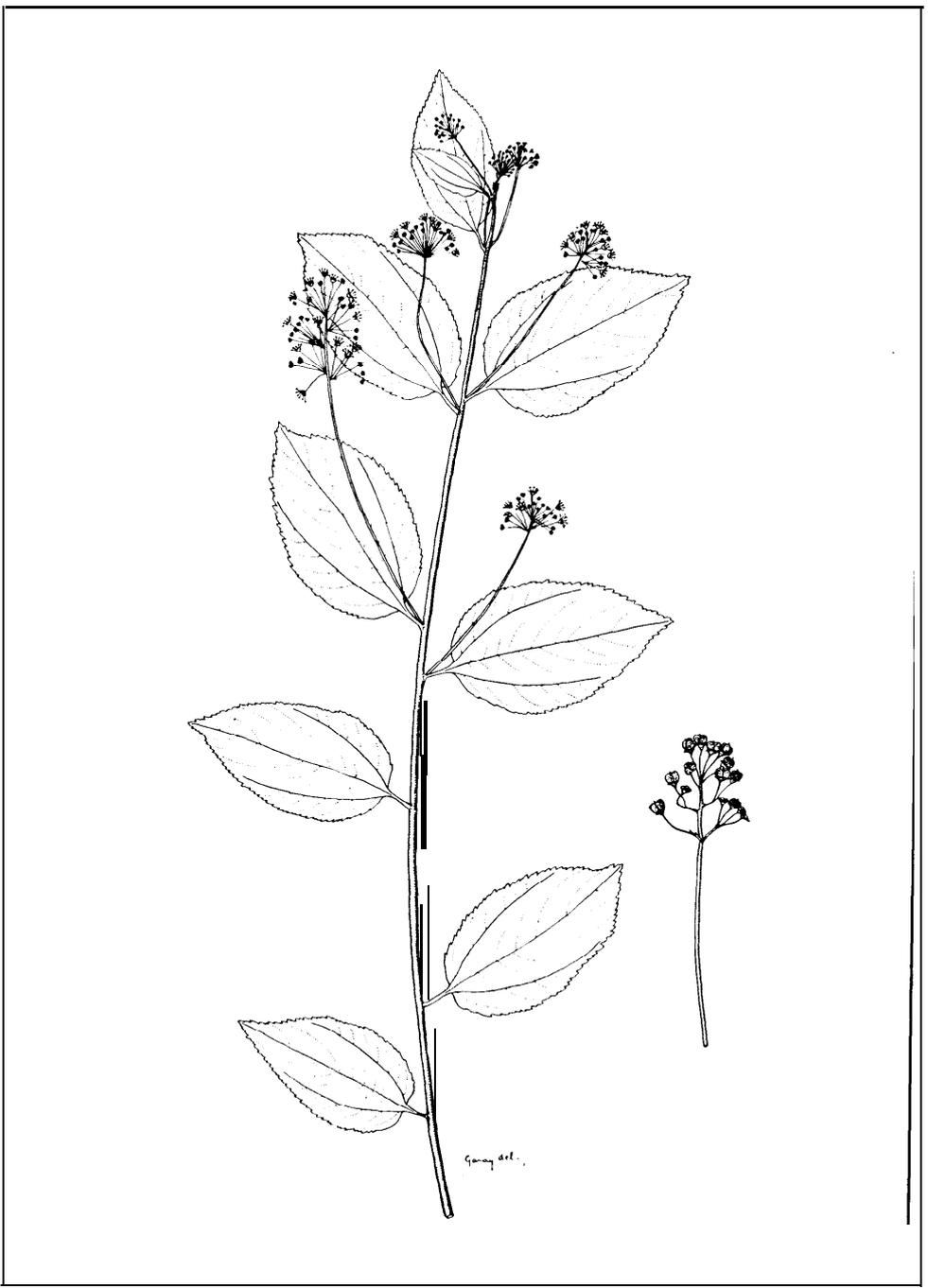
Flower - The flowers are greenish-yellow, perfect and very small, less than .25 inch across. They occur singly or in groups of 2-8 in sessile umbels in the axils of the lower leaves, opening in June.

Fruit - The fruit is a purplish-black 2-3-seeded globose berry-like drupe about .25 inch across. These are borne in small clusters and ripen in August or September.

Habitat - In mixed woods, shaded ravines or around the edge of sphagnum bogs.

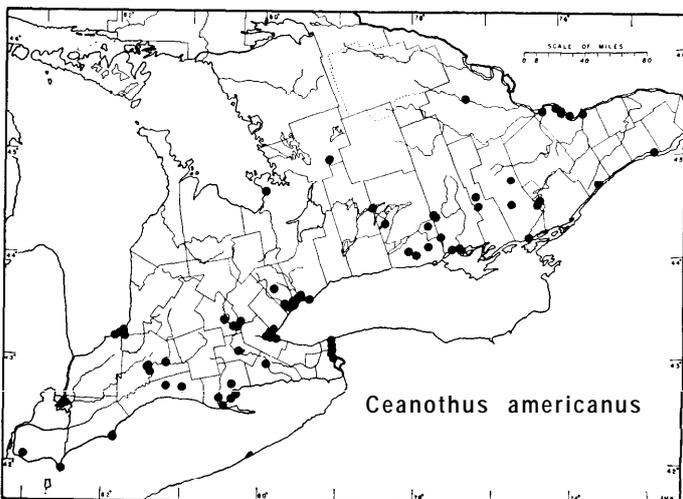
Range Introduced and established rather locally in woods,, ravines and around bogs near some of the cities in southern Ontario: in the vicinity of Ottawa, Toronto, Guelph, Galt and London. (Naturalized from Europe: rather local from southern Quebec to Minnesota, southern to Illinois and New England.)

FIELD CHECK - Alternate entire veiny leaves; small clusters of black berry-like fruits.



Ceanothus americanus Linnaeus

NEW JERSEY TEA



Habit - The New Jersey Tea is a low branching shrub less than 3 feet in height.

Twig - The twigs are reddish-brown to gray, smooth or finely pubescent.

Leaf - The leaves are prominently 3-ribbed, alternate and deciduous, smooth and green above, gray-green and minutely hairy beneath, at least along the veins. The shape is ovate or oblong to ovate-lanceolate with an acute or acuminate apex and a subcordate to rounded or rarely tapered base. The margins are finely serrate with gland-tipped teeth. The size varies up to 4 inches long and 2 inches wide including the grooved petiole which is .5 inch or less in length. Small densely long-hairy stipules occur on the young growth but these soon fall off.

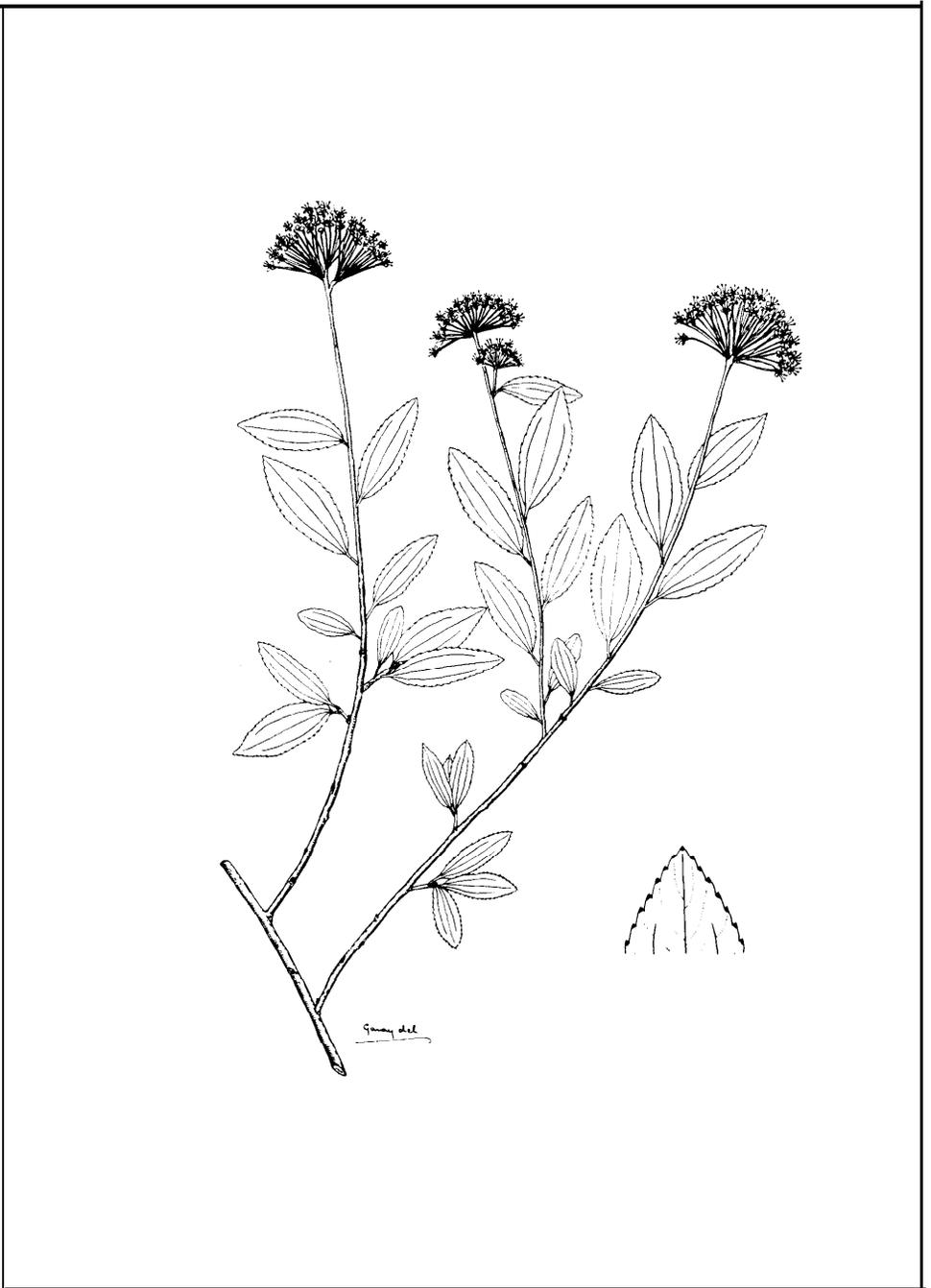
Flower - The flowers are white, perfect and very small, about 1/8 inch across. They are borne on slender stalks up to 3/8 inch long in rather showy thimble-shaped clusters on long stout stems which arise from the axils of the leaves and are progressively longer towards the base of the plant, The flowering stems reach 6 or 7 inches in length and are naked for most of their length or have one or two small narrow leaves just below the crowded terminal flower-clusters. (Late June to early August,)

Fruit - The fruit is a small 3-lobed roundish brown capsule 1/8 to 1/4 inch across on a saucer-like stalked base, These are borne in clusters at the ends of the branches and ripen in late August or in September. The fruit-bases persist through the winter-,

Habitat - Usually in dry situations; sandy or rocky soil in clearings, at the edge of woods, on river banks and lake-shores, in open woods and on shaded hillsides.

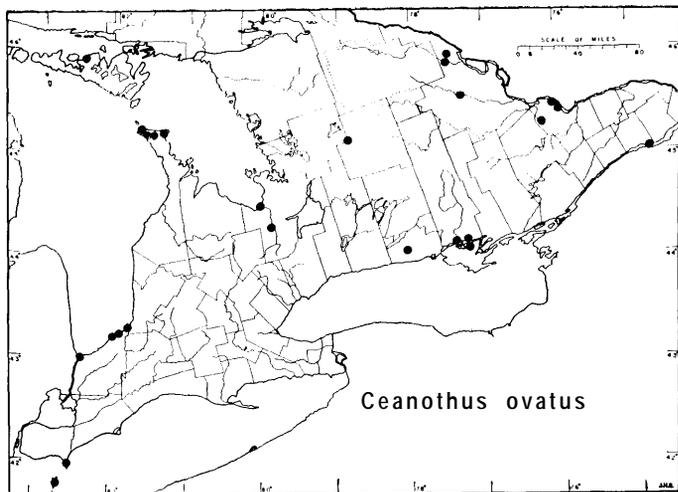
Range Common in the Carolinian Zone and north of the eastern half of Lake Ontario to the Ottawa and St. Lawrence valleys; also on the southeastern shore of Georgian Bay. (Maine and southern Quebec to southern Manitoba, south to Texas and Florida.)

FIELD CHECK - Three-ribbed glandular-serrate, alternate leaves; long stalked, mostly leafless flower clusters; small brown capsules with persistent saucer-like bases.



Ceanothus ovatus Desfontaines

NARROW-LEAVED NEW JERSEY TEA



Ceanothus ovatus Desfontaines NARROW-LEAVED NEW JERSEY TEA

Habit - The Narrow-leaved New Jersey Tea is a low, erect, much-branched shrub usually less than 3 feet in height.

Twig - The twigs are smooth, purplish-brown to gray in colour.

Leaf - The leaves are prominently 3-ribbed, alternate and deciduous, smooth and green above, somewhat paler green and varying from smooth to densely hairy beneath. The shape is narrowly elliptic to narrowly oval or ovate-lanceolate with an obtuse or rounded apex and a tapered base. The margins are finely serrate with dark gland-tipped teeth. The blade varies up to 2.25 inches in length and .25 to 5/8 inch in width including the short petiole 3/8 inch or less long. Small hairy stipules are present on the young growth but they soon turn brown and fall off,

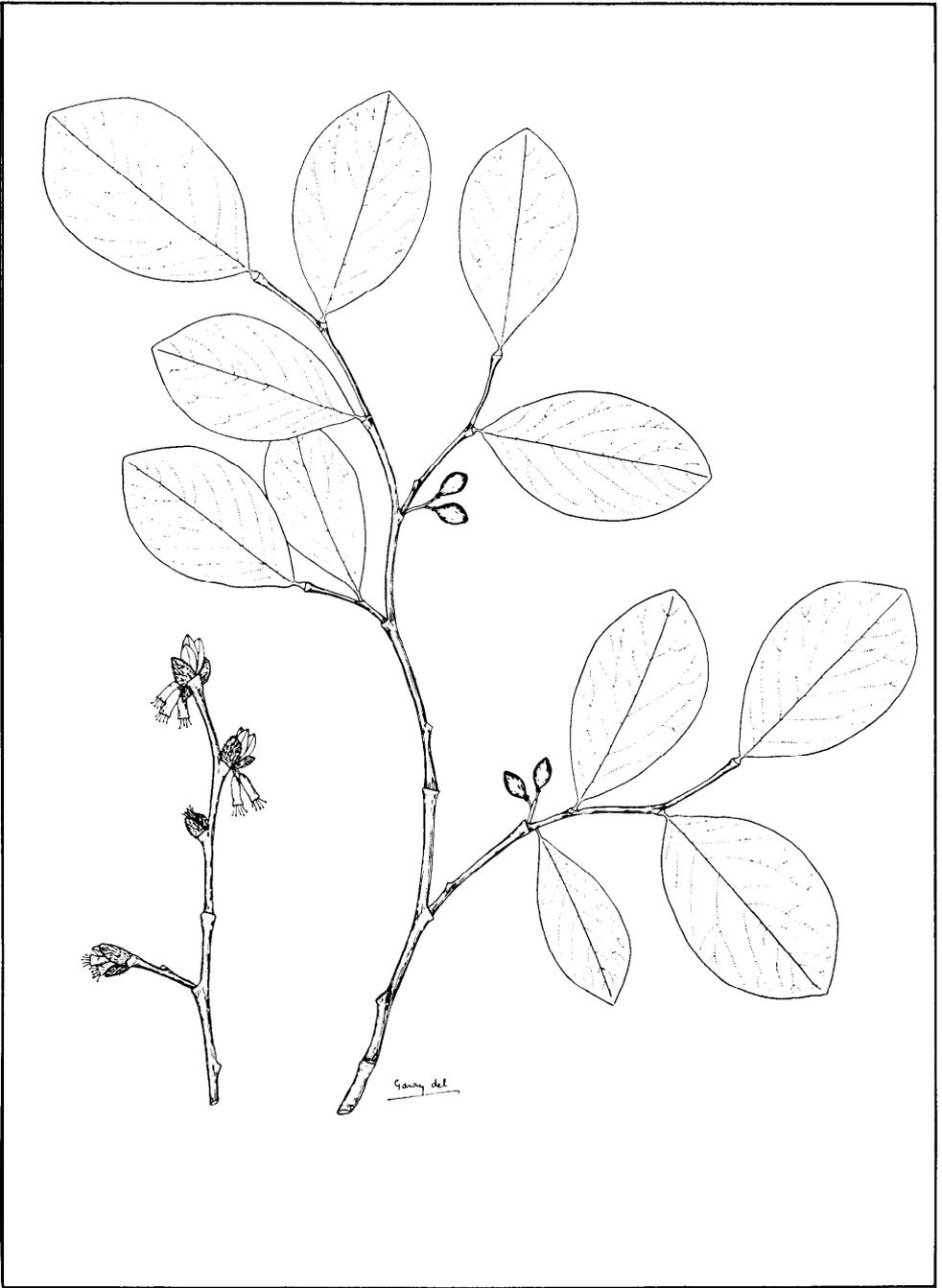
Flower - The flowers are white, perfect and very small, about 1/8 inch across. They are borne on slender stalks up to 5/8 inch long in rather showy round-topped clusters at the ends of normally leafy shoots, about the middle of June.

Fruit - The fruit is a small 3-lobed roundish dark brown capsule about 1/8 inch across on a stalked saucer-like base. These are borne in clusters and ripen in late July or in August.

Habitat - In dry situations: sandy oak and pine woods, rocky limestone barrens.

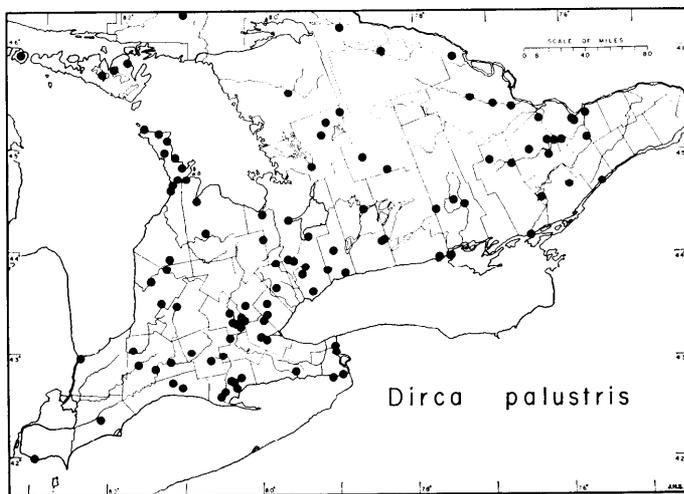
Range Rather local on sandy soil along or near the shores of the Great Lakes and the Ottawa River; on limestone barrens at the northern end of the Bruce Peninsula and in the Burnt Lands near Ottawa. Rare north of 46° north latitude, (Maine and western Quebec to Manitoba, south to Texas and Georgia.)

FIELD CHECK - Low much-branched shrub with narrow chiefly 3-ribbed glandular-serrate alternate leaves; rounded flower clusters at the ends of leafy branches; small dark brown capsules with persistent saucer-like bases.



Dirca palustris Linnaeus

LEATHERWOOD



Habit - The Leatherwood is a low to medium-sized shrub or dwarf tree usually less than 6 feet tall. It often grows with one main trunk dividing close to the ground and developing a much-branched system of erect or arching stems.

Twig - The branchlets are green at first, turning brown or grayish-brown. They are stout and pliant with conspicuous enlarged joints (nodes) where the leaves and buds arise. The bark is soft and fibrous, remarkably tough and pliable.

Leaf - The leaves are alternate and deciduous, thin, smooth and light green in colour. They are elliptic to ovate or broadly oval in shape, broadest about the middle, often somewhat rhombic or angular in outline with an obtuse or pointed apex and a rounded or often tapered base. There is a very short petiole, less than 1/8 inch long, which has an expanded dome-shaped base covering the bud for the following season. The margins of the blade are entire and the size varies up to 4 inches long and 22 inches wide.

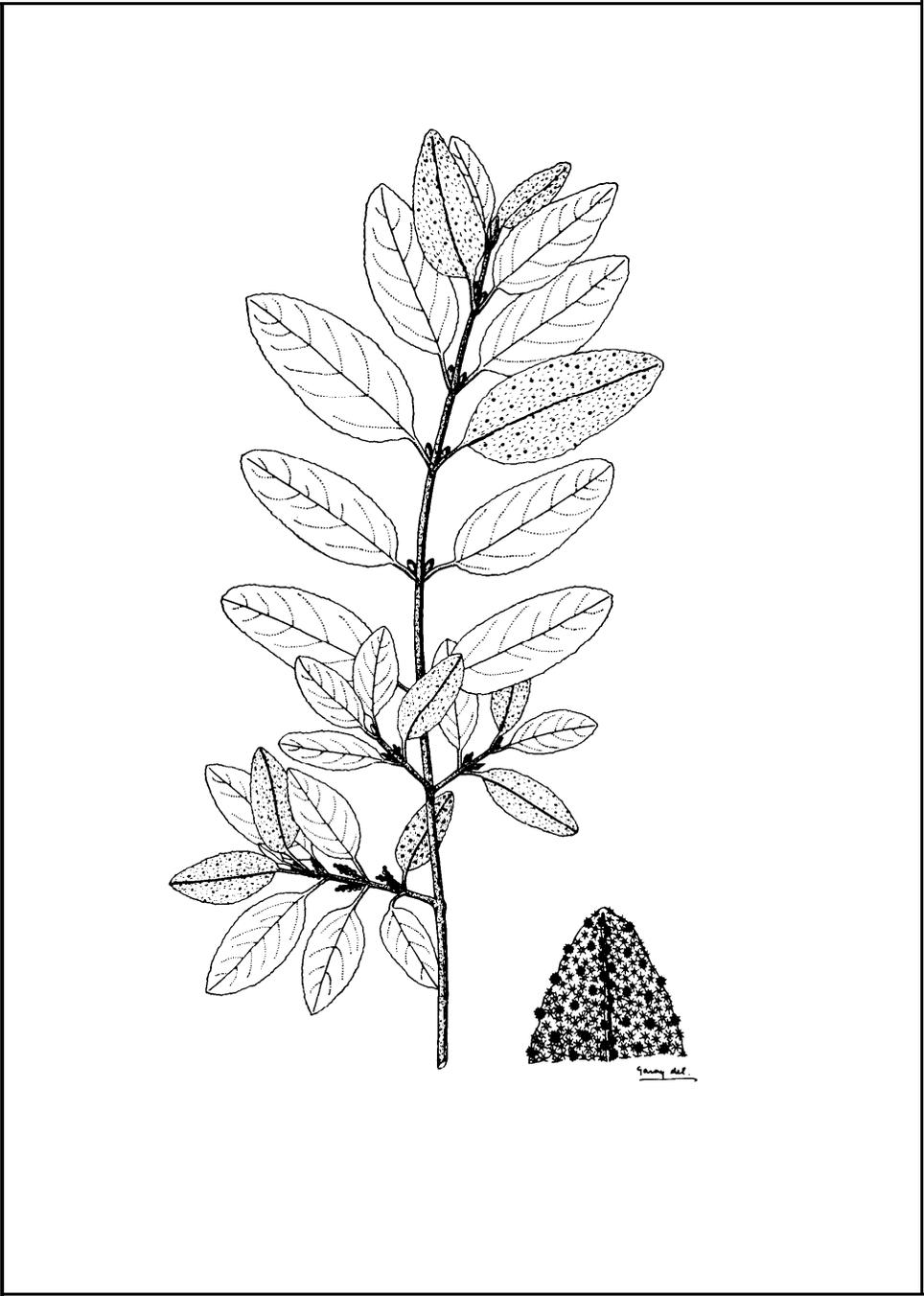
Flower - The flowers are perfect, pale yellow and tubular, .25 to 3/8 inch long and borne in pendulous clusters of 2-5 from the opening buds in early spring just as the leaves are unfolding (late April or early May). They are subtended by 2-4 very hairy dark brown enlarged bud scales which persist for several weeks.

Fruit - The fruit is a globose to ellipsoidal berry-like drupe 3/8 to .5 inch long, at first green then turning purplish-red. It contains a single dark brown seed, ripens in early summer (June or July) and falls off before autumn.

Habitat - Usually in damp or shaded woods on rocky or sandy soil; rarely on wooded sand dunes, in open jack pine woods or open rocky pastures.

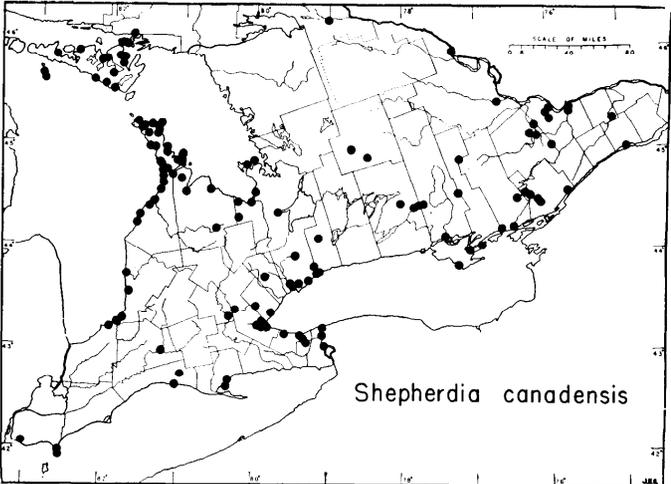
Range - Widespread throughout southern Ontario extending to about 47° north latitude, possibly just reaching the same northern limit as Beech and Sugar Maple, with which it is often found associated. (New Brunswick and Ontario to Minnesota, south to Louisiana and northern Florida.)

FIELD CHECK - Pliant branches with swollen nodes and tough fibrous bark; pale green entire and alternate leaves.



Sheperdia canadensis (Linnaeus) Nuttall

SOAPBERRY



Habit - The Soapberry is a low or medium-sized, much-branched and spreading shrub up to 4 or 5 feet in height

Twig - The young branchlets and buds are bright rusty-brown in colour, completely covered with a layer of fine whitish stellate hairs and numerous small brown overlapping circular scales. The older bark is brown to dark gray and minutely hairy.

Leaf - The leaves are thickish, opposite and deciduous, green or gray-green and sparingly stellate-pubescent above, densely silvery stellate-pubescent beneath and dotted with numerous circular dark-centered brown scales. Their shape is oval or elliptic with a rounded or obtuse apex and a rounded or tapered base. The rusty-scurfy grooved petiole is up to 3/8 inch long and the whole leaf varies in size up to 2.5 inches in length and 1.25 inches in width. The margins are entire or minutely irregular due to the presence of marginal brown scales along the lower surface. The veins are impressed above and only the mid-vein conspicuous beneath.

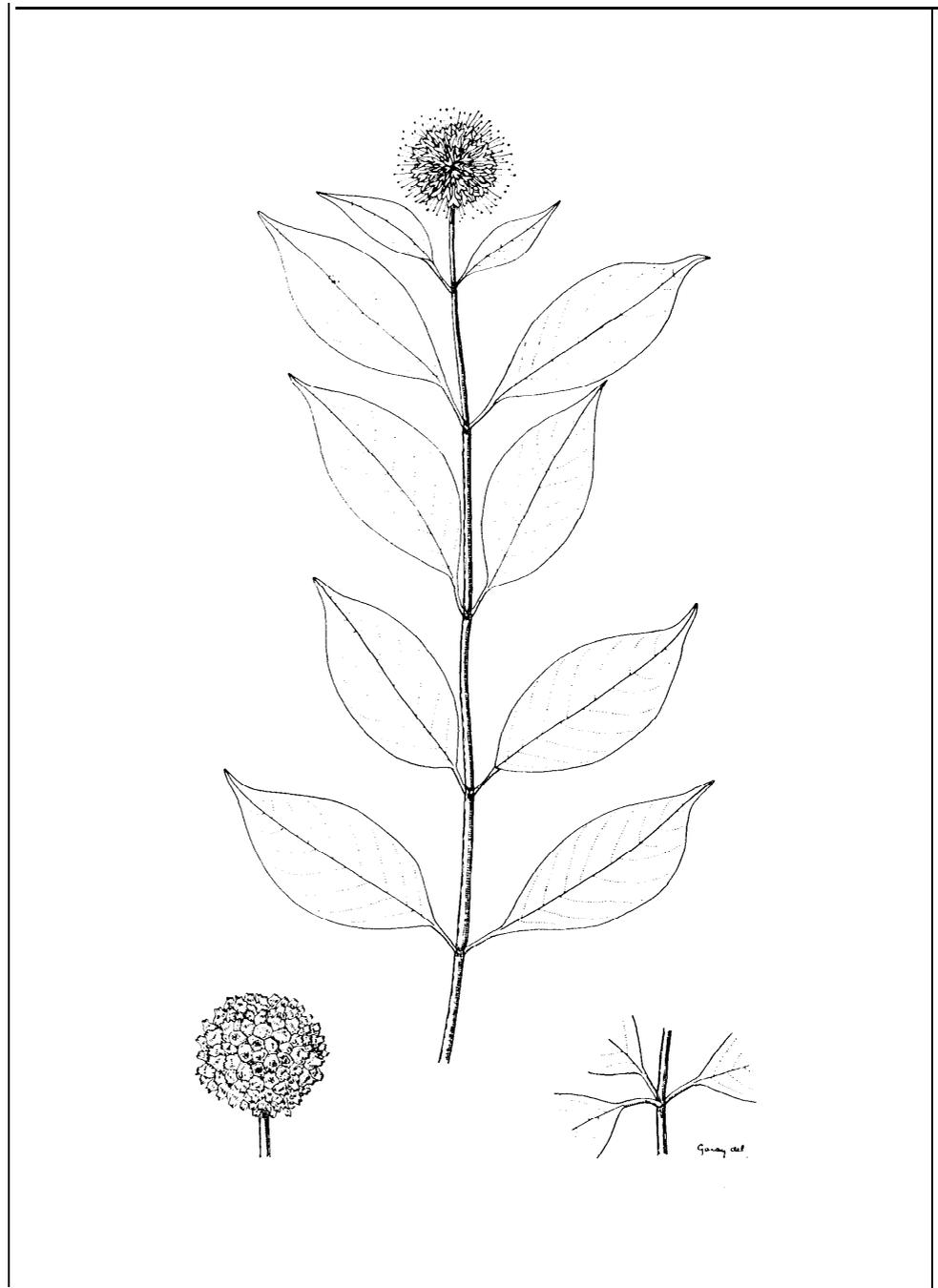
Flower - The flowers are very small, 1/8 to 3/16 inch across, greenish-yellow and chiefly dioecious. They are borne in dense clusters on short shoots at the nodes of the previous season's growth, opening in late April or early May.

Fruit - The fruit is berry-like, consisting of an achene enclosed in the enlarged pulpy red calyx tube. It is ovoid, slightly over .25 inch long and ripens in late June or in July.

Habitat - Usually in dry situations: sandy, gravelly or rocky banks and shores, dry or open rocky woods, dry slopes; occasionally in calcareous marshes.

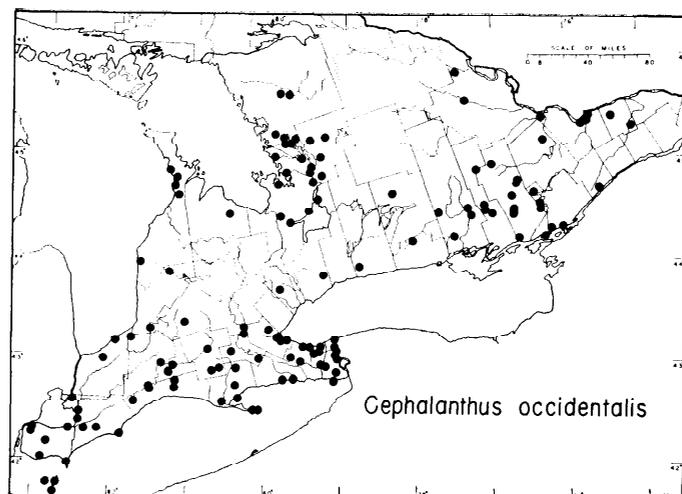
Range - Widespread in southern Ontario and north to Lake Superior and James Bay; very common on limestone in the Bruce Peninsula and on Manitoulin Island, (Newfoundland to Alaska, south to Maine, Ohio, Winnesota and New Mexico.)

FIELD CHECK - Rusty-scurfy stems ; opposite entire leaves with silvery-hairy brown-dotted lower surfaces; red berry-like fruits,



Cephalanthus occidentalis Linnaeus

BUTTONBUSH



Habit - The Buttonbush is a large spreading shrub usually with several stems from the ground or rarely tree-like, up to 8 or 10 feet in height.

Twig - The young branchlets are green at first, later turning brown, with scattered pale lenticels. The older stems have light brown pith and gray-brown to purplish-gray bark which is smooth or finely furrowed.

Leaf - The leaves are thickish, opposite or whorled in three's (or rarely in four's) and deciduous. They are bright green and glossy above and usually paler or softly hairy beneath. The blade varies in shape from elliptic-lanceolate to broadly ovate, the apex acute, acuminate or obtuse and the base rounded or tapered. The margins are entire or slightly wavy. There is a stout grooved petiole up to .75 inch long with a pair of short, triangular, sharp-pointed stipules at the base. The leaves vary in size up to 7 inches long and 3 inches wide.

Flower - The individual flowers are small, perfect, creamy-white, tubular and 4-parted, with a prominently exerted swollen-tipped style. They are borne in large numbers (100-200) tightly packed in spherical heads measuring up to 1.5 inches across with the thread-like styles forming a complete halo. These heads occur singly or in groups of two, three or more at the ends of the branches or on long stout stalks from the axils of upper leaves. The flowers open from about the middle of July to the end of August.

Fruit - The fruit is a hard spherical mass of nutlets ripening September or October. Each nutlet is a slender cone with compressed sides and a terminal persistent 4-toothed calyx remnant.

Habitat - In damp situations: along streams, at the edge of ponds, bays or marshes, in damp depressions of fields, and roadside ditches, usually where the roots are in water-logged soil at least part of the season.

Range - Widely distributed in southern Ontario to 45° north latitude and beyond to the Magnetewan River on the west and the Barron River on the east. Not reported from the intermediate upland area which includes Algonquin Park. (Southern Nova Scotia to Minnesota, south to Mexico and Florida; also in California and the West Indies,)

FIELD CHECK - Shrub of wet situations with opposite or whorled entire leaves; heads of white flowers; hard spherical heads of dry brown fruits.

CHAPTER 1

GENERAL DESCRIPTION OF THE WATERSHED

1. Municipalities

The watershed of the Credit River and its tributaries includes parts of the Townships of Toronto Gore, Chinguacousy, and Caledon in the County of Peel; parts of the Townships of Trafalgar and Esquesing in the County of Halton; part of Erin Township in the County of Wellington and parts of East Garafraxa, Amaranth and Mono in the County of Dufferin.

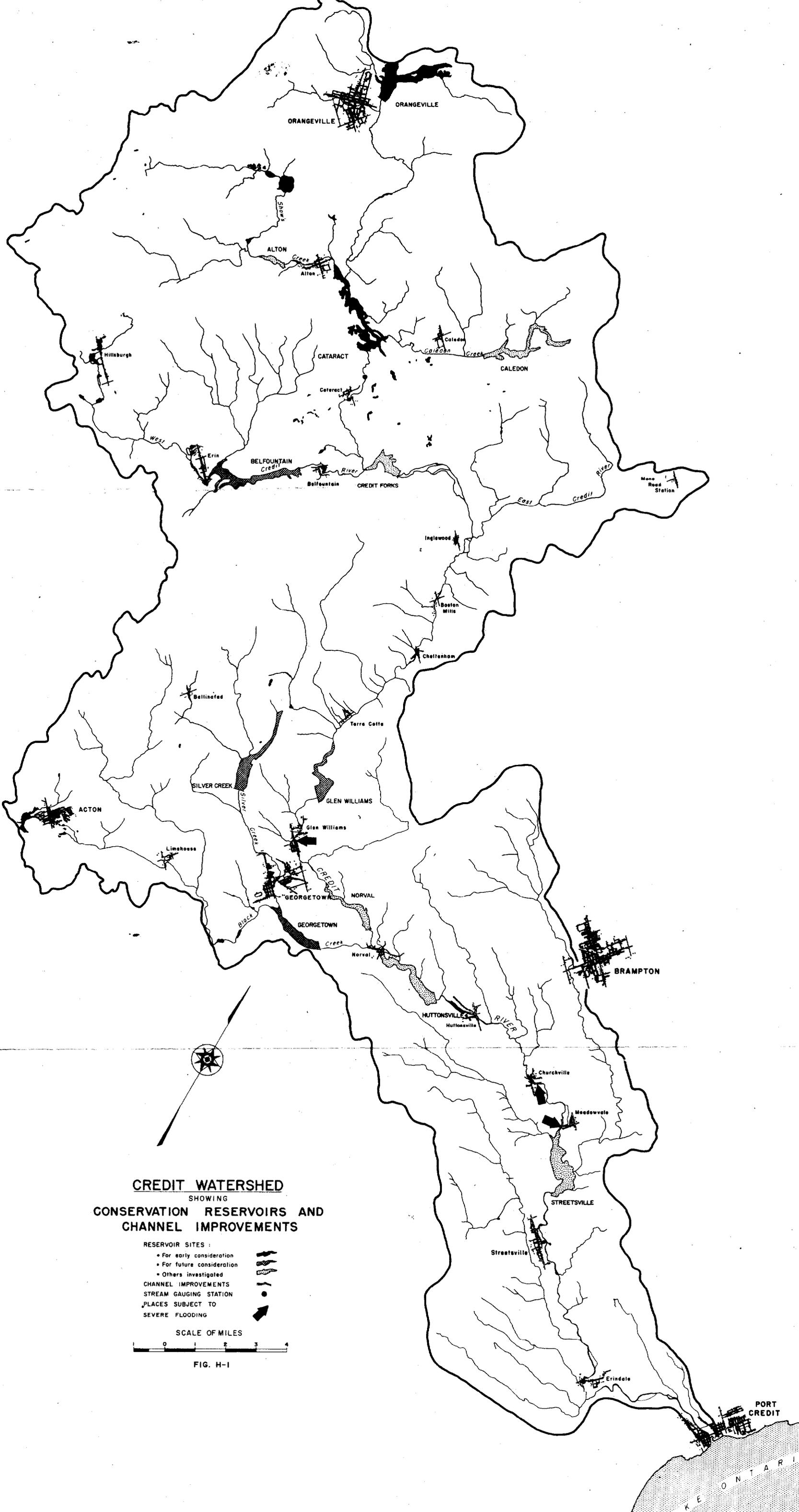
The Towns within the watershed are Acton, Georgetown, Orangeville and the westerly outskirts of Brampton. The incorporated villages are Port Credit, Streetsville and Erin. Non-incorporated villages located on or near the river and main tributaries are: - Erindale, Meadowvale, Churchville, Huttonsville, Norval, Glen Williams, Terra Cotta, Cheltenham, Boston, Inglewood, Credit Forks, Belfountain, Cataract and Alton.

The non-incorporated villages of Cooksville and Lakeview are also included in the area bordering Lake Ontario between the Credit and Etobicoke Creek Watersheds.

2. Shape and Dimensions (Figure H-1)

The watershed area lies in a north-westerly south-easterly direction and is adjacent to the Etobicoke and Humber Watersheds on the east; the Nottawasaga Watershed on the north; the Grand on the west and Oakville Creek Watershed on its south-westerly limit. The Credit Watershed with its great natural beauty is an asset to all the surrounding watershed areas and particularly the more densely populated ones included in Toronto Metropolitan Region Conservation Authority group.

The outline of the watershed area is very irregular and does not resemble any particular shape or form.



CREDIT WATERSHED
 SHOWING
CONSERVATION RESERVOIRS AND
CHANNEL IMPROVEMENTS

- RESERVOIR SITES :
- For early consideration
 - For future consideration
 - Others investigated

- CHANNEL IMPROVEMENTS
- STREAM GAUGING STATION
 - PLACES SUBJECT TO SEVERE FLOODING

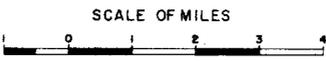


FIG. H-1

PORT CREDIT
 LAKE ONTARIO

The northerly segment (portion north of an east-west line through Cheltenham, approximately) varies from 9 to 14 miles in width and about 15 miles in depth; the central segment (area south of the above-mentioned line to the Queen Elizabeth Way) varies from 2 to 10 miles in width and about 24 miles in length; the lower part where it funnels into Lake Ontario about .75 of a mile wide and 1.25 miles long. The overall length of the watershed area is about 42 miles with an average width of about 9 miles and a total drainage area of 331.5 square miles.

In addition to the actual watershed area, the Credit Authority includes representatives of two areas in Toronto Township fronting on Lake Ontario and located on either side of the Credit Watershed.

The 20-square-mile area to the east includes the drainage area of several small creeks between the Credit and the Etobicoke Watersheds. Its frontage on the lake is about 3 miles and includes most of Port Credit and extends north-easterly to the westerly limit of Long Branch approximately. The wedge-shaped area extends north-westerly about 8 miles from the lake.

The westerly area is triangular in shape and has an area of 23 square miles. It also includes several small creeks which empty into Lake Ontario. It is bounded on the north by the Credit Watershed, on the south by Lake Ontario, with a frontage of 5.5 miles, and on the west by the westerly limit of Toronto Township. From the lake it extends back 4 miles to the apex of the triangle at No. 5 Highway.

3. The Terrain

The primary concern of the hydraulic report in the terrain is its topography as it affects the rate of runoff and to a large degree determines what measures may be used to control it. For the other phases of the terrain, such as

geophysical and soils classification the reader is referred to the soils section of the report.

North of Georgetown the watershed is rugged and the lateral slopes are rarely less than 25 feet to the mile and between Cataract and Inglewood they are as much as 500 feet in .25 of a mile. Along this stretch the beauty of the river gorge with its natural forest cover is equal to any in Ontario. The overburden in this area for the most part is moraine with limestone and shale outcroppings. Owing to the pervious nature of the overburden the rate of run-off from this area is quite low in spite of the steep lateral slopes, Most of the precipitation seeps into the ground giving rise to the many spring-fed creeks and rivulets for which the area is noted,

Below the escarpment and south of Georgetown the topography is not so rugged and varies from rolling to plain towards Lake Ontario. Lateral slopes vary from about 20 to 125 feet per mile on the average.

The overburden is mostly a fairly heavy clay soil with some limestone and shale outcroppings which tends to increase the rate of run-off. However, the rate of run-off even in this area is lower than on many of the watersheds in this region.

It is a good agricultural area and in addition to general farming, truck crop farming is becoming quite extensive. Many of those engaged in this type of farming are using river water for irrigating to increase their yields. With the rapid growth of the nearby urban centres an expansion of this type of farming is to be expected with a corresponding demand for water from the river for irrigation.

4. The River and Main Tributaries

(a) Courses

The main branch of the Credit River rises in a marsh $2\frac{1}{2}$ miles north-east of Orangeville. It skirts the

easterly limit of the town and follows an irregular course in a general south-easterly direction to Lake Ontario. From Orangeville to the Credit Forks, a distance of about 12 miles its course is south-easterly; from this point it is north-easterly for 1.5 miles where it separates into two channels which rejoin 2.5 miles farther down. The island area thus formed varies up to .25 mile in width and is itself traversed by several minor stream channels. From this point the course is generally due south to Glen Williams, a distance of about 11 miles; from Glen Williams it swings easterly 7 miles to Huttonsville and thence south-easterly 13 miles to a point one-half a mile south of Dundas Street where it makes a hairpin turn north and thence easterly about 4.5 miles to Lake Ontario, a total distance of about 55 miles from the headwaters.

The drainage areas of the river and its main tributaries are shown in Table H-1 together with those for places, damsites and stream gauges on the watershed.

The most important tributary streams are Shaws Creek, the West Credit, Caledon Creek, the East Credit and Silver Creek with its tributary Black Creek.

Shaws Creek rises about 4 miles south-west of the Village of Alton, flows through Alton and joins the main Credit about .5 a mile below the Alton crossroads. The length of its course from headwaters is about 10 miles.

The West Credit rises 1.5 miles north of Hillsburg, flows southerly through that village thence easterly through Erin and Belfountain and joins the main river at Credit Forks, the length of its course from the headwaters being about 12 miles.

Caledon Creek rises about 4 miles north-east of the village of Caledon, crosses Hurontario Street .5 mile south-east of that village and joins the Credit River about 1.5 miles north of Catararct, the length of its course from tile headwaters being about 7 miles.

TABLE H-1

CREDIT WATERSHED - DRAINAGE AREAS (SQUARE MILES)

Tributaries		Places		Damsites		Gauges	
Main Credit	170.89	Orangeville	13.99	Orangeville	10.92	Cataract	81.96
		Alton	26.30	Cataract	80.52		
		Credit Forks	125.32	Glen Williams	185.82	Erindale	320.46
		Norval	247.55	Norval	198.78		
		Streetsville	305.64	Credit Forks	127.83		
		Erindale	320.46	Huttonsville	253.11		
		Port Credit	331.20	Streetsville	298.11		
Shaws Creek	29.85			Alton	26.07		
West Credit	40.05	Erin	11.91	Belfountain	36.96		
		Belfountain	38.02				
Caledon Creek	18.84			Caledon	9.00		
East Credit	21.81						
Silver Creek	21.50	Georgetown	16.98	Silver Creek	13.08		
				Georgetown	48.03		
Black Creek (A tributary of Silver Cr.)	27.27	Acton	2.05				
		Limehouse	8.89				
Total Watershed Area -		331.47 Square Miles					

The East Credit rises 5 miles due north of Inglewood, flows south-easterly for 3.5 miles, thence south-westerly 5 miles where it joins the Credit .25 of a mile south-east of Inglewood. The length of its course is about 7 miles,

Silver Creek rises 6 miles north-west of Georgetown, flows southerly through Georgetown where it turns easterly for 4 miles and joins the Credit .25 of a mile upstream from Norval. The length of its course from headwaters to the confluence is about 11 miles.

Black Creek, a tributary of Silver Creek, rises about .5 a mile south of Acton, flows through Acton and thence in a general easterly course to Silver Creek about .75 of a mile downstream from Georgetown. Its course from headwaters is about 11 miles.

(b) Gradients

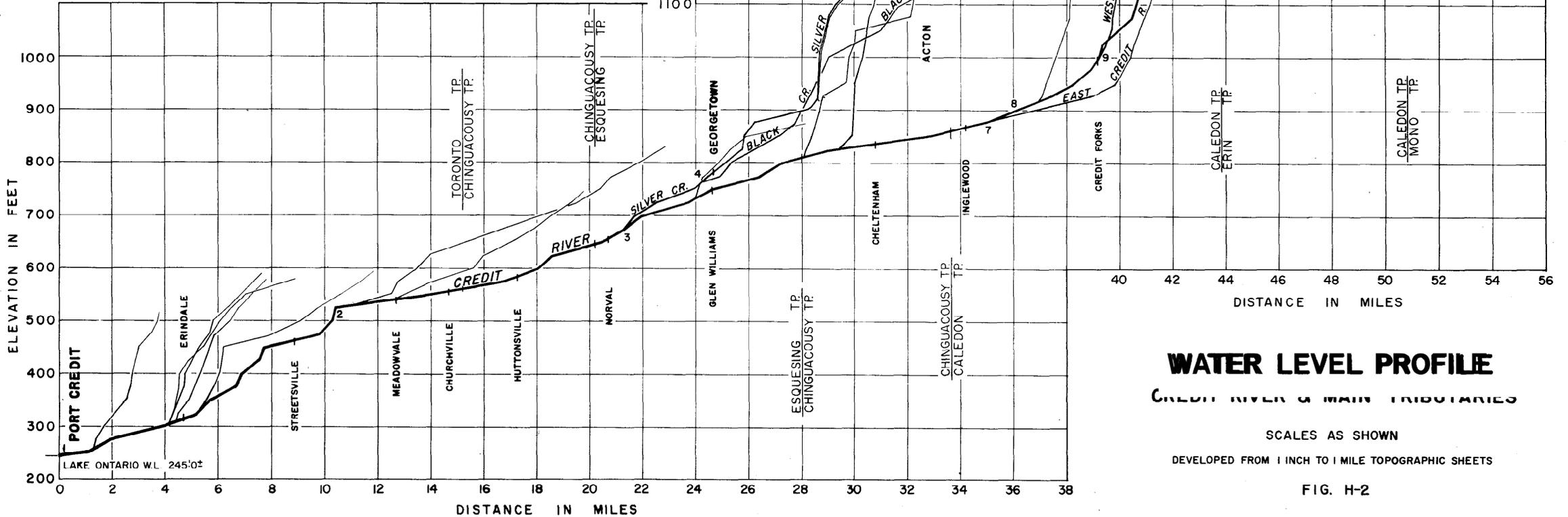
The gradients of the river and main tributaries are shown graphically and in a table in Fig. H-2. From the figure it is readily seen that the gradient of the main Credit is heavy throughout its course, the fall from the headwaters to Lake Ontario being 1,185 feet or an average of 21.4 feet to the mile. The central section which appears to flatten out is actually 16 feet to the mile. The southerly section to Lake Ontario is about 23 feet and the northerly section to headwaters about 27 feet to the mile. The greatest fall in this section is 230 feet in the 2.4-mile stretch between Cataract and Credit Forks which is equivalent to a gradient of 96 feet to the mile. It may be seen from Fig. H-2 that the gradient of the tributaries is even greater than corresponding stretches of the main river.

5. The River Valley

The Credit Watershed is the largest of several watersheds in the Toronto - Hamilton industrial region. Its position midway between these centres has, to a certain extent, protected it against exploitation such as has taken place along

GRADIENT TABLE

RIVER	FROM POINT TO POINT		DISTANCE IN MILES	ELEVATION OF POINTS		DIFFERENCE OF ELEVATION	GRADIENT FEET PER MILE
	1	2					
MAIN CREDIT	1	2	10.4	245	525	280	26.9
MAIN CREDIT	2	8	25.6	525	900	375	14.6
MAIN CREDIT	8	11	6.2	900	1250	350	56.4
MAIN CREDIT	11	17	13.2	1250	1430	180	13.6
MAIN CREDIT	1	17	55.4	245	1430	1185	21.4
SILVER CREEK	3	5	11.2	670	1270	600	53.6
BLACK CREEK	4	6	10.6	760	1200	440	41.5
EAST CREDIT	7	10	7.0	880	1290	410	58.6
WEST CREDIT	9	15	12.2	1000	1490	490	40.2
CALEDON CREEK	12	14	7.0	1250	1400	150	21.4
SHAWS CREEK	13	16	10.0	1270	1570	300	30.0



WATER LEVEL PROFILE
CREDIT RIVER & MAIN TRIBUTARIES

SCALES AS SHOWN
 DEVELOPED FROM 1 INCH TO 1 MILE TOPOGRAPHIC SHEETS

FIG. H-2

the Don and Humber Rivers; but postwar expansion has brought conditions that will make increasing demands on it for water supply, recreation and public use.

The watershed above the Forks is under forest cover to a greater extent than most valleys; and this factor, together with the groundflow through the pervious moraine, results in a remarkably well sustained flow of clear cold water; so much so that gauge records at Cataract show summer flows sometimes greater than those at Erindale, near the mouth of the river.*

Above the escarpment, the stream valleys show the influence of the varied moraine topography and vary from wide valleys with flat marshy bottoms to narrow stony valleys. Four reservoir sites were examined and surveyed on this section of the river and two in particular, above Cataract and Orangeville, show good possibilities. The part of the valley at and above the Forks provides some of the most spectacular scenery in Southern Ontario, with the clear river flowing in a weeded canyon 400 feet deep.

Below the Forks, the river flows through a broad flat-bottomed valley for about four miles to Inglewood, where it is joined by a small branch from the east known as the East Credit.

From Inglewood, through Boston Mills, Cheltenham and Terra Cotta, the river flows in a narrow trench along the foot of the escarpment. In this distance drainage from the east has only a width of one to two miles, but several small streams flow from the escarpment on the west side.

Near Glen Williams the river swings away from the escarpment into the clay plains, where it has cut a deep

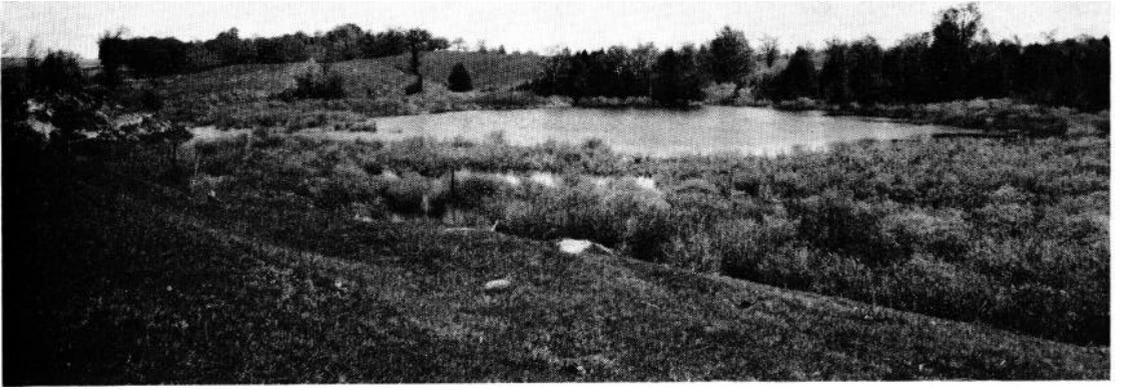
* For the extreme low flows shown in Table H-4 this is probably due in part to upstream dam operations and not to evaporation and seepage alone. It may also be attributed, to some extent, to the inaccuracy of the gauges at such low stages.

steep-walled valley, floored by a flood plain of varying width in which the river meanders have cut into the underlying shale in many places. It is in this area that 5 reservoir sites were surveyed. In most of them, the comparatively steep stream gradients and restrictions due to development, reduce storages to amounts that would be uneconomical for the benefits derived and the cost of construction.

The last major tributary, Silver Creek, enters this section at Norval. It drains a large area above the escarpment from Acton, and shows the importance of this area as a flow sustainer, by maintaining a good summer flow. Below Norval, as far as Erindale, the river flows in a valley of depths over 40 feet, often with the red Queenston shales exposed. One and a half miles above Streetsville, a good damsite exists, where a small storage is economically possible if land costs are not too high.

At Erindale the river makes a sharp bend in cutting through the old Lake Iroquois shore bar, and traverses the old lake plain to a drowned mouth at Port Credit.

As previously shown, the river grades are steep, and summer flows, particularly in the upper reaches, well maintained. These factors led to intensive use of the stream for power and rarely was a road crossing not the site of a mill. Of these, few remain, and few of these continue to use water power. In some cases it would be feasible to restore these dams for recreational use, although in most of them much of the pond area has been silted up.



The source of the Credit River, Caledon Twp. 3 miles east of Orangeville.



The Credit River at Terra Cotta, about midway down the watershed.



The mouth of the Credit River at Port Credit where it empties into Lake Ontario.

CHAPTER 2

FLOODS

1. History of Floods

Floods have always stirred the interest of people who happened to live within observing distance of their size and power. In part this interest was based on man's astonishment at the magnitude of a spectacular phenomenon of nature; in part it reflected man's fear of the injury to his person and possessions that the flood could occasion.

Civilized man today continues to combine these two emotions in his attitude toward floods. He stands gazing in amazement at the awful spectacle, deriving a sort of grim satisfaction from the very bigness of it; and he employs every skill of science to try to avoid the damage and loss that mark the records of the floods of the past.

The purpose of this chapter is to present in quick review the known record of floods on the Credit River in such a way as to be useful to those who are today charged with bringing that river and its tributaries under control, and with preventing injury to the persons and possessions of those who live and work in the watershed.

It is evident that floods on the rivers of Ontario did not begin with the coming of the white man. The first known references by white men to such floods generally speak of them as being events of annual recurrence; and specific mention of floods, at identifiable times and places, does not begin until the business of travel, settlement, road-building and other civilizing activities had given the newcomers an interest in the property that the floods could damage. The earliest known reference to floods on the Credit River concerns the building of bridges.

Capt. John Grahams Master Carpenter at York, has been with me, to look out the most Eligible Places to erect Bridges a Cross the large Creeks he is of opinion that there Cannot be a bridge made to stand the floods a Cross the River Credit, where the line

run by Mr. Aitkens Cross, nor no where near it, on account of the low flats along the River, which are over washed every high Waters, in the Spring season.."

So wrote Augustus Jones, Provincial Deputy Surveyor of Upper Canada, on the 24th of April, 1796, leaving no doubt in the mind of the reader, whether of his day or of the present, that he regarded floods on the Credit as annual events, threatening destruction to any bridge that was not both well placed and strongly built. The point at which "Mr. Aitken's line" crossed the Credit was about one mile due east of where the present Dundas Street crosses the river at Erindale; it is interesting to note that, despite the advice of Mr. Jones and that of Captain Graham, the Lieutenant Governor "does not approve of any great deviation from the Line as originally marked by Mr. Aitken". Jones reported on May 26 that the bridges over the Twelve-Mile Creek (Bronte) and the Sixteen-Mile Creek (Oakville) were completed, and states that the building of the bridge over the Credit "I will Punctually attend to". No further report is found, and the outcome of the decision to place the bridge at a point the surveyor and the master carpenter considered hazardous remains unknown.

In the middle of December, 1797, Captain Joseph Brant was on his way by land from the Grand River to York, when he was detained at Burlington Bay by high water in the rivers he had to cross. His letter of December 15 simply refers to "the rise of the waters", without identifying the streams in question. That a freshet on one of those streams would correspond to high water on all the others seems certain; and this seems to point to a flood on the Credit River. What remains uncertain is whether these floods damaged or destroyed the bridges that had been built in 1796; for any one of them to be made impassable would interfere with travelling the road to York. Captain Brant's letter accordingly supplies evidence of a freshet without supplying any details of the amount of damage done.

Of a freshet that occurred in January, 1799, the record is only a little more detailed. On the 14th of that month, John Stegmann, Deputy Surveyor, made the following entry in his Diary of Survey: "Remained at the River Credit on account of high water." The surveyor's only concern is with the delay to which he was subject, and no mention is made of the amount of damage done.

The freshets on the Credit River in the spring of 1801 were of sufficient severity to be referred to as "Great floods". In a letter dated June 6, 1801, James Givins, the Indian Agent, writes to inform the Lieutenant Governor in a matter concerning the Indian fishery on the Credit:

"it was in consequence of the Great floods that they were prevented from taking any salmon, as the waters were thereby rendered so thick and muddy that they could not see the fish".

The date of the flood is not given.

Somewhat more severe was the unexpected flood in September, 1804. On the 15th of that month, the Upper Canada Gazette published a brief account of the event:

"We understand that the late heavy rains have done material damage to the Roads in different parts of the country, insomuch as to render them in some places totally impassable, by sweeping away the causeways and bridges. At the Credit the water suddenly rose to such a height as entirely to overflow the ground occupied by the Indians as an encampment, for the purpose of fishing, carrying away all before it, The Indians, in the greatest consternation, narrowly escaped in the night with their lives, after having lost their canoes, arms and other property."

For the next fifteen years or so there is not even found the occasional passing mention of the freshets on the Credit. Then, with the one exception to be noted, there is again no mention of floods until 1850. The circumstance that, in nearly fifty years, there is found today only one reference to floods on the Credit River does not preclude the strong probability that, actually, there were many; whatever floods there may have been, their records have not come to light.

The exception referred to occurred in 1819. In that year, Samuel M. Benson, Deputy Surveyor, entered in his

Diary of Survey of Toronto Township: "April 13 - Credit, which is very high and the ice rattling down very fast ... April 14 - The Credit a foot higher than yesterday & free from ice."

During the earlier half of the nineteenth century, the newspapers seldom recorded the details of even the most destructive of floods. Beginning about 1850, and from that time on, they gave increasing attention to reports of damage caused by floods and became the best source of information regarding their frequency and severity.

The flood of 1850 was the subject of news dispatches in the Toronto Globe and the Christian Guardian, The Guardian of April 10 reported:

"Great injury has been effected by the late freshet, On Wednesday night (April 3), the water in the various streams contiguous to this City, rose to a remarkable height; Almost every dam and bridge upon the Don, the Humber, and the Credit has been swept away . . . An immense deal of damage has been done. Such a freshet has hardly ever been known in this part of the Province."

The account published by the Globe on the 13th undoubtedly refers to the same flood:

"From the Streetsville Review. - We have this week been visited with a flood which, for extent and violence, is without a precedent, so far as the memory of the oldest settler can reach. During Wednesday, (April 3) the rain fell without intermission, continuing to do so throughout the night, which, combined with the rapid melting of the snow in the back country, had the effect of swelling the river Credit and other streams in this quarter of the Home District, far beyond their natural dimensions. As might be anticipated, the damage done is very great, and every hour we are hearing of some fresh disaster, Along the banks of the Credit in particular, the destruction done by the angry waters has been immense - dams, bridges, fences, having been swept away. A large number of saw-logs have been carried off, to the serious loss of the unfortunate owners. Up to the time of our going to press we have not heard of the loss of any lives."

The year 1857 saw two floods on the Credit, one in February, noted merely as a continued thaw, with the creeks very high, and the second in September: "which flooded the fields and carried some fencing".

No further records of floods in this watershed have been found until 1869. On April 18 of that year the

country between the Credit River and Cooksville was "very much flooded" and some damage was done to Dundas Street.

A more severe flood occurred April 28, 1870, when the Dundas Street bridge at Springfield (now Erindale) broke in two and dropped into the water. It seems likely that there was other damage occasioned by such a flood, but the records mention only the one item.

On April 11, 1872, a Streetsville dispatch to the Toronto Globe tells of "the carrying away of the waste gates and a portion of the embankment at the woollen mills of Messrs. Barber Brothers" as the result of the spring break-up on the Credit. No other damage was reported. The operation of the woollen mills was interrupted for about three days.

In April, 1873, there were heavy rains accompanying the spring break-up on many streams, both east and west of Toronto; no mention is made of the Credit, which probably broke up with its usual "annual freshet", but did no damage worthy of report,

A surprise thaw, rain, and flood, "equal to our spring freshets", occurred pretty generally over Ontario early in December, 1873. A dispatch from Meadowvale, written on the 4th of December, states that the ice broke up, a temporary railway bridge was carried away, some damage was done to the dam of Messrs. Gooderham and Worts, and "a large jam of ice and timber passed down the river about ten this morning". Much greater damage at the same time was reported from other parts of western Ontario.

A thaw and rain in January, 1874, appears not to have caused a flood on the Credit. In that year the Credit broke up on March 4. Severe damage occurred at Streetsville, where the abutment at the eastern end of the bridge crossing the River Credit was washed away. If there was damage elsewhere it is not reported.

In 1875 the break-up took place on April 6. Although the flood was described as "much greater than usual",

no damage was reported.

The next flood to be reported on the Credit came in September, 1878. According to the Toronto Globe of September 14:

"On Tuesday night (September 10) rain began falling in this city, and with one or two slight intervals there was a steady downpour from that time up to yesterday afternoon (13th). Not only was the storm extensive in its area, but the rainfall was almost unprecedented. According to observations taken at the Toronto Observatory the depth of rain which fell here from the commencement of the storm up till noon yesterday was five inches."

Since this storm, in its effects on Southern Ontario, closely resembles Hurricane Hazel of October, 1954, it is of interest to trace its course from its origin.

According to the Globe:

"The storm originated in the Gulf of Mexico, where the barometer was low on September 6th. During the latter part of that day there were high north-easterly winds and heavy rains in Florida. The disturbance hovered over Cuba and Southern Florida until the night of the 10th. It then began to travel in a northerly direction, and by the morning of the 12th it was over South Carolina, accompanied by heavy rain. During the 12th it moved at the rate of over 30 miles an hour and by Friday morning (13th) was over the western end of Lake Ontario "

As a result, a disastrous flood occurred at many points in Ontario, from Port Hope on the east to London on the west. Among the numerous dispatches that *were* published in the Toronto daily newspapers, only two came from points on the Credit River. These both indicate severe and widespread damage without specifying the precise location of the damaged property. The following is taken from the Globe of September 14, 1878:

"Meadowvale, September 13. - The freshet on the river Credit has been something beyond the memory of the oldest inhabitant. It reached the highest this morning; Fences, bridges, mill dams, and in some instances cattle, were swept away. The damage to the mill owners has been very great all along the river, almost all of them suffering to some extent. Gooderham & Worts lost considerably."

The following dispatch appeared in the Toronto Mail, also on September 14:

"Port Credit, September 13. - Both bridges crossing the river, in fact all the bridges in the vicinity, are carried away."

Four further floods are known to have occurred on the Credit between 1878 and 1900.

Mullet Creek, at Streetsville, was in flood on March 20, 1881, but caused no serious damage.

Toward the end of March, 1882, a flood that must have been locally severe swept away several dams at Alton, but is not reported from other parts of the watershed.

On November 13, 1889, Alton was once again the only community affected, when an unusually severe flood swept over seven dams in quick succession.

On this occasion the flood was caused by the collapse of the centre post in the waste weir of the uppermost dam in the village, owned by McClelland Brothers:

"The centre post being the key to the whole structure, the tenant or cross-bar was knocked off, and all the posts were levelled in a moment. A body of water sixteen feet deep was at once released, and the whole seven acres of water contained in the dam dashed down the valley."

