RAISIN REGION CONSERVATION REPORT 1969

A supplement to The Raisin River Report 1966

ONTARIO

DEPARTMENT OF ENERGY AND RESOURCES MANAGEMENT

CONSERVATION AUTHORITIES BRANCH

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CHRONOLOGICAL ORDER OF ILLUSTRATIONS

RECOMMENDATIONS

1. That the Authority encourage the use of tile drainage.

2. That the Authority provide a private lands' assistance program designed to assist in the establishment of grass waterways.

3. That the Authority acquire 16,620 acres of land for an Authority Forest.

4. That the Authority maintain a continuing watch over local streambank problems and, where necessary, take action to arrest erosion.

5. That two additional manual rain gauges be installed at Apple Hill and Alexandria.

6. That one recording stream gauge be installed at the proposed Rivière Delisle damsite and one manual gauge on Rivière au Beaudet near Highway 34.

7. That the hydrologic gauge installations be undertaken within three years.

8. That the Authority consider Rivière Delisle and Green Valley dams for preliminary engineering and construction as funds become available.

9. That the Authority carry out minor channel clearing and dredging at the various locations indicated to reduce the possibility of ice jamming and consequent flooding.

10. That the Authority work to help control water pollution.

11. That no further introduction of smallmouth bass be made in Loch Garry, unless it can be shown that the populations of smallmouth bass which were previously introduced have survived.

12. That a check be made to see whether the muskellunge fry introduced into the Delisle River have survived the conditions of pollution in that river.

13. That if impoundments are built on the Delisle and Beaudet Rivers, they will be managed for wildfowl as well as summer flow, by the methods described.

14. That the area of the Garry River above the water supply dam, west of Alexandria, be improved for wildfowl by the methods described.

15. That subdivision control be set up for Kenyon Township, and that lot sizes on Loch Garry will not be less than 15,000 square feet where sewage and water facilities are to be provided on the lots.

half of Lancaster Township, which takes in the watersheds of small creeks flowing to the St. Lawrence River between the Raisin River and the east border of the Province of Ontario, is oriented to the flat lacustrine plain of the Soulange-Vaudreuil region of the Province of Quebec. For example, the major area of Lancaster Township exhibits high class lands which, in general, have a Class II agricultural capability (Canada Land Inventory). This land is only limited by a poor soil drainage condition.

Fragmentation of farmland has occurred within the Authority from the influence of absentee ownership of local property. This has been the result of several trends:

a. inheritance of local property by residents of other regions;

b. the aging of some local farmers resulting in reduction and cessation of active farming;

c. the purchase of local property by residents of other regions for rural retreat and summer home purposes; and

d. land speculation.

These trends can have a considerable effect on the continued development of areas of higher class agricultural soils. This is particularly conspicuous in regions where local property consisting of long rectangular lots does not conform to, or complement, the shape and direction of the landscape and watershed. This is especially true of Lancaster Township, where there is a large area of higher class agricultural soils, the potential for greater agricultural development and a lack of subdivision control and other sound planning measures.

Fragmented patterns of non-farming land ownership are significant in this township, and may influence future conservation projects designed to complement increases in agricultural cultivation and production.

Non-farming land ownership in Lancaster Township has been described. This includes both the non-active farmer and the agricultural land investor who lives outside the immediate area.

TABLE 1. LANCASTER TOWNSHIP NON-FARMING LAND OWNERSHIP

Concession	Total Acreage Absentee Owned	Percentage of Total Concession Area
I	2,608	32.3
II	1,775	32.6
III	2,707	38.2
IV	2,011	27.0
V	933	14.0
VI	1,499	20.0
VII	855	12.0
VIII	918	15.0
IX	2,759	30.0

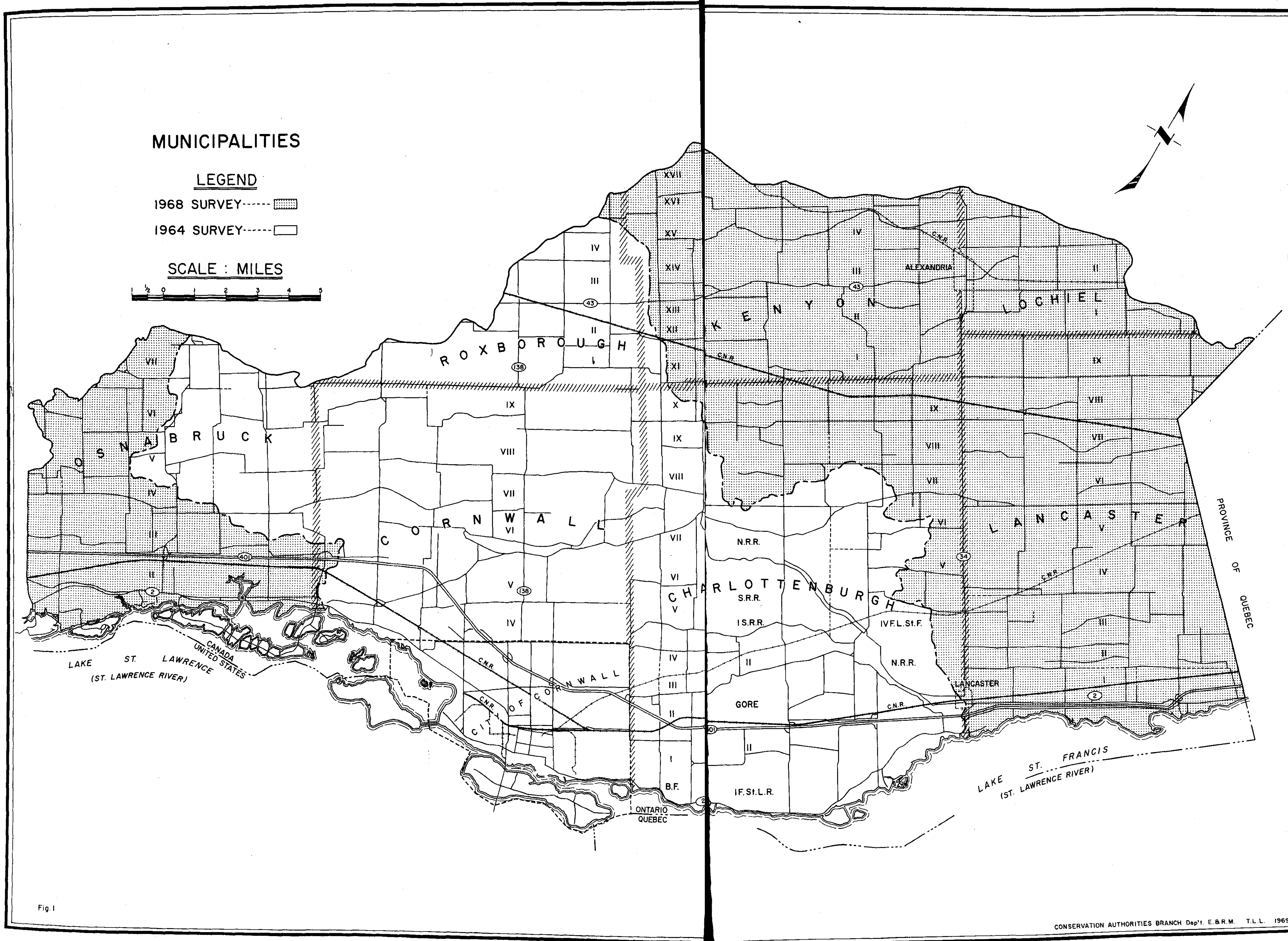
MUNICIPALITIES
LEGEND
1968 SURVEY
1964 SURVEY
SCALE : MILES
½ 0 1 2 3 4 5
OSNABRUCK
ROXBOROUGH
CORNWALL
KENYON
LOCHIEL
CHARLOTTENBURGH
LANCASTER
CITY OF CORNWALL
ALEXANDRIA
LANCASTER
GORE
N.R.R.
S.R.R.
I S.R.R.
IV F.L. St.F.
B.F.
I F. St.L.R.
C.N.R.
401
2
43
138
34
LAKE ST. LAWRENCE
(ST. LAWRENCE RIVER)
CANADA
UNITED STATES
ONTARIO
QUEBEC
LAKE ST. FRANCIS
(ST. LAWRENCE RIVER)
PROVINCE OF QUEBEC
CONSERVATION AUTHORITIES BRANCH Dep't. E.&R.M. T.L.L. 1969

Fig. 1

3. Land-Use Practices

In general, cropping practices in the watershed of the three larger streams added to the Authority, Hoople, Delisle, au Beaudet, reflect trends described in the 1966 report. Hence, there has been a gradual increase in the practice of row-cropping (corn) by local farmers, to make use of higher yields and nutrient values for the local livestock industry. In addition, however, the higher class flat lands of Lancaster Township may be on the verge of developing a soya bean industry. Thus, increases in cash-cropping, in the size of farm holding per owner and in field area, may be anticipated in this part of the Authority.

Detailed on-site investigations were made to determine the extent of each portion of the Authority which was being cultivated for annual crops such as spring grains, winter wheat and corn. These were compared with the farm areas being used for natural meadow pasturage and improved forages for hay and pasture. These studies gave an indication of the amount of land normally plowed and cultivated each year, in areas that are the potential origin of off-field soil losses from various forms of erosion. The erosion potential of local soils was described in the 1966 report.

The recent investigation sampled two separate areas across the Authority from east to west; one in the northern portion of the Authority between Dalhousie Mills and North Valley, and the other in the souther portion of the Authority between Curry Hill and Cornwall Centre. These samples disclosed that the greatest annual crop production is carried on in the areas of superior agricultural capability: the townships in the southern and eastern parts of the Authority, Cornwall, Charlottenburgh, Lancaster and the eastern portion of Kenyon Township. They support the theory that the row-crop potential of Lancaster Township has not yet been fully exploited.

4. Survey Features

The erosion potential of local soils was discussed in the report of 1966. Because larger areas are normally kept under grasses and forest mixtures, however, the off-field erosion in the Authority is difficult to locate and is mainly a potential hazard. However, an opportunity was available to relate the off-field erosion that occurs in the Raison Region Conservation Authority to local weather patterns, since local weather stations have been established because of the influence of the local office of the Department of Agriculture and Food. The location and mapping of erosion were also applied to local drainage problems, as a study of waterways and watercourses, since soil drainage requirements are directly related to outlet conditions.

5. Specific Erosion Study

A plot was established on the Wesley Creek watershed in Lot 32, Concession XIV of Lancaster Township. On June 7, stakes were established in two small rills in a spring grain field, on the banks and the bottom of an excavated waterway. The crop had grown to a height of four inches, but the field showed signs of previous erosion: small rills up to six inches in depth, extending up to 30 feet from the waterway into the field. The waterway itself had been dug in September 1967, and, according to local residents, had a history of bank-collapse problems. At the time of the stake installation, the waterway banks had steep slopes, some slumping and off-bank sheet erosion, and little vegetative cover. The water, however, was running clear, with fluctuating levels.

On June 13th, rainfall of 0.71 inches, which fell in a short period of time, was registered at a local rain gauge at Williamstown. By June 14, the rills under study had lengthened by 20 and 22.5 inches, respectively. One bank stake showed a 1/4 inch soil loss from the bank itself, and another exhibited a 1/2 inch deep deposit from the off-field sheet erosion behind it. Again, the water in the waterway was clear.

On June 20, a further 0.57 inches of rain fell. This produced a silting effect in the waterway, to a depth of 3.75 inches. Bank erosion losses were a further 0.25 inches, but no lengthening of the rills had occurred.

Further rainfall was measured during 3 successive days: June 23 - 0.23 inches; June 24 - 0.02 inches, and June 25 - 0.14 inches.

On June 25, bank erosion had increased to 0.7 inches and field edge losses were 0.3 inches. During this period, the adjacent crop had grown to heights ranging from 9 to 12 inches. No further silt deposition was measured. It was concluded that the silting was the result of the 0.71 inches rainfall occurring over the short period of time. Row crops will conceivably produce greater losses from larger areas of exposed soil surfaces.

6. Streambank Studies

Streambank studies were instituted early enough in the survey to allow observations to be made of the entire length of every stream in the additional portions of the Authority. Details of bank conditions on each stream are summarized.

a. Rivière Delisle

The principal bank problems on this river begin in the area of Lot 24, Concession 4 of Kenyon Township, and can be found at intervals from this point downstream. Certain common bank problems occur, but extensive erosion does not exist on the main stream. Cattle damage to the main banks can be found, but only occasionally. It is serious in one area only, on Lots 21 and 22 of the 9th Concession of Lochiel Township. Elsewhere there are slumps which tend to occur on the outside curve of stream meanders. Some banks are severely undercut. There appears to be a common erosion and undercutting problem where tributary ditches and streams enter the main river. These streams and ditches also exhibit a tendency towards gullying on their banks and silting at their entry point on the main stream. Undercutting is a problem and a hazard on bank areas occupied by large trees.

Erosion problems were also mapped on some upstream tributary sections. It should be noted that there is a local awareness of bank problems, indicated by the occasional establishment of rock rip-rap on eroded sections of streams, by private individuals.

b. Rivière au Beaudet

Upstream sections of this river exhibit few bank problems in Kenyon and Charlottenburgh townships. Erosion at the entry of tributary streams is only slight and there is some undercutting to be found at bridges. There is a potential for cattle damage due to the local practice of pasturing cattle close to the river banks.

In the Lancaster Township sections of the river, direct cattle damage to banks is common, particularly along curves in the river in Lots 20 to 23, and 31 to 37, of Concession 7. Erosion on the banks is occasional and there is some gullying, particularly at the entry point of tributary streams and ditches. This is accompanied by silting in the same locations. Slumping and undercutting problems are only slight and occur occasionally. There are some locations where limited undercutting is associated with large, standing trees on the banks.

c. Wood Creek

This small stream's banks exhibit conditions resulting from habitual use by cattle. Hence, bank erosion and some small scale gullying and silting are common.

d. Gunn Creek

The constant use of this stream's banks by cattle is similar to that of Wood Creek. Erosion and silting are common, as well as some slumping.

e. Sutherland Creek

Sutherland Creek exhibits larger and more frequently occurring bank problems than those on the other smaller streams of Lancaster Township. In its upper reaches, slumping and undercutting is noticeable on meander curves and there are cases of bank erosion on similar sites as a separate problem from the slumping and undercutting. Bank areas along woodlots are equally prone to undercutting and collapsing from the exposure of tree root systems. Woodlot cutting for pulpwood has also led to stream blockage. The slash has been deliberately thrown into the waterway. Pollution hazards from manure piles on the banks were also observed during survey. Along its middle reaches, the slumping, erosion and undercutting problem is greater as meanders increase in size and number. There are localized areas where the erosion problem has been accentuated by cattle. The problem of bank collapse due to exposed tree root systems is apparent once again as the creek passes through woodlot areas. Trees have collapsed and blocked the stream in the wider areas of the waterway, in the lower reaches.

Along the creek there are two sites where the spoil banks created by dredging have not been levelled.

In general many portions of banks in the stream systems of Lancaster Township exhibit steep high banks which, when dry, show some stability despite the lack of vegetative cover. However, slumping problems on steep banks occur during periods of high water, despite vegetative cover.

The eroded state of many streambank sections in Lancaster Township can, in large part, be attributed to livestock use.

Rehabilitation of these bank areas is only a partial solution, one which is certainly related to the need to provide alternate stock water supplies to local farmers.

The summaries of streambank problems are based on the more detailed survey observations which are available to the Authority.

f. Wesley Creek and Tributary System

This system exhibits slumping problems on 4 sites. Erosion on ungrassed portions presently is a possible hazard, although during the survey new rilling of bank areas was observed where cultivation has reached the bank's edges. Ditch entries to the main stream area exhibited silting and suggest a high erosion hazard. Areas where gentle bank slopes were combined with grass were stable.

g. Leon Creek

Leon Creek shows erosion and slumping conditions similar to those observed on Wood and Gunn Creeks. Much of this bank breakdown is also caused by cattle.

h. Finney Creek

Bank problems west of Highway 34, on this stream, are confined mainly to cattle damage at 6 locations. Similar damage accompanies other erosion effects and slumping in 5 locations from Highway 34 to the stream's mouth.

i. Hoople Creek

A summation of bank conditions is unlikely to provide the Authority with a worthwhile picture of the problems in this watershed. Streambank conditions on this system, therefore, are listed in detail.

TABLE 2. HOOPLE CREEK

Twp.	Con.	Lot	Streambank Problem Areas
Osnabruck	VIII	17 to 21	1. Pond — minor cattle erosion
	VII	21 to 24	1. Slumping, some silting 2. Areas of weed & willow blockage 3. 1 instance of minor gullying 4. Slumping on recent roadside ditching on south concession road 5. Banks too steep on recent ditch 6. Minor cattle erosion 7. Old spoil banks not levelled 8. Some blockage by branches
Osnabruck	VII	23 to 25	1. Silting 2. Cattle erosion

(Table Continued on Page 7)

TABLE 2, HOOPLE CREEK, Continued

Twp.	Con.	Lot	Streambank Problem Areas
Osnabruck	VI	22 to 25	1. Spoil bank not levelled 6 feet from bank 2. Banks of ditch steep 3. Some cattle erosion 4. Slumping 5. Silting in Hoople Creek 6. Blockage of creek by grass and bushes
Osnabruck	VI	25 to 27	1. Silting 2. Unlevelled spoil banks 3. Cattle erosion
			HOOPLE CREEK NORTH TRIBUTARY
Osnabruck	V	31	1. Silting
Osnabruck	IV	34 & 35	1. Willows in drainage ditch blocking passage
Osnabruck	V	32	1. Cattle erosion in drainage ditch
Osnabruck	V	25, 26, 27 (northern 1/3)	1. New spoil banks not levelled 2. Cattle erosion 3. Slumping, silting, gullying
Osnabruck	IV	26	1. Blockage of creek with rails and willows
Osnabruck	V	26 & 27	1. Undercutting 2. Cattle erosion
Osnabruck	V	27 to 30	1. Silting 2. Some cattle erosion 3. Grass and willows blocking stream
Osnabruck	IV	27	1. Minor cattle erosion 2. Water blockage by log jams
Osnabruck	IV	23 & 24	1. Willows blocking drainage ditches 2. Slumping 3. Undercutting and silting
Osnabruck	IV	34 & 35	1. Blockage by grass and branches 2. Cattle erosion 3. Spoil banks unlevelled
Osnabruck	III	34 & 35	1. Minor silting 2. Reeds and willow bushes in channel 3. Cattle erosion, silting in creek, blockage by reeds 4. Spoil bank unlevelled 5. Blockage by fallen trees, branches and rails near wooded area

(Table Continued on Page 8)

TABLE 2, HOOPLE CREEK NORTH TRIBUTARY, Continued

Twp.	Con.	Lot	Streambank Problem Areas
Osnabruck	IV	27 & 28	1. Spoil banks not levelled in woodland 2. Steep banks 3. Blockage by branches 4. Slumping caused by spoil banks being too close to bank in some parts 5. Severe cattle erosion 6. Silting, slumping and eddy erosion
Osnabruck	IV	25	1. Minor cattle erosion
Osnabruck	III	25, 26, 27 (North Branch)	1. Minor cattle erosion and slumping 2. Minor gullying
Osnabruck	III	25 to 33 (South Branch)	1. Spoil bank unlevelled 2. Minor cattle erosion 3. Blockage by old trees, branches
Osnabruck	IV	24	1. Minor cattle erosion
	III	24 & 25	1. Minor clogging by weeds
Osnabruck	III	22,23,24,25	1. Silting, minor slumping, eddy erosion 2. Spoil banks not levelled 3. Minor bank erosion, steep sides under-cutting 4. Unlevelled spoil banks very high and close to stream banks (22, 23) 5. Serious cattle erosion (22,23)
Osnabruck	III	20 & 21 (West Branch)	1. Cattle erosion 2. Spoil bank not levelled at north-west end 3. Silting, eddy erosion 4. Minor slumping
Osnabruck	III	16	1. Some silting 2. Minor cattle erosion
Osnabruck	III	19 & 20	1. Slumping, silting and cattle erosion where banks not stabilized 2. Silting and cattle erosion in ditch leading to Hoople Creek 3. Unlevelled spoil banks along drainage ditches
Osnabruck	II	18 & 19	1. Cattle erosion 2. Spoil banks not levelled in places 3. Minor slumping

(Table Continued on Page 9)

Twp.	Con.	Lot	Streambank Problem Areas
Osnabruck	II	16 & 17	1. Major slumping 2. Eddy erosion 3. Cattle erosion 4. Cattle erosion on shoreline at mouth of Hoople Creek 5. Minor silting
Osnabruck	II	2 to 6	1. Spoil bank unlevelled in bush at road #6 and near 401 at east part of block 2. Minor slumping and silting near mouth 3. Minor cattle erosion near mouth 4. Serious cattle erosion in one area 5. Silting and minor slumping between 401 and C.N. tracks 6. Small gullies near 401 7. Minor cattle erosion 8. Silting near 401 9. Cattle erosion in ditch running along 401, major slump
Osnabruck	II	7 to 13	1. Cattle erosion on banks at mouth 2. Banks slumping near bridge 3. Silting at mouth
Osnabruck	III	6	1. Unlevelled spoil bank on ditch leading into Hoople Creek 2. Silting, cattle erosion, minor slumping along 401
Osnabruck	III	9	1. Silting and steep banks in drainage ditches leading to Hoople Creek
Osnabruck	II	37	
Osnabruck	I	Below Highway #2	1. Spoil banks for waterways unlevelled

7. <u>Examples of Stable Slope Conditions on Local Streambanks</u>

The summaries of local streambank conditions all indicate that slope conditions are too steep, hence various forms of damage and collapse occur. Observations were made, therefore, to help define a stable bank slope condition. These can be related to local soils, and are listed. (See Table 3, page 10.)

It should be borne in mind that this list is a simple one, based on observations made by using simple instruments, hence the results are only approximate. The results are designed to provide the Authority with a practical range of slope ratios, especially for the locally prevalent Grenville soil series. More precise observations will be needed when bank stabilization works are instituted.

TABLE 3.

Soil Type	Approximate Maximum Allowable Slope Ratio for Stability
Grenville Loam	2 to 1
Bearbrook Clay	2.6 to 1
Kars, gravelly, sandy loam	2 to 1

8. Grass Waterways

Grass or sod waterways are necessary for soil conservation on sloping land. Regardless of the cropping system there will be many occasions when there will be runoff of surplus surface water. A waterway that has been broken up, properly shaped and seeded to a suitable grass and legume mixture and maintained as sod cover is the best way of allowing this surplus water to run off the land with a minimum of damage to the soil. Any farmer can use a grass waterway as a simple and effective erosion control measure.

The best locations for waterways are usually the natural drainage channels of the landscape. A waterway should be broad enough to carry the runoff expected over a period of approximately 10 years. The waterway should be wide and shallow and should have a dense sod cover established as soon as possible. This cover should not be broken up unless sod renewal is necessary. It should be clipped several times each summer and it should be maintained by regular fertilization.

Gullies and ditches, washed out by water runoff, are symptoms of land misuse. They often start in the natural runoff channels that have been cultivated or left unprotected. When they are small, gullies and ditches can be shaped into grass waterways easily, thus preventing erosion. Heavy equipment can shape a waterway very quickly.

Gullies, which may result from untreated waterways, will become greatly deepened and a serious problem if these waterway areas are left untreated. Extensive corrective measures may be necessary and may involve small check dams, tile installation or the construction of diversion waterways.

When fields are prepared for strip-cropping, grass waterways have to be carefully planned, particularly if special seeding and sub-drainage are required. Sub-drainage has been investigated by farm drainage researchers from MacDonald College at Ste. Ann de Bellveue in the Province of Quebec. Sub-drainage has been suggested for long-term installation in waterways that are subject to erosion and bank collapse, in areas in the western part of Quebec, bordering on the Township of Lancaster, where there are sites and soils similar to those of the Authority.

In many cases, when hay and pasture fields are being plowed waterways can also be created, simply by lifting cultivation implements over natural drainage ways.