The "rolling mass" forced out, Benjamin Ward's dam, where the Alton Knitting Mill was operated; an "unoccupied" dam owned by W. McClelland; the dam of the Beaver Knitting Mills, owned by William Algie; the dam of Alexander Dick, proprietor of the Dominion Foundry; R. Meek's dam, of the Alton Flour Mills; and McKinnon's dam, which supplied power to a flour mill operated by Stark Brothers. Two lives were lost in this sudden disaster, and the loss of property was estimated at \$25,000. The reports of the flood offer no explanation of the failure of the first dam; but the weather reports of the 12th and 13th of November indicate that much rain had fallen in the direction of Lake Huron, and this may have contributed to the collapse of the dam.

A heavy fall of rain on June 5, 1890, caused one of the most disastrous floods ever experienced in the town of Orangeville. On that day, between 1:30 and 5:00 p.m.,

"a seething torrent swept through the low-lying land in the south and east wards." A number of bridges, two mill dams and a shingle mill were among the property mentioned as destroyed.

Following the sudden spate of June, 1890, there are no reports of floods on the Credit for the space of twenty years. It is not likely that these years were actually free from floods. The frequency and distribution of the floods that have been noted between 1910 and 1955 suggest that their absence from the previous decades is rather a matter of incomplete reporting than of the non-occurrence of freshets on the Credit River .

In the flood of March 7, 1910, a part of the newly-constructed power plant dam at Erindale was washed out "by an unexpected flow of ice". No other serious damage seems to have been done.

Heavy rains occurred on the morning of March 10, 1911, causing an ice jam near Meadowvale that seriously threatened the dam at that point, "one of the largest on the Credit River, it being about fifteen feet high". Although the dam escaped damage, two men engaged in preventing such damage were swept into the river and drowned.

The flood of April 6 and 7, 1912, is described as very severe. On that occasion disastrous floods occurred on many rivers throughout Ontario.

"Freshets and inundations were the order of the day with the quartette of rivers in the vicinity of Toronto . The Credit, the Etobicoke, the Humber, and the Don were all on the rampage. All four rivers cleared themselves of the season's ice, and the clearing process brought with it serious damage, especially on the Credit and the Don."

Two days of warm sunshine caused the breaking up of ice that was in many places two feet thick; the ice jams that formed on the various dams backed up the water and created a pressure that broke the dams. Fourteen dams are listed as being damaged or destroyed, as follows:

The creamery dam at Alton; Deagle's dam, and James Bell's dam, at Cataract; Henry Bracken's dam, at Boston Mills; Haines

& Ellis' mill dam, at the Cheltenham Mills; the dam at the Terra Cotta Brick Works; the dam at Townsend's Brick Works; Barber's dam, at Georgetown; Sykes & Beaumont's dam at Glen Williams ; a dam at Norval; McMurchie's dam, at Huttonsville; Ward's dam, at Eldorado ; Brett & Company's dam, at Meadowvale; and the dam of the Erindale Electric Works, at Erindale.

The steel bridge at Glen Williams, built only three years before, was destroyed by this flood, and the Lake Shore Highway bridge at Port Credit was rendered impassable by the flow of water over the approach at the east end of the bridge.

While this impressive destruction took place, for the most part, on Saturday and Sunday, April 6 and 7, the situation as reported on the evening of the 8th was by no means free from the danger of further disaster. A dispatch from Port Credit, published on the 9th, states that:

"the bridges all down the river are marked with danger notices, and it is feared that several of them will collapse with any further increase in the volume of water passing under them. A large amount of earth and gravel has been washed from behind the abutment of the steel bridge across the river at Erindale, and it is feared that this bridge may go at any time. The current has been still too swift for any careful examination to be made of the foundations of the bridges."

That some, at least, of this apprehension was justified by the event is indicated by the report of the flood that appeared in the Toronto Weekly Sun, Wednesday, April 10, 1912: "The River Credit went wild, and within a space of twenty miles nearly as many bridges were swept away." Justified also (for once) was the cliché: "Never in the memory of the oldest residents has there been such a flood ...".

A flood in March, 1913, was severe only in the vicinity of Georgetown and Glen Williams; it was of more than ordinary duration: the river rose "unexpectedly" the night of Friday, March 14, and on the 17th "has not yet fully subsided". The big cement dam of the Glen Woollen Mills, at Glen Williams, was washed out; the damage was estimated at \$5,000. Part of

the Barber Paper Mills dam was also washed away. At least two bridges were destroyed, one of them crossing over the Barber dam, the other identified only as being the property of the township of Esquesing, a steel bridge about seventy-five feet in length.

After 1913 it is nine years before the next high water is recorded. The river on March 7, 1922, rose quietly, without breaking up the ice, then subsided as quietly, without doing any damage. It was reported only from Streetsville. About a week later the Brampton Conservator jocularly remarked that "Old Mrs. Credit River" and come up with a "better sample than that of last week". An ice jam at Churchville had backed up enough water to flood the cellars in that village; and that, apparently, amounted to more damage than had been reported on the 7th.

Of the next five floods to be recorded, none is the cause of serious damage.

On March 13, 1928, it was reported that the rivers in the vicinity of Toronto, including the Credit, had become "active" following a spell of mild weather; it was also stated that the ice on the Credit River had remained firm.

On January 18, 1929, the Credit was reported to be high at Port Credit; no damage was mentioned.

Two months later, on March 14, the suburban rivers made "a sporadic effort to assume flood proportions", but the effort ended in "no news" from the Credit.

On April 6 and 7, of the same year, there was a third "mild rampage", when Orangeville, Cheltenham, and Norval were threatened, but not damaged.

"While the flood of February 20, 1930, was described as "bad" at Streetsville and as "the worst experienced in a generation", it, does not appear to have caused any damage. An ice jam formed near Streetsville and the water rose ten feet at the bridge on Main Street of that village. Blasting operations were successful in clearing the jam and in opening a



The flood of April 5, 1950, reached a peak of twelve feet above normal, and is here shown flowing over the road and isolating the bridge at Churchville, where thirty homes were surrounded and the main street was under three feet of water.

channel. By evening the flood had subsided and the danger was past.

The flood of February 12, 1932, was said to be "one of the worst in the history of Peel County".

"At Churchville, Meadowvale, and Hutton, there were serious floods, but no damage of a serious nature, except in the case of the dam on the Brett estate, where the timbers gave way early today. A large dance pavilion at Ferndale was partly damaged, and the floor ruined. From Inglewood, Cheltenham, and Terra Cotta word has been received that the floods are now receding."

Ferndale is said to be the name of an entertainment resort near Boston Mills, between Inglewood and Cheltenham. Flooding on this occasion was widespread in Ontario; many other watersheds experienced damage more severe than that reported from the Credit.

The Credit River rose twice in the spring of 1934, on March 4, and again on March 20. Both threatened to be serious, and both passed off without doing any damage.

On March 11, 1936, minor flooding was reported at Port Credit .

The year 1937, that brought disastrous floods to western Ontario, was marked by two floods on the Credit. The first, on January 14, occurred at Alton, where the river "rose to flood heights" and caused minor damage, as well as temporarily depriving the sash and door factory of power.

The second flood of 1937 was the result of a heavy fall of rain on February 21, when two and a half inches of rain fell in four hours. At Alton the river rose four feet in the course of the afternoon and broke through Houston dam, necessitating the suspension of operations in the adjacent chopping mill. Heavy damage was done to roads and bridges throughout Peel County, and considerable damage was done by the flooding of cellars in several communities. The tracks of the Canadian National Railway were washed out near Inglewood. At Cheltenham, the Eclipse Flour Mill was isolated by a four-foot rise of the water level. Minor damage was caused to property at Glen Williams, Churchville and Meadowvale.

A sharp freshet occurred on February 6, 1938. The Credit River was reported jammed with ice at several points, but there was little damage.

The next serious flooding on the Credit came on March 17, 1942, the result of a one-and-a-half-inch rainfall. Houston's dam, at Alton; was again swept away; an electric power plant at Streetsville was forced to shut down; many highways were washed out or overflowed; at least one bridge was lifted from its abutments at Erin; and considerable damage to stored goods was caused by water in cellars and basements.

On May 31, 1942, a small creek near Victoria, swollen by a heavy downpour of rain, carried away a number of farm bridges. At the same time, highways near Alton were overflowed; and cellars at Erin were reported flooded. The amount of damage done was not great. The rainfall at weather stations adjacent to the affected area was three to four inches in forty-eight hours.

The village of Glen Williams experienced a sudden and disastrous flood on March 7, 1946. Unusually mild weather followed by heavy rain led to the break-up of the ice on the pond above the dam of the Beaumont Knitting Mills.

Suddenly, watchers saw a great tidal wave, choked with ice cakes, sweeping downstream. In a matter of minutes it swept away part of the Beaumont dam, roared over the flat lands bordering the river, and turned half the village into a torrent."

This flood was described in newspaper reports as "the worst within memory". Damage was done to the Beaumont Knitting Mills; to the factory of the Glen Textiles Ltd.; and to the plant of the Provincial Paper Limited, at the outskirts of Georgetown, where some stocks of paper were wetted and several electric motors were put out of action. The damage was estimated to be in excess of \$4,000. Fortunately, no lives were lost.

Floods in April, 1947, were widespread in Southern Ontario. They were noticed in the Credit Watershed only as the cause of an interruption to traffic on the highway between



Ice piled on the main street of Glen Williams by the flood of March 7, 1946, when an ice-jam broke and a "tidal wave" swept without warning through the village, causing considerable damage to factories, churches, and homes.



The flood of April 5, 1950, carried out a section of the bridge at Glen Williams, surrounded homes, overflowed the streets, and damaged the dam.

Orangeville and Arthur. On April 5 and 6, the "notorious sink hole" was covered with water too deep for any traffic but high-riding trucks. On the 5th, truck traffic was allowed to proceed; on the 6th, the road was closed to all traffic.

The reports of the freshet on the Credit, March 21, 1948, are limited to a single sentence: "The Credit River overflowed at Glen Williams, but damage was light."

On March 28, 1950, train service on the Canadian National Railway line was interrupted between Inglewood and Caledon East by high water along about half a mile of track.

A severe flood occurred on April 4, 1950, when a considerable part of the village of Alton was inundated. One dam was broken, and two or three others threatened by overflowing water. Water from above the dam of the Western Rubber Company flooded the main street of the village and poured into cellars and basements. Highway No. 24, between Alton and Orangeville, was flooded. A highway bridge was carried away at Glen Williams. At Churchville the water level rose twelve feet, and many residents were forced to flee from their homes. The bridge across the Credit River was under water, and business properties in the village were flooded. The retaining wall at Norval grist mill, and part of the head-race, were washed out. Minor damage was reported from Meadowvale and Port Credit..

The flood of March 30, 1951, affected Churchville, Meadowvale, Huttonsville, Streetsville, Inglewood and Erindale Park. At Churchville, where the threat was most serious, the river rose eight feet above normal; ten families moved from their homes as a precaution. No actual damage was reported.

On February 4, 1952, the Credit rose about 4 feet in the vicinity of Churchville and Meadowvale. No flooding took place.

On the 11th of March in the same year, the Credit overflowed its banks at Churchville and Meadowvale.



Traffic on Highway No. 9, on March 9, 1950 was brought to a halt by flood waters the Credit River at a point about a mile west of Orangeville

At Churchville eighteen houses were surrounded by water, and some families were evacuated. Dynamite was used to break the ice jam that was causing the overflow, and in the course of the afternoon the river began to recede.

A third flood in 1952 occurred on March 31, when the village of Alton was the chief sufferer.

"On Monday night (March 31-April 1) the mill dam behind the Alton Sash and Door Co. went out some time during the early morning hours. Nobody witnessed the break ... Thirty-two feet of the dam's retaining wall were washed away."

There had been much rain during the evening of the 31st. No reports of flooding were received from other points on the river .

On April 22, 1952, the Credit Watershed experienced a fourth flood, though the cause was a flow of surface water and not a rise of the Credit River. At Inglewood "a 10-inch torrent caused by a two-hour rain, resulted in the flooding of the Inglewood Hotel, the library, and several cellars, and a major washout of a CNR and CPR branch line crossing-here".

An unusually prolonged and severe series of floods occurred throughout Southern Ontario between February 15 and March 2, 1954. Because the flooding was almost continuous from February 15 to 23, followed by a general recession, and that followed again by renewed flooding, "for the second time in two weeks", on the 1st and 2nd of March, it has been recorded as two floods. The Peel Gazette, of Brampton, describes the situation on the Credit at the beginning of the flood period.

"The angry waters of the Credit River tumbled through heaps of rotten ice Monday, Tuesday and Wednesday (February 15, 16 and 17), climbed their banks and swept through the valley from Huttonsville, through Churchville and Meadowvale to the lake shore, spreading disaster and despair as more than 100 people were forced to flee their homes in Tuesday's horror of rain and squalls, sleet and driving blizzards of wet snow."

During Tuesday afternoon the water at Churchville rose three feet in an hour until, in the part of Churchville known as Martin's Camp, twenty-five homes stood in five feet of water.

During the ensuing week the occupants of these homes were given temporary shelter on higher ground. At Meadowvale several homes were wholly or partly surrounded by water, as an ice jam formed at the bridge near the old mill. And in both villages, while the level of the waters slowly receded, the residents kept an anxious eye on the dam at Huttonsville; for as long as that dam held there was the hope of survival, and if it failed, that hope was gone. And the holding of the Huttonsville dam depended, in turn, on the holding of other dams in the upper parts of the watershed.

By Tuesday the 23rd, it was known that all the upper dams had held and the worst of the danger was past. Martin's Camp was "still a desolate sight", although the waters which threatened it had receded. At Meadowvale the situation was returning to normal and the river was "almost back to its channel." The evacuated families had returned to their homes. The eight-day flood was over.

The second flood began on March 1. According to the Peel Gazette:

"Ten families, including about thirty children, fled their homes in the low-lying Martin's Camp at Churchville for the second time in two weeks Monday (March 1) as the Credit River, swollen with rain, did a repeat performance through the valley. Many of these cottage residents had moved back into their flood-soaked homes only this week-end after staying with friends in the area since the February 15-16 trial by water The water, which began to rise sharply about 2:00 p.m. Monday was at full flood by supper time, and . . . the river was as high Tuesday morning (March 2) as it had been at the height of the flood two weeks ago."

Blasting of ice jams between Churchville and Meadowvale was credited with preventing the water from rising still higher. Much of the ice had melted or softened in the course of these two weeks; and this circumstance favoured the blasting operations and at the same time relieved the flood-fighters of the menace of large masses of solid ice.

At the same time water was reported to be high at Inglewood. "At Inglewood, south of Orrngeville, CNR tracks were just showing above the swollen Credit River."



A heavy fall of snow in the headwater uplands, followed by unusually mild weather, caused a prolonged flood in February, 1954 at several villages along the lower reaches of the Credit River. This aerial view of Meadowvale was taken on February 17th.



At Churchville, on February 16th, 1954, the waters of the Credit River rose three feet in an hour, drove thirty families from their homes. This photograph shows one such family being removed from their home by boat, on February 17th.

After reaching its peak height about noon on March 2, the waters began to recede, and the second bad flood of 1954 came to an end.

The flood on the Credit River that resulted from "Hurricane Hazel", while not so disastrous as the corresponding flood on the adjacent Humber, was, nevertheless, very severe. Part of the watershed was visited on October 19, when damage was noted at many points, and there were indications that the flows in the lower part of the river had been very heavy. On the whole, however, the damage observed was on the scale of a spring freshet and not of a major disaster.

Between Georgetown and Terra Cotta, the river seems to have risen little above its banks, and no flooding was reported at Glen Williams. Peak flow at Georgetown has been calculated at between 3,500 and 4,000 cubic feet per second. Below Georgetown the peaks rose more sharply, and the run-off from the clay plains was more intense.

One major bridge, at Port Credit, was damaged so seriously as to be impassable. No houses at this place were reported destroyed, although some were flooded and had to be evacuated. There was extensive damage at Streetsville, where a dam broke, roads were washed out and cellars were flooded. The McCarthy Milling Company's dam at Creditvale was also broken and the approaches to the Creditvale bridge were washed away. At Meadowvale, flooding was on a larger scale than in previous freshets, but little more land was flooded. The five houses between the old mill race and the river were again surrounded, and water flowed over the paved road to the depth of a foot.

At Churchville, water rose higher than any previous level and the residents in Martin's Camp suffered severely. Water rose one foot higher than the highest spring flood level and remained up until Saturday morning, the 16th. The area is shielded from the direct rush of the flood water, so that little structural damage was done to the houses which were inundated. At Huttonsville no damage was done to

residences, but a section about fifty feet long of the downstream apron of the mill dam collapsed. This does not immediately affect the stability of the dam, but may lead to eventual undermining of the main dam wall unless it is repaired.

At Norval a situation of potential hazard to the highway was created when the water in the disused mill race over-topped and cut through the bank below the highway. The water filled the old mill-race bridge with gravel, cut through the old road embankment to make a new channel to the river, tore out a corner of the old mill building foundation, and exposed the footings of the highway bridge. Although there is no immediate danger at times of low or moderate flow, it is to be noted that, following this flood, about three-quarters of the flow passed down the new channel; low flows leave the old main channel entirely dry. Unless the principal flow is rediverted into the old channel, high spring flows will undoubtedly cause further damage along the new channel.

From Belfountain, minor damage and flooded cellars were reported. Between Cataract and the Credit Forks there were two serious washouts on the railway. In the vicinity of Crmgeville, flood waters covered the road on Highways Nos. 9, 10 and 24; while in the town itself many basements were flooded and serious damage was done to the newly-opened Lord Dufferin Hospital.

The extent and severity of the damage done in the Credit Watershed were obscured by the focussing of attention on the much more spectacular damage on other rivers in the province; not only did the reports from the Humber, the Don and the Etobicoke fill the pages of the newspapers, but they induced residents of communities on the Credit to view their own losses as light by comparison with those of their neighbours. In the present review, the reports of damage on the Credit have been assembled from several newspaper sources; and the total array, when compared with other flood periods on the same river, is estimated to be very severe.

TABLE OF RECORDED FLOODS AND FRESHETS ON THE CREDIT RIVER

1797 - 1955

- 1797 - About December 14. Letter, Joseph Brant to D. W. Smith, written from Burlington Bay, December 15, 1797, states that "the rise of the waters" between Burlington Bay and York prevents him from proceeding to York by land.
- 1799 - January 14 John Stegmann, Deputy Surveyor, entry In is Diary of Survey: "Monday 14th - Remained at the River Credit on account of high water." Sharp freshet.
- 1801 - Spring. Letter, Givens to Green, June 6, 1801: "... it was in consequence of the Great floods that (the Indians) were prevented from taking any salmon." Heavy flood.
- 1804 - September, Upper Canada Gazette, September 15, 1804: "At the Credit the water suddenly rose to such a height as entirely to overflow the ground occupied by the Indians as an encampment, for the purpose of fishing, carrying all before it." Heavy flood.
- 1819 - April 13-14. S. M. Benson, Deputy Surveyor, entry in his Diary of Survey of Toronto Township: "April 13 - Credit, which is very high, and the ice rattling down very fast." "April 14 - The Credit a foot higher than yesterday & free from ice." Sharp freshet.
- 1850 - April 4-5. Christian Guardian, April 10, 1850: "Almost every dam and bridge upon...the Credit has been swept away ." Toronto Globe, April 13: "During Wednesday (3rd) the rain...had the effect of swelling the river Credit." Severe.
- 1857 - February 10-22. Diary of W. R. Forster, 1857. February 10-18: "Continued thaw with a great deal of rain, the creeks very high..." February 22: "Continued mild weather, creeks subsided." Sharp freshet.
- 1857 - September 5 . Diary of W. R. Forster, 1857. September 5 : "This afternoon a most tremendous storm of rain, which flooded the fields and carried some fencing." Heavy flood.
- 1869 - April 18. Toronto Globe, April 20, 1869: "The flood on Sunday night was so great that a portion of the Dundas street road and embankment a mile west of Cooksville was carried away. The country in that direction is very much flooded." Heavy flood.
- 1870 - April 28. Toronto Globe, April 29, 1870: "The large bridge...spanning the River Credit, at Springfield (Erindale), broke in the centre to-day, and dropped into the water. As the water is very high at present (28th), the traffic is entirely suspended." Severe.
- 1872 - April 9. Toronto Globe, April 11-12, 1872. Toronto Leader, April 11-12, 1872. Damage to Barber Bros.' dam at Streetsville. Severe.
- 1873 - December 4. Toronto Globe, December 5, 1873: Freshet at Meadowvale "equal to our spring freshets": temporary railway bridge carried away, and Gooderham & Worts' dam damaged. Severe.

- 1874 - March 4. Toronto Globe, March 7, 1874: "The abutment on the eastern end of the long bridge crossing the river Credit (at Streetsville) was washed away yesterday (March 4th) by the freshet." Severe.
- 1875 - April 6. Toronto Globe, April 7, 1875. Flood at Streetsville "much greater than usual". Heavy flood.
- 1878 - September 13. Toronto Globe, September 16, 1878: "Meadowvale, September 13: The freshet on the river Credit has been-something beyond the memory of the oldest inhabitant...Fences, bridges, mill dams and... cattle were swept away." Very severe.
- 1881 - March 20. Brampton Conservator, March 25, 1881. Mullet Creek, at Streetsville, in flood. Sharp freshet.
- 1882 - March Brampton Conservator, March 31, 1882. Dams swept away at Alton. Severe.
- 1889 - November 13. Toronto Globe, November 14, 15, 18, 23. Brampton Conservator, November 14. At Alton, six dams and four bridges destroyed, two lives lost. Severe.
- 1890 - June 5. Toronto Mail, June 7, 1890. Toronto Globe, June 7 and 9, 1890. At Orangeville, "one of the most disastrous floods this town has ever experienced... a seething torrent...A number of bridges ...were swept away." Two mill dams broken. Severe.
- 1910 - March 7. Toronto Globe, March 8, 1910. At Erindale, part of power company's new dam washed out "by an unexpected flow of ice". Heavy flood.
- 1911 - March 10. Toronto Globe, March 13, 1911. "The heavy rains of Friday morning (March 10) caused heavy ice jams and in the afternoon the residents of Meadowvale believed their dam would be carried away." Two men drowned. Sharp freshet.
- 1912 - April 6-7. Toronto Globe, April 8 & 9, 1912. Toronto Mail & Empire, April 9, 1912. Wingham Advance, April 11, 1912. Toronto Weekly Sun, April 10, 1912. Fourteen dams and several bridges on the Credit were carried away on the 6th and 7th; others threatened. Very severe,
- 1913 - March 14-17 Toronto Globe, March 18, 1913. Dams and bridges damaged and destroyed at and near Georgetown. Severe.
- 1922 - March 7. Toronto Globe, March 8, 1922. At Streetsville, the river reported to be rising, the ice not yet broken. No flooding was reported. Sharp freshet.
- 1922 - March 14(?). Brampton Conservator, March 16, 1922. At Churchville, water in cellars, result of an ice jam. Sharp freshet.
- 1928 - March 13. Toronto Globe, March 14, 1928. Rivers in the vicinity of Toronto said to be "active" following a spell of mild weather, but "the Credit River ice has remained firm". Sharp freshet.
- 1929 - January 18. Toronto Globe, January 19, 1929. High water reported at "the Port Credit River ". Sharp freshet.

- 1929 - March 14. Toronto Globe, March 15, 1929. Refers to "a sporadic effort to assume flood proportions", after which suburban rivers" (including the Credit) "settled into a normal flood level". The Credit River "furnished no news". Sharp freshet.
- 1929 - April 6-7. Toronto Mail & Empire, April 6 & 8, 1929. Toronto Globe, April 8, 1929. The Credit River "on the rampage" at Orangeville, Cheltenham and Norval threatened. Sharp freshet.
- 1930 - February 20. Toronto Globe, February 21 & 24, 1930. At Port Credit and Streetsville "the flood is said to be the most serious in many years". Sharp freshet.
- 1932 - February 12. Toronto Globe, February 13, 1932. Toronto Mail & Empire, February 13, 1932. "At Churchville, Meadowvale; and Hutton, there were serious floods." Some damage at Orangeville. Heavy flood.
- 1934 - March 4. Toronto Globe, March 5, 6 & 7, 1934. Serious floods threaten damage at Port Credit, Erin-dale and Streetsville. Sharp freshet.
- 1934 - March 20. Toronto Globe, March 21, 1934. Threat of flood seen in prolonged continuance of two-foot ice on the Credit River at Port Credit. No flood.
- 1936 - March 11. Toronto Globe, March 12 & 13, 1936. Minor flooding near Port Credit. Sharp freshet.
- 1937 - January 14. Toronto Globe & Mail, January 15, 1937. "The Credit River flowing through Alton, rose to flood heights." Sharp freshet.
- 1937 - February 21. Toronto Telegram, February 22, 1937. Toronto Star, February 23, 1937. Floods at Alton, Cheltenham, and Glen Williams. Severe.
- 1938 - February 6. Toronto Globe & Mail, February 7, 1938. The Credit River was reported jammed, "but there was little damage". Sharp freshet.
- 1942 - March 17. Toronto Star, March 17 & 18, 1942, Toronto Globe & Mail, March 18, 1942. Canadian National Railways, Engineer's Report, dated December 19, 1950. Floods at Streetsville, Hillsburgh, Georgetown, Inglewood and Erin. Heavy flood.
- 1942 - May 31. Toronto Star, June 1, 1942. Flood near Victoria (Peel County), near Inglewood, and on the Alton-Orangeville highway. Sharp freshet.
- 1946 - March 7. Toronto Star, March 8, 1946. Toronto Telegram, March 9, 1946. Sudden flood at Glen Williams. Severe.
- 1947 - April 5-6. Toronto Globe & Mail, April 7, 1947. Highway flooded near Orangeville. Sharp freshet.
- 1948 - March 21. Toronto Globe & Mail, March 22, 1948. "The Credit River overflowed at Glen Williams, but damage was light." Sharp freshet.
- 1950 - March 28. Canadian National Railways, Engineer's Report, dated December 19, 1950. Flood between Inglewood and Caledon East, on March 28. Sharp freshet.

- 1950 - April 4. Toronto Globe & Mail, April 5 & 6, 1950. Toronto Star April 4 & 5, 1950. Toronto Telegram, April 4 & 6, 1950. Floods at Alton, Orangeville, Glen Williams, Churchville, Norval, Meadowvale and Port Credit. Severe.
- 1951 - March 30. Toronto Telegram, March 31, 1951. Toronto Globe & Mail, March 31, 1951. Floods at Churchville, Meadowvale, Huttonsville, Inglewood and Streetsville. Heavy flood.
- 1952 - February 4. Toronto Telegram, February 4, 1952. "The river had risen four feet". and threatened to flood Churchville and Meadowvale. Sharp freshet.
- 1952 - March 11. Toronto Telegram, March 11, 1952. Toronto Globe & Mail March 12, 1952. Credit River overflows banks at Churchville and Meadowvale, "18 houses surrounded by twelve inches of water". Heavy flood.
- 1952 - March 31. Orangeville Banner, April 3, 1952. "On Monday night (March 31) the mill dam behind the Alton Sash & Door Co. went out some time during the early morning hours...Thirty-two feet of the dam's retaining wall were washed away." Heavy flood.
- 1952 - April 22. Toronto Telegram, April 23, 1952. At Inglewood a hotel basement flooded, and ten inches of water over tracks of C.N.R. and C.P.R. Sharp freshet.
- 1954 - February 15-23. Canadian Press releases in all Ontario daily newspapers throughout this nine-day period. Also: Peel Gazette (Brampton), February 18 & 25; St. Catharines Standard, February 17, 19 & 20; St. Thomas Times-Journal, February 17; Galt Reporter, February 19; Guelph Mercury, February 19; Kitchener-Waterloo Record, February 19; Oshawa Times-Gazette, February 19; Owen Sound Sun-Times, February 19; Peterborough Examiner, February 19; Stratford Beacon-Herald, February 19; Welland Tribune, February 19; Toronto Star, February 20; Toronto Globe & Mail, February 22; and Toronto Telegram, February 22, 1954. Prolonged flooding and much damage, especially at Churchville and Meadowvale. Very severe.
- 1954 - March 1-2. Peel Gazette (Brampton), March 4, 1954. Brampton Conservator, March 4, 1954. Department of Highways Official Daily Winter Road Bulletin, March 2, 1954. Churchville flooded "for the second time in two weeks". Severe.
- 1954 - October 15-18. "Hurricane Hazel". Toronto Globe & Mail October 16 & 18, 1954. Toronto Telegram, October 16, 1954. Toronto Star, October 16, 1954. Department of Highways, Road Reports, October 18 & 19, 1954. Flooding at many points on the Credit River, bridges damaged at Port Credit. Very severe.
- 1955 - March 1. Brampton Conservator, March 3, 1955. Peel Gazette (Brampton), March 3, 1955. Flood at Churchville. Heavy flood.
- 1955 - March 11. Toronto Globe & Mail, March 12, 1955. Toronto Telegram, March 12, 1955. Flood at Churchville. Heavy flood.

On March 1, 1955, the Credit River flooded the homes of eleven families in the Martin's Camp section of Churchville. By the morning of the 2nd the waters had receded, and the danger of further flooding "would appear to have passed for the present".

Ten days later, on March 11, Martin's Camp was once again threatened with floods. The rise of the river was attributed to an ice jam beneath a bridge at Churchville.

"The river began rising at 5 :00 a.m., and at the peak of the flood, five hours later, water was a foot deep on the main street and creeping slowly toward Martin's Camp. Twelve of the 15 families left their homes when it was feared they would be inundated. By noon workers had smashed a wide gap in the jam and the water began receding rapidly".

The record includes 54 floods over a period of 160 years ; and it seems highly probable that a considerable number of floods have taken place of which no record has been found. These 54 known floods have occurred in 40 out of the total of 160 years. There are accordingly, in that space of time, 120 years in which there is no known record of flooding on the Credit River.

2. Causes of Flooding

Precipitation is the source of all stream flow and run-off and to a large degree the stream flow characteristics are determined by this factor. However, there are many other factors which influence the amount and rate of run-off and degree of flooding which may be grouped into four classifications as follows:

- (a) Geophysical, which are more or.. less permanent
- (b) Climatic, which are variable
- (c) Ice jams
- (d) Encroachments.

(2) Geophysical

The geophysical factors include the size and shape of the watershed; surface slopes and stream gradients; nature of the soils, whether pervious or impervious, and their

condition as to cultivation and vegetative cover ; natural water storage areas such as lakes, ponds, and swamps, and other artificial factors such as storage reservoirs and farm drains.

The lateral slopes and stream gradients in the Credit Watershed are both comparatively high, but due to the pervious nature of the soils in the upper part of the watershed and in some degree to the natural forest cover, the run-off from this area is among the lowest for Southern Ontario.

(b) Climatic

The climatic factors affecting run-off are extremely variable and the magnitude of floods is largely governed by the climatic conditions obtaining at the time. As pointed out above, all stream flow originates from precipitation and the amount, intensity, duration and extent of this factor are probably the most variable and the most important. The temperature - especially the intensity and duration of freezing periods which produce large volumes of sheet ice on open water areas, permit the accumulation of precipitation in the form of snow and ice and freeze the ground surface - to a large extent influences the volume of spring run-off and floods which occur at that time. The relative humidity, direction and velocity of winds, are less important factors in this group.

Up until the advent of the floods which followed Hurricane Hazel, spring floods produced by adverse climatic conditions were, according to the records, the most frequent and the most severe and floods due to "summer" storms were generally considered to be secondary. However, the "Hazel" floods, which were due to heavy precipitation alone, exceeded all known flood peaks of the streams in the Toronto arm and in many cases those of other- rivers in Southern Ontario.

The flow at Brampton was estimated at 5,000 c.f.s.*or a rate of run-off equivalent to 185 c.s.m. †

It has been estimated that the average 48-hour

* c.f.s. - cubic feet per second

† c.s.m. - cubic feet per second per square mile of drainage area = : flow in c.f.s

rainfall over the Humber Watershed amounted to approximately 8.9 inches, of which about 90 per cent ran off directly.

(c) Ice Jams

Ice jams result from an adverse combination of climatic and geophysical conditions, and are an important factor in many of the floods on the Credit River.

Large volumes of ice are formed in open water areas by freezing temperatures and later released when the temperature moderates and produces a thaw. The ice sheets break up and large floes are carried downstream by the current until they are caught by a snag, gravel bar, sharp bend in the river or at a narrow bridge opening. The ice floes pile up upon one another and are quickly consolidated by the pressure of additional ice and impounded water.

The ice jam acts as a dam and the impounded waters rise and overflow the surrounding properties. In many cases the water will do considerable damage in cutting a new channel around the jam. Also, flooding downstream is often aggravated when the jam breaks due to pressure or moderating temperatures, and the water surges down and boosts the flood peak.

In almost all cases of flooding along the Credit, the chief cause is reported to be due to jams of heavy ice from the mill ponds. In the still waters of the ponds, ice forms to a thickness of from two to three feet and these massive floes will jam where the lighter stream ice would pass unobstructed. Many of the existing dams are now no longer used for producing power and are left unattended with the ponds full in the winter. In particular, the dams at Huttonsville, Norval and Georgetown have large pond areas where large volumes of massive ice form. If these ponds were drained in the fall, not only would spring floods flush out silt accumulations and increase the usability of the pond, but the reduced ice formation would afford a substantial protection for downstream areas. This regulation of the dams could be carried out by the

Authority in co-operation with the owners, or by acquisition of the dams and water rights,

(d) Encroachments

Encroachments include all man-made works built in the natural flood plains of the river. The presence of these encroachments, such as narrow bridge openings with high approaches projecting out into the river valley, railway embankments, factories, houses and other buildings, not only aggravate the flood situation by retarding the flow and obstructing the normal passage of ice floes, but have actually created the existing flood problems, since there would be little concern at times of high water if these flats were unoccupied. However, it would be economically impossible to keep all railway lines, roads and other services beyond the reach of the flood waters and the present development of some of these lands prevents them from being reclaimed for the river,

However, there are many old encroachments which have been abandoned and which could be removed from the river channel and flood plains to advantage. One of the most serious is the remains of the old dam at Cheltenham. Located in the river, these remains obstruct the passage of ice and other debris such as trees and create a real threat for the dwellings on the flats a short distance upstream. Another is the old pier and abutments in the river and the embankment across the flats at Meadowvale. Ice floes are often held back by this pier located in the river and the embankment directs the flood waters towards the dwellings to the east rather than permitting them to spread out over the vacant land to the west.

As stated above, it would not be practical to abandon all lands within reach of the flood waters, nor would it be practical to confine all flows to the present channels either by diking or through the construction of reservoirs, and therefore it is necessary to compromise.

Following flood Hazel last October, many of the more seriously affected properties were expropriated, and it is

intended that these lands will be restricted to recreational use only with no permanent buildings or other structures to be built within the flood plain. This program should be continued and any necessary further proposed encroachments should be carefully considered. Only those that are absolutely necessary should be permitted and then only after their design has been examined from the standpoint of flooding.

3. Remedial Measures for Flood Control

(a) Conservation Measures

The conservation measures generally employed to control floods are:

- (1) Proper land use practices
- (2) Reforestation
- (3) Reservoir storage

(1) Proper Land Use Practices

With regard to conservation, proper land use practices have to do with such farming methods as tend to reduce surface run-off and soil erosion. Important among these are contour tillage, restricted crop rotation, winter cover crops, long-term pasture, diversion terraces, grassed waterways, etc. Contour tillage is ploughing furrows along contour lines or through points of equal elevation. With this method each furrow serves as a miniature dam delaying the surface run-off and promoting infiltration, which increases the soil moisture and raises the ground-water table. Contour tillage also reduces the loss of vital topsoil by erosion and the subsequent silting of the stream channels. This method is generally satisfactory for the smooth regular slopes, but with the more irregular and steeper slopes it may be necessary to employ one or more of the other methods mentioned above to retard the run-off and hold the topsoil in place.

The report of the Select Committee of the Province of Ontario on Conservation, which was submitted to the Legislative Assembly on March 13, 1950, stated:

"Water control must begin with a program of proper land use. Such a program requires the co-operation of a great many individuals over a period of years. This is a program which cannot succeed overnight. The first essential is to persuade every landholder that both his individual advantage and the public good, call for such a program. It is a fundamental recommendation of this Committee that:

"To reduce excessive water run-off, which increases the flooding of river valleys, land use practices tending to soil wastage, soil depletion and soil erosion must be discouraged and discontinued, and the farm-planning program set out in the chapter on soils in this report must be adopted and implemented."

(2) Reforestation

The reforestation of marginal and submarginal land has an ameliorating effect on run-off. It retards run-off, checks erosion on all types of slopes (steep as well as moderate), increases low summer flow, and reduces silting.

The delay in snow melt due to a preponderance of forest cover, until a time when high temperatures and rain arrive, could intensify floods. However, there is no known record for any flood in Southern Ontario that might be attributed to this adverse effect of forest cover. The Credit Watershed has about 16 per cent of forest cover and any increase would benefit the flood problem in that, in relation to the cleared land, there would be a lag of a few days in the snow melt contribution.

A paper on the influence of forest cover on water conservation, which was published in the Transactions of the American Society of Civil Engineers for the year 1929, * is of interest and is quoted as follows:

"In an address before the Mississippi Flood Control Conference at Chicago, Ill., early in June, 1927 United States Forester W. B. Greeley took the position that, while the main reliance for handling large flood discharges must be placed upon engineering structures, forests have a definite part in flood control, together with other forms of land

* Paper by E. F. McCarthy, Esq., Director, Central States Forest Experiment Station, Forest Service, U.S. Department of Agriculture, Columbus, Ohio.

use which check erosion and favourably influence natural storage conditions. This attitude is the rational one, and engineers facing the problem of flood control in the Mississippi will doubtless feel that any agency which will assist in lowering the flood crests and in retaining the flood water within predetermined bounds should be used if economically feasible. . . . The Forestry Committee on the Relation of Forests and Waters submitted the following statement to the Fifth National Conservation Congress.++

'In the mountains, the forests break the violence of rain, retard the melting of snow, increase the absorptive capacity of the soil cover, prevent erosion, and check surface run-off in general, thus increasing the underground seepage and so tend to maintain a steady flow of water in streams'.

"Zon† has summarized the effect of forests on stream flow as follows:

'Among the factors, such as climate and character of the soil, which affect the storage capacity of a water-shed, and therefore the regularity of stream flow, the forest plays an important part, especially on impermeable soils. The mean low stages as well as the moderately high stages in the rivers depend upon the extent of forest cover on the water-sheds. The forest tends to equalize the flow throughout the year by making the low stages higher and the high stages lower.

'Floods which are produced by exceptional meteorological conditions cannot be prevented by forests, but without their mitigating influence the floods are more severe and destructive."

(3) Reservoir Storage

The foregoing water conservation measures provide substantial and necessary aid in reducing flood crests and increasing low flows, and are an integral part of the plan to remedy the problem. They require time and the co-operation of all landowners, however, and alone would never be sufficient for major floods. Storage reservoirs are therefore often necessary to satisfy the flood problem. With adequate storage

* Raphael Zon et al. The Relation of Forests and Water. Sub-Committee on Forest Investigations.

† Raphael Zon. Forest and Water in the Light of Scientific Investigation, Final Report, National Waterways Commission, Appendix V.

provided in a system of regulated reservoirs, a sufficient volume of the flood run-off may be impounded and controlled to the extent that flood crests may be lowered to a safe stage. In conjunction with some local improvement, the excess flood run-off can then be confined within the river channel at places subject to floods. Also, with the reservoirs full at the end of the flood period, the water may be held for release at times of low flow to provide a reliable sustained rate of flow which will assure adequate dilution of sewage effluent and industrial waste, and a dependable supply for any industries that may use water from the river. There are also other benefits. Lakes would be created for recreation, and the ground-water table raised in the vicinity, and to some extent downstream as well. The increased flow would restore fish life, and the waters would be safer for domestic use and recreation.

Agriculture on the Credit Watershed is already highly productive but such conservation measures, if implemented, would further increase the well-being directly or indirectly of all the residents of the watershed and would help restore the rivers to a sanitary condition. The above measures are not a new concept, but have been practised in Europe for generations, though only in recent years on this continent, Many conservation authorities have been set up in the United States and their methods have increased production to such a degree that it is obviously in the interests of our own land-owners to adopt these well proven measures.

(b) Expedients

- (1) Channel improvement
- (2) Dikes
- (3) Diversions

Channel improvement, dikes and diversions are classified as expedients and are not recommended when other conservation methods are possible and practical. Their only

object is to get rid of the water by providing an adequate channel through or around the trouble area. The benefits of such measures are only local and as they tend to increase the velocity of the flood waters they often aggravate the flood conditions at other trouble areas downstream. For reasons of economy, however, these expedients are sometimes necessary.

(1) Channel improvement

Channel improvement includes widening, straightening, deepening and regrading the river channel through, and often for some distance below, the trouble area, It is sometimes necessary to protect the banks from erosion by rip-rap or other means to stabilize the new channel.

(2) Dikes

Dikes are earth embankments with an impervious clay core located at or near the river and built high enough to seal off the flooded area and confine the flood waters to the river channel, If the velocity is low and there is no danger of ice scouring, they may be protected against erosion by turf, otherwise it is often necessary to face the river slopes with stone or concrete. Pumping installations may be necessary to remove the local drainage trapped behind the dikes.

Dikes should be provided with ample freeboard, be substantially built and maintained in good condition, for should they be topped or burst the damage could be greater than if they had not been there.

(3) Diversions

If reservoirs, channel improvement or diking are impracticable or ineffective, it is sometimes possible to detour the stream or part of it around the flooded area, win some cases divert it to another watershed if the topography is favourable.

CHAPTER 3

HYDROLOGY

1. Precipitation, Run-Off and Stream Flow

Precipitation is the condensation of moisture from the atmosphere which appears mainly in the form of rain and snow and occasionally in the form of hail, sleet or dew. Precipitation also occurs to a small extent from the condensation of fog. The amount of precipitation is usually expressed as depth of water in inches.

Run-off is the amount of water a drainage area supplies to the open streams and, in a broad sense, is the excess of precipitation over evaporation, transpiration and deep seepage. The rate of run-off is expressed in cubic feet per second per square mile (c.s.m.). Run-off is termed stream flow when it reaches a defined watercourse.

The ratio of run-off to precipitation is usually very high in the spring and often is greater than 100 per cent due to the accumulation of ice and snow throughout the winter months. On the other hand, the percentage of run-off during the summer months is usually quite low particularly after a long period of drought. Depending upon the intensity and duration of the rainfall many storms do not affect the stream to any noticeable degree. For a wet month such as May the run-off is usually about 45 per cent.

Stream flow consists of surface flow and ground water which is constantly entering the stream channel along its full course. Surface flow is that portion of rainfall, melted snow or ice which reaches the stream channels directly by flowing over the ground surface. It is the component which forestry and land use practices strive to conserve by retarding this overland flow as much as possible to promote greater seepage and more rapid percolation to the ground-water table.

Surface flow also includes water falling on the surface of the stream, its tributaries and other connected open water areas. It usually constitutes the greater portion of stream flow and is responsible for the fluctuations in stream flow,

The ground water flow (percolation) to the stream is going on continuously and is responsible for maintaining the stream flow during periods of drought. This portion is known as the base flow, Stream flow is expressed in cubic feet per second (c.f.s.) which is the volume of water that passes a particular section of the stream in one second.

2. Measurement of Precipitation

The catch of precipitation along with other observations is measured by a network of meteorological stations which cover most of the world. They are administered in Canada by the Department of Transport, Ottawa and the first station set up in Canada was at Toronto in 1840. For some years they were comparatively few in number but since the advent of the aeroplane requiring better forecasts they have greatly increased. The Meteorological Service publishes monthly reports which show daily records of precipitation, temperature, station atmospheric pressure, relative humidity, cloud amount, sunshine duration and the velocity and direction of wind.

The stations are classified according to their equipment and personnel and quoting from their publications the classifications are:

"Class 1 - A station where standard equipment consists of a mercury barometer; wet, dry, maximum and minimum thermometers; anemometer, barograph and rain gauge. At most of these stations complete observations are taken four times daily at fixed synoptic hours, viz. 01.30, 07.30, 13.30,

and 19.30 hours E.S.T. At the stations designated by 'T' the synoptic reports are immediately communicated by means of radio and telegraph to the teletype network linking all forecast offices in Canada.

(A) Indicates that the observations are taken at an airport.

(R) Indicates that the observations are taken at a radio range station at which there is no airport,

(S) Indicates that the observations are taken at a seaplane base.

Class II - A station where the equipment consists of a maximum and minimum thermometer and a rain gauge, although at a few stations the equipment is more extensive.

Class III - The meteorological equipment consists only of a rain gauge,

Class IIM or IIIX - A station in operation during the summer months only.

Chief Stations: - These are denoted by the letter 'F' indicating that these stations are Dominion Public Weather Offices and/or District Aviation Forecast Offices where forecasts are issued regularly,

At stations designated by 'C' the equipment consists only of a sunshine recorder and/or an anemometer)."

The stations available to determine the amount of precipitation on the Credit Watershed are Melville, Alton, Georgetown, Altoa and Port Credit located within the watershed (Figure H-1) and the adjacent stations, Brampton, Malton, Snelgrove, Hornby and Clarkson. Malton is the only Class I station, the remainder being either Class II or III.

The distribution of precipitation may be determined by the arithmetic mean of the stations, or by the isohyetal or the Thiessen methods. The last two methods are the most accurate although when checked with the results using the simple arithmetic mean of the stations, there was very little difference,

Table H-2 shows the monthly precipitation on the Credit Watershed for the wettest and driest years on record in terms of run-off, and the average monthly precipitation for the period 1945 to 1952 inclusive. It also shows from the hydrometric records at Cataract and Erindale the depth of run-off in inches for the corresponding years and its percentage of the precipitation. The data for the average year are a combination of average months and do not correspond to any one particular year of records.

For each month of the year the table shows the precipitation as depth in inches of water. For the winter months the conversion factor of one-tenth of the recorded depth of snow was used to determine the equivalent depth of water.

(a) The October 14, 15, 1954, Storm

On October 15, 1954, south-central Ontario was struck by a severe storm known as Hurricane Hazel. The heavy rainfalls and high winds that accompanied the storm and the flooding which followed caused serious loss of life and extensive property damage.

The storm centre apparently passed to the east of the Credit Watershed as indicated by the maximum 48-hour rainfall of 8.41 inches recorded at Snelgrove just north of the Town of Brampton. This storm might just as well have passed up the Credit Valley in which case the resultant floods in this area would have been considerably greater.

The rainfalls, on the Credit Watershed during the 48-hour period preceding the flood flows of October 16,

TABLE H-2

MONTHLY PRECIPITATION FOR THE MAXIMUM AND MINIMUM YEARS
OF RUN-OFF ON RECORD AND FOR AN AVERAGE YEARLY PERIOD

Month	Max. Year - 1946-47			Min. Year - 1948-49			Average		
	Precip'n Ins.	Run-Off Ins.	%	Precip'n Ins.	Run-Off Ins.	%	Precip'n Ins.	Run-Off Ins.	%
Oct.	3.40	0.13	3.8	1.85	0.37	20.0	2.73	0.39	14.3
Nov.	1.81	0.22	12.2	3.97	0.55	13.8	3.00	0.45	15.0
Dec.	2.25	0.32	14.2	1.87	0.53	28.3	2.64	0.57	21.6
Jan.	3.39	1.11	32.7	2.36	0.81	34.3	2.78	1.11	39.9
Feb.	1.37	1.42	103.6	2.98	1.47	49.3	2.54	1.42	55.9
Mar.	1.73	2.96	171.1	2.49	1.64	65.8	2.83	2.96	104.6
Apr.	3.23	4.25	131.6	1.36	0.85	62.5	2.88	2.17	75.3
May	5.14	1.16	22.6	0.42	0.39	92.8	2.23	0.81	36.3
June	4.31	3.97	92.1	0.52	0.23	44.3	2.66	0.94	35.3
July	4.00	1.57	39.3	2.83	0.24	8.5	3.25	0.49	15.1
Aug.	2.81	0.36	12.8	2.91	0.14	4.8	2.52	0.29	11.5
Sept.	1.93	0.21	10.9	2.83	0.20	7.1	2.29	0.26	11.3

Run-off values for January, February and March for Maximum Year 1946-47 are average, as records not available.

recorded at the Meteorological Stations within and adjacent to the watershed were:

Clarkson	5.31 inches	Alloa	7.46 inches
Port Credit	6.35 "	Georgetown	6.73 "
Brampton	8.35 "	Alton	5 . 5 5 "
Hornby	6 . 8 7 "	Melville	5 . 4 4 "
	Snelgrove	8.41 inches	

These are the actual amounts of rainfall recorded at each of the stations, no adjustments having been made for the effect of the high winds which accompanied the rains.

From the above the average rainfall over the whole watershed amounted to 6.72 inches. For the area above the Cataract gauge (81.96 sq. mi.) the average rainfall was 5.49 inches and for the area between the Cataract and Erindale gauges (238.5 sq. mi.) 7.07 inches, The accompanying Table H-3 lists the rainfall and flow data together with the computed run-off factors for this storm.

3. Measurement of Stream Flow and Run-Off

Hydrometric stations or "gauges" as they are called record the run-off after it reaches the stream or river as flow, The flow is expressed in terms of cubic feet per second (c.f.s.) of water which passes the section of the river at the gauge. These records combine all of the many geophysical and meteorological factors previously listed, which influence the volume and rate of run-off, When reliable and continuous, the value of the records of a gauge increases with the years of operation.

The rate of run-off varies greatly over a watershed usually increasing progressively from the lower regions to the headwaters and several gauges at strategic points are therefore necessary for accurate run-off determinations.

The gauges are of two general types: staff and chain gauges which are read manually once or more daily and

TABLE H-3

FLOW AND RUN-OFF DATA - OCTOBER 1954 FLOOD

Area	Drainage Area Sq. Miles	M.M.D.* Flow C.F.S.	Run-Off C.S.M.t	Rain Average Depth on Area		Run-Off	
				Inches	Acre Feet	Acre Feet	%
Above gauge at Cataract	81.96	823	10	5.49	23,971	4,574	19
Between gauges at Cataract and Erindale	238.5	-	-	7.07	89,905	24,282	27
Entire area above Erindale	320.46	11,200	35	6.72	114,853	28,856	25

*M.M.D. - Maximum Mean Daily

t C.S.M. - Cubic feet per second per square mile

automatic recording gauges which keep a continuous record of the water stages. The staff gauge is a graduated rod which is usually attached to a bridge abutment, or other structure on the river banks, with the zero end in the water and from which the water stages may be read directly, Chain gauges are mounted above the river and are used to measure the distance from a known point down to the water surface. With this distance, the depth of water or stage is then readily determined, Automatic gauges or water level recorders, record the river stages by a continuous line on graph paper from which the flow may be determined for any time of the day. Automatic gauges require the construction of a suitable well and housing for their operation. The section of the river at the gauge is metered, and a rating curve prepared from which the flow is determined for readings of the gauge.

The systematic measurement of stream flow was begun in 1912 by the Ontario Hydro-Electric Power Commission, but as they were interested only in the development of power, gauges were usually established only on those streams with power potential and many of these were discontinued after a few years of operation. In 1919, following a co-operative agreement with the Hydro Commission, the then Department of the Interior (now the Water Resources Division of the Department of Northern Affairs and National Resources) assumed the responsibility of this work. Unfortunately hydro power was still the motive and the meterings were confined to those streams where such development appeared feasible, In 1944 when the Department of Planning and Development was established, they requested the above Department at Ottawa to install gauges on many of the rivers in Southern Ontario which, owing to their "flashy" nature, were not suitable for power and had not been metered.

At present there are about 55 stream gauging stations in operation in Southern Ontario financed under a joint agreement between the Federal and Provincial Government.

There are two manually read hydrometric gauges on the Credit River, one at Cataract with continuous records dating from 1915 and the other at Erindale with continuous records dating from 1945. Their location is shown in Figure H-1, The maximum and minimum mean daily and the mean monthly discharges at the respective gauging points for each year of record up to and including 1954 together with the monthly means for the periods of record are shown in Table H-4. Blank spaces for the winter months indicate that flows could not be recorded because of ice conditions at the time.

4. Hydrographs

"The Hydrograph is a correct expression of the detailed run-off of a stream, resulting from all the varying physical conditions which have occurred on the drainage area above the gauging station previous to the time which it represents."

Figure H-3 shows continuous hydrographs of mean daily flows for the Cataract and Erindale gauges for all the years of records. Figure H-4 shows spring and summer flood hydrographs for the Cataract and Erindale gauges together with the hypothetical spring flood hydrograph for each. In each case the hypothetical flood is 1-1/3 times greater by volume than the greatest flood on record for the period concerned.

The vertical measurements of the hydrograph represent flow in c.f.s. and the horizontal measurements, time. The area of the hydrograph for any period of time represents the volume of water that has passed the gauge for that period. In order to avoid the use of astronomical numbers, volume is expressed in acre feet † instead of cubic feet.

* Definition given in "Hydrology" by Professor D.H. Mead.

† An acre foot is one acre in area and one foot deep. The flow of one c.f.s. for one day = 1.98347 acre feet or approximately 2 acre feet per day.

TABLE H-4

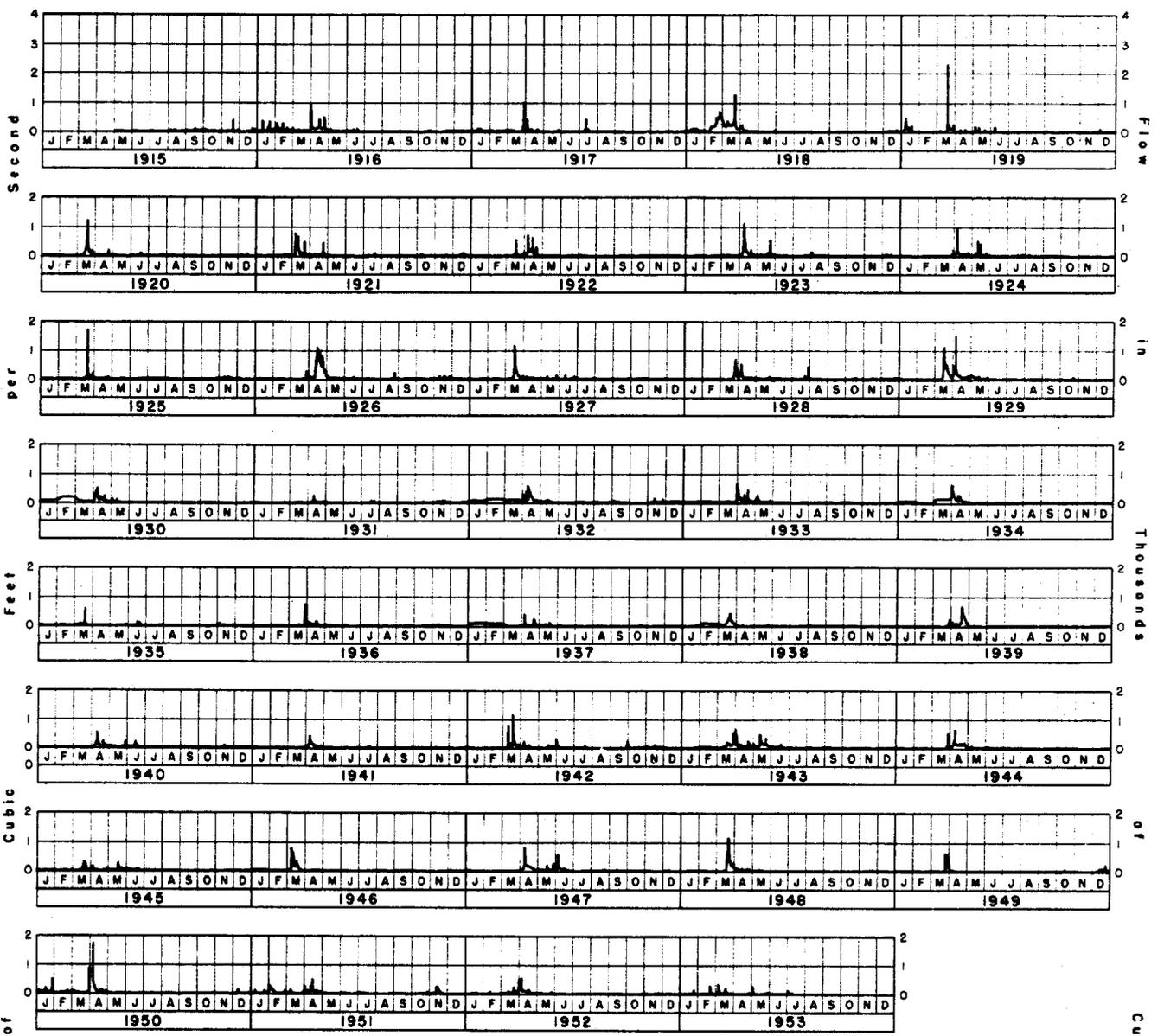
CREDIT RIVER AT ERINDALE
 Maximum, Minimum, Mean Daily and Mean Monthly Flows in Cubic Feet per Second for the Gauge at Erindale
 Drainage Area 320.46 Square Miles

YEAR	OCTOBER			NOVEMBER			DECEMBER			JANUARY			FEBRUARY			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER				
	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean					
1945-46	800	155	294	395	185	257	300	105	159	-	-	-	-	-	4,660	185	1,070	800	105	334	155	82	119	185	62	140	155	7	74	117	4	59	105	3	49			
1946-47	105	10	36	155	18	65	185	4	86	-	-	-	-	-	-	-	-	4,220	185	1,230	2,790	105	327	4,770	147	1,150	3,120	47	438	234	66	99	91	32	60			
1947-48	91	4	48	20	7	14	91	7	15	-	-	-	-	-	-	-	-	4,400	121	214	251	70	122	495	43	106	467	76	130	149	13	75	193	7	72			
1948-49	139	58	103	325	70	158	205	115	150	-	-	225	-	-	8,150	305	1,670	689	625	90	247	150	76	111	90	53	69	150	38	68	53	39	107	43	58			
1949-50	243	43	103	158	53	90	657	150	333	1,260	58	372	438	208	456	2,240	130	4,600	3,730	192	689	7,560	233	1,110	478	142	302	660	128	394	149	47	86	142	66	86	26	66
1950-51	186	61	83	186	61	106	376	83	272	1,620	160	329	1,040	-	444	3,790	186	635	3,540	330	761	353	128	203	216	79	130	425	83	125	119	72	85	119	63	81		
1951-52	250	75	106	760	89	222	-	-	126	-	-	518	2,870	145	406	2,690	201	792	2,990	216	951	692	186	260	149	96	113	149	59	93	201	75	104	123	77	98		
1952-53	149	83	104	353	89	157	269	66	157	565	-	242	1,390	111	292	1,140	111	420	452	134	197	1,140	138	353	495	99	189	87	140	261	77	111	173	72	95			
1953-54	116	77	92	173	77	104	-	69	121	-	160	2,990	-	690	5,010	173	850	2,690	201	583	452	119	224	233	111	140	103	61	77	96	66	77	149	72	88			
MEAN	231	63	108	281	72	130	298	75	158	1,148	109	308	1,746	155	436	3,926	185	823	2,591	179	625	718	116	225	810	91	270	571	56	137	152	49	82	128	44	74		

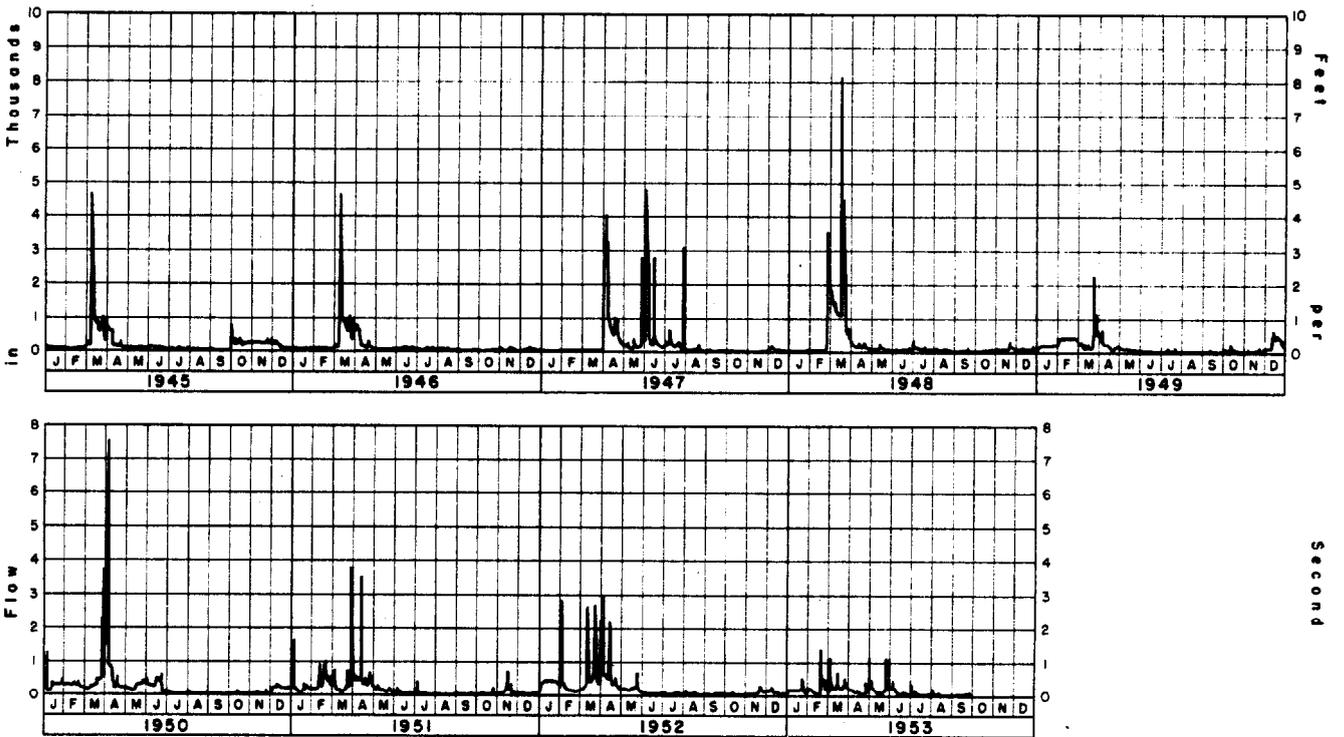
CREDIT RIVER AT CATARACT
 Maximum, Minimum, Mean Daily and Mean Monthly Flows in Cubic Feet per second for the Gauge at Cataract
 Drainage Area 81.96 Square Miles

YEAR	OCTOBER			NOVEMBER			DECEMBER			JANUARY			FEBRUARY			MARCH			APRIL			MAY			JUNE			JULY			AUGUST			SEPTEMBER			
	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean				
1914-15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	74	25	41	41	18	28	49	22	30	109	24	53	179	27	60		
1915-16	102	29	47	450	22	59	166	27	52	470	12	147	330	12	131	1,120	10	155	940	83	266	120	49	77	123	40	69	43	20	31	37	16	22	13	19		
1916-17	92	18	32	51	21	35	120	21	47	157	17	64	123	17	55	1,060	15	203	410	51	113	115	27	48	57	27	38	435	24	74	51	23	29	28	22	25	
1917-18	52	23	33	55	16	29	75	6	29	175	16	96	740	18	288	1,260	156	450	317	41	82	98	25	41	38	21	27	26	15	20	28	14	20	80	20	31	
1918-19	57	21	29	42	20	29	121	18	45	495	12	114	42	9	20	2,360	26	238	257	38	77	216	28	82	202	22	41	28	18	22	36	17	20	28	17	19	
1919-20	70	19	29	105	22	40	141	16	38	15	12	14	20	16	19	1,240	20	250	220	40	76	74	38	54	110	24	54	92	20	38	56	20	27	26	14	21	
1920-21	56	24	33	92	28	44	115	24	47	83	28	38	83	24	37	800	35	180	415	47	91	87	32	46	83	20	37	158	24	41	20	29	33	20	26		
1921-22	105	24	40	83	30	39	107	30	62	42	33	38	35	28	30	580	35	136	665	48	206	58	32	49	74	26	37	41	20	31	45	15	26	41	15	26	
1922-23	35	15	28	41	20	29	35	24	30	34	20	29	34	12	14	8	87	15	57	1,160	51	260	550	41	86	64	32	40	45	20	28	180	24	37	38	22	28
1923-24	59	16	21	34	17	25	104	30	45	-	-	-	-	-	15	230	-	58	465	55	188	540	50	146	59	30	41	69	27	37	80	17	36	50	22	29	
1924-25	50	17	30	38	-	27	25	-	32	-	-	32	-	-	60	1,690	-	219	114	30	53	37	24	29	37	15	23	45	12	20	30	12	19	45	12	24	
1925-26	50	24	32	141	30	58	-	-	32	-	-	45	-	-	40	296	-	87	1,120	63	424	150	30	63	114	24	40	37	19	25	263	19	45	59	21	35	
1926-27	67	28	42	155	45	77	-	-	52	-	-	24	-	-	35	1,200	-	228	122	50	72	173	45	68	127	34	58	107	25	39	38	15	26	35	18	24	
1927-28	65	22	28	112	22	41	-	-	47	-	-	39	-	-	31	1,765	-	159	555	55	141	147	28	50	72	28	41	410	26	72	90	21	40	40	16	27	
1928-29	109	23	44	111	34	54	-	-	54	-	-	54	-	-	37	1,160	-	271	1,540	61	263	192	45	73	46	20	33	82	16	30	26	16	21	25	13	17	
1929-30	127	15	30	99	-	38	-	-	-	-	-	112	-	-	227	-	-	80	560	57	201	152	43	68	52	28	38	52	16	28	26	15	17	23	13	16	
1930-31	23	15	18	41	23	31	-	-	28	-	-	23	-	-	28	-	-	280	35	97	46	25	34	92	20	32	104	23	42	40	17	27	31	19	25		
1931-32	41	22	29	114	26	49	-	-	67	-	-	143	-	-	182	-	-	138	625	59	194	117	43	70	65	27	39	52	28	38	80	28	38	130	26	46	
1932-33	57	35	43	199	42	81	-	-	73	-	-	79	-	-	75	-	-	94	730	65	203	280	55	86	57	26	38	59	18	27	46	17	24	37	17	23	
1933-34	41	17	28	-	-	39	-	-	39	-	-	96	-	-	25	-	-	195	660	57	220	57	27	39	57	22	28	26	16	21	35	16	20	16	20		
1934-35	34	17	23	57	18	36	-	-	34	-	-	66	-	-	30	-	-	152	57	30	40	90	23	41	152	26	55	72	27	37	34	17	23	48	16	25	
1935-36	35	23	30	114	34	54	-	-	69	-	-	25	-	-	23	790	-	169	266	67	120	85	41	54	90	30	47	35	22	26	50	19	26	67	26	37	
1936-37	64	34	47	83	-	51	-	-	30	-	-	178	-	-	173	-	-	41	169	64	143	169	42	73	44	19	31	35	19	27	41	13	25	46	17	28	
1937-38	66	20	37	62	27	44	-	-	32	-	-	28	-	-	121	473	-	146	165	42	61	96	35	56	39	19	29	56	19	28	107	10	28	94	13	28	
1938-39	37	23	27	56	19	33	-	-	34	-	-	43	-	-	33	-	-	8	705	105	234	127	26	67	26	43	56	22	33	56	19	27	41	22	29		
1939-40	50	22	36	50	29	38	-	-	32	-	-	52	-	-	12	75	-	45	580	19	159	222	26	67	211	37	75	50	15	28	81	15	26	87	22	41	
1940-41	79	22	38	146	34	50	-	-	35	-	-	35	-	-	40	1,190	22	213	268	34	95	585															

Flood hydrographs are roughly triangles or a series of triangles rising from and receding to the normal or base flow. It is by means of the hydrograph that the volume of storage to prevent floods up to a given magnitude is determined. If the "channel capacity", that is, the flood stage in c.f.s., of a trouble area is known and a hydrograph is constructed for that place the area under the hydrograph above the channel capacity flow line is the net storage required for a flood of that magnitude. The net storage is then increased to allow for losses in dam operation, dead storage, etc.



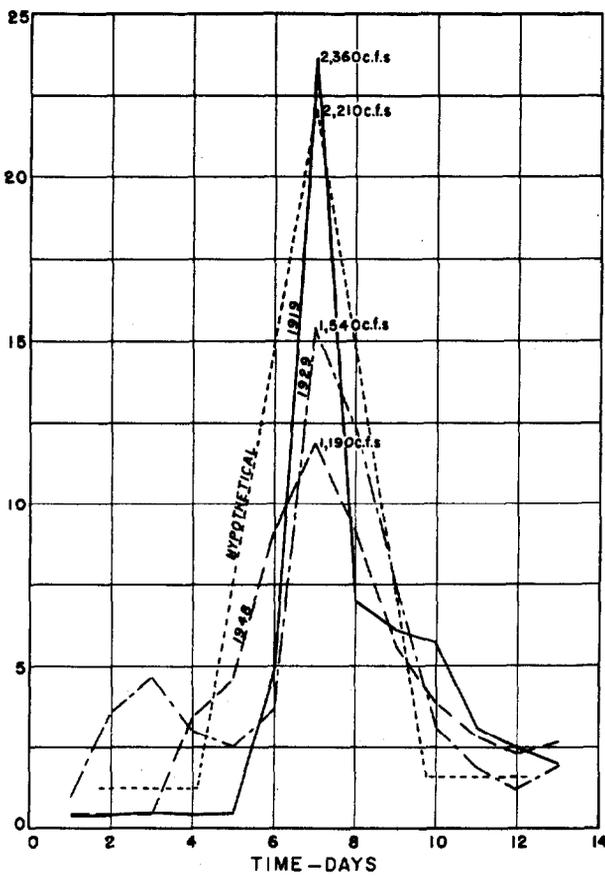
GAUGE at CATARACT
 Drainage area 82.0 sq. miles



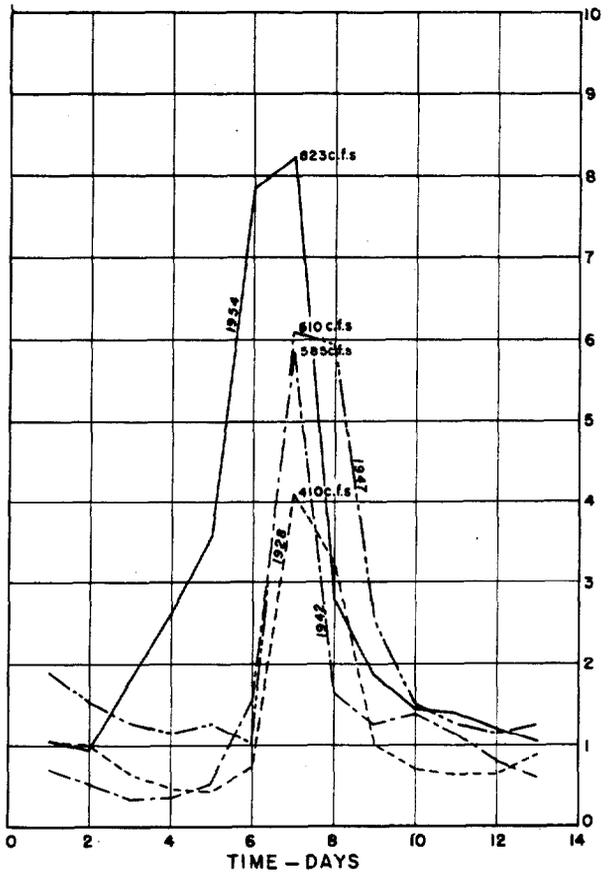
GAUGE at ERINDALE
 Drainage area 320.5 sq. miles

HYDROGRAPHS

Mean daily flows plotted from records of the Water Resources Division,
 Dept of Northern Affairs and National Resources, OTTAWA

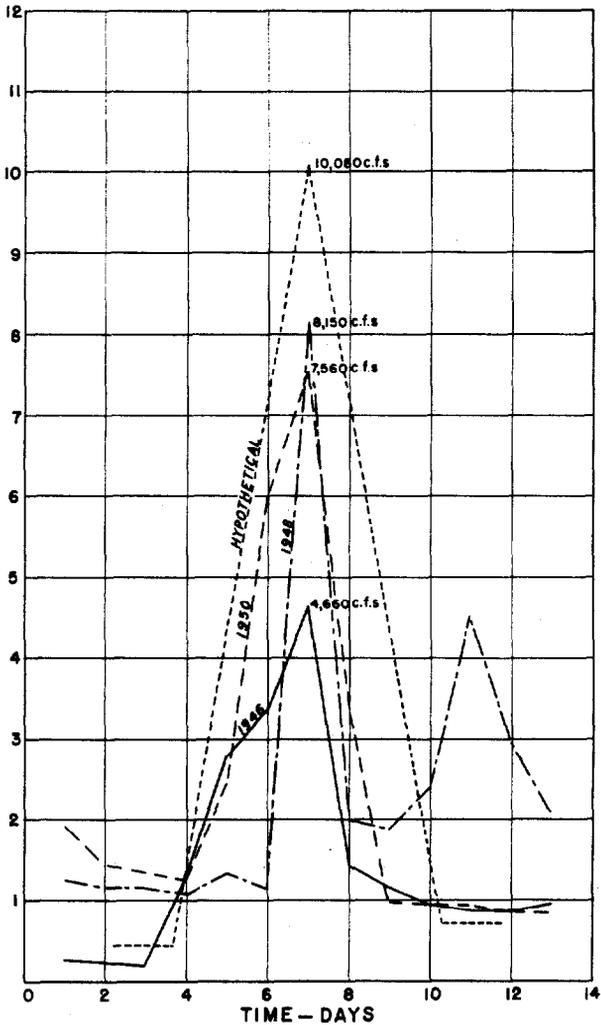


SPRING FLOW HYDROGRAPHS

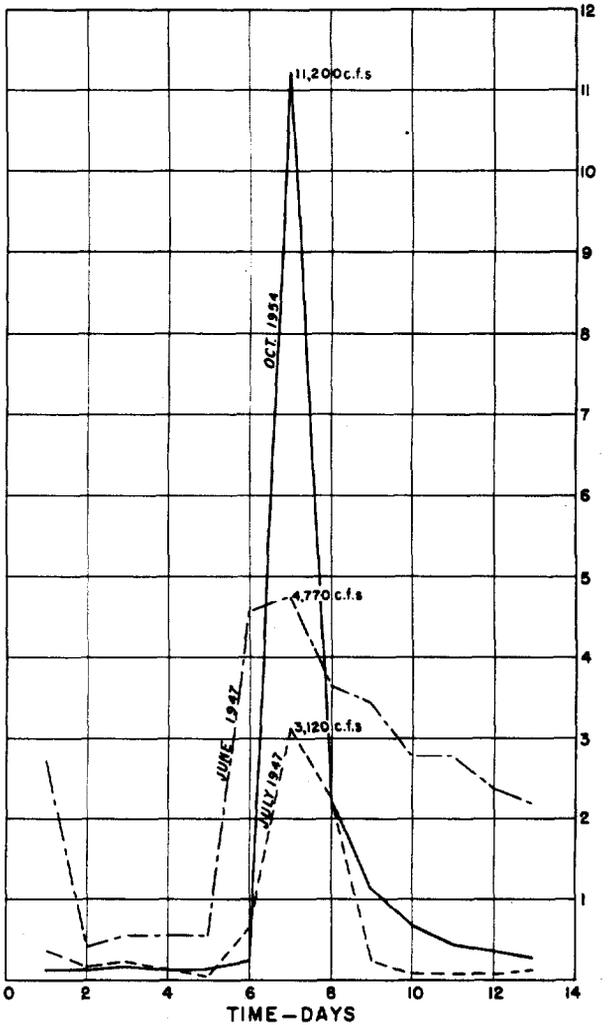


SUMMER FLOW HYDROGRAPHS

Gauge at CATARACT. Drainage area 81.96 sq. miles



SPRING FLOW HYDROGRAPHS



SUMMER FLOW HYDROGRAPHS

Gauge at ERINDALE. Drainage area 320.46 sq. miles

HYDROGRAPHS
of
SPRING and SUMMER FLOW
at
ERINDALE and CATARACT

Mean daily flows from records of the Water Resources Division, Dept. of Northern Affairs and National Resources—Ottawa.

CHAPTER 4

THE FLOOD PROBLEM

1. General

The Credit River, in common with most rivers of Southern Ontario, has high spring flows (Table H-4) which cause damage and inconvenience along its valley. The river's flood plain, however, has not been encroached upon to the extent that others have and damage is consequently less, although wide-spread; having been reported at various places throughout the length of the river. In most cases, damage at any particular location is small and confined to private properties bordering the river.

The river channel is generally adequate to carry the normal flood flows but local damage, even at times of low flow, has been caused by ice jams forming at the bends or constricted points. This damage is said to have lessened recently with the disappearance of many of the old mill dams which permitted the formation of large masses of ice in the quiet ponds above them.

At several points buildings have been erected in the flood plain, and further encroachment should be prevented. Protection, in a few cases where damage is now done, may be accomplished by local measures of diking or channel improvement. Township roads crossing the valley are often flooded because of ice jams or inadequate bridge openings, but such flooding is of short duration and is generally an inconvenience only.

2. Factors contributing to the problem

As mentioned earlier in the report the stream gradients and lateral slopes of the Credit Watershed are very high particularly in the upper reaches and are such as would produce a high rate of run-off. On the other hand, the nature of soils, vegetative cover and natural storage areas on the whole tend to retard run-off and to a large degree offset the effect of the steep gradients.

The value of these favourable characteristics may be seen from a comparison with the run-off from the Conestogo Watershed. This area is similar to the Credit in size and shape but the soils are mostly of a clay type and there are fewer natural water storage areas and less forest cover. On the other hand the stream gradients of the Conestogo River are about one half those for the Credit.

During the March 1948 floods the run-off from the Conestogo amounted to 63.1 c.f.s. per square mile for a peak flow of 20,000 c.f.s. while the corresponding value for the Credit was 25.4 c.f.s. per square mile or a peak flow of 8,150 c.f.s.

There is some difference in the climatic factors but this would only account for a small portion of the above variation which is chiefly attributable to the favourable characteristics of the watershed.

Flooding along the Credit Valley in most cases results from ice jams which restrict the natural channels and force the water out over the surrounding low-lying land, During the winter months large volumes of ice are formed in the quiet open water stretches of the river which are broken up and carried downstream at the time of a break-up. These masses are further strengthened by frazil ice which is formed in the rapid stretches of the river.

Frazil ice is formed in open water exposed to air at temperatures well below freezing under conditions that provide sufficient turbulence in the water to carry the ice crystals away as quickly as they are formed, In this way an ice sheet is prevented from forming and the frazil ice passes downstream and is carried under the ice sheets formed in the quiet water areas. In this way great thicknesses of ice may be built up.

It was not possible to investigate this factor but it is felt that, with the steep river gradients which exist

on the Credit River large masses of ice would be formed in this manner which when released at the break-up would readily jam at the first obstruction and cause trouble.

Encroachments on the flood plains are another factor although as previously mentioned these are not as extensive on the Credit as in the case of some of the neighbouring watersheds. The absence of large urban centres with their expanding suburbs has probably lessened the demand for development of the low areas and most of the larger centres are located on higher ground.

3. Proposed Remedial Work and Costs

The methods generally employed in providing flood protection have been outlined in Chapter 2. These may be classified into two general groups. Conservation measures such as; proper land use practices, reforestation and reservoir storage and expedient measures such as; channel improvement, dikes and diversions or a combination of two or more of the above.

When conditions are suitable flood control by means of storage reservoirs is superior to the other methods since it provides other benefits and permits the fuller use of the water. However, under the present land use along the main river, the cost of any program of reservoirs for flood control alone would be out of proportion to the resulting benefits and unless the reservoirs can be justified in part by their recreation and water storage benefits flood protection by local improvement is recommended.

Flooding has occurred to a varying degree at many points along the river and its tributaries. The places most frequently flooded are Glen Williams, Churchville and Meadowale and to a lesser extent, Norval and Streetsville. The flooding at Norval and Streetsville can be taken care of locally at small cost but more extensive work is required at Glen Williams, Churchville and Meadowvale to correct their problems.

(a) Churchville

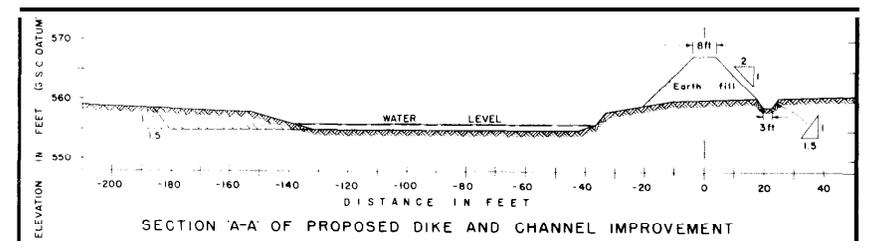
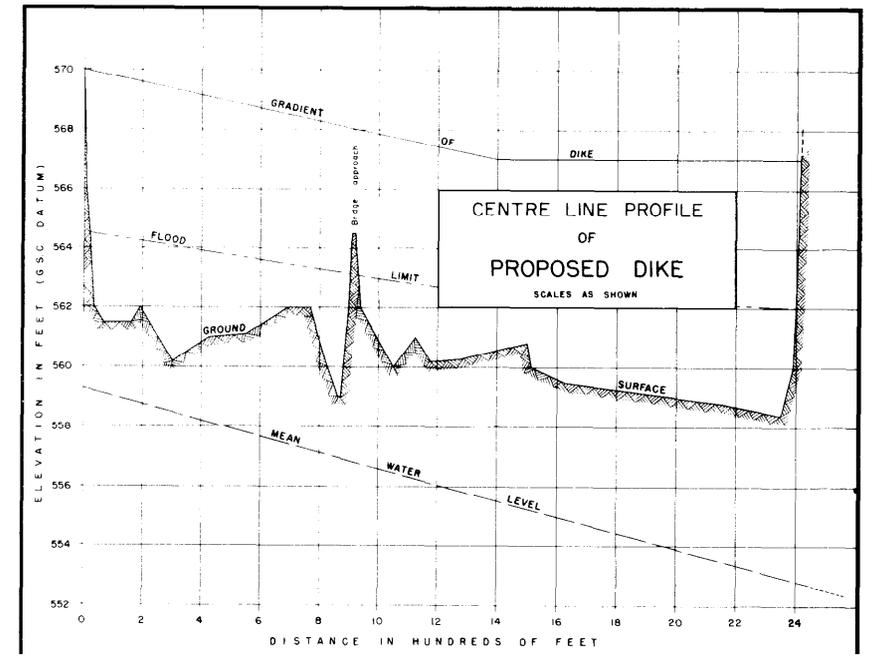
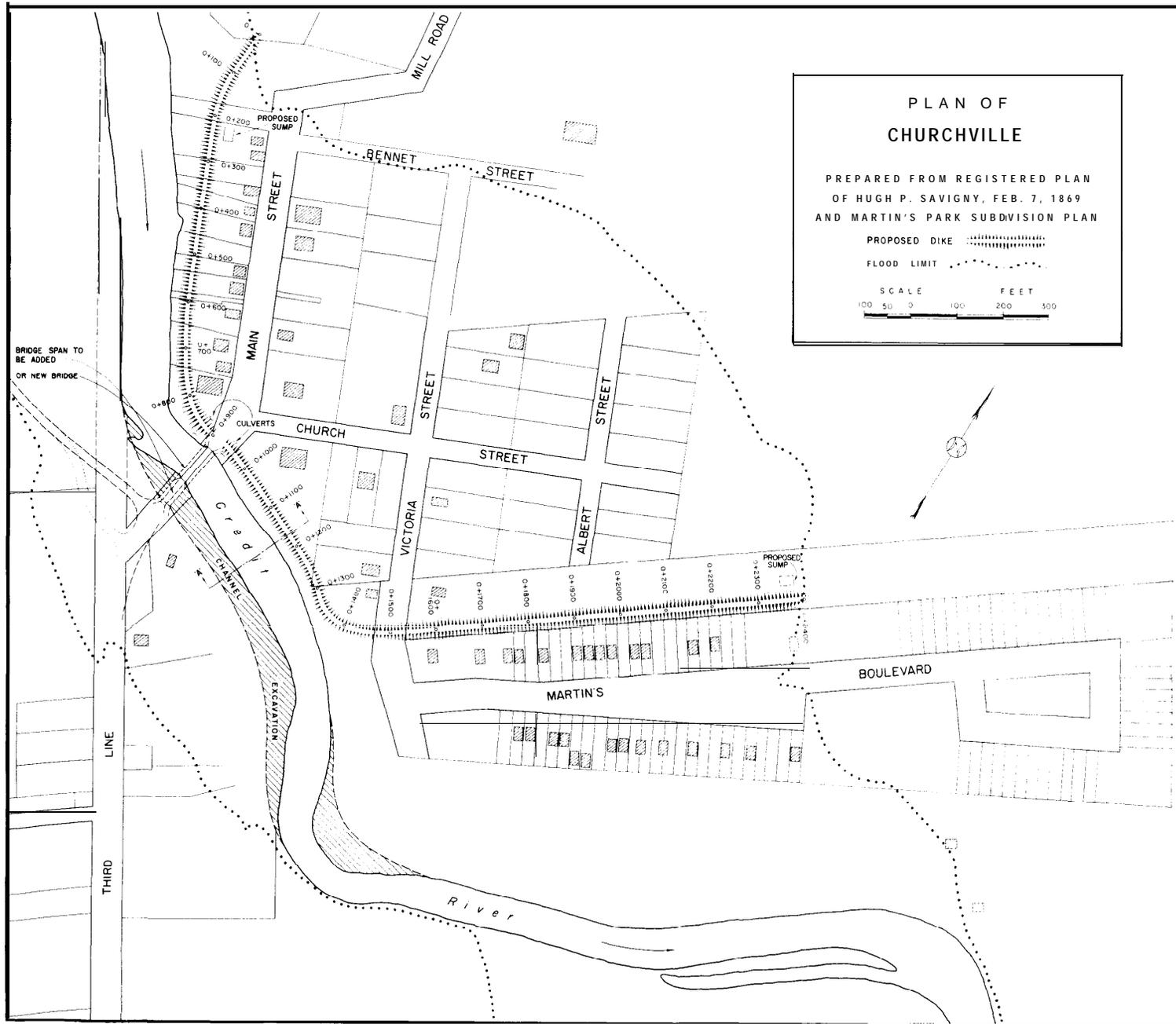
The Churchville flooded area and the proposed flood control measures are shown in Figure H-5. Since the Martin's Park area has been expropriated by the Flood Homes and Buildings Assistance Board and reserved as conservation land, protection for this lower part is no longer required. It is proposed to construct a dike from the high ground at the north end along the river bank and across Main Street as far as the Martin Camp, thence leaving the river and continuing along a line parallel to and near the northerly limit of the Park to the high ground on the east. The top of the dike would be 8 feet wide with 2:1* side slopes and a length of 2,413 feet more or less. This location would shorten the length of the dike, follow higher ground and would still provide a substantial flood channel for the river.

At the crossing of Main Street the top of the dike, if continued, would be about one foot above the end of the present bridge. Since a freeboard of 5 feet above high water mark has been provided for, an opening could be left in the dike which could be sandbagged should flood waters ever approach that stage.

There are two low areas within the ditched-off area and it will be necessary to construct two sumps with pumps to take care of the internal drainage during flood periods. The exact extent of the internal drainage area is not known but should this prove to be excessive then it may be necessary to construct an intercepting ditch along the high ground on the east side to reduce the local drainage, This would be cheaper than providing larger pumps to handle the water.

Two culverts fitted with flap-gates would also be necessary at either side of the bridge approach to permit the normal drainage to pass through the dike to the river.

Two feet horizontal to one foot vertical.



CHURCHVILLE FLOOD AREA
SHOWING PLAN, PROFILE AND TYPICAL SECTION
OF PROPOSED DIKE AND CHANNEL IMPROVEMENT

The effect of the dike will be to shove the flood waters that covered the area behind the dike over on the south side of the river which, for a flood of the magnitude of Hazel, would raise the water level nearly 3 feet on the dike at the bridge which is the critical point. This would aggravate conditions on the south side of the river and leave barely enough freeboard on the dike for a flood of the Hazel magnitude. Also, floods of greater magnitude are possible and should be provided for to prevent topping of the dike.

An examination of the photograph, in the History of Floods, of the 1950 spring flood at Churchville shows that the bridge opening is too small. In the foreground the water may be seen going over the road which is only 3.8 feet below the deck and 0.6 feet below the bottom of steel of the bridge. By proportioning peak flows from the Erindale gauge records those at Churchville were 8,800 c.f.s. for the 1950 spring flood and 11,000 c.f.s. for the flood following Hurricane Hazel in October 1954. In order to pass flows of this magnitude an additional span would have to be added or the present bridge extended 68 feet to give a clear opening of 152 feet. The south bank would be widened accordingly and the excavated material could be used in the dike. Widening the bridge opening and the channel below alone would not prevent flooding since the constriction of the river channel lower down would cause a backwater and force the water out over the flats. It is believed, however, that in conjunction with the dike protection would be afforded against any likely future flood.*

The present bridge is in fair condition but is narrow (a 13 ' 6" roadway) and except that the excavation from the river widening could be used to build a portion of the

* The maximum is not known but meteorologists say that the probable maximum rainfall for this area is 13 inches in 48 hours.

dike, if not delayed too long, it would be better to wait and build a new bridge. The cost of a new bridge 30' wide to comply with highway specifications and 154 feet long would be approximately \$74,000.

Changing the length of the bridge either by adding a span or renewing it altogether would necessitate relocating the 3rd Line Road to give a safe approach to the bridge.

The estimated cost of the work including a new bridge and 20 per cent for engineering and contingencies is \$131,424.

If the present bridge is simply extended by adding a new 68-foot span, the above cost could be reduced by \$54,000.

(b) Meadowvale

The Meadowvale flooded area and the proposed flood control measures are shown in Figure H-6. A dike is proposed along the left or south-easterly side of the river. Commencing at the old millpond embankment, the dike crosses Willow Lane and cuts across the corners of Lots 72 to 78 inclusive (excepting Lot 75) and continues along the river-bank across Lots 79 to 85 inclusive to the old railway embankment. From this embankment it continues along the river tying in to the Malton sideroad embankment, a total length of about 1,570 feet. The top of the dike would be 8 feet wide with 2:1 side slopes and would be 5 feet above the highest known water level.

There would be a ditch along the inside of the dike to the old tailrace, to take care of the local drainage inside the dike. A sump would be constructed to collect this water from which it would be pumped over the dike into the river.

The old railway embankment is an obstruction and should be removed, as should the old pier of the former

railway bridge which sits in the middle of the river. The material from the embankment would help build the dike.

From the abutments of the bridge upstream for a distance of 120 feet, the outside face of the dike should be rip-rapped with hand-placed stone to prevent erosion. The estimated cost of the work is \$20,200.

(c) Glen Williams

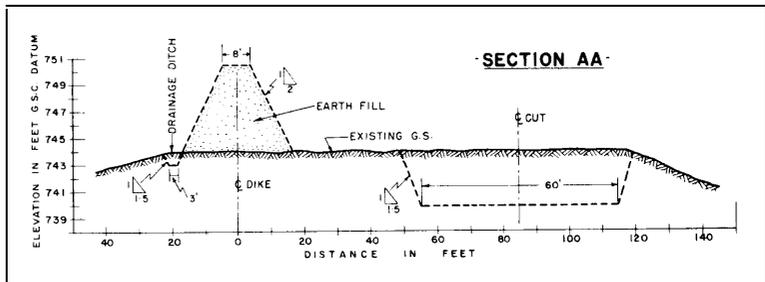
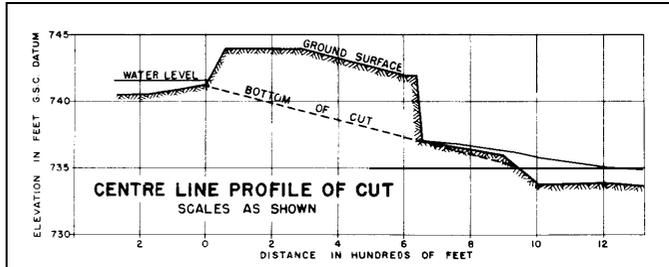
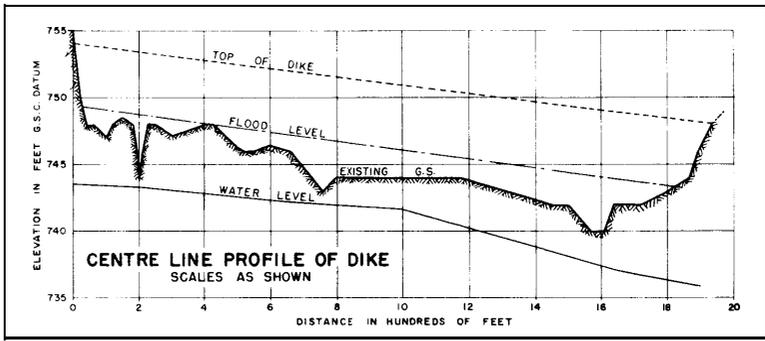
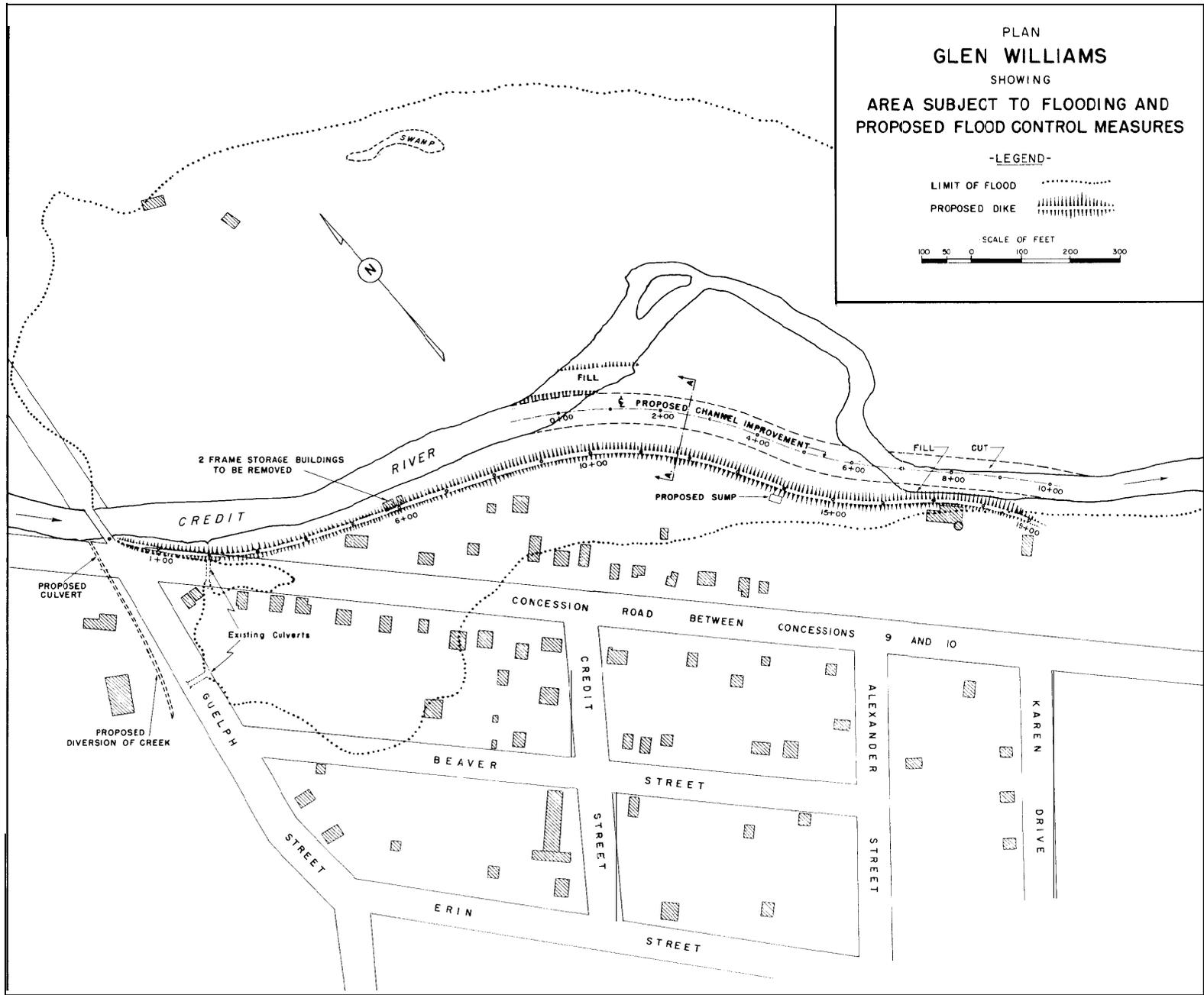
At Glen Williams flooding has been sporadic and chiefly due to ice jams. This was borne out when the high flows following the rains of Hurricane Hazel caused no damage. Fig. H-7 shows the flooded area and the proposed channel improvement and dike.

Ice jamming at the loop and on the shoals at the lower end of the village is the major cause of flooding and it is proposed to cut off the loop by a channel 650 feet long and a bottom width of 60 feet, which is the approximate width of the present channel. In order to make room between a house and a barn for a dike, a strip 10 feet wide would be filled on the south side between stations 18+25 and 15+85 with a corresponding widening on the opposite side of the river.

The amount of excavation is approximately 6,530 cubic yards and is believed to be all common excavation.

It is not expected that channel improvement alone will prevent future flooding and it is proposed to build a dike along the south bank of the river, using the material excavated from the channel to build part of the dike. The dike would provide 5 feet of freeboard above the highest known water level. The upper end would tie in to the Guelph Street bridge, and the lower end into the old existing dike. It would be 1,850 feet long with a 8-foot top width and 2:1 side slopes.

The creek which joins the river 200 feet downstream from the bridge would have to be diverted to follow the



GLEN WILLIAMS FLOOD AREA
 SHOWING PLAN PROFILE AND TYPICAL SECTION
 OF PROPOSED DIKE AND CHANNEL IMPROVEMENT

FIG. H-7

Glen Williams flood area

road embankment and discharge into the river at the upstream side of the bridge. The former culvert would be filled in and the grade of the road approach to the bridge raised to that of the dike.

A ditch would follow the inside of the dike to a sump where the surface run-off behind the dike would be pumped into the river.

If the dike were built in conjunction with the channel diversion the excavation (less the amount to plug the old channel) could be used in the dike but approximately 5,500 cubic yards of additional material would have to be found to complete the dike.

The estimated cost of the channel improvement including the dike and appurtenances, engineering and contingencies is \$22,400.



Churchville-The park area and buildings in the background are flooded almost annually.



Meadowvale-The Credit River at the abandoned railway line. The old bridge pier and railway embankment contribute to flooding and should be removed.



Glen Williams-This view shows the limited protection offered by the natural river bank. Spring flows readily overtop this bank and flood the roadway and buildings on the right.

CHAPTER 5

LOW FLOW RECORDS AND LOW FLOW PROBLEM

1. Minimum and Average Flows

(a) At Cataract Gauge - Drainage Area 81.96 sq. mi.

The Cataract gauge has continuous records dating from May 1915. Table H-4 shows the maximum and minimum mean daily and mean monthly flows to September 30th, 1954, a period of 40 years of flow records. The lowest mean daily flows on record occurred in 1946; the minimum flows being 11 c.f.s. for each of the three months of July, August and September and the mean or average for these months being 17, 17 and 16 c.f.s. respectively. The average minimum mean daily flow for the 40-year period was 17 c.f.s. for the month of August with a minimum mean monthly flow of 26 c.f.s. being recorded for this month.

(b) At Erindale Gauge - Drainage Area 320.46 sq. mi.

The Erindale gauge has continuous records dating from 1945. Table H-4 shows the maximum and minimum mean daily and the mean monthly flows to September 30th, 1954, a period of nine years. This is a comparatively short term gauge but it records the driest year since 1915 namely, 1946*, as indicated by the Cataract records. The lowest mean daily flows for that year were 7, 4, and 3 c.f.s. for July, August and September, respectively, with corresponding mean monthly's of 74, 59 and 49 c.f.s. The average minimum mean daily for the nine-year period was 44 c.f.s. for September with a minimum mean monthly 74 c.f.s. being recorded for this month.

It will be noted that although the drainage area of Erindale is four times that of Cataract the 1946 low mean monthly flows at Erindale were only about three times those at Cataract. The inaccuracy of the rating curves of these gauges at low stages may to some extent account for the difference

* The 1955 records at the time of writing had not been published and will probably show record lows since the run-off throughout Southern Ontario was below normal this year.

between the gauges, out the discrepancy is probably due chiefly to mill operations on the river with some further loss from seepage and evaporation.

2. Low Flow Problem

An examination of the foregoing summary of low flows indicates that during many days of the year the river is reduced to a mere trickle. These low water stages usually occur at a time when the water is needed most and when the temperatures are highest which further aggravate the problem, The fact that a serious problem does exist at such times is emphasized by the fact that the amount of sewage and industrial waste entering the river exceeds the natural flow.

It is not possible to say what development will take place on the watershed within the next two decades and what will be the demand on the river for water. It would not be an overstatement, however, to say that expansion will follow the same pattern as that of the Humber and Don Watersheds. Georgetown alone has recently had a large subdivision plan approved in draft to accommodate seventy future industries, Early and careful planning by the Authority and the municipalities concerned is required to ensure an adequate and sanitary supply of water for the future expansion of domestic, industrial, irrigation and recreational needs. Domestic and industrial water supplies for the lower regions will probably be pumped from Lake Ontario but for the upper and major part of the watershed it would probably be more economical to supply water from reservoirs by gravity. Multi-purpose reservoirs would also furnish wide-spread benefits for irrigation, increased summer flow and recreation.

There are many factors to be considered before the necessary minimum sustained flow can be determined and similarly the amount of storage to supply it. First there is the amount required for domestic and industrial use and that required to satisfy the riparian rights of owners along the

river for livestock watering and irrigation. Further to the present needs this amount should provide for any anticipated future development in the area. Then there is the problem of dilution and a standard for the sewage and industrial wastes being disposed of in the river will have to be established before the amount of storage required to make the river water safe for its many users can be determined.

Another factor which determines the amount of storage necessary is the period for which a minimum sustained flow is required. Normally the natural flow is deficient at intervals throughout the period June 1st to February 28th a total of 273 days. Of this period, generally the summer period, June 1st to September 20th - 112 days, is the most critical and sufficient storage to maintain the flow during this interval is generally acceptable.

3. Uses of the River

(a) Domestic

At present Streetsville is the only municipality taking water directly from the river for domestic purposes. The dam at the upper end of Streetsville is used as a reservoir and supplies the needs of 2,000 people. Throughout its course river water is used extensively to water livestock and where sanitary, it is also used by many individual residents along the river. Probably, many of the wells near the river are affected both in quantity and quality by the stream at that point.

If the river is to be used to any great extent for domestic supply then it is imperative that an acceptable minimum sustained flow be determined and that this flow be maintained at all times.

(b) Industrial

There are many industries along the river which use river water in their processing, The Tannery at Acton requires about 750,000 gallons daily and the Wool Combing Plant

also takes water from the same stream. Other plants at Alton, Cheltenham, Georgetown, etc. are dependent upon river water for their operations.

The rapid industrial expansion of the southern part of the watershed is mentioned elsewhere in this report. Georgetown and Meadowvale are already planning large areas for industrial development, some of which are already assured. Other municipalities along the river will also encourage industry and it can be expected that many industries will require water from the river.

(c) Irrigation

An increasing amount of water is being taken from the river for irrigation. This is a recent development with the introduction of aluminum tubing, sprinklers and pump units, and can be expected to increase as population pressure in the metropolitan area makes more intensive use of the land necessary. At the time of the survey about 1,200 acres in the lower reaches of the river were in orchards or specialized crops and at least ten pumping units were in operation on the river. Since the capacity of these pumps is of the order of 1 c.f.s. and none is returned to the river it can be seen that even those presently operating could have an appreciable effect on the flow and any great expansion in their use, which is highly probable could seriously affect the summer flow. The flow at Erindale has dropped as low as 3 c.f.s. at a time when it is most urgently needed by the crops, To irrigate an area of 1 acre with 1 inch would require 22,687 gals, of water and if taken from the river in one day it would be equivalent to 0.042 c.f.s., or 0.42 c.f.s. for a 10-acre field. Obviously, it would not take many farmers to pump the river dry at times of low flow. Already in the Lake Erie tobacco districts the farmers have pumped many branches of the streams dry and they are damming creeks, excavating dug-out ponds and are considering building large reservoirs to impound water during the spring run-off in order to satisfy their needs.

(d) Sewage Disposal

The river furnishes the only means of disposal for nearly all the waste products of human and industrial activities on the watershed. This is probably the greatest single use of the river and is such as to seriously interfere with the other uses of the river and cause great concern to all those who would use it.

A number of municipalities within the watershed are served by sewer systems and some provide partial sewage treatment. As mentioned previously there are many industries using river water in their operations and this water is all returned to the river, Some industries treat their process water before returning and others do not.

In all cases the above effluents contaminate the natural river flow to some degree, depending upon the efficiency of their treatment.

The subject of pollution is an important one in the Credit Watershed and is dealt with more fully in the following chapter.

(e) Fire Protection

The chief requirement for this purpose is that an adequate supply is available at all times. In built-up areas it is common to have one water supply to serve all purposes but large industries often install their own fire system. In case of fires along the river, the river would supply the water to fight these fires at the present time and in the future also unless municipalities installed waterworks systems with Lake Ontario as the source of supply. Should there be a big fire during a dry season when the flows are extremely low, there might not be enough water to control and put out such a fire.

An illustration of this occurred recently on the Grand Watershed. The local fire-brigade had gained control of a farm fire when the water supply failed and all buildings were destroyed.

(f) Water Power

The physical features of the Credit River are such that water power cannot be developed economically. At one time there were numerous mills operating along the river and its tributaries but most of these have been abandoned over the years probably due to the lack of flow and the more economical use of outside hydro power.

In spite of the inherent disadvantages of this power source there are still many mills operating along the river with one at least developing hydro-electric power for peak demand periods.

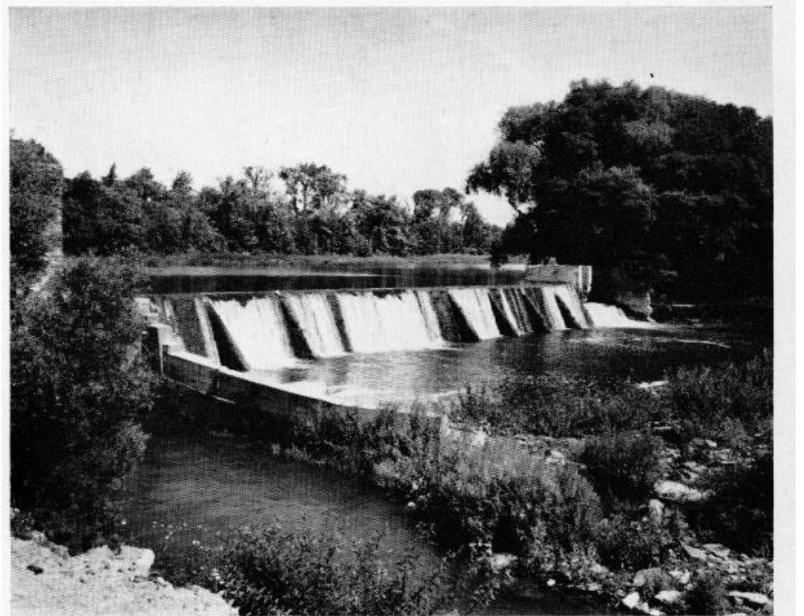
The larger mills operating in this area were those developing electric power of which the Cataract and Erindale were probably the best known.

The "Cataract Junction" plant which had the greatest installed horsepower was purchased by the Ontario Hydro-Electric Power Commission in 1944 from the Cataract Power Company and operated until January, 1947, when it was closed down as the plant had been poorly constructed and was uneconomical to operate. At high heads discharge from the dam was causing serious erosion to the nearby C.P.R. embankment which required a long expensive retaining wall estimated at the time to cost \$50,000.00 to protect it, and for these reasons the dam was destroyed about 1953. The Cataract Dam and Reservoir referred to later in this report is upstream from this site.

The Erindale plant was taken over by the Ontario Hydro in 1917. It was operated until 1922 and then abandoned as being uneconomical. The dam was later breached to avoid a possible failure in flood season. The town recently considered restoring the plant for operation during peak periods but decided that it was uneconomical. On the other hand Streetsville, in conjunction with hydro power, finds it worth while to operate their plant during peak hours.



Water power provided by means of a low dam is used in the operation of this mill near Streetsville.



Stream flow is converted into electrical power at the Streetsville Dam.



River water being used to irrigate pasture lands. Increased flow for the Credit will be required if this practice increases.

Table H-5 listing the water power sites on the Credit River was obtained from the book "List of Water Powers in the Province of Ontario" published by the Department of Lands and Forests in 1946.

(g) Recreation

Probably one of the most important uses of the Credit River is that for recreation purposes, The rugged forested beauty of its valleys and the clear cold spring waters of its upper reaches and their proximity to the Metropolitan area all enhance its importance in this respect,

Recreation is the subject of another phase of this Conservation Report and is dealt with fully in that section. However, it might be pointed out here that any proposed hydraulic measures for flood control and water conservation take full cognizance of the recreational aspects of the watershed and any proposed work would be designed to further that interest as far as possible. In many cases, hydraulic works, particularly reservoirs, may be integrated with recreational areas to provide added water facilities for the latter.

TABLE H-5

LIST OF WATER POWERS ON THE CREDIT RIVER AND TRIBUTARIES AS OF 1946

River and Power Sites	Site Numbers		Head in Feet	Drainage Area Sq.Miles	Est. Cap. in H.P. at 80% Eff.		Installed H.P.	Remarks
	Undev. Site No.	Power Dev. No.			At ordinary min. flow	At ordinary 6 mths. flow		
Alton	-	2HB ₁₉	23	55	25	42	190	
Alton	-	2HB ₃₃	--	-	-	-	40	
$\frac{1}{8}$ mile from Cataract Junction	-	2HB 8	10	85	16	28	65	
Cataract Junction	-	2HB 1	72	86	118	210	670	Formerly developed
Inglewood	-	2HB ₂₂	7	145	19	34	50	
Inglewood	2HB ₂	-	10	145	27	49	-	Formerly developed
$\frac{1}{2}$ mile from Cheltenham	2HB ₃	-	9	175	30	53	-	Formerly developed
Cheltenham	2HB ₄	-	9	175	30	53	-	Formerly developed
2 miles from Georgetown	-	2HB ₂₀	8.5	198	32	56	75	
$\frac{1}{2}$ mile above Georgetown	2HB ₅	-	12	203	47	82	-	Formerly developed
Georgetown	-	2HB ₂₇	10	205	39	69	80	
$\frac{1}{2}$ mile below Georgetown	2HB ₆	-	21	205	82	145	-	Formerly developed
Norval	2HB ₇	-	12	256	59	104	-	Formerly developed
Churchville	-	2HB ₃₀	8	271	41	73	50	
Meadowville	-	2HB ₁₂	10	283	54	95	108	
Streetsville	2HB ₈	-	11	306	64	113	-	Formerly developed
Streetsville	-	2HB ₁₇	12	306	70	123	276	
$\frac{1}{4}$ mile below Streetsville	-	2HB ₁₈	11	306	64	113	120	
1 mile below Streetsville	2HB ₉	-	19	318	116	204	-	
Erindale	2HB ₁₀	-	50	324	309	545	-	Formerly developed
West Branch (Trib. to Credit) -								
Hillsburg	-	2HB ₁₁	22	4	2	3	50	
$\frac{1}{2}$ mile below Hillsburg	-	2HB ₁₀	29	4	2	4	47	
Erin	-	2HB ₃₅	--	-	-	-	25	
Branch at Norval (Trib. to Credit) -								
Limehouse	-	2HB ₂₉	16	7	2	4	25	
1 mile from Stewarton	-	2HB ₂₅	16	26	8	14	60	
Stewarton	2HB ₁₁	-	8	27	4	7	-	Formerly developed

Table H-5

CHAPTER 6

POLLUTION

The Credit River system drains 331.5 square miles of agricultural land and also many built-up areas of which the following are the chief:

<u>Built-up Area</u>	<u>Population</u> (est. 1954)
Georgetown	4,100
Orangeville	3,564
Acton	2,900
Streetsville	1,822
Port Credit	(in part)

The river has, therefore, a wide variety of uses, all of which should be taken into account in any study of its sanitary aspects. The watercourses not only function as drainage channels for agricultural land, but also supply water for stock and, in a few places, for irrigation. The river is also required to supply drinking water and power for municipal use at Streetsville, and water for cooling and processing at various other points. It is expected to provide recreation facilities such as swimming and boating, a sustained annual yield of fish, and also cover and food for wildfowl. The valley provides attractive scenery for parks and playgrounds. At the present time the river also has to dilute and remove large amounts of industrial wastes, milk wastes, and both treated and untreated sewage. Lastly the river is used for removal of fine silts from gravel pits. The control of all these uses is therefore a very complex problem.

1. General Effects

Pollution effects are of two kinds: those affecting public health and those which are not a hazard to human health but which are offensive to people or harmful to stock or to fish and other aquatic organisms. The first type can usually be measured by the concentration of an indicator

organism (the bacillus E. coli). The second type is measured in terms of poisonous compounds which may be introduced into the river and in terms of oxygen depletion and the oxygen demand (B.O.D.)*. Silting has additional effects. Shifting sand bottoms are virtual aquatic deserts.† Colloidal clay prevents light penetration and retards the growth of aquatic organisms, making the water unsightly and undesirable for swimming. Silt from land of good fertility may occasionally fertilize the water, producing an unsightly growth of algae. More often silt covers the normal bottom fauna and destroys the stream for fish.

The commonest type of pollution is that caused by the discharge of wastes containing dissolved or suspended organic compounds. Domestic sewage and most industrial wastes are predominantly of this type. Certain bacteria and other organisms cause the decomposition of these organic compounds by consuming the organic solids and combining them with oxygen. The resulting shortage of oxygen in the water is one of the chief symptoms of a polluted stream.

Aerobic decomposition of organic compounds in water, (i.e. in the presence of ample dissolved oxygen) finally results in the formation of compounds such as carbon dioxide, water, nitrates and sulphates.** Being comparatively stable, they exert no further demand for oxygen, produce no

* The B.O.D., or Biochemical Oxygen Demand, is a measure of the oxygen that will be demanded by the material in the course of its complete oxidation biochemically. It is determined wholly by the availability of the material as a bacterial food and by the amount of oxygen utilized by the bacteria during its oxidation.

† Tarzwell, C.M. and Gaufin, A.R., "Some Important Biological Effects of Pollution Often Disregarded in Stream Surveys". Proceedings of the 8th Industrial Waste Conference, 1953, Purdue University, U.S.

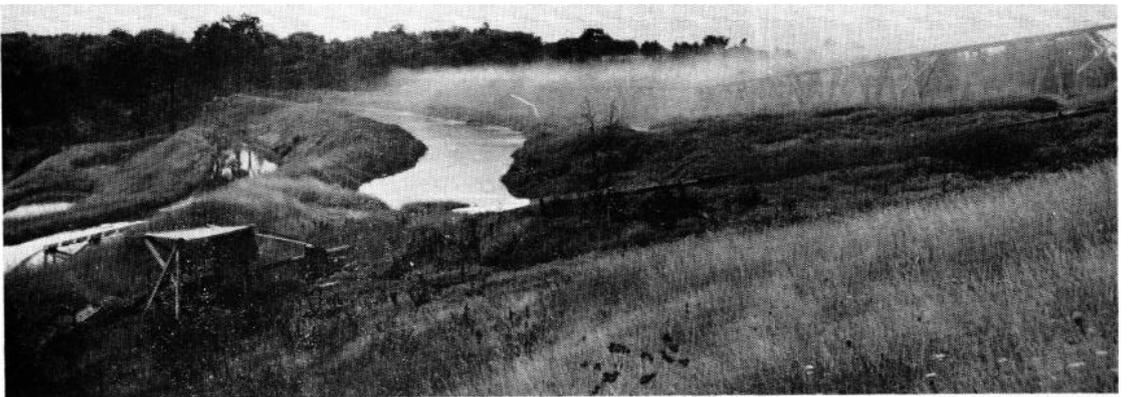
** Proper treatment of sewage wastes should include two phases primary treatment (mechanical removal of most solids) and secondary treatment (digestion of the remainder by aerobic decomposition, as here described).



Silt from gravel washing plants seriously affects the fish life and the appearance of the river.



Effluent from a sewage disposal plant entering Credit River, June, 1955.



Spray line and settling basins help to reduce the amount of tannery wastes reaching the main streams.

foul odours, and do not cause septic conditions in the water. They do, however, fertilize the water and stimulate the growth of plant and animal life in the stream. Dense growths of green algae are normally a sign that the stream is recovering from organic pollution.

In the absence of dissolved oxygen in the water "anaerobic decomposition of organic wastes takes place. Oxygen is then consumed from the organic materials and compounds remain such as methane gas, hydrogen sulphide gas, ammonia and others having little or no oxygen. Many of those products have highly disagreeable odours typical of polluted waters. Sometimes the decomposition products are lethal to fish and other aquatic organisms, but more often these die from lack of oxygen.

Since the amount of oxygen water can dissolve is so small*, sewage treatment facilities should be designed to turn out an effluent that is already decomposed biologically, so that the stream's oxygen reserves will not be called upon to an appreciable degree for this purpose.

The types and abundance of both plant and animal species in a stream provide an excellent measure of the condition of the water. At the one extreme severely polluted waters may contain extensive growths of gray-brown fungi, vast numbers of scavenger types of bottom-feeding organisms, a great bacterial population (or a sterile condition), and little or no dissolved oxygen. At the other end of the scale clean waters will support green algae, insect larvae, snails, clams, game fish and other organisms requiring abundant oxygen.

The time and distance required for recovery of a polluted stream depend on many factors, such as the

* Less than 20 parts of oxygen per million parts of water by weight,

temperature and volume of flow of the water, the type of pollutant at the polluting effluent, the type of stream bed and types of obstructions such as dams.

A full report on pollution on the Credit would require that the following work be carried out:

- (a) Bacterial plate counts at all points suspected of bacterial pollution, and at regular space intervals in the river's course elsewhere.
- (b) Measurement of the oxygen content in bacterially polluted sections and where industrial wastes enter the river, with additional measurements of the Biochemical Oxygen Demand below sources of industrial and bacterial pollution in order to estimate the rate of recovery of the river.
- (c) Measurement of the amount of silting and turbidity and their effects on the life of the stream.
- (d) Assessment of pollution sources.

2. Conditions on the River

A reconnaissance survey was made in 1954. Three methods were used:

(a) Water samples at 28 stations tested on one run by the Ontario Department of Health, with special reference to the coli. count and the B.O.D.

(b) A general survey of the biological aspects of every stream course with respect to:

- a Fish habitat.
- b The appearance and general condition of the stream, with particular reference to recreation purposes including swimming.
- c A detailed survey of obviously polluted areas to note the sources of pollution.

(c) A detailed examination of the effect on the bottom fauna of the river of silting from gravel washing operations.

The effect of pollution of the river on the fish life is described in the Wildlife Section of the report.

Some of the more significant data obtained from the samples taken by the Ontario Department of Health are shown

on the accompanying map. The Streetsville area was not sampled at that time. The chief pollution at Streetsville probably occurs in winter.

Deductions that may be drawn from the coli. counts made in 1954 must be considered in relation to the fact that the dilution of wastes in the lower part of the river in 1954 was much greater than would occur in a dry summer; e.g., the minimum daily flow at Erindale was 3 c.f.s. in 1946, but the minimum daily flow in 1954 at the same point was 60 c.f.s.*

The following summarizes the general conditions of the river at various points.

(a) Orangeville

There are several sources of industrial pollution in Orangeville, including two dairies and a woollen mill, and the wastes from various residences enter the stream, but these cannot be compared with the effect of the sewage treatment plant. Following heavy rains the treatment plant is overloaded and apparently raw sewage enters the stream, Even with considerable dilution from an unpolluted tributary having a minimum flow of 2 c.f.s. the Credit at No. 10 Highway showed a coli. count of 240,000 M.P.N. † per 100 ml.** This is a very remarkable pollution of one of the chief headwaters of a famous trout stream. At present the sediments from the treatment plant are pumped to drying beds in the summer and in winter an old digester is used for storage of sludge until spring. There appeared to be a shortage of sludge drying beds.

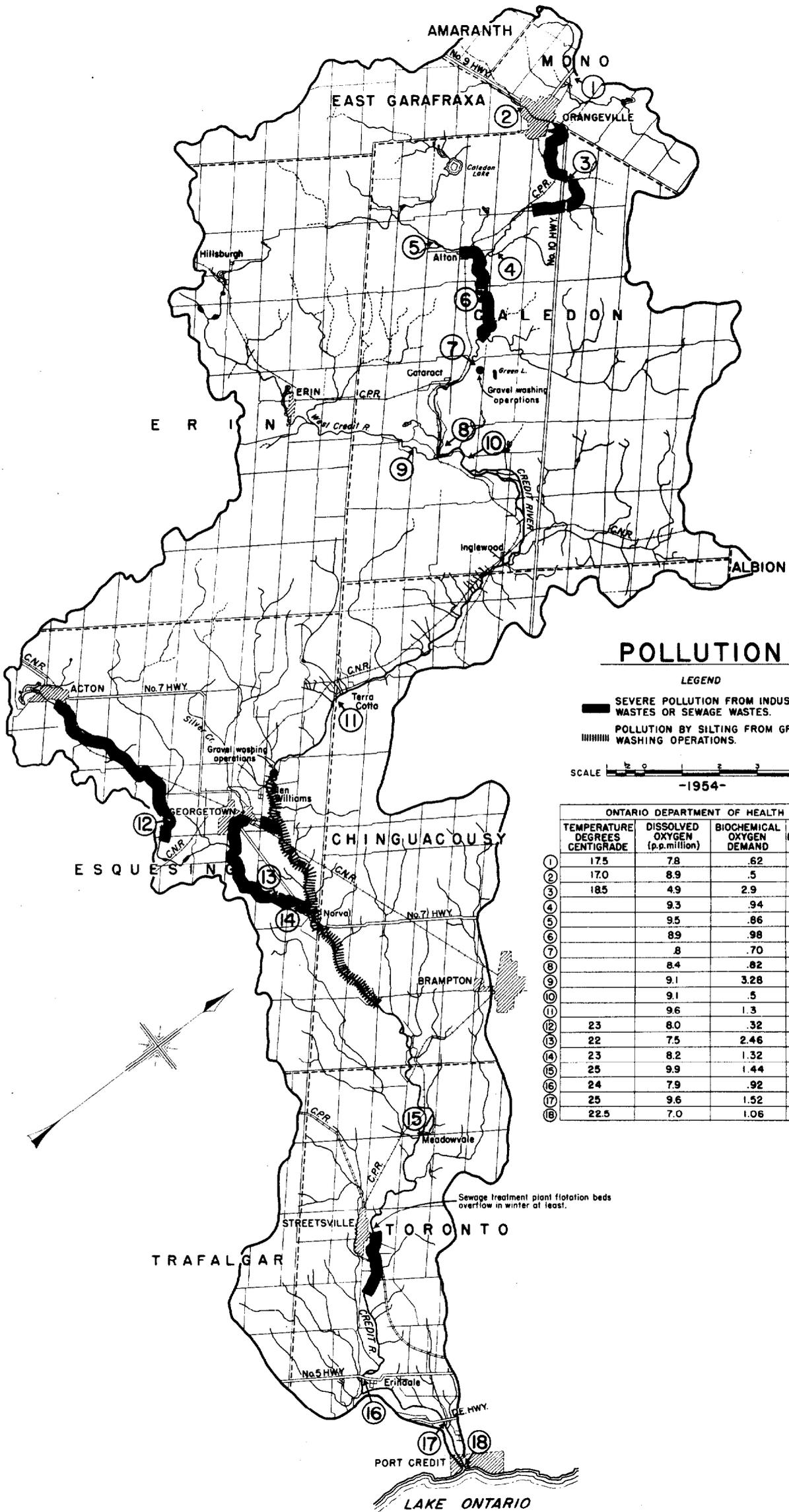
(b) Alton

Alton is a village which has no treatment plant, and this condition is to be expected for a village of this size.

* Data from the Water Resources Division, Department of Northern Affairs and National Resources, Ottawa,

† M.P.N. = Most probable number.

** ml. = Millilitre.



POLLUTION

LEGEND

- SEVERE POLLUTION FROM INDUSTRIAL WASTES OR SEWAGE WASTES.
- POLLUTION BY SILTING FROM GRAVEL WASHING OPERATIONS.

SCALE MILES

-1954-

ONTARIO DEPARTMENT OF HEALTH DATA

	TEMPERATURE DEGREES CENTIGRADE	DISSOLVED OXYGEN (p.p.million)	BIOCHEMICAL OXYGEN DEMAND	COLI COUNT M.P.N. per 100ml.
①	17.5	7.8	.62	170
②	17.0	8.9	.5	350
③	18.5	4.9	2.9	240,000 +
④		9.3	.94	220
⑤		9.5	.86	70
⑥		8.9	.98	2,400
⑦		.8	.70	1,600
⑧		8.4	.62	64
⑨		9.1	3.28	350
⑩		9.1	.5	130
⑪		9.6	1.3	1,600
⑫	23	8.0	.32	2,400 +
⑬	22	7.5	2.46	2,400 +
⑭	23	8.2	1.32	2,400 +
⑮	25	9.9	1.44	280
⑯	24	7.9	.92	39
⑰	25	9.6	1.52	220
⑱	22.5	7.0	1.06	1,600

Sewage treatment plant flotation beds overflow in winter at least.

LAKE ONTARIO

However, there is gross pollution of the tributary passing through the village from several factories and many houses along the edge of the stream.

The position may be summarized as follows -
The river receives:

- Raw sewage and garbage - From 3 residences
- Raw sewage - From 1 factory employing more than 50 persons
- Drains from septic tanks (or raw sewage) - From 3 residences and 2 mills
- Garbage only - From 2 residences

This tributary joins with the main branch descending from Orangeville, and the pollution from Alton affects the river for at least a mile below the junction. It also completely spoils what should be a most attractive large pond.

(c) Acton

Acton has a disposal plant using the activated sludge system and handling a maximum of about 250,000 gallons a day. The plant is considered by the Ontario Department of Health's Sanitary Engineering Division to be efficiently run. Dried sludge was being stockpiled in August 1954 because very few farmers are prepared to make use of it.

There is no doubt that the chief pollution in this tributary comes from tannery wastes. There have been many complaints concerning these. It should, however, be remembered that most other tanneries in Ontario have either a convenient sewer or a large lake into which to pass their effluents with little or no treatment. This plant, which employs more than 400 people, has made a considerable effort to reduce the effect of the various effluents which amount to about 750,000 gallons per day. The plant uses both chrome and vegetable tanning methods.

The effluent from the tannery is collected in a large concrete sump, holding approximately 80,000 gallons, and pumped away for sedimentation. After removal of the settleable

solids, the liquid is pumped to storage ponds, awaiting disposal by evaporation and seepage.

The system of ponds is extensive. There are two large sedimentation ponds, a number of small storage basins, and twenty larger ponds for storage and evaporation. The largest storage pond has a capacity of 25,000,000 gallons.

Effluent is stored in the large ponds during the winter and the impounded wastes, together with those currently produced, are disposed of during the late spring, summer and fall.

The seepage area covers over 35 acres and this area is ploughed and channelled several times during the operating season. Effluent is supplied to all elevated sections of the area through a system of pipe-lines, launders and open ditches and an elevated spray line with 300 nozzles assists in the evaporation operation.

The settled solids are removed from the sedimentation ponds by drag-line equipment and are deposited in an area reserved for this purpose.

Part of the water is used for cooling purposes and this water is returned to the creek.

This somewhat extended operation requires eleven large pumps of which the value is approximately \$20,000. Additional expenditures for pipe, ground cultivation equipment, pump-houses, earthworks and miscellaneous items would total more than \$150,000.

There is an operating staff on waste disposal of 4 to 6 men steadily employed from April to November. Experimental work on new or improved methods of tannery waste disposal is reported to be in progress during part of each operating season, with the hope of decreasing costs and increasing the rate of disposal. Possible uses for by-products have been investigated but without success.

The problem of disposal is complicated to some extent by the fact that this tannery also treats the effluent from a wool-souring plant whose factory is adjacent to the tannery.

In spite of these extensive operations there is inevitably an effluent with a high oxygen demand.

Samples collected on September 3, 1954, showed the following condition of the effluent tested by the Department of Health's Sanitary Engineering Division:

5 Day B.O.D.	Solids		pH at Lab.
	Total	Susp. Diss.	
294	2104	84 2020	7.0

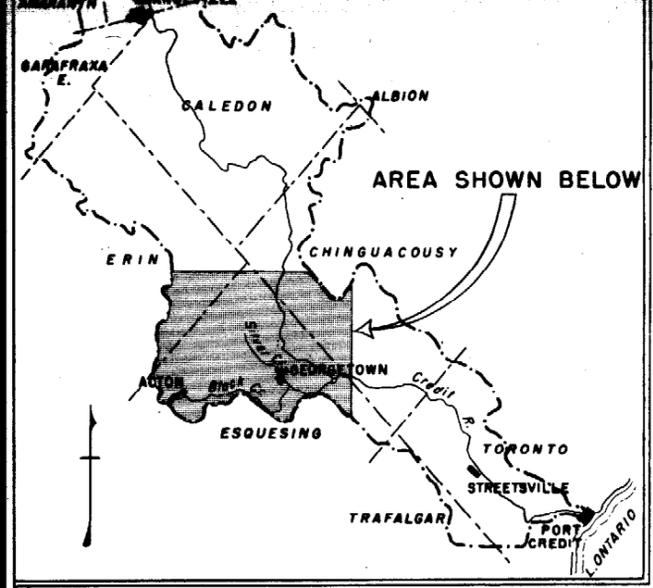
While the B.O.D. mentioned above of 294 is high, it is lower than that of many tanneries, and indicates the extensive treatment. An accompanying map shows the septic condition of the stream below the tannery and its gradual recovery.