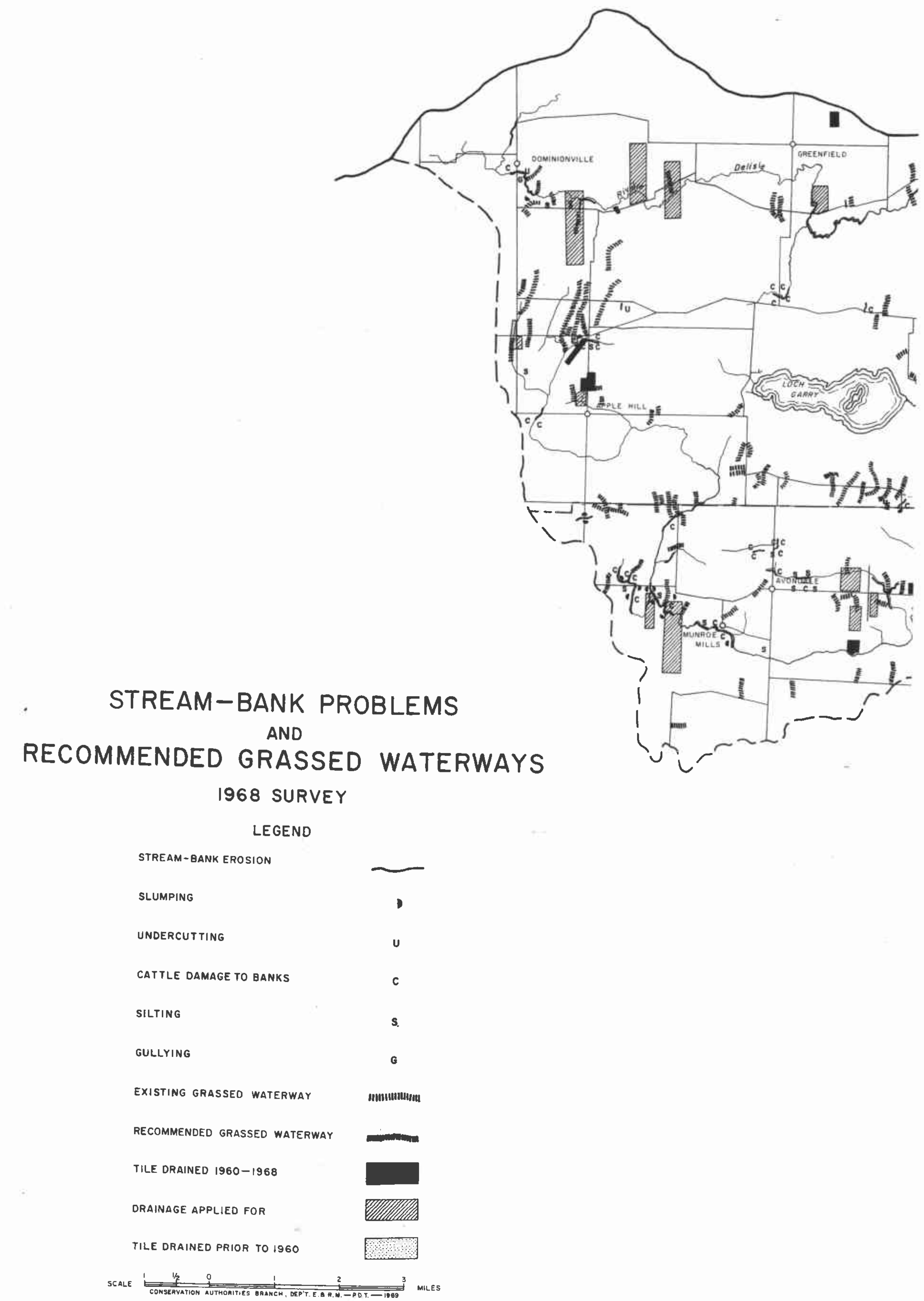

Fig. 2

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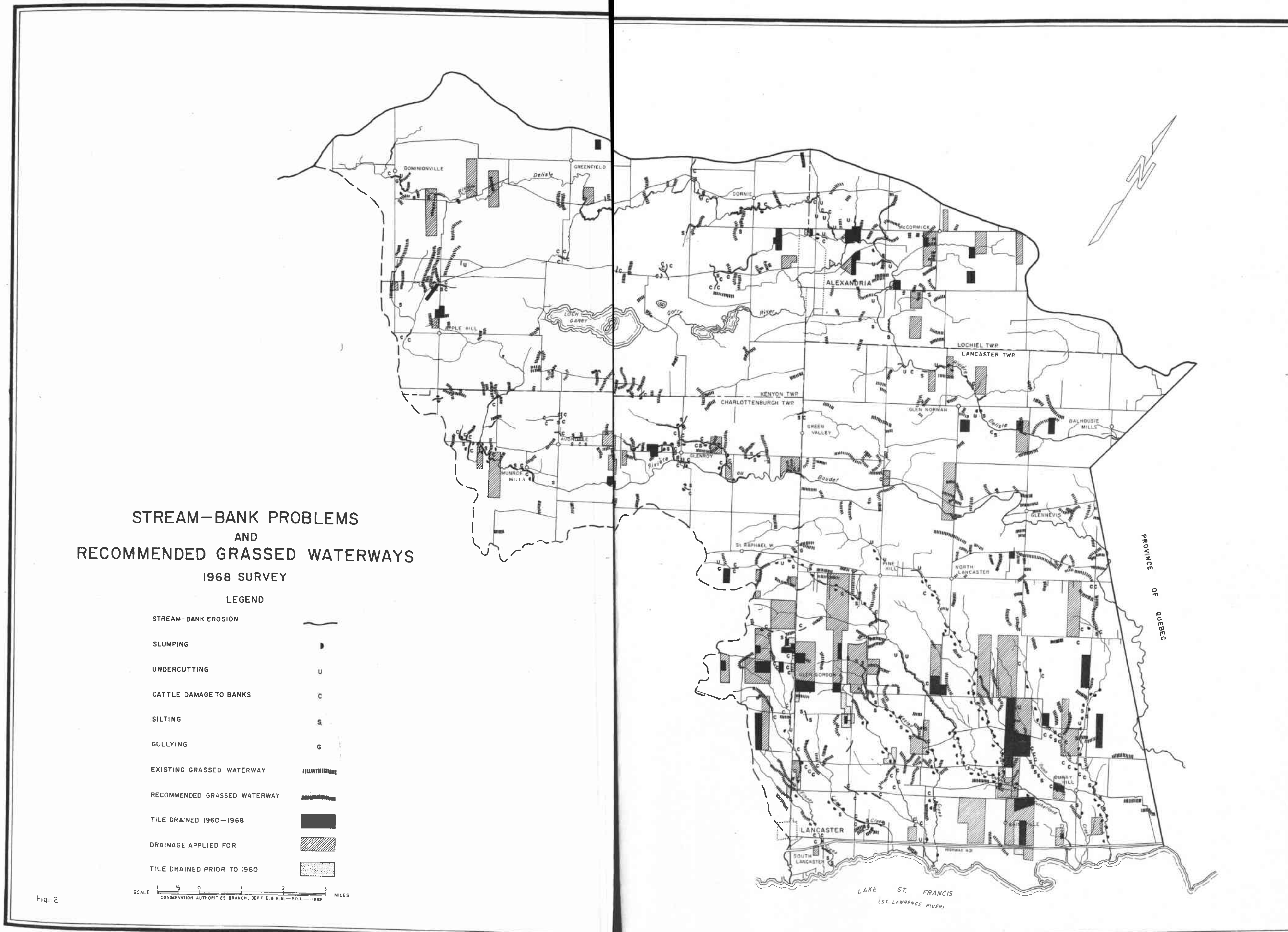
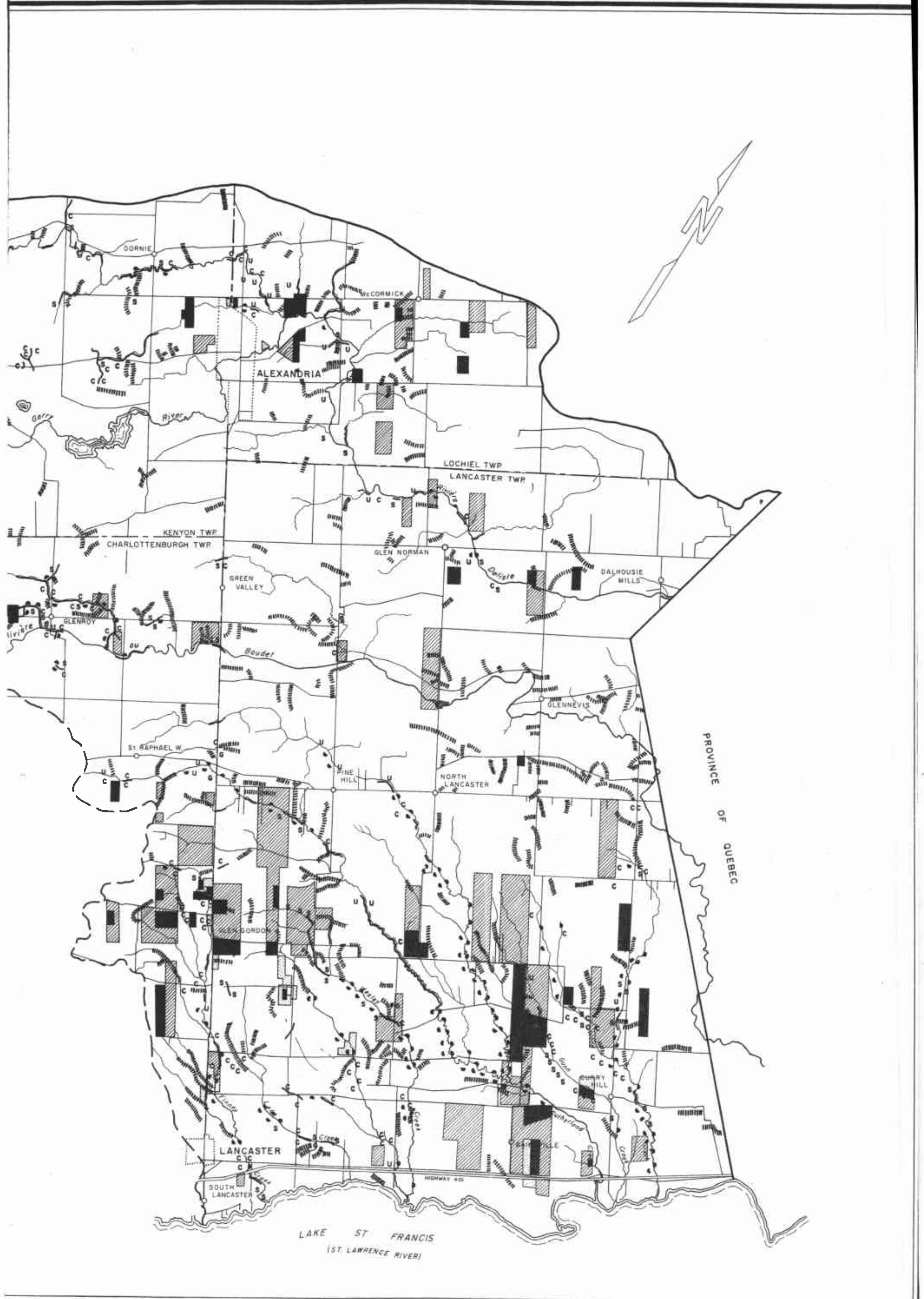


Fig. 2



STREAM-BANK PROBLEMS AND RECOMMENDED GRASSED WATERWAYS

1968 SURVEY

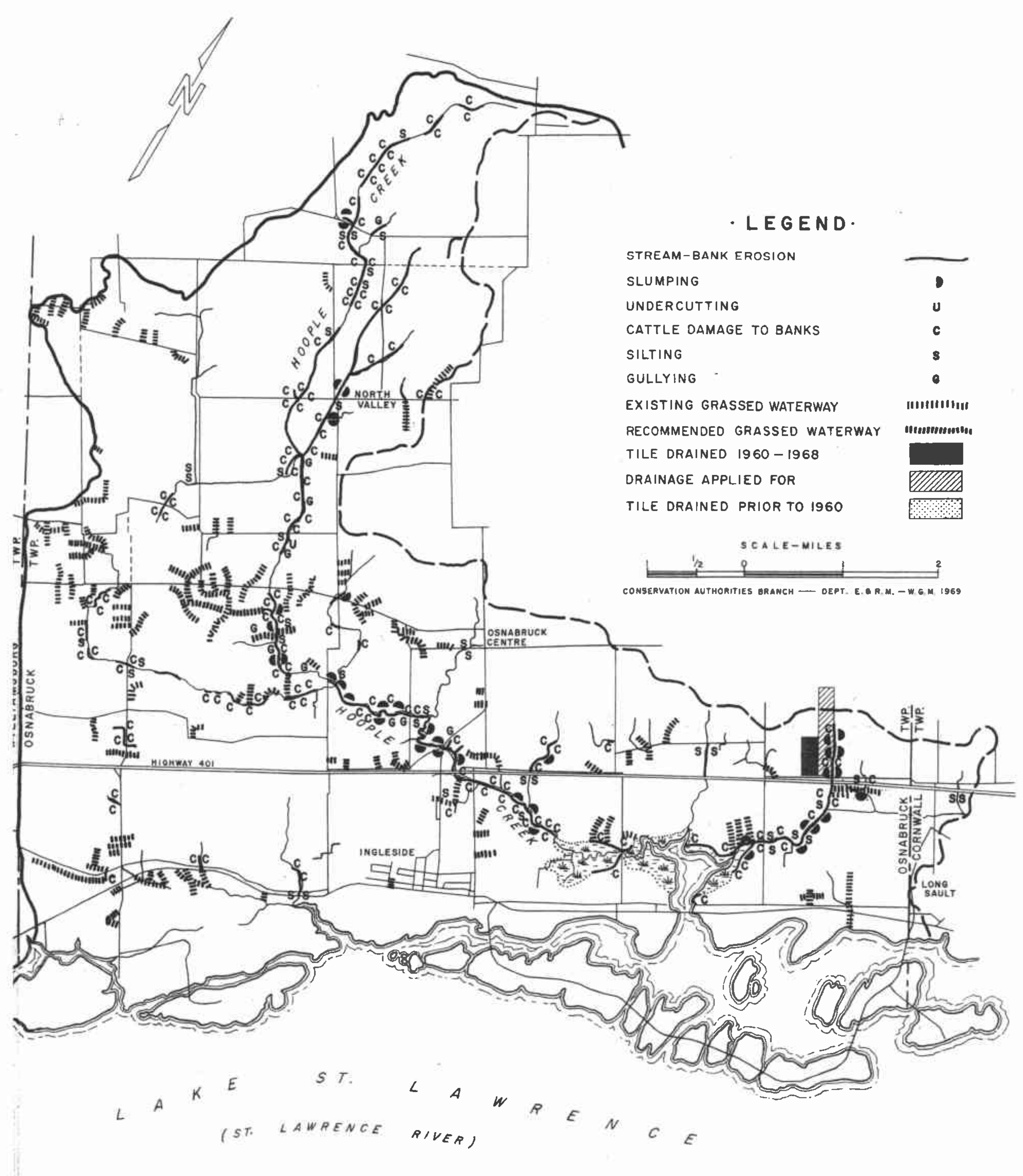


Fig. 3

In local areas, the sites of potential or existing waterways often tend to take on distinct characteristics. Thus in the Hoople Creek watershed, 131 separate and interconnected waterways were mapped in 1968, about 30 per cent of these being of the kind that are already sodded in some form. At the present time they require the Authority's efforts to persuade their owners to leave them uncultivated, at least until their sod cover requires renewal. In the main, these waterways are short and are directly associated with the local roadside ditches that act as outlets. Only about 17 per cent of the grass waterway sites in this watershed are connected to streams or municipal drains. Many of these drains could have been made less erosion-prone by constructing gentler bank slopes and seeding them.

One fairly good example of sodded ditch sides is located just west of Osnabruck Centre, in the 3rd and 4th Concession of Osnabruck Township.

The remaining 70 per cent of the selected waterways in the Hoople Creek watershed will permit the Authority an opportunity to set up a practical and worthwhile assistance program for local property owners. In order to ensure that these sites are treated, it may be necessary for the Authority to enter into an agreement with each landowner to provide all of the required work and seeding.

In the eastern region of the Authority, 423 sites needing grass waterways were mapped in 1968. These are equally divided between sodded waterways that should remain undisturbed for a time, and waterways that require preparation and seeding. Just under 23 per cent of the waterway sites in this region are directly connected to existing streams.

This 23 per cent is perhaps the area of prime concern to the Authority at the moment, because of the local history of streambank collapse, the need for sound and efficient tile systems outlets and the potential for an expansion of local cash-crop enterprises. About 58 per cent of this group consist of grass waterways in need of preparation and seeding.

Grass waterways have a tendency to fill up with sediment. In extreme cases the location of a waterway may be shifted to such an extent that the water flows along the edges. This often creates further erosion. For this reason, the edges of grass waterway should be left irregular. A permanent waterway will be insured if a little care is exercised when the waterway is crossed with tillage implements, if furrows are not plowed parallel to the waterway, if it is mowed to prevent excess forage accumulation and if it is protected from livestock trampling when the ground is wet and soft.

The following is a suggested method of establishing the grass waterways (with recommended seeding mixtures).

<u>Seed Mixture and Fertilizer</u>

Erosion Control: Embankments
Waterways
Gullies

Fertilizer

Work in a mulch of sawdust or wood chips or straw, along with 800 lbs./ac., of 5-20-10 fertilizer before seeding. Apply 300 lbs./ac., of a 10-10-10 fertilizer at time of seeding. Two months after seeding, top-dress with 150 lbs./ac., of a 33-0-0 fertilizer each month until the new seeds are established.

Well-Drained Soil		Poorly Drained Soil	
Seed	Lbs./ac.	Seed	Lbs./ac.
Bromegrass	15	Reed Canary-grass	11
Creeping Red Fescue	6	Kentucky 31 Fescue	10
Pennlawn Fescue	6	Timothy	5
Timothy	5	Alsike	6
Perennial Ryegrass	3	Perennial Ryegrass(Norlea)	5
White Dutch Clover	5	Ladino	3
	40		40

Alternate Seeding

Kentucky 31 Fescue	10
Birdsfoot Trefoil	25
Perennial Ryegrass (Norlea)	5
	40

9. Gravel Pits and Quarries

An examination of all local gravel pits, borrow pits, and quarries was made in 1968. Certain distinct differences in local features of gravel pits and quarries can be noted.

In the Hoople Creek Watershed no old quarries were mapped. Ten gravel or borrow pits were mapped. Seven of these contain water at various depths. Within the eastern region of the Authority, 16 pits, all of them used for gravel, were mapped. None of these showed any evidence of useful water.

CHAPTER II

FARM DRAINAGE

1. General

Farm drainage is essential for the proper management of wet, fertile soil used for agricultural purposes. It is a useful and often necessary conservation practice. However, by no means should all wet land be drained. Organic soils can be overdrained to the extent that, once they become dried out, rapid oxidation occurs and they become difficult to rewet and often the resulting soil is not sufficiently fertile to repay the cost of drainage. The benefits should be weighed carefully against the costs, these costs may include any natural resource loss such as waterfowl habitat.

In addition to the benefit of better crop production derived from well drained farms, there are other benefits which can be listed as follows:

a. by drying up the wet fields, the property value of the farm is increased, as well as its workable acreage;

b. good drainage also permits efficient and early machine operation in the spring;

c. livestock are more productive on the improved pastures; and

d. management is easier because all fields can be placed in rotations and soil building crops can be included. Crop root damage caused by soil heaving is reduced, and yields are thus increased.

2. Surface Drainage

Surface drainage removes the surface water by the use of shallow open ditches.

Systematic surface drainage is a method of carrying excess surface water safely off the land. It consists of a system of parallel, shallow bottom ditches and intervening lands formed to direct surface water into these collection ditches. The distance between ditches is governed by internal soil drainage and land slope.

Surface drainage costs vary with land conditions. They are highest on a flat, fine-textured soil where ditches are spaced closer together and require more careful grading, and where land smoothing is more difficult. The total cost of ditching and land smoothing varies from $15 to $25 per acre.

Open ditches are usually not real drainage systems. They merely act as outlets for other types of systems. Open ditches waste land, interfere with farming operations, encourage weed growth, and are difficult to maintain. Open ditches are necessary, however, and are still the most economical methods of removing large volumes of water.

3. Subsurface Drainage

Subsurface drainage is accomplished by the provision of horizontal passages in the subsoil. Gravitational water may seep into these passages and flow to suitable outlets. Modern practice uses clay or concrete tile or perforated pipe to provide a drainage passage.

Tile drainage is usually the only practical way of removing the excess water from a soil. Tiles used in lateral drains are nearly always hollow cylinders one foot in length and 4, 5, or 6 inches in bore. These tiles may be made of burned clay or concrete. Some tiles are perforated piping.

The tiles are laid end to end in the bottom of a trench, which is then backfilled. Water enters the tile line through perforations and the cracks between the ends of adjoining tiles. The tile line is given a slight slope to cause a free flow of water towards the desired outlet. A network of tile laterals is connected by a system of main lines which drain to a surface outlet. The function of the tile is to stabilize the drainage channel.

4. Examination of Local Farm Drainage Problems

After consultation with the local agricultural representative, the general condition of all the tile drain outlets were studied, in the Authority area surveyed in 1968. By so doing, some insight into the local problems associated with tile installation and use could be noted. Generally, within the area studied the history of tile installation falls into three categories: the systems installed prior to 1960, those installed between 1960 and 1967, and the drainage systems surveyed by the Department of Agriculture and Food on recent applications.

The observations of the first two categories can be summarized by Townships.

a. Cornwall Township

About 75 per cent of the tile outlets established before 1960 in this Township, have protective end-grates. Only half of them have had erosion-preventing materials, such as rock rip-rap, placed below the outfall. Some occurrences of silting were noted, as well as one case of silting created by localized cattle erosion.

The later installations established in this township after 1960 exhibit similar problems but on a slightly lesser scale. There is some evidence of increases in the instances of silting.

b. Charlottenburgh Township

Rip-rapping beneath tile outlets was used on half of the systems installed in this township before 1960. End-grates were also utilized in 75 per cent of these systems. Silting is common in most outlet tiles and outlet waterways also show silting signs from other sources.

The more recent systems show similar trends. Silt problems generally are minor. Areas upstream from tile outlets exhibit silting from local cattle erosion.

c. Kenyon Township

Only one tile system was installed in the Authority section of this township prior to 1960. It is a very old system established in 1910 without any protective measures, but it has only been damaged by livestock.

Livestock damage is also a prevalent feature of the outlet sites of recent tile installations in this township. Silt accumulation is not a problem. End-grates are also notably absent.

d. Lochiel Township

Just two tile systems were installed before 1960 in the portion of this township within the Authority. Neither of these have protective grates on end pipes or outlet slope rip-rapping. The more recent installations show a 50 per cent increase in end-grate use and outlet rip-rapping.

e. Lancaster Township

Fifty per cent of the tile systems installed in this township before 1960 have outfall slope stabilization with rock rip-rap. Some of the remaining outlet sites have been stabilized with grass. Slightly over 70 per cent of these systems have utilized protective grates for end-pipes and a similar number show slight silting. Some of this originates from outlet ditches eroded because of cattle damage to the banks. Over two-thirds of the more recent, post-1960, installations exhibit stabilized banks at outfall sites. Almost 90 per cent of these systems show end-grates on outlets. Siltation has not occurred at local tile outlets, but about half of the outlet ditches and waterways exhibit silt accumulation from other agencies.

It is apparent that local farmers have not only recognized the value of tile drainage, and installed it, but have, in many cases, shown care in maintaining stable and unsilted outlet conditions.

The problems point out inconsistencies in local methods. The Authority, therefore, can function in a practical way by encouraging greater care of tile outlets.

At the present time, about 3.8 per cent of the area in the eastern section that has soil drainage problems has been tiled. A further 9.6 per cent has been surveyed for further tile installation. This leaves over 60,000 acres in need of similar treatment. In the whole Authority, slightly over four per cent of the capable land needing this form of drainage has been treated and a further 8.5 per cent has been surveyed in preparation for tile installation. Thus, a total of 70,000 acres remains to be properly drained if these lands are to become agriculturally more productive. Authority support of such a program is in order.

5. Assistance in Planning Farm Drainage

As Chapter 2 has noted, there is a general need for more farm drainage in the Raisin watershed. To meet the problems of engineering and financing, the provincial government has, from time to time, enacted laws to provide much needed assistance.

The Department of Agriculture, through its Soil Advisory Service, will help the farmer plan his farm in the most efficient way for his particular type of agriculture. Recommendations may be made regarding improved drainage for the farm.

The Agricultural Engineering Extension Specialists will advise on drainage problems and, if necessary, will prepare a drainage plan for the farm.

These services are available upon application through the county Agricultural Representative.

Financial assistance for tile drainage is available through the Township Clerk, under the Tile Drainage Act.

Since farm drainage is a highly recommended conservation practice, it furthers the objectives of the Conservation Authority. It is recommended that the Authority work closely with the Department of Agriculture to encourage effective farm drainage.

CHAPTER III

FORESTRY

1. Forest Cover Types

The analysis of all the standing forest cover in the additional parts of the Raisin Region Conservation Authority indicates little significant difference in the distribution of forest cover types from that of the original area surveyed in 1965. However, local differences occur and they can be related to the local features of the Hoople Creek Watershed, and the large area between the eastern boundary of the Raisin Region watershed and the border between Ontario and Quebec. The detailed descriptions of forest species' combinations in the Raisin River Conservation Report, nevertheless, are still applicable.

Within the new sections of the Authority, most of the forest cover is confined to nine species' combinations.

TABLE 4.

Cover Type	Percent of Total Forest Cover
Aspen	15.0
Grey Birch — Red Maple	4.9
Sugar Maple — Basswood	12.3
Sugar Maple	6.3
White Cedar	15.3
Tamarack	3.7
Black Ash — White Elm — Red Maple	8.2
Ash — Hickory	4.8
Silver Maple — White Elm	13.9
White Elm	15.6

Six cover types occupy between 0.2 and 0.6 per cent of the forest area studied in 1968, and they are quite minor components of local woodlands. These six types are: Paper Birch, Sugar Maple — Beech — Yellow Birch, White Birch, White Spruce — Balsam Fir, Beech — Sugar Maple and Black Ash.

Five other cover types are found locally only as traces. These five types are: White Pine, White Pine — Hemlock, Hemlock, Black Spruce and Bur Oak.

In comparison to the main Raisin River watershed, there are greater acreages of Aspen cover in Lochiel and Lancaster Townships. These are concentrated in the southern portion of Lancaster Township and the area where the Rivière Delisle approaches the border of Quebec. This concentration may be the result of natural re-invasion of fields that failed to produce good agricultural crops because of high moisture conditions in primarily good agricultural soils.

Some of this acreage may also be a result of heavy cutting for pulpwood, which favours the regeneration of species that produce heavy "sucker" shoot populations. The Hoople Creek watershed exhibits a somewhat heavier woodlot component of the wet site type, Black Ash — White Elm — Red Maple. This cover is mainly associated with swampy areas.

Generally, the townships where wet depressions and hummocky areas of limey soils are found exhibit a greater acreage of white cedar. The presence of white cedar is not necessarily indicative of poorly drained marginal areas; white cedar stands may be the residual stands from pulpwood cuttings. Local markets do not utilize this species. Its utilization therefore is still dependent on a vigorous post market and the ability of local equipment to reach stands of white cedar that are located in wet areas.

2. <u>Condition of Woodlands</u>

Woodland and scrubland cover a total of 27.3 per cent of the combined Hoople Creek watershed and the eastern region of the Authority. This is a condition similar to that of the main Raisin River watershed, as is the fact that 73.4 per cent of the woodland in the new areas is hardwood. The area of pure conifer cover is almost precisely the same (9.1%). There is a larger percentage of mixedwood in the additional sections (16.4%) and this can be explained by the slightly greater acreage of white cedar, a species which tends to mix with other species quite easily in Eastern Ontario.

The wooded portions of the two newer sections exhibit a heavier component of pulpwood-size material, 64.2 per cent compared to 56.3 per cent in the main Raisin River watershed. This is the material in the 4 to 10 inch d.b.h. class. The surprising fact in comparing the woodlands of the new sections to those of the Raisin River watershed, is the lesser area of woodlands of saw-log size. The new region's woodlands contain only 20.1 per cent of materials in the 10 to 15 inch d.b.h. class, and 5.0 per cent in the 18 inch and over class. This fact suggests, that in the period between the Raisin River watershed survey of 1966 and the 1968 survey, there have been considerable increases in pulpwood cutting, because of the large and attractive local market. In fact, the 1968 survey located 6,604 acres of cut-over woodlands. This represents 14.3 per cent of the existing woodlands compared to 5.4 per cent in the original Raisin River watershed, a large increase in local woodlot exploitation in so short a period.

Deliberate woodland grazing also appears to have increased since it is a common practice in 50.3 per cent of the woodland portion of the newer sections. In addition, since almost 95 per cent of the surveyed woodlots are unfenced, it is apparent that the casual use of woodlands in local pasture programs is habitual. There are also more acres of wooded pasture in the newer regions, 7,317 acres, compared to 3,000 acres on the Raisin River watershed. Since wooded pasture mainly occurs in Kenyon, Lancaster and Charlottenburgh Townships, it is possible that a relationship exists between local wooded pasture and the more intensified agriculture practised in these townships. Woodland grazing has almost certainly created most of the poor forest regeneration conditions in these areas, since over 97 per cent of the new area's woodlands exhibit unsatisfactory regeneration conditions. Most of this (71.8%) can be classified as poor, and can also be related to areas of intensified agriculture.

FOREST COVER TYPES BY TOWNSHIPS

PERCENTAGE BY TOWNSHIP

1968

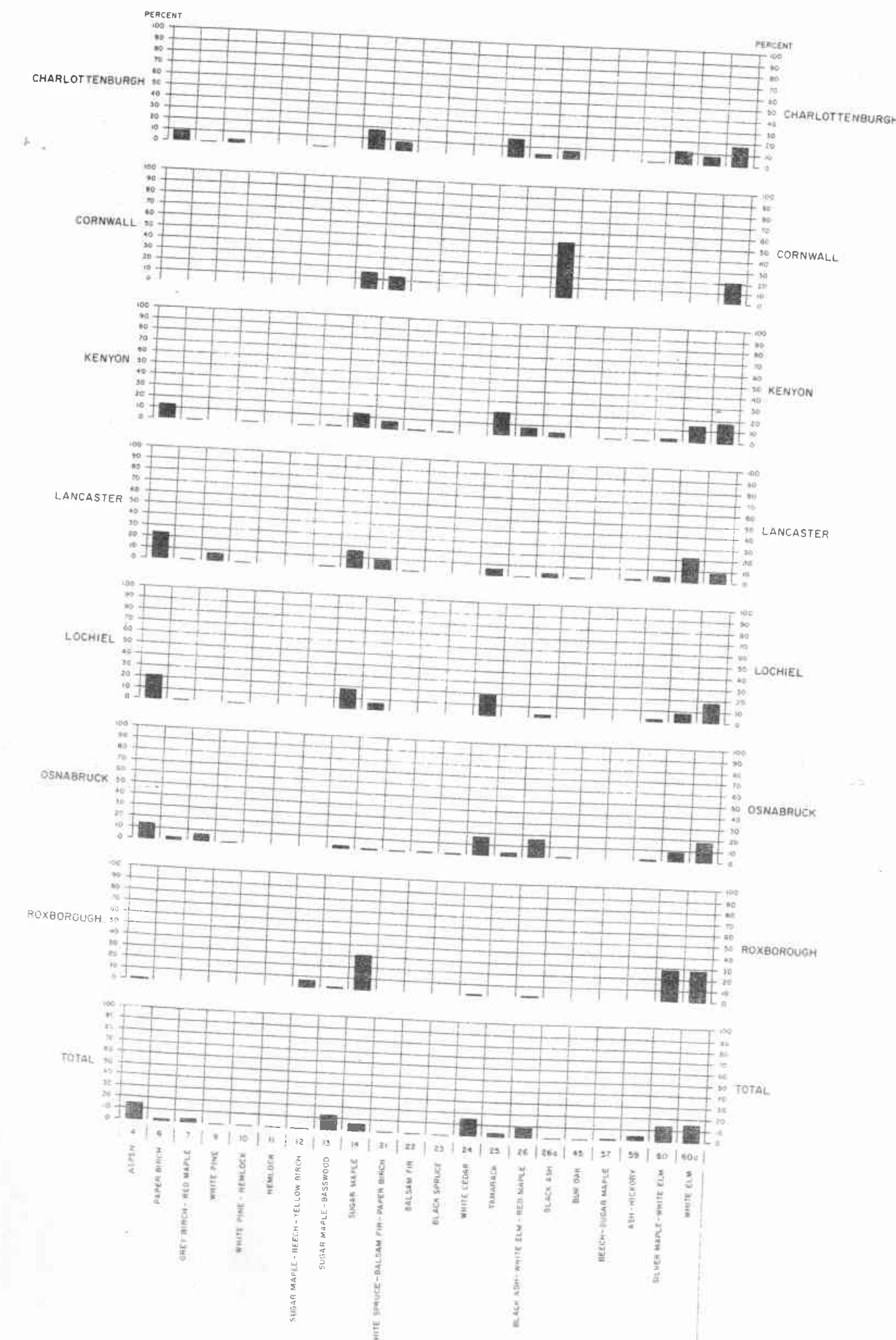


Fig. 4

WOODLAND CONDITIONS BY TOWNSHIPS

PERCENTAGE BY TOWNSHIP

1968

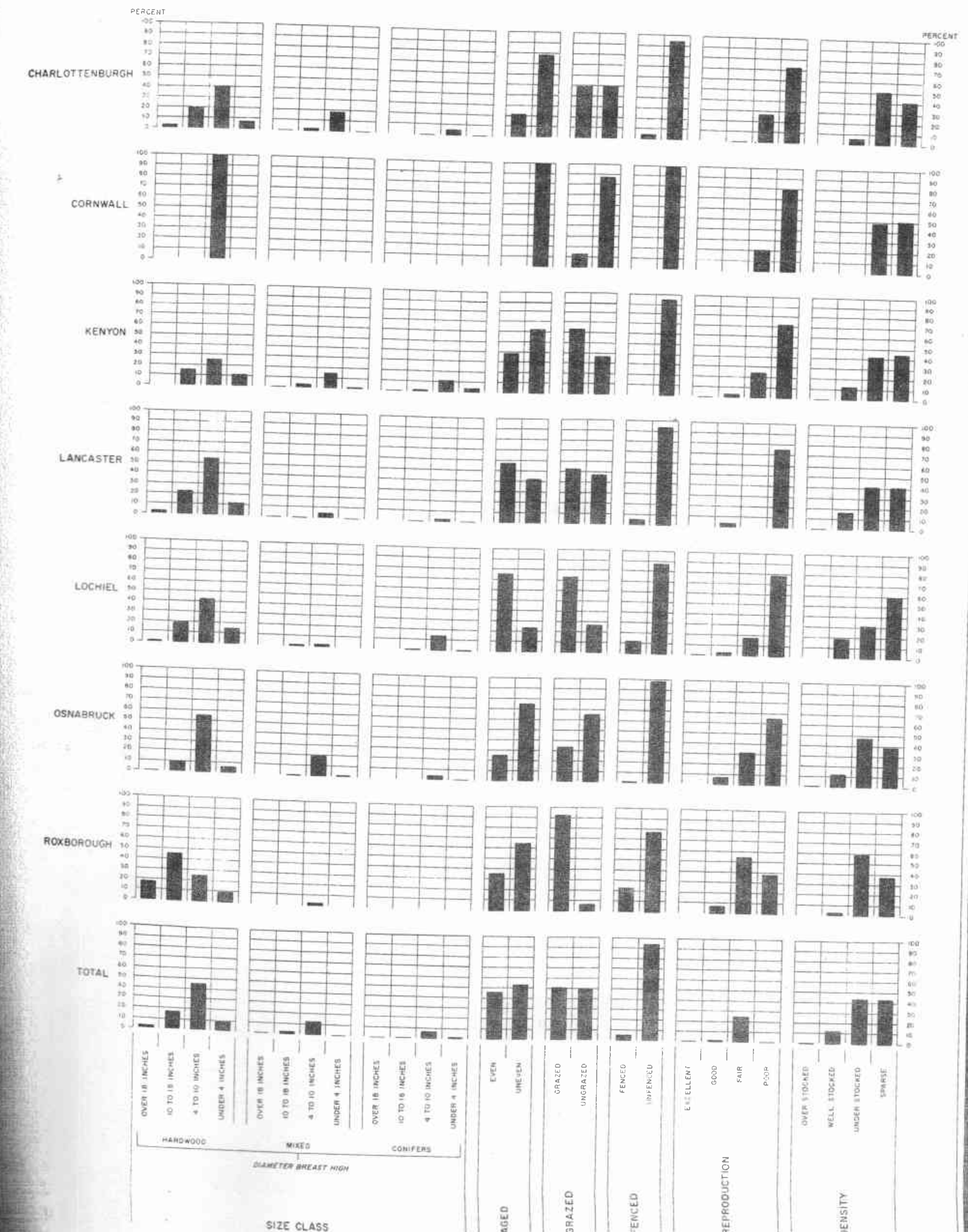


Fig 5

CONSERVATION AUTHORITIES BRANCH Dept. E.&R.M. T.L.L. 1969

Evidently, a similar relationship exists in the state of woodland density, since well over 80 per cent of the newer regions' woodlots are either poorly stocked stands or open stands. The need for better local woodlot management, therefore, is clear.

3. Scrublands

Scrubland conditions in the sections added to the Authority show distinct differences from those described in the Raisin River Conservation Report of 1966. Although the total acreages of woody cover of various types are comparable, only about half as much scrub cover is to be found in the newer areas. Almost 78 per cent of this is wet scrubland.

The Authority should, therefore, show some caution in considering programs concerned with scrublands, and wet scrublands particularly, since it can anticipate some portion of this cover is located on areas that would benefit, for agricultural purposes, from tile drainage. Elsewhere, essential stock watering ponds can be created in wet scrublands; these ponds would serve in reducing the damage to local streambanks.

TABLE 5.

Township	Wet Scrub	Dry Scrub
Kenyon	2599	682
Roxborough	108	
Lochiel	282	166
Lancaster	828	136
Charlottenburgh	867	541
Cornwall	7	
Osnabruck	1443	211
Total	6134	1736

4. The Effect of Logging

The surveys 1966 and 1968 have indicated clearly that logging, particularly for pulp-wood, has increased steadily in recent years in the area of the Raisin Region Conservation Authority. This is a confirmation of previous reports by the Department of Lands and Forests indicating an over-cut of local woodlands.

Basically, much of this cutting is designed to boost local rural incomes. It has also led to gradual increases in the mechanization of logging, particularly on the part of logging contractors.

In 1968, a mechanized logging operation was observed in a wet-site silver maple stand, on both sides of a tributary stream of Hoople Creek. Such types of modern equipment as a four-wheel skidder and a tracked logging trailer were in use.

The tendency to create skid roads with deeply incised wheel tracks and the deliberate crossing of streams were noticeable in the operation. Each of these had created a temporary erosion problem and sediment loads in the waterway. The waterway itself had frequently been blocked with slash. The Authority, therefore, should be prepared to take an active stand in criticism of such operations; with modern equipment there is ample opportunity for loggers to remove material from woodlands without damaging the sites.

5. Woodlot Logging and Regeneration

An examination of local woodlot harvesting indicates a preference for clear-cutting. An analysis of local forest cover shows the gradual trend towards over-exploitation, leading to the loss of potential sawlog material. An examination of 188 cut-over areas, during the 1968 survey, also revealed that local loggers heavily favour the harvesting of young sugar maple and basswood stands, or stands in which sugar maple is the dominant species. Over half (52.1%) of the examined cut-over areas indicated that this was the species composition of the former stand. Another 23.9 per cent was former white elm or elm-dominant stands from moist and wet sites, and 12.7 per cent was made up of soft maple dominant compositions. These findings all exhibit the distinct, local tendency to exploit those species which would respond to good management practices and produce a variety of merchantable products. However, all of the cut-over stands were stands in a diameter range that makes them useful only for pulpwood.

Representative examples of these clear-cut areas were selected for closer study to ascertain the response of the logged-over area within a post-cut period of 2 to 10 years. It is desirable for harvested woodlots to regenerate satisfactorily.

The regeneration plots show that there is a far better chance of satisfactory continuation of the former stand composition if a reasonable residual number of trees is left intact, and if these residual trees do not experience windfall. There is also a local problem of cattle grazing on cut-over areas. This problem has led to heavy invasions of wild raspberries, dogwood, sedges and grasses in some cases. When no residual trees are left as seed sources, the resultant regeneration from coppice growth permits a distinct possibility of changes in stand composition to lower grade species, such as poplar. One of the sample areas indicated an almost complete change-over of desirable ash, oak, elm and white pine to grey birch, from external seed sources, and to red maple and poplar, from coppice growth. Nevertheless, a number of the areas under investigation did show regeneration of the original stand.

6. Streambank Problems in Wooded Areas

After the overall streambank studies had been completed, data from the study maps were transferred to field maps. The areas in which woodlots were adjacent to streambanks had been plotted on these maps. Field staff were then sent to 48 selected sites to make erosion observations, particularly regarding the possibility of a local relationship between trees and streambank problems.

Slumping occurs regardless of cover, but there is some evidence that deep-rooted trees slow the process of undercutting the banks. As it was indicated in the major streambank study, slumping is related mostly to steep slopes.

Litter and lack of ground vegetation are also definite local factors in allowing sheet erosion in wooded areas. There were instances of streambank collapse, from leaning and fallen trees, but none of these collapses was considered serious. Even in wooded areas, streambank breakdowns, small gullies and general erosion problems were almost entirely the result of cattle drinking from the stream.

There are possibilities, however, indicated by some of the study observations, that the use of deep-rooted, short-stemmed trees, shrubs and grasses, in conjunction with rock rip-rap, are likely to produce acceptable forms of streambank erosion control. Thick stands of woody material also discourage livestock from using streambanks.

7. Windbreaks and Shelterbelts

The value of various types of shelter was discussed in the original Raisin River Conservation Report of 1966. In most cases the principles set down in that report are applicable to the new regions of the Authority. With an increase in cash-cropping in the eastern section of the Authority, greater acreages of exposed mineral soil can be expected. However, since the soils in the area most capable for this form of agriculture contain clay-based soils, losses from wind effects are likely to be minimal. Hence, local windbreak promotion should concentrate on the shelter principle for buildings, livestock and crops.

During the 1968 survey, some field staff time was alloted to observing the local shelter conditions. After an examination of air photo mosaics of the Authority region, representative areas were chosen within each township in the new portion for detailed observation work. Generally, each set of observations was tabulated to show the following conditions:

a. Field pattern;

b. Hedgerow pattern — i.e. intact, partially removed, completely removed;

c. Hedgerow profile;

d. Hedgerow height pattern;

e. Hedgerow content;

f. Woodlot height and profile and type of shelter provided; and

g. Type of building shelter, whether planted, natural or both.

It is rare to find rural settlement patterns where the residual wooded areas have been left in specific positions for shelter purposes, although both hedgerows and woodlots can serve in this function. Shelter effects are also influenced by field patterns and sizes. Hence, in the case of small fields, some shelter effect is almost certain, even if there are only a few trees and shrubs present at the edges. As fields enlarge, such edges, unless carefully managed, can have only a limited beneficial sheltering effect.

In the northern and western regions of the Authority, such as Osnabruck and Kenyon townships, small field patterns are common and, although partial tree removal is also common and local hedgerows tend to be irregularly shaped with large openings in them, some shelter effect remains. These provide some shelter for livestock. There are some areas in these two sections of the Authority where the use of living shelter for buildings is deliberate; this indicates a local awareness of the need. This is particularly true of some cases where new rural residences have been built with accompanying windbreaks. However, there are few instances of deliberate planting or maintenance of live shelters for barns and out-buildings. Maintenance of windbreaks is also generally lacking.

The use of woodlots for any formal shelter is also occasional or inadvertent, since few woodlots are strategically placed or are managed to serve this purpose.

In the new eastern section of the Authority fields have tended to enlarge, particularly in the flat areas where row-cropping is increasing. Woodlots follow a common pattern, similar to other agricultural regions of Ontario; they are left along mid-property lines some distance from buildings and roads.

Complete removal of hedgerows is also common in this particular part of the Authority.

Here again, there is evidence of a local awareness of the value of shelters for buildings, since living shelter was observed occasionally, as well as some cases of shelter belt planting. There are also houses that have been deliberately located within woodlots, particularly if the woodlots were close to roads.

As cash-cropping increases in this section, the Authority should investigate the application of field windbreaks. This investigation should include the use of shrubs such as Carragana; the roots of these forms of shrubby material can easily be prevented from interfering with adjacent crops.

8. Forest Plantations on Private Land

a. Hoople Creek

Private forest plantations in this watershed are of various ages and usually cover relatively small acreages, 1 to 14 acres. Large plantations are rare. Private planting has been minimal. Mounds, adjacent to wet areas, are favourite sites for private plantations. Several conifer species are planted, usually in an off-contour pattern.

Survival of planted stock has been inconsistent. The limited amount of plantation care, which has usually been in the form of a little pruning or thinning, has also been inconsistent. This inconsistency is similar to that found in the area of the original Raisin River survey of 1966. Plantations in the Hoople Creek watershed have been used to extend present woodlots, and on rare occasions, for shelter purposes. It is also noticeable, as plantations get older, that they are invaded by natural hardwoods which may eventually replace the planted species.

b. Eastern Section

Within the eastern region of the Authority the average size of private plantations is just under 4 acres, exclusive of one area of 40 acres

that was mapped in 1968. Since the total reforested acreage on private land amounts to 265 acres, such smaller plantations cannot contribute much, even to the individual's effort to increase wood production. About 45 per cent of these plantations are designed to increase the area of local natural woodlots. Of the remaining plantations, 26 per cent are primarily designed for shelter purposes and the rest are new woodlot areas.

Plantations in this region share common site problems, a general orientation to wet and moist sites, and to bedrock close to the surface. Despite some shelter from adjacent hedgerows and woodlots, wind shaping of plantations, or at least the edges of plantations, is usually present.

The use of hardwoods, even as a small percentage of planted mixtures, is rare, although the invasion of private reforestation by local hardwoods is very common. Invasions were observed in 61 per cent of the plantations studied in this section in 1968.

Equally as common as these hardwood invaders, are heavy populations of ground vegetation, grasses, common weeds, and woody shrubs which, in combination with the site conditions, may have had a heavy influence on erratic survival rates of planted trees. However, this same ground vegetation has been controlling the erosion hazard on some of the slightly-sloped sites chosen for reforestation. Rarely are contoured lines used in furrow planting.

Management problems are common and local pruning efforts, particularly, tend to be crude. The need for proper thinning was often noted during survey in 1968, as well as the need for pruning misshapen trees, particularly Scotch pine.

Damage by rabbits and insects was common and there was a certain amount of damage by deer and livestock. Incidences of blister-rust in white pine were found in Kenyon Township.

Information on the latest methods of insect control, as well as advice on the kind of general management effort each property owner should undertake, is obtainable through consultation with the Department of Lands and Forests' office at Kemptville. The owner is easily able to contend with many of these problems by inspecting his plantation periodically and planning and performing management work regularly.

9. Forest Conservation Measures Required — Authority Forest

A notable feature of the areas of the Authority recommended for systematic purchase is the large acreage of woodland on almost every property. Only 14 per cent of the recommended properties consists of clear areas that need to be planted to trees. A further 18.7 per cent is scrubland and wooded pasture, which, in this case, are considered collectively because of the similar conditions of woody growth frequently found in each category of cover.

The greater acreage of existing woodland is patchy in each of these recommended areas. A better consolidation of forest cover is in order.

The final acreage of woodland owned by the Authority would create continuous forest blocks on land suited only for this purpose. In only one case, in the upper reaches of Hoople Creek, is the recommended forest area directly related to existing stream systems. Nevertheless, the management systems applied to these areas should, as a general requirement, feature techniques designed to curb erosion and stream sedimentation.

Local property, based on long, narrow, rectangular lots tend to be situated in opposite directions to the soil deposits. This tends to produce an irregularly-shaped land-use pattern of agricultural fields, scrubland and woodland, which does not conform to the shape and direction of the landscape and watershed. Hence, many properties contain a portion of good land and marginal land with some form of woodland cover and each area is too small for efficient management. Some such areas are better suited to farm consolidation and private woodland improvement, rather than public ownership.

When useful agricultural fields are inevitably part of Authority forest land purchases, it is proper for the Authority to lease them to neighbouring farmers after purchase. The Authority can then concentrate its forestry effort on the existing woodland areas.

A total of 16,620 acres has been recommended for acquisition and they are detailed here.

a. Roxborough and Kenyon Townships — Area 1 (Eastern Authority Region)

This is an area west of Greenfield and north of Dominionville in the upper reaches of the Rivière Delisle. It is recommended for purchase as a forest consolidation measure and as a limited, source area protection.

b. Kenyon Township — Area 2 (Eastern Authority Region)

This is an area near Greenfield that is almost entirely wooded, and it should be kept in a wooded condition.

c. Kenyon Township — Area 3 (Eastern Authority Region)

This area is east of Greenfield and adjacent to the Canadian National Railway. It should be maintained in a forested state.

d. Kenyon Township — Area 4 (Eastern Authority Region)

This area lies north of Highway 43. Its purchase is recommended for a forest consolidation scheme and for its general complementation to the recommended Rivière Delisle reservoir area.

e. Kenyon Township and North Charlottenburgh Township — Area 5

The purchase of this area is recommended for forest consolidation purposes around the block of land surrounding Loch Garry.

f. Charlottenburgh Township and Part of Lancaster Township — Areas 6, 7 and 8 (Eastern Authority Region)

Forest consolidation is the major reason for recommending purchase of these areas, north of St. Raphael West. These properties adjoin other recommended property blocks in the Raisin River watershed.

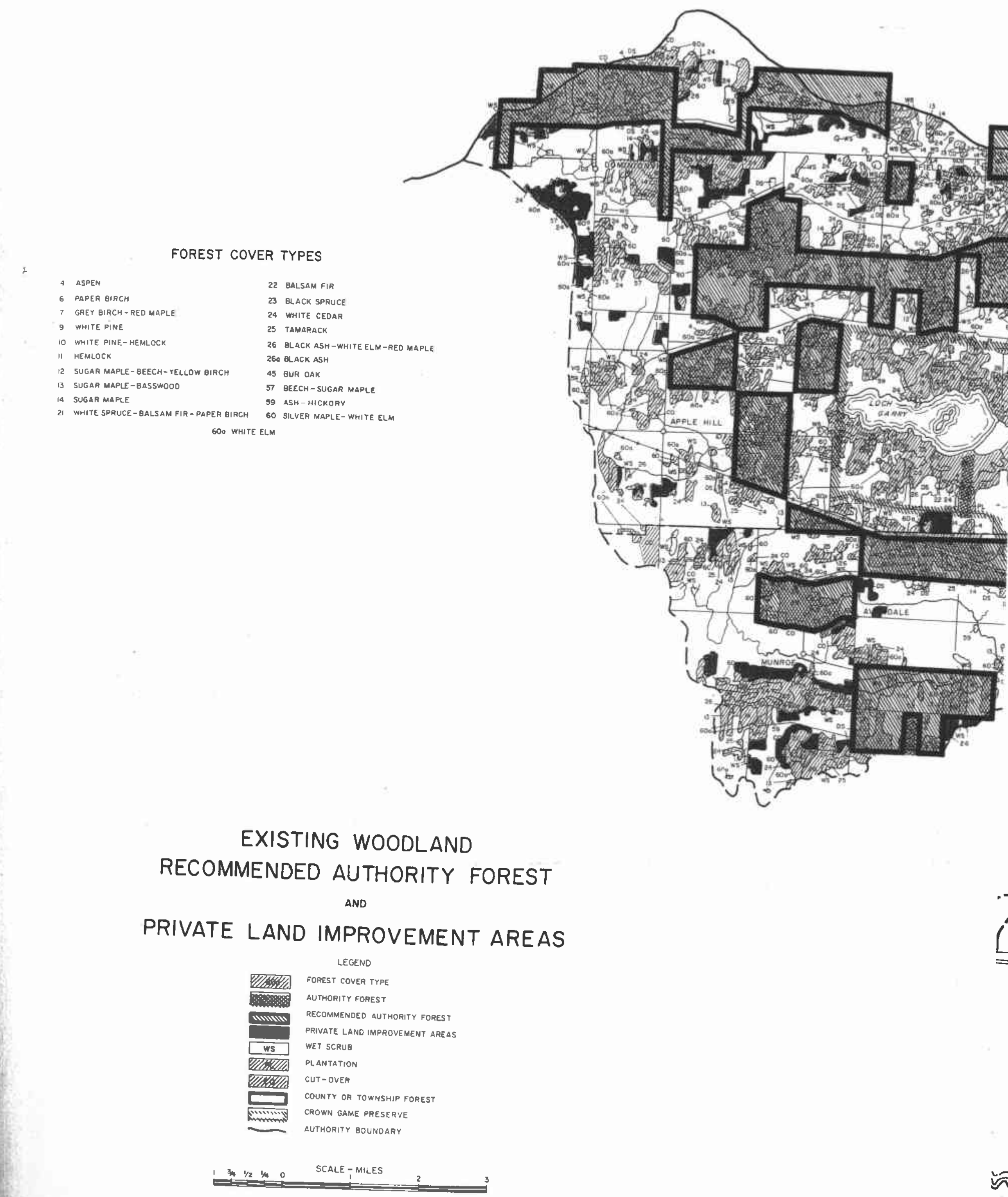


Fig. 6

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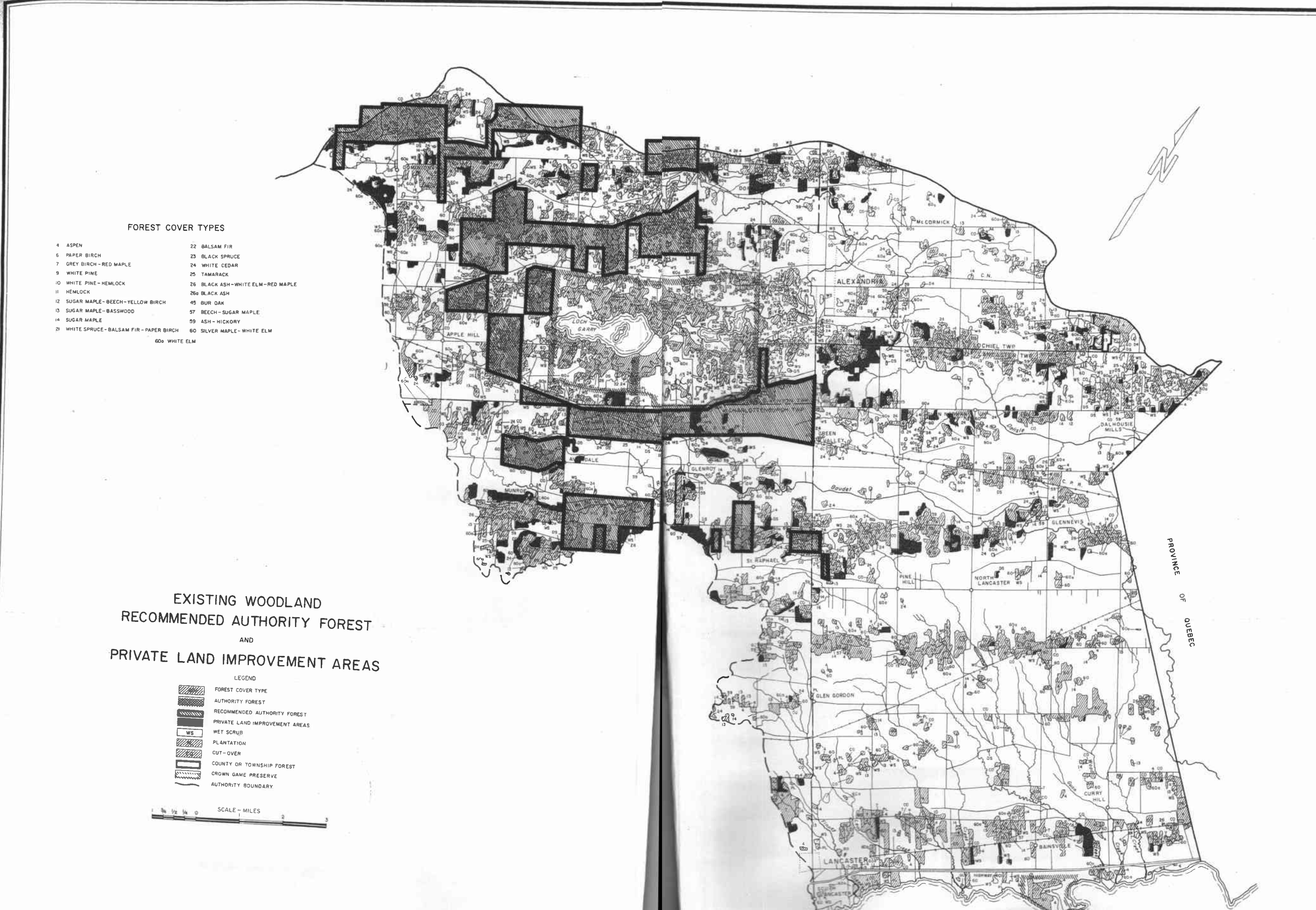

Fig. 6

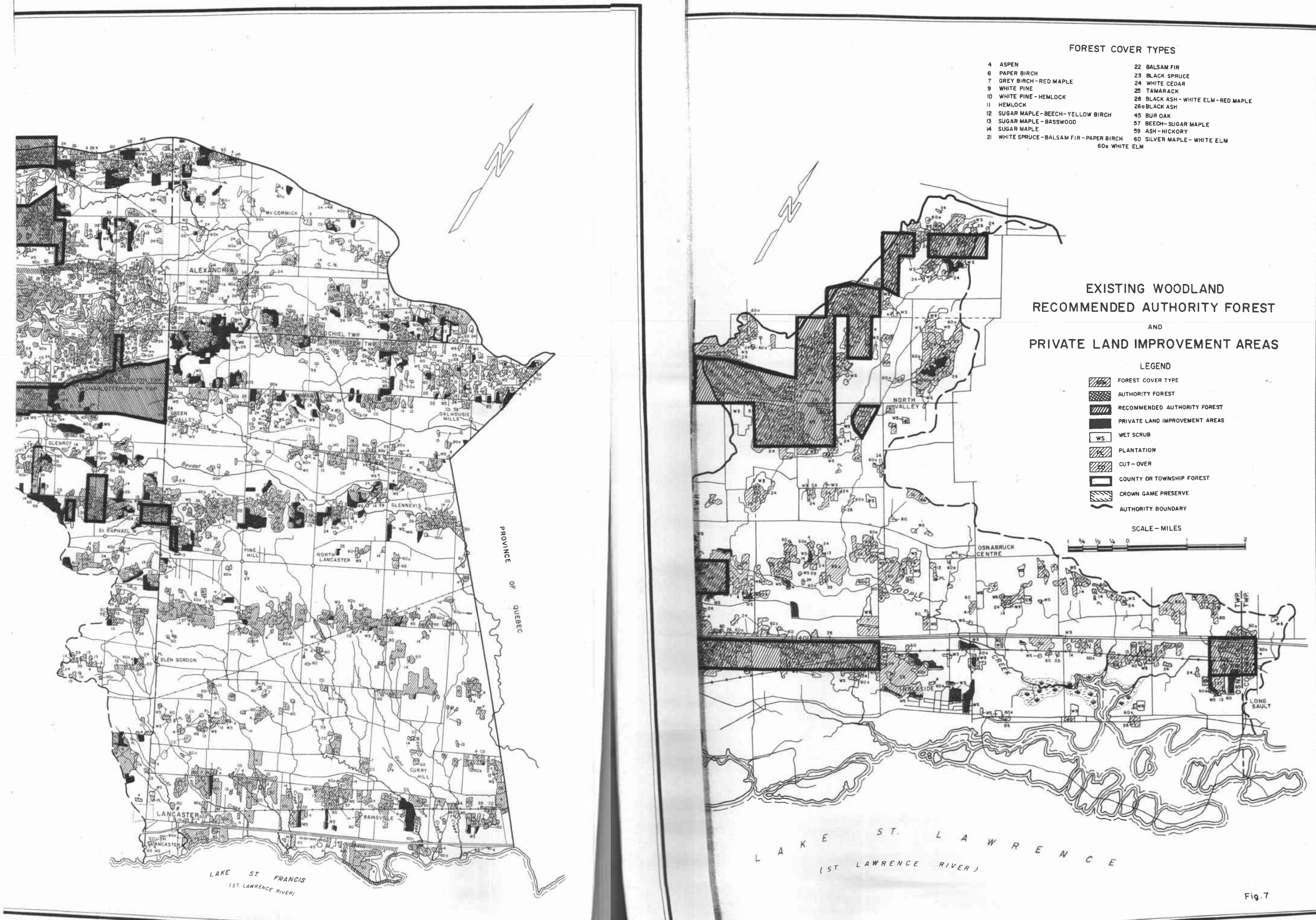

Fig. 7

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g. North Osnabruck Township — Area 9 (Hoople Creek Watershed)

This area is related to tributary systems of the upper reaches of this watershed, north and west of North Valley. Forest consolidation is needed in the area, as well as open land reforestation and the preservation of source areas. The Authority may wish to retain source areas under its own management.

h. Gallinger Town West — Area 10 (Hoople Creek Watershed)

This is a wooded area that should be kept in that state.

i. Ingleside West — Area 11 (Hoople Creek Watershed)

This is a long, rectangular area adjoining Highway 401. Woodlot consolidation and some reforestation is needed.

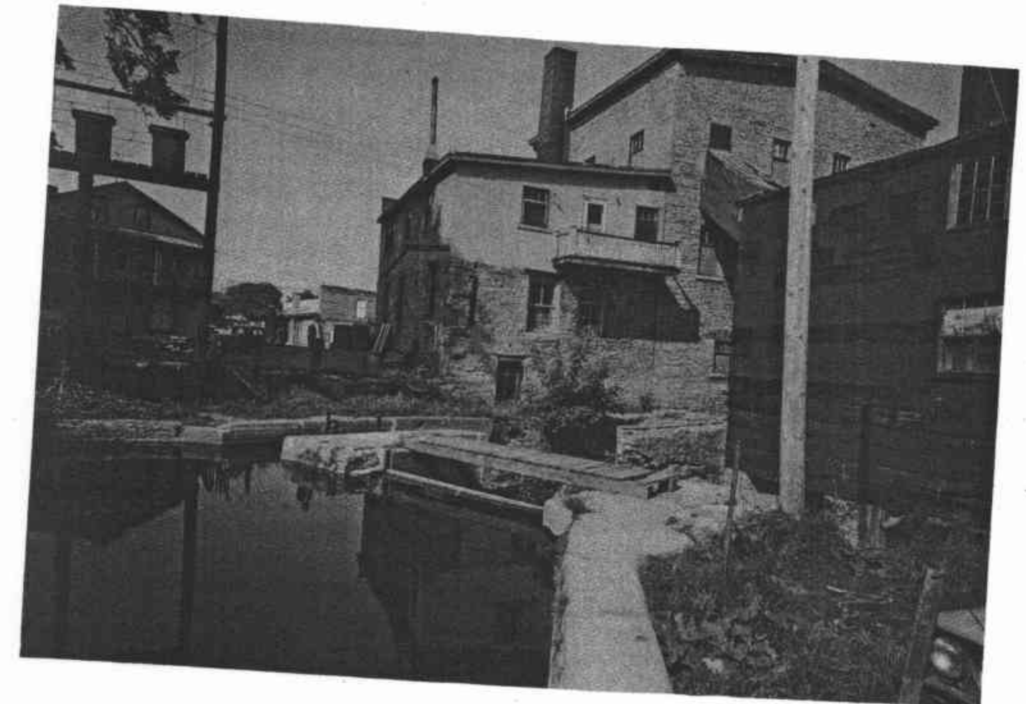
j. Lunenburg South — Area 12 (Hoople Creek Watershed)

This area lies astride the boundary between Osnabruck and Cornwall Townships. It is a natural appendage of the Lunenburg — Grants Corners block of land, recommended for purchase in the Raisin River Conservation report of 1966.