While the sewage treatment plant inevitably contributes to the B.O.D. load of the stream, it appears that most of the primary septic zone is above the effluent of the sewage disposal plant. It is probable that the most critical effects of the tannery wastes occur when occasional toxic slugs are released rather than from the daily pollution load. It is recommended that an attempt be made to keep the 5-day B.O.D. of the tannery effluent down permanently below 200.

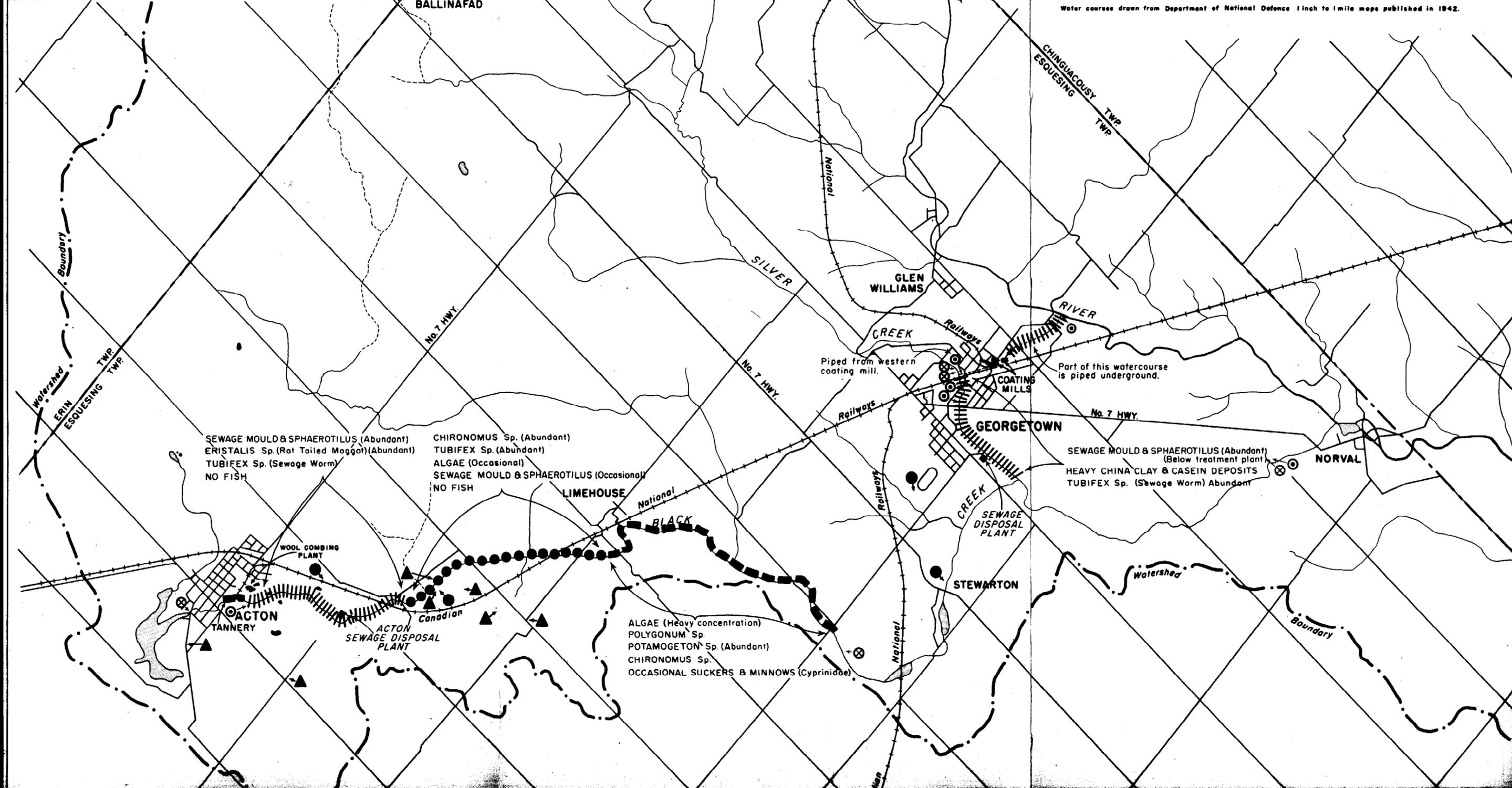
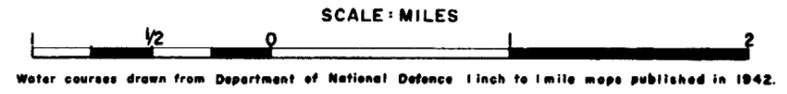
Possible improvements to the pollution problem from these tannery wastes were discussed, after the survey, with the Department of Health's Sanitary Division. Two recommendations are made. The first is that the final basin above the dam where the effluent enters the Acton Creek should be divided into six quite separate divisions, walled off from each other, The bed of these divisions would consist of fine sand varying from .5 to .75 mm.* maximum diameter. The effluent, after

* mm = Millimetre.

POLLUTION OF BLACK CREEK AND SILVER CREEK (CREDIT RIVER WATERSHED)



- LEGEND**
- RELATIVELY CLEAN WATER
 - SEPTIC ZONE
 - RECOVERY ZONE A
 - RECOVERY ZONE B
 - GRAVEL PIT
 - GARBAGE DUMP
 - INTAKE PIPE
 - OUTLET PIPE



treatment, would pass on a Monday into one of these basins and on the next day into the second basin and so on. During the summer at least, the remaining debris after percolation would dry and curl up and be raked off before the effluent of the succeeding Monday or Tuesday is passed into the basin.

The second recommendation has reference to the stability of the dam holding back the final effluent from the river. This dam has already given way once.

The dam was examined by an engineer of the Hydraulic Section, and it was found that it had poor lines and was founded on very poor material. According to information obtained, borings taken some years ago have shown very plastic clay up to 50 feet deep in the majority of holes, and one hole showed "very fluid lean clay plus a small amount of organic silt". At one time the lower part of the dam was shoved out under the weight of the top fill and settled down, and the deficiency was made up by more top fill.

The dam was not designed to be water-tight but was intended to function as a filter for the effluent from the tannery, and all liquids seep through under the dam and escape. There is no visible outlet from the pond. A siphon is used only if the water level is too high.

The dam might function as a filter for years or until it became saturated, provided that the depth of water did not exceed 15 feet.* At greater depths trouble can be expected. It has stood for 9 years and at times has contained a 25-foot depth of water. It is believed that the structure has always been a source of concern.

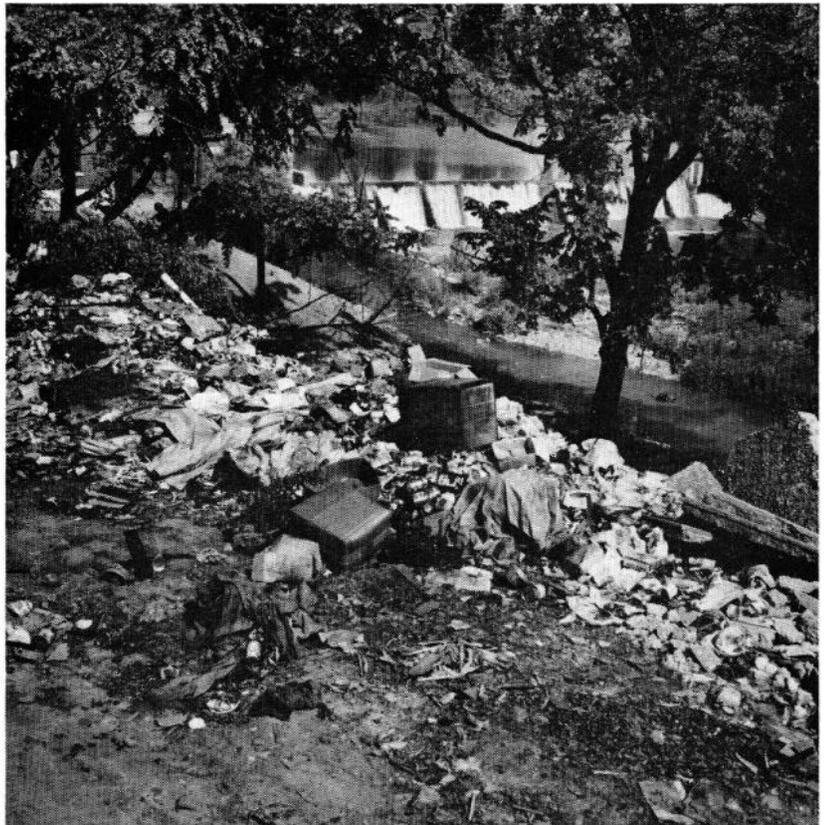
The town of Acton has a refuse dump extending along a slope of 300 feet by 25 feet deep. There appeared to be no orderly method of covering the rubbish. This dump probably contributes to pollution of Black Creek during heavy rains and in spring.

* When inspected, there was 15 feet of water and leaks were in evidence.



Silver Creek in Con. IX of Esquesing Twp. showing the white appearance of the stream, chiefly from the china clay effluent from paper mills.

The dumping of refuse along the edge of streams is one form of pollution. This particular case is near one of the villages on the Credit.



(d) Georgetown

Pollution at Georgetown is caused by the combined effects of a disposal plant and two paper coating plants, along with various lesser industries.

The disposal plant, which is of the trickling filter type, operates near peak capacity. Attempts to treat industrial sewage at this plant have not been successful. The sludge is reported high in nitrogen, low in phosphates and potassium, and therefore somewhat incomplete as an agricultural fertilizer.

The chief effects from the coating plants come from the disposal of casein, which has a high oxygen demand in water, and from starch and very extensive deposits of china-clay. The effluents of one coating plant and the disposal plant pollute Silver Creek down to the point where it enters Black Creek, (Acton Creek). Turbidity in Silver Creek is so great that, at a point half a mile downstream from the effluent pipe of the coating plant, the Secchi disc reading was less than one inch on most days in midsummer, Dilution from Acton Creek is great enough to reduce the effect of the Georgetown pollution to a relatively negligible amount apart from possible bacterial effects, but much china-clay goes down Acton Creek in flood times. This coating plant is reported to have plans in an advanced stage for installation of equipment to coagulate and precipitate almost all of the solids in its wastes by a modern process. Pollution from the second coating plant passes through several settling beds and receives some treatment before it enters the main Credit River-directly.

There was no evidence that the Georgetown refuse dump, which lies alongside the fairgrounds, is affecting the stream-courses. Some industrial wastes and refuse are, however, dumped. down the bank of the main river below the old factory near the dam, so that they pollute the river in flood time. These had an offensive odour when examined on August 14, 1954.

(e) Streetsville

Streetsville makes use of the river as a source of drinking water after treatment. The present sewage treatment plant is much overloaded, particularly in winter when the top of the flotation bed freezes. At times sludge and probably raw sewage enter the river in winter at least. The present plant is intended to serve about 250 houses; Streetsville now has about 1,000 houses and is still growing. The present plans include the immediate construction of a new and large sludge bed, and the construction of another complete activated sludge treatment plant to take care of the growing population. These are very urgently needed. The Credit below Streetsville is extensively used for recreation. There are numerous public picnic sites. An accompanying photograph shows swimming and picnicking activities at points below the present treatment plant, in an area subject to occasional pollution.

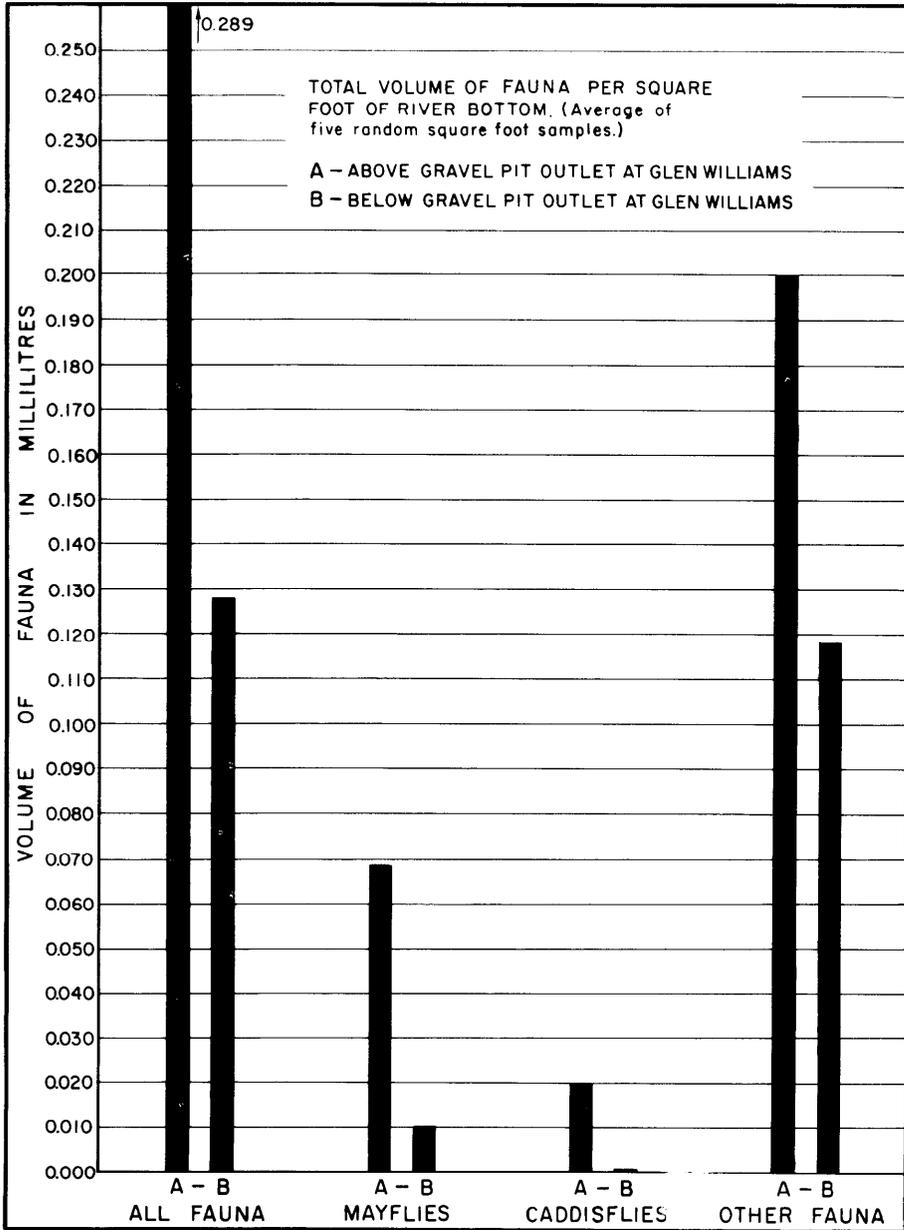
(f) Sand and Gravel Pits

There are two gravel pits which are radically affecting the condition of the river. From one of these at Glen Williams the washing water was passing a large amount of silt and colloidal material into the Credit River in June 1954. A dam, making a new settling bed, was constructed during the summer and the pollution was considerably reduced. However, there was great difference between the productivity of the river in bottom fauna between the Credit above the effluent and the Credit below it. The differences in volume and numbers of bottom fauna in the two areas are shown on the accompanying graphs.

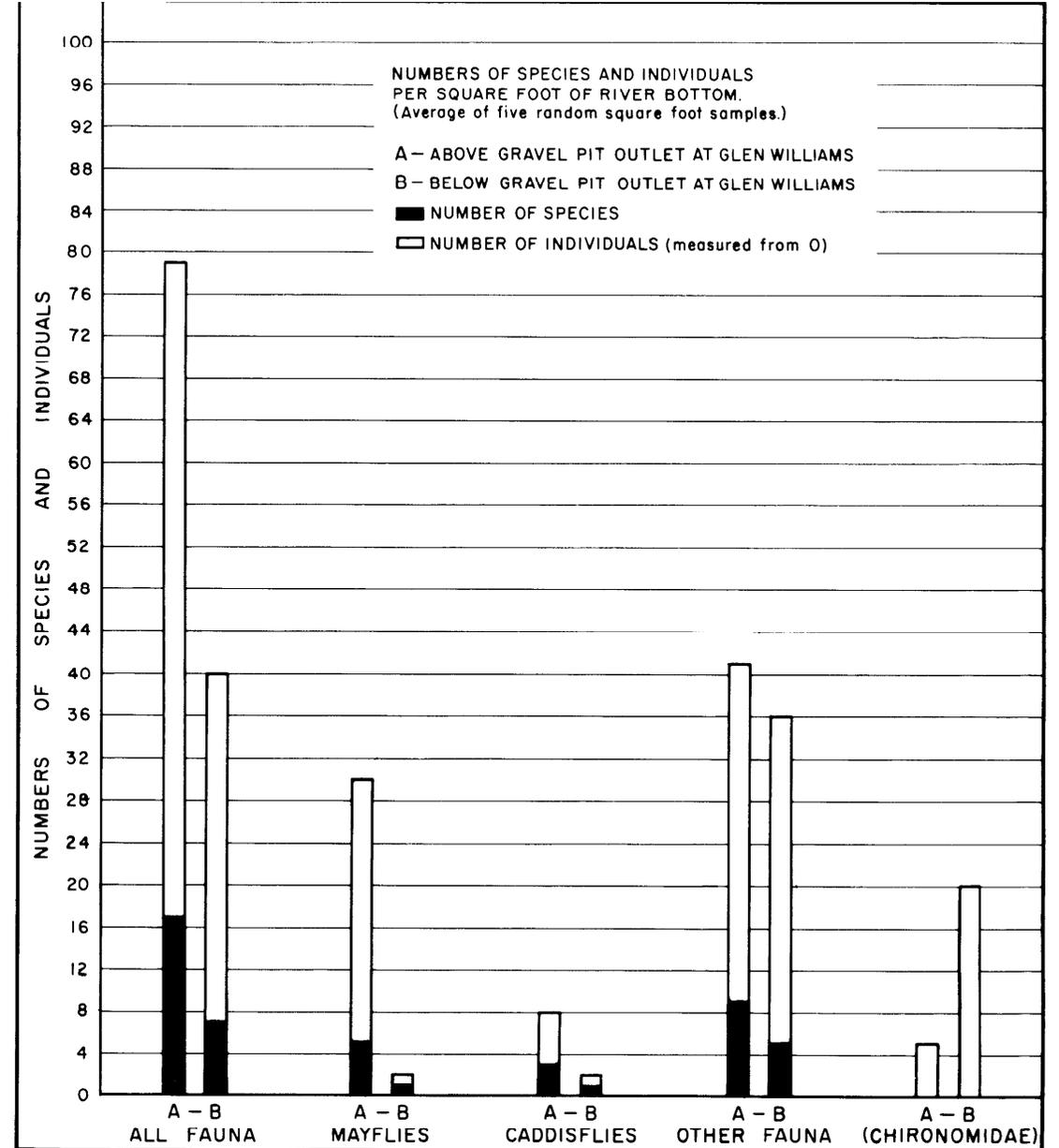
There were numerous complaints concerning renewed heavy silting of the river from this operation, in April 1955. The visible evidence of silting was apparent both in 1954 and 1955 down as far as the Huttonsville dam and pond but not below these .

EFFECT OF SILTING ON BOTTOM FAUNA

MAIN CREDIT RIVER ABOVE GEORGETOWN



(All fauna referred to are visible to the naked eye.)



The second gravel washing operation affecting the river was found above Cataract on the east side of the Credit, just south of No. 51 Highway. At the time of inspection there was very little silt reaching the river, but it was evident that the settling pond would soon be filled with silt and that immediate action was needed to prevent the spoiling of the trout spawning beds below in that part of the river.

The silting at Glen Williams had the additional effect of spoiling the appearance of the river and its interest for swimming.

There can be no doubt that the addition of silt and colloidal material in large quantities to a body of clean water, affecting both its production of game fish and its appearance and use for recreation, constitutes pollution, and that steps should be taken to prevent this pollution. It is also apparent that the cost of removal of silt and colloidal material from the effluent of a gravel washing operation should be a normal part of the operating cost of any gravel pit whose effluent reaches the river. The provision of ample settling beds and possibly the addition of coagulants should, therefore, be insisted upon by the Conservation Authority.



The area around the dam at Streetsville is attractive to swimmers but this lies a short distance below the outlet of the sewage treatment plant. The river's flow was much above the average summer flow when this photograph was taken.

Credit Valley Park, one mile south of Streetsville. It is of the greatest importance that such attractive parksites should have clean, unpolluted water available for swimming.



CHAPTER 7

REMEDIAL MEASURES FOR LOW FLOW AND POLLUTION

1. General

The uses of the river water and extent of pollution have been outlined and from an examination of the flow records it will be realized that the natural flow is too low and unreliable during some periods to meet the present requirements or help alleviate the pollution.

As mentioned previously, when practical, reservoirs provide the best means for flood control and for the low flow phase of the hydraulic problem, they provide the only practical solution. By storing water during periods of high run-off reservoirs serve the dual purpose of flood control and conserving water for use during periods of drought. Thus dams and reservoirs are to be recommended for this phase of the problem.

2. Types of Dams and Reservoirs

(a) Dams

Reservoirs are created by dams constructed across the river valleys at strategic points. There are many types of dams in use and the selection of any one type is usually governed by the physical characteristics of the site and economic and practical considerations. The type most suitable and the one generally used in Southern Ontario in recent years is the earth-filled gravity type structure with a central concrete section. The Fanshawe Dam on the Thames River above London and the Shand Dam on the Grand River near Fergus are of this type. They consist essentially of a concrete spillway section fitted with gates and valves to give the necessary discharge control flanked with earth embankments. The embankments have an impervious clay core to make them water-tight and are faced with heavy rip-rap to prevent erosion from wave action and local drainage down the slopes.

(b) Reservoirs

Dams create artificial lakes of different types according to the purpose for which they are used; whether for recreation only, a combination of flood control and recreation or those which are used for the dual purpose of flood control and increasing subsequent low flows.

(1) Flood control and recreation reservoirs combine flood control with recreation. These reservoirs would impound water during the spring run-off, and thereafter be emptied as soon as possible down to a determined lake level in order that vegetation would not be killed. They would remain approximately at that level until late fall, or throughout the winter, and then lowered to the dead storage level before the spring break-up. With this type the full capacity of the reservoir is available for flood control but the impounded water is wasted, none being used for increasing low flows. The water level of the lake would be fairly constant throughout the summer months. Cottages and other permanent buildings would have to be kept above the maximum possible water level and any boathouses or wharfs would have to be either floating or portable.

The Fanshawe Reservoir on the North Branch of the Thames near London is an example of this type.

(2) Flood control and summer flow reservoirs serve the double purpose of flood control by impounding the flood waters during periods of high run-off for subsequent release to augment the flows during periods of low run-off throughout the summer, fall and winter months. The ever-changing water level kills vegetation within the reservoir and, as it is lowered, leaves trash and a poor beach. Owing to these conditions their recreational value is greatly impaired. However, there are recreational possibilities even with this type of reservoir, as may be seen at Lake Belwood behind the Shand Dam on the Grand River. There are many boats in this lake and the

Grand River Conservation Commission have leased lots and many cottages have been built along the shores. Various service clubs have established campsites and the Commission have prepared picnic areas for the use of visitors. The Luther Marsh Reservoir on the Upper Grand and the Conestogo Reservoir presently under construction are also of this type.

(3) Summer flow and flood control reservoirs The chief function of this type is to provide storage for augmenting the natural stream flow throughout the summer, fall and winter months. They are operated in the same manner as the Flood Control and Summer Flow Reservoirs but the primary concern at periods of high flow is to fill the reservoir rather than trying to time the filling to provide the most effective flood control. However, with experience and a knowledge of the potential run-off from above the reservoir, substantial flood control benefits may be achieved also by timely regulation of the dam.

Since the reservoir level would be progressively lowered throughout the summer the recreational value of the reservoir area would be limited, but this feature of the river throughout its length below the reservoir would be greatly enhanced by the sustained increased flow provided by the reservoir.

The reservoirs recommended for the Credit Watershed would be of this type.

3. Possible Reservoir Sites

A preliminary investigation of the possible reservoir sites was made from the topographical sheets covering the watershed area and twelve sites were selected for further field investigations. Of these, ten appeared to be feasible and the areas were surveyed and contour plans prepared. Subsequently four of those surveyed were also eliminated for various reasons, A brief description of all those investigated follows:

(a) Recommended Sites

(1) Orangeville reservoir site (Figure H-8)

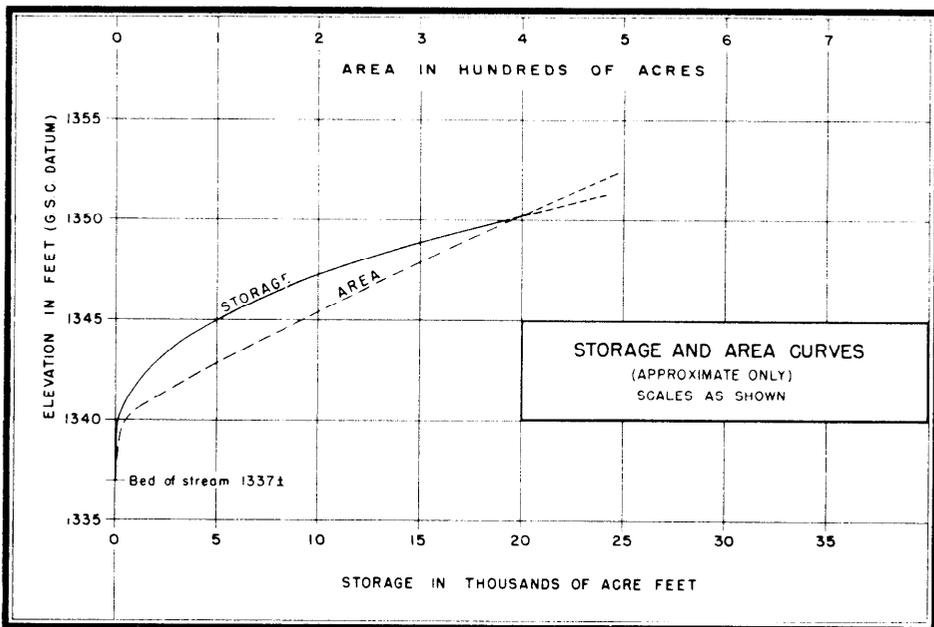
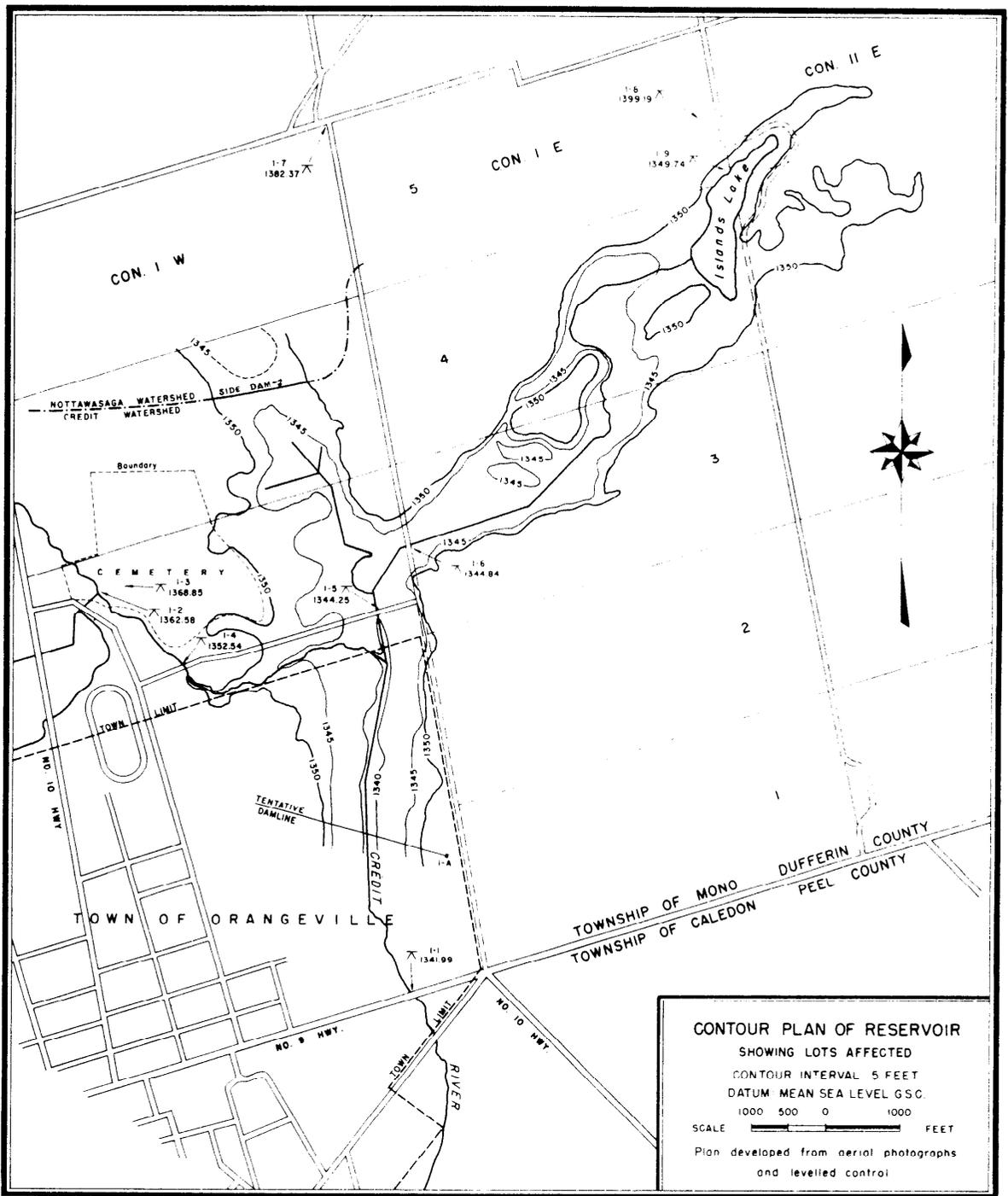
This reservoir would occupy an area of 391 acres which at present is a swamp covered with low-grade scrub growth, mostly willow. The damsite lies about one-quarter of a mile east of Orangeville, and the flooded area extends north and east from that point.

The main dam would be about 1,550 feet long and 18 feet high, with a maximum water depth of 13 feet at the dam and it would control the run-off from a drainage area of 10.92 square miles. A side dam would be necessary at a saddle on the divide to the Nottawasaga River, but need only consist of a simple earth dike with a maximum height of ten feet, and total length of 1,250 feet.

The reservoir would have a maximum storage of 1,934 acre feet. Strategically located, this reservoir would prevent the flooding of No. 9 Highway east of Orangeville and its controlled discharge throughout the summer would improve flow conditions and help alleviate the pollution condition existing below the Town of Orangeville.

The land to be flooded is of low value, and no buildings lie below the high-water line. A side road from Orangeville would be covered for a length of 2,080 feet to a maximum depth of 8 feet, and Hurontario Street for a length of 960 feet. Since these roads provide the only access to a farm located in Lot 3, Concession 1E, Mono Township, it would be necessary to fill a causeway to the farm along Hurontario Street. This would involve a fill with an average depth of 4 feet over a length of 800 feet, or about 3,360 cubic yards, at a cost of approximately \$1,680 for a 12-foot roadway.

This site is one of the most strategically located in the watershed for providing summer flow, and both construction and land acquisition costs should be low and comparable to the Luther Marsh Dam and Reservoir project on the Upper Grand River. The estimated cost of the Orangeville Dam and Reservoir is \$410,000.



CREDIT WATERSHED
No. 1 - ORANGEVILLE RESERVOIR
 TOWNSHIP OF MONO
 COUNTY OF DUFFERIN
 ONTARIO DEPT. OF PLANNING AND DEVELOPMENT
 CONSERVATION BRANCH
 HON W M NICKLE, MINISTER

FIG. H-8

(2) Cataract reservoir site (Figure H-9)

The Cataract reservoir appears to have the best possibilities of those studied. The wide, flat valley is not developed, except for a small group of three cheaply constructed cottages at the damsite, and land costs should be comparatively low. Some timber of merchantable size is in the second-growth swamp forest that occupies the valley floor.

A dam at the line of the road allowance between Lots 15 and 16, Caledon Township in Concession III, would have a crest length of about 850 feet, with total height of 38 feet above the stream bed and maximum water depth of 33 feet. This height will give the C.P.R. tracks along the reservoir a free-board of 5 feet above maximum water level at the dam. The drainage area above the dam is 80.52 square miles.

The storage capacity would be about 2,573 acre-feet and would be in a good position to supply summer flow over the maximum length of river through the droughty clay plains.

Reservoir length at maximum water level would be about 2.5 miles and it would cover the road between Lots 20 and 21 to a depth of 4 feet. The estimated cost of this project is \$1,180,000.

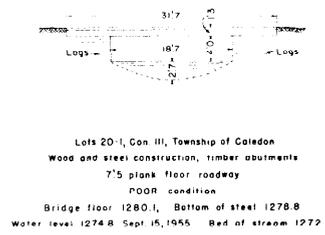
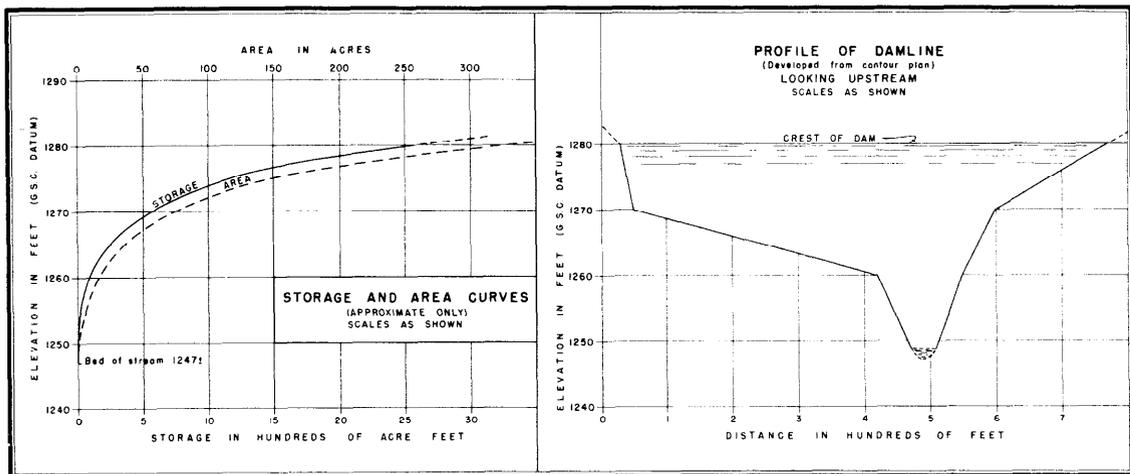
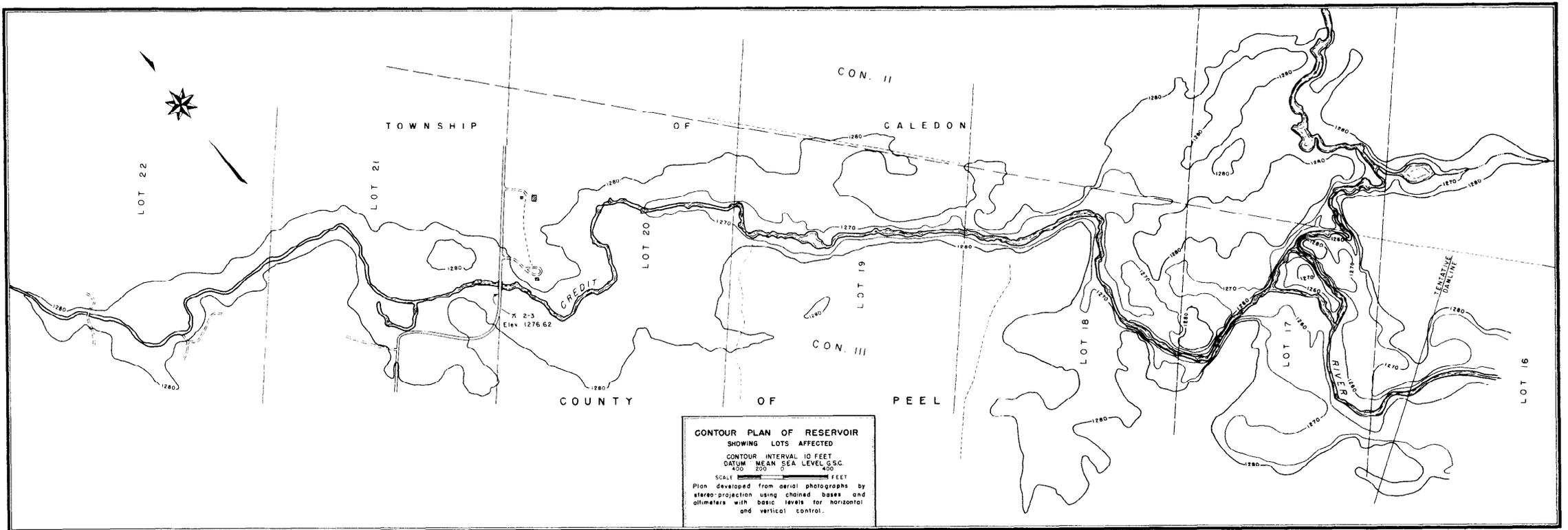
(b) Sites for Future Consideration

(1) Belfountain reservoir site

The damsite for this reservoir would be located along the road between Concessions V and VI W.H.S.*in Lot 10, Township of Caledon. The dam would have a crest length of 1,060 feet, a total height of 54 feet, a water depth of approximately 49 feet at the dam and a drainage area of 36.96 square miles.

When full, the reservoir would have a length of 2.2 miles, an average width of about 800 feet, a surface area of 280 acres and storage of 3,936 acre-feet. The land is covered with a good growth of timber, but little agricultural

* W. H. S. - West of Hurontario Street.



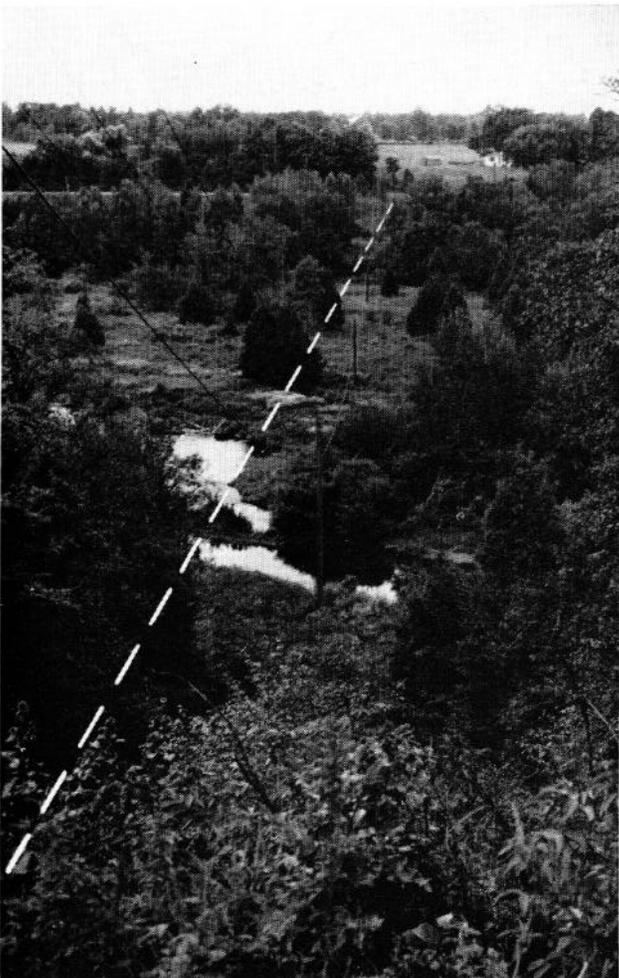
CREDIT WATERSHED
No. 2 - CATARACT RESERVOIR
TOWNSHIP OF CALEDON
COUNTY OF PEEL
ONTARIO DEPT. OF PLANNING AND DEVELOPMENT
CONSERVATION BRANCH
ON W. M. NICKLE, MINISTER

FIG. H-9

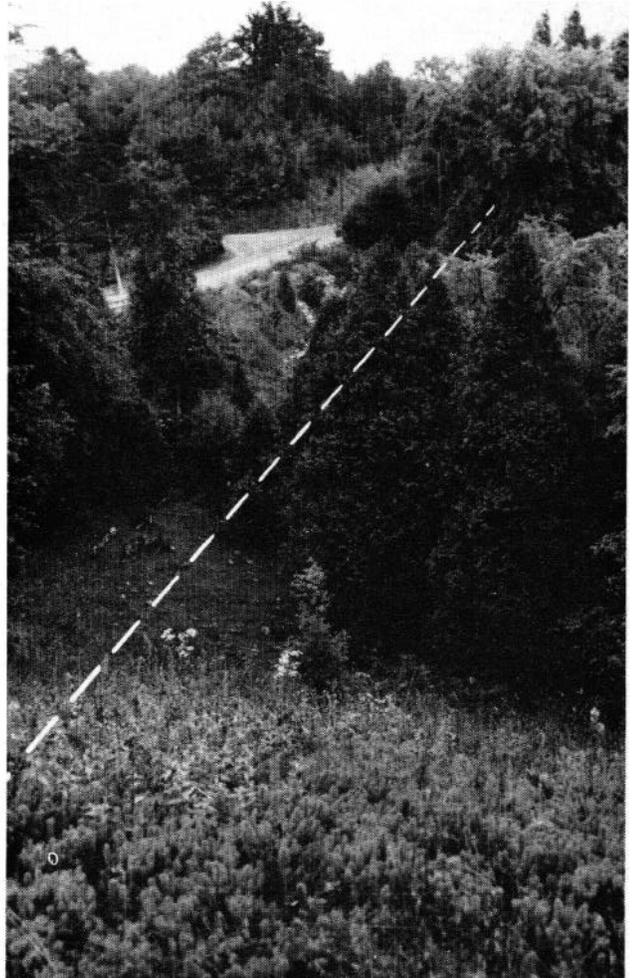


Orangeville Damsite looking west across the valley, Lot 1, Con. IW, Mono Township. Broken line in this and following damsite pictures indicate approximate crest of the dams.

Cataract Damsite-looking east across the valley. Lot 16, Con. IIIW, Caledon Twp.



Belfountain Damsite - looking south along damsite line. Lot 2, Con. VI, Caledon Twp.



land is affected. Three cottages, of estimated value \$3,500 each, lie below the flood line.

Although the stream has a well maintained summer flow here, the location is good to provide increases in the river through the scenic Forks and throughout the lower river.

(2) Silver Creek reservoir site

This reservoir site lies on a small branch of the lowest major tributary, known locally as the West Credit, three miles above Georgetown. This tributary is heavily polluted from Acton and Georgetown, and the reservoir site is well located to provide summer flow to help alleviate this condition. Although this is one of the best natural reservoir sites in the watershed, it is doubtful that it can be used to its full capability because of the small drainage area. A 68-foot dam is possible and storage at that height would be 6,517 acre-feet; however, the average freshet run-off of March and April from the drainage area of 13 square miles is approximately 3,000 acre-feet, so that the reservoir formed by a dam 48 feet high could only be used to its full capacity half of the time but the storage from high run-off years could be carried over and used in the lean years.

This reservoir area is undeveloped, except for some rough pasture at the lower end, and there are no structures. At the maximum dam height, the reservoir would have a length from 2.2 miles, a width at the broad lower section of 1,500 feet and a water surface area of 200 acres. The crest length of a 68-foot dam would be 1,180 feet.

(3) Glen Williams reservoir site

This reservoir site, situated on the main river 1.5 miles above Glen Williams, provides a well located storage, but costs would probably be high.

The valley development at the originally proposed damsite made it advisable to locate the damline along the road between Concessions X and XI, Township of Esquesing,

where the dam would have a crest length of 2,300 feet and total height above the present stream bed of 41 feet. The drainage area above this site is 185.8 square miles.

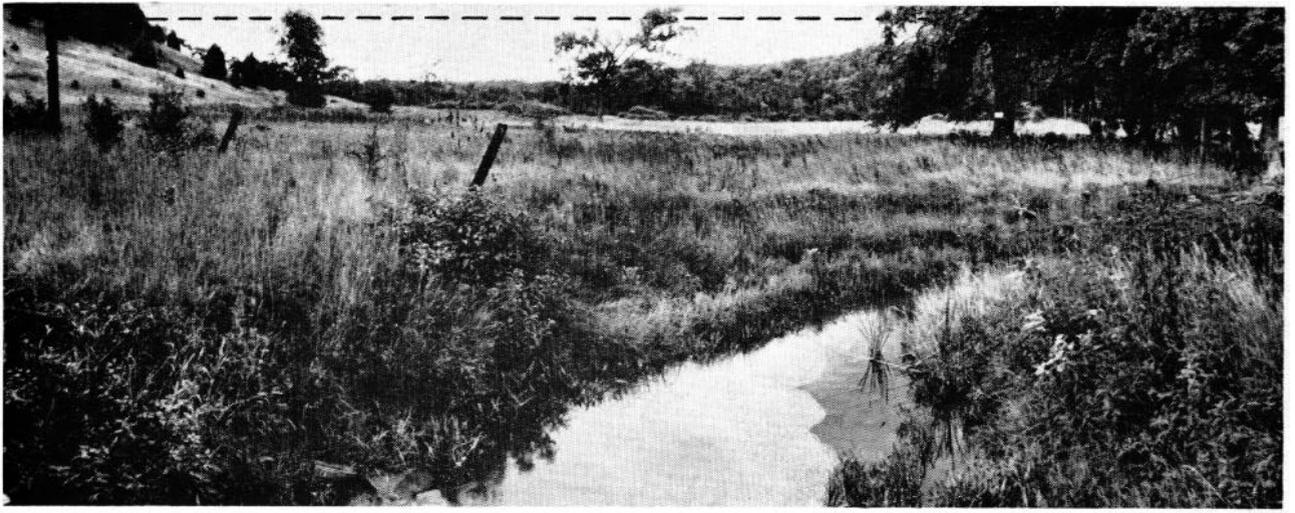
Reservoir area would be 180 acres at full capacity, with a length of 1.2 miles to the Townline road. The land is not in intensive use, some fifty acres being in hay, while the balance is pasture or low-grade woodlots. Storage capacity would be 2,303 acre-feet.

(4) Georgetown reservoir site

This reservoir site is located on the West Credit about 1.5 miles below Georgetown. It is well located to provide additional flow to a heavily polluted branch, and unlike the Silver Creek Reservoir on the same stream, could be developed to its fullest capability. On the other hand, it would not alleviate the polluted condition of the stream through Georgetown.

The dam would lie along the road between Concessions IX and X, Esquesing, and would have a crest length of 1,350 feet and height of 54 feet above the present river bed. This height would bring the maximum water level to the elevation of the Georgetown sewage plant outfall.

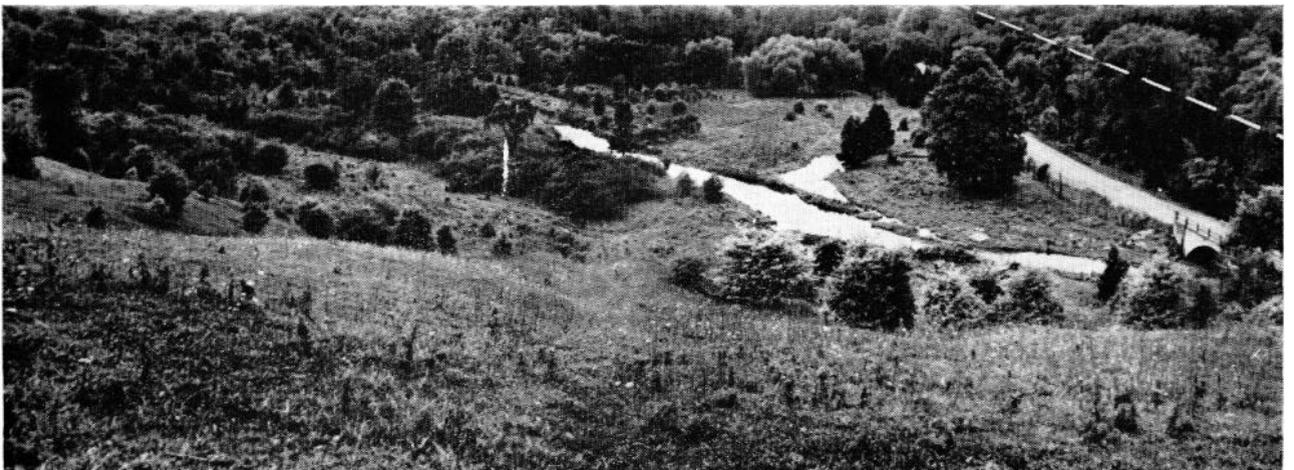
At full stage the reservoir would cover 201 acres and hold 3,677 acre-feet of water. Much of the flooded land is pasture and scrub woodlot, but some 40 acres are in hay. The reservoir would cover the road between Concessions VIII and IX for a length of 1,400 feet to a maximum depth of 4 feet, and surround two houses east of this road, a cottage and unfinished bungalow at a total estimated value of \$9,000. No other structures would be affected. Lots 551 to 557 inclusive of the Delrex Development Ltd. project No. 339 would be affected also. This allows for a strip 100 feet wide and 10 feet above high-water level.



Silver Creek Damsite downstream from road between Lots 25/26, Con. VIII, Esquesing Township.



*Glen Williams Damsite area upstream from the road on Lot 23, Con. XI, Esquesing Township. The dam would be along road visible at lower **left corner**.*



Georgetown Damsite Area. Dam would be located along road (right) between Con. IX and X, Lot 13, Esquesing Township.

(c) Other Sites Investigated

(1) Norval reservoir site

This reservoir site is located on the main river about one half mile above the village of Norval.

A dam at this site would have a crest length of 1,430 feet and total height of 62 feet. The drainage area at this point is 198.8 square miles.

The river here has cut into the Queenston shales and foundation conditions should be suitable, although the rock is readily erodible and would require protection below the spillway.

The reservoir would have a capacity of 4,798 acre-feet and a surface area of 2,130 acres at maximum capacity. It would have a length of 1.8 miles, extending to the tailwater of the disused paper mill at Georgetown.

The land to be occupied by the reservoir is largely undeveloped but includes a large part of the Upper Canada College property which is used for recreational purposes and demonstrations of conservation practices, many of which were laid out a number of years ago and could not readily be replaced. For this reason and the fact that there are a number of suitable sites upstream, this site was abandoned.

(2) Caledon reservoir site

This reservoir appeared from topographic sheets to have a storage of 1,900 acre-feet, that would represent a run-off of about three inches from its drainage area of 9 square miles.

Examination of the site on the ground showed that surface run-off was very small, presumably because of the highly pervious moraine deposits that cover the drainage area. So little run-off occurred that the stream channel was frequently indefinite, and in places cultivation of grain fields was carried out across the channel.

In view of this condition and the agricultural use of the land that would be occupied by the reservoir, it was considered that the site was unsuitable, and no further work was carried out.

(3) Alton reservoir site

The damsite for this reservoir would lie along the road between Concessions IVW and VW, Township of Caledon, about .75 of a mile upstream from the village of Alton. The dam-site topography would not permit a high dam and the comparatively steep gradient of the stream would make the reservoir short and of low capacity. The maximum height of dam is 37 feet with water depth of 32 feet and a length of 1,000 feet. Reservoir length would be 4,000 feet with an average width of 700 feet and a capacity of 403 acre-feet.

The reservoir area of 45 acres is mostly swampy low-grade land and contains no structures, except a swimming pool at the damsite (said to have cost \$6,500). However, the small storage and comparatively high dam would make the unit cost of storage uneconomical, and the controlled drainage area of 26.07 square miles would be too small to be effective against flood flows, although the site is well located to supply summer flows.

(4) Credit Forks reservoir site

This site appeared marginally feasible from examination of topographic sheets with an approximate estimated storage capacity of 4,150 acre-feet and a controlled area of 128 square miles.

Several factors were against it, notably the comparatively high dam required and the fact that the reservoir would occupy the most scenic part of the valley.

It was believed that these considerations would make construction unjustifiable and no further ground surveys were carried out.

(5) Huttonsville reservoir site

The site of the dam would be along the road between Cons. V and VI W in Lot 7, Township of Chinguacousy. The dam height would be 50 feet with a water depth 45 feet and crest length of 1,800 feet.

The reservoir would have a length of 11,000 feet with a surface area of 283 acres at maximum storage level, and maximum capacity of 4,822 acre-feet. The drainage area is 253.11 square miles.

The land in the reservoir is of comparatively high value at the lower end, where there are established orchards and a new \$12,000 6-room bungalow. About 30 acres of orchard and 50 acres of cultivated or tillable land are involved. The balance of the area is pasture or low-grade woodlot. In addition to the new bungalow mentioned, there is a small summer cottage, approximate value \$2,000 in Lot 8, Con. VI W, which would be flooded.

The reservoir site lies in the centre of a district in which market gardens and orchards form the main land use. The water stored here would undoubtedly be of value as the practice of irrigation spreads.

(6) Streetsville reservoir site

This is one of the best reservoir sites on the lower river, and is well situated to control flow into the Town of Streetsville. However, the high development of the Toronto area is approaching the valley here, and all the land to be flooded is in use.

The dam would be located about 1,000 feet below the road between Cons. III and IV in Lot 7, Township of Toronto. Bedrock is exposed in the left bank and bed of the river, but it is a low-grade shaly limestone, in thin horizontal beds, and shows considerable weathering. Much excavation and grouting would probably be necessary to ensure against leakage. The dam would have a height of 31 feet and crest length of 490 feet. The drainage area is 298.11 square miles at this point.

Storage capacity of the reservoir is 3,402 acre-feet and the reservoir would have a length of 8,000 feet and average width of 2,500 feet, with a surface area of 458 acres.

The land in the reservoir is, to a large extent, used as improved pasture and cropland. Two large farmsteads, with a building value estimated at \$25,000-\$30,000 each, would be flooded, as well as 1,450 feet of the road between Cons. II and III and the bridge there. A cottage (\$6,000) on this road and the access to an estate would be submerged. In addition, the proposed super-highway to Windsor is planned to cut across the head of the reservoir.

In summation, it may be said that this reservoir provides good storage with a comparatively small dam, but the large spillway capacity would necessitate an expensive structure, and the location is too far down the stream to benefit many. Land acquisition costs will undoubtedly be very high because of the buildings involved, and the fact that most of the land is now in use.

4. Proposed Remedial Work

The above six reservoir sites surveyed and found to be economical have a combined storage capacity of about 20,940 acre-feet which, in view of the potential development of this area, is barely adequate. The Orangeville and Cataract sites are the best of these sites and are recommended for early construction at a cost of \$410,000 and \$1,180,000 respectively. Also some effort should be made to acquire the lands for the remaining sites in the near future before the land values become too high.

Table H-6 lists the dam and reservoir data for all the sites investigated,

TABLE H-6

DAM AND RESERVOIR DATA
FOR RESERVOIR SITES INVESTIGATED ON THE CREDIT WATERSHED

Reservoir	Maximum Storage Capacity	Surface Area At Max. Capacity	Length of Dam	Elevation - G.S.C.		Height Above Stream Bed	Depth to Bedrock Assumed 10'	Height Above Bedrock	Remarks
				Bed of Stream	Top of Dam 5' Freeboard				
	Ac. Ft.	Acres	Feet	Feet	Feet	Feet	Feet	Feet	
Orangeville	1,934	391	1,550	1,337 _±	1,355	18	10	28	} Recommended for early construction
Cataract	2,573	328	850	1,247 _±	1,285	38	10	48	
Belfountain	3,936	280	1,060	1,211 _±	1,265	54	10	64	
Silver Creek	6,517	200	1,180	887 _±	955	68	10	78	} For future consideration
Glen Williams	2,303	180	2,300	769 _±	810	41	10	51	
Georgetown	3,677	201	1,350	708 _±	762	54	10	64	
Norval	4,798	2,130	1,430	663 _±	725	62	10	72	
Caledon	No Survey Made								} Eliminated as being unsuitable
Alton	403	45	1,000	1,389 _±	1,426	37	10	47	
Credit Forks	No Survey Made								
Huttonsville	4,822	283	1,800	605 _±	655	50	10	60	
Streetsville	3,402	458	490	509 _±	540	31	10	41	

Table H-6

CHAPTER 8

CONSERVATION STORAGE

1. General

A summary of the maximum, minimum and mean daily flows at Cataract and Erindale is shown in Table H-4, The present uses of the stream flow and the extent of pollution have been described and it may be readily realized that undesirable conditions exist along the river. The pollution is aggravated by the lack of natural flow, with added dangers to the health and welfare of all who use the water.

Production in the mills using water power and industrial plants requiring process water is interfered with and their fire hazard is increased. Also, during periods of low flow algae and other wastes accumulate in pools and back-water areas where they decay, producing foul odours and an unsightly mess.

It is not possible to visualize the future requirements at the present time, but it is strongly recommended that the Authority carefully consider the available reservoir sites and take steps to purchase the lands required for the more desirable sites now. Otherwise, it is conceivable that land values could increase to such a point as to make the projects uneconomical and perhaps even impossible.

2. The Planning Year and Operation of Reservoirs

The "Planning Year" as used by this Department simply divides the twelve-month period into two periods, viz:

Period A	<u>Period B</u>
92 days	273 days
Mar. Apr. May	June July Aug. Sept. Oct. Nov. Dec. Jan. Feb.
Replenishing	Draft

Period A - or the replenishing period is the period of high flows and practically all the flooding occurs during this time. The reservoirs would be filled to their summer flow capacity during this period and beyond, depending upon the magnitude of the spring freshet.

Period B - or the draft period includes the months during which the flows are generally low and should be increased by additional flow released from the storage reservoirs in order to maintain a minimum permissible flow.

The operation of the reservoirs would conform to this period as closely as possible, depending on the magnitude of the spring run-off and the low-flow period demand, As the primary function of the reservoirs on the Credit is to augment the low flow periods, full capacity would be maintained at all times if possible and the spillway capacity would be large enough to discharge the unpredictable if necessary.

3. Conservation Storage Losses

The holding capacity storage of a reservoir is not all available for discharge as certain losses must be accounted for and deducted, so that the remainder or net storage is what may be used to augment the low flows.

(a) Dead Storage

A reservoir should never be drained bone dry. A certain amount of water is retained to protect the discharge tubes at the foot of the dam, and to facilitate enough silting of the reservoir bottom in the immediate vicinity of the dam to protect natural and artificial seals against damage. Dead storage space, therefore, is not used for flood control, nor is the water available to supplement low flows at the end of a dry period.

The amount of dead storage depends upon the gradient of the bed of the reservoir and its width in the vicinity of the dam, and will vary for each reservoir.

(b) Seepage

In a reservoir there is always some loss due to seepage, but this is not considered as serious and may be disregarded, since it is thought that the additional hidden storage due to raised water tables will compensate for any water lost by seepage.

(c) Evaporation

Evaporation loss is a direct function of the water surface area and the rate varies directly with temperature and wind velocities. In this case precipitation was considered as rain up to the end of November and as snow from then to the first of March.

Total evaporation was calculated from a modified formula by Thornthwaite and applied to the open water surface. The results are shown in Tables H-7 and H-8.

(d) Ice Formation

The amount of ice forming in the reservoirs will also vary directly with temperature and in this case was assumed to be 12 inches in depth during an average year, from December to February, inclusive.

(e) Reservoir Space for Hypothetical Flood

Where flood control is the prime function of a reservoir it is usual to reserve additional space to provide for an hypothetical flood caused by unusual rainfall occurring shortly after the spring run-off when reservoirs are full.

The reason for this precaution assumes that the spring flood waters are being discharged and the channel capacity flow is at the maximum. Any additional flow, such as would be caused by an unusually heavy rain, if space was not available in the reservoir, would have to be discharged and would overflow the channel causing flooding.

In this case, the areas subject to flooding are being protected by dikes to the extent of the maximum high water known. Should such a storm occur after the spring run-off with

reservoirs full, it would be safe to discharge this additional water from the dams without topping the dikes.

Therefore it is not necessary to reserve storage space in the reservoirs to take care of a flood which might occur shortly after the spring run-off period when the reservoirs would be full.

4. Conservation Storage Available and Possible Sustained Increase in Low Flows

The storage losses and the remaining conservation storage available for increasing low flows for each of the reservoirs together with the possible sustained discharge for a 112-day period (June 1 to September 20 inclusive) and for a 273-day period (June 1 to February 28 inclusive) for the driest year on record are shown in Table H-7. Table H-8 shows similar data for the river at Erindale for the average year of the period of records.

Based on the existing flow records for the Erindale gauge, the average flows for the 112-day and 273-day periods at this point are 58.0 c.f.s. and 175 c.f.s. respectively for the driest year on record and 141 c.f.s. and 189.0 respectively for the average year of the period of records. The Orangeville and Cataract Reservoirs would provide flow increases of approximately 17 c.f.s. and 8 c.f.s. for the respective 112-day and 273-day periods.

TABLE H-7

RESERVOIR LOSSES CONSERVATION STORAGE AND SUSTAINED FLOW
AVAILABLE AT ERINDALE FOR THE DRIEST YEAR ON RECORD

Reservoir	Mean Surface Area - Acres	Losses in Acre-Feet			Holding Capacity Acre-Feet	Conservation Storage Acre-Feet	Aver. Discharge from Reservoirs c.f.s.
		Evaporation and Winter Ice	Dead Storage Approx.	Total Loss Reservoir Space			
For 112-Day Period							
Orangeville	195	218	180	398	1,934	1,536	6.9
Cataract	164	184	100	284	2,573	2,289	10.3
Belfountain	205	229	100	329	3,936	3,607	16.2
Silver Creek	112	125	120	245	6,517	6,272	28.2
Glen Williams	180	201	80	281	2,303	2,022	9.1
Georgetown	150	167	100	267	3,677	3,410	15.3
TOTAL	1,006	1,124	680	1,804	20,940	19,136	86.0
For 273-Day Period							
Orangeville	195	361	180	541	1,934	1,393	2.6
Cataract	164	303	100	403	2,573	2,170	4.9
Belfountain	205	379	100	479	3,936	3,457	6.4
Silver Creek	112	207	120	327	6,517	6,190	11.4
Glen Williams	180	333	80	413	2,303	1,890	3.5
Georgetown	150	277	100	377	3,677	3,300	6.1
TOTAL	1,006	1,860	680	2,540	20,940	18,400	34.9

For the driest year the average flows for the 112-day and the 273-day periods are 58.0 c.f.s. and 175 c.f.s.

With the above reservoirs in operation these flows could be increased to 144 c.f.s. and 209.9 c.f.s. respectively.

TABLE H-8

RESERVOIR LOSSES, CONSERVATION STORAGE AND SUSTAINED FLOW
AVAILABLE AT ERINDALE FOR THE AVERAGE YEAR OF RECORD

Reservoir	Mean Surface Area - Acres	Losses in Acre Feet			Holding Capacity Acre-Feet	Conservation Storage Acre-Feet	Aver. Discharge from Reservoirs c.f.s.
		Evaporation and Winter Ice	Dead Storage Approx.	Total Loss Reservoir Space			
For 112-Day Period							
Orangeville	195	149	180	329	1,934	1,605	7.2
Cataract	164	125	100	225	2,573	2,348	10.6
Belfountain	205	156	100	256	3,936	3,680	16.6
Silver Creek	112	85	120	205	6,517	6,312	28.4
Glen Williams	180	137	80	217	2,303	2,086	9.4
Georgetown	150	114	100	214	3,677	3,463	15.6
TOTAL	1,006	766	680	1,446	20,940	19,494	87.8
For 273-Day Period							
Orangeville	195	281	180	461	1,934	1,473	2.7
Cataract	164	236	100	336	2,573	2,237	5.0
Belfountain	205	295	100	395	3,936	3,541	6.6
Silver Creek	112	161	120	281	6,517	6,236	11.5
Glen Williams	180	259	80	339	2,303	1,964	3.6
Georgetown	150	216	100	316	3,677	3,361	6.2
TOTAL	1,006	1,448	680	2,128	20,940	18,812	35.6

For the average year the average flows for the 112-day and the 273-day periods are 141.0 c.f.s. and 189.0 c.f.s.

With the above reservoirs in operation these flows could be increased to 228.8 c.f.s. and 224.6 c.f.s. respectively.

METHOD AND ACCURACY OF SURVEYS1. Reservoir Surveys

The contour plans of the Cataract, Glen Williams and Norval Reservoirs were drawn by means of stereo-projection from aerial photographs using the Wild projector for Cataract and the multiplex for the other two. Levels were carried from geodetic bench marks to the reservoirs, and bench marks established for vertical control. Intermediate spot elevations were determined by means of the FA 176 Wallace and Tiernan altimeters using the two-base method. The horizontal control was by check-chained stretches along the roads or other readily identified lines for each line of photographs whereby the scales of the photographs were reliably determined. The limit of storage error is believed to be within 5 per cent for these three reservoirs.

A less expensive method was used in the survey of the other reservoirs.* The vertical control was from geodetic bench marks to the damsites as with the other reservoir sites, but from the damsites a stadia traverse encircled the reservoir areas, using the mean H.I. method.† The stations were pin-pointed on the photographs and the contours sketched in under a stereoscope. The traverse was plotted and the contours then transferred from the photographs to a plan by means of the "Sketchmaster". These storages determined from these plans may have an error of as much as 15 per cent and the areas should be surveyed by a more orthodox method if and when the dams are built.