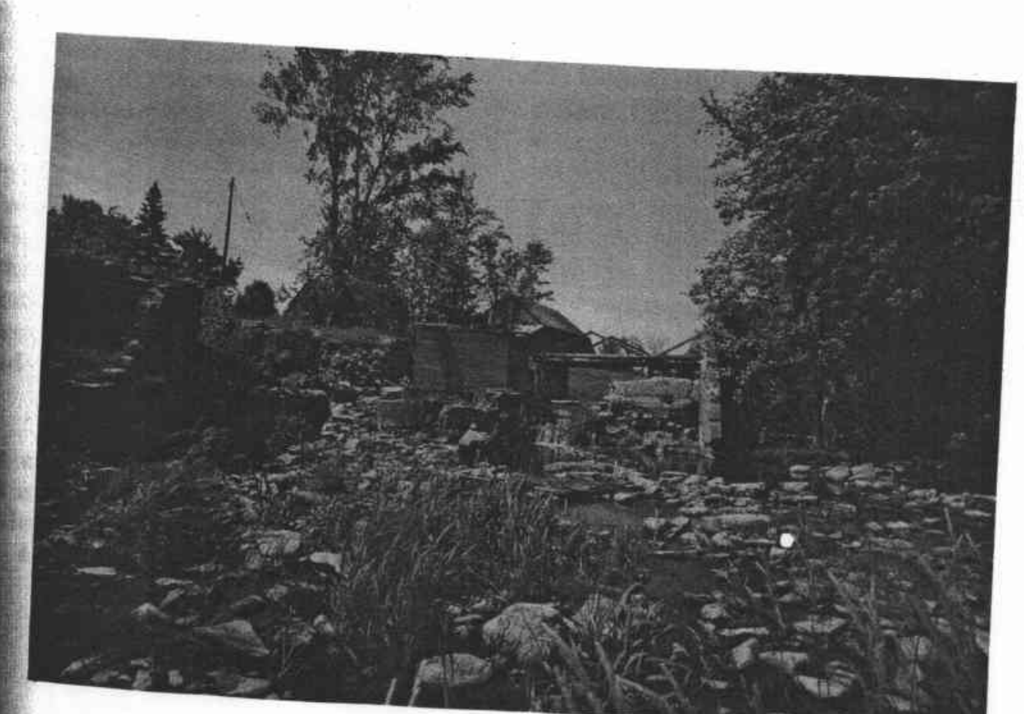
TABLE 6. RECOMMENDED AUTHORITY FOREST LANDS IN AREAS SURVEYED IN 1968 (in acres)

Area	Woodland Area (ac.)	%	Wooded Pasture and Scrubland	%	Cleared Land (ac.)	%
Eastern Region						
1	1769	73.4	335	14.7	286	11.9
2	168	90.0			19	10.9
3	486	76.2	100	15.9	44	7.9
4	2136	70.8	573	19.0	305	10.2
5	3079	65.5	965	20.6	654	13.9
6	442	46.4	249	26.2	262	27.4
7	311	56.4	174	31.5	68	12.1
8	162	40.0	118	36.5	19	13.5
Sub-Total	8560	66.0	2534	21.4	1657	12.6
Hoople Creek						
9	1824	71.5	374	14.6	335	13.9
10	187	97.0			6	3.0
11	660	72.5	131	14.4	118	13.1
12	118	55.9	25	11.8	68	32.3
Sub-Total	2789	72.2	530	13.6	547	14.2
GRAND TOTAL	11312	68.2	3064	18.5	2204	13.3

Total Area Recommended — 16,620 Acres



Spillway & Grist Mill at the Outlets of Mill Pond in the Town of Alexandria.



Remains of Munroe Mills.

CHAPTER I

THE RIVERS AND THEIR WATERSHEDS

1. The Watersheds

Rivière Delisle, Rivière au Beaudet and Hoople Creek, as well as the Raisin River, arise within the Glengarry till plain. The drainage pattern is peculiar in that the headwaters of most of these streams flow sluggishly for long distances between the ridges before finding outlets to the main channels. The depth to bedrock seldom exceeds 100 feet, and over much of the area the till is less than 25 feet in depth.

These streams, their river courses and gradients, are described in the following sections.

2. Rivière Delisle

Rivière Delisle, which has a drainage area of about 88 square miles, drains the northern portion of the Raisin region.

The river has two branches (Figure 8). The main stream has its headwaters near Dominionville and from there flows in a north-eastern direction towards Highway 34, north of Alexandria. East of Highway 34, it turns south-east as far as Glen Norman and then, at Dalhousie Mills, swings north-east into the Province of Quebec. Less than one mile below Highway 34, it is impounded by a dam which was once used to generate power for the town of Alexandria.

The other branch, known as the Garry River, has its source at the spring-fed Loch Garry. Here, a dam was constructed in 1967 to supply water for the town of Alexandria. From Loch Garry the water meanders to the so-called Middle Lake where water is impounded by the Kenyon Dam. From the Kenyon Dam, the Garry River flows to Alexandria where a mill dam forms a small reservoir from which water is pumped to be treated in the town's water filtration plant. From Alexandria it flows through the fourth day on its way to join Rivière Delisle about one mile downstream from the Alexandria power dam.

The total drop of the main branch of Rivière Delisle, from its source to its confluence with Garry River, is about 150 feet in a distance of 21.3 miles. Its average gradient is 7 feet per mile. The Garry River drops 93 feet in 10.6 miles, or 8.8 feet per mile. Below the confluence the drop is about 25 feet in 10.4 miles, or 2.4 feet per mile.

3. Rivière au Beaudet

Rivière au Beaudet, whose drainage area is about 58.1 square miles, has its source about 2 miles north of Apple Hill. For the first 10 miles it follows a zigzag meandering south-easterly course through several swamps to Munroe Mills, the site of the remains of an old dam. The river then flows in a north-easterly direction towards the Quebec border. The drainage system is unusual: in the lower portion, the main channel lies close to the southern limit of the basin and most of the tributaries enter from the north side.

The total drop of the Rivière au Beaudet is approximately 185 feet over a distance of 37.6 miles, an average gradient of 5 feet per mile.

4. Hoople Creek

Hoople Creek, located at the western end of the Raisin Region Authority area, has its source in a marshy area about 5-1/2 miles north-west of Osnabruck Centre. It flows in a southerly direction to a point 1-1/2 miles west of Osnabruck Centre, and then easterly for a distance of about 4 miles. At this point it empties into the St. Lawrence River halfway between Ingleside and Long Sault. Hoople Creek has been dredged and straightened for almost its entire length and its mouth was inundated by the construction of the Barnhart Island Dam, on the St. Lawrence River. The total drop for Hoople Creek is about 55 feet over a distance of 10.5 miles, an average gradient of 5.2 feet per mile (Figure 9). Its basin covers an area of 47.8 square miles.

5. Lancaster System

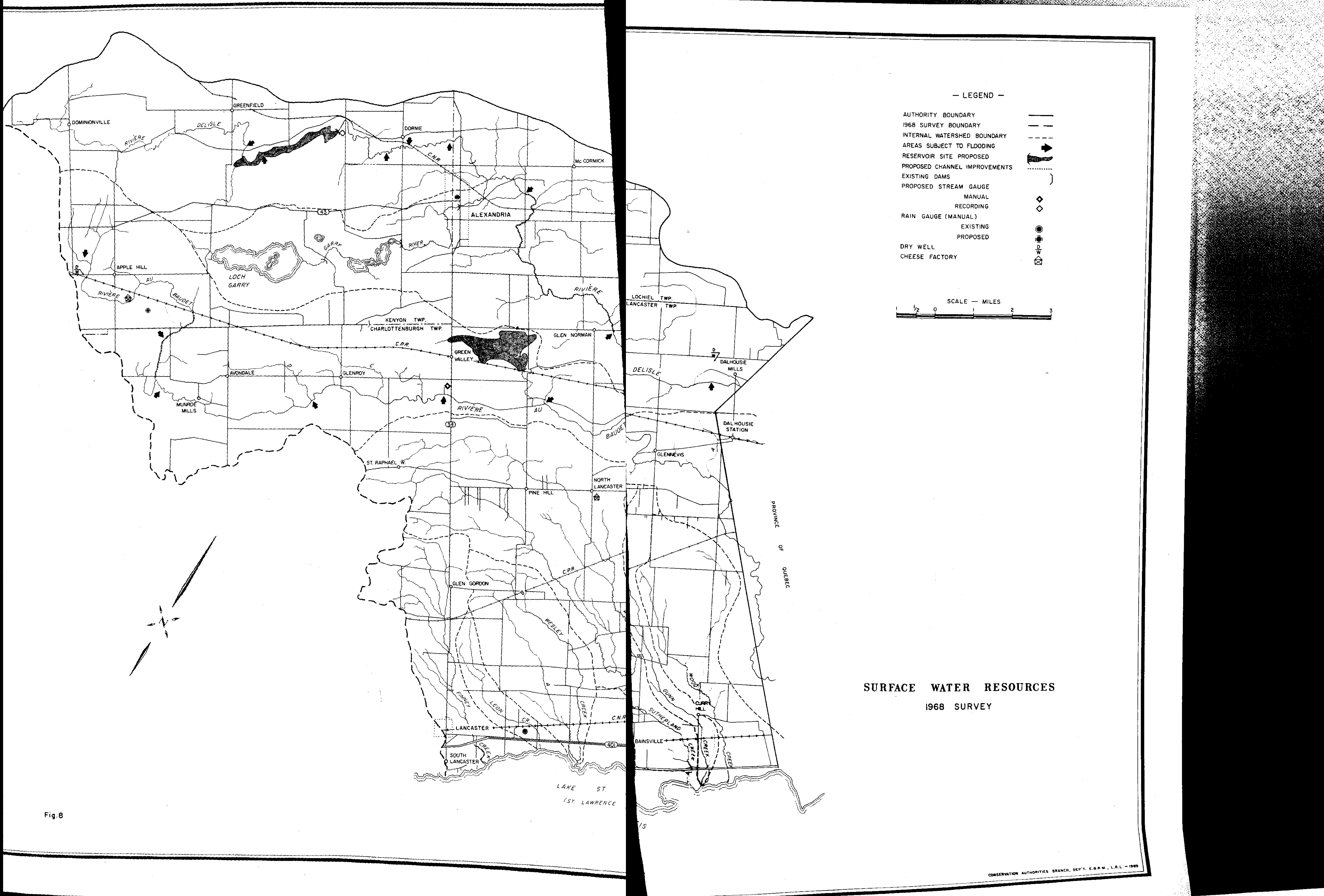
This system includes Finney, Wesley, Sutherland, Gunn and Wood Creeks which drain the 65.8 square mile area fronting on the St. Lawrence River between South Lancaster and the Ontario-Quebec border.

Drainage areas of these streams are given below and their water level profiles are shown in Figure 10.

TABLE 7. MINOR WATERSHEDS — LANCASTER TOWNSHIP

Stream	Drainage Area sq. mi.
Finney Creek	8.7
Wesley Creek	10.0
Sutherland Creek	28.5
Gunn Creek	4.7
Wood Creek	10.2
Others	3.7

The streams originate in an area known as the Lancaster Flats, which extends four to eight miles back from the St. Lawrence River. As it is indicated by its name, this area is very flat and poorly drained.


— LEGEND —
AUTHORITY BOUNDARY
1968 SURVEY BOUNDARY
INTERNAL WATERSHED BOUNDARY
AREAS SUBJECT TO FLOODING
RESERVOIR SITE PROPOSED
PROPOSED CHANNEL IMPROVEMENTS
EXISTING DAMS
PROPOSED STREAM GAUGE
MANUAL
RECORDING
RAIN GAUGE (MANUAL)
EXISTING
PROPOSED
DRY WELL
CHEESE FACTORY
SCALE — MILES
1/2 0 1 2 3
SURFACE WATER RESOURCES
1968 SURVEY
DOMINIONVILLE
GREENFIELD
DORNIE
Mc CORMICK
RIVIÈRE DELISLE
C.N.R.
ALEXANDRIA
GARRY RIVER
LOCH GARRY
APPLE HILL
RIVIÈRE AU BAUDET
KENYON TWP.
CHARLOTTENBURGH TWP.
C.P.R.
GREEN VALLEY
GLEN NORMAN
AVONDALE
GLENROY
MUNROE MILLS
RIVIÈRE AU BAUDET
ST. RAPHAEL W.
PINE HILL
NORTH LANCASTER
GLEN GORDON
WESLEY
FINNEY
LEON
CREEK
LANCASTER
SOUTH LANCASTER
LAKE ST.
(ST. LAWRENCE
LOCHIEL TWP.
LANCASTER TWP.
DALHOUSIE MILLS
DELISLE
DALHOUSIE STATION
GLENNEVIS
PROVINCE OF QUEBEC
WOOD
GUNN
SUTHERLAND
CURRY HILL
BAINSVILLE
CREEK
CONSERVATION AUTHORITIES BRANCH, DEP'T. E.&R.M., L.R.L. - 1969
Fig.8

SURFACE WATER RESOURCES

1968 SURVEY

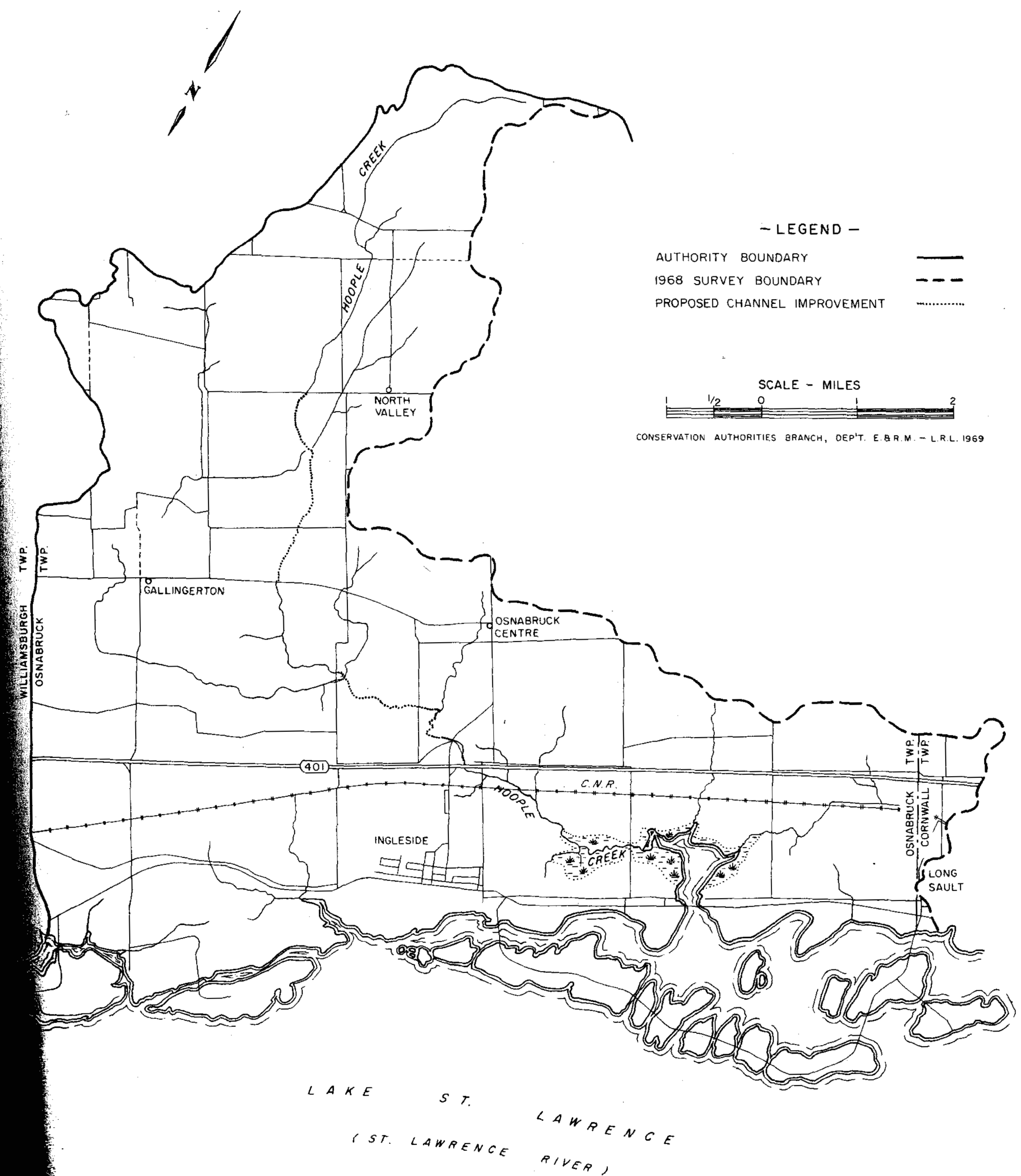
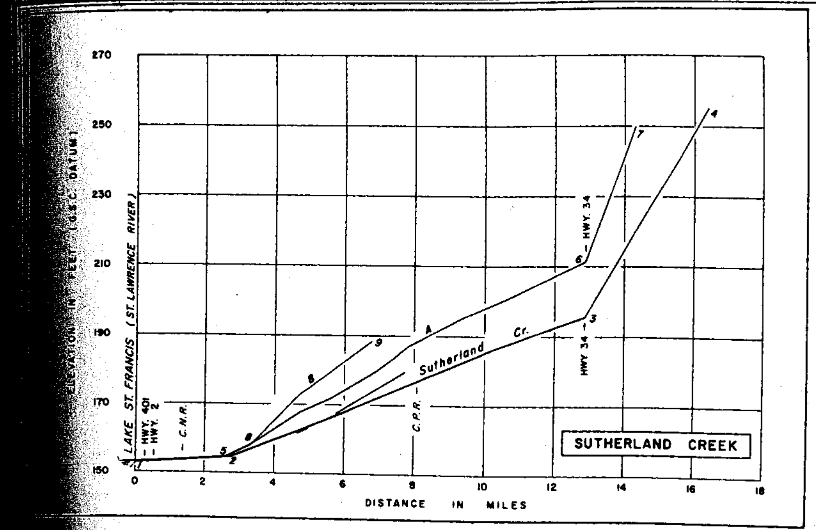
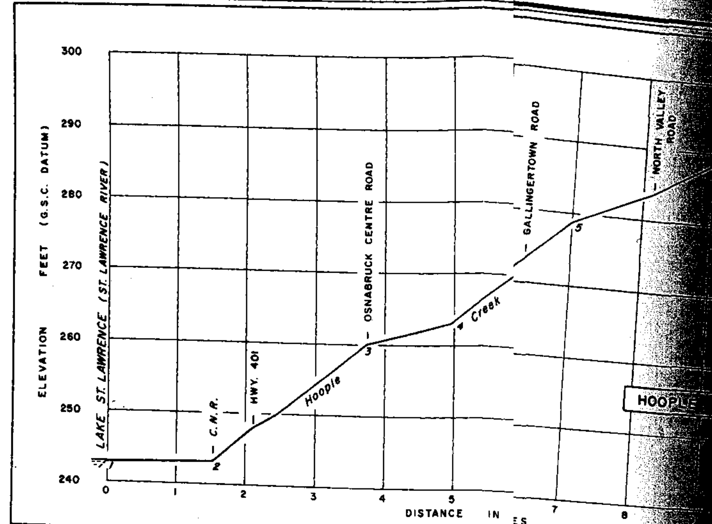
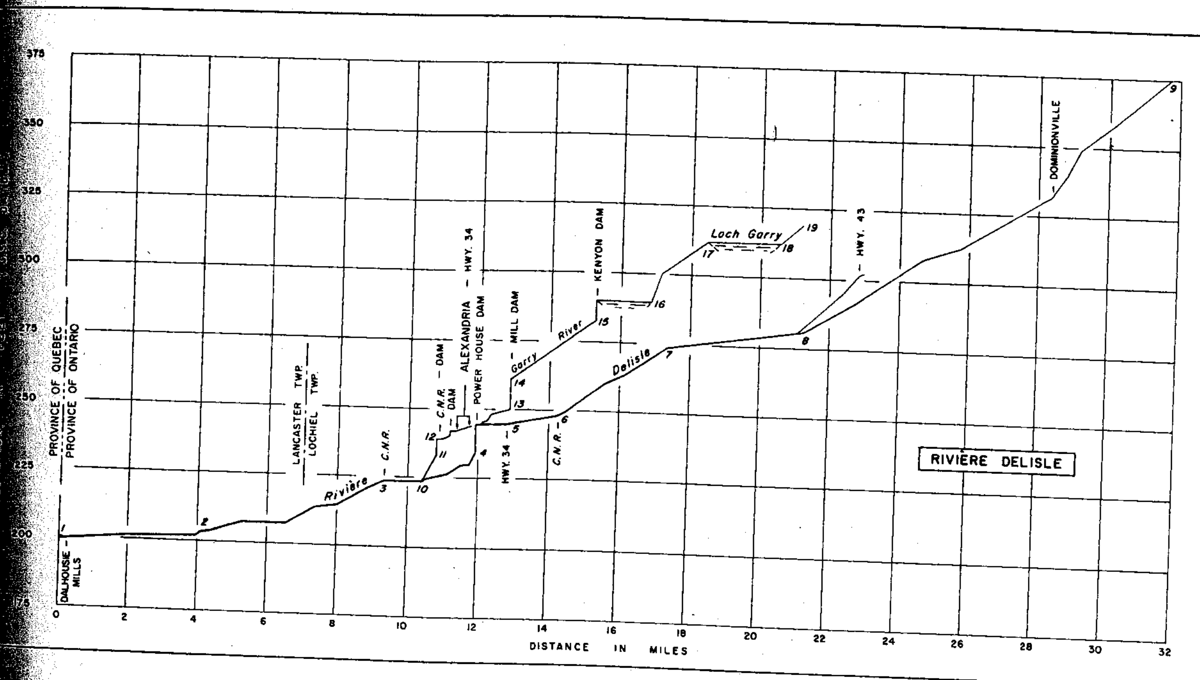
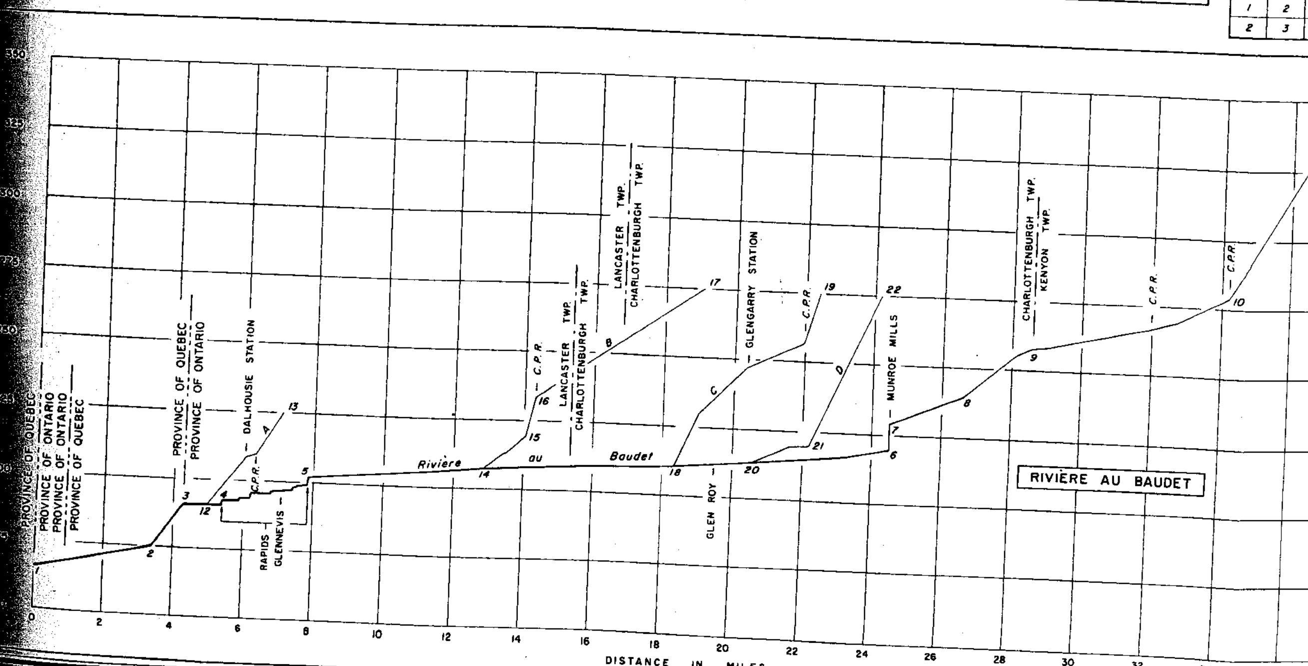


Fig.9









STATIONS FROM	TO	…TANCE MILES	DIFFERENCE IN ELEV.	GRADIENT FT./MILE
…VIÈRE DELISLE				
1	2	4.0	8	[illegible]
2	3	5.3	22	[illegible]
3	4	2.5	11	[illegible]
5	6	1.5	4	[illegible]
6	7	3.3	26	[illegible]
7	8	.9	7	[illegible]
8	9	.4	93	[illegible]
10	11	.4	10	25.0
12	13	.1	11	[illegible]
14	15	.4	21	8.7
16	17	.6	22	13.7
18	19	.7	7	10.0
…SLEY CREEK				
1	2	[illegible]	3	2.5
2	3	[illegible]	17	5.7
3	4	[illegible]	16	5.2
1	5	[illegible]	2	1.8
5	6	[illegible]	6	6.0
6	7	[illegible]	28	9.3
3	8	[illegible]	11	6.5
…LAND CREEK				
1	2	[illegible]	1	0.4
2	3	[illegible]	41	4.1
3	4	[illegible]	60	16.7
5	6	[illegible]	56	5.5
6	7	[illegible]	39	27.1
8	9	[illegible]	30	8.6
…D CREEK				
1	2	[illegible]	1	0.9
2	3	[illegible]	18	5.8

NOTES:

All tribut…
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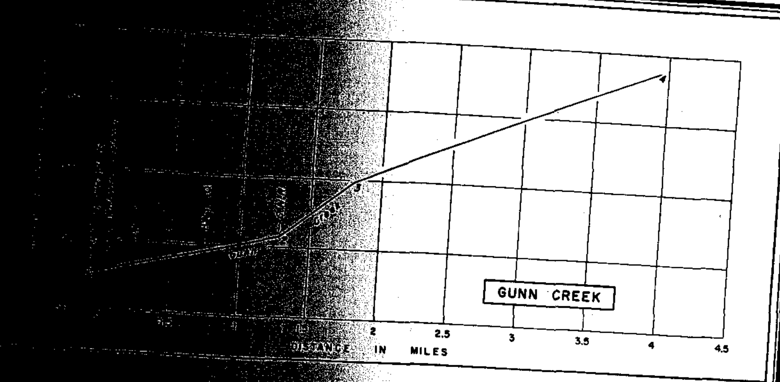
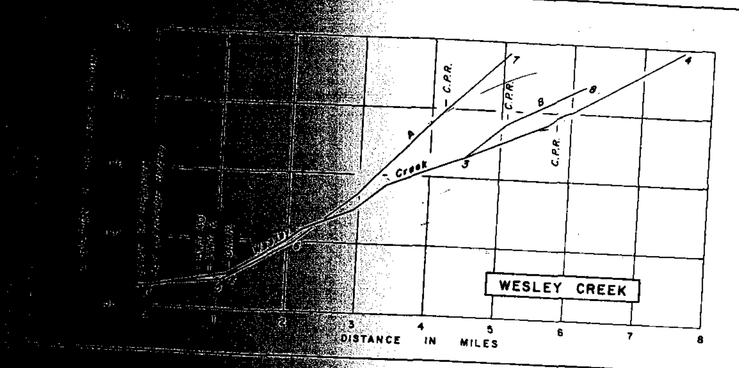
SCALE…

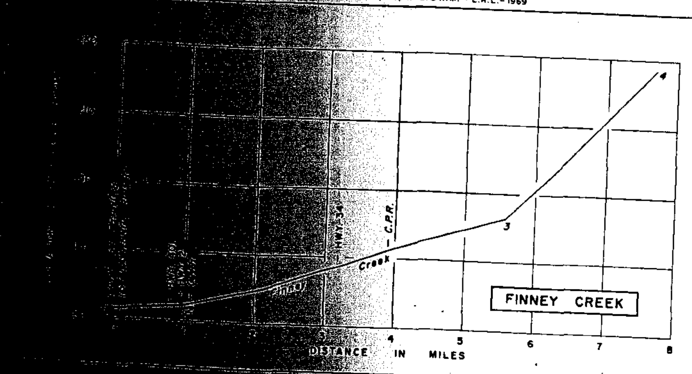


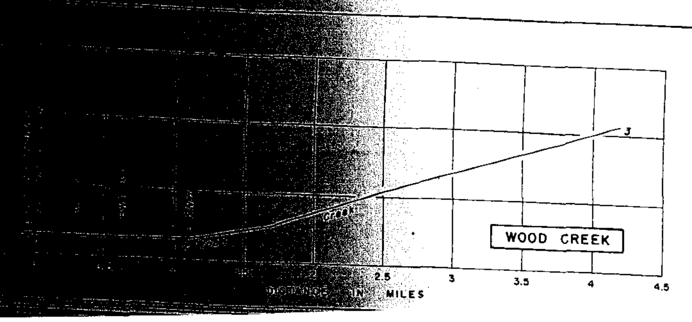


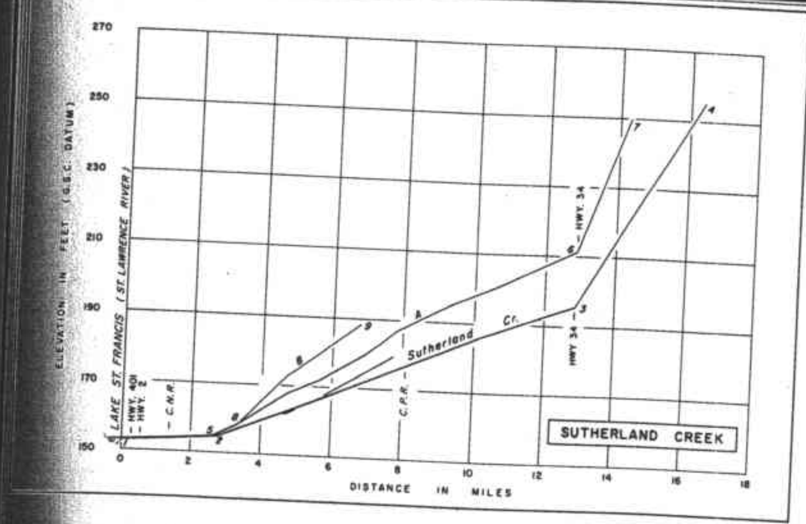
WATER LEVEL PROFILES

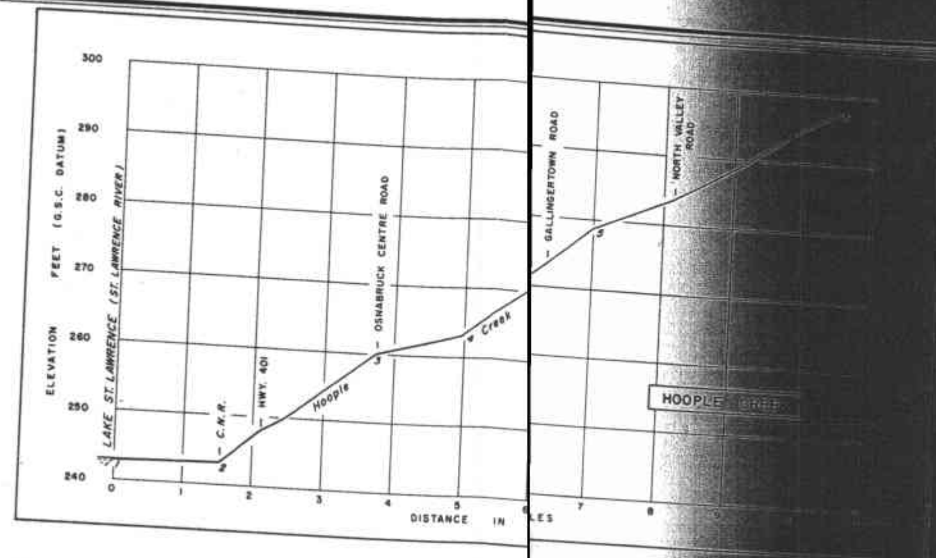
CONSERVATION AUTHORITIES BRANCH, Dep't. E.&R.M. - L.R.L. - 1969