Contour plans of the Alton, Huttonsville and Streetsville reservoirs which were considered impracticable at the present time are not shown in the report but are available should they ever be wanted.

* Caledon and Credit Forks sites were not surveyed at all.

† Mean Height of Instrument Method.

No subsurface exploration has been made at any of the damsites and as no designs have actually been made of the dams, the costs are only approximate.

2. Local Improvement Surveys

The local improvement surveys at Glen Williams, Churchville and Meadowvale are stadia surveys. A checked line of levels was run from geodetic bench marks to each of the areas and bench marks established. A stadia traverse was made of the area and the elevation of the stations determined by mean H.I. Sufficient stadia shots were taken from the stations to prepare contour plans with reliable 2-foot intervals. The dikes as shown on Figures H-5, H-6, and H-7 were located from the contour plans and the quantities determined by cross-sections of the dikes from the plans. The contour plans are not shown in the report but are available when wanted.

CHAPTER 10

COMMUNITY PONDS

During the summer of 1954 a reconnaissance of all the existing and former ponds on the watershed was made to determine which sites were most suitable for development as community ponds for water supply and/or recreational purposes. In all approximately 115 sites were visited and the present condition of each noted.

In 1955 the above sites were reviewed together with other possible sites on the watershed and 30 were selected for more detailed investigations. In selecting these sites consideration was given to their proximity to urban centres and proposed recreational areas as outlined in the recreation section of this report.

Eleven of the above sites were discarded for various reasons and the remaining 19 sites are shown in Fig. H-10 and are briefly described below. They constitute a guide from which the Authority may select sites for construction in conjunction with their recreational program and/or water supply needs.

The sites are designated numerically and the letters with them indicate their classification. "E" indicates existing millsites with dams requiring some or no repairs. "P" indicates possible pond sites. "N" indicates natural ponds or lakes.

Inventor of existing Ponds and Possible sites for Community Ponds

2P At Streetsville, Lot 4, Con. V, W.C.R., Toronto Township, exists a location suitable for park development. The creek running through the location has insufficient flow to maintain a good recreational pond although it does not show signs of pollution.

3P On Lot 9, Con. I, W.C.R., Toronto, Township, there is a possible site for recreational purposes but the flow is not sufficient to maintain a clean shore. The site might be used for a very restricted irrigation pond.

4P Meadowvale, Lot 11, Con. III, W.C.R., Toronto Township.

 The forebay of an old mill pond at this location might be reflooded to produce a recreational pond. In order to get a worthwhile depth of water, some of the accumulated silt would have to be excavated. The pond would be essentially a by-pass pond fed by the main Credit River. New headworks would be required with control to obviate ice trouble. Some dredging or re-directing of the old tailrace to form the by-pass outlet, would also be required.

 The flats on the island formed between the main river and the forebay pond would be an excellent parksite.

6E At Norval, Lot 12, Con. XI, Esquesing Township, the dam requires repairs on the Taintor gates which would amount to \$2,000.00 to make them function properly. At present one gate is out entirely but could be repaired and made serviceable. On May 27, 1955, with flash boards in place, the dam showed a head of 7'6".

 If the water were raised to the full head possible a pond of roughly six acres would be created,

 The surrounding area to the north-east is suitable of development for recreational purposes although the stream at this point shows some evidence of pollution.

7E On the north-east half of Lot 16, Con. VII, Esquesing Township, at Stewartons, a dam consisting of 400' of earth embankment and 35 feet of concrete spillway with flash board control. The structure is not in first-class condition but is impounding about 12 acres up to 13 feet in depth. The south-east bank rises quite abruptly. The north-west side is fringed by the village road. The shores

of the pond are too restricted to be suitable for recreational purposes. Another disappointing feature is the pollution from Acton located on this stream.

8E On Lot 18, Con. X, Esquesing Township, stands the Georgetown paper mill dam. This dam has 3 40-foot openings with no apparent control. The head is 10 feet without flash boards and there is a 6-foot clearance between the crest and the I-beams of the bridge which is combined with the water-holding structure. Due to silting there is heavy reed growth along the south-west bank and at the upstream end. The north-east bank is ideal for recreational development although the area is limited.

This site is within 1.5 miles of the centre of Georgetown. At present a subdivision capable of containing 4,000 people within 4 years is being started on No. 7 Highway 2 miles east of Georgetown. With this population in mind the area might be given further consideration for recreational development.

There is a sewage outlet 200 feet upstream from the dam which would have to be moved to a position below the dam to avoid polluting the pond.

Limehouse District

10P If the pollution from industries upstream could be stopped an excellent recreation site could be developed in Lots 16-22, Con. VI, Esquesing Township.

A new spillway would be required in the old and historic grist mill dam at Limehouse. The pond formed by such a structure would be about 5 acres in area and 5 or 6 feet deep. There is now a natural by-pass from the pond.

Just downstream from the old grist mill can be seen the remains of the woollen mill. The rapid flowing creek has a fall of 75 feet in a half mile in this area. Both banks of the creek are well wooded with cedar and other trees. In this fast-flowing section low 2-foot retaining dams could be built to form wading pools along the stream.

Further downstream a dam could be constructed in co-operation with the township roads department on the side road between Lots 17 and 18, Con. VI. About 8 acres of flats would be flooded. On the downstream side of the road the wide and attractive flats could be developed for a park.

12E On the main Credit River, almost anywhere between Glen Williams and Inglewood, the picturesque valley flats are suitable for recreational development. No dam is required to impound water here as the river is quite large and has good summer flow. At Inglewood there is a timber dam which raises the water to the level of the surrounding flats, impounding 4 acres and giving 4-foot head at a plastic mill.

A dam on the main stream anywhere in the above area for creating a recreational pond at reasonable cost is out of the question as the banks are too far apart, making a dam a costly structure,

16E At Erin there is a combined roadway (Church Street) and dam. The head is 6' 69" and the spillway opening is 11 feet long. The flash boards on the spillway were in poor shape and should be replaced together with the stop logs. The easterly abutment requires repairs,

This dam should be repaired to maintain the present 12-acre community park pond.

18E Lot 22, Con. VII, Erin Township. 1.5 miles south-west of Hillsburg.

At present there is a pond of roughly 8 acres and approximately 4 feet at greatest depth, held by an earth dam 260 feet long with an 8-foot top. The easterly banks are well adapted for wading. Below the dam there is a cleared area of 4 acres of organic soil which is quite soggy. The upstream end of the pond carries a heavy growth of bullrushes.

The eastern shore of the pond which rises in a knoll to about 12 feet above the pond is ideal for park development.

19E Lot 25, Con. VII, Erin Township, in Hillsburg.

The Guelph Fishing Club uses this ten acre, up to 8-foot deep, pond for fishing and fish retention purposes. The surrounding area is ideal for park development. There is a bush on the north-west. On the east and west is cleared gently sloping ground. Hillsburg village is less than .25 mile east of the pond. The village road embankment acts as part of the dam for the pond. The Guelph Fishing Club has control of the pond at present.

20E Lot 23, Con. IV, W.C.R., Caledon at the western edge of Alton Village.

Here a concrete dam in need of repair retains a head of 14 feet. The five-acre pond of 10-foot depth is surrounded by an ideal parksite area. The north side is wooded and the south side cleared and gently rolling pastureland. The buildings on the south side are in a rather dilapidated condition. Water is clear, clean with a good flow and contains some fish.

There are outcroppings of limestone rock in the banks just upstream from the dam.

21E In the village of Alton just downstream from pond No. 20E there is a 5-acre pond created by a 20-foot high dam which is holding 18 feet of water. The spillway is in poor condition. The abutments are poorly designed with faulty joints to the earth embankment.

There is a limited recreational area on the north side of the pond. The south side is fringed with a cedar hedge and the village road.

22E Lot 26, Con. III, W.C.R., Caledon Township, spring-fed pond, 6 acres, holds 7 feet of water. The drainage area of the pond is 100 acres. To make a permanent pond here would require the raising of 400 feet of township road.

There is a good sandy loam beach on the east side sloping gently into the pond.

The outlet is 6 feet wide and 10 feet deep, of concrete construction with stop planks. There is bush on the north, a roadway on the south and cleared, gently rolling land on the west and east.

The pond and surroundings provide an excellent location for recreational purposes but the surrounding country is not thickly populated.

There is no pollution in this clear, clean spring-fed pond.

23E Lot 26, Con. I, W.C.R. Caledon Township at Melville.

This is the site of an old mill but no buildings are now in evidence. The 10-acre pond is almost entirely on the Scott property. Depth of pond is up to 10 feet.

The dam was severely damaged by Hurricane Hazel. Existing are 2 six-foot sluices and a 17-foot sluice with flash-board control. The total length of dam is 150 feet.

Sufficient flow for self-cleansing was noted. The surrounding area is suitable for park development but there is a marshy region at the upstream end of the half-mile-long pond. The land on the north bank is controlled by the golf course.

If this site is to be used for recreational purposes, a new dam would be required and, in addition, a thorough investigation of pollution from Orangeville should be made.

24N Caledon Lake, Caledon Township, Lot 29, Con. IV, W.C.R.

This natural lake 65 acres in area is reputed to be 40 feet deep. The shore is covered with thin bush. The north fringe of the lake has been built on and now has 30 summer dwellings. Some recreational facilities are provided by the Caledon Lake Company, which owns the property and operates it privately. The lake is said to contain fish. Each dwelling appears to have a separate small boat landing.

25N Mono Township, Lot 4, Con. I, W.C.R.

This is a 35-acre lake fringed on the south-east side by swamp area well infested by mosquitoes.

There is a road allowance around the eastern fringe of the lake but no roadway.

In order to make this lake suitable for recreational purposes a 200-foot belt around the shore would have to be cleared and 1,000 feet of roadway provided.

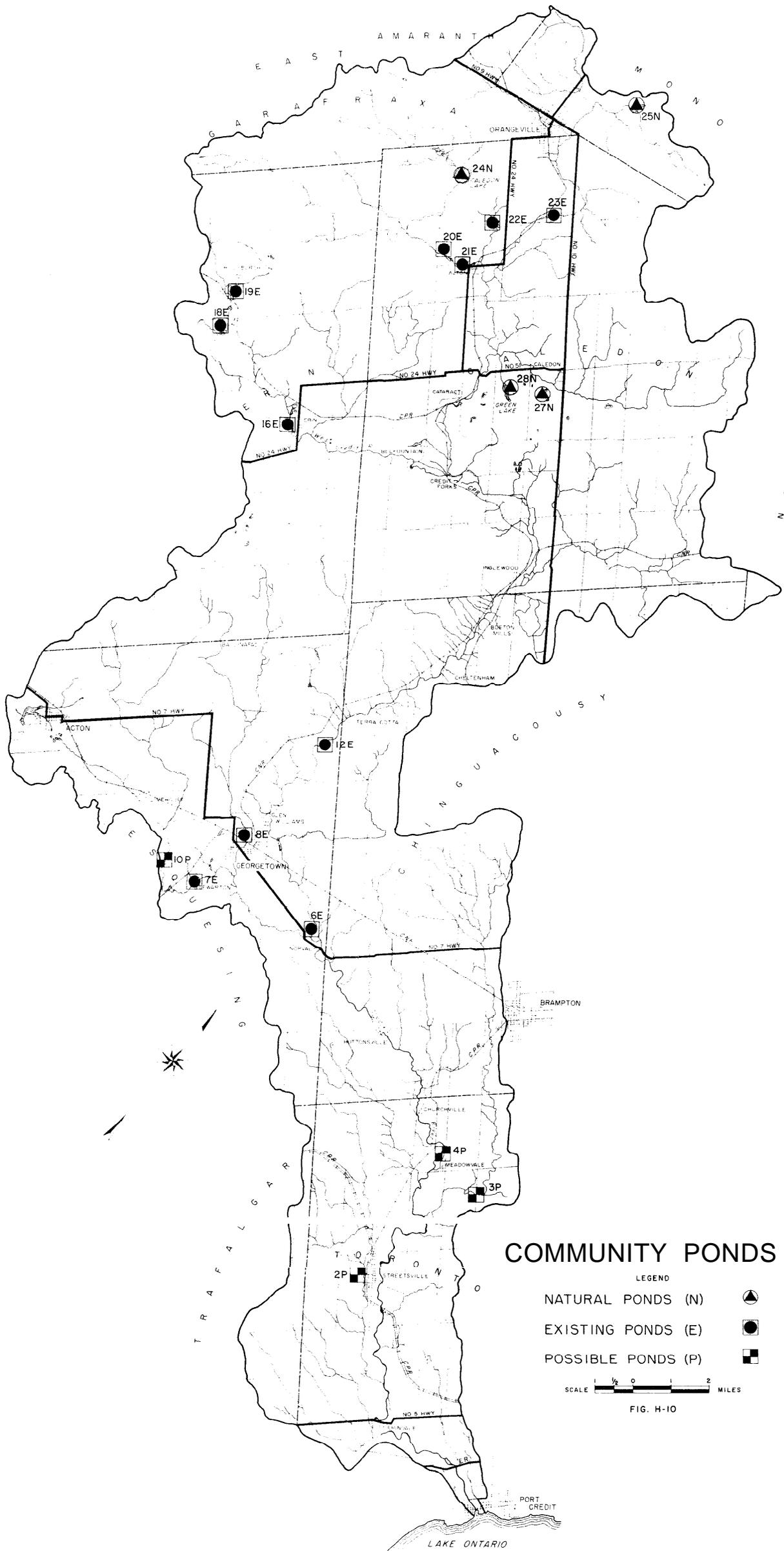
The lake is fed by a spring creek having 2,500 acres drainage area. The water is clear, depth not known.

27N Rush Lake, Caledon Township, Lot 14, Con. I, W.C.R.

20 acres marshy at the north end. The banks are well defined with no overland outlet. Caledon gravel in evidence to great extent. The surrounding area is rolling farmland and is suitable for a park site.

28N Green Lake, Lots 13 and 14, Con, II, W.C.R., Caledon Township.

This 65-acre spring-fed natural lake has clean banks and clean water and is suitable for recreational purposes. There has been very little development to date. Very little reed growth is in evidence. The surrounding area is rolling, cleared farmland with banks sloping gradually into the water, No dam or construction is required.



COMMUNITY PONDS

- LEGEND
- NATURAL PONDS (N)
 - EXISTING PONDS (E)
 - POSSIBLE PONDS (P)

SCALE 1 1/2 0 1 2 MILES

FIG. H-10

CHAPTER 11

SUMMARY

The foregoing investigations of the flooding have shown that Glen Williams, Churchville and Meadowvale are the three major trouble areas but that the damage sustained at each does not warrant the construction of costly reservoirs. Therefore, local protection by means of channel improvement has been recommended for these places.

Much of the flooding along the river in the past has been due to the heavy sheet ice which has been allowed to form in mill ponds. This hazard could be greatly reduced by proper dam regulation or by emptying the ponds before the freeze-up and it has been recommended that the Authority take some action in this regard.

The low flow problem, while not as serious as on some watersheds, is causing concern in many local areas and is rapidly becoming more wide-spread. With low water stages the river becomes increasingly polluted and the potential recreational value of the river is destroyed.

The uses of the river water have been briefly outlined, but the future needs for domestic, industrial and agricultural purposes require a more detailed study which is beyond the scope of this report at the present time. However, six possible reservoir sites with a total storage capacity of approximately 20,940 acre-feet have been outlined. This is the maximum storage available within reasonable economic limits that could be developed and utilized to provide increased summer flows. This amount of storage would provide 86.0 c.f.s. for a 112-day period or 34.9 c.f.s. for a 273-day period for the driest year on record, Or, for an average year, it would provide flow increases of 87.8 c.f.s. and 35.6 c.f.s. for the 112- and 273-day periods respectively.

Such a large-scale system of reservoirs would necessarily be a long-term program but it is strongly recommended that the Orangeville and Cataract dams and reservoirs be given immediate consideration and that steps be taken to acquire the lands for the other sites before the land values increase to the point where the project would no longer be economically possible.

The municipalities in the lower part of the watershed may obtain water from Lake Ontario and some may be able to obtain sufficient supplies from wells, at least for the time being, but it is certain that there will be an increased demand upon the river for water and it is urged that the necessary measures be taken now to meet this future need.

While reservoirs are being recommended primarily for the purpose of increasing the natural river flow throughout periods of low water stages, they would also reduce the flood hazard at many points along the river. This is particularly true of the Orangeville project which could readily be regulated to prevent the flooding of No. 9 Highway crossing which occurs almost annually during the spring break-up. The reservoirs would provide many other benefits such as raised ground water tables, recreational facilities and increased power development at those mills using water power,

In addition to the large reservoirs for increasing the low flows and flood control, there are numerous existing ponds and suitable sites where small ponds could be constructed at a reasonable cost to provide water facilities for recreational centres and/or water supplies for nearby urban areas.

A reconnaissance of 115 existing and former pond sites and of about another 20 possible sites on the watershed was made to determine the most suitable sites. From these, 30 were selected for a more detailed investigation and of these

nineteen were finally selected and are listed in Chapter 10 as a guide to the Authority in laying out a community ponds program.

CHAPTER 1

INTRODUCTION

Several factors affect planning for fish and wildlife in the Credit Watershed:

1. Much of the watershed, both land and water, is more spectacular than other areas close to Greater Toronto with its population of more than one million. Hence the watershed is visited by great numbers of people, including hunters looking for upland game and waterfowl, fishermen seeking fish, and a growing army of naturalists interested in the opportunities to see and enjoy the varied forms of animal life.

2. The watershed includes a substantial part of the Niagara Escarpment and a part of the interlobate moraine and therefore has much rough land particularly suited to wildlife, and has also in its upper section an abundant flow of springs providing exceptional opportunities for fishing.

3. There is a larger than usual proportion of the land in city-owned clubs, private estates and summer cottages,, On much of this land the fish and game are protected from public interference and fostered with more than ordinary care, some to be harvested and others left to fluctuate naturally.

4. The watershed has also much agricultural land of high quality.

All of the factors affecting wildlife that are described above could not be examined in a single rapid reconnaissance in one summer. Sound deductions for improvements to upland game and waterfowl cannot be made on the basis of a single season's observations, but require a study of the existing habitat and of the dynamics or changes of populations for a period of several seasons. Such studies are already being made by the Divisions of Research and Fish and Wildlife of the Department of Lands and Forests.

The field work on this survey was concentrated on the most immediate problems, particularly on those related to other aspects of conservation. A beginning has only recently been made in the basic research on game environments in Southern Ontario. The techniques of stream and lake surveys are at present farther advanced. In the present survey the chief detailed work was therefore the study of the environment of fish. The extent of pollution of the river, at least from the point of view of fishing, was given special attention. Since there is a rapidly growing interest in natural history in the Credit Watershed and in the populations surrounding it, particular attention was also paid to listing those species of animals that may be met with.

CHAPTER 2

FORMER SPECIES

At least six species of mammals which probably were found in the Credit Watershed at the time of settlement no longer occur in it. These are the marten, fisher, wolverine, timber wolf, Canada lynx and the wapiti, or American elk. The cougar, a more southern species in this part of Canada, may have occurred in the watershed. The bobcat, or bay lynx, may still occur rarely in the northern part of the area.

Among the birds which were permanent residents the wild turkey may have been found in the watershed. There is archaeological evidence that its former range in Ontario extended north and east to Lake Simcoe. Apart from recent introductions it is not now found in Canada.

The passenger pigeon, a migrant, is now extinct. Its vast flocks astounded the early settlers. The Credit Valley lay almost in the centre of the Ontario nesting area, In 1819 passenger pigeons were extremely abundant near Churchvilles*. There are several records of later nesting colonies in the watershed, e.g. at Esquesing Township, Concession I, Lot 28, and at Georgetown, where there was a very large nesting ground reported in the 1850's. The last large flocks occurred between 1850 and 1870. A few birds bred near Campbellville in 1886, just outside the watershed. The last birds reported in the watershed were a flock of ten seen at Orangeville in 1899

Perhaps the best known of the former wildlife of the watershed was the Atlantic salmon. A few references may serve to describe the greatness and decline of the salmon

* From Survey Diary of J. M. Benson, Toronto Township, in the Ontario Archives.

† The last four records are from: Mitchell, Margaret H. The Passenger Pigeon in Ontario. Royal Ontario Museum of Zoology Publication, 1935.

runs on this river. Concerning Cataract, or "Church's Falls", John Lynch, in 1873*, refers to the salmon as follows:

"These falls were still more remarkable in former times as forming the final barrier to the navigation of the salmon westward. In those times on two or three occasions in each summer, the Credit was filled with salmon, actually to overflowing, fresh and fat pushing their way westward to deposit their eggs. In a few weeks thereafter, those that had escaped the spear of the Indian or the new settler, might be seen wending their way backward pale and thin".

The salmon must have met a similar barrier at Belfountain. Lynch also refers to "Salmonville", five miles from Georgetown.

J. W. L. Forster gives a clue to the time of disappearance of the salmon, writing as follows: †

"Grandfather Forster ... had the genius of an Isaac Walton, thanks to fine practice in the streams of Cumberland, and in the days of the salmon runs in the rivers of Upper Canada. These salmon runs were only a tale to me, but it was the joy of my boy life to visit him in his riverside cottage in Glen Williams and accompany him on occasions when he would try to 'cast' for trout in the River Credit".

Since the "boy life" of J. W. L. Forster, referred to above, must have fallen between 1855 and 1869, the salmon runs were probably over at least before 1855.

In the Canadian Gazetteer,** printed 1846, the following reference was made to "the Credit river".

"...This river has long been celebrated for its salmon fishing, immense quantities having been annually taken, in the spring, during their passage up the stream to deposit their spawn. But, from the great number of mills which have been erected on the river during the last four years, the fishing is destroyed, the salmon being unable to make their way over the dams. Immense quantities of lumber are sawn at the mills on the river, and shipped at Port Credit."

This appears to place the last runs about 1841-42, confirming Forster's statement that they were "only

* Lynch, John. Directory of Peel County 1873-74. p. 71.

† Forster, J.W.L. Under the Studio Light. 1928. p. 14.

** Smith, W.H. Canadian Gazetteer. Toronto, 1846. p. 40.

a memory" by 1855. There were several mills on the Credit before 1835, but most of these used races and by-pass ponds with only low weirs. The mills built in the 1840's had large darns across the main stream in many cases.

The presence of the high dams, the silting of the inshore waters of Lake Ontario, the destruction of spawning beds by great quantities of sawdust and bark, and the intensive commercial fishing by nets and spears, are thought to be the chief causes for the disappearance of the salmon from Lake Ontario about 1890.

Amongst the reptiles, the hog-nosed snake almost certainly was formerly found in the Credit Watershed, The last Toronto record was of one taken in 1907.*

The Massassauga rattlesnake is also considered to have been fairly common throughout this part of Southern Ontario and was almost certainly found in the Credit Watershed,

CHAPTER 3

PRESENT SPECIES

1. Introduction

There is a rapidly growing interest in natural history in Ontario. In the area of Greater Toronto there is a long record of activity in this direction. Hence the wildlife of the Credit River is better known than that of many parts of the Province. The natural beauty and wild conditions along the cliffs and hills of the escarpment and the beauty of the Credit River are attracting more and more people to the Credit Forks area every year. The shore of Lake Ontario too is of exceptional interest because of the great variety of migrating waterfowl and shore birds. The shoreline is also on the Great Lakes migration route of many species of hawks. Lists are therefore included here of all the species of mammals, birds, amphibians and reptiles that may be encountered in the watershed.

The animals found in the Credit Watershed are a mixture of northern and southern species with ranges which overlap in this area from two of the major life zones of North America, known as the "Canadian" and "Carolinian" zones.*

The Carolinian Zone includes much of southwestern Ontario and a small part of the watershed, where a combination of the latitude and the modifying influence of Lake Ontario supports a more southern vegetation. The two different zones can be indicated by a few examples. Amongst the birds the White-throated Sparrow, a northern species, is present in summer in the northern part of the watershed only, and the Orchard Oriole which lives in the Carolinian Zone is found in summer only in the southern part. Amongst the mammals, the Eastern Flying Squirrel may be found in the southern part of the watershed, while the Northern Flying Squirrel and the Bog Lemming occur in the northern area.

* Lee R. Dice. The Biotic Provinces of North America. Ann Arbor, Michigan. 1943.

2. Present Mammals

The following list of mammals which may be found on the Credit Watershed was prepared with the assistance of S. C. Downing, Research Assistant, the Division of Mammalogy, of the Royal Ontario Museum of Zoology, Toronto.

The arrangement and terminology of the list follow those in Mr. Downing's "Provisional Check List of the Mammals of Ontario" †.

The most common mammals in the area are probably the meadow mouse and the mole shrew; the white-footed mouse is also a common species.

No exhaustive survey of the mammals of the Credit has been made. The late C. E. Hope, of the Royal Ontario Museum of Zoology staff, however, did a considerable amount of collecting in the Forks of the Credit area, over a period of fifteen years. Mainly as a result of his efforts, the mammals of the Credit Watershed are well represented in the museum's collections.

In the following list species represented by specimens in the collection from the Credit Watershed are marked by one asterisk (*), while those represented by specimens from closely adjacent areas are marked with a double asterisk (**).

The list also includes those species which, from their general distribution, probably occur in the region.

MAMMALS OF THE CREDIT WATERSHED

* Cinereous Shrew (<u>Sorex cinereus</u>)	The common long-tailed shrew of the region.
* Smoky Shrew (<u>Sorex fumeus</u>)	Of general occurrence.
Water Shrew (<u>Sorex palustris</u>)	No actual record of this northerly species, but it is to be expected in the upper reaches.
Pigmy Shrew (<u>Microsorex hoyi</u>)	No records, but the species may occur anywhere in the area,

† Misc. Publication No 2, Royal Ontario Museum of Zoology, Toronto. 1948 .

- * Mole Shrew
(Blarina brevicauda) Common and of general distribution.
- * Hairy-tailed Mole
(Parascalops breweri) Occurs sporadically throughout the area.
- * Star-nosed Mole
(Condylura cristata) Of regular occurrence.
- * Little Brown Bat
(Myotis lucifugus) The common small bat of the region.
- Long-eared Brown Bat
(Myotis keenii) A rare species which may occur anywhere in the region.
- * Least Brown Bat
(Myotis subulatus) Of rare occurrence, this species is more likely to be found hibernating in caves than as an active summer resident.
- ** Silver-haired Bat
(Lasionycteris noctivagans) Of general occurrence, particularly in migration.
- ** Pipistrelle
(Pipistrellus subflavus) Of rare occurrence likely to be found hibernating in caves than as an active summer resident.
- ** Big Brown Bat
(Eptesicus fuscus) The common large bat of the area.
- ** Red Bat
(Lasiurus borealis) An uncommon species, most likely to be met with in migration.
- * Hoary Bat
(Lasiurus cinereus) A rare species which may be met with in migration,
- ** European Hare
(Lepus europaeus) Introduced and generally distributed.
- * Varying Hare or Snowshoe Rabbit
(Lepus americanus) An inhabitant of cedar swamps and other cool areas in the upper part of the valley.
- * Cottontail
(Sylvilagus floridanus) Of general occurrence, probably more common in the lower parts of the watershed.
- * Black or Grey Squirrel
(Sciurus carolinensis) General, most common in the hardwood areas.
- * Red Squirrel
(Tamiasciurus hudsonicus) General, most common in the coniferous areas.
- * Woodchuck or Groundhog
(Marmota monax) Common and of general occurrence.
- * Eastern Chipmunk
(Tamias striatus) Common and of general occurrence.
- Eastern Flying Squirrel
(Glaucomys volans) To be expected in the southern part of the region.

- * Northern Flying Squirrel (Glaucomys sabrinus) Although seldom seen this species is not uncommon in the northern half of the area .
- Beaver (Castor canadensis) Probably abundant in the past. A few pairs have now re-established themselves in the watershed.
- Deer Mouse (Peromyscus maniculatus) The short-tailed form of this species, the prairie deer mouse (P. m. bairdii), most certainly occurs in the Lake Ontario section of the valley, while the long-tailed form, the woodland deer mouse (P. m. gracilis) should be looked for in the extreme headwaters of the drainage system.
- * White-footed Mouse (Peromyscus leucopus) This is the common native mouse of the wooded areas, and the one found in summer cottages and other buildings.
- * Bog Lemming (Synaptomys cooperi) A northern species found in the upper reaches of the Credit.
- Red-backed Mouse (Clethrionomys gapperi) Like the woodland deer mouse, this is a northern form which might occur in the upper reaches of the region.
- ** Muskrat (Ondatra zibethica) A common inhabitant of the marshy areas.
- * Meadow Mouse (Microtus pennsylvanicus) Common throughout the region wherever suitable grassy areas occur.
- * House Rat (Rattus norvegicus) Introduced, commensal.
- House Mouse (Mus musculus) Introduced, mainly commensal, but occasionally lives in a wild state away from towns and farm buildings.
- * Meadow Jumping Mouse (Zapus hudsonius) Of regular occurrence along streams in open meadows .
- * Woodland Jumping Mouse (Napaeozapus insignis) A northern species found in the headwater region of the drainage system.
- Porcupine (Erethizon dorsatum) Found in the larger tracts of forest and uncleared wastelands.

- * Brush Wolf
(Canis Latrans)
- This small relative of the timber wolf reached Eastern Ontario from the west about 1920. Although much of the sheep killing attributed to wolves is actually performed by dogs, the brush wolf can be a menace to the farmer's sheep and other livestock. Fortunately, it is unlikely to become common enough to constitute a serious danger to livestock, but the species is definitely an inhabitant of the wilder areas of the valley.
- * Red Fox
(Vulpes fulva)
- A regular resident of the valley, the red fox has been abundant during the last decade.
- Black Bear
(Ursus americanus)
- A former inhabitant. Occasional wanderers from the Bruce Peninsula still reach the upper parts of the watershed.
- * Raccoon
(Procyon lotor)
- A common resident of the area and a nuisance to the corn fields. Like the red fox, this species has increased considerably in numbers in the last decade or so.
- ..x Ermine
(Mustela erminea)
- This short-tailed species is more common in the northern sections of the region, but occurs throughout the area.
- * Long-tailed Weasel
(Mustela frenata)
- Occurs throughout the area but is most likely to be met with in the southern section,
- ** Mink
(Mustela vison)
- Of general occurrence along the streams, rivers and lakes of the watershed.
- Skunk
mephitismephitis)
- Common throughout the area and a valuable check on certain insect pests such as the cut-worm, in spite of its doubtful reputation.
- Otter
(Lutra canadensis)
- This wide ranging species may still be found occasionally along the more remote streams.
- Bobcat or Bay Lynx
(Lynx rufus)
- The bobcat occupied the Credit in pioneer days but probably disappeared before the 1900's. Following a recent increase in its numbers to the south, there appears to be a northerly movement of the species taking place, and it could be found again in the wilder parts of the region.

White-tailed Deer
(Odocoileus virginianus)

The white-tailed deer was perhaps never completely driven out of the area with the settling of the country. Remote sections of waste-land perhaps always offered refuge to a small number of deer. With the protection given to it , the deer has increased in numbers and is now a common sight in the wilder sections along the escarpment .

3. Birds

At least 230 different species of birds either breed in, migrate through, or visit the watershed, apart from those now extinct.

The list of birds has been divided into sections corresponding very roughly to the two life zones described earlier in this chapter, and also because many species of shore birds and waterfowl that are not seen in the northern region migrate along the shoreline of Lake Ontario. This is well illustrated by the fact that 85 migrants have been recorded in the southern area and only 53 in the northern area.

The dividing line between the northern and southern area is arbitrarily made the Brampton sideroad, which passes through Huttonville and Brarnpton, and thence north-easterly along No. 7 Highway towards Woodbridge. The birds occurring are listed as permanent residents, migrants, summer residents and winter or summer visitors. All of the permanent residents nest in the watershed with the exception of the Herring and Ring-billed Gulls. Inevitably there will be rare visitors which have been omitted from this list, but every species listed has been seen in the watershed,

All species which are listed as summer residents probably breed in the watershed but for some species no records happen to be available of nesting activities. The Golden Eagle is a good example. Two Golden Eagles, observed by Gerald Bennett, were present at Credit Forks on June 27, 1958 and the species almost certainly nests on the cliffs of the escarpment.

The list of birds that may be seen is based chiefly on observations and records of J. L. Baillie of the Royal Ontario Museum of Zoology, Mrs. L. McDougall and Mr. Donald Perks, both of Port Credit, Wing-Commander D. A. MacLulich and the late C. E. Hope.

The arrangement and terminology follow those of L. L. Snyder's "Ontario Birds" (Toronto, 1951). A few names which might be misleading have more specific information added in brackets.

A guide to the list follows:-

- PR = Permanent Resident
- M = Migrant
- SR = Summer Resident
- WV = Winter Visitor
- SV = Summer Visitor
- Acc = Accidental
- * = Breeding records available

BIRDS OF THE CREDIT WATERSHED

	Southern Area			Northern Area		
Common Loon		M			M	
Red-throated Loon		M				
Red-necked Grebe			SR*			
Horned Grebe		M			M	
Western Grebe				Acc ^M		
Pied-billed Grebe			SR*			SR*
Gannet				Acc ^W		
Double-crested Cormorant		M				
Great Blue Heron			SR			SR
Egret (American)		M				
Green Heron			SR*			SR*
Night Heron (Black-crowned)				SV		
American Bittern			SR*			SR*
Least Bittern				SV		
Whistling Swan		M				
Canada Goose		M			M	
Brant		M			M	
Snow Goose				Acc ^M		
Blue Goose		M			M	
Mallard			SR*	WV		SR*
Black Duck			SR*	WV		SR*
Gadwall		M				
Baldpate		M				
Pintail		M				
Green-winged Teal		M			M	
Blue-winged Teal			SR*			SR*
Shoveller		M			M	
Wood Duck			SR*			SR

	Southern Area			Northern Area		
Redhead	M					
Ring-necked Duck	M			M		
Canvas-back	M					
Greater Scaup	M		WV			
Lesser Scaup	M		WV	M		
Common Golden-eye	M		WV	M		WV
Buffle-head	M		WV	M		
Old-squaw	M		WV	M		
Harlequin Duck			Acc ^{WV}			
King Eider			Acc ^{WV}			
White-winged Scoter	M		WV			
Black Scoter	M					
Ruddy Duck	M					
Hooded Merganser	M			M		
Common Merganser	M		WV	M		
Red-breasted Merganser	M					
Turkey Vulture	M				SR*	
Goshawk	M		WV	M		WV
Sharp-shinned Hawk		SR*			SR*	
Cooper's Hawk		SR			SR*	
Red-tailed Hawk		SR*			SR*	
Red-shouldered Hawk		SR*			SR*	
Broad-winged Hawk	M				SR*	
Rough-legged Hawk	M		WV	M		
Golden Eagle	M				SR	
Bald Eagle	M			M		
Marsh Hawk		SR			SR*	
Osprey	M			M		
Peregrine Falcon	M				SR	
Pigeon Hawk	M			M		
Sparrow Hawk		SR*	WV		SR	WV
Ruffed Grouse	PR*			PR*		
Common Pheasant	PR*			PR		
Virginia Rail		SR*			SR*	
Sora		SR*			SR*	
Yellow Rail	M			M		
Black Rail						Acc
Gallinule (Florida)		SR*				
American Coot		SR		M		
Killdeer		SR*			SR*	
Black-bellied Plover	M			M		
Turnstone	M					
American Woodcock		SR*			SR*	
Common Snipe	M			M		
Whimbrel (Hudsonian Curlew)	M					
Upland Plover		SR*			SR*	
Spotted Sandpiper		SR*			SR*	
Solitary Sandpiper	M			M		
Greater Yellow-legs	M			M		
Lesser Yellow-legs	M			M		
Knot	M					
Dunlin	M					
Semipalmated Sandpiper	M					
Sanderling	M					
Glaucous Gull	M		WV			
Iceland Gull	M		WV			
Great Black-backed Gull	M		WV			

	Southern Area				Northern Area			
Herring Gull	PR				PR			
Ring-billed Gull	PR					M		
Bonaparte's Gull		M						
Common Tern		M						
Caspian Tern		M						
Black Tern			SR*					
Thick-billed Murre				Acc ^{WV}				
Rock Dove	PR*				PR*			
Mourning Dove			SR*				SR*	
Yellow-billed Cuckoo			SR*				SR*	
Black-billed Cuckoo			SR*				SR*	
Screech Owl	PR*				PR*			
Horned Owl	PR*				PR*			
Snowy Owl				WV				WV
Barred Owl	PR				PR			
Long-eared Owl	PR							
Short-eared Owl	PR							
Saw-whet Owl	PR*				PR*			
Whip-poor-will		M					SR	
Nighthawk			SR*				SR	
Chimney Swift			SR*				SR*	
Ruby-throated Hummingbird			SR*				SR*	
Belted Kingfisher			SR*				SR*	
Yellow-shafted Flicker			SR*				SR*	
Pileated Woodpecker	PR*				PR*			
Red-headed Woodpecker			SR				SR*	
Yellow-bellied Sapsucker			SR				SR*	
Hairy Woodpecker	PR*				PR*			
Downy Woodpecker	PR*				PR*			
Arctic Three-toed Woodpecker				WV				WV
Eastern Kingbird			SR*				SR*	
Crested Flycatcher			SR*				SR*	
Eastern Phoebe			SR*				SR*	
Yellow-bellied Flycatcher		M				M		
Traill's Flycatcher			SR*				SR*	
Least Flycatcher			SR*				SR*	
Eastern Wood Pewee			SR*				SR*	
Olive-sided Flycatcher		M				M		
Horned Lark			SR*	WV			SR	WV
Tree Swallow			SR*				SR*	
Bank Swallow			SR*				SR*	
Rough-winged Swallow			SR*				SR*	
Barn Swallow			SR*				SR*	
Cliff Swallow			SR					
Purple Martin			SR*				SR*	
Canada Jay								Acc
Blue Jay	PR*				PR*			

	Southern Area				Northern Area			
Crow (American)			SR*	WV			SR*	
Black-capped Chickadee	PR*				PR*			
Boreal Chickadee				Acc ^{WV}				
White-breasted Nuthatch	PR*				PR*			
Red-breasted Nuthatch	PR*				PR*			
Brown Creeper	PR*				PR			
House Wren			SR*				SR*	
Winter Wren			SR*				SR*	
Bewick's Wren				Acc ^M				
Marsh Wren			SR*				SR*	
Sedge Wren			SR				SR	
Mockingbird				Acc ^W				Acc ^W
Catbird			SR*				SR*	
Brown Thrasher			SR*				SR*	
Robin			SR*	WV			SR*	
Wood Thrush			SR*				SR*	
Hermit Thrush		M				M		
Swainson's Thrush		M				M		
Gray-cheeked Thrush		M				M		
Veery			SR*				SR*	
Bluebird			SR*				SR*	
Golden-crowned Kinglet	PR				PR			
Ruby-crowned Kinglet		M				M		
Water Pipit		M				M		
Cedar Waxwing	PR*				PR*			
Great Shrike		M		WV		M		WV
Loggerhead Shrike			SR*				SR*	
Starling	PR*				PR*			
Yellow-Throated Vireo			SR				SR*	
Solitary Vireo		M				M		
Red-eyed Vireo			SR*				SR*	
Philadelphia Vireo		M				M		
Warbling Vireo			SR*				SR*	
Black and White Warbler			SR*				SR*	
Golden-winged Warbler		M				M		
Tennessee Warbler		M				M		
Orange-crowned Warbler		M				M		
Nashville Warbler			SR*				SR*	
Parula Warbler		M				M		
Yellow Warbler			SR*				SR*	
Magnolia Warbler		M				M		
Cape May Warbler		M				M		
Black-throated Blue Warbler			SR				SR	
Myrtle Warbler		M				M		
Black-throated Green Warbler		M					SR	
Blackburnian Warbler		M				M	SV	
Chestnut-sided Warbler			SR				SR	

	Southern Area			Northern Area		
Bay-breasted Warbler		M			M	
Black-poll Warbler		M			M	
Pine Warbler			SR*			SR
Palm Warbler		M			M	
Ovenbird			SR*			SR*
Water thrush (Northern)		M				SR*
Connecticut Warbler		M			M	
Mourning Warbler			SR*			SR*
Maryland Yellowthroat			SR*			SR*
Yellow-breasted Chat			SR			SR
Wilson's Warbler		M			M	
Canada Warbler			SR*			SR*
American Redstart			SR*			SR*
House Sparrow	PR*				PR*	
Bobolink			SR*			SR*
Eastern Meadowlark			SR*			SR*
Red-wing			SR*			SR*
Orchard Oriole			SR*			
Baltimore Oriole			SR*			SR*
Rusty Blackbird		M			M	
Grackle			SR*			SR*
Cowbird			SR*			SR*
Scarlet Tanager			SR*			SR*
Cardinal	PR*				PR*	
Rose-breasted Grosbeak			SR*			SR*
Indigo Bunting			SR*			SR*
Evening Grosbeak				WV		WV
Purple Finch	PR*				PR*	
Pine Grosbeak				WV		WV
Hoary Redpoll						WV
Redpoll				WV		WV
Pine Siskin				WV		SR
American Goldfinch	PR*				PR*	
Crossbill (Red)				WV		WV
White-winged Crossbill				WV		WV
Towhee			SR*			SR*
Savannah Sparrow			SR*			SR*
Grasshopper Sparrow			SR*			
Vesper Sparrow			SR*			SR*
Slate-colored Junco	PR*				PR*	
Oregon Junco				WV		
Tree Sparrow				WV		WV
Chipping Sparrow			SR*			SR*
Field Sparrow			SR*			SR*
Harris's Sparrow				Acc ^M		
White-crowned Sparrow		M			M	
White-throated Sparrow		M				SR*
Fox Sparrow		M			M	
Swamp Sparrow			SR*			SR*
Song Sparrow			SR*			SR*
Snow Bunting				WV		WV

4. Amphibians and Reptiles

The watershed contains at least 24 species of amphibians and reptiles. Many people have an unreasoning fear of frogs, toads and salamanders, although they are harmless, and useful to the gardener and farmer. Of the salamanders the mudpuppy is revolting in appearance to most people, but remains near the bottom of rivers and is not frequently seen. The adults of the other salamanders are occasionally encountered under logs and detritus in forested land.

All of the species of snakes reported appear to be generally distributed in the parts of the watershed not yet built up. The Eastern garter snake is probably the commonest, The northern water snake is found only around ponds or near streams, One species of turtle, the wood turtle, is included because it has been recorded from Thistletown on the Humber River and at Bronte Creek in Halton County, and so should in all probability be found in the Credit Watershed.

The watershed is not within the known range of any venomous snake. It is very unlikely that any rattlesnake remains in the area. It should be added that neither copperheads nor water moccasins occur in Ontario at all, and the common water snake, which is hostile to man when wild, when captured rapidly becomes docile.

The writer is indebted to Mr. E.B.S. Logier, Associate Curator, Division of Ichthyology and Herpetology, Royal Ontario Museum of Zoology, for the following list of species known to occur in the watershed:

AMPHIBIANS AND REPTILES OF THE CREDIT WATERSHED

Salamanders

Mudpuppy	<u>Necturus maculosus maculosus Rafinesque</u>
Jefferson's salamander	<u>Ambystoma jeffersonianum Green</u>
Spotted salamander	<u>Ambystoma maculatum Shaw</u>
Newt	<u>Diemictylus viridescens viridescens Rafinesque</u>
Red-backed salamander	<u>Plethodon cinereus cinereus Green</u>

Frogs and Toads

American toad	<u>Bufo terrestris americanus</u> Holbrook
Spring Peeper	- <u>crucifer crucifer</u> Wied,
Tree toad	<u>Hyla versicolor versicolor</u> LeConte
Swamp tree frog	<u>Pseudacris nigrita triseriata</u> Wied.
Bullfrog	<u>Rana catesbeiana</u> Shaw
Green frog	<u>Rana clamitans</u> Latreille
Wood frog	<u>Rana sylvatica</u> LeConte
Leopard frog	<u>Rana pipiens</u> Schreber
Pickerel frog	<u>Rana palustris</u> LeConte

Turtles

Snapping turtle	<u>Chelydra serpentina serpentina</u> Linnaeus
*Wood turtle	<u>Clemmys insculpta</u> LeConte
Central painted turtle	<u>Chrysemys picta marginata</u> Agassiz

Snakes

Northern water snake	<u>Natrix sipedon sipedon</u> Linnaeus
De Kay's brown snake	<u>Storeria dekayi dekayi</u> Holbrook
Red-bellied snake	<u>Storeria occipitomaculata occipitomaculata</u>
	<u>Storer</u>
Eastern ribbon snake	<u>Thamnophis suaritus suaritus</u> Lanaeus
Eastern garter snake	<u>Thamnophis sirtalis sirtalis</u> Linnaeus
Eastern ring-necked snake	<u>Diadophis punctatus edwardsi</u> Merrem
Eastern smooth green snake	<u>Opheodrys vernalis vernalis</u> Harlan
Eastern milk snake	<u>Lampropeltis doliata triangulum</u> Lacepede

* Not yet reported from the watershed, but probably occurs in **it**.

CHAPTER 4

IMPROVING THE LAND FOR WILDLIFE

There are many varied types of land in the Credit Watershed. The requirements of food and cover vary greatly for different species of wildlife. The recommendations here listed are therefore those which can be most generally applied by the landowner.

1. Woodlands

The elimination of grazing of woodlots would be the most useful single measure in improving the wildlife environment. Reforestation plans are included in the Forestry report. In plantations, up to about the tenth year from planting, the entire planted area is valuable for wildlife. But large blocks of coniferous trees will, at least after the twelfth year from planting, have little or no undergrowth and will, apart from their edges, be comparatively sterile as far as upland game and most forms of wildlife are concerned. The chief improvements to be expected will therefore come from good management of the farm woodlot. Selective cutting is both sound forestry practice and good planning for wildlife. Landowners who have woodlots in which the crown canopy has closed over considerable areas, and who wish to produce a proper environment for wildlife, will find that release cuttings, slashings to stimulate sprout growth, thinnings and felling timber for sale will improve rather than retard the carrying capacity for wildlife. Construction of brush piles from cuttings is recommended where rabbits are desired, two or three such brush piles per acre being the normal spacing.

2. Cultivation Practices

All good farming practices which make a more luxuriant vegetation will improve the farm environment for wildlife. A few special practices will give more specific benefits. Strip-cropping, described elsewhere in this report, is of particular value since by this means no extensive area

is denuded of cover at one time by harvesting. In the less flat parts of the watershed, filter strips, either above water-diversion terraces or used as emergency waterways, provide travel lanes and nesting cover for wildlife. Cover crops such as the clovers provide a habitat and food for wildlife in areas that would otherwise be barren during the winter months.

The elimination of brushy fencerows is now becoming more common in the Credit Watershed. Those who are interested in wildlife improvement will find that the inclusion of a few field boundary hedges on the farm will moderate the effect of winds on crops, serve as travel lanes and cover for wildlife, and harbour large numbers of songbirds which help to control insect pests. Inevitably the presence of boundary hedges on a farm tends to encourage the growth of weeds. This is the price that must be paid for improved wildlife conditions. Rosa multiflora is an excellent hedge-forming shrub. It has a tendency in Southern Ontario to die back in winter, but rapidly forms a dense hedge, which is reported to be proof against cattle and hogs. It provides both cover and food and does not exhaust the nearby cultivated ground. However, in view of its questionable hardiness, it should not be planted in the Credit Watershed without consultation with the nearest biologist or forester of the Department of Lands and Forests, at either Hespeler or Maple.

3. Cover Patches

Field corners are frequently barren of crops. Therefore a fence crossing which embraces the corners of four fields may be made into a haven for ground-nesting species by planting a few trees and shrubs and protecting them. It is important to rid such areas of useless weeds by crowding them out with useful species such as white sweet clover or the normal climax type of open vegetation, which is bluegrass.

4. Ponds and Streams

The importance of water to wildlife is often

forgotten. Many farms have at least one low spot where a small amount of work with a scoop will provide a darn and a pond to provide nesting and feeding sites for water and marsh birds. If possible, ponds for wildlife should be separate from those intended for cattle or for fish. Willow cuttings pushed in the ground around such a hollow will rapidly provide wildlife cover. New water areas are usually very rapidly invaded by aquatic plants, but additional species may have to be introduced. No extensive duck food studies have been made in Southern Ontario. Wild rice may be introduced, but since it is not well adapted to wide variations in water levels, being often sterile in fluctuating waters, it cannot be considered as certain to succeed. The idea has long been current, and fostered by many sportsmen's organizations, that the planting of wild rice is the answer to the problem of how to attract ducks to any area. The fact is that wild rice is of little significance to ducks in Canada except in the fall, and does not provide good cover or nesting sites. The following species which may be easily obtained are recommended as certain to be valuable duck foods. If none of them occur in ponds or shallows with good cover for ducks they can be introduced,

Sago Pondweed	<u>Potamogeton pectinatus</u> L.
Red-Head Pondweed	<u>Potamogeton Richardsonii</u> (Ar. Benn.) Rydb.
Wild Millet	<u>Echinochloa crusgalli</u> (L) Beauv.
Japanese Millet	<u>Echinochloa frumentacea</u> (Roxb) Link
Wild Celery	<u>Vallisneria americana</u> Michx.
Knotweed	<u>Polygonum pennsylvanicum</u> L.
Water-Smartweed	<u>Polygonum coccineum</u> Muhl.
Three-square	<u>Scirpus americanus</u> Pers.
Great Bulrush	<u>Scirpus validus</u> Vahl., var. <u>creber</u> Fern.
Duckweed	<u>Spirodela</u> sp. and <u>Lemna</u> sp.

Those who are interested in farm ponds for wildlife will find very useful details of the various types of pond and methods for constructing each type in a booklet "Farm Ponds" which is available from the Provincial Government. * Farm ponds differ from those intended for wildlife in that care is usually taken to prevent the growth of aquatic vegetation

* Applications may be made to the nearest provincial Agricultural Representative or to the Department of Agriculture, Parliament Buildings, Toronto.

in a farm pond intended only for watering stock or fire protection purposes. Otherwise the construction and details of ponds for wildlife should follow one of the types there described.

CHAPTER 5

FISH

1. Introduction

The purpose of this survey was to classify the waters of the Credit drainage basin as to their present suitability for fish, and to make recommendations for possible improvements, with examples in detail.

2. Methods

The procedure here adopted followed closely that used in previous surveys made by the Department of Planning and Development in other river systems. The Credit River and its tributaries were visited at 266 stations. The stations were from half a mile to three miles apart on each stream course. The topographic features of the valley and the erosion, vegetation, volume of flow, turbidity, temperature and type of bottom were listed for each station. At all suitable stations collections of the aquatic insects and other invertebrates were made. At most of the stations collections of fish were also made. The collections were later examined and classified, and were used in zoning the various sections of the river, as shown on the accompanying map.

The aquatic insects such as mayflies, stoneflies and caddisflies were most useful for this purpose, since many of them are reliable indicators of the stream conditions at the critical time of year. Some species are confined to waters which remain cold and usually clear in summer, such as trout waters, Other species are indicators of permanent flow or of polluted water or of the maximum summer temperature of the water. Thus the potentialities of a stream for particular species of fish are indicated. Fish collections and records of maximum-minimum thermometers substantiated these findings at their particular stations.

Since the procedure here used follows that of previous river surveys, it allows close comparisons of the

characteristics of many rivers. The present criteria and methods were developed from more intensive year-round research carried out by Dr. F.P. Ide, of the Department of Zoology, University of Toronto, on parts of the Nottawasaga River and Algonquin Park streams, already reported on*, and on other streams in Southern Ontario. The analysis by J. B. Hallam † of previous river surveys made by the Department of Planning and Development was also found useful.

The streams were examined between June 25 and September 20, 1954, and many of them were examined only once. It was therefore necessary to rely partly on deductions made from the presence or absence of species known to be reliable indicators.

Thermometers were installed as follows:

Continuous recording thermometer	Maximum-minimum thermometers	
1		on the main stream near Terra Cotta
	7	on the main stream at various points between Orangeville and Port Credit
	1	on the Belfountain tributary
	1	on the tributary traversing the south-east part of Caledon Township
		on Black Creek from above Acton to Norval, and on Silver Creek, at Georgetown.

* Ide, F.P. The Effect of Temperature on the Distribution of the Mayfly Fauna of the Stream. University of Toronto Studies, Biology 39, Ontario Fisheries Research Laboratory, Publication 50, 1935.

Ide, F.P. Quantitative Determination of the Insect Fauna of Rapid Water. University of Toronto Studies, Biology 47, Ontario Fisheries Research Laboratory, Publication 59, 1940.

Sprules, W.M. An Ecological Investigation of Stream Insects in Algonquin Park, Ontario. University of Toronto Studies, Biology 56, Ontario Fisheries Research Laboratory, Publication 69, 1947.

† Hallam, J.B. Habitat and Associated Fauna of Selected Species of Fish in Ontario Streams. M. A. Thesis, University of Toronto, 1954.

These thermometers were kept in place during the latter part of July, all of August and part of September. Two of the thermometers were used for shorter periods at other stations. Readings from the maximum-minimum thermometers were taken at intervals of two days, or in a few cases three days.

3. The River Valley

The variety in kinds and numbers of fish inhabiting a river system depends greatly on the physiographic conditions of the watershed. The major features determining the river's course and condition are therefore mentioned here,

Almost all of the streams in this watershed that have permanent flow are fed from the land above the escarpment. The main branch of the Credit River rises amongst the sandy and gravelly hills, terraces and swamps, close to Orangeville. The first tributary of importance drains the land surrounding Caledon Lake, and joins the main branch below Alton. The west branch of the Credit rises in swamps near Hillsburgh and drains much of Erin Township. The two branches cross a wide and swampy spillway and drop from the escarpment edge in spectacular falls and rapids at Cataract and Belfountain, joining at the Forks of the Credit.

Below the Forks the river drains an alluvial plain and is increased by a tributary (South Caledon Creek) from the east, which crosses Highway No. 10 westwards near the base of the Caledon mountain. Below this tributary the Credit River flows close to the escarpment edge for some 15 miles, and there are many short steep watercourses descending the escarpment.

The next important tributary drains the land surrounding Acton, passes through Stewartown, gains in volume of flow from Silver Creek at Georgetown, and enters the Credit at Norval. Below this point the tributaries are unimportant except as contributing to flood conditions and silting. The main river now flows through a wide valley cut more than 60

feet in the boulder clay, until it is deflected north-eastward by a barrier beach of a former lake at Erindale. It finally passes through this and becomes much ponded and weedy, reaching its mouth at Port Credit, where there is another sand bar.

Twenty major obstructions to the movement of fish are shown on the accompanying map. These include 18 dams and also the High Falls at Cataract and the dam and waterfall at Belfountain. Some of the dams on the smallest streams are not included in this total.

Small residual lakes and ponds are fairly common in the northern part of the watershed. All of the larger natural ponds have surfaces at elevations between 1,250 and 1,400 feet, with the exception of Caledon Lake whose surface is at about 1,480 feet elevation.

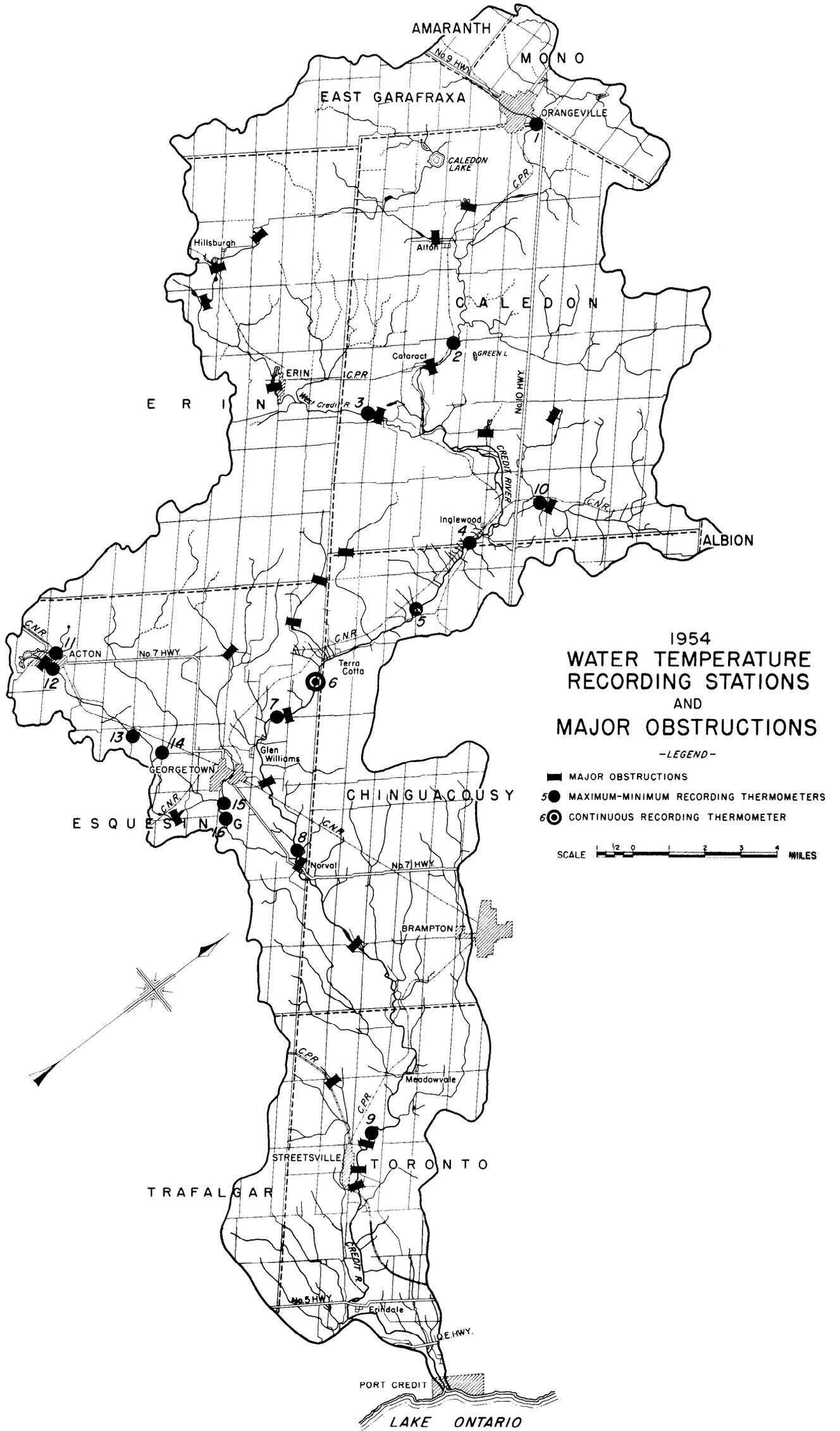
The main stream, apart from the sections immediately above the lower dams, had a very high proportion of gravel and stone bottom. Silt was relatively uncommon, being recorded as a major constituent in only 38 of 266 stations with permanent flow.

The general condition of the stream bottom and the bottomlands in at least the lower sections of the Credit Valley was radically affected by the hurricane of October 1954. However, the effect of the hurricane above Terra Cotta was relatively mild and at Credit Forks the river did not rise as high as it had already risen in the spring of the same year.

4. Permanence of Flow

Permanence of flow of the river and its tributaries is shown on the accompanying map "Biological Conditions of Streams? A few comments may be added to the information on the map. Below Credit Forks very few of the streams running off the escarpment have a permanent flow. It appears probable that the surface of the bedrock dips westward from the escarpment edge.

Water Temperature Recording Stations



The Credit exhibits two unusual features. One is the great reduction in the flow of the main stream during dry summers from Credit Forks down at least to Erindale. For example, the minimum daily flow at Cataract in 1946 was 11 cubic feet per second, and this was reduced to a minimum daily flow of 3 c.f.s. at Erindale in September in spite of the addition of many tributaries. In more normal years the flow at Erindale does not fall below about 30 c.f.s. In 1954 the minimum daily flow at Erindale was 61 c.f.s.

The other unusual feature is the remarkable evenness of flow in the trout-producing water in the upper regions of the river. Thus in the nine years ending 1954 the minimum daily flow at Cataract neither fell below 11 c.f.s. nor rose above 18 c.f.s.

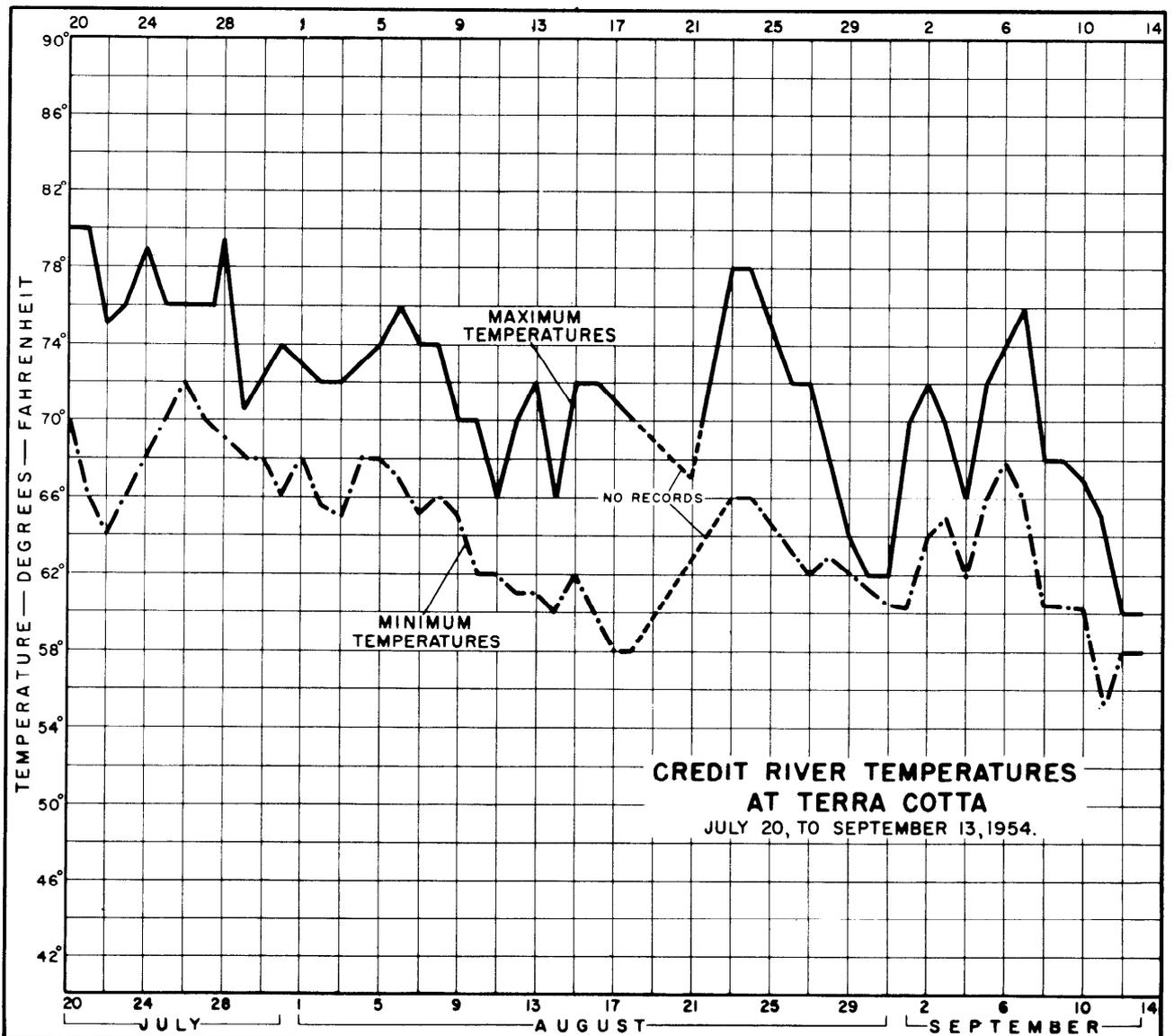
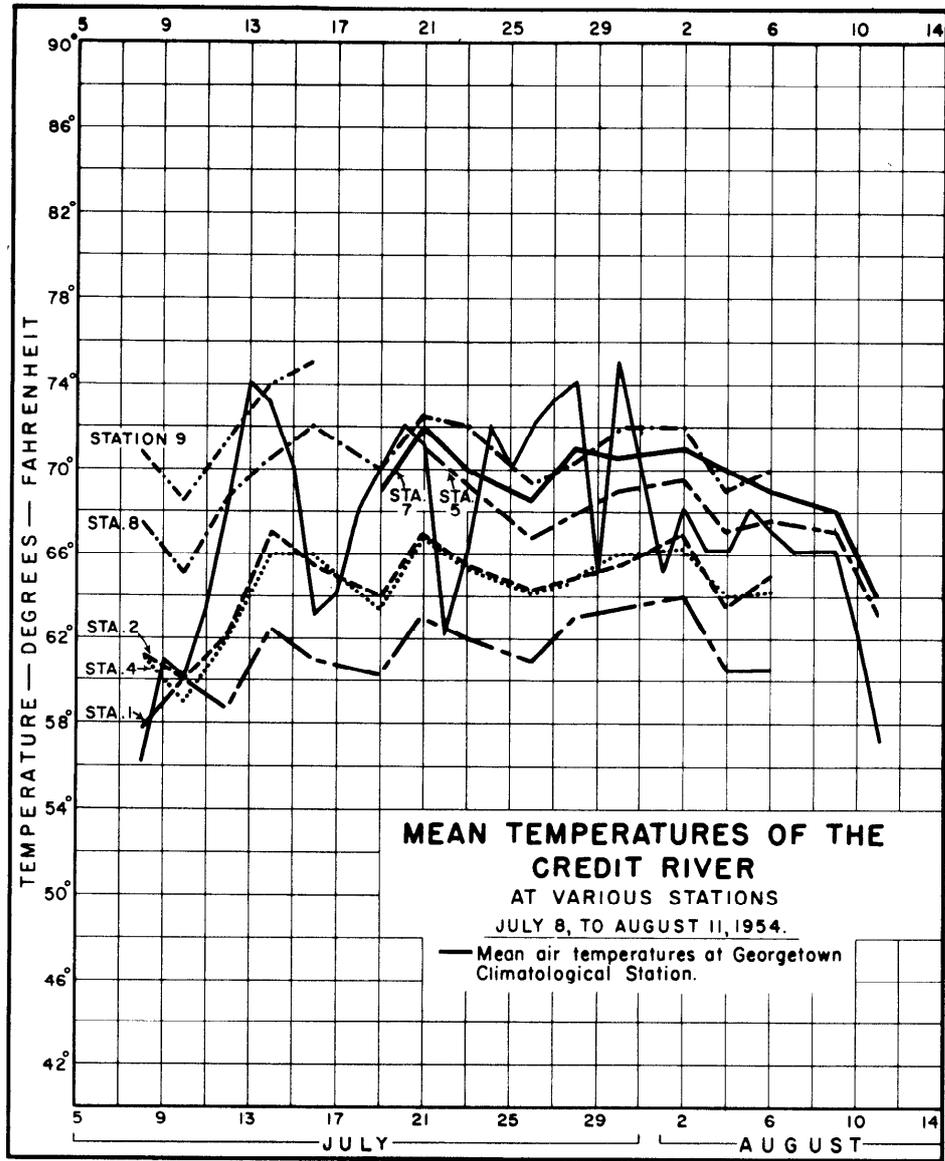
From the flows estimated during the 1954 survey it seems that there is very little underwater seepage into the main stream, at least below Credit Forks.