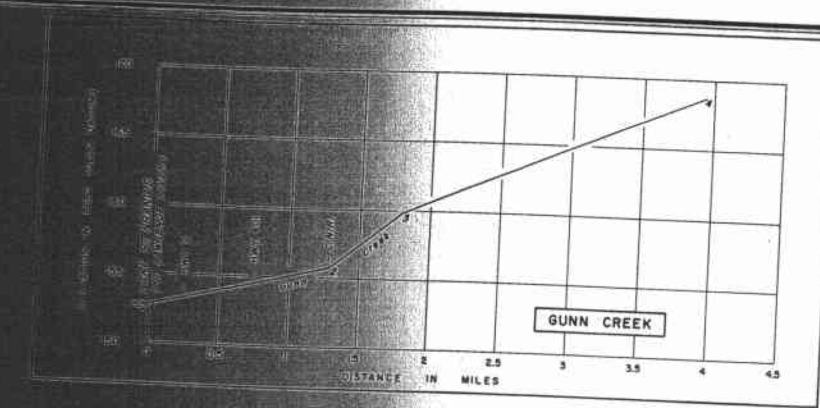
Fig. 10

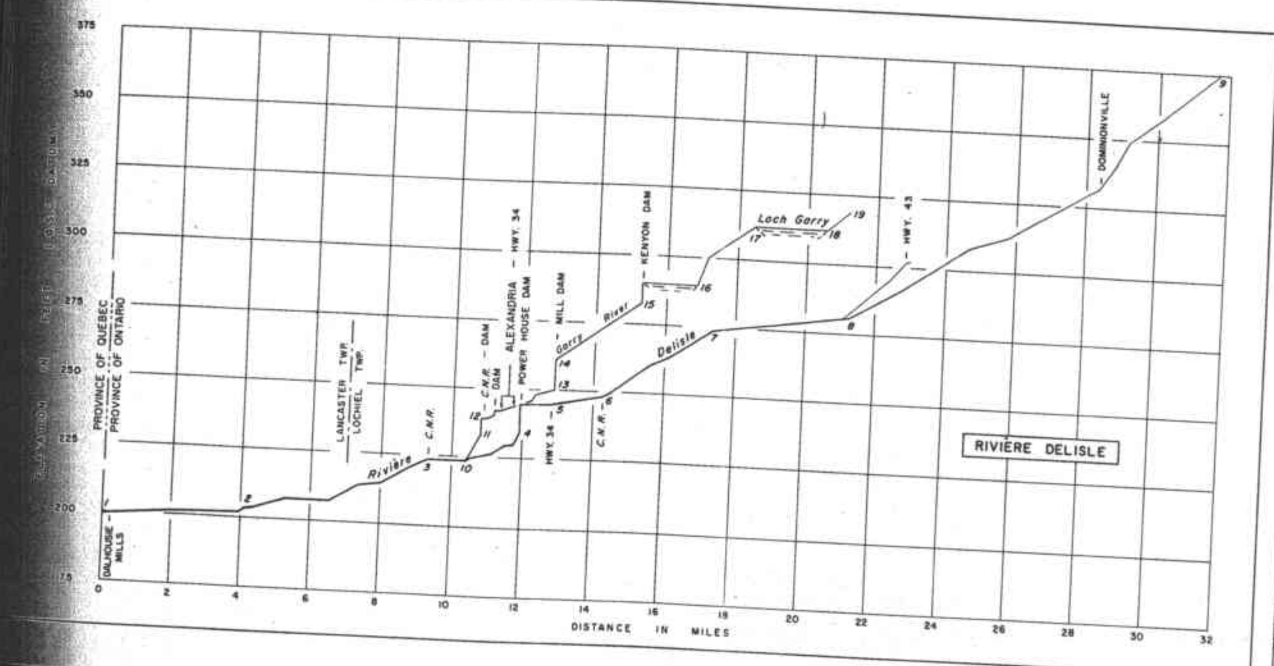


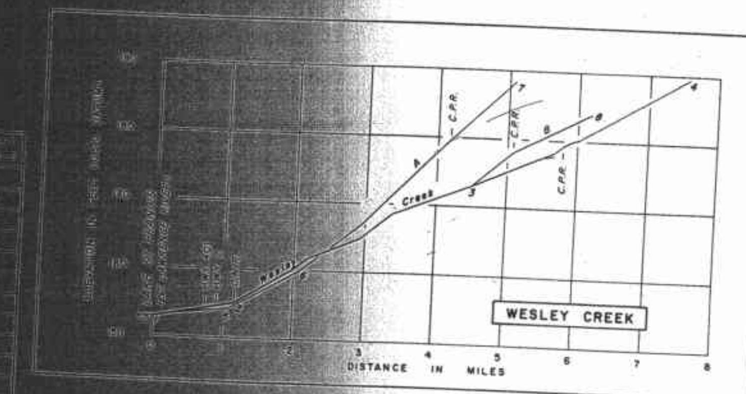


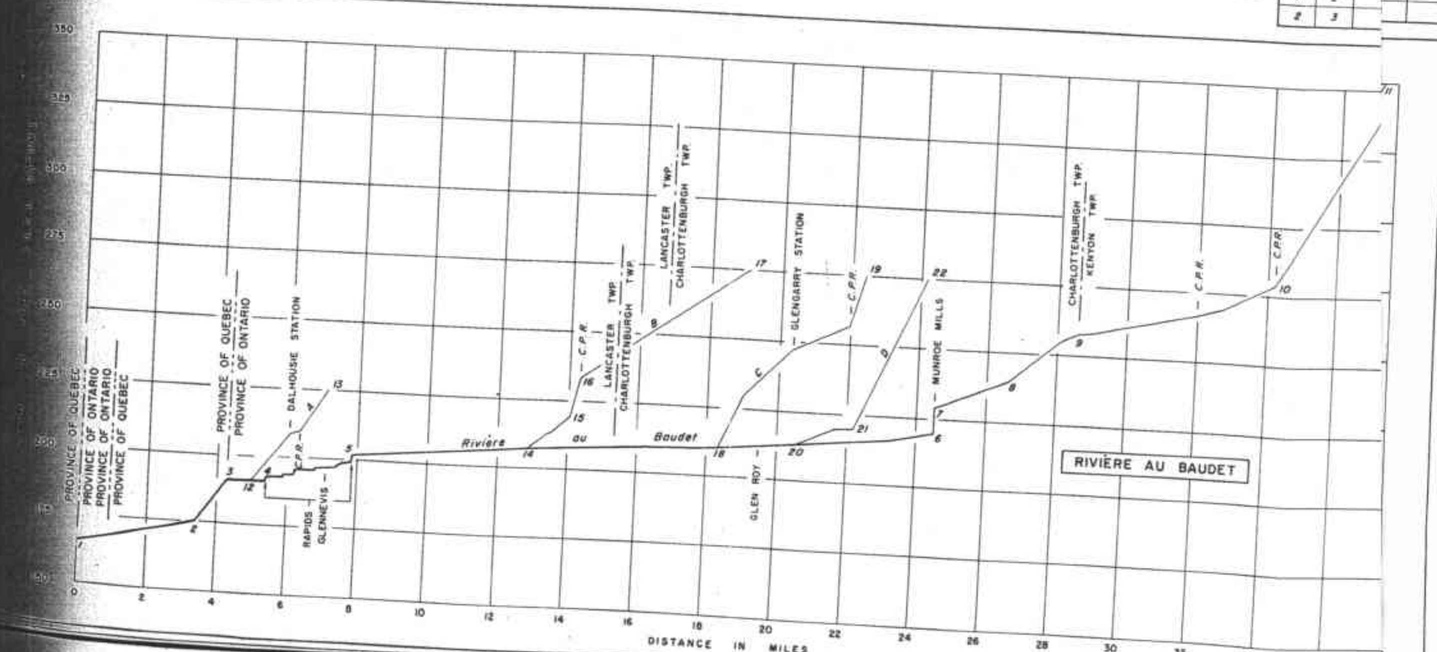


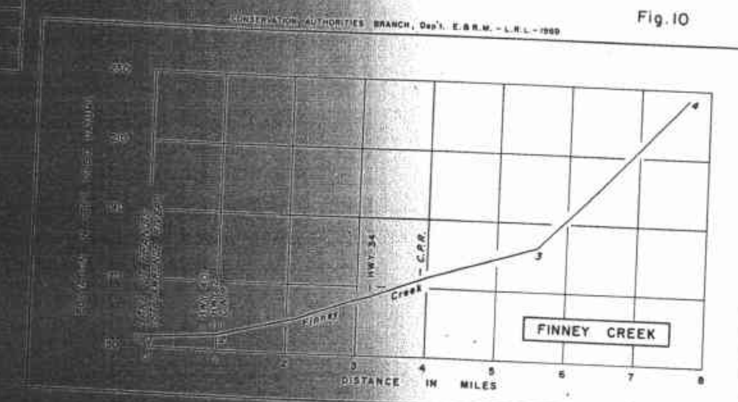


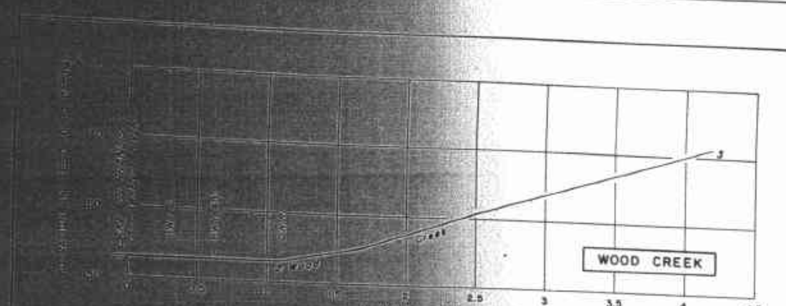












GRADIENT [illegible]

STATIONS FROM	STATIONS TO	DISTANCE IN MILES	DIFFERENCE IN ELEV.	GRADIENT FT./MI.
RIVIÈRE DELISLE				
1	2	4.0	8	2.0
2	3	5.3	22	[illegible]
3	4	2.5	11	4.4
5	6	1.5	4	2.7
6	7	3.3	26	7.9
7	8	3.9	7	1.8
8	9	10.4	93	8.9
10	11	0.4	10	25.0
12	13	2.1	11	5.2
14	15	2.4	21	8.7
16	17	1.6	22	13.7
18	19	0.7	7	10.0
WESLEY CREEK				
1	2	1.2	3	2.5
2	3	3.3	17	5.1
3	4	3.1	16	5.2
1	5	1.1	2	1.8
5	6	1.0	6	6.0
6	7	[illegible]	28	9.3
3	8	[illegible]	11	6.5
SUTHERLAND CREEK				
1	2	[illegible]	1	0.4
2	3	[illegible]	41	4.1
3	4	[illegible]	60	16.7
5	6	[illegible]	56	5.5
6	7	[illegible]	39	27.1
8	9	[illegible]	30	8.6
WOOD CREEK				
1	2	[illegible]	1	0.9
2	3	[illegible]	18	5.8

NOTES:

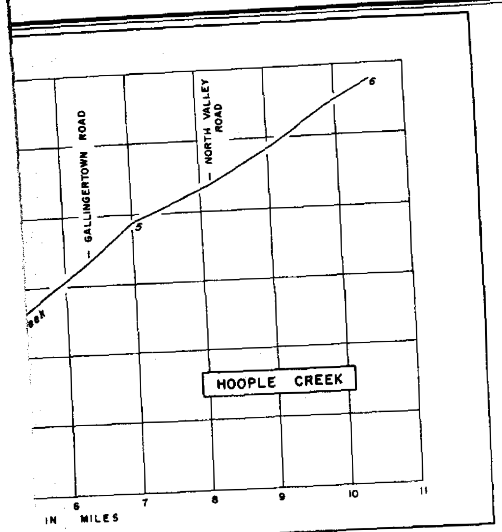
All tributaries [illegible]
information [illegible]
supplemented [illegible]
sheets.

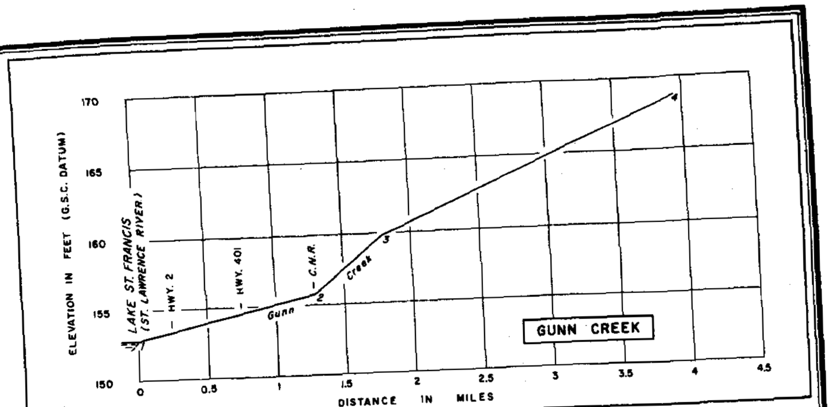
SCALES AS SHOWN

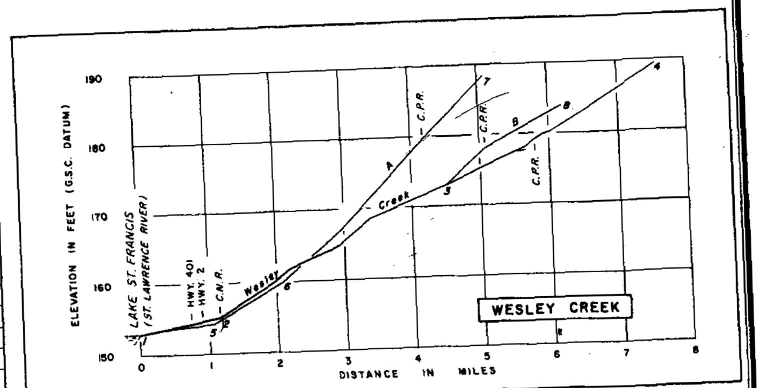
WATER LEVEL PROFILES

CONSERVATION AUTHORITIES BRANCH, Dep't. E.&R.M. – L.R.L. – 1969

Fig. 10







GRADIENT TABLE

Stations To	Distance in Miles	Difference in Elev.	Gradient Ft./Mile
RIVIÈRE DELISLE			
2	4.0	8	2.0
3	5.3	22	4.2
4	2.5	11	4.4
6	1.5	4	2.7
7	3.3	26	7.9
8	3.9	7	1.8
9	10.4	93	8.9
11	0.4	10	25.0
13	2.1	11	5.2
15	2.4	21	8.7
17	1.6	22	13.7
19	0.7	7	10.0
WESLEY CREEK			
2	1.2	3	2.5
3	3.3	17	5.1
4	3.1	16	5.2
5	1.1	2	1.8
6	1.0	6	6.0
7	3.0	28	9.3
8	1.7	11	6.5
SUTHERLAND CREEK			
2	2.8	1	0.4
3	10.0	41	4.1
4	3.6	60	16.7
6	10.2	56	5.5
7	1.4	39	27.1
9	3.4	30	8.6
WOOD CREEK			
2	1.1	1	0.9
3	3.1	18	5.8

Stations From	To	Distance in Miles	Difference in Elev.	Gradient Ft./Mile
RIVIÈRE AU BAUDET				
1	2	3.4	10	2.9
2	3	0.8	15	18.7
3	4	1.1	1	0.9
4	5	2.4	11	4.6
5	6	16.6	17	1.0
7	8	2.1	10	4.8
8	9	2.0	18	9.0
9	10	5.6	21	3.7
10	11	3.4	71	20.9
12	13	2.0	34	17.0
14	15	1.1	12	10.9
15	16	0.3	14	46.7
16	17	4.8	41	8.5
18	19	4.0	64	16.0
20	21	1.8	6	3.3
21	22	2.0	55	27.5
HOOPLE CREEK				
1	2	1.5	1	0.7
2	3	2.2	17	7.7
3	4	1.2	3	2.5
4	5	2.0	16	8.0
5	6	3.5	19	5.4
GUNN CREEK				
1	2	1.3	3	2.3
2	3	0.5	4	8.0
3	4	2.2	9	4.1
FINNEY CREEK				
1	2	1.0	1	1.0
2	3	4.6	29	6.3
3	4	2.1	44	20.9

WATER LEVEL PROFILES

Fig. 10

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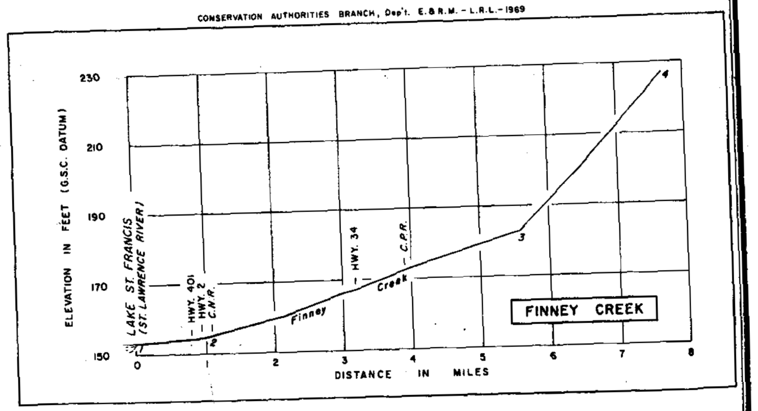
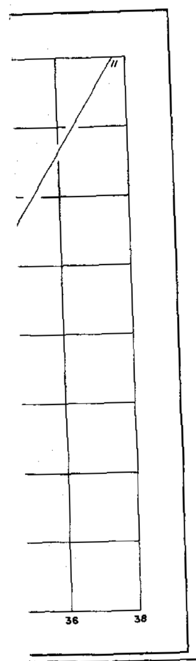


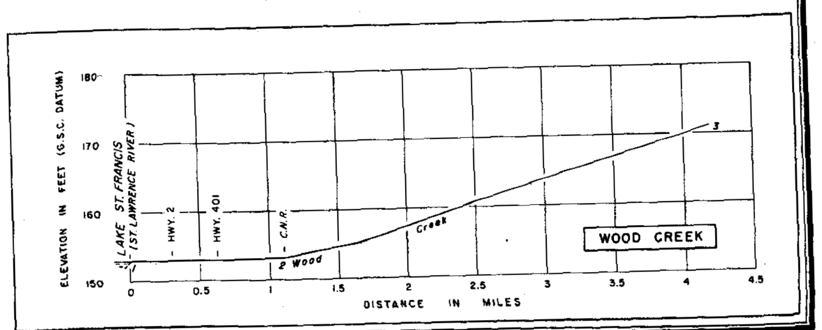


NOTES:

All tributaries not necessarily shown.

Information obtained from field survey data, supplemented by 1:50,000 National Topographic sheets.

SCALES AS SHOWN



CHAPTER II

WATER PROBLEMS

1. Nature of Problems

The water problems within the Raisin Region Authority include: poor farm drainage, spring flooding, low summer flows, water pollution and streambank erosion. In general, they result from improper water management associated with an increasing exploitation and development of the watershed. Nature maintains its balance of renewable resources. It is when man's work conflicts with nature that problems arise.

In the Raisin Region none of the problems, except streambank erosion, can be considered extreme. In this report, thought is given to the future with the hope that the problems will be solved before they reach major proportions.

2. Flooding and Drainage

Any overflow or inundation from a river may be regarded as flooding, but it becomes of real significance only when the water causes, or has the potential to cause loss of life or property damage. Most floods occur on the plains adjacent to the rivers and result from natural causes: excessive rainfall, melting snow or a combination of the two.

Flood water causes damage by inundation and erosion from high velocities. In some instances, sediment deposits resulting from the erosion may be beneficial to agricultural lands, but more frequently, the deposits of fine soil particles and sand have a damaging effect. Bridges, buildings, roads, farm lands and stream channels are often destroyed by the scouring action of fast-flowing flood waters.

Along Rivières au Beaudet and Delisle, several agricultural areas have suffered periodically from minor flooding. Every spring, farm bridges and fences have been washed out.

Because of slow draining of flood water from flat lands, seeding is often delayed. In some cases, the area is too wet and is rendered virtually useless for cultivation during the spring growing season.

On Hoople Creek, Rivière au Beaudet, Delisle and other small streams entering into the St. Lawrence River, many reaches have been dredged and straightened in an attempt to improve drainage. This has resulted in improved local drainage, but it is suspected that in some instances, flocd problems in lower reaches have been aggravated.

3. Low Flow and Water Supply

Domestic and other water supplies, which are sufficient and suitable in quantity and in quality are important to the health and well-being of a community.

Problems associated with low flow normally occur during the summer and fall. The streamflow record of the South Nation River indicates that approximately 68 per cent of surface runoff occurs in March and April. Only 6 per cent of surface runoff occurs from June through September. It is this low streamflow during hot, dry, summer months that is of major concern.

In the Raisin region the problems involve insufficient water supplies for stock watering, pollution abatement, domestic and industrial uses. The town of Alexandria, because of industrial development, for many years was faced with the problem of getting a dependable supply of good quality water. This was solved in 1967 by the construction of Loch Garry Reservoir.

Another major source of water supplies is ground water. However, in some areas such as the vicinities of Dalhousie Mills and Apple Hill there is a long history of wells drying out during periods of low rainfall. The situation could probably be improved by deepening the wells. In other areas, the ground-water table is too high and should be lowered to improve the productivity of the soil.

4. Pollution

The effects of pollution are many and varied, and usually go unnoticed until it is too late to prevent them. Community health is threatened, fish die, and the aesthetic qualities of the streams are impaired.

Cheese production is the chief industry along the rivers. It is also the major source of pollution. The factory at Dalhousie Mills is singular in its importance. This factory is located in the Province of Quebec, but effluent is discharged into a water course which enters into Rivière au Beaudet in Ontario. This problem indicates the need for co-operative effort between the Provinces in order to solve some of the water problems occurring on inter-provincial streams such as the Rivière au Beaudet and Rivière Delisle.

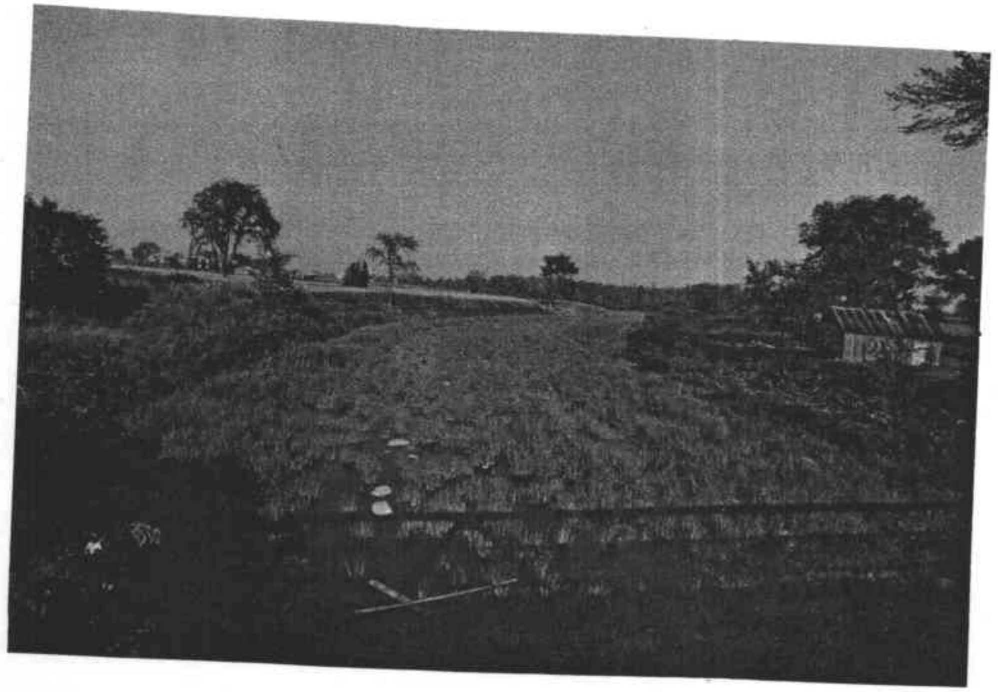
Except for the source of pollution previously mentioned, this problem is not critical in the Raisin region although there are some isolated areas of pollution from other causes. The sight and smell of any of these isolated areas of pollution make the whole stream suspect and thus act as a deterrent to the use of any part of the stream.

The causes, effects and possible solutions to the problems of pollution are discussed more fully in Chapter IV of the Biology Section.

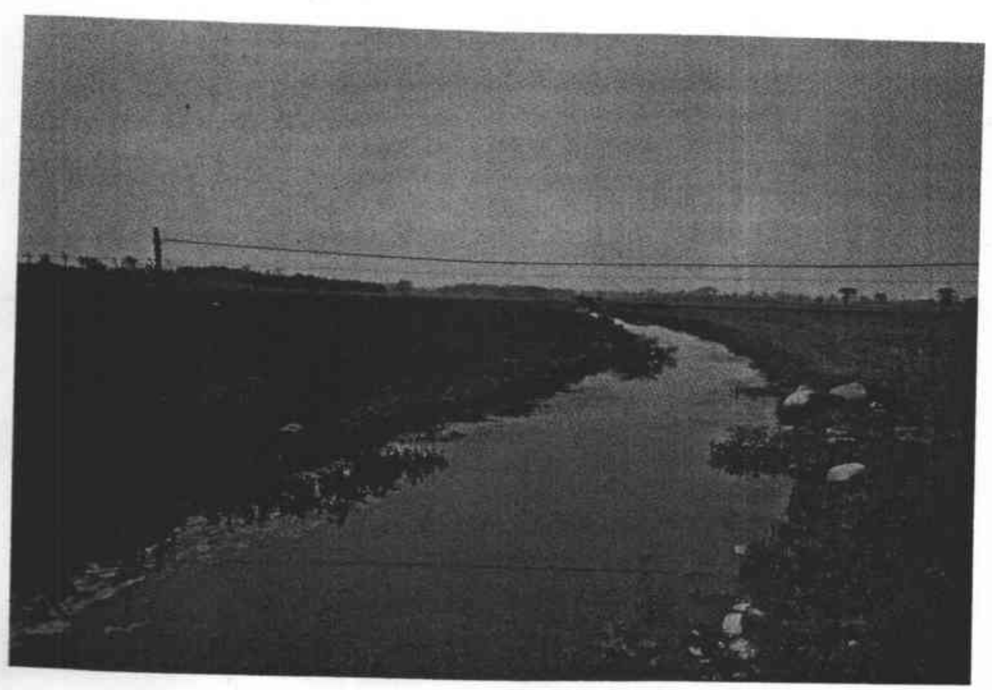
5. Erosion

Soil erosion is a serious problem throughout the watershed. Many streambanks have collapsed, and outlets of tile drains have been plugged. Sheet erosion is also evident in the watershed.

Erosion causes the loss of valuable, fertile topsoil. Streams carrying sediment become cloudy, and the sediment can have detrimental effects on the fish population. Also, the sediment which is deposited in stream channels, lakes, reservoirs and harbours, requires costly dredging. This problem is described in greater detail in Chapter I of the Land Section.



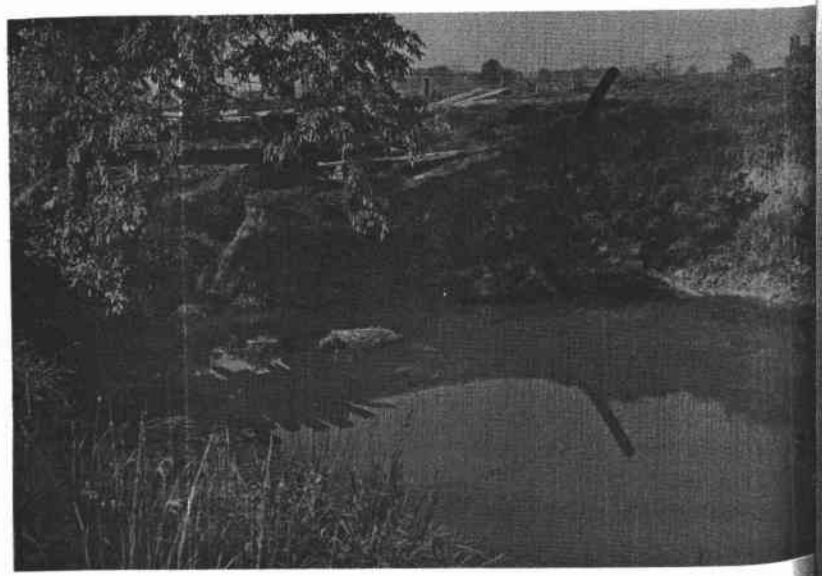
Rivière Delisle Near the Quebec Border — Low Flows are Prevalent in the Summer Months. Similar Conditions Exist in Other Creeks.



Rivière au Beaudet Showing the Wide Flood Plain South of Green Valley, Looking Upstream from the Bridge on Highway 34.

Farm Bridge Across Rivière Delisle was Destroyed by Fast Flowing Flood Waters.

A Farm Lane Condusive to Ice-Jamming, Crossing the Rivière Delisle.



A Farm Lane Crossing Sutherland Creek.

CHAPTER III

HYDROLOGY

1. General

Hydrology is the science that deals with the origin, distribution, and properties of the waters of the earth. The circulation of water in its various forms from the sea to the atmosphere, to the ground, and back to sea again is known as the hydrologic cycle.

The activities of man are greatly affected by this movement of water, particularly that portion of the cycle between the incidence of precipitation over land areas and the subsequent discharge of water through stream channels or its direct return to the atmosphere by evapotranspiration. For a proper assessment of water problems, a knowledge of this phase of the cycle is essential.

The hydrologic cycle, as a whole, remains in balance. However, in a small region such as a watershed, the quantities of moisture in any part of the cycle may vary widely. These fluctuations are the primary subjects of a study in hydrology. For example, a temporary imbalance of the cycle, in which great volumes of water are concentrated in the streams, results in a flood. Conversely, small of negligible amounts of water in the precipitation phase of the cycle, combined with increased evapotranspiration losses, leads to drought.

2. Climate Characteristics

The climatic factors on a watershed are many and variable. Those most influencing the rate and volume of runoff are the amount and intensity of rainfall, amount of snow and ice accumulation, radiation, temperature and wind.

Several meteorological stations have been established in the Raisin region since 1867. Unfortunately, some stations have either been discontinued or have only a short period of record. A list of the stations and their observation programs is given in Table 8.

Figure 11 shows the mean monthly precipitation (rain plus snow on the basis of ten inches of freshly fallen snow equalling one inch of water) at Cornwall. These records indicate that the mean annual precipitation is 33.13 inches, 26.75 inches is rainfall and the equivalent of 6.38 inches is in the form of snow.

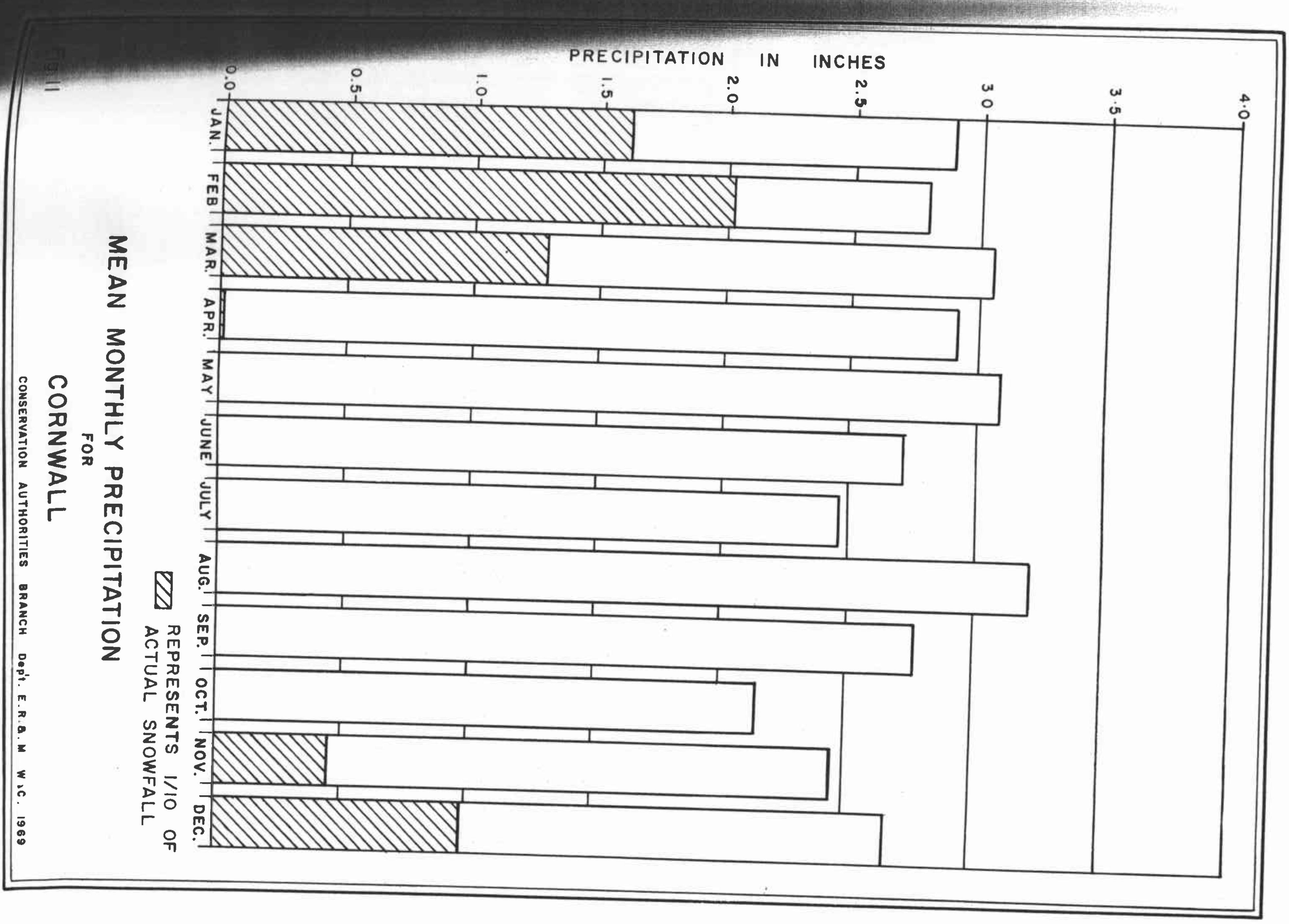
3. Streamflow Records

Of the many types of hydrologic data, streamflow data are the most important for the study of water management programs. Peak flow records are required for the design of flood control works. Data are required on minimum flows and duration for estimating the dependable water supply. Data on total runoff and its variations are necessary for the design of storage reservoirs for conservation purposes.

TABLE 8.

METEOROLOGICAL STATIONS

Station	Latitude	Longitude	Elevation (feet above mean sea level)	Temperature	Precipitation	Rate of Rainfall	Windspeed	Sunshine	Period of Record: Began Year	Began Mo.	Ended Year	Ended Mo.
Alexandria	45° 19'	74° 40'	260	x	x				1888	07	1894	01
Apple Hill	45° 13'	74° 45'	300	x	x				1950	11	1964	08
Cornwall	45° 01'	74° 44'	175	x	x				1867	01	1887	12
Cornwall Ont. Hydro	45° 01'	74° 48'	250	x	x	x	x	x	1954	12	----	--
Lancaster	45° 09'	74° 28'	165		x				1961	07	----	--



The collection of streamflow data by direct measurement of velocity and water surface elevation is known as stream gauging. The types of gauges in general use are the staff and box (tape and weight) gauges which are read manually, and the clock-run automatic gauge-height recorders. The latter type are usually installed at permanent stream gauging stations like the one illustrated in Figure 12. Manual gauges have a much lower initial cost but, unlike the automatic recorder, do not yield a continuous water stage record.

The stage record is converted to a discharge record by metering the stream. The river is corss-sectioned at the gauge site and flow velocity is measured with a current meter. The cross-sectional area multiplied by the average velocity yields the discharge measurement. Periodic meter measurements of flow, and simultaneous stage observations provide the data required to develop a rating curve. The flow at any particular stage can thereafter be determined from the stage records by the use of a rating curve for the gauging site.

Unfortunately, no streamflow records are available for those streams studied during the 1968 survey.

4. <u>Design Flows</u>

The design of any river control structure requires the implementation of a design-flood flow. The risks to the property and the structure under consideration will influence the designer's judgment in the selection of the design-flood magnitude. For structures such as large dams, it is essential that the spillway be of sufficient capacity to safely facilitate the greatest flow that could occur. For lesser control works, such as channel improvements where no serious damage could result from an overbank flow, flows of a lesser magnitude may be used. In evaluating flood-flows for design purposes, three standards are generally considered.

a. <u>100-Year Flood Flow</u>

This is a flood which is expected to occur, on the average, once every 100 years. In other words, there is a one per cent chance that a 100-year or a greater flood will occur in any year. This definition does not imply in any way that such a flood, having occurred once, will not recur for the next 100 years. The size of this flood is estimated by frequency analysis of available flow records or by the application of unit hydrograph to the 100-year storm. The antecedent conditions of the watershed that are likely to occur at the time of the storm are carefully evaluated.

b. <u>Regional Flood Flow</u>

This flow is usually considered equivalent to the maximum flow known to have occurred over a meteorologically similar region. For a watershed in Southern Ontario, Hurricane Hazel, which caused severe flooding in the Toronto area in 1954, is usually adopted as the regional flood.

c. <u>Maximum Probable Flood Flow</u>

This is the greatest flow that may be expected from the most severe combination of the critical meteorological and hydrological conditions in the region. This flow concept is used for designing spillways where there may be loss of life or disastrous property damage in the event of a flood.

The main watersheds in the Raisin Region vary from 4.7 to 88 square miles and the approximate values for flows of these magnitudes are indicated below.

d. <u>Peak Flow Values</u>

i. 100 year flood flow — 60 to 250 c.f.s. per sq. mile;

ii. Regional flood flow — 150 to 570 c.f.s. per sq. mile; and

iii. Maximum probable flood flow — 320 to 1170 c.f.s. per sq. mile.

5. <u>Hydrologic Data and Water Management</u>

Hydrologic gauges and their records are vital to a systematic study of the natural forces of a watershed. Without this knowledge, the proper planning of flood plains, low flow maintenance, flood control, dam operation and other water management projects is not possible.

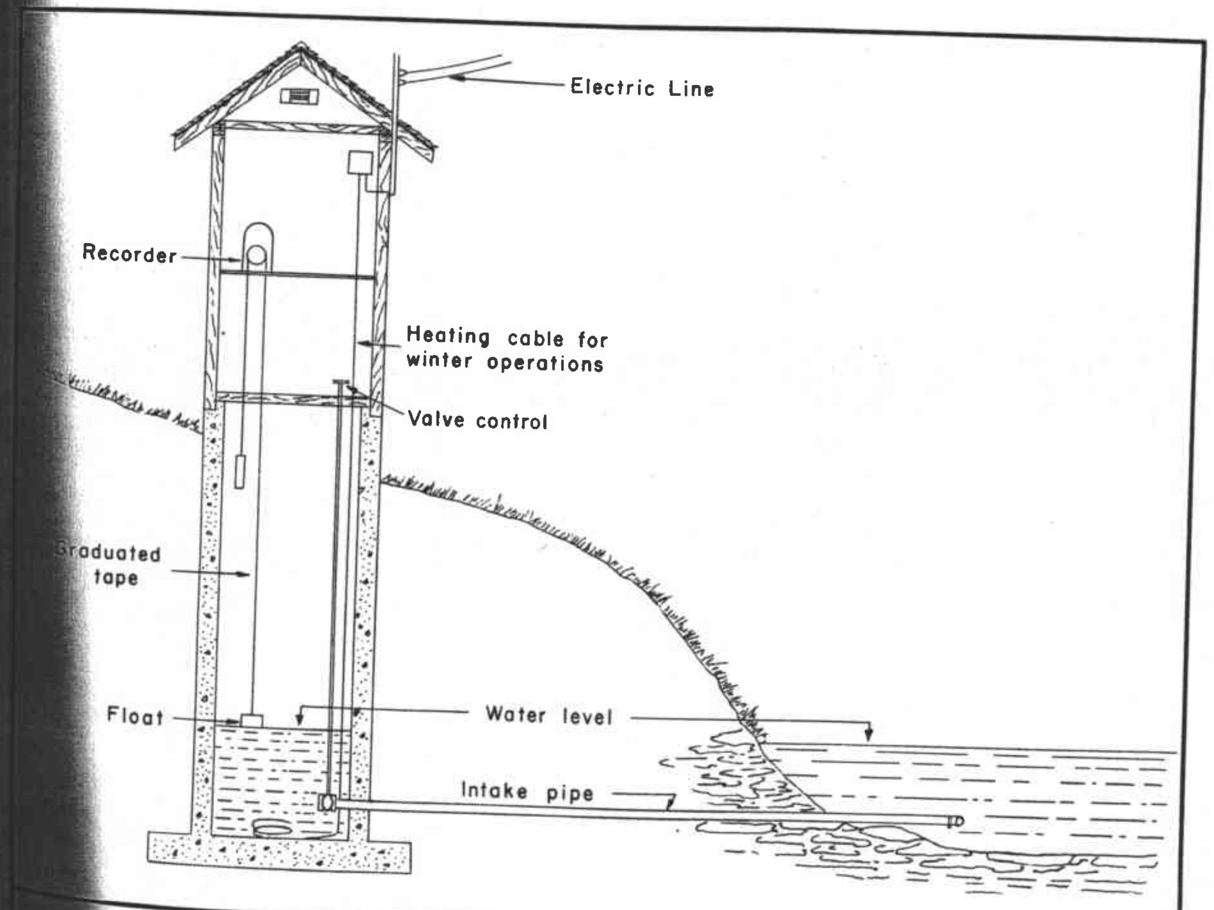
Precipitation and streamflow are the common elements measured by hydrologic gauges. Other elements measured are: temperature, humidity, evaporation, radiation, sunshine, wind, soil moisture and ground water. Measurements of the various elements can be made by a variety of recording or manual instruments. The manual instrument provides records for one or two readings a day. The recording instrument, with its continuous record, is much more valuable because the time distribution is a vital component in hydrologic analysis.

It is essential to know approximately the capacity and available water supply of any reservoir before plans can be prepared for its use and before its construction can be justified.

In developing design criteria for a dam, long-term gauge records are desirable in order to define the régime of the river. From precipitation and streamflow records, the lag time and rainfall-runoff relation may be determined for the damsite. Also a unit hydrograph may be derived. The unit hydrograph is useful in determining the flow which can be expected from a particular rainstorm. If long-term records are available, frequency analyses can be performed to determine the recurrence interval for high flows (floods) and low flows (droughts).

Hydrologic records are important in setting up operational procedures for a reservoir. Past floods, as well as hypothetical flows, can be routed, theoretically, through the reservoir to determine the reduction in the downstream peak. During the actual operation of the reservoir, the precipitation and streamflow gauges are necessary to provide the dam operator with information on the expected flow. The operator can then adjust his gate opening for the anticipated flow conditions.

TYPICAL STREAM GAUGE STATION



TYPICAL STREAM GAUGE INSTALLATION

VATION AUTHORITIES BRANCH, DEP'T. E.&R.M. T.L.L. 1968.

Fig. 12

6. Hydrologic Gauge Network

The desirable density of hydrologic networks should reflect the hydrologic regimen of an area and the ultimate use to which the data are to be directed. A general survey of water resources may be served by a relatively scanty network, while the development of a specific, important water project would require a much higher density of stations. Because of the large number of factors involved in this problem, there is a broad range of network requirements.

a. Rain Gauges

At present there is one recording gauge in Cornwall and one manual gauge at Lancaster. The manual gauge readings at Apple Hill were discontinued in August 1964. It is recommended that the gauge at Apple Hill be reactivated and that one additional manual gauge be installed at Alexandria.

b. Stream Gauges

There is one manual gauge on the Raisin River at Williamstown, which has been in operation since November 1960.

One recording stream gauge is recommended for Rivière Delisle at the proposed damsite near Greenfield. A typical installation is shown in Figure 12. A less expensive installation consists of a housing large enough to protect the automatic recorder mounted on top of a vertical 30-inch culvert pipe.

One additional manual gauge is proposed for Rivière au Beaudet near Highway 34.

c. Development of Network

To develop an adequate network of hydrologic gauges, the Authority should initiate a program for the installation of the additional gauges. This installation could be extended over several years.

Stream gauges are installed under the auspices of the Inland Waters Branch of the Canada Department of Energy, Mines and Resources. They also meter the stream each month and publish records of the daily flow in their annual reports. Cost of this work is shared equally by the federal government and the Province of Ontario.

The rain gauges can be installed by Conservation Authorities Branch personnel in less than an hour. The observers act voluntarily and the records are turned over to the Conservation Authorities Branch.

The locations shown in Figure 8 are approximate and the final location of the proposed gauges will have to be selected in the field. It is recommended that the gauge installations be started immediately and completed within three years.

CHAPTER IV

REMEDIAL MEASURES

1. General

The flood control and conservation remedial measures suggested in this chapter are submitted as aids to the solution of water problems in the region. It has not been possible to deal completely with all the problems, but the major ones have been investigated and recommendations have been made.

2. Flood Control Measures

Flood control is aimed primarily at the reduction of flood damage. It may be achieved by one or more of the following measures:

a. Proper land-use practices;

b. Reforestation;

c. Reservoir construction;

d. Channel improvements and diversions;

e. Dike and flood wall construction;

f. Flood plain zoning; and

g. Flood warning system.

The proper use of the land and the reforestation of marginal and sub-marginal land can retard surface runoff and reduce flooding. Agricultural and forest practices recommended for the Raisin Region are listed in the Land and Forest chapters of this report.

Other measures have been investigated and some will be discussed in greater detail in the following section.

3. Degree of Flood Protection

The degree of flood protection is influenced to a large extent by economics. The cost of protection must be weighed against the reduction of flood damage. The degree of protection is a matter of policy for the governing agency. Generally, in Southern Ontario, protection is provided against the regional flood indicated in Chapter III, Hydrology. This protection may be reduced if the possibility of loss of human life, extensive property damage and interruption of services is considered extremely unlikely.

4. Zoning and Flood Plain Acquisition

Nearly all flood damage occurs in a river's flood plain. Men occupy and utilize the flood plain for economic advantages. The fertile sediments carried by the stream have an important bearing on the utilization of the flood plain for agricultural production. The flatness of the flood plain is an asset, particularly for transportation. Because rivers are a major source of domestic and industrial water, flood plains have been considered advantageous sites for settlements.

Flood plain occupancy, however, is in direct competition with the river itself. Man must pay for the occupancy, and the price depends on the degree of flood protection implemented.

An efficient and economical method of flood control restricts the use of the flood plain by limiting development to parks, open space and agriculture. Thus, the flood waters are allowed to spill across the flood plain without causing serious damage.

Zoning requires municipal control of the flood plain's development. To restrict or restore flood plains to the uses mentioned previously, it may be necessary to acquire these lands.

When developing a zoning program, three categories of land should be considered:

a. Floodway

The channel of a river and those portions of the adjacent flats which ordinarily carry and discharge the flood flow of the river.

b. Flood Plain Lands

The area adjoining the river which has been, or may be, covered by flood waters.

c. Conservation Lands

As it is applied to the lower sections of the main river valley systems, this term includes all the land between the crests of the valley slopes.

The physical interpretation of these three definitions is shown in Figure 13.

In flood plain acquisition programs, it is preferable to acquire area to the limit of conservation lands. The Authority then controls the valley slopes. These slopes are extremely important, since they prevent encroachment of the flood plain, permit the development of parks and open space and prevent the placing of fill in the valleys, which might restrict the free passage of high flood flows.

5. Flood Warning System

With the establishment of the rain and stream gauges as proposed on the Surface Water Resources map (Figures 8 & 9), a good basic data collection system

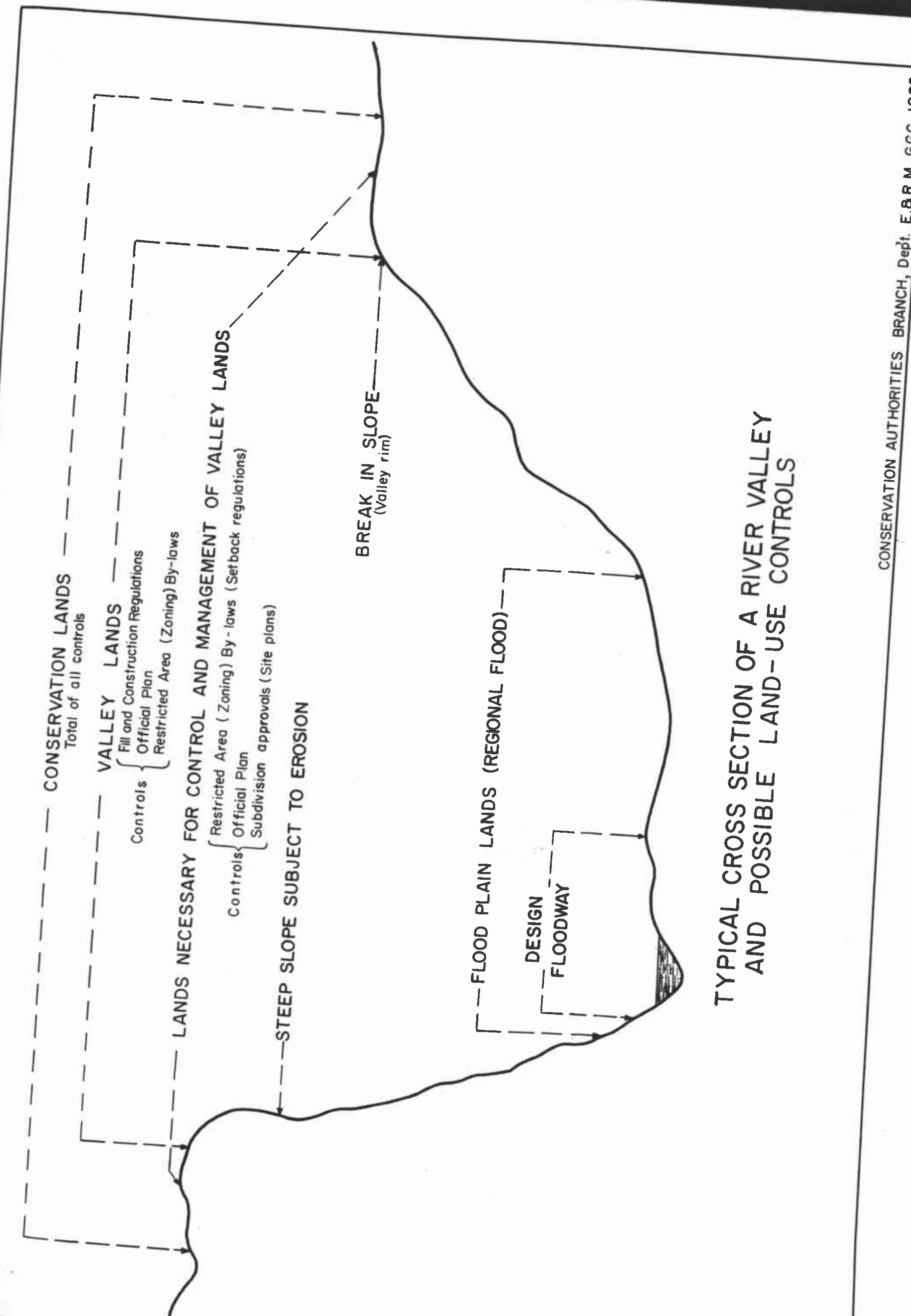


Fig.13

would be available for flood-warning purposes. The Authority should establish contact with all gauge observers on the watershed. During critical periods, the observers would supply rainfall and streamflow data to the Authority. This information would then be submitted to the Conservation Authorities Branch to assist in the development of forecasts.

Flood forecasts are issued as required to Authority personnel and broadcast to the public by means of radio and television. Flood warning is aimed primarily at alerting people to avoid loss of life. It also makes possible the removal of property from rising flood waters and is essential for the safe operation of dams.

6. Reservoirs

a. General

The purpose of a reservoir is to store water during times of flood conditions, and to release it when the critical flood conditions are past. The construction of upstream reservoirs is the most useful measure for reducing flood damage in the downstream part of the watershed. Because of the possibility of their multiple use, reservoirs play an important role in a flood control program. Such reservoirs, providing benefits through flood control, direct water supply for low-flow augmentation and recreation, are economically justifiable.

b. Reservoirs Investigated

To correct the problem of flood damage and low summer flows, considerable effort was directed towards locating sites for a number of reservoirs. Sites were established by a study of 1:50,000 topographic maps and screened by field inspection. Field surveys were conducted at selected sites to obtain detailed topographic mappings.

Several possible reservoir sites which warranted further study were investigated; the pertinent data is summarized in Tables 9 and 10.

Two flood storage values are quoted in Table 9. The flood storage "normal" would be the available flood storage between the normal holding or "regulated" level and the maximum water level. The flood storage "maximum" would be the maximum storage available if the reservoir were drawn down to the dead storage level, prior to a flood. A drawdown of five feet was used to compute the "conservation storage", which could be used for water supply and low flow augmentation. This drawdown is a maximum where the reservoir is to be used for recreation.

The conservation storage was converted into an equivalent flow for two periods: summer period, June 1 to September 20, 112 days; and, yearly period June 1 to February 28, 273 days.

These two periods are used to evaluate the improvement to streamflow during the dry summer months and to show the improvement in flows in all but the months of March, April and May when the natural flow is usually sufficient.

TABLE 9.

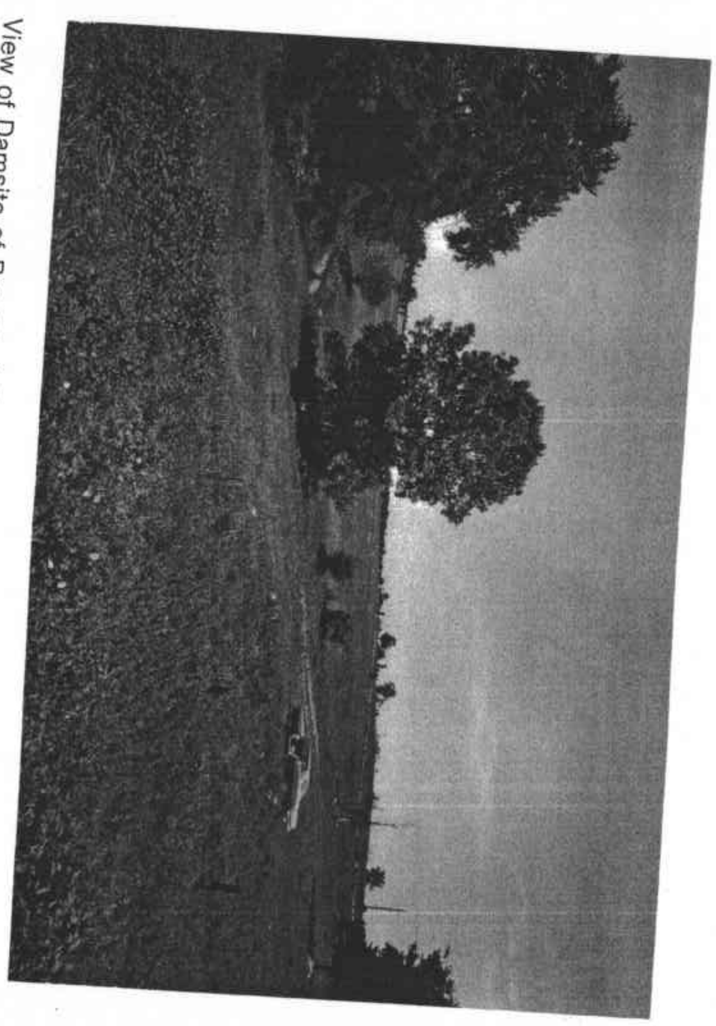
RESERVOIR SITES INVESTIGATED

Reservoir	Conservation Storage: Between Elevations (1)	Conservation Storage: Acre-Feet	Low Flow Augmentation 1M C.F.S.: 112 Days	Low Flow Augmentation 1M C.F.S.: 273 Days	Flood Storage - Normal: Between Elevations (2)	Flood Storage - Normal: Acre-Feet	Flood Storage - Normal: Run-off Ins. (3)	Flood Storage - Maximum: Between Elevations (5)	Flood Storage - Maximum: Acre-Feet	Flood Storage - Maximum: Run-off Ins.	Total Storage Ac.-Ft.
Delisle "A"	280-285	1700*	7.6	3.1	285-289.5	2100	1.4	280-289.5	3800*	2.6	4800*
Delisle "B"	290.5-285.5	2500*	11.2	4.6	295.5-300	3600*	2.5	280-300	11,300	7.8	12,300*
Green Valley	245-250	1250*	5.6	2.3	250-252	1000*	6.3	245-252	2250	14.1	3,000

Notes:
(1) An allowable drawdown of five feet has been assumed.
(2) Between regulated and maximum water level.
(3) Runoff in inches from drainage area.
(4) Equivalent flow in c.f.s. for summer period of 112 days, June 1 to September 20, and yearly period June 1 to February 28 of 273 days.
(5) Between the dead storage and maximum water level.

* Data from 1:50,000 topographic maps and of limited accuracy.

View Looking Upstream at Proposed Rivière Delisle Reservoir Site.



View of Damsite of Proposed Green Valley Reservoir on a Tributary of Rivière au Beaudet, Looking Upstream from C.P.R. Tracks.

TABLE 10.

DAM & RESERVOIR DATA

			Elevation in Feet G. S. C.					Estimated Cost			
Dam	Drainage Area In Sq. Mi.	Storage Capacity Ac.-Ft.	Stream at Site	Max. Water Level	Top of Dam	Dam Height Feet	Dam Length Feet	Dam	Land	Total	Per Ac.-Ft.
Delisle "A"	27.4	4,800	272	289.5	294	22	500	346,000	65,000	411,000	86
Delisle "B"	27.4	12,300	272	300	305	33	820	1,000,000*	150,000	1,150,000	94
Green Valley	3.0	3,000	236	252	255	19	530	227,000	120,000	347,000	116

* Including an allowance of $100,000 for bridge replacement.

When the design is finally complete, priorities for the uses of the reservoir should be established and the storage allocated accordingly. Storage losses would have to be included in the calculation. The amount by which evaporation exceeds rainfall on the reservoir itself for the summer period could be equivalent to a drop of six inches or more in level.

The sites that are recommended at this time are shown on the watershed map (Figure 9), and described briefly in the following sections. The word "site" refers to the reservoir as a whole and "damline" to the location of the dam.

i. <u>Rivière Delisle Dam and Reservoir</u>

The Rivière Delisle Reservoir would be used for flood control, low flow improvement, pollution abatement and recreation. It could also be used for water supply for the town of Alexandria. The damline is located on Concession IV, Lot 13, Kenyon Township and about three and one-half miles north-west of Alexandria. The dam would have a concrete ogee spillway with earth-fill embankments.