The gradients of all the branches are illustrated in the Water section of this report.

Although the month of July, during the survey, was exceptionally dry so far as precipitation was concerned, the effect on the river's flow was negligible. The conditions for fish were not extreme during the course of the survey so far as flow was concerned. This fact should make the 1954 classification of particular value since extreme conditions of flow do not usually occur more than once in ten or more years.

The reduction in flow in dry summers may be attributed either to evaporation, particularly evaporation from the ponds backed up behind the dams, or to the removal of water for irrigation. This procedure is rapidly increasing in Southern Ontario, and may soon have a radical effect on the capacity of the Credit River to produce fish. It will of course reduce the capacity of the river to dilute the wastes from sewage and industrial plants.

Credit River Temperatures



5. Temperature Conditions

The summer temperature conditions affecting the distribution of fish are shown on the accompanying map. Adult speckled trout should thrive best in the lower parts of the sections coloured blue. The greatest daily fluctuations in temperature are found in the sections coloured green. Speckled trout may inhabit some of the green sections, particularly the upper parts, in early or late summer but will move out or be killed in the warm days of midsummer. Brown trout appear to adapt themselves better to the higher temperatures in these sections, and several were caught by angling between Norval and Inglewood, although there have been several kills of brown trout, presumably from high temperatures, at Norval.

The maximum and minimum water temperatures noted at the continuous recording thermometer at Terra Cotta in 1954 were 81° and 58° Fahrenheit. At Terra Cotta the water temperature rose from 59 ° to 79 ° in a single five-day period, but there was adequate time for acclimation of the fish to the high temperature. A summary of the temperatures of the water between July 20 and September 15 follows. The mean water temperatures for various representative stations are shown on the accompanying graphs, along with the mean air temperatures at Georgetown for the corresponding period.

Terra_Cotta Water Temperatures

<u>Temperature Limits</u> <u>o Fahrenheit</u>	<u>Total Hours Recorded</u>	<u>Maximum Consecutive</u> <u>No. of Hours</u>
51 - 55	0	0
56 - 60	78	43
61 - 65	288	57
66 - 70	509	43
71 - 75	257	25
76 - 80	58	11
81 approx.	4	4

These records have not been summarized with respect to season, because they do not begin until July 20, but in fact, the

highest water temperatures recorded occurred in July and all the 55 °-60 ° temperatures occurred in September, This would not always be true. When a river which has many cool springs, such as the Credit, reaches a low flow, almost all of its flow is coming from cool springs, and the temperature may therefore be lower than when the flow includes a higher proportion of run-off. In 1954 the flow of the Credit did not come close to the lowest flows which have occurred.

From these records it can certainly be concluded that in the stretch of river from Terra Cotta to Norval the margin of safety, even for brown trout, is very small and that high summer temperatures will frequently be a critical factor in their survival. Their growth rates are also radically reduced when the water temperature rises much above 70 °.

6. Fish Distribution

The following 36 species of fish were found in the rivers and streams of the watershed during the survey of 1954.

LIST OF FISHES FOUND IN THE CREDIT RIVER 1954

<u>Common Name</u>	<u>Scientific Name</u>	<u>No. of Stations at which the Species was collected in 1954</u>
<u>Herring Family</u>	<u>Clupeidae</u>	
Alewife	<u>Pomolobus pseudoharengus</u> (Wilson)	2
<u>Salmon Family</u>	<u>Salmonidae</u>	
* Brown trout	<u>Salmo trutta</u> Linn.	4
* Rainbow trout	<u>Salmo gairdnerii</u> Richardson	1
* Eastern speckled trout	<u>Salvelinus fontinalis</u> (Mit chill)	45
<u>Sucker Family</u>	<u>Catostomidae</u>	
Common sucker	<u>Catostomus commersonii</u> (Lacepede)	43
Hog sucker	<u>Hypentelium nigricans</u> (Le Sueur)	11
Redhorse	<u>Moxostoma</u> sp.	1
<u>Minnow Family</u>	<u>Cyprinidae</u>	
Longnosed dace	<u>Rhinichthys cataractae</u> (Cuvier and Valenciennes)	13

+ Species of particular interest to anglers are starred.



A tributary of the Credit close to its spring source. This photograph, taken in zero weather, shows the effect of the relatively warm spring source, keeping the stream unfrozen.

This is the typical appearance of the Erin tributary where it runs in a shallow and wide course cutting through a former glacial spillway. The stream would be much improved for fish if it were narrowed and deepened here at intervals.

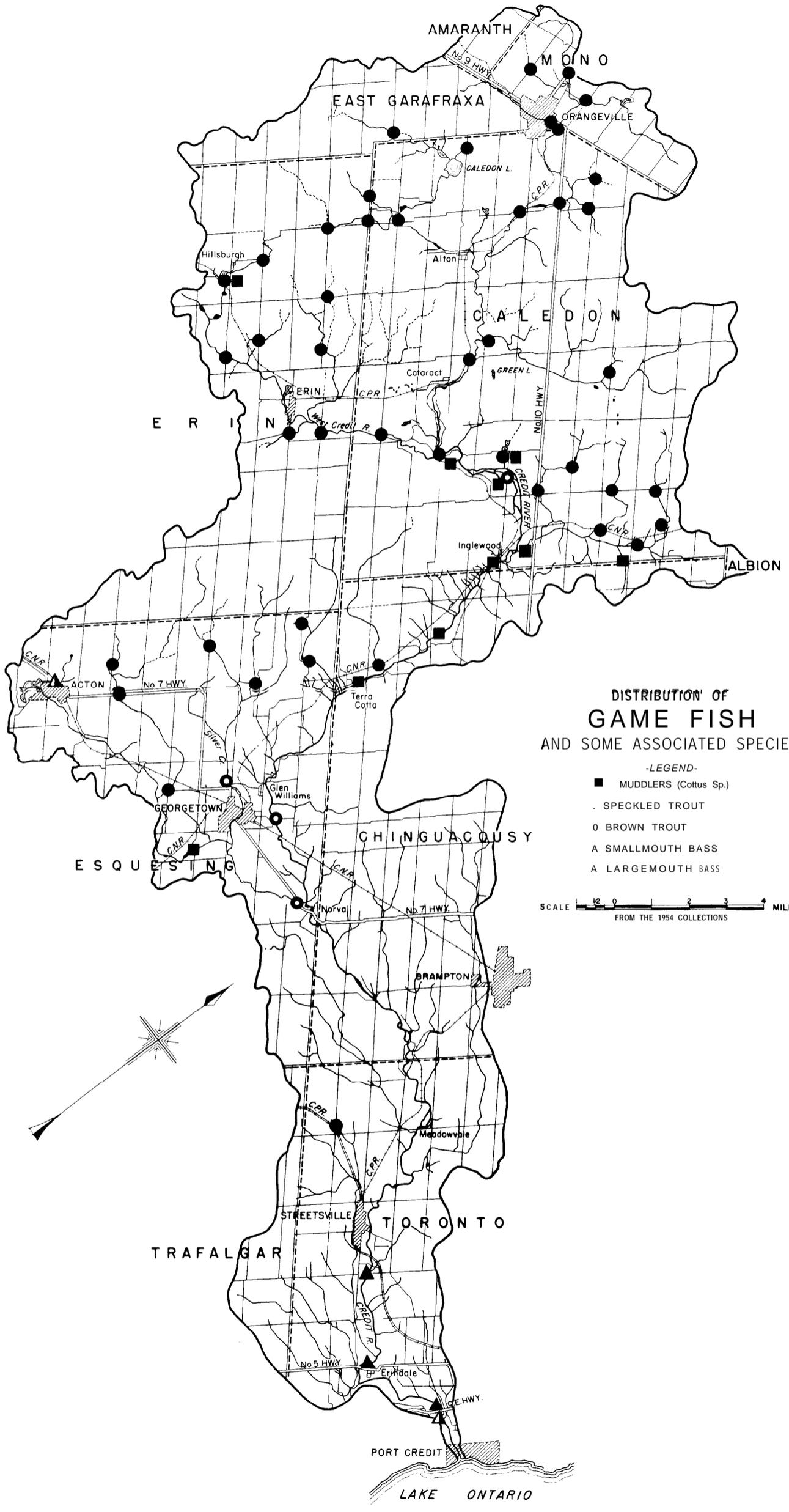


Blacknosed dace	<u>Rhinichthys atratulus</u> (Hermann)	72
Hornyheaded chub	<u>Nocomis biguttatus</u> (Kirtland)	5
*Creek chub	<u>Semotilus atromaculatus</u> (Mitchill)	85
Finescaled dace	<u>Pfritille neogaea</u> (Cope)	1
Redsided dace	<u>Clinostomus elongatus</u> (Kirtland)	12
Redbelly dace	<u>Chrosomus eos</u> Cope	14
Fathead minnow	<u>Pimephales promelas</u> Rafinesque	9
Bluntnose minnow	<u>Hyborhynchus notatus</u> Rafinesque) 18	18
Common shiner	<u>Notropis cornutus</u> Mit chill)	31
Rosy faced shiner	<u>Notropis rubellus</u> (Agassiz)	1
Blacknosed shiner	<u>Notropis heterolepis</u> Eigenmann and Eigenmann	10
Mimic shiner	<u>Notropis volucellus</u> (Cope)	1
<u>Catfish Family</u>	<u>Ameiuridae</u>	
*Brown bullhead	<u>Ameiurus nebulosus</u> (Le Sueur)	1
<u>Mudminnow Family</u>	<u>Umbridae</u>	
Mudminnow	<u>Umbra limi</u> (Kirtland)	5
<u>Pike Family</u>	<u>Esocidae</u>	
*Pike	<u>Esox lucius</u> Linn.	1
<u>Killifish Family</u>	<u>Cyprinodontidae</u>	
Banded killifish	<u>Fundulus diaphanus</u> (Le Sueur)	2
<u>Perch Family</u>	<u>Percidae</u>	
Log perch	<u>Percina caprodes</u> (Rafinesque)	1
Johnny darter	<u>Boleosoma nigrum</u> (Rafinesque)	15
Fantail darter	<u>Catnotus flabellaris</u> (Rafinesque)	13
Iowa darter	<u>Poecilichthys exilis</u> (Girard)	2
Rainbow darter	<u>Poecilichthys caeruleus</u> (Storer)	18
<u>Sunfish Family</u>	<u>Centrarchidae</u>	
*Smallmouth bass	<u>Micropterus dolomieu</u> Lacepede	3
*Largemouth bass	<u>Micropterus salmoides</u> (Lacepede)	1
Pumpkinseed	<u>Lepomis gibbosus</u> (Linn.)	4
*Rock bass	<u>Ambloplites rupestris</u> [Rafinesque]	15
<u>Sculpin Family</u>	<u>Cottidae</u>	
Slimy muddler	<u>Cottus cognatus</u> Richardson	1
Northern muddler	<u>Cottus bairdii</u> Girard	8
<u>Stickleback Family</u>	<u>Gasterosteidae</u>	
Brook stickleback	<u>Eucalia inconstans</u> (Kirtland)	38

(* Species of particular interest to anglers are starred.)

(The arrangement and terminology are those approved by Dr. W. B. Scott, Curator, Division of Ichthyology, Royal Ontario Museum of Zoology, Toronto.)

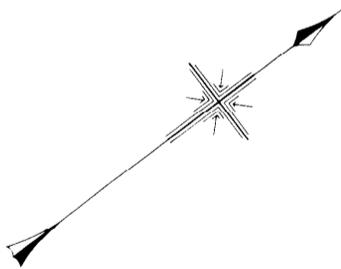
The distribution of the major game fish species and some others, based on the 1954 collections, is shown on the accompanying map. The map is, of course, not intended to provide an estimate of the relative numbers or of the locations



DISTRIBUTION OF
GAME FISH
 AND SOME ASSOCIATED SPECIES

- LEGEND-
- MUDDLERS (*Cottus* Sp.)
 - SPECKLED TROUT
 - BROWN TROUT
 - ▲ SMALLMOUTH BASS
 - ▲ LARGEMOUTH BASS

SCALE 0 1 2 3 4 MILES
 FROM THE 1954 COLLECTIONS



where fish of legal size will be found. Further collecting or angling would of course increase the known range of some of the species. There will also be one or two additional species. The smelt, for instance, no doubt enters the Credit River in spring. Brown trout are no doubt much more widely distributed in the central section of the main stream than is shown by the collections. Rainbow trout were noted only on a stocked pond on a tributary north of Georgetown.

Of the 161 stations where there was evidence of permanent flow, speckled trout were found at 45 stations, They were common in the permanent unpolluted tributaries from Georgetown north, but south of Georgetown were found in only one small stream near Streetsville. They were not found during the survey anywhere in the main stream below Credit Forks, although they should thrive in the river for at least two miles below this point, so far as summer temperature is concerned. The presence of predatory brown trout in this section, and the very heavy fishing pressure, might account in part for the fact that no speckled trout were found there during the survey. In this connection the distribution of sculpins (muddlers) is interesting. These are small fish which are commonly restricted to streams suitable for speckled trout. Of the nine stations at which sculpins were found, three lie on the main Credit below Credit Forks.

Pike were reported as common in Acton Pond, which was not examined during the survey, They were not observed in any of the streams during 1954, but probably occur in the warmer and more silted sections. As they are exceptionally active and alert, they are not very commonly collected in small minnow seines,

The largemouth bass which were noted at Acton are presumed to have been introduced there. Smallmouth bass were found only in the lower sections of the main stream. The brown bullhead or catfish is a common species in the main stream, from near Huttonsville to the mouth.

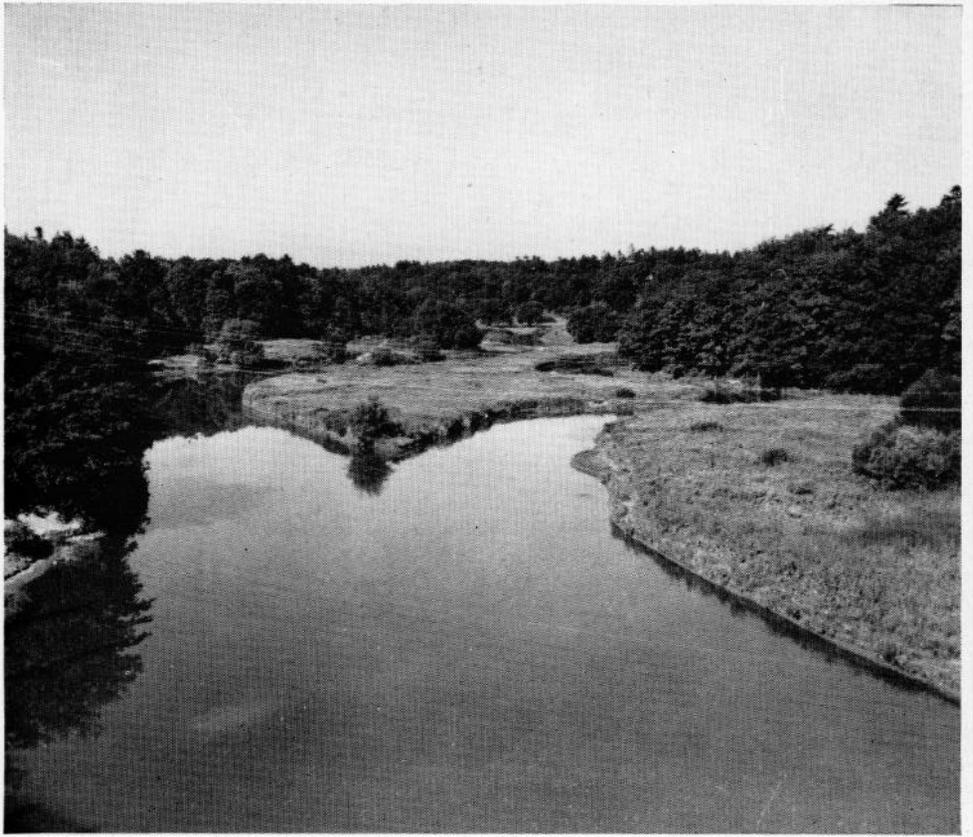
The common sucker was found in almost all of the streams except the coldest and the hog sticker was found only in the main stream below Credit Forks and in a tributary of Acton Creek. Creek chub probably have the widest distribution of all fish species in the river, and also appeared to be the commonest fish.

7. Pollution

Pollution of the Credit River is discussed in detail in the Water section of this report. However, as far as pollution concerns fish the heavily polluted areas are shown on the map "Biological Conditions of Streams". These include sections of tributaries below Orangeville, Acton and Georgetown, and on Black Creek from Alton almost down to its junction with the main Credit at Norval. All of these sections were once excellent trout streams. All are now spoiled for game fish.

The effluent of the Streetsville sewage treatment plant did not noticeably affect the river during the survey of 1954, so far as fish are concerned. Healthy small-mouth bass were present in the river near the McCarthy mill, just below Streetsville, as well as six other species of fish. The bottom fauna at this point appeared to be typical of relatively unpolluted streams. However, the growth of population and industries of Streetsville will increase the pollution problems below the town, particularly in winter, when the sludge freezes in the flotation beds. Apart from the public health aspects of the problem, the best indication of pollution is probably the presence or absence of certain sensitive plant and animal species, since these show what has happened to the stream over a long period of time while physical or chemical tests show only the condition of the water at the time of testing.

The silting of the Credit and its tributaries from operations at two gravel pits results in a great reduction



A. sluggish section of the Credit in the wide valley one mile above Port Credit. The small mouth bass is the chief game fish in this part of the river.



Here a tributary has high cut banks, although there is no stream in summer. The usual improvements to control bank erosion of this type would include smoothing the bank to an even slope and giving it a cover of Reed Canary Grass, or covering it with stones or boulders.

in the production of bottom fauna below them, and probably affects the suitability of the river for fish. Further details are given in the Pollution chapter of the Water section of this report.

It is recommended that the Conservation Authority:

- (a) Set up an Advisory Committee on Pollution -
- (b) Urge the enactment of legislation defining the terms of reference of the Pollution Control Board of Ontario and giving it adequate powers to enforce its decisions.
- (c) Urge the installation of a permit system for every new outlet, large or small, which leads into a watercourse.
- (d) Urge the setting up of a time limit within which all municipalities, industries and home owners who now pollute a stream or streams must adequately treat their industrial or other wastes.
- (e) Carry out an extensive educational program concerning pollution.

8. Stream Improvements

There are local reports that fishing success has declined in at least the Credit Forks area since thirty or forty years ago. The sizes of the larger speckled trout taken and the number of fish of legal size appear to be reduced. There is no statistical evidence of this because the fishing effort and the resultant catch have not been measured. The reports may also be untrue, because there are probably many more people fishing than formerly. Little is known concerning the present trend in the trout population, i.e., concerning the growth rate and survival of naturally spawned and introduced fish. Changes in the character of the river bed, in the effects of competition and predatory brown trout, and in the water temperatures, may have been the critical factors in different years, but fishing pressure may have had the greatest effect.

Growth Rates

The average lengths in inches for speckled trout in the Credit River ((near Credit Forks)) at different ages

have been measured as follows:*

Year Class	2	3	4
Length in inches	7.4	8.1	9.0
No. of fish examined	25	15	1

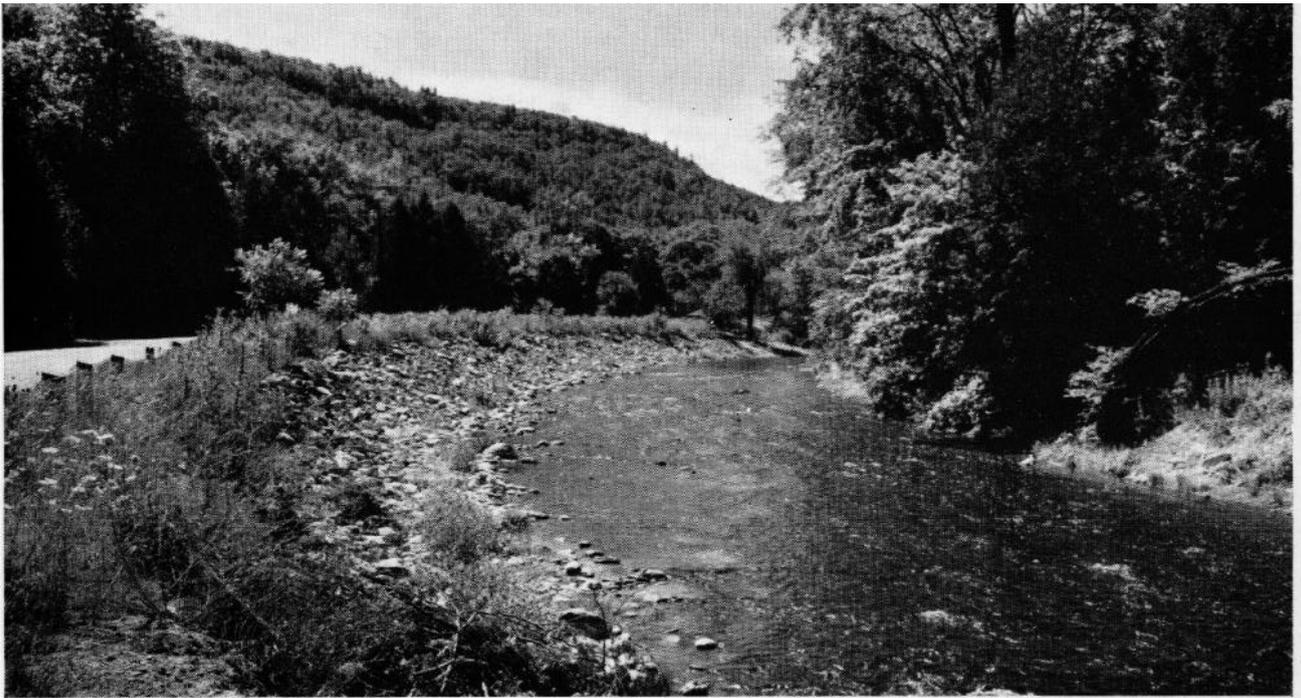
These growth rates compare favourably with growth rates from other Southern Ontario waters, but since only fish in the creel were examined, the slower-growing fish in the lowest age class may be missing from the sample.

The present survey was a reconnaissance survey only. Detailed plans of improvements of the many types of stream cannot therefore be included in this report. Many who fish the Credit think that all that is necessary to restore it to its former productivity is that more and more trout fingerlings or fry should be introduced into it. The known facts do not substantiate this theory. It seems more probable that improvement of the present habitat for fish will give better results.

In the absence of any well-ordered data concerning fish populations any recommendations for improvements are subject to error. The effects of the competition from other species, and of predation by brown trout 3rd the older speckled trout, are little understood. There are, however, certain obvious deficiencies in the habitat for trout in the watershed. Many of the tributaries now fall far short of the ideal in their amount of cover for trout. The main stream is in many areas short of good potholes, large boulders with eddies and submerged rocks. The amount of cover for fish as indicated by the presence of deep holes, logs, large boulders and weeds, was recorded during the survey as follows:-

Poor or none:	46%	of those stations examined where there was permanent flow
Fair	27%	ditto
Good	21%	"
Excellent	6%	"

* Ontario Department of Lands and Forests' Research Division data.



Poor fish cover, eroded banks and lack of shade, along the main Credit below Credit Forks. One advantage of this section of stream is that dry-fly casting is easy on this stretch of river.

This tributary of the Credit has alders on the banks, several deep holes and good fish cover both from logs and bank vegetation. This is an excellent trout stream in Erin Township.



Two examples of the kind of stream improvement which could be easily carried out on trout streams are shown on the accompanying maps. The stream shown in area "A1" is the main Credit near Credit Forks. It is very heavily fished but has almost no first-class trout cover. Improvements of this area are not simple, because the flow and gradient are such that the spring run-off has very great force.* The chief problem here is obviously the shallowness of the water. First-class trout streams should show a good percentage of deep pools. If the Conservation Authority wishes to produce a stream with a good distribution of pools and rapids, it might install a few low dams and deflectors of large boulders at the spots located on the map. If the boulders are not large and well keyed together they will certainly wash out during the spring floods. They would be subject to some movement in any very severe flood, but could be replaced in a few hours. There are probably ample at the site itself. When better control of run-off in the upper parts of the watershed is achieved by improved land use methods, any dams or deflectors will be less effective. The improvements numbered 3, 7 and 9 on the map appeared to be the most promising at the time the survey was made. There has been some movement of the smaller boulders since the survey.

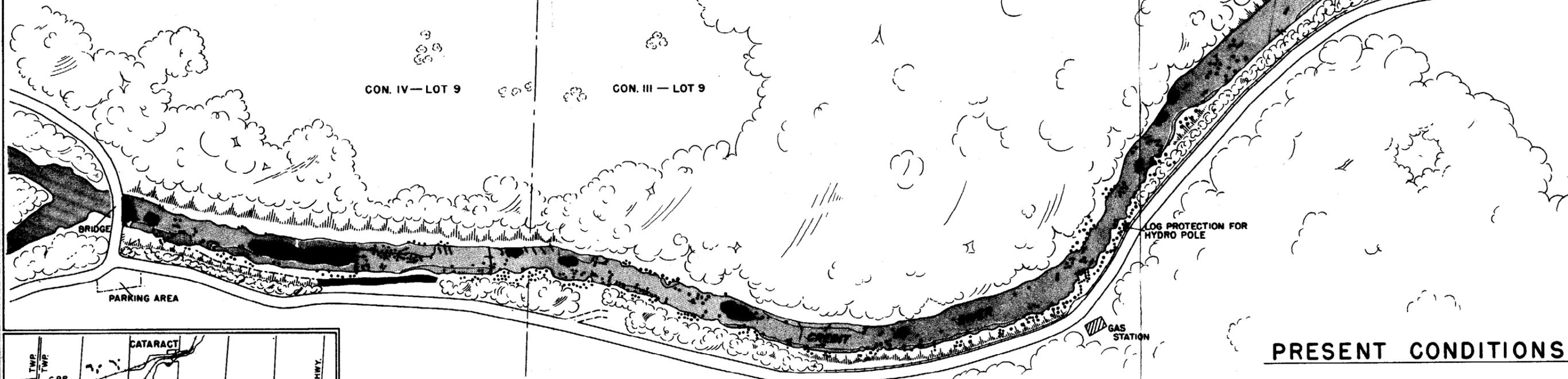
This area was selected because it lies in the proposed Credit Valley Conservation Area, and a large number of people would benefit from any improvements.

Examples of the type of stream improvement that can be easily carried out on a smaller trout stream are shown on another accompanying map, Area "B". At present this stream is cold but satisfactory for young speckled trout, although its temperature is such that it will not produce

* Maximum estimated flow 3,520 c.f.s. in March 1919.
Maximum annual estimated flow (average for 30 years)
1,200 c.f.s. (Figures based on the flow of the main
branch of the Credit at Cataract, with additional
allowance for the west branch which enters just above
the Forks,)

CALEDON TOWNSHIP

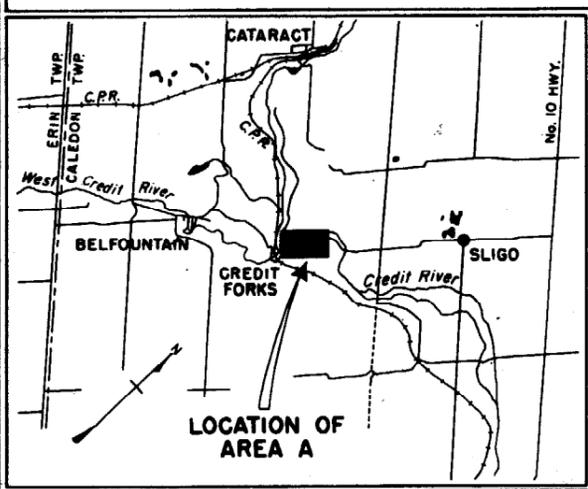
CON. IV — LOT 9 CON. III — LOT 9



PRESENT CONDITIONS

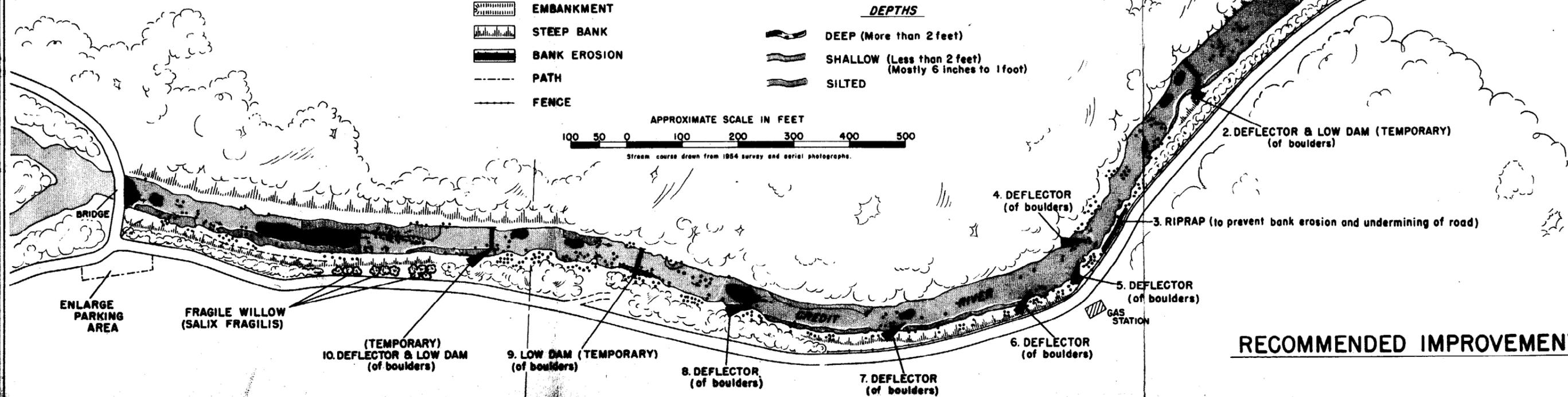
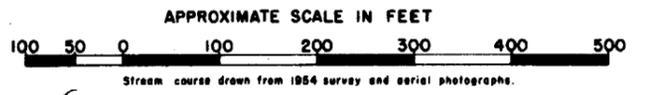
STREAM IMPROVEMENT PROJECT
AREA A
SHOWING

PRESENT CONDITIONS AND RECOMMENDED IMPROVEMENTS



— LEGEND —

- | <u>PRESENT CONDITIONS</u> | <u>RECOMMENDED IMPROVEMENTS</u> | |
|---------------------------|---|--|
| MIXED WOODLAND | DEFLECTOR | |
| LARGE ROCKS TO BOULDERS | LOW DAM | |
| LOG OR TREE IN STREAM | FRAGILE WILLOW (<i>Salix Fragilis</i>) | |
| EMBANKMENT | <u>DEPTHS</u> | |
| STEEP BANK | DEEP (More than 2 feet) | |
| BANK EROSION | SHALLOW (Less than 2 feet)
(Mostly 6 inches to 1 foot) | |
| PATH | SILTED | |
| FENCE | | |



RECOMMENDED IMPROVEMENTS

rapid growth in larger fish, It has various other faults such as bank erosion, lack of cover, lack of depth and the silting effect from cattle trampling. For those owners interested in making a productive and attractive stream the first requirement would be to fence the stream from cattle and to provide rubble or gravel at any cattle crossing (which would be fenced from the rest of the stream). It is good practice in such a case to keep the fence which crosses the stream on separate poles from the main fence at the crossing, as shown on the map, so that high water can only destroy a short section of fence!, Small low dams or deflectors will control bank erosion. It should be remembered that below about 55 ° the cooler the stream the slower the growth of trout will be - this applies both to the speckled trout and brown trout - and above 700 there will be a corresponding decline in trout growth rate. The Conservation Authority could greatly stimulate interest in stream improvement by sponsoring protection of a short stretch of stream course as a demonstration of what can be done, Either an easement must be arranged with the farmer concerned or, alternatively, the stream might be in part of a county or Authority forest,,

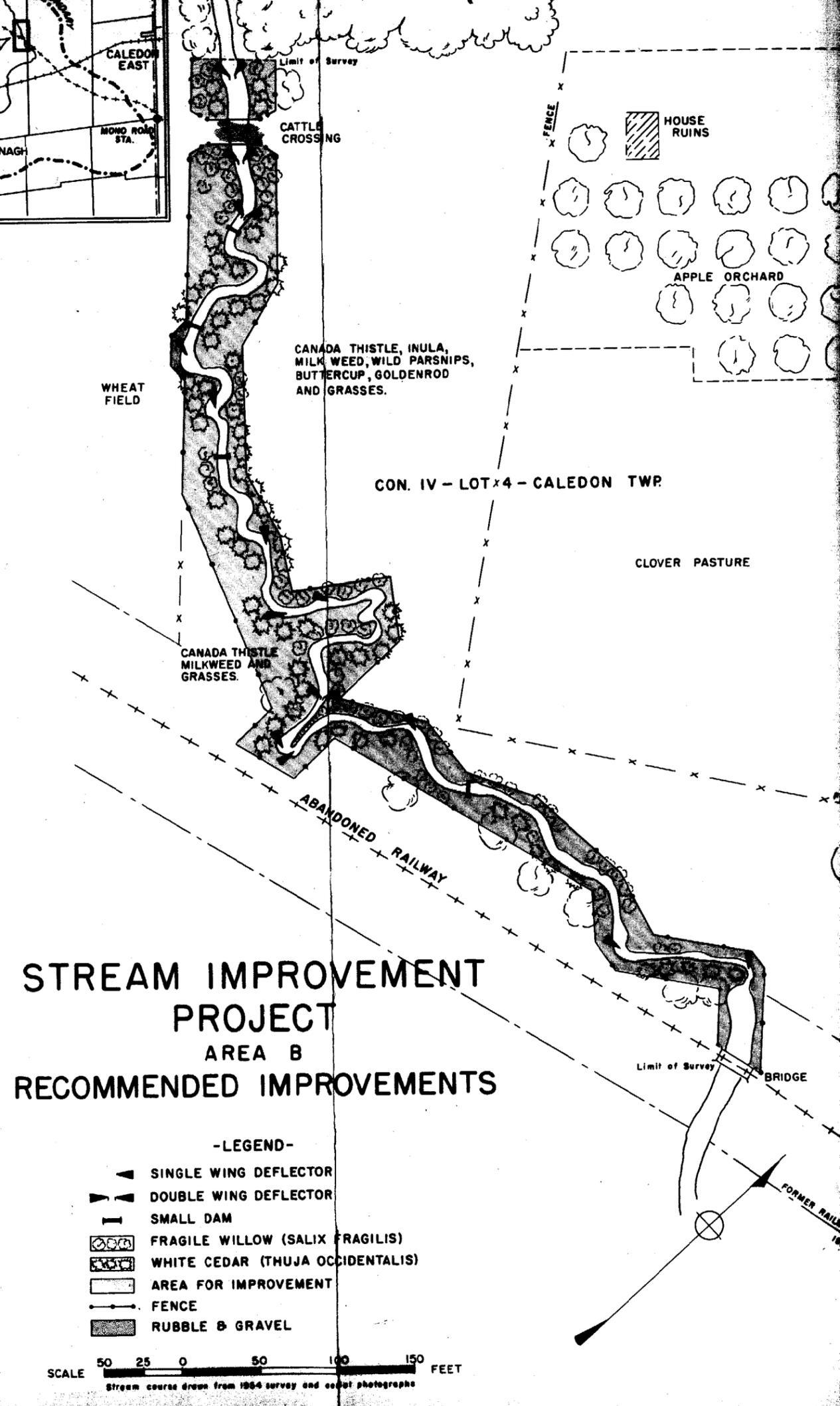
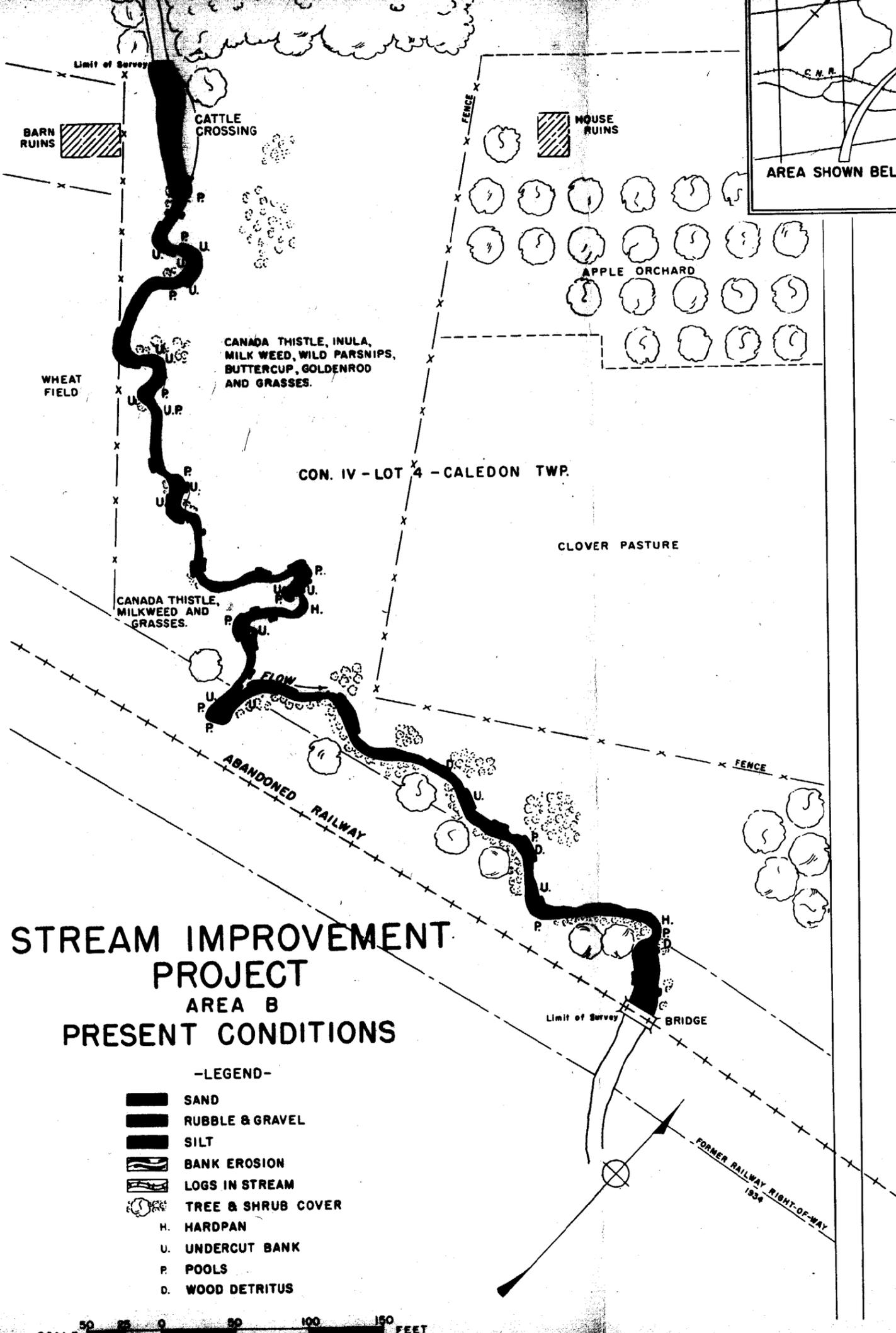
In the lower sections of the river the chief improvements needed are:

- (a) More complete treatment of sewage effluents at Streetsville.
- (b) Bank erosion control.

These measures may tend to increase the populations of game species such as smallmouth bass and to reduce such non-game species as carp and suckers.

9. Ownership

Of the 266 stations examined on the Credit, 21 were found to be posted against fishing, but many road crossings were not stations, and there were probably 60 or more crossings at which the waters were posted. This number is certainly





Field stone placed along the bank of the main Credit to prevent erosion, one and a half miles north of Inglewood.

An upstream small dam. Bank-cribbing to prevent erosion can be seen in the background, and there is fair fish cover.



rapidly increasing. Good trout water open to the public and within easy access from the large centres of population is rapidly becoming a rarity. Some governments, for example that of New York State, have already acquired stretches of first-class trout rivers so that they will not be lost to the general public. The Credit River, besides its fishing, has a great deal of spectacular scenery and its gorge also contains a very interesting flora. The Conservation Authority might therefore consider the possibility of urging the acquisition of at least one or more good stretches of the river and valley for the public. The area shown on the accompanying map "Stream Improvement, Project A", is particularly suitable for acquisition since it runs beside a good road.

10. Farm Fish Ponds

There is ample room for improvement of this type of fishing. The chief research on management of farm fish ponds has been carried on in southern and warmer climates, and therefore the findings cannot be applied without qualification to an area having the climate of Southern Ontario, but some definite recommendations may be made. Suitable methods for the construction of six types of farm pond are given in a bulletin, "Farm Ponds", which may be obtained from the Ontario Department of Agriculture,

From the fisherman's point of view, farm ponds are of two main kinds;

(a) Trout Ponds

The first is the cool pond with continuous inflowing water and maximum temperatures at the surface of about 75°Fahrenheit with cooler bottom. Ponds of this type are adapted to the production of speckled or brown trout. They are usually placed near the headwaters and may range in size from about an acre to 8 or 10 acres. Depth should be 10 feet or more in the deepest part. Spring flow of as low as half a cubic foot per second will maintain a pond of one acre.

The outlet of each dam should be a pipe (with a screened inlet at the bottom of the pond) rising close to the normal surface level and there passing through the dam, so that cold water is drained from the bottom and the warmed surface water is not allowed to flow over the dam. The surface water in the pond serves as an insulating layer, and the water below the pond has scarcely been heated by its passage through the pond. The pipe should be of such a size as to discharge the minimum summer flow, In flood time the additional flow would pour over the dam at a suitable outlet, or be carried around it by a grassed spillway,,

The by-pass type of pond has two particular advantages for the production of either speckled or brown trout. A pond of this class is built close to but not on a permanent stream and gets its name from the fact that the water supply is by-passed through a pipe from the stream to the pond. The first advantage is that there is no danger of the pond filling up with silt, because any excessive run-off goes down the permanent stream channel and not through the pond, The other advantage is that by controlling the amount of cold water entering the pond the temperature of the pond may be adjusted to give the maximum growth rate in the fish kept there.

However, trout ponds do not normally have spawning beds for trout and, therefore, must be managed on a put-and-take basis, i.e. stocked artificially.

(b) Warm-Water Ponds

The second and commoner type of farm pond is the warm-water pond. Most farms have at least one low spot suitable for a fish pond. It is frequently good practice to have separate ponds devoted to wildlife and fish and to control the aquatic plants in the fish pond.

In managing warm-water ponds for fish the following points should be kept in mind.

(1) A minimum depth of 15 feet over at least 25 per cent of the pond should be planned to avoid excessive winter kill, probably the critical factor in fish survival in farm ponds in Ontario.

(2) If suckers, carp or large numbers of minnows are already present in the pond, it is usually best to destroy all fish in the pond before stocking.

(3) It is often necessary to control existing aquatic vegetation. There are both mechanical and chemical methods available.*

(4) There have been few tests made in Ontario of the efficiency of applications of fertilizer in increasing the crop of plankton, the smaller aquatic invertebrates. The research now being carried out in this field may lead to application of fertilizers such as 8-8-4 becoming more general.

(5) Since many of the species commonly recommended for introduction grow very slowly in Ontario waters, research to determine the most satisfactory species will be needed, New ponds and those in which the previous fish have been destroyed might be stocked experimentally with a combination of large-mouth bass (Huro salmoides) and bluegills (Lepomis machrochirus) at the rate of 100 bass and 1,000 bluegills per acre, Fishing should be deferred until some of each species have spawned successfully.

The chances of success with these species would be greatest if the pond was situated within 5 to 10 miles of Lake Ontario, in the part of the watershed with a relatively mild climate.

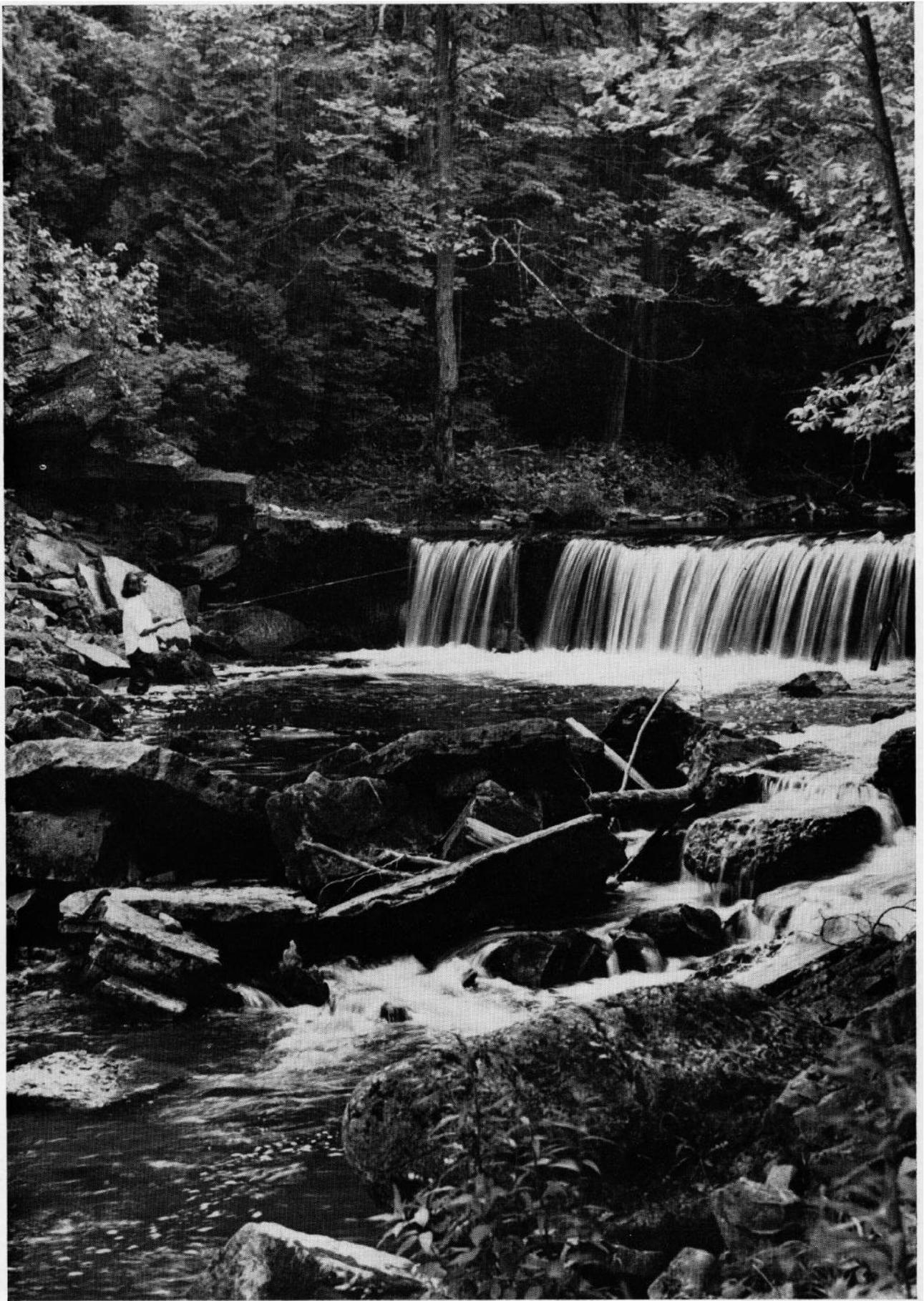
* Speirs, J. Murray. Summary of Literature on Aquatic Weed Control. Canadian Fish Culturist, 3: (4); August 1948.



An attractive pair of spring-fed artificial ponds were developed for speckled trout fishing



Dense aquatic vegetation in the shallows of Erin pond. If the stream here had a close succession of good pools and riffles there would be more game fish and more fishing



The west brunch of the river spills over a low dam and rushes downstream through a rugged boulder-strewn bed to its junction with the main stream at the Forks of the Credit about a half mile away.

CHAPTER 1

RECREATION PLANNING

There is an urgent and ever-increasing need for public recreation facilities on the Credit Watershed. The extent and design of existing developments is hopelessly inadequate to satisfy current requirements and prospective future demands. To cope with this undesirable situation a bold and positive recreation program for the Credit River must be commenced immediately. The manner in which people utilize their leisure hours profoundly influences the development of personal character, physical health and mental stability. The provision of public recreation facilities is recognized as a sound social investment in the human resources of an area. The Credit Valley Conservation Authority has a vital role to play in the program as indicated by the schemes outlined in subsequent chapters.

Comprehensive recreation planning in the Credit Valley necessitates the consideration of the particular combination of physical, social and economic factors which lie at the foundations of the need for the immediate increase in public parklands within the area. Some of the factors involved are peculiar to the watershed and its surrounding region, while others are manifestations of general social and cultural patterns applicable over far wider horizons.

The location of the watershed with respect to the major concentrations of urban population in south central Ontario is a feature of the greatest importance. The valley lies in close proximity to Metropolitan Toronto and Hamilton, the two largest centres of a belt of rapidly expanding and coalescing urban nuclei stretching from Oshawa to the Niagara Peninsula. Moreover the upper reaches of the Credit are readily accessible to the heavily populated industrial centres in the central part of the Grand River.

Approximately 38 per cent of the total population of Ontario reside within a 45-mile radius of the Forks of the Credit in the central section of the valley. While the province as a whole is currently showing an increase of about 3 per cent each year, much of the heavily populated urban area on the periphery of the watershed is growing at a rate of 5 per cent per annum. If present trends continue it is possible that in the next 25 years there will be 2,400,000 people living within the area encompassed by the aforementioned radius from the heart of the river basin. About 80 per cent of this total will likely be situated in Toronto, Hamilton and the inter-connecting lakefront plains. The plight of the larger urban centres, which are already in dire need of conveniently located regional parks beyond the confines of built-up areas, will be proportionately intensified unless positive action is taken to remedy conditions.

A new attitude, which is in many ways a reflection of the humanistic trends of the age, has developed towards the position and importance of recreation in the life of the individual. The constantly accelerating tempo of life is placing a severe strain on the health and stamina of the average person so that definite periods of rest, diversion and retreat have become essential. It is recognized that wholesome outdoor recreation conditions the mind and body for the more satisfactory attainment of the basic necessities of life. Shorter working hours, paid vacations and increased wages have provided the people with the leisure time and financial resources with which to enjoy a wide variety of activities.

A gradual rediscovery of the excellent recreation resources of many of the rivers and smaller lakes of Southern Ontario is now in progress. The Credit watershed is one area where the public is becoming increasingly aware of the superb recreation potential which was by-passed by

many in their enthusiasm for Northern Ontario and the shores of the Great Lakes.

While the public demand for recreation space is growing, certain developments within the area, which are sometimes themselves the result of the increased demand for recreation space, have noticeably curtailed the use of private lands as a supplement to publicly owned parks.

Some farmers are securely fencing their riverfront property and heavily posting it with "no trespassing" signs in an effort to exclude the host of Sunday motorists who now roam the countryside in search of places to picnic. Many farmers do not object to a few well-behaved and considerate people using their riverbank meadows. However, an invasion of twenty or thirty cars on a holiday afternoon, coupled with the irresponsible vandalism and slovenly picnic habits of some people who indiscriminately destroy trees and fences and leave the area strewn with bottles, paper and garbage, have forced many to close off their property to everybody,

The continued growth of summer cottages and country estates is also exercising a marked effect in this respect. These developments are naturally located in the more choice areas. These new forms of land use usually result in the strict enforcement of private property rights, It is no longer possible to have the dual use of the land which was often the case when the area was in pasture and woodland or simply lying idle.

If developments continue at the current rate and no provision is made for public use of riverfront areas the local residents of the rural townships in the northern sections of the watershed will find that they are cut off from the water. The farm population will suffer as well as the urban residents who visit the area on week-ends.

The privately owned lands in the valley flats on the outskirts of urban centres have often formed an

important recreation resource for the community. While they lay idle awaiting subdivision, or were put to a use which did not demand the rigid exclusion of the public, trespass was often permitted. Many of the villages and towns of the valley are now undergoing rapid expansion on their margins. They will soon find themselves surrounded by a solid wall of securely fenced private property, which prevents the population in the interior of the municipality from reaching the riverfront and shuts out the suburban residents who own homes behind the initial waterfront subdivision. The loss of these resources will be felt and in some cases the situation is already reaching serious proportions.

In a general manner the local and immediately accessible recreation resources of the densely settled Toronto-Hamilton area can be separated into four distinct groups on the basis of the four contrasting physiographic features of the region. There are the resources associated with the lakefront, those of the level plains to the rear of the shoreline, those found in the tumbled sandy hills of the interlobate moraine a few miles to the north, and finally those of the Niagara Escarpment. The Credit Watershed cuts diagonally across all of these groups and hence its recreation potential bears certain relationships to all four.

The waters and beaches of the Lake Ontario shoreline form an obvious unit in this fourfold grouping. In the case of the Credit Watershed, this resource offers little possibility of development. Most of the lakefront on either side of the mouth of the river is now subdivided and built upon. In addition the Dominion Government has begun operations to convert part of the area to a port. Moreover, most of the lakefront is bounded by cliffs and a narrow stony beach. The Long Branch Rifle Ranges just beyond the eastern boundary of the watershed appear to be, one of the most promising open areas that could be partially converted into a large parkland, if the Dominion Government should decide to vacate the property.

The choice multiple-use recreation lands of the relatively level plains to the rear of the lakefront are associated with the wooded slopes and flood plains of the deeply carved valleys which traverse them from north to south. Within the large urban centres close to the lakefront these valleys are closely hemmed in by a built-up area, which unfortunately in many instances has encroached upon them.

The proposed greenbelt of Metropolitan Toronto aims at the development of the lower sections of the Don and Humber Rivers. To the north beyond the cities and towns large sections of the valleys still lie among the more tranquil surroundings of the open countryside. In many instances these areas should be preserved for parklands.

The Credit River cuts across this plain in a deeply entrenched valley of imposing proportions and immense recreation potential. When compared with the Don and Humber there has been little development along its lower course with the exception of the village of Port Credit. However, there is little doubt that the overspill of rapidly expanding Metropolitan Toronto will shortly engulf large sections of the lower Credit Watershed for a considerable distance back from the present highway and lakefront subdivision. Actually the initial shocks of the future development have already hit the area, as is well known.

This lower section of the valley should be preserved as a greenbelt area for the urban development which will undoubtedly take place on either side. Moreover the flat valley floors are highly susceptible to periodic floods and hence entirely unsuitable for permanent buildings. When the Faulkner Marsh is completely filled and converted to parkland, Port Credit will possess a riverfront recreation area running from the Lakeshore Road to the C.N.R. tracks. The remainder of the valley in Toronto Township northward from the C.N.R. to the Dundas Highway should be

devoted to greenbelt uses. No future subdivisions involving riverfront areas should be permitted unless the valley lands are secured for public use. A positive program of parkland acquisition should be steadily carried forward in this area.

To the north the more desirable sections of the valley should be developed as Conservation Areas, a large part of which would be devoted to recreation purposes. Eventually these should be linked by a riverbank nature trail and public footpath,

The third group of recreation resources is found on a belt of tumbled hills (the interlobate moraine) lying to the north of the plains. A large part of the area abounds in springs and kettle lakes which often form the sources of the streams running southward across the level agricultural plains to Lake Ontario. Much of this area contains steeply sloping, droughty, erodable sandy soils of low agricultural capacity. In certain sections large patches of excessively bouldery soil are frequently encountered. Much of this hilly land should be devoted to reforestation and recreation uses. This physiographic feature, together with a part of the Niagara Escarpment; constitutes the essential core of the proposed "Outer Greenbelt" of Metropolitan Toronto.

In the Credit Valley this belt of rough land is confined to the north-east section of the watershed and tends to merge imperceptibly into a chain of hills flanking and overriding the Niagara Escarpment. Although built up in a different manner, these separate chains of hills bear such marked similarities of form that their separation is of little significance to recreation,

The presence of the Niagara Escarpment, running in a general north-south direction across the central section of the watershed, is a factor of great importance from the recreation standpoint. This escarpment,

containing the only really significant vertical topography in Southern Ontario, possesses immense recreation potential throughout its entire length. At the Forks of the Credit it embodies one of the finest natural playground areas to be found within a convenient distance of the densely populated areas to the south. In any general inventory of the recreation resources of the Credit Valley and the surrounding region this area occupies such an outstanding position that the thought of its establishment as a public park is inevitable,

In the Province of Ontario parks may be established under a number of different administrative bodies in order to serve the various needs of the people. These needs range from small roadside plots, with picnic tables to accommodate motorists, to the great parks of Northern Ontario covering many square miles of territory for the protection of the headwaters of rivers and wildlife.

The small parks with roadside tables, fireplaces, and in some cases, with accommodation for campers, are set up and maintained by the Department of Highways on land which was purchased in the acquisition of new rights-of-way .

Under The Community Centres Act, which is administered by the Department of Agriculture, small communities may erect Community Centres and lay out athletic fields with parks to fill the requirements of rural areas.

Large municipalities may establish parks within or without their own boundaries under either The Municipal Act or The Public Parks Act. These are the usual type of city or town parks which may be used solely for park purposes or embody municipal services such as waterworks or sewage disposal plants,

Certain special parks such as the Niagara Parks and the St. Lawrence Parks are administered by commissions responsible to the Lieutenant-Governor-in-Council.

Provincial Parks such as Algonquin and Quetico Parks, which usually fill a number of roles such as watershed control, wildlife preserves, tourist areas for canoeing, fishing, trailer parking and sometimes for summer cottages, are administered by the Department of Lands and Forests.

Under The Conservation Authorities Act, s.15(gg)

"For the purpose of carrying out a scheme an authority shall have power...to acquire lands with the approval of the Minister, and to use lands acquired in connection with a scheme, for recreation purposes and to erect, or permit to be erected, buildings, booths and facilities for such purposes and to make charges for admission thereto and the use thereof."

Several Authorities, notably the Grand and Thames, have established recreation areas as a part of a conservation scheme which have proved to be a great benefit to the people of the area, It should also be remembered that recreation developments offer the Conservation Authority a valuable medium of publicity. For many people the recreation schemes proposed in this report when established will be the first personal contact they will have with the work of the Authority,

From the above resume of park establishment and management in Ontario it might appear at first glance that there is an overlapping of services in this regard. However, an examination of the Acts indicates that each type of park serves a special need and is administered by the Department, Municipality or other group most closely concerned with that need.

An interesting comparison can be made between the need for development of recreational facilities in Southern Ontario and the work of the National Trust of England regarding a similar problem.

The objectives in England were -

1. To protect and, if necessary, to acquire for the public some of the finest structures (e.g., town and country houses, mills, bridges, barns, cottages and even streets).

2. To protect fine panoramas, whole stretches of countryside, bodies of water, pieces of coastline and certain mountains for public use.

3. To protect or acquire areas of special interest because of the rarity or diversity of the geology, fauna or flora.

The chief emphasis of this movement when it began was placed on country houses. A few interested individuals founded the National Trust in 1895 and incorporated it as a non-profit company. The original objective was to arouse public interest. There was a successful appeal for funds in 1901, and in 1907 the National Trust was incorporated by Act of Parliament. The Trust now owns many historic buildings and almost 150,000 acres of land. It accepts areas varying from less than half an acre to 10 square miles. It owns numerous large houses and protects by restricted covenant many others. The Trust is not financed by the British Government but by private donations. The Trust now accepts only estates which are self-supporting, or gifts of structures or land which must be adequately endowed.

This interesting development in England is included in this report to indicate that areas in Ontario similar to those acquired by the National Trust may be retained for public use by means other than large contributions from the Government or the Authority concerned. There are owners of land in Ontario who would be willing to bequeath part or all of their land, or buildings of historic interest, to a public body or to covenant with such a body so that land might be worked but still made use of by the public. There is no reason why such properties should not be thus bequeathed to Conservation Authorities who could provide continuity of control, technical supervision and adequate maintenance.

CHAPTER 2

*THE CREDIT FORKS

MULTIPLE-USE CONSERVATION AREA

This chapter, which advocates the immediate establishment of a 5,163-acre multiple-use Conservation Area at the Forks of the Credit River, contains the major recommendation of the Recreation section of the report. While other aspects of the program discussed in the succeeding chapters are of importance, they are admittedly dwarfed before the magnitude of this project, which would constitute one of the most significant recreation developments undertaken in this province within the last half century.

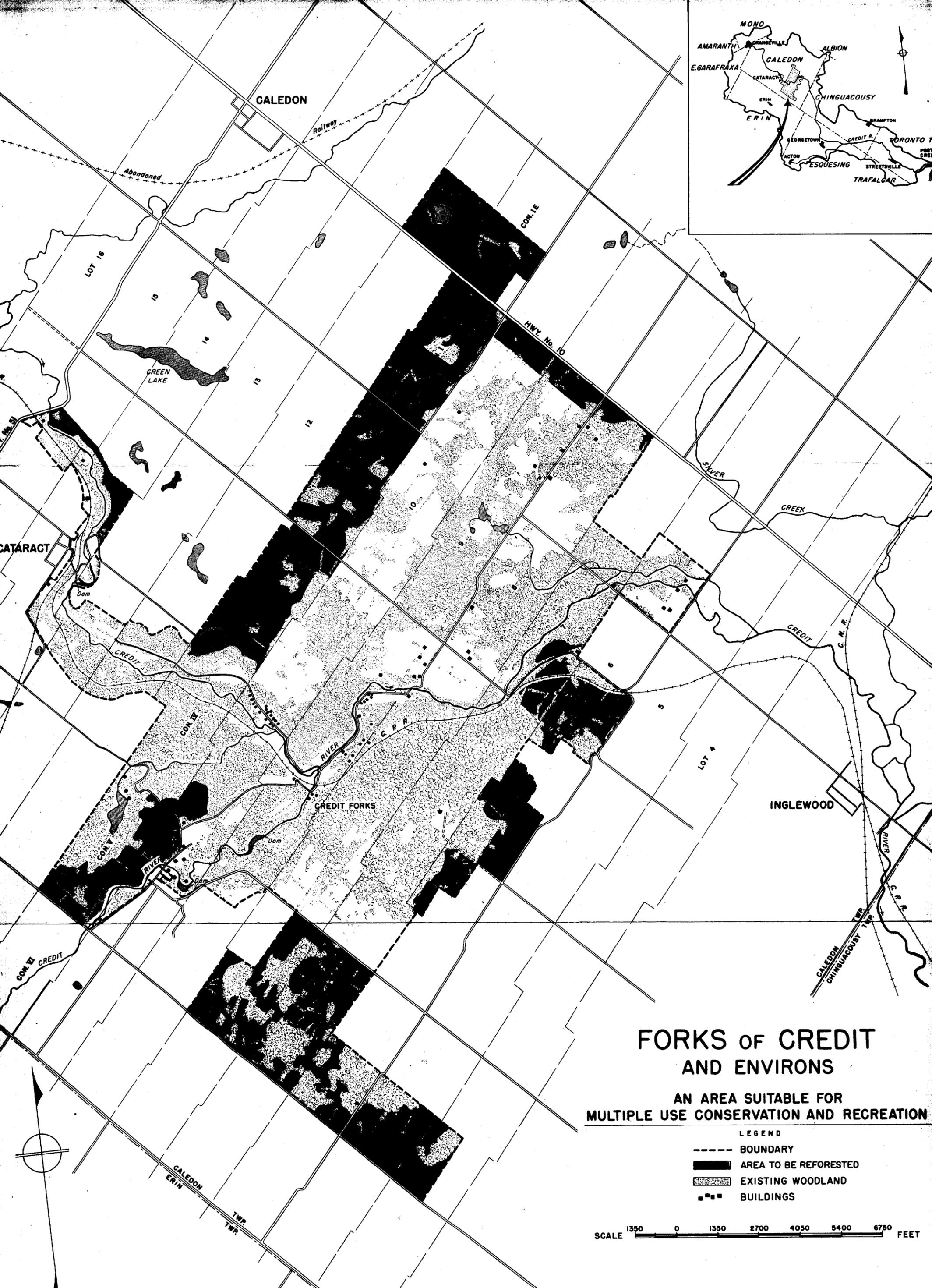
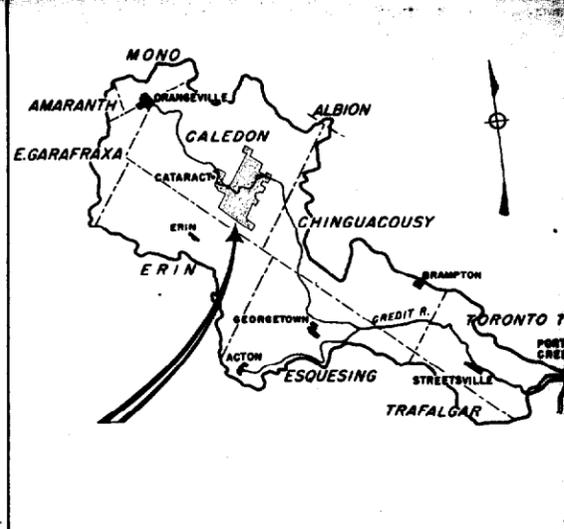
The convenient location, topographic configuration, aquatic resources and suitable forest cover have combined to characterize this scenic landscape as one of the finest potential parklands adjacent to the densely populated parts of South Central Ontario. No other area in the entire region is so ideally suited to a development of this nature.

1. Central Regional Location

Approximately 1,860,000 people or about 38 per cent of the total population of Ontario reside within a 45-mile radius of the Forks of the Credit River. About 85 per cent of these people live in densely populated urban areas and are desperately in need of conveniently located and spaciouly designed regional parks in the open countryside.

The approximate road distances from selected urban centres surrounding the heart of this development are presented in the following table.

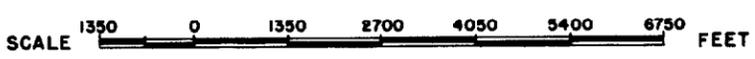
* The studies on which these recommendations are based were made before the recent revision of The Public Parks Act, and before the establishment of a new Division of Parks in the Provincial Department of Lands and Forests. The findings of this chapter, however, appear to be strengthened by the changes mentioned above.



FORKS OF CREDIT AND ENVIRONS

AN AREA SUITABLE FOR
MULTIPLE USE CONSERVATION AND RECREATION

- LEGEND
- BOUNDARY
 - AREA TO BE REFORESTED
 - ▨ EXISTING WOODLAND
 - BUILDINGS



Distances to the Park from Selected Urban Centres

<u>Urban Centre</u>	<u>Population</u>	<u>Distance</u>
Brampton	11 ,165	17.5
Guelph	30,950	26.0
Hamilton	222,902	56.0
Kitchener-Waterloo	69,695	42.0
Orangeville	3,564	12.0
Port Credit	5,129	30.5
Metropolitan Toronto	1,250,773	50.0

No Provincial Park is so centrally located with respect to the main axis of Ontario' urban population as this recreation area would be. Rondeau Park and Ipperwash Park have about 4 per cent and 8 per cent respectively of the total population of the Province within a 50-mile radius of their nuclei. Algonquin Park has only 8 per cent of the provincial population within a 100-mile radius of the administrative centre of the park, and hence this area is too far distant from the main population concentrations to be useful for day trips. Nevertheless the aforementioned parks certainly perform an important function in the overall recreation pattern of the Province.

In addition it should be noted that part of this park would front a two-mile stretch of Highway No. 10 south of Caledon. Hence it would certainly be utilized by American tourists in their annual trek to the Ontario Northland. It could serve them as an overnight rest point or as a brief luncheon stop-off.

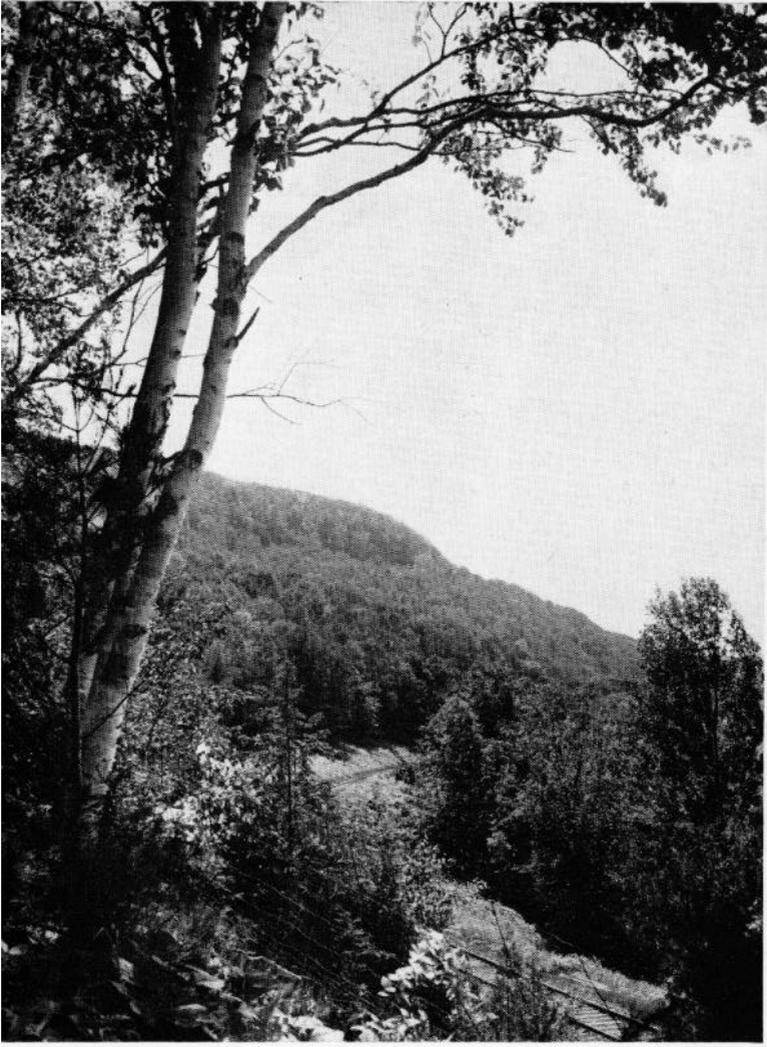
2. Topography and Geology

The area within this proposed development may be separated into three distinct topographic divisions, namely, the face of the Niagara Escarpment which could be considered to form the spinal cord of the park, the bouldery and hummocky lands in the north and west, and finally the rolling to level plains stretching south and east from the base of the escarpment

to Highway No. 10. This pleasing variety and sharp contrast of topographic form enhances the scenic qualities of the landscape and provides the basic foundation necessary for the diversity of recreation activities required in a regional park of this nature.

The 200-foot Niagara Escarpment is undoubtedly the most striking feature of the terrain. The relatively horizontal bedrock formations of Southern Ontario provide little variation in the vertical configuration of the southern part of the province with the sole exception of the linear belt of the Niagara Escarpment stretching from the Niagara River to Tobermory. Ideally suited to the development of a north-south scenic drive and parkway through the central part of Southern Ontario and the establishment of a chain of regional parks at selected points, this escarpment embodies one of the greatest recreation assets of the southern part of the province and the only one of its type. No medial points along the entire length of the 250-mile ridge can rival the area about the Forks of the Credit for scenic quality, potential diversity of recreation development and ready accessibility for such a large proportion of Ontario's population,

Here a large and well-marked triangular V-shaped valley has been deeply carved in the limestone-capped escarpment by the torrential meltwaters of the glacial epoch and the subsequent erosion of the east and west branches of the Credit River. At the Forks and its immediate environs the steep and heavily wooded face of the escarpment provides some of the most imposing scenery of its kind to be found anywhere in Southern Ontario and has long been the object of acclaim by artists and naturalists. To the east of the Forks, the face of the northern wing of the valley, running roughly in an east-west direction, has been partially masked by a deposit of bouldery and hummocky glacial till which has obliterated the sheer front of the cliffs. Due to the deforested nature of the slopes, from atop this ridge



The well wooded cliffs of the escarpment at the Forks of the Credit are an imposing feature of this parkland.

Below the falls at Cataract the waters of the Credit River speed turbulently downstream through an unevenly graded boulder-strewn bed entrenched in a well wooded steep-sided valley of great natural beauty.



there is a superb view of the landscape to the south, east and west. On a clear day the skyline of Toronto, 50 miles distant, is clearly visible. The bowed southern wing of the valley preserves its sheer walls for some distance, but in the southern section of the park, where the hard limestone cap rock has been eroded away and the red shales exposed at the surface, the steepness subsides and a relatively easy ascent of the escarpment is possible. From this relatively deforested vantage point superb views can again be obtained to the south and east. The steep slopes of both the northern and southern wings of this re-entrant are ideally suited to hiking, riding and skiing.

The deeply carved valleys of the east and west branches of the Credit River above the Forks offer some excellent exposures of large sections of the underlying bedrock, At Cataract the massive dull gray formation of Silurian limestone, which forms the hard rock cap of the escarpment, has been completely cut through by the river and its point of contact with the red sandstones and shales of the Rochester formation is clearly visible for a considerable distance. This location, in addition to its scenic beauty, is of considerable scientific interest and is frequently visited by professional geologists, students and amateur naturalists engaged in a study of the geological pattern of the region.

Above the escarpment the park extends to the west through an area of extremely rough terrain embracing a tumbled mass of bouldery hillocks interspersed with poorly drained hollows. Suitable only for forest growth and now largely in need of reforestation, this area has been included within the proposed park since it provides excellent hiking land and a superb buffer area for the main core of the development. In a reforested state its recreation potential would be greatly enhanced in future years,

Below the face of the escarpment the park contains two distinct topographic forms, Stretching immediately southward from the northern limb of the valley and extending as far as

the flood plain of the Credit River, there is an area of well drained rolling upland containing a pleasing variety of attractive hardwood bush and open fields. The remainder of the park is composed of wooded river flats and open meadows of exceptional recreation value. In this section occasional poorly drained and swampy pockets of land are encountered.

3. Woodland Cover

Approximately 3,300 acres or 64 per cent of the total area of the park is woodland and the particular characteristics of this sylvan pattern greatly improve the quality of the site,

The tree cover fortunately occurs in a continuous and tenuous mass which reaches to most sections of the park and encloses open valley flats and hillsides of sufficient size and strategic location to create a true impression of variety and spaciousness. Developments in the various pockets of open land would be adequately screened on all sides by broad belts of trees and thus the parkland environment would be thoroughly maintained at all times. It is possible to move in any direction from the Forks of the Credit through a woodland atmosphere which preserves that quality of seclusion and remoteness which is a necessary feature of a development of this nature.

As can be seen from the accompanying table of forest cover types, there is sufficient variety in the composition to provide frequent and pleasing contrasts to the eye and considerable general interest for the naturalist.

Hardwood species, comprising 82 per cent of the woodland acreage, form the dominant component of the tree cover. Sugar maple, either in pure stands or in association with beech, is the dominant deciduous tree of the well-drained upland sites and amounts to over half the area of broad-leaved species. Black ash, white elm and red maple occupy about 460 acres of the more low-lying and poorly-drained locations.

Aspen poplar is common throughout the area and is associated with a variety of drainage conditions. Conifers, dominating many sections of the valley floors and the depressed areas of the rolling plains to the south and east of the escarpment face, cover about 600 acres. White cedar entirely dominates the softwood group, with only 12 acres of tamarack being present. Unfortunately, white pine is scarce in the area,

Forest Cover Types

<u>TYPE</u>	<u>Acreage</u>	<u>Percentage of Total</u>
Aspen Poplar	630	19.0
Birch	46	1.4
White Pine, Hemlock	15	.4
Sugar Maple, Beech, Yellow Birch	10	.3
Sugar Maple, Basswood	81	2.5
Sugar Maple	641	19.4
Yellow Birch	58	1.8
Balsam Fir	6	.2
White Cedar	579	17.5
Tamarack	12	.4
Black Ash, White Elm, Red Maple	370	11.2
Beech, Sugar Maple	765	23.1
White Elm	91	2.8
	<hr/>	<hr/>
Total	3,304	100.0

The variety of species greatly enhances the scenic qualities of the landscape. The profuse display of colour encountered every autumn in the vicinity of the Forks of the Credit annually attracts thousands to the area. The fiery red, orange and yellow blaze of the deciduous trees, sharply contrasting with isolated gleaming birch trunks and the sombre green hues of the adjacent conifer stands, is set forth on an imposing framework of rugged gray limestone cliffs and crumbling red sandstones interwoven with sparkling streams and picturesque waterfalls. Here nature presents one of the finest spectacles in all of South Central Ontario,

The woodlands of this area were heavily cut through from 1870 to 1890 and no stands of virgin timber remain. Approximately 30 per cent of the cover is composed of trees from 10 to 18 inches in diameter and the majority of these are hardwoods. About 65 per cent of the woodland is composed of trees 4 to 10 inches in diameter and the bulk of the conifers falls into this class. A little less than 5 per cent is made up of small trees under 4 inches in diameter and less than 1 per cent is hardwood over 18 inches. There are about 175 acres of small conifers in reforestation plots scattered throughout the area,

In spite of the absence of really large trees, the woodland is ideally suited to recreation uses. The majority of the trees are of satisfactory size and form for shade purposes and with proper forest management should develop into a dense stand of excellent hardwoods in the ensuing years.

4. Aquatic Resources

The park contains ten lakes and ponds varying from one to ten acres in extent in addition to approximately eight miles of beautiful river frontage along the Credit River and its west branch, including the falls of Belfountain and Cataract. There are several miles of small tributary streams through various sections of the park and the face of the escarpment abounds in springs. The rough hills at the base of the northern wing of the valley possess a considerable artesian water supply as evidenced by the borings on the property of the Caledon Mountain Trout Club.

Fortunately, from the recreation point of view? the eight miles of river frontage is associated with two sharply contrasting valley formations. This lends scenic variety to the landscape and permits of an essential diversity of activities,

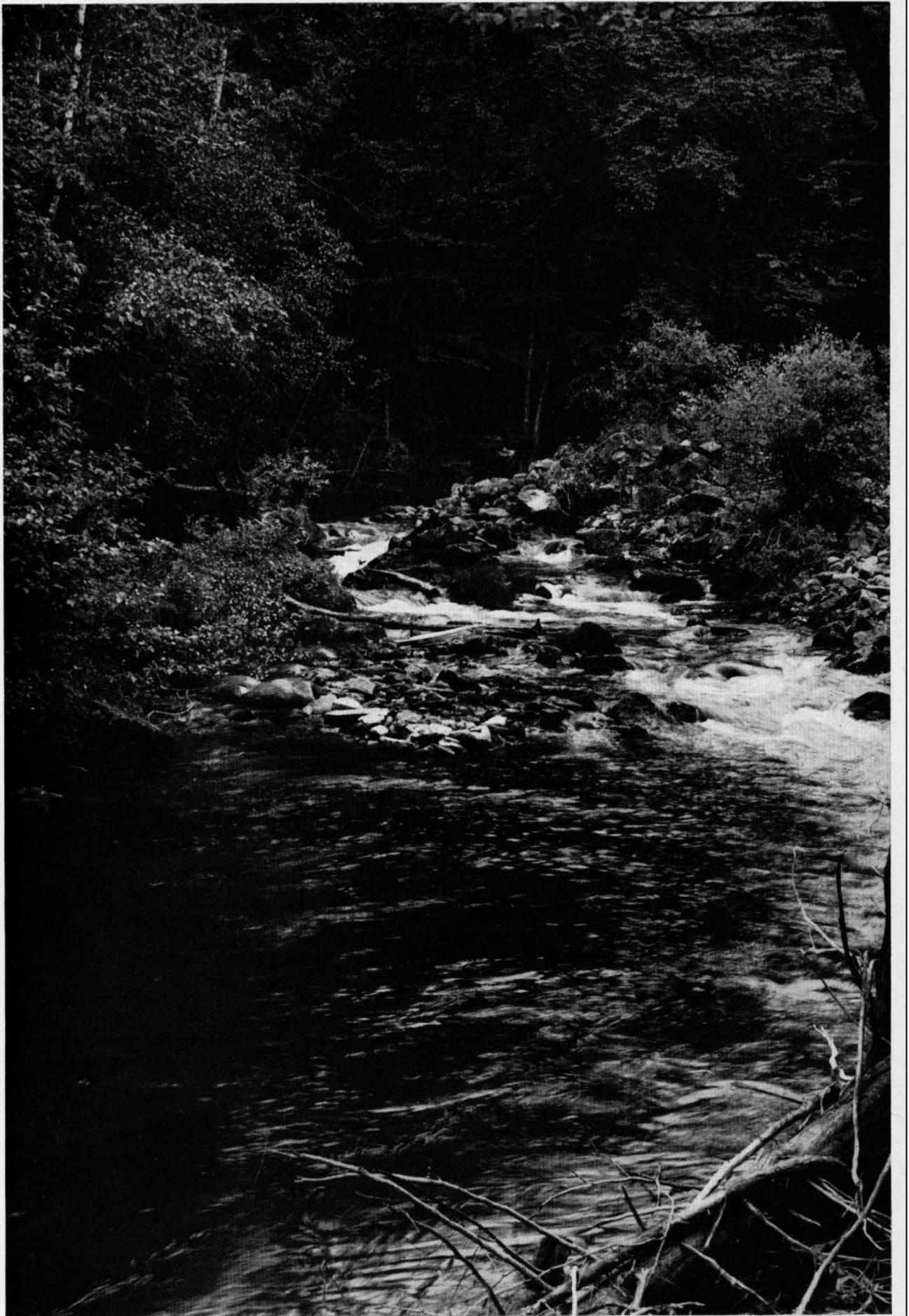
Above the Forks of the Credit the main river and its west tributary have carved deep and steep-sided gorges through the overlying gray limestone, often exposing the red

shales beneath. The 200- to 300-foot valley walls, which vary from sheer unscalable rock cliffs of imposing structure to more accessible but still steeply sloping gravel terraces, are densely covered with aspen poplar and white cedar. In this section the river, approximately 20 feet wide and one to two feet in depth, flows fairly rapidly over a rough bouldery and gravelly bed, frequently producing picturesque miniature rapids. Pure and cold springs emerge from the walls of the valley in many places.

Within the park area the river drops over the rugged rock face of the escarpment in two picturesque waterfalls. At Cataract, where the remains of the former hydro plant are still standing, the sparkling waters of the main Credit River tumble 30 feet from an overhanging limestone ledge into the beds of red shale in the valley below and speed turbulently downstream through a boulder-strewn and unevenly graded bed. At Belfountain the west branch of the river spills over a limestone ledge and boulder dam in a light curtain of foam approximately 30 feet in height. The two falls, which are among the best of any along the entire length of the escarpment with the exception of the incomparable Niagara cataract, add beauty and variety to the landscape,

These more rugged sections of the river valley are ideally suited to hiking and camping due to their more isolated situation. Large playing fields necessary for-group picnics cannot be developed due to the paucity of level terrain,

Below the escarpment the Credit winds its way through wooded plains and gently sloping valleys in a sinuous and oftentimes braided course. The stream remains about the same width and depth, but the rough bouldery bottom is largely replaced by a bed of smaller stones and pebbles frequently overlain with bars of sand and silt. The bold, rugged aspect of the former reaches gives way to a more tranquil rural atmosphere, well wooded throughout its course in this section and satisfactorily interspersed with open meadows, these riverbanks are ideally suited to family and institutional picnics.



Flowing through a well wooded valley which is deeply entrenched below the level of the surrounding landscape, the west branch of the Credit River between Belfountain and the Forks presents many secluded reaches where trout lurk in the shaded pools.

Within the area the waters of the Credit are clear and unpolluted. Generally speaking, however, the stream is of insufficient depth for satisfactory swimming. This handicap could be easily overcome by the construction of weirs, by-pass ponds or the artificial deepening of certain sections of the channel.

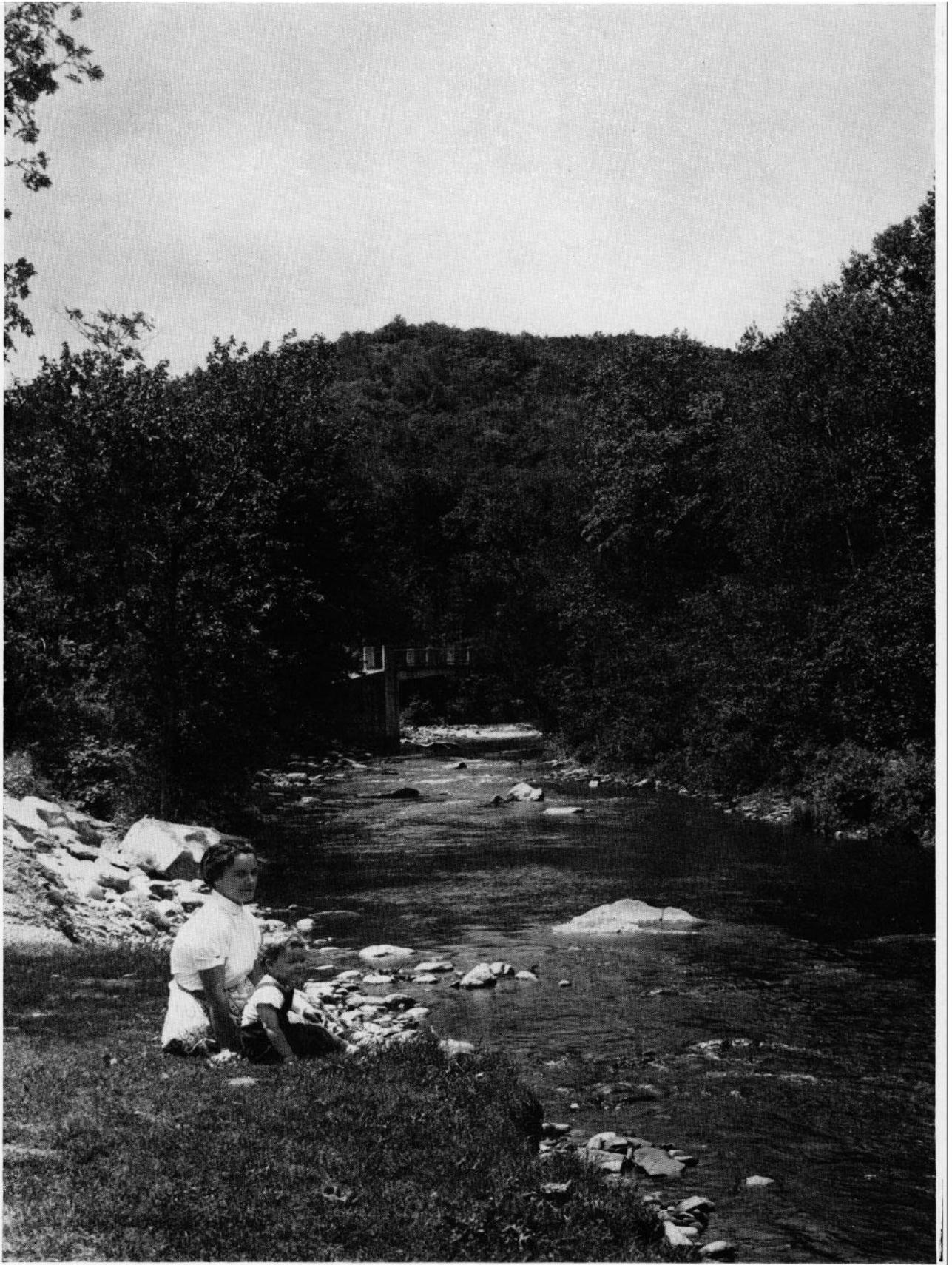
As stated, there are ten small lakes and ponds within the area. Some are relatively shallow, small in area and almost entirely lacking in marginal shade trees. Many could be readily improved for recreation purposes at a reasonable expense. Dufferin Lake, approximately nine acres in extent and surrounded by a dense woodland of yellow birch, cedar and hemlock, is one of the finest aquatic resources of the proposed Conservation Area. The clear, warm and deep waters provide good swimming but the swampy margins of some sections of the lake necessitate the use of a dock leading into deep water and hence the area is dangerous for non-swimmers.

The Caledon Mountain Trout Club contains several beautiful trout ponds covering a total area of about 10 acres. The ponds are fed by springs and artesian wells bored into the rolling hills flanking the northern limb of the valley and hence the waters are relatively cold at all times.

5. Wildlife

Due to the dense woodland cover, the abundance of clear cool water and the relatively inaccessible nature of certain sections, the area contains a considerable variety of wild fauna.

From the point of view of temperature and purity the water of the main streams is suitable for speckled trout, and hundreds of people fish the river annually with limited success. Unfortunately, the shallowness of the water provides insufficient cover for trout over a very large part of the course of the river. A deepening of certain sections of the stream would undoubtedly improve the habitat. The ponds of Caledon



There are many ideal picnic sites along the banks of the Credit River immediately below the Forks of the river.

Mountain Trout Club naturally contain an abundance of fish. Dufferin Lake also offers good fishing.

Deer are plentiful and there is a goodly representation of all the typical small mammals of the region. The bird life is sufficiently varied and plentiful to satisfy the demand of the ornithologists. In the summer of 1953 two Golden Eagles, a rare bird in this region, were observed at the Credit Forks. The species probably nests along the sheer cliffs of the escarpment.

6. Present Land Use

There are four distinct existing and potentially expandible forms of private land use within the area, namely, agriculture, gravel extraction and quarrying, permanent residential homes and recreation of several types. Each of these forms of land use presents certain problems in the acquisition of the area as a public parkland or in the preservation of the superb natural recreation potential of the locality.

Approximately 1,800 acres or 35 per cent of the area is currently devoted to agricultural uses. However, only one-third of this is cultivated land; the remainder consists of rough unimproved pasture of low carrying capacity, of which at least half should be devoted to reforestation purposes. Less than 500 acres of really good agricultural land would be retired from production by this development and the majority of this lies in scattered patches which could not be satisfactorily combined into economic farm units. Only two first-class farms, which are engulfed by surrounding bush and hill lands, have been included in the Conservation Area. Hence no large area of high-class agricultural land will be taken out of production by this scheme.

The Lockport limestone cap of the escarpment has been quarried in some sections. In 1954 some stone was being removed from a small quarry close to the east boundary of Lot 6,

on Concession IV West, Caledon Township. Fortunately, up to the present time quarrying in this area has not destroyed the intrinsic build of the landscape nor seriously marred its natural beauty. However, if really extensive operations were undertaken here the scenic quality of the landscape could be seriously impaired if not utterly destroyed. There are abundant supplies of limestone for building purposes or cement manufacturing to the rear of the escarpment from the Niagara River to Tobermory, Therefore the prohibition of quarrying in this park should not present any serious handicap to industry.

The old glacial terraces along the valley walls of the Credit River above the Forks and the rugged hillsides abutting the northern limb of the valley in the escarpment contain a considerable supply of sand and gravel. On the southeast corner of the junction of Highway No. 51 with the Credit River, the valley slope has been ripped open for gravel and considerable quantities have been removed. There were no other such operations within the proposed area during the summer of 1954.

Extensive sand and gravel extraction along the river terraces and the escarpment slopes within this area will result in the utter destruction of the irreplaceable scenic beauty. Unless pollution controls were rigidly enforced, the clear waters and clean riverbeds would be choked with an unsightly mass of sand and silt from the washings and tailings and the natural habitat for trout would be completely destroyed, Admittedly the pollution aspect can be controlled, but the wholesale stripping of forest cover and the ugly scars which would remain along the torn-up terraces and hillsides would destroy the unique recreation value of the area.

Sand and gravel are certainly required for construction purposes. The increased pace of building in the surrounding areas has undoubtedly strained supplies in some quarters. The immense volume of material required for various aspects of the St. Lawrence Seaway Development could have an impact on

the supplies of this area. Either directly or indirectly the price of extraction at this site is the destruction of the finest potential multiple-use Conservation Area within a convenient distance of 36 per cent of Ontario's population. Economical alternative gravel resources could be found elsewhere, but no other potential public recreation asset of this calibre exists in this region.

There are a few permanent residences falling within the area but these do not constitute any serious obstacle to the implementation of the scheme, The boundaries of the development skirt the built-up area of Cataract and Belfountain. The few permanent residents living in the immediate environs of the Credit Forks and at a number of other scattered points could be moved out over a period of time and in a manner that would not cause undue hardship to anyone. Their continued residence in the area for a considerable period of time would not impair the success of the scheme unduly.

Due to improved highways, shorter working hours and an increased appreciation of the advantages of a rural atmosphere, there has been an immense increase in suburban residential building. This movement is spreading ever further from the central cores of the metropolitan centres. The superb scenic qualities of this area and its ready accessibility to Toronto or Hamilton and surrounding towns could form a strong inducement for prospective home owners, Permanent homes have been constructed along Highway No. 10 just to the south of the park boundary and it may not be long before subdivision takes place along the rim of the northern limb of the valley, from where there is easy access to the highway and an excellent vista across the countryside to the south and east.

Approximately 50 summer cottages and a number of larger estates are grouped about the Credit Forks and in the vicinity of Cataract, The factors which have combined to make this a desirable public parkland have also been an attractive force for summer cottages and estates. These developments can

be regarded as tacit evidence in support of the recreation potential of the area. Summer properties will undoubtedly increase in this area as the years pass, hence the sooner the scheme is put into effect the less will be the resultant disturbance to private property. Some form of acquisition program similar to that arranged for permanent homes could be instituted in this case. It should be mentioned, however, that the landscaping and high standard of construction associated with some of the estates within the park area has oftentimes improved the quality of the scenery rather than detracted from the natural beauty.

The property of the Caledon Mountain Trout Club also lies within the area. An imposing clubhouse, surrounded by three large trout ponds and hatcheries, is situated on 183 acres of rolling land at the base of the northern wing of the re-entrant to the escarpment.

Belfountain Park, a picturesque development on the outskirts of the Village of Belfountain, has also been included in the area. The scenic quality of the falls and the swimming pool created by the dam across the lip of the falls are valuable recreation assets.

7. The Urgency of the Schemes

It cannot be stated too emphatically that there is need for immediate and positive action if this land is to be set aside for the people of Ontario. As noted in the previous section, there is a wide variety of current and potential forms of land use within this area, some of these could utterly destroy the natural beauty of the landscape and its superb recreation potential. Others, such as residential building or cottage developments, while they may not obliterate the scenic quality of the area entirely, would, certainly make a serious incursion on the wilderness aspect and immeasurably complicate and increase the cost of the eventual acquisition of the land. The area must be obtained before any further development takes place;

and it becomes more vulnerable with each passing day.

In addition, the population of the surrounding region is rapidly increasing and the need for a regional park of this nature is becoming proportionately greater. From 1942 to 1954 the population of Ontario increased by about 1,300,000 and the large urban centres within a 45-mile radius of this proposed parkland have received the largest proportion of this increase. Their recreation resources are strained to the utmost and some immediate relief is absolutely essential.

It should be remembered that it may prove advisable to extend the Conservation Area southward along the heavily wooded rim of the escarpment or along the river flats of the river plains. It may also be advantageous to extend it northwards of Highway No. 51 if this area is developed as a flood control and water storage reservoir.

8 Nature of Proposed Developments

A Conservation Area of this size, diversity of landscape types and proximity to dense centres of population can be developed so as to satisfy a wide variety of recreation activities at all seasons of the year. As the area would be utilized during both the winter and summer, maximum returns could be gained from the investment.

During the winter the snow-clad hills of various sections of the escarpment offer excellent ski and toboggan runs. Trails could be developed through parts of the woodland. In the colder weather the skating on ponds would be excellent. The natural beauty of the winter landscape and the broad expanse of the parkland is ideal for sleighing parties or winter hiking.

In the summer the park would be suitable for either family or larger group picnics and thousands of people could be accommodated in a number of scattered picnic areas without excessive crowding, Picnic tables, fireplaces, playground apparatus and adequate swimming facilities would all be provided at these points.

It should be possible to set aside part of the area for camping. This would provide a conveniently located site for youth organizations in the surrounding urban municipalities who must secure sites that keep transportation costs to a minimum. The ever-expanding Youth Hostel organization would probably make very extensive use of a site in this area since it is within cycling distance of many members in urban municipalities.

The whole area is ideally suited to hiking, cycling and riding. Large sections of the parkland in more isolated and inaccessible locations could be set aside as wilderness areas for nature study purposes.

CHAPTER 3

OTHER PROPOSED MULTIPLE-USE CONSERVATION AREAS

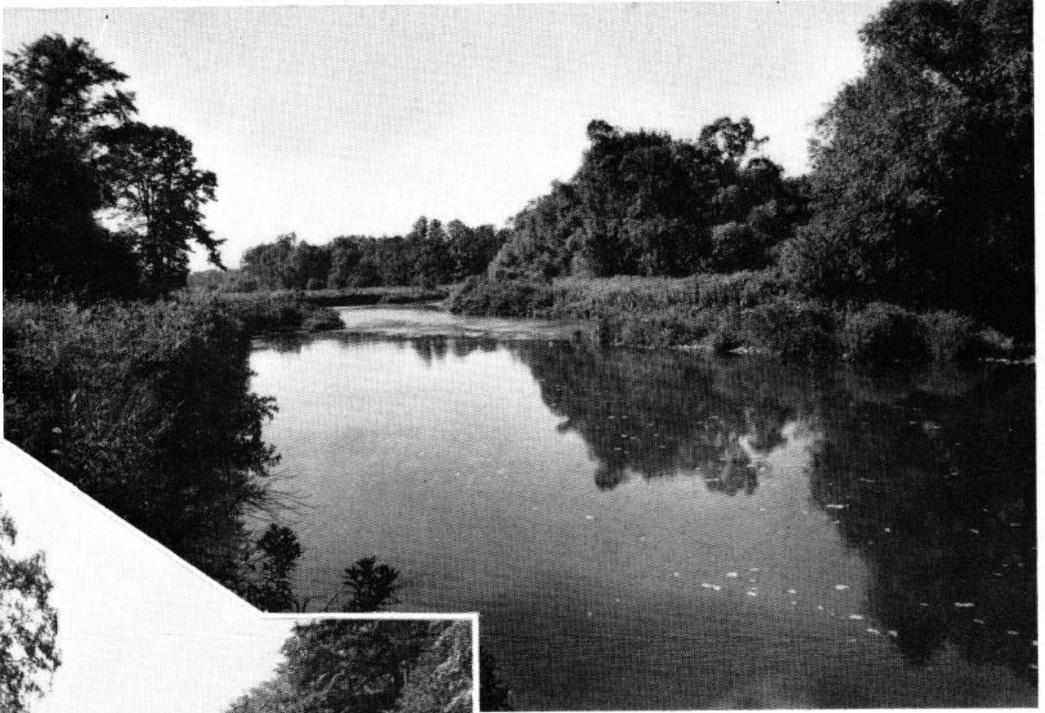
In addition to the large multiple-use area at the Forks of the Credit, the full utilization of the recreation potential of the watershed necessitates the development of a chain of small conservation areas along various sections of the river and its major tributaries. Ideally this chain should be linked by public footpaths and hiking trails along the riverbank areas.

The urban municipalities within the valley should immediately secure and commence to develop the riverbanks and flood plains within their boundaries as municipal parklands and public footpaths. The Credit Valley Conservation Authority should concentrate its attention on similar developments in the open countryside.

There are many sites within the valley which are very suitable for development by the Authority as small parks. To provide an example of the type of development envisaged and to bring to attention specific schemes to be immediately undertaken, four projects in various parts of the valley are fully described in the following sections of this chapter.

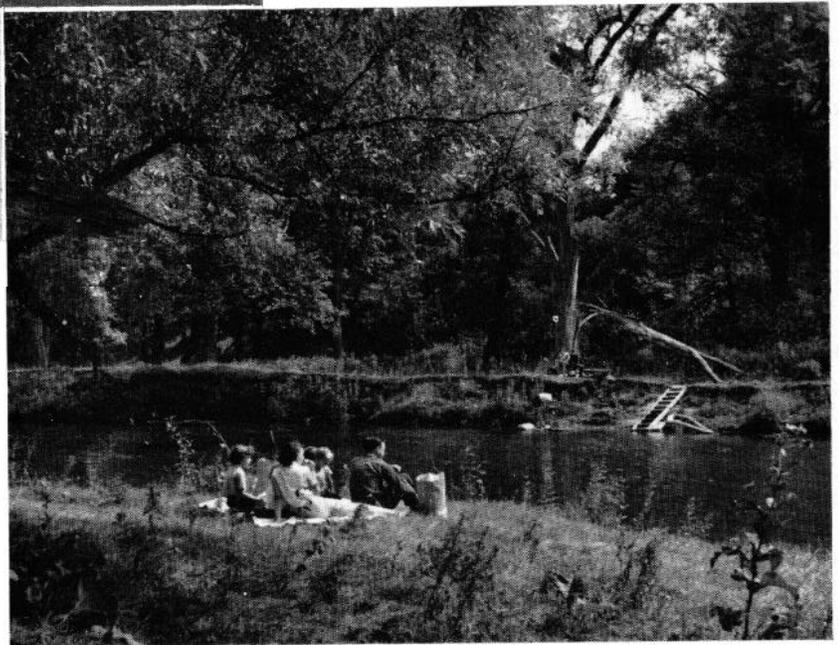
It must be remembered that land is relatively expensive in most sections of the Credit Valley due to the close proximity of the watershed to the rapidly expanding peripheral urban areas, Wherever possible, it is desirable for the Authority to aim at a multiple land use program which combines water conservation and reforestation schemes with recreation, This ensures the maximum returns from the investment in land purchase and permits the Authority to compete effectively in the real estate market where potential intensified multiple land use is an important factor in price determination.

The Credit River in the Meadowvale-Churchville Conservation Area presents languid stretches of water which mirror the trees on the banks.



The well wooded banks of the Credit River frame a picturesque section of the Terra Cotta Conservation area.

The open pasturelands along the banks of the Credit in the Meadowvale-Churchville Conservation Area are a popular picnic area.



1. The Meadowvale - Churchville Conservation Area

The 377 acres of river flats and valley slopes lying between Meadowvale and Churchville have been selected for development by the Authority as a multiple-use Conservation Area in the southern section of the watershed.

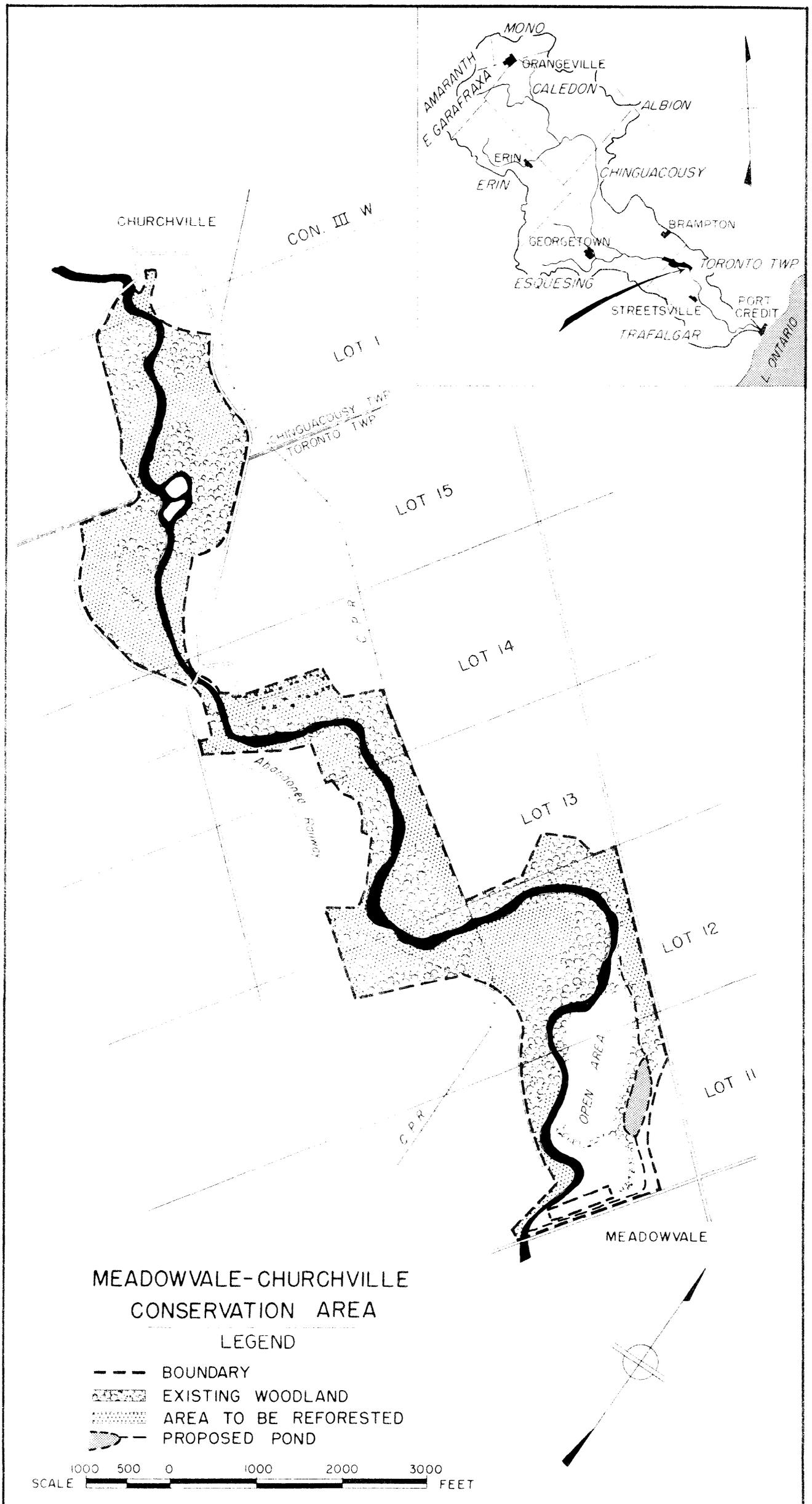
The river bottom lands included in this scheme are very susceptible to flooding. Almost every spring all or certain sections of the area are covered with water up to several feet in depth. Hence the land is entirely unsuitable for permanent buildings of any type. In the spring of 1955 a number of houses on low-lying land at Churchville, together with Martin's Park, were purchased by the Provincial Government for removal due to flood hazard. This land has been included in the area covered by the scheme.

Certain sections of this Conservation Area, especially at the northern end, could be reforested. At the south-east corner of the property on the outskirts of Meadowvale a by-pass pond could be constructed cheaply on the site of the old mill pond. The remainder of the area should be devoted to parkland uses.

(a) Description of the Property

In this section of its course the Credit River wanders through a broad and flat flood plain which is only a few feet above the level of the stream even in the period of low summer flow. Changes in the stream course are frequent at the northern end of the area. Here the main flow of the river frequently shifts from one ill-defined channel to another, leaving behind empty gravel-choked beds and cut-off meanders.

While the vagaries of the stream render the area unsatisfactory for building, and in some instances unsuitable for agricultural use, the 3.2 miles or 17,000 feet of river frontage make an excellent recreation asset. Although of insufficient depth for swimming in most cases, with the



MEADOWVALE-CHURCHVILLE
CONSERVATION AREA

LEGEND

- BOUNDARY
- ▨ EXISTING WOODLAND
- ▩ AREA TO BE REFORESTED
- PROPOSED POND

SCALE 1000 500 0 1000 2000 3000 FEET

Meadowvale-Churchville Conservation Area

exception of deeper holes at Churchville and at the old dam above Meadowale, the waters could be deepened at various places if desired. At this point the stream is relatively clean and clear and sufficiently warm for swimming. In summer the water temperature rises to about 80° on warm days. The water is not seriously polluted. When tested in 1954 the coli bacteria count was 280 per 100 millilitres. The maximum count allowable for swimming is 2,400.

About 56 acres of the total area is now wooded and many of the trees are of a suitable size and form to provide ample shade for recreation purposes. The majority of the trees are white elm from 10 to 18 inches in diameter. There are also about 5 acres of beech and sugar maple of a similar size. While the more dense woodland covers only about 15 per cent of the area, many large trees are scattered about various sections of the riverbank and flood plains.

Approximately 61 acres, or slightly over 16 per cent of the land, is periodically cultivated. The majority of the area, comprising 248 acres, is used as pasture. A large proportion of this is weed-infested meadowland of a very low carrying capacity.

Apart from a row of cottages south of Churchville, which were converted to permanent homes and have since been condemned because of flood hazard as stated previously, there are no permanent buildings within this proposed Conservation Area,

The site is conveniently situated with respect to lakefront concentrations of population and only a few miles south-east of Brampton and north of Streetsville. The C.P.R. single-track branch line between Streetsville and Orangeville runs through the heart of the area.

(b) Proposed Development

Approximately 75 acres, the majority of which lies at the northern extremity of the property, should be set

aside for a program of reforestation and woodlot management. In addition, it will be necessary to spot-plant hardwoods in various unshaded sections of the proposed recreation areas.

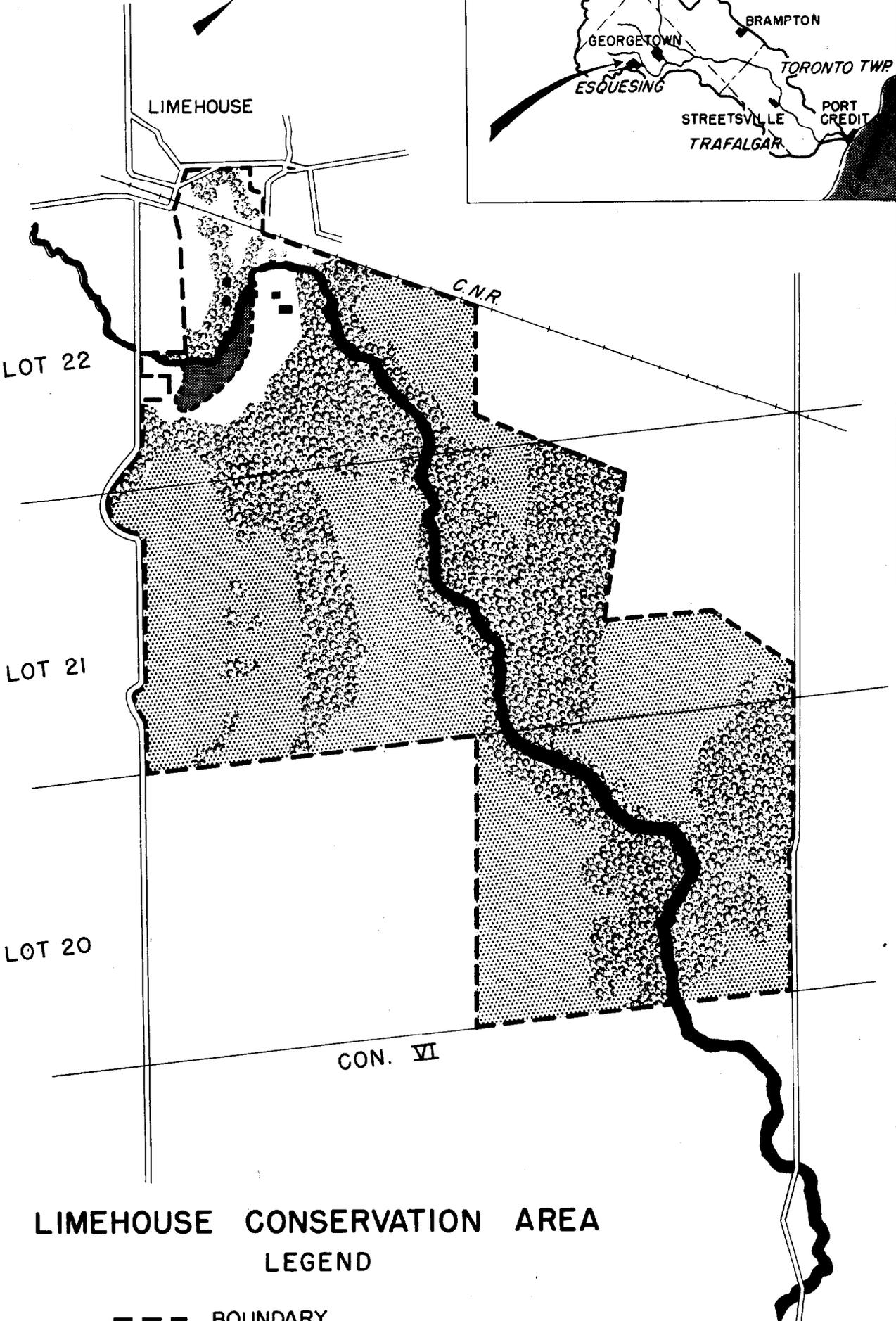
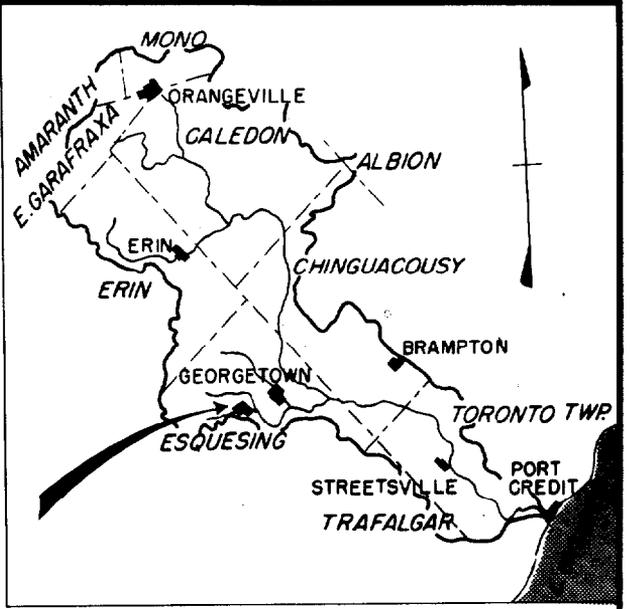
A 5-acre demonstration by-pass pond can be simply and economically constructed on the site of a former mill pond at Meadowvale. At the old dam, about 1,800 feet north of the pond, the level of the Credit would have to be raised approximately 2 feet to lead water into the channel of the mill race which still remains. The mill race itself would have to be cleaned out with a dragline and the soft silt, deposited in the former pond, excavated for a new basin. A small control gate would be installed at the southern end of the pond. The excavated earth could be used for fill in low-lying sections adjacent to the construction. The whole operation would cost approximately \$5,000. Whenever desired, clean water could be led into the pond from the Credit River or shut off. In winter the entire pond could be drained to prevent ice damage.

In addition to providing an excellent demonstration model at a minimum cost, the pond would serve as a swimming pool, thus enhancing the recreation potential of the area.

The remainder of the land should be devoted to recreation uses. The flat, treeless, weed-infested plain between the river and the proposed pond could be graded, seeded to grass and developed as a large sports field suitable for football, baseball or cricket. Picnic tables and fireplaces could be set up at various points along the riverbanks and footpaths established throughout the area. Entrance roads could penetrate the site at several points or a north-south driveway could be run throughout the development,

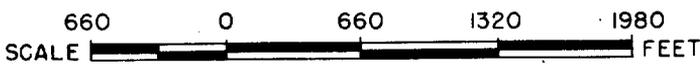
2. The Limehouse Conservation Area

Approximately 315 acres of land immediately south and east of Limehouse are recommended for treatment by the Authority as a multiple-use Conservation Area.



**LIMEHOUSE CONSERVATION AREA
LEGEND**

- BOUNDARY
-  EXISTING WOODLAND
-  AREA TO BE REFORESTED
-  PROPOSED POND



(a) Description of the Property

In this locality the steep face of the Niagara Escarpment, which stands forth boldly at the Forks of the Credit, has been almost completely masked by a deep deposit of glacial till plastered along its base. In the north-east half of the conservation area the level, bedded limestones are covered by a thin layer of soil or directly exposed at the surface. The remainder of terrain is composed of rolling plains and river bottom lands sloping to the south-east.

Silver Creek, a major tributary of the Credit originating in Acton Pond and emptying into the main river at Norval, flows through the heart of the property. Although this stream is severely polluted at present due to the dumping of dyes and tannery wastes at Acton, the waters would improve rapidly if the source of pollution were satisfactorily controlled. In the northern section of the park the river drops sharply to the broad valleys of the rolling plains below in a series of miniature rapids and stepfalls, encased in a twisting rock-sided channel. In all there are approximately 6,000 feet of river frontage on the property.

Approximately 115 acres or 36 per cent of the Conservation Area is tree-covered. Hardwoods comprise two-thirds of the woodland, with sugar maple, paper birch, white elm and beech - sugar maple forming the major cover types. White cedar and hemlock are the representative softwoods. The majority of the trees, from 4 to 10 inches in diameter, are of sufficient size and satisfactory form to meet recreation requirements.

Approximately 73 acres or 23 per cent of the area is now used for pasture. About half of this consists of unimproved grassland on bouldery or excessively shallow soils. little arable land will be removed from production by the scheme.

There is one two-storey solid brick house and a small frame barn situated on the property just to the east of the old mill ruin. The remains of the old lime kilns are located close by.

This Conservation Area lies about 2.5 miles west of Highway No. 7 and approximately midway between Georgetown and Acton. The Canadian National Railway skirts the northern edge of the development and there is a small station at Limehouse.

(b) Proposed Development

Approximately 50 per cent of the open land within the boundaries of the area included in the scheme is recommended for immediate reforestation.

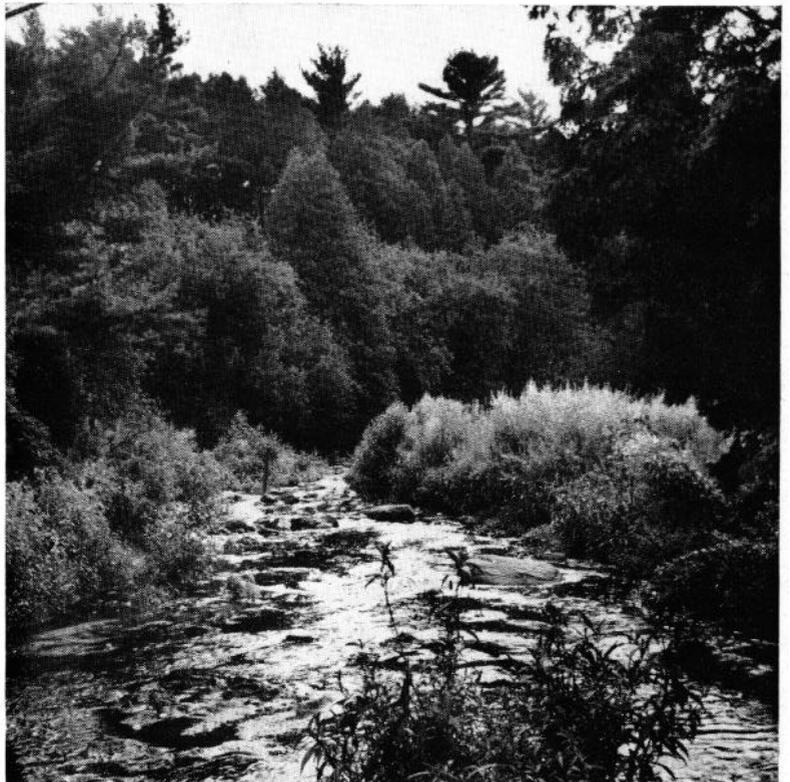
The old 4-acre pond, which has become almost entirely silted up, should be excavated. A small dam could be constructed at a minimum cost at the site of the old mill ruin. This demonstration pond would make an excellent swimming resource once the pollution of the stream is overcome. Immediately below the mill ruin, where the stream drops about 50 feet over a series of limestone ledges and boulders, it would be advisable to construct a series of small rock weirs to further enhance the beauty of the site.

The waters of Silver Creek contained some excellent trout fishing before they were so severely polluted. When the stream is again restored to a satisfactory standard the section below the pond should be restocked. The cold waters, frequent gravel beds and shady overhanging banks should provide an excellent habitat for trout.

The old limestone kilns, 8 in number and situated to the north and south of the railway, should be preserved on the site. They constitute an excellent historic monument to a former period in the history of the development of Limehouse.

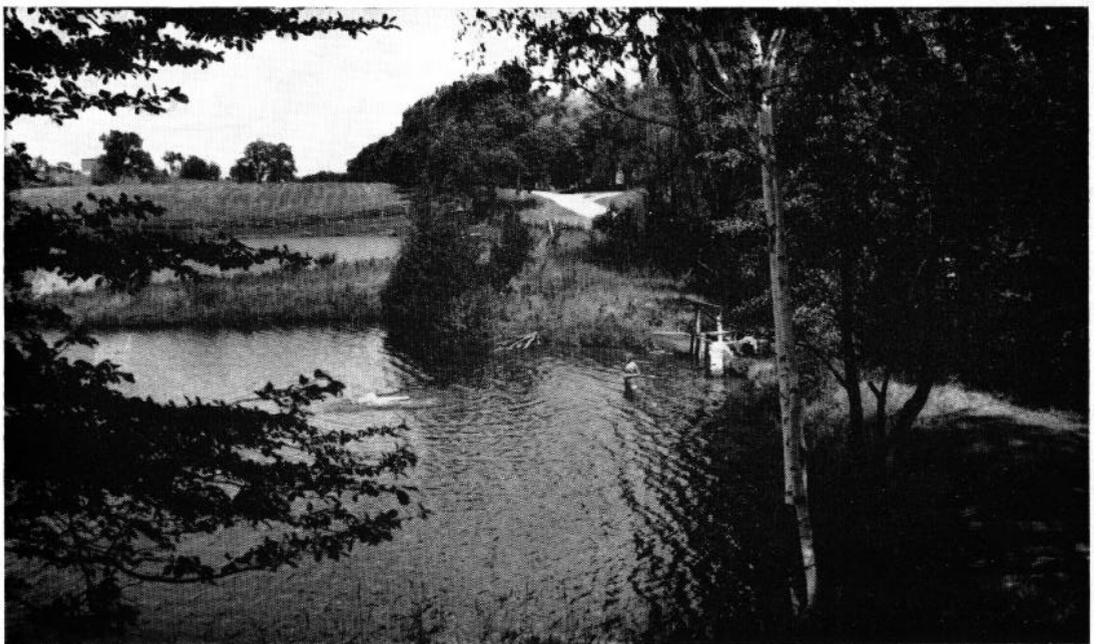


The old ruins of the lime kilns in the northern section of the Limehouse Conservation Area should be preserved since they are a monument to a former period in the history of pioneer development.



Silver Creek flows through the heart of a beautifully wooded valley south of Limehouse. When the polluted condition of the waters of the stream is overcome this Conservation Area will offer superb recreation resources.

The warm, clear waters of the large pond in the North Caledon Conservation Area provide excellent swimming.



A large part of the riverbank area together with existing woodlands and the land immediately surrounding the proposed community pond would be used for recreation. Picnic tables and fireplaces could be arranged in convenient locations throughout the entire area. When the pollution is overcome the recreation value of the river will be immense.

3. Terra Cotta Conservation Area

Situated along the banks of the Credit River about a mile north of Terra Cotta, the 185 acres included within this Conservation Area are recommended for treatment under a reforestation and recreation scheme.

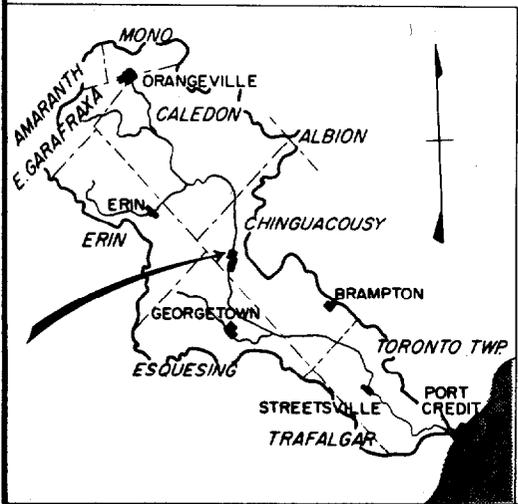
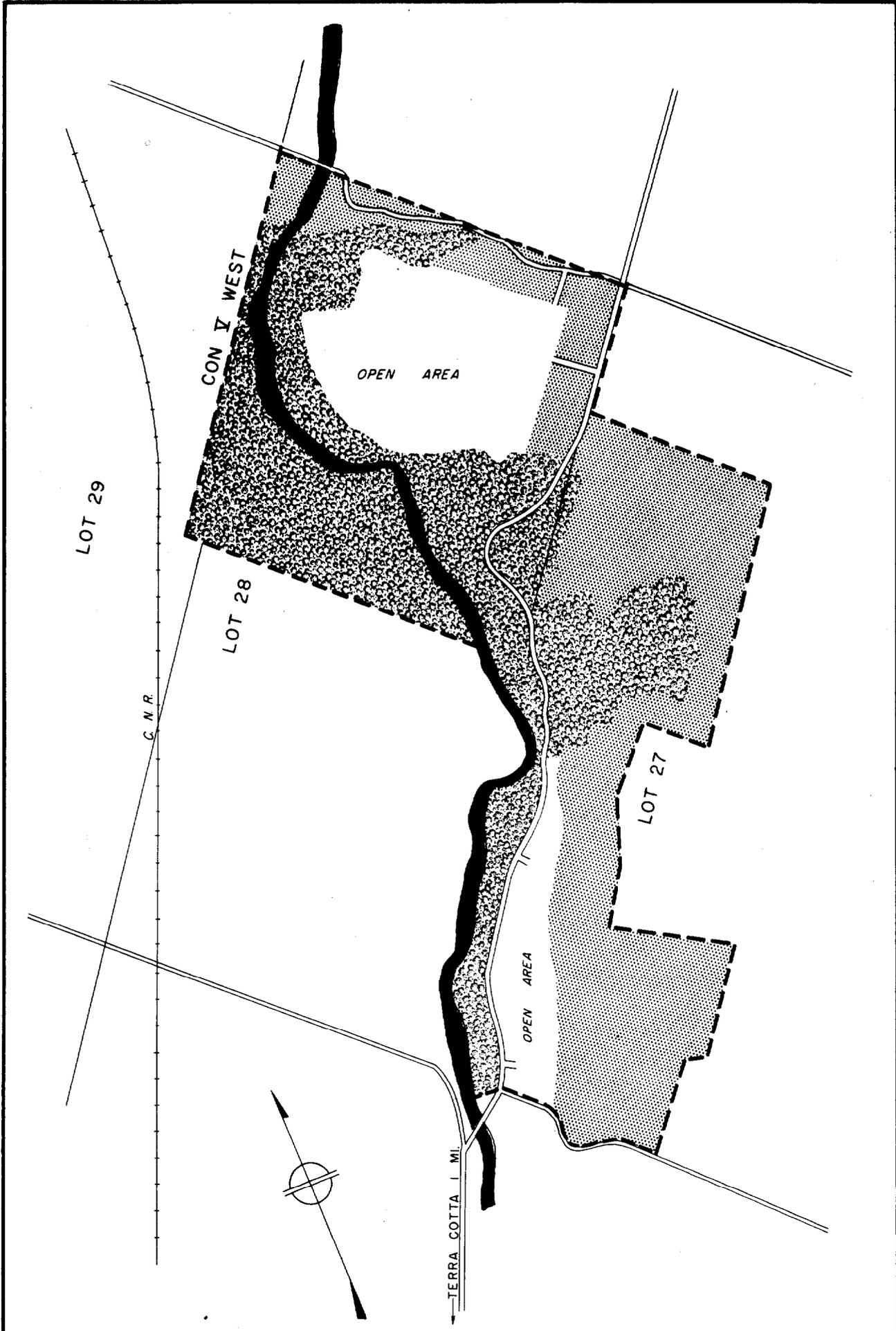
(a) Description of the Property

Topographically the area embraces a section of steep sloping and eroded valley wall along with an expanse of level river plains. The picturesque qualities of the Terra Cotta area, which are known to thousands, are well represented at this point.

There is approximately a mile and a quarter of stream flowing diagonally through the property. At several points in the south-east section the river is of sufficient breadth and depth for good swimming.

About 45 per cent of the area is now forest-covered. Beech and sugar maple are the dominant species in the composition of the well drained areas. Over two-thirds of the trees are between 10 and 18 inches in diameter while the remaining one-third varies from 4 to 10 inches. The more poorly drained land, comprising approximately 20 acres, contains stands of white elm from 10 to 18 inches in diameter.

The open section consists mainly of steep-sided or poorly drained lowland pastures and idle land. About 8 acres south of the road in the south-west corner of the park are occasionally cultivated as hay pastures.



TERRA COTTA CONSERVATION AREA LEGEND

- BOUNDARY
- EXISTING WOODLAND
- AREA TO BE REFORESTED



(b) Proposed Development

About 55 acres situated on the steep eroded hillsides and partially in the valley flats could be immediately reforested. The existing woodland can be placed under a forest management program.

The remainder of the open land should be devoted to recreation uses. Space for playgrounds and parking is available in the north-east corner of the development. Picnic tables and fireplaces may be placed along the shady river-banks at selected locations.