Two possible dam heights were investigated. In Scheme "A", the dam would be 22-feet high and the reservoir would have a total storage of 2,550 acre-feet at a water level elevation of 289.5 feet above sea level. The estimated cost of the dam and reservoir is $411,000. The reservoir site and general layout for the proposed dam are shown in Figure 14.

In Scheme "B", the dam would be 11 feet higher. It would raise the maximum water level to an elevation of 300 feet, increasing the total storage to 12,300 acre-feet. One objection to this second scheme is that the bridge at the northern end of the reservoir would have to be raised. The cost of Scheme "B" is estimated at $1,150,000.

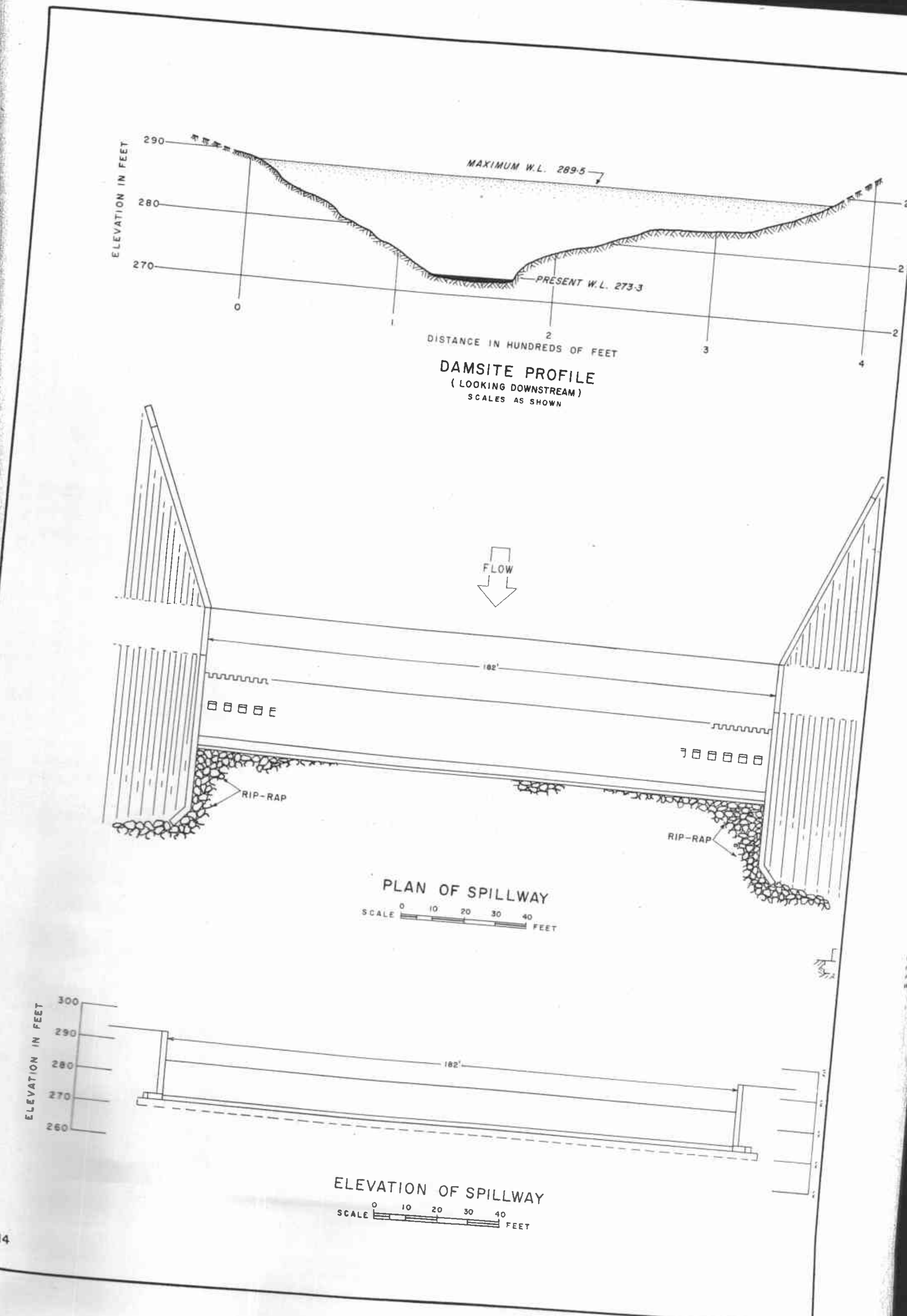
ii. <u>Green Valley Dam and Reservoir</u>

The Green Valley Reservoir would be used for flood control, low flow augmentation and recreation. The damline is located north of the Canadian National Railway tracks, about two miles east of the Village of Green Valley. It is on a tributary of the Rivière au Beaudet.

The proposed dam consists of a free overflow spillway and earth-fill embankments. The reservoir would have a total storage of 3,000 acre-feet at a water level elevation of 252 feet above sea level. The cost of the dam and reservoir is estimated at $347,000. The reservoir site is shown in Figure 15, and the type of structure would be similar to the one shown for the Rivière Delisle scheme in Figure 14.

c. <u>Design Flow for Proposed Reservoirs</u>

Since there are no stream gauging stations at or near the proposed dam sites, the spillway design flows have to be estimated by some



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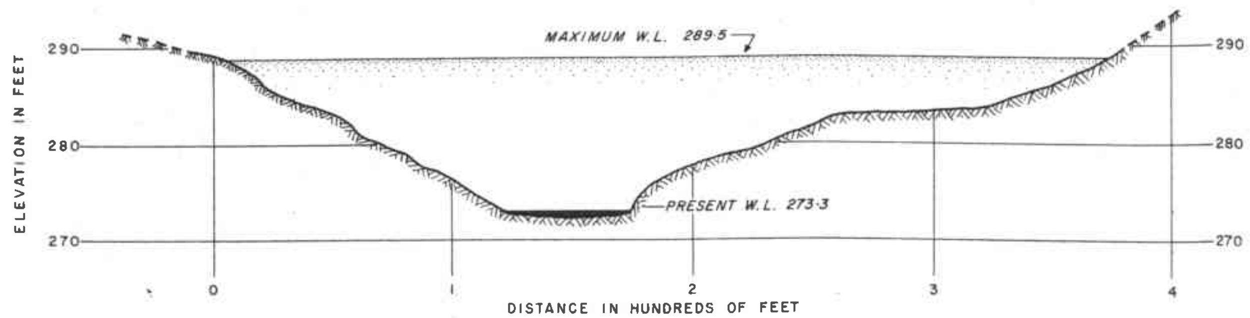
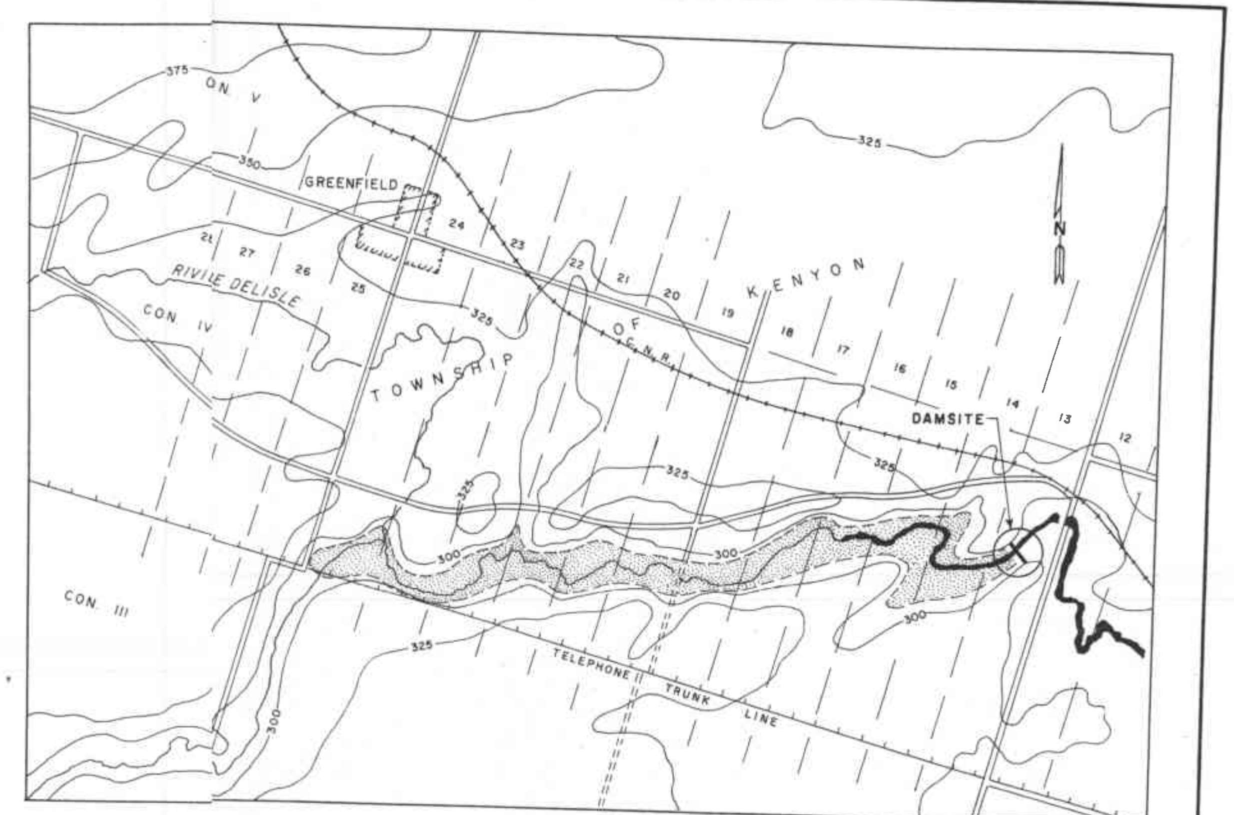
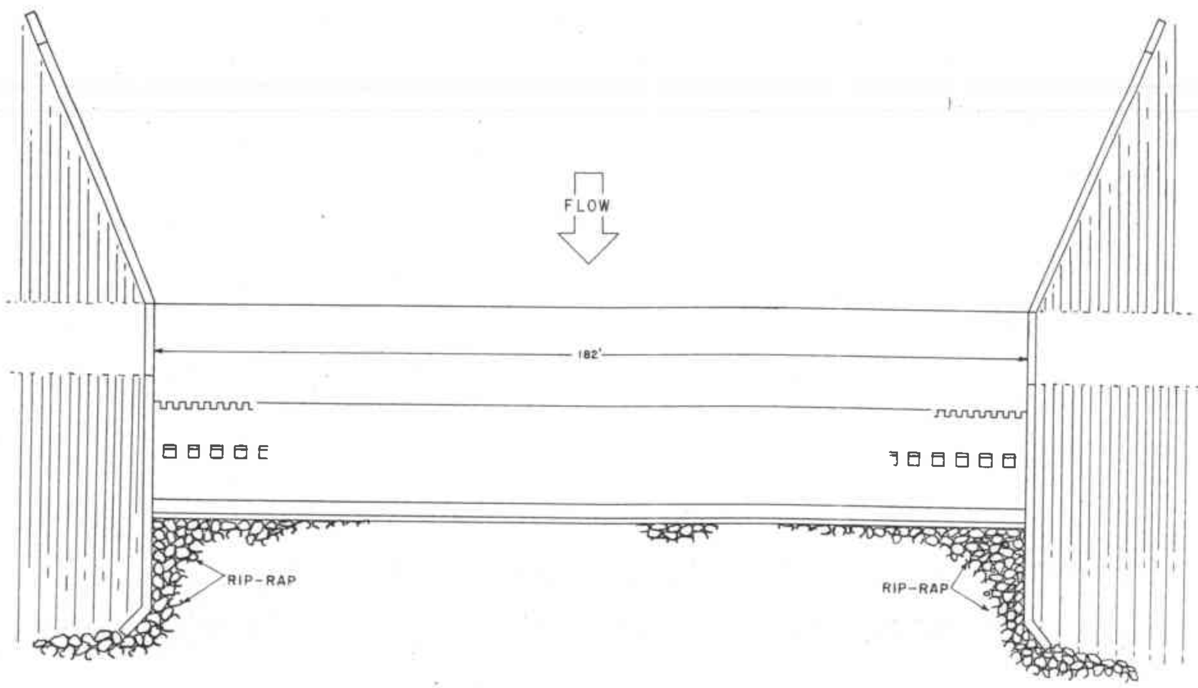


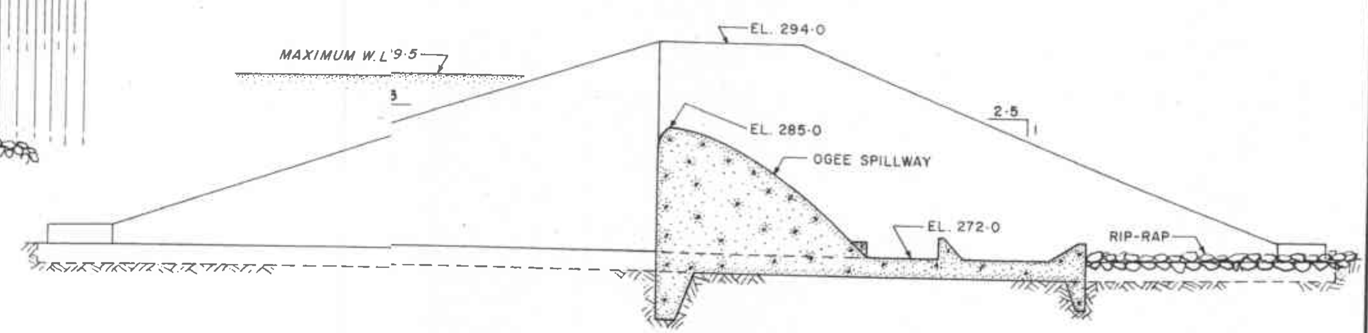
DAMSITE PROFILE
(LOOKING DOWNSTREAM)
SCALES AS SHOWN



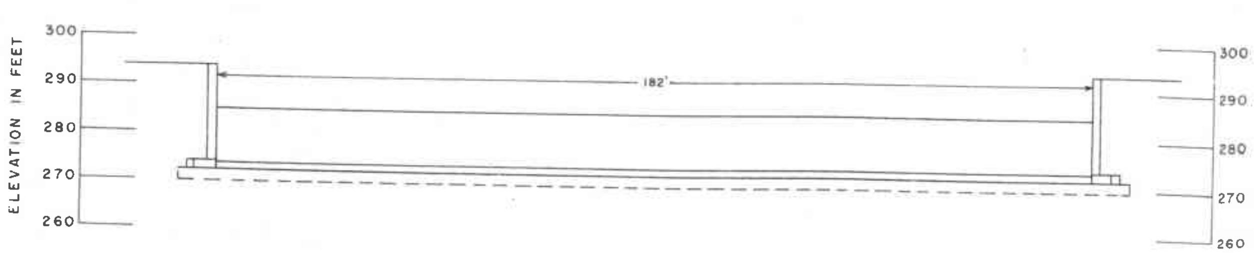
SITE PLAN
SCALE 0 ½ 1 MILES



PLAN OF SPILLWAY
SCALE 0 10 20 30 40 FEET



SECTION THROUGH DAM
SCALE 0 10 20 FEET



ELEVATION OF SPILLWAY
SCALE 0 10 20 30 40 FEET

PROPOSED

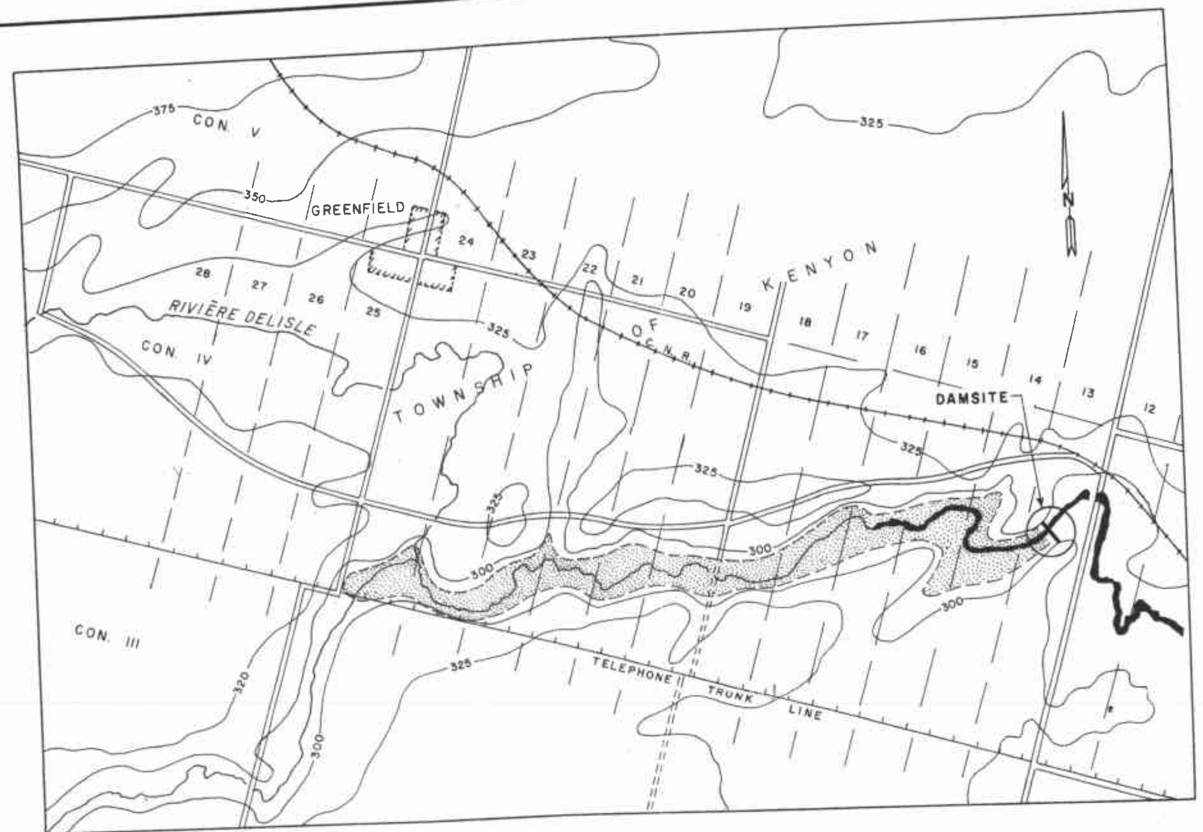
RIVIÈRE DELISLE RESERVOIR

SCHEME A

SCALES AS SHOWN

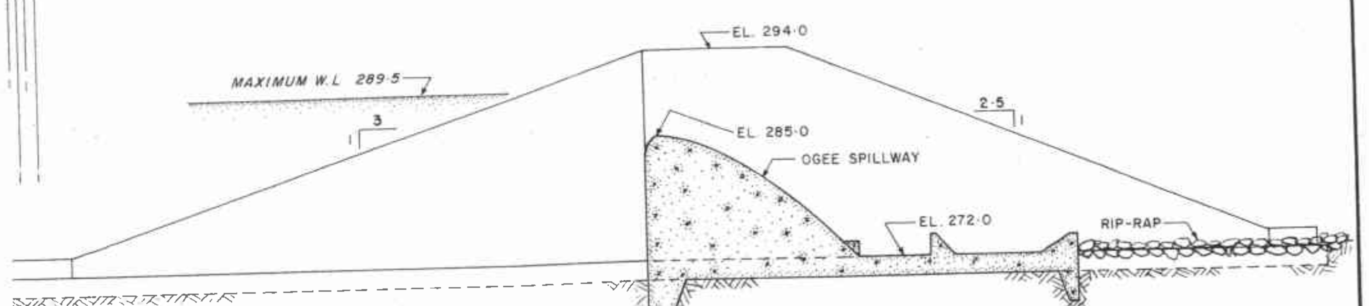
NOTE - ALL ELEVATIONS SHOWN ARE G.S.C. DATUM

CONSERVATION AUTHORITIES BRANCH - Dept. E.&R.M. - W.G.M. - 1969



SITE PLAN

SCALE 0 ½ 1 MILES



SECTION THROUGH DAM

SCALE 0 10 20 FEET

PROPOSED

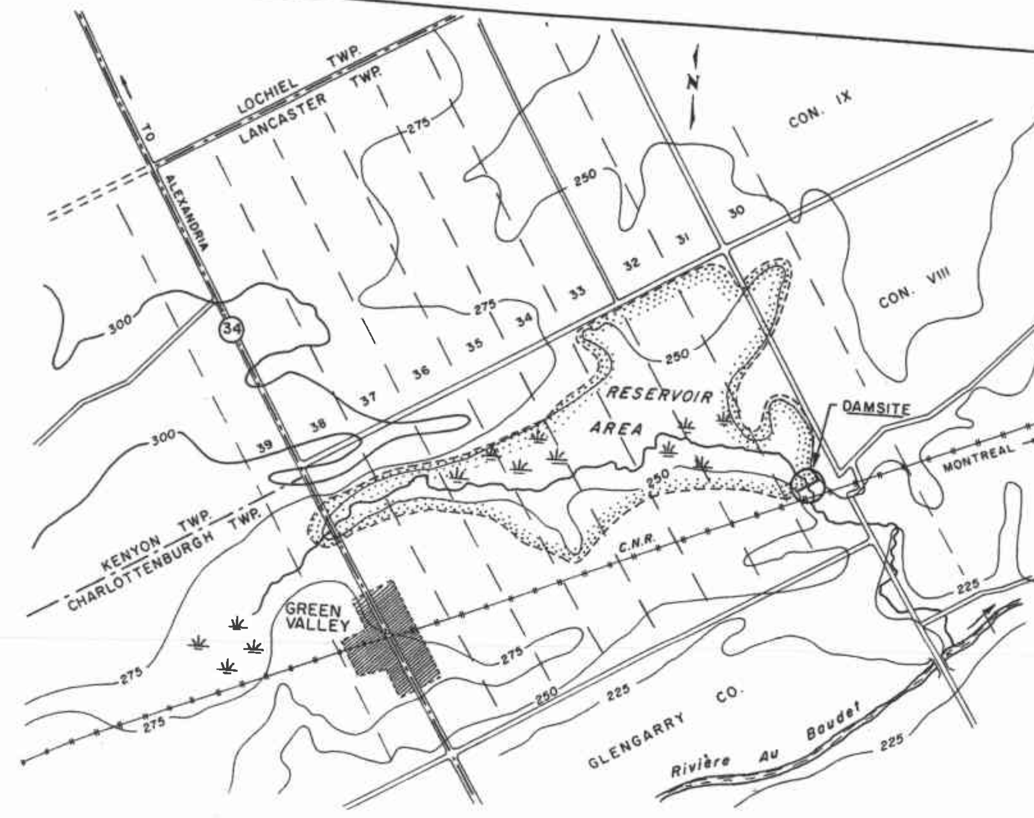
RIVIÈRE DELISLE RESERVOIR

SCHEME A

SCALES AS SHOWN

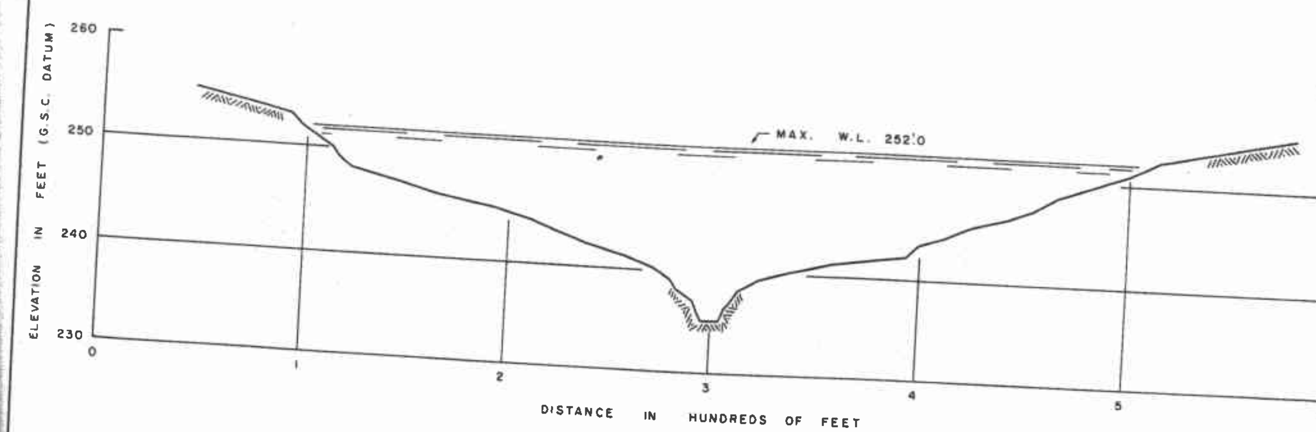
NOTE - ALL ELEVATIONS SHOWN ARE G.S.C. DATUM

CONSERVATION AUTHORITIES BRANCH - Dept. E.& R.M. - W.G.M. - 1969



SITE PLAN

SCALE 0 ½ 1 MILES



DAMLINE PROFILE

(LOOKING UPSTREAM)

PROPOSED

GREEN VALLEY RESERVOIR

SCALES AS SHOWN

CONSERVATION AUTHORITIES BRANCH, Dep't. E.& R.M., L.R.L. - 1969

Fig. 15

empiral method. The synthetic hydrograph approach, as it is outlined in the "Design of Small Dams", published by the U. S. Bureau of Reclamation, has been adopted in this study.

The synthetic hydrographs derived from 100-year storms (Hurricane Hazel), and maximum probable storms are summarized in Table 11.

For a preliminary design to estimate spillway costs, the Hazel-centred storm, also known as "regional flood" was used for the Rivière Delisle Dam.

The flow resulting from a 100-year storm was chosen as the spillway design-flow for the Green Valley Reservoir, since there is little danger of loss of life and only a minor threat of property damage from a dam failure.

d. Summary

Because of the considerable expenditures involved in reservoir construction, the two proposed projects may be beyond the financial capability of the Authority at the present time. However, consideration should be given to development in the near future.

It is recommended that the Authority consider these two dams for preliminary engineering and construction as funds become available.

During the preliminary engineering, detailed topographic mapping and soil investigations of the dam sites would be required.

7. Inventory of Existing Dams

There are five dams regulating the streams and lakes in the region, other than the dams on the Raisin River.

Other structures once existed throughout the area, but these have either been removed or ceased to function as effective controlling devices.

a. Rivière Delisle — Alexandria Power Dam

This dam is located about 1 mile north of the Town of Alexandria, on Lot 36, Concession III, Township of Lochiel. It was built in 1935 to generate electric energy for local consumption from the water power of the Rivière Delisle.

This is a concrete gravity dam 110 feet long and 12 feet high with an overflow spillway, 66 feet long and 9.5 feet high. It is also equipped with a low-flow pipe and valve.

The structure is in fair condition, although it is no longer used for power generation.

TABLE 11.

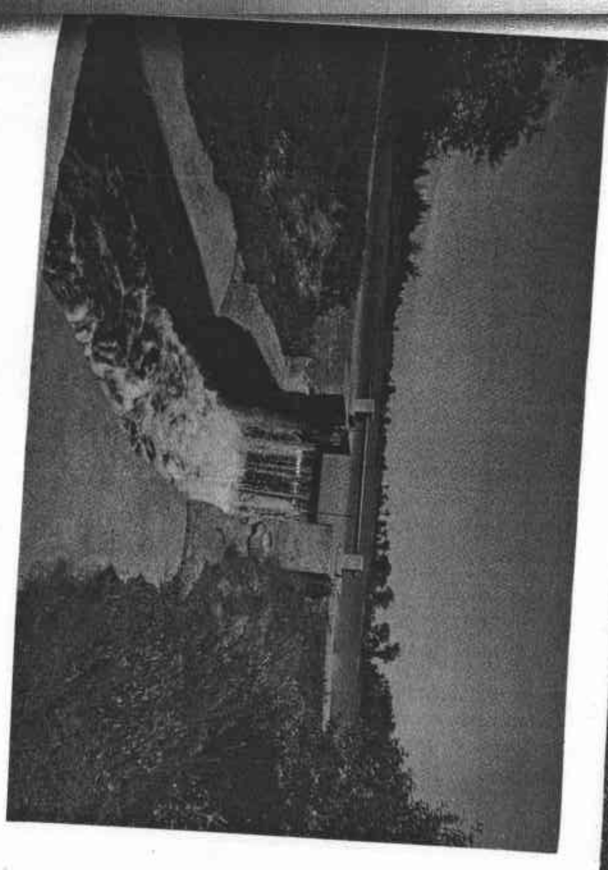
SPILLWAY DESIGN FLOWS

Dam	Drainage Area Sq. Mi.	Lag# Hours	Runoff Curve No. +	100-Year Storm Rain Inches	100-Year Storm Runoff Inches	100-Year Storm Flow Peak c.f.s.	100-Year Storm Flow Peak c.s.m.*	Hazel-Centred Storm Rain Inches	Hazel-Centred Storm Runoff Inches	Hazel-Centred Storm Flow Peak c.f.s.	Hazel-Centred Storm Flow Peak c.s.m.	Maximum Probable Storm Rain Inches	Maximum Probable Storm Runoff Inches	Maximum Probable Storm Flow Peak c.f.s.	Maximum Probable Storm Flow Peak c.s.m.
Delisle	27.4	11	79	4.0	2.0	2200	80.4	8.1	5.6	5700	208.0	15.5	12.7	14300	510.3
Green Valley	3.0	2	90	4.2	3.1	1240	413.3	8.4	7.2	2600	866.7	16.1	14.8	6680	2225.5

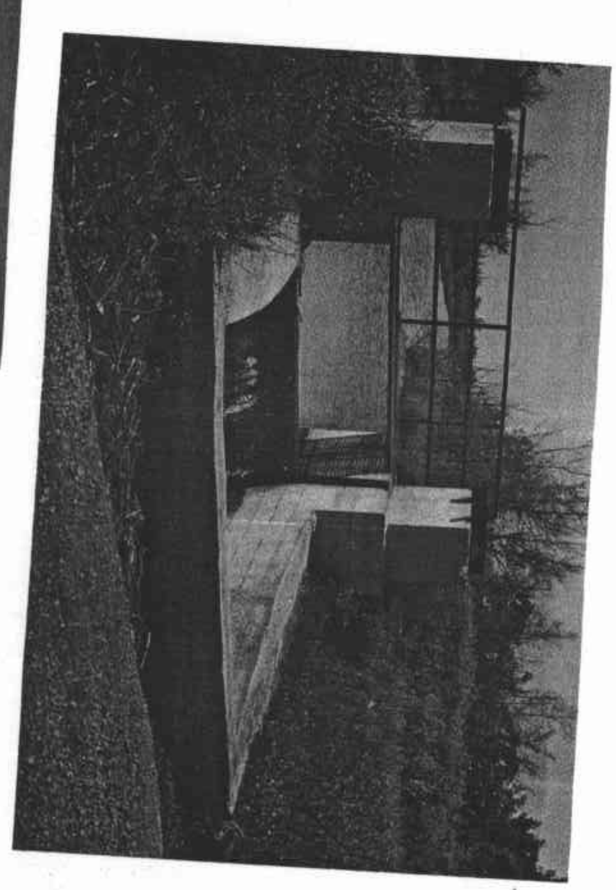
Lag is defined as the time from the centroid of rainfall to the hydrograph peak.