4. North Caledon Conservation Area

Approximately 550 acres of land on Lots 24 to 27 of Concession IIIW in Caledon Township are recommended for development as a multiple-use Conservation Area.

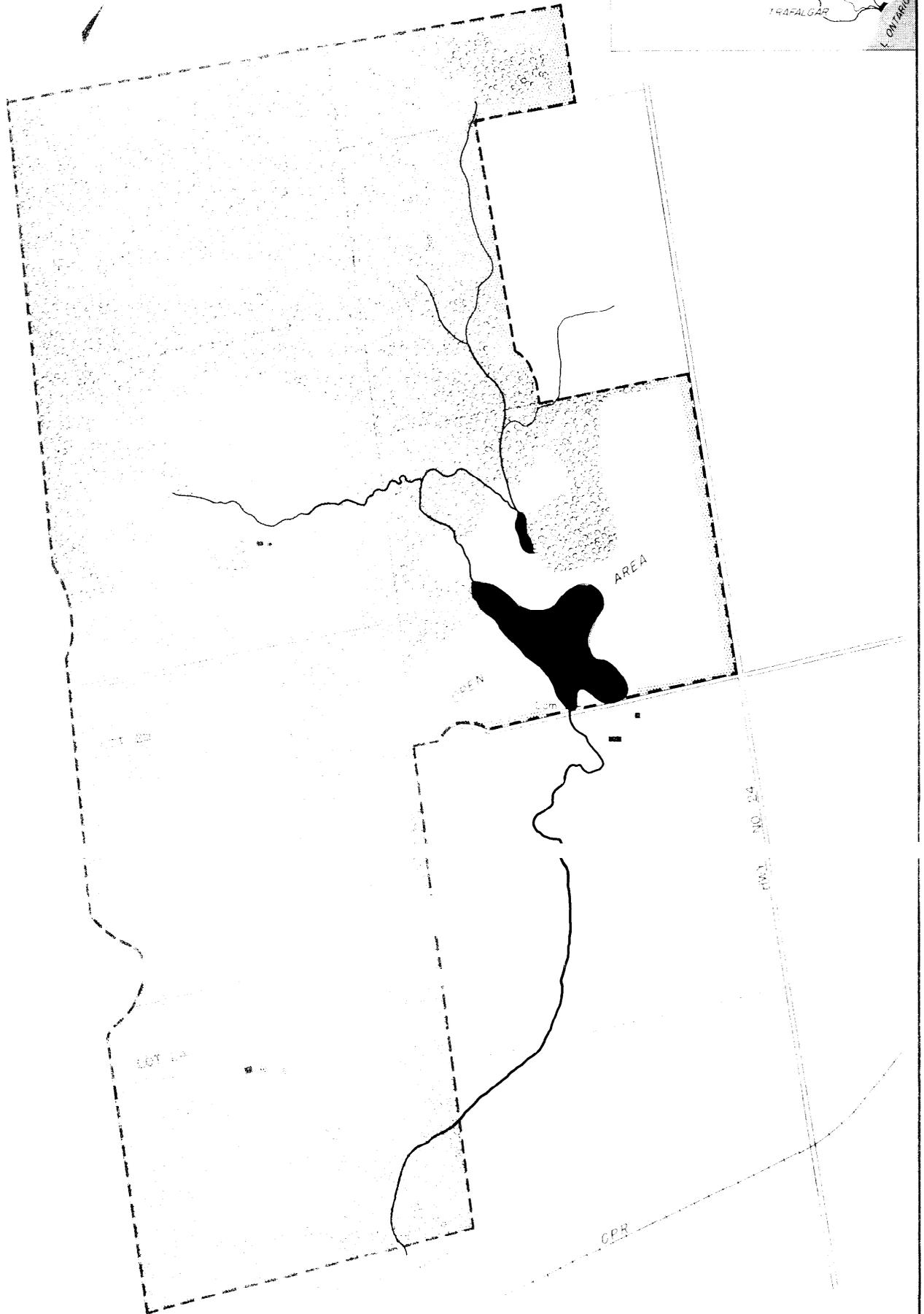
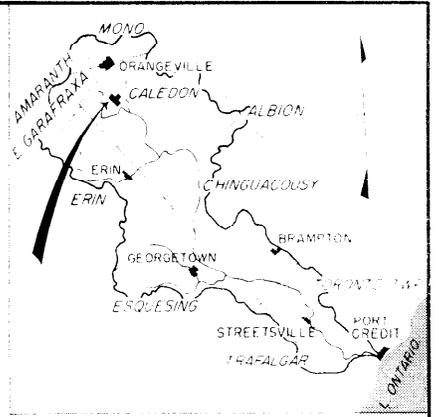
(a) Description of the Property

For the most part this Conservation Area is composed of a rough and bouldery tract of excessively sandy soils frequently interspersed with poorly drained potholes and a sinuous network of small spring-fed streams originating on the property.

As this is a source area for a short tributary stream entering the main Credit River at Alton, the waters are cool and unpolluted. In addition to the streams there is a 10-acre pond in excellent condition on the east half of Lot 26 and another shallow natural pond about 300 feet in length immediately to the north-east of the former.

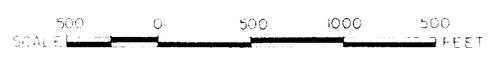
About 290 acres or slightly less than 53 per cent is forest-covered. Hardwood cover types comprise 91 per cent of the woodland with the beech - sugar maple association dominating. White cedar, the sole representative of the conifers, covers approximately 27 acres of the low-lying land.

Approximately 40 acres of rolling terrain adjacent to Highway No. 24 is now cultivated. The remaining



NORTH CALEDON CONSERVATION AREA
LEGEND

- - - BOUNDARY
- EXISTING WOODLAND
- AREA TO BE REFORESTED



open land is in pasture, the majority of which is unimproved grassland associated with rough, steep hillsides.

The only buildings in the area are located on the west half of Lot 26. Here there is an abandoned barn and house in poor condition.

This development would form the northern terminal point of the Scenic Route and Conservation Trail discussed in Chapter 7. Situated only a short distance from both Orangeville and Alton, it would serve as an organization centre for outdoor community recreation activities in the northern end of the valley.

(b) Proposed Development

Approximately 300 acres of the property, as illustrated on the accompanying map, are in need of immediate reforestation, This will protect the springs of the source area and assure the continual flow of the stream. Eventually a crop of merchantable timber would be produced.

The remainder of the area, approximately 75 acres, would be devoted to recreation purposes. The 10-acre pond, in addition to providing a source of water for fire protection for a large part of the reforested area, will furnish excellent swimming. A minimum of repairs, involving the building up of the road level and the strengthening of the earthworks of the dam, will bring the pond into first-class shape. The small shallow pond to the rear, which is about the dimensions of a municipal swimming tank, could be converted cheaply into an excellent pool for swimming or wading. There is ample space for a car park and the development of playing fields. Picnic tables, fireplaces and playground equipment could be placed in suitable locations. As almost half the woodland cover is composed of trees from 10 to 18 inches in diameter there is sufficient shade in most sections of the area. However, some spot-planting will be required around the margins of the pond, which unfortunately are almost treeless.

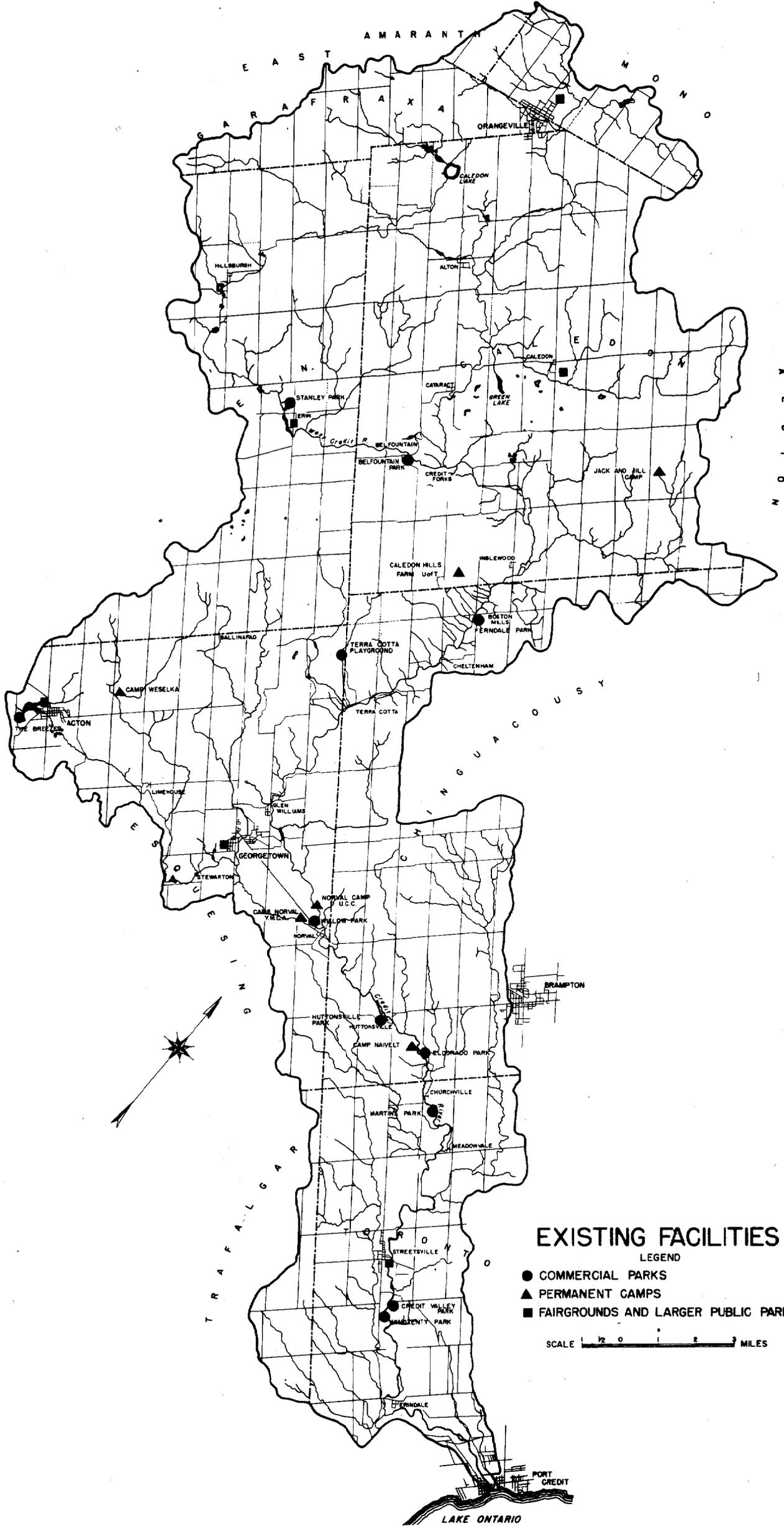
CHAPTER 4
COMMERCIAL PARKS

The small commercial park occupies a significant position in the current recreation patterns of the Credit Valley. Several of the developments, including Stanley, Belfountain and Eldorado Parks, were established prior to 1914 and their locations are closely connected with the railway network. In the 'inter-war period there was a steady but unspectacular increase in commercial parks. Since 1950 there has been a marked upsurge in these developments and during this period about 50 per cent of the park area has been established. These later developments are dependent upon the motorist and hence bear no direct relationship to railway lines,

It is estimated that the combined attendance at the 12 commercial parks of the Credit Valley during the summer of 1954 was approximately 180,000 people. On a major holiday or an exceptionally fine Sunday, over 15,000 people utilize these facilities. About 60,000 people visit Stanley Park in a summer season. Several other parks have a seasonal attendance ranging from 20,000 to 25,000 people.

The vast majority of the patrons come from the Toronto area. However, the people of Hamilton and district form a significant proportion of the total attendance at the parks above the escarpment and in actual fact form the majority of those patronizing "The Breezes" at Acton. The local residents of the watershed frequently visit the parks in their immediate vicinity and Brampton people form a noticeable segment of the total patronage of Ferndale, Terra Cotta, Huttonville, Eldorado and Martin's Parks. Only one of these developments, namely Willow Park, is utilized by passing American tourists and their numbers are insignificant in the overall picture.

Some of the most important factors affecting the development of these parks follow.



EXISTING FACILITIES

LEGEND

- COMMERCIAL PARKS
- ▲ PERMANENT CAMPS
- FAIRGROUNDS AND LARGER PUBLIC PARKS

SCALE 1 1/2 0 1 2 3 MILES

N O I S I B L Y

The presence of the concentrated mass of urban population in Metropolitan Toronto and Hamilton and along the intervening lake front to the south is of prime importance since recreation space in these areas is at a premium. Moreover, the "park in the countryside" cannot be duplicated within these urban centres.

The ever-increasing number of automobiles and the continued improvement of the roads of the area have brought the Credit Valley within easy reach of the urban dwellers at a minimum expenditure of time and money.

The natural beauty of the Credit Valley itself has been a strong attractive force. The broad and shaded flats of the lower reaches of the river together with their reasonable aquatic resources are ideally suited to recreation activities. The natural beauty of the escarpment in the central part of the watershed has few if any rivals within such a short distance of Metropolitan Toronto. The wooded cliffs, vistas, waterfalls and fast-running streams of this section annually attract thousands of motorists and thus provide a steady flow of traffic for the commercial parks of the area to draw upon.

1. Mindzenty Park

This recreation development, which was established in 1953, is conveniently located in the broad valley flats on the west bank of the Credit River about two and a half miles north of Highway No. 5 and one and a half miles south of Streetsville. The park is owned and operated by the St. Elizabeth's Hungarian Catholic Church, Toronto, but it is open to everyone. On an average week-end Hungarians form a minority of those in attendance.

The park occupies about 15.6 acres of elm-shaded river bottom land. Unfortunately, the river at this point is suitable only for wading. In addition, the flats are susceptible to seasonal flooding which could materially alter the course of the river, overlay the grassy meadows with troublesome boulders and destroy any low-lying buildings,

A road has been bulldozed down the steep valley shoulder to provide a convenient entrance for automobiles. A refreshment booth has been erected, about a dozen picnic tables laid out on the flats, and toilets and changing facilities constructed. No improved playing fields have been developed as yet.

The admission charge is 50 cents per car, regardless of the number of occupants. Up to 2,000 people have visited this park in a single day and the total seasonal attendance is approximately 10,000 people.

2. Credit Valley Park

Situated on 10.5 acres of river bottom land on the east bank of the river, Credit Valley Park is located about one mile south of Streetsville.

The river banks and the margins of the park are well provided with shade trees and there is ample open space in the centre for playing fields. The river at this point is not deep enough for swimming. In high water periods or in the event of an ice jam the entire flats may be inundated. In spite of flood hazards, there has been considerable development in this park since it was first opened in the fall of 1944. About ten cabins and two cottages have been built by Toronto members of a Czechoslovakian Mutual Benefit Society. These are rented to members of the organization during the summer season. A small central recreation hut has been constructed in addition to a refreshment booth. About a half-dozen picnic tables are scattered along the river bank. A rough soccer field is available for recreation and a set of three swings has been erected.

The admission charge at this park is 25 cents per car. An attendance of 200 to 300 people is not uncommon on a holiday and the total seasonal attendance is approximately 4,000.

3. Martin's Park

Opened about 1937, the small 3-acre park lies on the east bank of the Credit at Churchville. Approximately 30

The pond created by the dam across the lip of the falls on the west branch of the Credit River greatly enhances the scenic qualities of Belfountain Park and provides excellent swimming.



The swimming in the pond above and the stream below this dam is a popular feature of Huttonsville Park. The dam is now in need of considerable repair.

Credit Valley Park situated on ten acres of river bottomland about a mile south of Streetsville is a popular week-end picnic area.



picnic tables have been set out along the well-shaded banks of the river. Three swings have been constructed and horseshoe pits are available for the use of the patrons. The river, being 10 to 12 feet deep in places, is suitable for swimming, There are no extensive playing fields. Refreshments may be purchased in a small general store immediately opposite the park.

In spite of its limited size, this park is a popular recreation point. The admission charge is 25 cents per car. Total seasonal attendance is approximately 1,000 cars.

4. Eldorado Park

Located on the main Credit River midway between Huttonsville and Churchville, this is one of the oldest parks on the watershed, having been developed before the first war. It was originally served by a railway line and for many years was operated by the railway interests as a park and amusement centre. In 1936 the property was purchased by the United Jewish People's Order Mutual Benefit Society and Camp Naivelt was developed on the site. However, approximately 25 acres of the property are open to the public as 'parkland.

This park offers a considerable range of facilities, One covered shelter, with a capacity of 200, is available to picnickers. There is a dance hall on the grounds but this is now mainly used for concerts. A refreshment concession is also available. There is a ball field with a satisfactory screen. Patrons are permitted to use the swimming pool of Camp Naivelt so the shallow condition of the river is no handicap.

The admission charge is 50 cents per car and this includes the use of the swimming pool. The annual attendance at this park for picnic purposes is approximately 7,500. There have been up to 10,000 people in attendance on particular conventions, A holiday crowd of 500 is not uncommon.

5. Huttonsville Park

First opened in 1925, this commercial park, which is situated on the Credit River about a quarter of a mile above Huttonsville, occupies about 13 acres.

There is ample open space for playing fields and two baseball diamonds have been built. A large number of picnic tables are situated in shady locations and up to 1,500 may be served at one sitting. There is a central refreshment booth and a dance hall on the property where movies are shown occasionally.

There is swimming in the mill pond above the dam, and the area below is used for wading. Two diving-boards and a 13-foot diving tower have been built. Unfortunately, the mill pond is silting up at a fast rate. However, there is still sufficient open water for good swimming.

The admission charge is 50 cents per car. On a fine holiday about 600 cars enter the park. The total seasonal attendance would be in the vicinity of 20,000 people.

6. Willow Park

This 10-acre commercial park, which lies on the west bank of the Credit at Norval, was opened in 1950.

About 25 picnic tables are scattered about the willow-shaded river flats and two fireplaces have been built. Two small swings have been constructed and an open field is available for sports. Five cottages have been built for rental purposes.

The river is of sufficient depth for swimming within a limited area. Three punts are available for rental at a rate of 50 cents per hour.

The admission charge is 50 cents per car. On a good Sunday the park will be visited by about 100 cars. The total seasonal attendance is approximately 3,000 people. As this park is situated beside Highway No. 7, it is occasionally patronized by passing American tourists who stop for meals,

7. The Breezes

Located immediately west of Acton and about a mile south of Highway No. 7, this 25-acre development was begun in 1953.

Since the park is located on the western extremity of Acton pond the aquatic resources are reasonably good. A dock has been built on the foundations of an old railway bridge. Five boats are available for rental at the rate of \$2.50 per day or 50 ¢ per hour. The swimming is good.

About 25 clean, well painted picnic tables have been placed beneath the birch and poplar trees on the margins of the pond and a picnic shelter has been erected. The open fields are kept well mown for sports and a baseball diamond has been constructed. A small refreshment booth is situated in the central section of the park.

Perhaps 1,500 people attended this centre in 1953. When the park is fully developed it will be able to accommodate large picnics and the seasonal attendance should then climb very rapidly. The minimum admission charge is 25 cents per car and the maximum for a full carload is 50 cents. It is worthy of note that the majority of the patrons of this park are Hamilton residents with only a sprinkling of Toronto people attending.

8. Terra Cotta Playground

Embracing about 100 acres of land on the red clay slopes of the escarpment, Terra Cotta Playground is situated about one and a half miles north of the main Credit River at Terra Cotta.

An extensive range of facilities has been installed in this development since it was taken over by the present operators in 1952. The area had been partially developed by a previous owner about 1949. Two excellent ponds have been constructed for swimming and two more are now under development for use as trout ponds. Ample open fields are available for

sports purposes. Swings have been installed and about 45 picnic tables have been placed about the park. Ten cabins have been erected for rental at \$25 per week.

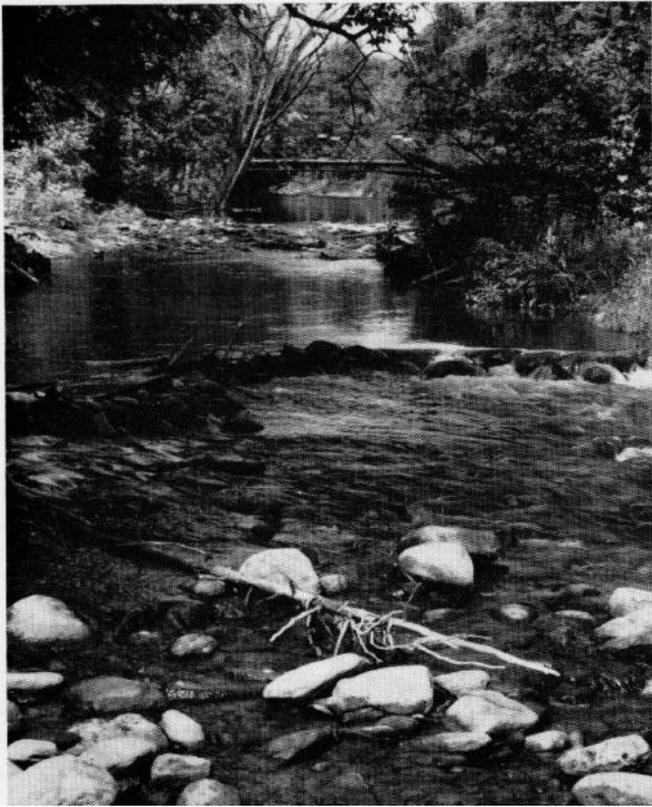
Admission charges are 50 cents per car or 10 cents per person. Total seasonal attendance is estimated at 20,000. Several large industrial picnics utilize the facilities of this park each year.

9. Ferndale Park

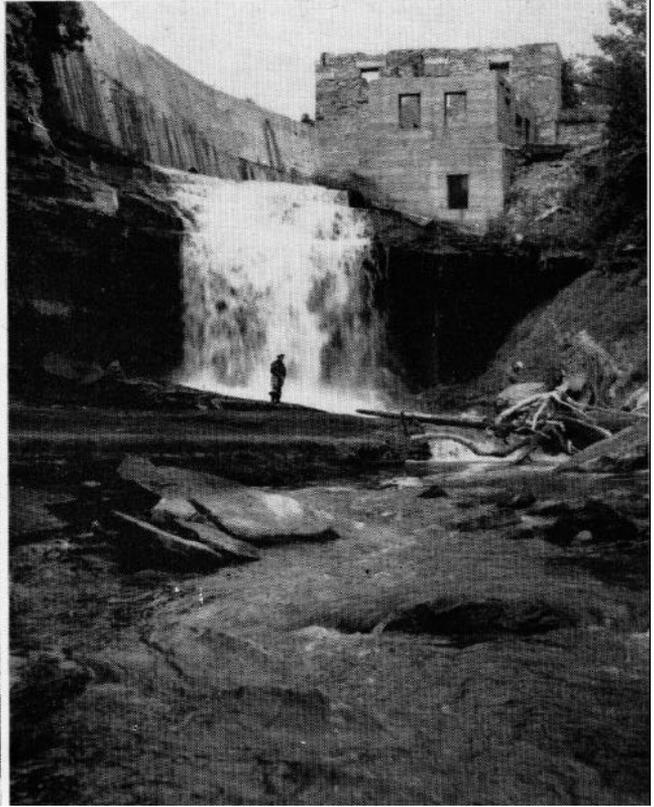
Located on the banks of the Credit at Boston Kills, Ferndale Park was first opened about 1921.

In spite of the obvious flood hazard on the river flats which constitute the main body of the park, extensive building has taken place. There are 46 cottages in the park and the majority of these are rented by the season to people from the Toronto area. A large combined dance hall, kitchen and tearoom, which is sometimes used as a dining hall, has been constructed. Flush toilets have been installed. Collapsible picnic tables are set up about the park as required. There is a refreshment booth and general store in the main hall. There are two or three swimming holes in the river at points where the water is about six feet in depth. Sand has been hauled in to create a satisfactory beach and river bottom.

There is no charge for admission to this park. The annual seasonal attendance is about 15,000. There is a total summer resident population of about 500 in the rented cabins and in a group of privately owned cottages to the south and west of the park. Most of the patrons of this park come from the Toronto area, although a considerable number of Brampton people are regular visitors. Hamilton residents used to come to the park by train, but this business has now disappeared.



The wooded banks of the Credit River about a mile below the Forks frame the vista over the shadowed waters.



At Cataract, where the remains of the hydro plant are still standing, the sparkling waters of the main branch of the Credit River tumble down overhanging limestone into the beds of soft red shales in the valley below,

In Belfountain Park the west branch of the Credit River spills over a boulder dam and limestone ledges in a flimsy curtain of foam.



10. Belfountain Park

Established shortly after the turn of the century, Belfountain Park lies amidst surroundings of great natural beauty, Here the west branch of the Credit drops off the escarpment in a picturesque waterfall which has been further heightened by the construction of a stone dam.

The grounds have been ornamentally landscaped in many places and a suspension bridge constructed across the gorge of the Credit in front of the falls.

About 75 picnic tables are available and a small picnic shelter. Two cabins have been constructed and the owner's permanent home is located on the property. There is a refreshment concession in the central section of the park. The pond created by the dam provides excellent swimming.

The admission charge is 50 cents per car and 10 cents per person arriving on foot, The total seasonal attendance is about 25,000 and on a busy holiday about 1,500 people use the park. Many visit the area simply to view the spectacular falls.

11. Stanley Park

Situated in the northern part of the village of Erin and first opened in the decade of the '90's, Stanley Park is one of the oldest and most popular developments on the Credit Watershed.

The 52-acre recreation centre offers a wide range of well developed facilities to accommodate large crowds, There are about 185 individual picnic tables and a covered pavilion which will accommodate 1,000 people. A dance hall has been constructed and two large refreshment booths are available, On the property there are 11 cottages with running water and flush toilets in addition to 14 cabins.

Large playing fields are available and two base--ball diamonds have been constructed. Playground equipment

includes three sets of adult swings, a set of baby swings, two sets of teeters and two slides.

There is excellent swimming in a large pond. Ten boats are available for rental at 50 cents per hour.

There is no admission charge. Organized picnics are charged 15 cents per head for services rendered. This is the most heavily utilized park on the watershed, with an annual attendance of at least 60,000 picnickers.

CHAPTER 5

PERMANENT SUMMER CAMPS

At the present time there are four permanent camps on the watershed and they occupy an area of about 365 acres. The total seasonal attendance is approximately 1,100 and over 90 per cent of the campers come from Toronto and district.

The close proximity of these centres to the urban concentration of population has been an important factor in their development. Supplies have always been easy to procure at reasonable cost and travelling expenses are at a minimum in both time and money. The watershed possesses sufficient scenic attraction and a healthy outdoor environment to be suitable for this type of development. However, it should be noted that the aquatic resources of the river have proved insufficient in three of the camps where artificial swimming pools have had to be constructed. At the Ukrainian Youth Camp it has been necessary to dam and bulldoze the creek to build a pond for swimming.

1. Camp Naivelt

This camp, situated on the main Credit River about two miles north of Churchville, has been developed by the United Jewish People ' Order Mutual Benefit Society on 115 acres of land purchased from the Canadian Pacific Railway in 1936.

The site contains a desirable mixture of level valley flats suitable for playing fields and high and dry valley slopes above the level of the flood plain which are satisfactory for the construction of permanent buildings.

For sleeping accommodation the camp utilizes 47 two-bed cabins in addition to a dozen bungalows, some of which have several rooms. Drinking water is obtained from seven drilled wells. Septic toilets are used. There is a central dining hall which will handle up to 200 at one sitting.

A baseball diamond has been constructed, and also badminton and volleyball courts.

Unfortunately the river is unsatisfactory for aquatic sports. The water is too shallow for either swimming or boating. An excellent swimming pool 85 feet long by 45 feet wide was constructed in 1948. The water for the pool is pumped from the river, filtered and chlorinated. Up to the present time there has been no water supply problem at any season of the year.

The total seasonal attendance is approximately 450 and a staff of 10 supervises camp activities, The average stay of the campers is two weeks but 15 to 20 per cent remain for the entire summer. Approximately 95 per cent of the children come from the Toronto area. Fees are \$21 per week.

2. Camp Norval - West End Y.M.C.A.

Located on 80 acres of land on the main Credit River about half a mile west of Norval on Highway No. 7, Camp Norval is the oldest operating unit on the watershed, having been first opened in 1926.

All buildings are situated on high and dry land well above the flood plain of the river. The well wooded valley slopes and river flats in conjunction with the open upland fields provide a satisfactory combination for recreation purposes, There are twelve cabins for sleeping accommodation, in addition to four administration and staff buildings and a small hospital, A large central dining hall has been constructed Drinking water is obtained from two drilled wells but when these fall below requirements water is hauled from Georgetown. Septic tanks are used for toilets.

The camp is endowed with a full range of recreation facilities. There is an excellent open-air tarmac-surfaced basketball court, baseball diamonds and several sets of swings. The swimming pool, 100 by 45 feet and 8 feet in its deepest part, is of the highest standard.



Some of the permanent camps have constructed dams across the smaller tributaries, to provide ponds for swimming like this one at Camp Weselka.

A large number of picnic tables have been laid out along the banks of the Credit River in the Streetsville Recreation Centre. This park development offers an excellent example of the manner in which the river-front resources should be handled.



The pond in Acton public park is extensively used for swimming by the local residents and week-end picnickers from the surrounding urban centres.

The total summer attendants at this camp is 400 to 450 children. Sixteen junior leaders and a staff of ten operate the camp during the height of the summer season. The average stay for each camper is about two weeks. Approximately 20 will remain for the two summer months. Fees are \$20 per week.

3. Camp Weselka

Camp Weselka is situated on a small tributary stream of the Credit about two miles east of Acton. Owned and operated by the Ukrainian Youth Association, it was first opened in the summer of 1954.

When visited late in the summer of 1954 this 100-acre camp was in the initial stages of development. An old farmhouse served as a dining hall and administration building, Old street cars were converted into sleeping quarters.

The creek has been dammed and the bed bulldozed to create a 20-acre pond with a maximum depth of 7 feet. This will satisfy the swimming requirements of the camp.

It is expected that in 1955 the camp will have a maximum capacity of 50. A total seasonal attendance of 180 is expected and approximately 80 per cent of the children will come from the Toronto area.

4. Camp for Jack and Jill

Opened in 1946, this children's camp is situated to the east of Highway No. 10 about two miles south of Caledon. The camp is unique since it is for young children between the ages of four to nine years.

There are ample playing fields on the 70-acre property. Swings, slides and general playground are satisfactory. A concrete swimming pool 30 feet by 60 feet has been constructed. Water is diverted directly into the pool from an adjacent spring-fed creek.

An old farmhouse has been very satisfactorily converted into an administration building, kitchen and central

CONCESSION XI

U.C.C. CONSERVATION AREA

LEGEND

- REFORESTED AREAS
- BUILDINGS

SCALE IN FEET approx.

0 800



LOT 15

LOT 14

COTTAGE

CULTIVATED

LOT 13

NORVAL HOUSE

ESQUESING TWP.

BARN

UPPER CANADA HOUSE

LOT 12

West

Branch

Credit

NORVAL



dining hall. A barn has been transformed into excellent sleeping quarters, playrooms and craft shops.

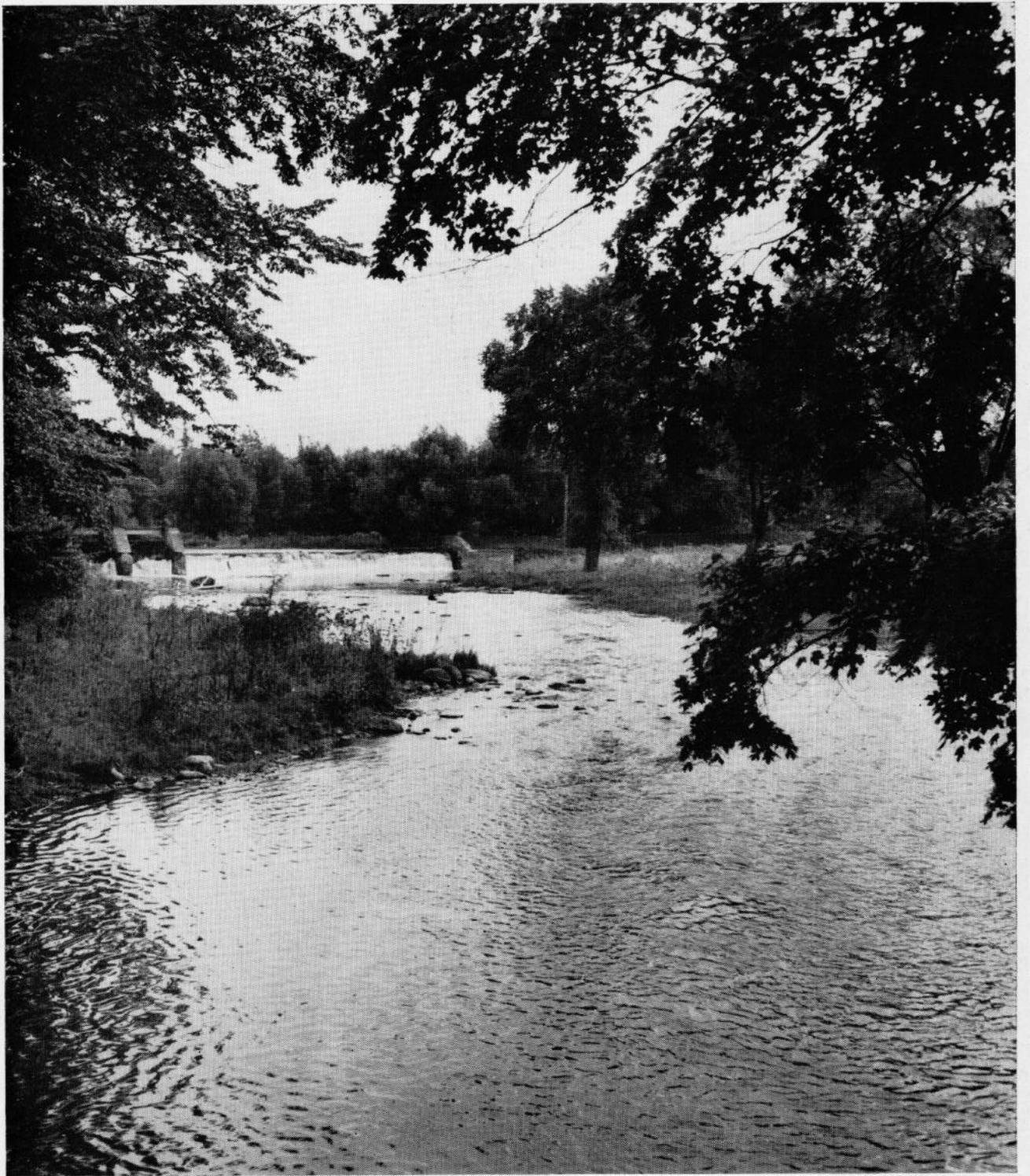
The capacity of this camp is about 50 children in addition to leaders, kitchen staff and a nurse. The total seasonal attendance is about 100 and the average stay per child ranges from 3 to 6 weeks. Fees are \$120 for 3 weeks. Campers come from a fairly wide area including Buffalo, Toronto, Chatham and London.

Two other developments on the watershed, namely the Upper Canada College Camp immediately above Norval and the Caledon Hills Farm of the University of Toronto, are somewhat unique. Although they do not conform completely to the pattern of the previously discussed permanent camps, many of their characteristics are so closely allied that they may be most conveniently reviewed in the concluding section of this chapter,

5. Upper Canada College Camp Norval

In 1912 the college purchased 500 acres of land on the outskirts of Norval with the intention of moving the institution to this site at a later date. Having abandoned the original plans for the property, it has been used since 1939 as a combined week-end recreation and nature study centre for the boarders attending the school in Toronto.

The Credit River winds its way through the camp in a beautiful broad valley carved below the level of the surrounding agricultural plains and lined throughout a large part of its course with a fine stand of white elm interspersed with balsam, poplar, hard maple and beech. The frequently encountered sand and gravel bars of the shallow stream create small stretches of sparkling, fast-flowing water which much increase the beauty of the valley. The rolling terrain stretching to the east and west from the lip of the valley is currently devoted to agricultural and re-forestation uses.



The Credit River at Norval where it emerges from the 500-acre tract owned by Upper Canada College. Here boys from the Senior and Preparatory Schools have carried out reforestation and other conservation projects.

Norval Rouse, a gift of the "Old Boys" of the College, was opened in 1939. This building contains a central bunkroom with accommodation for about 25 boys in addition to a kitchen and quarters for both the resident housekeeper and the visiting master in charge of the campers.

During the school term, boys are brought to the camp in groups of 10 or 15 for week-ends commencing on Friday evening and ending on Sunday night. These trips offer the students an opportunity for wholesome outdoor recreation in the open countryside and provide a medium through which they may gain a first-hand knowledge of botany, zoology, agriculture and conservation. From the start reforestation has occupied a prominent position in the activities of the campers. Between 1939 and 1954 approximately 231,000 trees have been planted on the property.

During the winter months the valley slopes are suitable for skiing and tobogganing, Fortunately there is sufficient variation in gradients to satisfy the requirements of beginners as well as those who are more advanced in these sports. In the spring and fall, hiking and games occupy a large portion of the camper's time.

6. Caledon Hills Farm University of Toronto

Situated on the Caledon Hills a few miles west of Inglewood, this 150-acre property was purchased in 1950 by Hart House, of the University of Toronto. Originally the farm was intended to provide a centre for outdoor recreation and a medium whereby the students of the university could develop an appreciation of rural life and rural problems, As the project evolved it began to assume an increasingly important role as a conference centre for varsity clubs and academic groups.

About 50 acres of the farm are under cultivation while the remaining 100 acres are covered with hardwood bush. Atop the hill there are two farm houses, a barn and two stone sheds, The second floor of the smaller house is a dormitory

for girls. The upper floor of the larger house is the men's sleeping quarters, while the ground floor contains a kitchen, dining room, common room, store room and sun room. The barn is used for stock and the storage of about 100 tons of hay, Two abandoned, water-filled quarries make fine ponds for swimming and skating.

Although it is difficult to determine accurately the number of people who use these facilities each year, it is certain that the number has steadily increased since the opening of the farm. During the 1954 - 55 season at least a thousand paying guests visited the site in addition to those attending the first Annual Winter Carnival.

CHAPTER 6

PUBLICLY OWNED PARKLANDS

There is a total of approximately 120 acres of publicly owned parkland within the confines of the Credit Watershed. These recreation areas are divided between the various municipalities in the proportions indicated in the following table:

<u>Public Parklands</u>	
Towns *	55 acres
Villages	45 acres
Townships	<u>160 acres</u>
Total	260 acres

The combined population of the three towns lying wholly within the watershed is 10,577. In effect there are about 5.5 acres of public parkland for every 1,000 people living within these municipalities. Within the villages of the valley, which include Port Credit, Streetsville and Erin, there are approximately 4.5 acres of park per 1,000 population. The average for the villages is considerably depressed by the low acreage within Port Credit. However, the situation within this municipality shows signs of considerable improvement. When the Faulkner Marsh property is converted into parkland at the completion of the sanitary fill operation, the recreation picture will be greatly improved with respect to riverfront parkland. The purchase of a 31-acre river valley park within the village of Streetsville is the most significant recreation development within the watershed in recent years and other municipalities would do well to follow this lead. The total parkland of the rural municipalities is 20 acres and this is composed of the fairgrounds at Caledon and a small community ball park at Inglewood.

* Includes the parklands of Acton, Georgetown and Orangeville.

It is difficult to lay down generally applicable standards with respect to the minimum amount of parkland required per capita of population. The National Playing Fields Association of Great Britain recommends a minimum of 6 acres of playing fields per 1,000 of the population. American authorities vary greatly in their estimates. Town planners frequently talk in terms of 5 acres per 1,000 of the urban population. On the other hand, many recreation planners categorically state that there should be at least 1 acre of parks and playgrounds for every 100 people. In a recent article in "Community Planning Review"* Spence-Sales states that the open spaces should not be less than 10 per cent of the area of the surrounding housing development.

The paucity of municipal recreation facilities becomes evident when one considers the intrinsic nature of the aforementioned parkland and its location. About 78 acres or 63 per cent of the area is composed of fairgrounds. Of these, only Acton Park is situated on a sizeable body of water and can fulfil the functions of a multi-purpose park. Many of the others have been developed for use as ball parks or sports fields in addition to their original function as fairgrounds. They are of limited value as multi-purpose parklands.

The Streetsville Memorial Recreation Centre on the banks of the Credit is the only real multi-functional, publicly owned park area within the valley in addition to the Acton fairgrounds. The popularity of the former area with week-end picnickers as well as its use by local residents attests to its value.

The lakefront situation on either side of the mouth of the Credit is serious from the point of view of public parkland. The lake is a major recreation resource

* Spence-Sales, H. How to Sub-Divide. Community Planning Review, Ottawa, 1950. p. 25.

which is wasted if the public is cut off from it.

No major shoreline park is available between Sunnyside Beach in Toronto and the mouth of the Credit, and this deplorable condition extends westward to the Hamilton area. As building continues apace behind the lakefront, thousands of people will find themselves entirely excluded from a superb recreation resource. The village of Port Credit contains only two small lakefront parks, namely Ben Machrie Park and Hiawatha Park, and in neither case is there a satisfactory shoreline. For years the rough shingle beaches on either side of the mouth of the Credit River, in spite of their obvious limitations, have provided a means of public access to the lakefront. When these lands are completely developed by the Dominion Government for port facilities their loss will be felt unless compensating space can be provided to the west or east. Due to the fact that much of the shoreline is bordered by a low cliff with a narrow and often stony beach, suitable park areas are not obvious and moreover almost all the shoreline has been privately developed. For this reason the recent parkland development at the mouth of the Etobicoke Creek in Long Branch takes on special significance. Should the Dominion Government decide to vacate the rifle ranges at Long Branch, which lie adjacent to this new recreation development, serious consideration should be given to converting a large proportion of this area into public parkland.

The pond and damsite at Erindale with the surrounding land, amounting to 140 acres, has been leased on a long lease to the Township of Toronto for use as a park. It is the intention of the Toronto Township Council to develop this area by removal of silt and perhaps construction of a mill dam, and to have facilities for supervised swimming and possibly a picnic and sports area also. This area is not shown on the map of existing facilities, as the map was printed before the change of ownership.

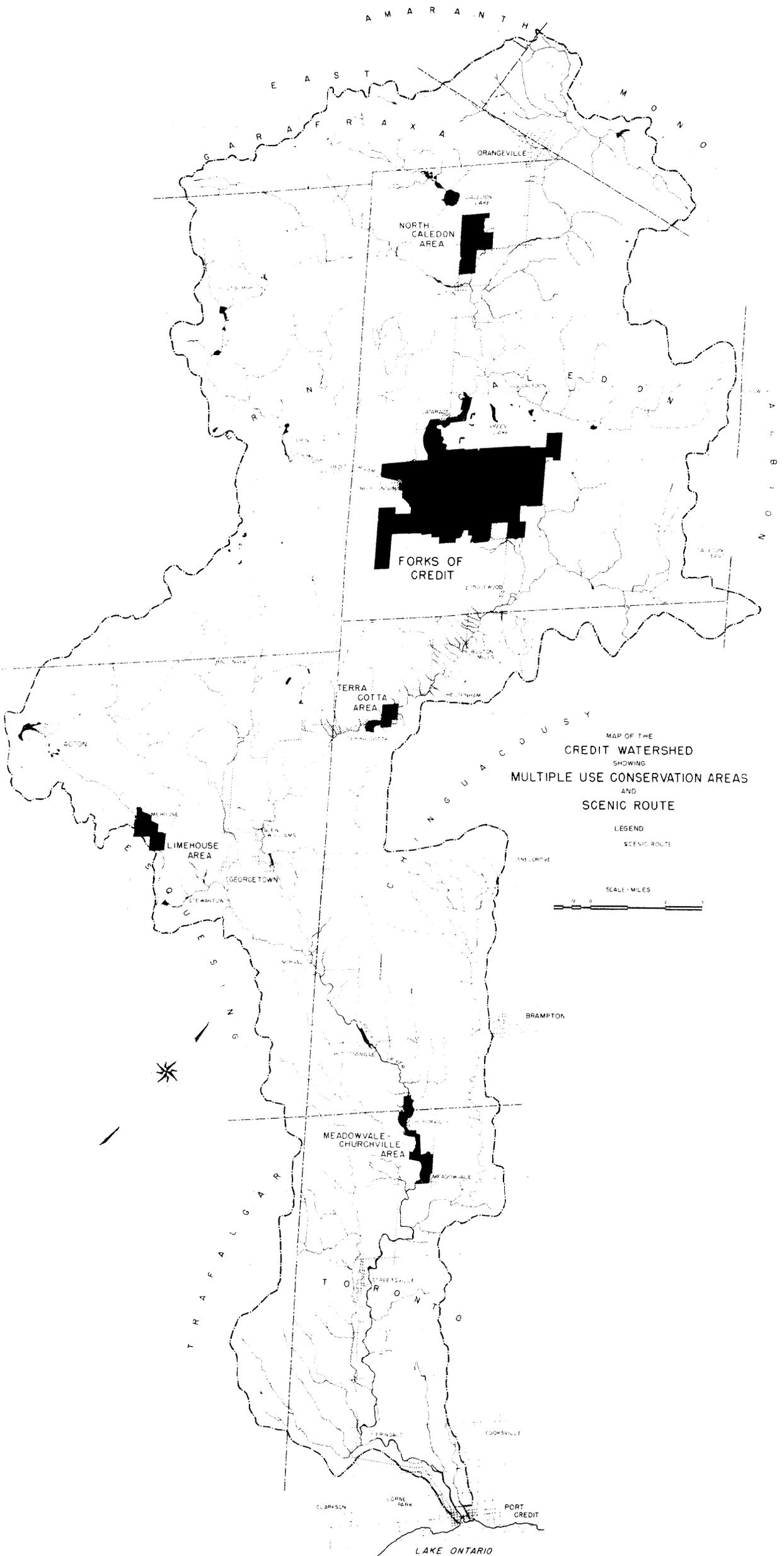
CHAPTER 7

SCENIC ROUTE

It is recommended that the Credit Valley Conservation Authority establish a Scenic Route of about 62 miles in length running from the lakefront to Orangeville at the northern extremity of the watershed.

This route is intended to fulfil both a recreation and an educational function. Often it is impossible to combine these two functions satisfactorily in a single route because they differ considerably in their basic requirements. A scenic route primarily demands a scenic landscape, while a conservation trail must illustrate the physical pattern of the area and the conservation developments and problems related to various forms of land use. However, in this instance a union of the two may be feasible since the north-south scenic route through the most attractive sections of the valley fortunately crosses all the major physiographic formations and their characteristically associated forms of land use, because the latter tend to run in distinct east-west belts across the watershed. As there are obvious inter-relationships between recreation and education, this dual aspect enhances the general interest of the route.

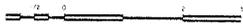
On summer week-ends and holidays a very large number of motorists tour the watershed to enjoy the beauty of the landscape. Proximity to the large urban centres makes the area particularly suitable for "an afternoon drive". Judging from the volume of this type of traffic encountered on the watershed in the summer of 1954 and the number of people asking for information about possible scenic areas, it is almost certain that a well-marked route of the type proposed would be a heavily utilized and greatly appreciated development which would bring the Authority a volume of favourable publicity far outweighing the money and effort expended.



MAP OF THE
CREDIT WATERSHED
 SHOWING
MULTIPLE USE CONSERVATION AREAS
 AND
SCENIC ROUTE

LEGEND
 SCENIC ROUTE

SCALE - MILES



Approximately 62 per cent of the route illustrated on the accompanying map can be classed as scenic when compared with the average landscape for the region. The scenic sections are of satisfactory length, quality and spacing to hold the interest of the motorist throughout the drive. The remaining mileage consists of linkage between these parts. In some instances, interesting conservation features are located along these stretches and this tends to compensate for the deterioration of scenic quality.

From the lakefront to a point above Glen Williams, the route traverses the level plains of the Lower Credit. The finest scenery of this area is associated with the deeply carved and relatively well wooded valley of the main river and hence the route closely parallels or cuts across this feature. For a considerable distance the waters of the stream are in full view and the drive skirts a proposed conservation area between Meadowvale and Churchville. Special mention should be made of the colourful fields of flowers in the market gardens of the Huttonsville area at certain seasons of the year, North of Glen Williams the route climbs the escarpment from where there are some exceptionally fine views, The drive then descends from the limestone-capped ridge across the slopes of red shale into the main valley of the Credit River at Terra Cotta. It then follows the stream northward, passing a second conservation area recommended for development by the Authority. The route enters the proposed Credit Forks Multiple Use Conservation Area and then climbs the escarpment. From here there are superb vistas across the countryside. Passing by the falls at Belfountain and Cataract, the route leads northward across the rolling plains to the proposed North Caledon multiple-use conservation area near Alton. From there a spur extends northward to Orangeville.

It will be noted that the majority of the areas proposed for development by the Conservation Authority lie

alongside this route which also passes through the proposed multiple-use development, at the Credit Forks. Hence there will be ample conveniently spaced picnic facilities along all parts of the drive.

The success of a scenic route is largely dependent upon the condition of the roads. When the motorist seeks the less heavily travelled routes and the relatively unrestricted views of the open countryside, he realizes that the road conditions will not equal those of the major provincial highways. However, there is little pleasure and relaxation in manoeuvring through a mass of ruts and potholes and negotiating a continual series of hairpin turns which endanger the car and occupants.

On this route the road conditions can be classed as generally good. About 37 per cent of the total length is paved, the remainder being gravel-surfaced and in good condition at most times of the year. About 5 per cent consists of provincial highways. In most instances these serve as connector sections. Approximately 20 miles or 32 per cent of the drive is associated with county roads, only 2 miles of which are not paved. Gravel-surfaced township roads, comprising 60 per cent of the route, form its largest single component. Fortunately most of these are kept in reasonable condition at all times.

It will be noted that several provincial highways traversing the watershed in a rough east-west direction cut across the scenic drive. In addition, Highway No. 10, leading southward from Orangeville to the Queen Elizabeth Way, lies just a few miles to the east of the northern and southern sections of the route. Hence it is possible for Toronto or Hamilton people to approach this route along these east-west highways, drive along it for a convenient distance north or south and return via an alternative provincial highway. A person travelling to the northern extremity of the tour may return quickly to the south via Highway No. 10.

The money and effort required by the Authority to establish this route is well within its ability. Directional arrows would have to be set up at suitable points. A small map and booklet could be printed for distribution at gas stations and other outlets. Arrangements would have to be made with the townships to see that their gravel-surfaced roads were put into a suitable condition early in the spring and maintained till late in the fall, as they would be carrying a larger volume of traffic for a somewhat longer period than usual.

A Conservation Trail, which might be combined with the scenic route, would have an important educational value for school children and adults and represent an excellent medium through which the Credit Valley Conservation Authority could acquaint the general public with the nature of the problems of the watershed and the work that it proposes to undertake.

In a trail of this nature a number of points are marked out at which there are interesting features illustrating the characteristics of the valley and the conservation problems associated with them. It is advisable to prepare an illustrated booklet similar to the excellent brochure prepared by the Don Valley Conservation Authority containing a brief discussion of the significance of each of the stops. These booklets may be released to the general public through a variety of channels and distributed to children making a tour of the trail in organized school groups. In the case of organized groups of children or adults the Authority could provide a technical guide to explain the features of the route in greater detail.

As a guide to the Authority in the establishment of a scheme of this nature, the remainder of the chapter is devoted to a preliminary discussion of a chain of stations that could be established on a Conservation Trail. This is not

intended to be a rigid and finalized sequence but merely an indication of the type of project in mind. The stations could be increased or decreased as circumstances warrant. Any route of this type obviously requires frequent revision since the landscape of the area is in a state of flux due to the rapid development in certain sections.

1. Faulkner Marsh and the Mouth of the Credit River

The area along both sides of the Credit River from the C.N.R. tracks to the mouth of the stream is of considerable interest due to the revolutionary changes which are now taking place in the landscape.

The Faulkner Marsh lying between the C.N.R. and the Lakeshore Road was formerly marshland playing a subsidiary role in the recreation patterns of the Village of Port Credit. During the summer the river is used extensively for canoeing and rowing, In the winter a small pond in the south-east section close to the Lakeshore Road provided good skating. The marsh is now being progressively filled, beginning at the north-east corner. Methods of sanitary fill which will not be offensive to the surrounding built-up area are being employed. There is a great need for dumping grounds for the surrounding urban area, so the project is assured of ample fill. When the filling is completed it is planned to develop the site as a large riverside park of which Port Credit is in dire need.

With the exception of a small park area in the south-west corner of the junction of the Lakeshore Road and the Credit River, the riverside from the road to the mouth of the stream and a considerable stretch of shoreline to the east and west is owned by the Dominion Government. This section is to be developed into a modern port. Building has already commenced with the construction of a long pier into the lake, and the dredging of the entrance to the river mouth,

The proposed scenic route follows the old Mississauga Road through an area of fine suburban homes.

and alongside the golfcourse. The sandy plains stretching to the west, which were formerly given over to market gardens and orchards because of easily worked soils, favourable climate and close proximity to the cities of Toronto and Hamilton, are now being rapidly subdivided and built upon.

2. Sand and Gravel Pits of the Iroquois Shoreline

The stratified deposits of sand and gravel which can be clearly seen from the road in the walls of a pit of the Sherman Sand and Gravel Company represent the shoreline deposits of old glacial Lake Iroquois which stood at a much higher level than present Lake Ontario. The deposits were formed in much the same way as sand and gravel beaches are being built up along certain sections of Lake Ontario today. Wherever a large river such as the Credit entered the former Lake Iroquois, there was a tendency for particularly large deposits to accumulate.

These old shoreline deposits surround the Toronto region and have been extensively exploited for building material because of their quality, ease of extraction and close proximity to a centre of extensive and continuous construction. There is a marked chain of operating and abandoned pits extending to the west of this development and eastward in a broad arc reaching beyond Oshawa.

Economically these sand and gravel beds represent one of the most significant geological resources in the Toronto Region. Material worth millions of dollars has been extracted from them in the past. Unfortunately many sections of the countryside have been badly disfigured by the ugly scars of abandoned pits. However, this condition is not a necessary and unavoidable consequence of gravel operations. Sometimes abandoned pits can be levelled, landscaped and used as building sites. They can be graded, overlaid with a deposit of topsoil, planted to grass or trees, and thus restored to a condition which is no longer offensive to the eye.

3 . Commercial Parks

The broad, deeply entrenched valley of the lower Credit River contains some exceptionally fine parkland within a convenient distance of the larger centres of population. Commercial park operators have taken advantage of this situation as is evidenced by this development begun in 1953.

4. Recent Residential Developments in Streetsville

Due to close proximity to industrial and commercial developments in the surrounding metropolitan areas, some of the more conveniently located small villages and towns of the Credit Valley have had an extensive residential development in the last decade. The expansion at the northern extremity of Streetsville has been particularly heavy although the trend is by no means confined to this village.

It will be realized that rapid developments of this nature can put a considerable strain on existing municipal water and sewage systems, necessitating the expansion of old facilities or the construction of entirely new plants. The Streetsville water is pumped from the Credit River and then filtered and chlorinated before distribution through the mains. The capacity of the plant has been recently enlarged to meet increased demands and new trunk mains were laid down in 1955. Plans are now under way for the expansion of the sewage disposal plant and this work will probably be carried out very shortly.

A rapidly expanding village such as Streetsville could soon find itself desperately short of recreation space as the more desirable areas along the river front are subdivided, built upon and securely fenced off from the public to the edge of the river bank. Idle land along the margins of the river on the outskirts of the village, which, although it was privately owned, was used for playing fields and often treated as if it were public property, becomes suddenly cut off. In

anticipation of this problem Streetsville has developed a superb recreation area along the banks of the Credit in the central part of the town.

5. Recommended Woodlot Improvement Project

North of Streetsville there are several well managed woodlots which might be visited in the route of a conservation trail. A typical one is a 6-acre woodlot of hard maple and beech intermixed with black cherry, white ash, red oak and occasional white pine.

In 1933 the owner, in co-operation with the Department of Lands and Forests, converted the area into a Demonstration Woodlot and put it under a management program. In 1934 a considerable number of beech trees were removed in order to make way for the second growth. In 1951 some defective white pine was cut out, During this entire period the woodlot was kept free of grazing cattle.

It will be noted that the larger hardwoods, ranging from 10 to 18 inches in diameter, have now reached saw log size and in the next few years will likely undergo rapid growth as they approach maturity. There has been an excellent response to the previous removal of the beech, as can be seen by the size and form of the second growth. As the area is fenced from cattle there has been a good development of maple, black cherry and white ash seedlings, These form the basis of the succeeding crop. The remaining white pine is progressing favourably. The crown cover of the entire woodlot ranges from 75 to 100 per cent.

In the Forestry section of this report it is recommended that the Conservation Authority enter into an agreement with the present owner to maintain this woodlot under good management so that it may serve as an example of the results that may be achieved if other woodlots in the area are suitably handled.

6 . Permanent Summer Camps

At the present time there are four permanent camps on the watershed with a total summer attendance of about 1,100 people. The broad, shady valley flats and well drained hillsides on the lower sections of the valley are ideally suited to the development of summer camps. Camp Naivelt, situated on 115 acres of land purchased from the C.P.R. in 1936, offers a good example of one of the most elaborate developments of this type in the entire watershed.

7. Market Gardening in the Huttonsville Sand Plain

Between Churchville and Norval the route passes through the heart of a sand plain extending for two or three miles on either side of the river. These sand deposits probably represent the remains of a delta at the point where the Credit River emptied into a small lake covering the portion of Peel County now overlain with an extensive covering of clay soils,

The well drained and easily worked sands have been devoted to market garden, flower and orchard production, as can be seen from the landscape surrounding this stop, Many of the fields on this sand plain are irrigated either by water pumped directly from the river by gasoline engines or by water hauled from the stream in specially constructed tanks.

This small area of intensive cultivation closely resembles the agricultural pattern on the sand plains of the lakefront areas from which it is separated by extensive till and clay plains. While the market gardens and orchards of the lakefront section have been largely replaced by urban development, this area has remained relatively unaltered to date.

8. Dairying and General Farming on the Peel Till Plain

This relatively level till plain, broken only by the deep incision of the Credit River to the west and minor valleys of the tributary streams, stretches southward from the

base of the escarpment in a gentle dip, Now almost entirely deforested with the exception of the deep valley of the Credit and certain sections of the secondary streams, the plain is devoted to dairying and general farming.

The soils, formed on a clay till deposited during the glacial epoch, vary in colour from red to gray from north to south in response to the colour of the bedrock shale from which the till deposits of the parent material were derived. The sloping land alongside the stream courses possesses good natural drainage. The soils are designated as Oneida clay loam. Most of the broad, level plain contains an imperfectly drained soil known as Chinguacousy clay loam. Here the productivity and range of crops are improved greatly by tile drainage. Pockets of poorly drained soil called Jeddo clay loam are found in the low-lying areas. Immediately to the south and east of Brampton the soils become heavier and less well drained due to a veneer of clay which was deposited over the till when there was an extensive pond covering this area during a stage in the retreat of the ice from Southern Ontario.

Inherently these soils are low in organic matter, phosphorus and calcium and contain only a moderate supply of potassium. However, liberal quantities of barnyard manure and phosphate fertilizers will maintain fertility.

Dairying plays a leading role in the agricultural pattern of the locality and while Holstein-Friesian cattle predominate, Jerseys and Ayrshires are often encountered, Swine and chickens supplement the income of most farms. Spring grains, mostly oats and mixed grain, occupy about 20 per cent of the area while winter wheat occupies about 7 per cent. Hay and clover cover about 25 per cent. Corn, grown for fodder, plays an important part in some farm operations but only about 2 per cent of the land is given over to this crop. Clover, alfalfa and other grasses are grown for hay. Pasture occupies about 25 per cent of the land.

9. Dams and Mill Ponds

Because of a satisfactory volume of flow at most seasons of the year there has been an extensive development of mills and dams along the banks of the Credit River. Electric power was formerly obtained from the falls at Cataract and at Erindale in the southern part of the valley. Some of the mills between Streetsville and Georgetown are still using water power.

The Georgetown dam, about 125 feet in length and 6 feet above the level of the water, impounds a 5-acre pond with a maximum depth of 12 feet. The old abandoned millrace at the western end of the pond once carried water to the former paper mill south of the road. Since 1948 this building has been used by DeHavilland Aircraft as a storage warehouse. As can be seen from the profuse development of reeds close to the banks, there has been an extensive accumulation of silt in the pond.

This pond, along with the river and its steep and shaded banks to the north, constitutes a significant recreation resource for the people of Georgetown and the surrounding area. The site is just a mile and a quarter from the heart of Georgetown. Every day throughout the summer the children swim in the river and hike and play along the banks, When the new subdivision is completed to the south of Highway No. 7 another 4,000 people will be added to the population of the town and the pressure on recreation facilities in the area will become very great indeed.

Georgetown should purchase this private property for development as a municipal riverfront park. This step should be taken before the upper banks of the river are subdivided for some other use such as the construction of hi&-class residences overlooking the river. The pond could be easily cleaned and deepened with a dragline. The cost of this operation could be largely offset by the sale of silt as top-soil for the gardens and lawns of newly constructed residential areas.

10. Forest Cover of the Escarpment Face

Due to the steepness of the topography and the shallow nature of the soils, large sections of the Niagara Escarpment have remained in forest cover. The woodlands in this area contain many small tributary streams which drop off the escarpment in beautiful step-rock falls. The forest cover types are typical of those that can be found in a large proportion of the uplands.

The extensive stands of hard maple, 4 to 10 inches in diameter in most cases, probably represent the climax species for the well-drained upland areas. Poorly drained hollows, wet spring lines and stream banks are often occupied by white elm or a mixed cover type composed of black ash, white elm and red maple.

The larger trees have been culled from most of the forested tracts of the escarpment. However, when fenced from grazing cattle the subsequent growth is progressing favourably. The entire area is best suited to forest production in combination with public parkland and private recreation developments

11. Quarrying the Lockport Limestone

The dull grey Lockport limestone which forms the hard erosion-resistant cap of the Niagara Escarpment has been extensively quarried in various parts of the valley for many years. These beds, which outcrop along the face of the escarpment, dip gently to the westward beneath a deep covering of glacial drift and underlie the entire north-west portion of the Credit Watershed.

The presence of this hard dolomite limestone formation is responsible for the magnificent escarpment which sweeps across the heart of the watershed. These beds have offered far greater resistance to geological weathering and erosion than have the softer shales to the south and east, and consequently a sharp elevational difference has resulted at the

junction of the two formations. This escarpment, extending from the Niagara Escarpment to Tobermory, constitutes the only really significant vertical feature in the entire area of the Southern Ontario section of the Great Lakes Plains. It is ideally suited to the development of a north-south scenic highway with strategically located regional parks such as that recommended for the area surrounding the Forks of the Credit

Limestone has been quarried from the area in large blocks for the construction of homes and public buildings. The increased consumption of smaller cut ornamental stone has stimulated recent extraction from the area. Vast quantities of lime have been manufactured from this material in the past and the large abandoned kilns at Limehouse bear testimony to this once flourishing business.

12. Summer Cottage Developments

Because of the scenic qualities of the landscape and the close proximity to large concentrations of urban population, the Credit Watershed proved attractive for the development of summer cottages from a very early date. Almost all the current owners reside in Toronto, Hamilton and the larger centres of the intervening lakeshore area.

The cottages along the riverfront in the vicinity of Terra Cotta are a fair representation of the type of construction prevailing throughout the watershed. Of modest design and economical construction, they are satisfactory as summer dwellings where the emphasis is upon outdoor activity and minimum of shelter. Due, however, to the acute housing shortage in the metropolitan areas to the south, many of the summer residences in the valley have been winterized for all-year dwelling. Such a procedure can place a considerable strain on the public facilities of the township such as schools and roads. Often the general basic design and layout of cottage colonies is unsuitable for permanent residence,

Regardless of any improvements that may be carried out, such areas soon deteriorate into veritable rural slums.

13. Brickworks

The extensive deposits of red shale and clay at the base of the escarpment provide a valuable source of raw material for brick manufacturing, since they are relatively easily exploited and conveniently situated with respect to major areas of construction in Southern Ontario.

The Provincial Brick Company has erected a large plant at this point and is extracting clay from the hillside. Just north of the plant the company has constructed a number of houses for its employees.

It is worthy of note that brick manufacturers beyond the watershed are becoming interested in these supplies of brick clay. During the summer of 1954 companies located in Kitchener were trucking these clays to their plants.

14. The Forks of the Credit

The scenic qualities of the landscape and the recreation significance of the surrounding terrain have been extensively treated in Chapter 2 of the report.

15. The Falls of Cataract

The geological interest associated with this point and the recreation value of the area are explained in Chapter 2 of the report.

16. Private Reforestation

Plantations on one 325-acre estate near Alton represent the largest reforestation and woodlot management scheme on the watershed. This was the first privately owned Tree Farm in Ontario to be certified by the National Tree Farm Committee of the Canadian Forestry Association.

There are approximately 120 acres of reforested land on a number of plots scattered amongst and around the

natural- woodland cover of the estate. The plantations are mostly composed of conifers. Red, white and Scotch pines are the dominant softwoods. Some of the shelterbelt blocks of Scotch pine are about twelve years of age. Small plantations of white ash, black walnut and red oak have been started in selected areas.