* Cubic feet per second per square mile.

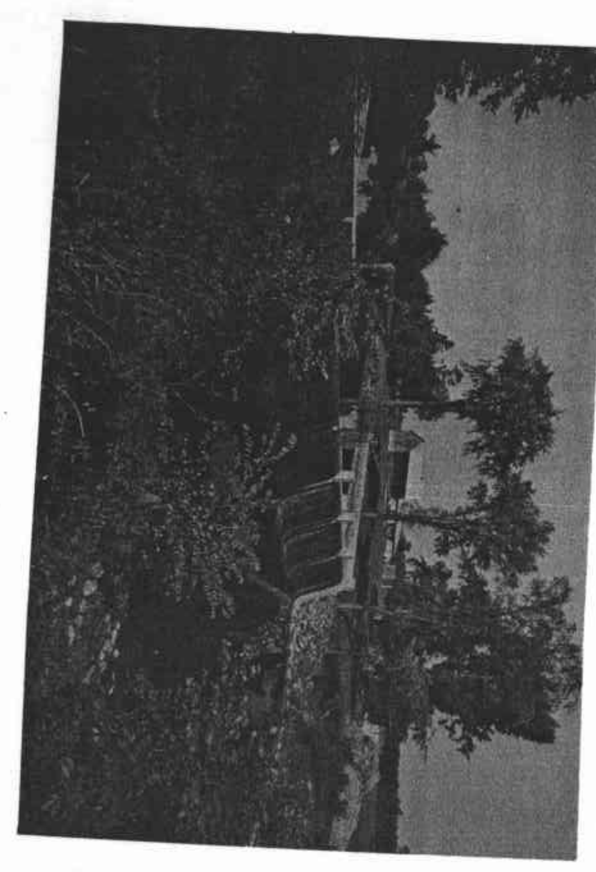
\+ Runoff curve number represents approximately the ratio in percentage between surface runoff and storm rainfall.



Kenyon Dam.

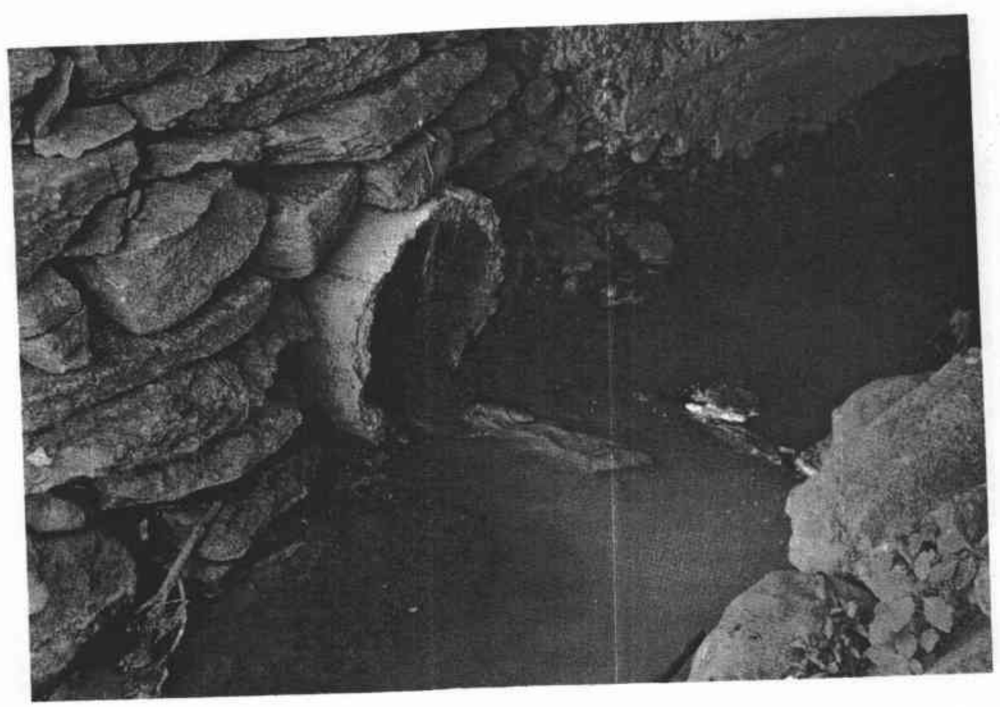


Loch Garry Dam.



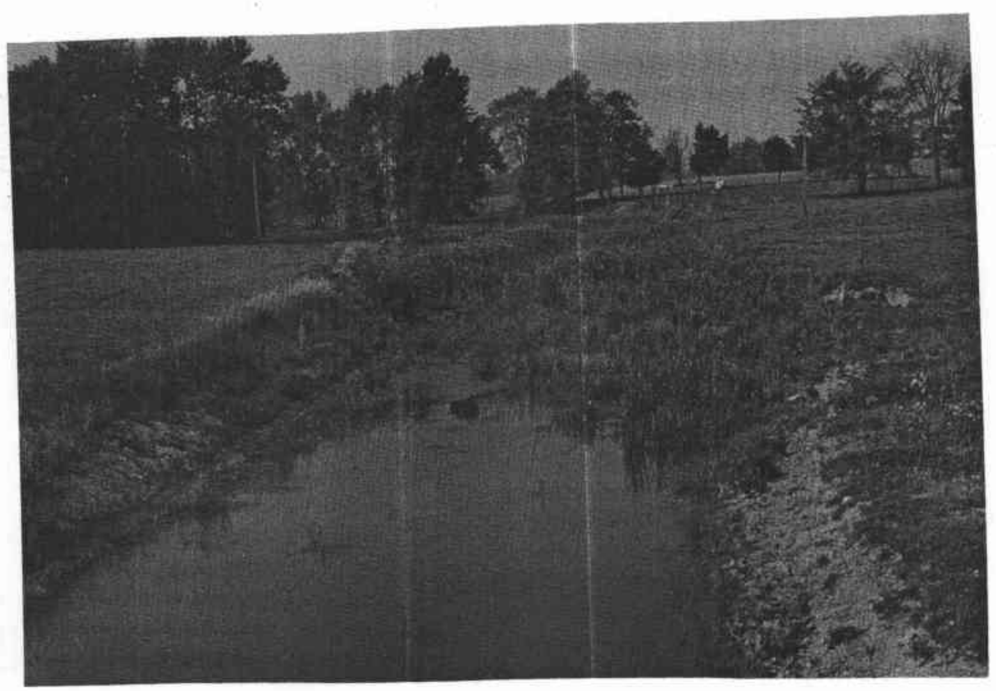
Alexandria Power Dam.

Cheese Whey Deliberately Dumped Into a Roadside Ditch which is a Waterway, in Lancaster Township, Contrary to the Provisions of the Ontario Water Resources Commission Act.



The Effluent Pipe to Tributary A of the Rivière au Beaudet from the Cheese Factory at Dalhousie Station (Quebec).

Dredging on Wesley Creek Necessitated Placing an Additional Culvert Under the C.P.R. Tracks.



Deteriorated Channel of Sutherland Creek.

b. <u>Garry River</u>

i. <u>Loch Garry Dam</u>

This dam is about 5 miles south-west of the town of Alexandria in Lot 15, Concession II, Township of Kenyon. The purpose of this structure is to regulate the outflow from Loch Garry, the headwater of the Garry River.

The earth dam is about 600 feet long and 8-1/2 feet high. The control of the water level is achieved by a concrete spillway with an 8-foot by 5-foot stop-log section.

The dam, which has been built recently to improve the municipal water supply of Alexandria, is in good condition.

ii. <u>Kenyon Dam</u>

Kenyon Dam is located in Lots 6 and 7, Concession II, Kenyon Township, about 2 miles south-west of Alexandria. It is a rock-filled dam about 440 feet long and 5 feet high. It controls the flow of the Garry River by means of sloplogs and several low-flow pipes. This spillway is 8 feet wide by about 7 feet high. It is in poor condition.

iii. <u>Alexandria Mill Dam</u>

This historic old mill dam is on the Garry River near the centre of Alexandria. It is an earth and masonry dam, built many years ago, mainly for the purpose of providing power to the adjacent grist mill.

The dam is about 30 feet long and 12 feet high and has two spillways with widths of 5-1/2 and 6-1/2 feet respectively. The control structure is in poor condition and requires some repairs and regular maintenance.

iv. <u>Alexandria Golf Course Dam</u>

This dam is located immediately downstream from the Glengarry Golf Course, about 1 mile north-west of Alexandria. It is 100 feet in length, and has a spillway 10 feet wide and 2-1/2 feet deep. Its primary purpose is to stabilize the flow of the Garry River.

8. <u>Channel Improvements</u>

Over the years, extensive dredging has been conducted on many reaches of streams in order to provide suitable outlets for tile drainage. A permanent outlet with free discharge is essential. When the outlet is submerged during high flows, silting occurs in the drain. Preliminary surveys of stream profiles and cross-sections were carried out to determine where the streams might possibly be deepened.

The preliminary surveys, especially the stream profiles, indicated that most of the small streams in Lancaster Township have been well-graded. These include Finney, Wesley, Sutherland, Gunn and Wood Creeks.

On Hoople Creek, Rivière au Beaudet and Delisle, there are several reaches where moderate dredging could be done to improve the channel capacity. The maximum depth of dredging would be less than five feet. These reaches are shown in Figures 8 and 9.

Besides these reaches, consideration should also be given to minor channel clearing and dredging at various trouble spots such as those shown in the illustrations. These channel obstructions are conducive to ice jamming and consequent floods, and therefore, should be removed.

9. Legal Aspects

In Ontario, the control of lakes and rivers which are not international waters comes under the jurisdiction of a number of acts and agencies:

a. The Conservation Authorities Act, 1968, is administered by the Ontario Department of Energy and Resources Management.

This Act was passed in 1946 and re-written in 1968, for the purpose of co-ordinating local conservation efforts on a watershed basis and providing financial assistance for approved conservation projects. One of the most important functions of the Conservation Authorities is the construction of water conservation and flood control projects.

b. Department of Lands and Forests administers a number of acts concerned with resource management and is consulted before construction of any structure which may affect its interests.

c. Ontario Water Resources Commission Act

This Act, passed in 1956, established the Commission to control and regulate water for public use. The Commission's activities have been directed toward water supply and pollution control.

Section 28a of this Act deals with regulations regarding the removal, diversion and storage of water for purposes other than domestic, farm (not including irrigation), and fire fighting. The section states that no person shall take more than 10,000 gallons per day by any means — including diversion and storage in a pond — without a permit issued by the Commission.

d. Navigable Waters Protection Act

There are additional acts which may in some way affect river management, but the ones listed are the most important.

10. Conclusion

In river management, conservation authorities have adopted, in general, the objectives of flood control, conservation of water for low flow improvement

and streambank erosion control. Also, they are extremely interested in water quality and pollution since these affect their programs. The authorities work closely with the Ontario Water Resources Commission to help control pollution.

It has been the endeavour of this report to evaluate the water problems in the Raisin region and to set out the technically feasible methods of water management so that the present and future needs of the communities of the watershed will be met.

It is hoped that this report will serve as a basis from which the Authority will develop a long-range program for water conservation. In line with this premise, the report may be considered as semi-technical. In general, the engineering carried out for this report was of a reconnaissance nature.

During the course of the surveys, bench marks were established along all main streams and several major tributaries. These bench marks, as well as those established by the Geodetic Survey of Canada and by the Department of Highways, give elevation above mean sea level at some semi-permanent locations. These data are on file with the Conservation Authorities Branch and are available upon request. Those who are concerned with any works on and over streams are urged to tie in their reference point with the known elevation given by the bench marks. By so doing, comparison can be made of key elevations in any improvement works, such as outlets of tile drains. This will help in evaluating the possible effect of these works on the river régime.

CHAPTER I

FISH AND FISH HABITAT

With regard to fish, the only rivers of any significance in the area that has been added to the Raisin River Conservation Authority are the Rivière au Beaudet and the Rivière Delisle, both of which cross the provincial border into Quebec.

Apart from the fish in Loch Garry, which are discussed separately, the only legal sport fish species likely to be available is the northern pike.

A review of published and unpublished manuscripts, in addition to a search of the collection records of the Royal Ontario Museum, has yielded the following information about the fish fauna of these two rivers.

TABLE 12. NUMBER OF FISH SPECIES IN EACH RIVER

	Number of Fish Species Known to Occur	Additional Number That Might Occur
Rivière au Beaudet	14	9
Rivière Delisle	20	5

On the basis of this information, the Rivière Delisle contains more species than the Rivière au Beaudet. Explanations of this fact cannot be determined from the current data. A list of the forms existing in each river is appended to this report (Table 13).

There are additional species, listed below, that might occur in each river. Some species, such as Anguilla rostrata, Esox Lucius, Semotilus corporalis, and the Moxostoma spp., inhabit Lake St. Francis and might, therefore, be expected to ascend these two rivers. Additional species which are known to inhabit the Rivière Delisle possibly occur in the Rivière au Beaudet although, as yet, no records exist.

Most of the species occurring in these rivers are commonly known as "minnows", although many of them do not belong to the official minnow family (Cyprinidae).

The brown bullhead (or catfish) is probably the most useful fish in the Rivière Delisle, and it is the most probable additional species in the Rivière au Beaudet. The majority of bullheads weigh less than a pound, but they provide a valuable recreation for both old and young people. No elaborate equipment and no great skill are needed to catch them. They are excellent pan fish. When taken from cool clear water in spring and fall, the flesh is firm and tasty.

There is no evidence that the brown bullhead is over-exploited in Ontario, and no special fishery regulations have been imposed to protect them.

TABLE 13. Fish Species Inhabiting the Beaudet and Delisle Rivers, Glengarry Co., Ontario
(An Asterisk Indicates That Specimens Are Available in The Royal Ontario Museum Collections.)

Species	Beaudet	Delisle
Family Umbridae		
central mudminnow Umbra limi	x	
Family Cyprinidae		
northern redbelly dace Chrosomus eos	x	x*
finescale dace Chrosomus neogaeus		x*
cutlips Exoglossum maxillingua		x*
brassy minnow Hybognathus hankinsoni	x	x*
common shiner Notropis cornutus	x	x*
blacknose shiner Notropis heterolepis	x	
rosyface shiner Notropis rubellus		x
mimic shiner Notropis volucellus		x
bluntnose minnow Pimephales notatus	x*	x*
fathead minnow Pimephales promelas	x*	x
creek chub Semotilus atromaculatus	x	x
pearl dace Semotilus margarita	x*	x*
Family Catostomidae		
white sucker Catostomus commersoni	x*	x
Moxostoma rubreques		x*
Family Ictaluridae		
brown bullhead Ictalurus nebulosus		x
stonecat Noturus flavus		x*
Family Cyprinodontidae		
banded killifish Fundulus diaphanus		x
Family Gasterosteidae		
brook stickleback Eucalia inconstans	x*	x

(Table 13 continued on page 51)

TABLE 13, continued

Species	Beaudet	Delisle
Family Centrarchidae		
pumpkinseed Lepomis gibbosus	x	x
rock bass Ambloplites rupestris	x	x
Family Percidae		
Johnny darter Etheostoma nigrum	x*	
logperch Percina caprodes		x*
TOTAL	14	20

TABLE 14. ADDITIONAL SPECIES LIKELY TO OCCUR

Rivière au Beaudet:	
northern pike	Esox lucius
fallfish	Semotilus corporalis
silver redhorse	Moxostoma anisurum
northern redhorse	Moxostoma macrolepidotum
brown bullhead	Ictalurus nebulosus
stonecat	Noturus flavus
American eel	Anguilla rostrata
banded killifish	Fundulus diaphanus
Rivière Delisle	
northern pike	Esox lucius
fallfish	Semotilus corporalis
silver redhorse	Moxostoma anisurum
northern redhorse	Moxostoma macrolepidotum
American eel	Anguilla rostrata

1. Loch Garry

Loch Garry covers an area of 846 acres and has a shoreline of seven miles. Fish species in the lake include largemouth bass, northern pike and bullheads. Largemouth bass and smallmouth bass are reported to have been introduced into the lake. At least one winterkill has occurred and this may have reduced the smallmouth bass population. For this reason no recommendations are made concerning the fish in the lake.

2. Hoople Creek

The fish of Hoople Creek, at the western end of the Raisin River Conservation Authority area, do not appear to be important. The bay of Hoople Creek, north of Highway 401, is heavily infested with carp.

3. Muskellunge

Muskellunge have been observed in Lake St. Francis, but it appears extremely unlikely that this species would ascend either the Rivière au Beaudet or the Rivière Delisle as far as the Ontario border. However 1,500 muskellunge fry were introduced into the Rivière Delisle by the Department of Lands and Forests in Lochiel Township in 1968. It is recommended that the success of this planting of muskellunge be checked out immediately.

CHAPTER II

GAME

There is little game of significance in this part of Ontario.

1. Deer

Deer are present in small numbers. They use the small woodlands and partly-open farm lands for summer range. In winter they tend to yard up, some going north to the Crown Game Preserve around Garry Lake and the wooded marsh east of it. A second group of about 25 deer are found in the area of woodlands close to Lake St. Francis and centred on Pte. Mouillée.

There is a second preserve known as the Lancaster Crown Game Preserve. This area is now in private ownership. It is in Lancaster Township and is close to an area of poplar, white cedar, dogwood, willow and silver maple. Incidentally, the best method of providing deer habitat is to cut down maples whose branchlets are too tall for deer to reach. This produces sprout growth, which provides excellent winter food.

2. Ruffed Grouse

Ruffed Grouse occur in a few of the denser woodlots. They are not common to the area. In this kind of sparse habitat their numbers do not fluctuate as widely as they do in the northern forests.

3. Hungarian Partridge

Only two Hungarian Partridges were noted during several weeks spent by the survey party in this area. This small count may have been the result of the survey taking place during the breeding season, and the survey party concentrating on streams and wetlands. No systematic search was made of the proper habitat. Previous surveys have indicated that the centre of the eastern Ontario "Hun" population is about 50 miles west of the area examined in 1968. C. H. D. Clarke[1] wrote about these birds and their habitat in this area:

> "The greatest numbers are on clay plain. The agricultural regime is dairy farming with small fields. The pasture part of the rotation is long but, because of the long winter, there has to be a substantial acreage of feed grains. Wheat, oats, barley, rye, buckwheat, corn and some millet are grown, and a mixture of oats and barley is popular. Wheat is first to be harvested, and wheat stubble grows up to a luxuriant crop of clover from underplanting; but all stubbles have legumes and there are many fields of alfalfa and clover planted without an advance crop of cereals."

[1] In a letter to "The Field", an English journal, 1967.

The birds are found in stubble during the autumn, and it is a waste of time to look for them in oats, though the barley-oat mixture is good. Obviously they prefer barley, which is readily had in mixture, rye, buckwheat and corn. Millet is wonderful, but there is little of it. Corn, mixed with sorghum, is also fine.

All these crops are important. Hay, pasture, and field borders supply nesting sites. Hay crops, fortunately, are cut late enough for hatching to be mostly completed. Legumes are important in winter as a source of vitamin A and protein. Though it is best to have grain available, the birds can survive with leaves of legumes and a spice of weed seeds. In deep snow they are capable of burrowing down to food through any depth. Freezing rain, forming a thick glaze of ice, is a hazard and can force the birds, at some risk, to farm manure piles, which they frequent anyway.

In this area the roads must be passable at all seasons for the school bus and the milk pick-up; so that, in an emergency, the birds can be fed if the snow plough operator ploughs to the green on the road margin. We have examined many birds killed or captured in different ways in winter and they were in good condition except where they had been exposed to prolonged blizzards combined with very cold weather.

Our birds have passed through several low periods, fitting the unexplained pattern of cycles. Crashes come suddenly: turnovers are high. Few birds live to two years of age. If the young of any year should fail then the left-over birds will give a ragged shoot. In 1966 we had the best year since 1950.

The genetical potential of any animal is enormous, but adaptation to a new environment does not follow automatically. Our partridges that have adapted seem to be something special, and all releases of any other stock are prohibited, since there is no conceivable good resulting from such releases and other stocks might prove fatal to the established birds. We have caught some birds and set them out in other areas, and hope in time to have the whole of southern Ontario populated. Whether this will help, whether final success must await the natural spread of the wild birds, or whether they are capable of thriving only where they are, can only be guessed.

Changes in agricultural practices have taken place, notably: mechanization, use of many chemicals and introduction of hybrid corn, but the story so far is good. We keep our fingers crossed.

4. European Hare (Jackrabbit)

This species is very uncommon east of Brockville although there have been records of its appearing in this area. Jackrabbit hunting, therefore, is not carried out to any marked degree in the Raisin River region.

5. Cottontail

The cottontail is fairly common wherever there is suitable brushy cover adjacent to farm fields. This must be considered as the main game species in the area, apart from waterfowl along the St. Lawrence shore. Any landowner who wishes to increase the habitat for cottontails can do so by leaving two or three brush piles per acre in woodlots.

CHAPTER III

IMPOUNDMENTS

The watercourses of the additions to the Raisin River Authority were examined carefully in May and early June 1968. The purpose of this examination was to locate areas for impoundments that could be used for wildfowl. These impoundments had to be adjusted to coincide with, or complement, the work of the Water section, which was directed to improving the summer flow of the rivers.

No suitable site was found on Hoople Creek in the western addition to the Authority.

Three possible sites were found in the eastern addition. These are described below.

1. Main Beaudet

The main course of the Rivière au Beaudet was examined in May and June, 1968. There was a scarcity of waterfowl habitat and a definite lack of aquatic vegetation at that time. The only sector with a potential for wildfowl was the area of scrub willow along the riverside southeast of Avondale and west of Glenroy. This area is marked in symbols of marshy vegetation on the topographic sheet. The river here is almost flat and could be easily flooded by a low dam. No ideal duck foods, such as Elodea (Duckweed), Potamogeton pectinatus (Sago Pondweed) or Zizania (Wild Rice) were in the river at the time of examination.

Apart from this project, which should be considered for the future, the main Beaudet shows no potential for improvement for wildfowl.

2. Impoundment on Tributary B of the Rivière au Beaudet

A reservoir has been proposed to improve summer flow in tributary B of the Rivière au Beaudet. The details of the dam structure and the boundaries of the area to be flooded will be found in the Water section of this report. This area includes parts of Lots 29 to 39, Concession VII, and Lancaster Township, east of Green Valley. A much larger area than that proposed would be flooded on the Rivière Delisle. The proposed surface area at the maximum stage would be between 400 and 500 acres.

There is an element of chance in the effect on wildfowl of any impoundment. The main factors are:

a. The extent of treatment of vegetation before an impoundment is flooded;

b. The variation in dates of the fluctuations of water level in the impoundment;

c. the soil reactions under water in the flooded area in the growing season;

d. the wind effects in distributing seeds and new vegetation; and

e. the effect of artificial aids to the impoundment, such as: blasting in the willow scrub, Wood Duck nesting boxes and the supply of new waterfowl foods and cover.

The objectives of wildlife impoundments have to be adapted to the primary requirements of the increase in summer flow. For wildlife improvements it would be an advantage to have the water level high in the spring and considerably lower in summer so that crops which are attractive to wildfowl can be sown. However, the water level should be raised rapidly in the fall before migration begins. Suitable brood habitat, in general terms (for Wood Ducks particularly), seems to consist of a patchy pattern of emergent cover interlaced with a network of open water passageways *. Each impoundment should have at least one refuge area, to prolong the hunting season in the remainder of the impoundment. The co-operation of the hunters would be required. Where public hunting takes place this co-operation is seldom found. Many hunters do not observe hunting regulations, and a few hunters, disregarding the regulations concerning refuge areas, might spoil the refuge system. A firm stand should be taken to see that the regulations are enforced. Any impoundment's bottom contours at intervals, particularly in the upper sections, would have to be known. For the proposed impoundments these were unknown at the time this report was written.

For the impoundment on tributary B of the Beaudet, the present objective, to improve summer flow, is a top water level of 350 feet G.S.C. It has been proposed that the water be drawn down 5 feet, to 345 feet G.S.C. This will increase the summer flow by 3 cubic feet per second, and will still leave a considerable area of water surface in the summer.

In the Valens impoundment in the Hamilton Region Conservation Authority's area, prime duck foods have been sown or planted, and have already proven to be a great attraction to wildfowl. Sago Pondweed and Duckweed are recommended as the best wildfowl foods. They should rapidly develop a good population of invertebrate life, chiefly on the undersides of the leaves. In wet, unshaded soils which will be out of water or in the shallows in summer, but flooded in the fall, plants which will provide abundant seed such as selected species of Knotweed (Polygonum coccineum and Polygonum natans) should be introduced. They may already be present in the stream course and can be transplanted to higher elevations.

Of the 2,000 acres which surround and include the reservoir, much of which will have to be acquired, it was found that the following percentages of cover existed:

* Webster, C. G. and F. B. McGilivrey. Providing Brood Habitat for Wood Ducks. Wood Duck Management and Research, Wildlife Management Institute, Washington, 1966.

%	Cover
31	Scrubland (with a small amount of woodland)
27	Natural meadow
16	Wooded pasture (formerly overgrazed woodland)
12	Improved pasture
7	Unimproved pasture
7	Spring grains
100	

The majority of the land which will actually be flooded is now in wet scrub (willow and dogwood), or in wet sedges (Scirpus and Carex), and lightly wooded pasture. It should be possible, when the area to be flooded has been delineated on the ground, to select areas which can be seeded with Buckwheat along the edge of the impoundment, immediately after the water level has been lowered to the summer holding level. These areas will be either in or close to the water in the fall, and would be heavily used by wildfowl. For wildlife purposes the low flow valve should be closed in the fall so that the water will be high during the hunting season.

Mallards and Black Ducks will not hestitate to walk ashore to feed. The same applies to Canada Geese. Geese were seen flying across the watershed several times during the summer and three were seen in the Hoople Creek bay, north of Highway 401, in May 1968.

If plans are made for the introduction of Canada Geese to the reservoirs, the Giant Canada Goose should be selected. In addition to selection of the right stock for release, the next most important thing is the introduction procedure. On the basis of the experience of the research group at the Delta Waterfowl Station in Manitoba (in co-operation with Ducks Unlimited), the most promising method is to move young goslings to a farm at the release site, hold them there, fenced for one or two years, and then allow them to fly out and select their own nesting sites. By this time, the geese will have strong ties to the area in which they have been raised and, once they themselves have raised broods, they will migrate, yet are likely to home to the original nesting area.

Islands should be left in the area of the reservoirs, as Canada Geese prefer them for breeding purposes.

3. Proposed Impoundment on the Rivière Delisle

There is an impoundment proposed on the Rivière Delisle. Its major purposes would be to increase summer flow and to dilute the present pollution at Alexandria. The details of the structure and the area to be flooded (about 260 acres) are discussed in the Water section of the report.

This is a very long, narrow reservoir, averaging only about 1,000 feet in width. When it was examined by biologists in 1968 it was found that the upper section had been dredged. The lots are narrow and it is obvious that a much greater area than the reservoir itself would have to be acquired to ensure that the purchases would conform with lot boundaries. The proposed impoundment includes parts of Lots 13-24, Concession IV, in Kenyon Township.

The area to be flooded now includes some very poor pasture, several sections covered with elm and silver maple, a considerable area of wet willow scrub, a small woodlot of white cedar and some lightly wooded poor pasture (which is in reality the end product of a grazed woodlot). There is also a small cutover area.

At the time of the examination (May 1968), many species of aquatic vegetation which might be present were not in evidence. Only Nuphar, the yellow water lily, could be identified at that time. The area should be re-examined in the middle of summer, when any aquatic vegetation can be recognized. The lowest point on the river was listed by the biology crew as, "probably good for ducks". However, this section is likely to be deep water if the reservoir is created and filled. It is probable that some of the aquatic plants will migrate through floating or seed disperson to the edges of the flooded area. Those large trees that will be drowned should be left in place where they may provide nesting holes for Wood Ducks. Much of the edge will be in willow scrub, providing excellent cover for waterfowl. In the first few years of the impoundment the water should be very fertile; after this time the impoundment will be relatively sterile. The level of the water should then be let down as far as possible so that sunlight and heat will act on the substrate, releasing new fertile compounds, for the production of aquatic vegetation and invertebrates.

The general principles of managing this impoundment, both to improve summer flow and to increase the wildfowl population, follow those already listed for the reservoir for summer flow on the tributary of the Beaudet.

It is recommended that the Authority select a small part of any land to be acquired for reservoirs and post it against hunting, so that there will always be a waterfowl refuge in any reservoir. The remainder of the reservoir should be open for hunting in season.

4. Long-range Plans

The Department of Lands and Forests already owns 245 acres of land in Lancaster Township, and haslong-range plans for management of the waterfront of the St. Lawrence River as far as the eastern boundary of the area where the St. Lawrence Parks Commission operates. The Conservation Authority should support these plans by every means in its power.

5. Garry River

A considerable area of open water was found in the widened section of the Garry River below Loch Garry and above the Alexandria water supply dam. This area lies within the Loch Garry Crown Game Preserve.

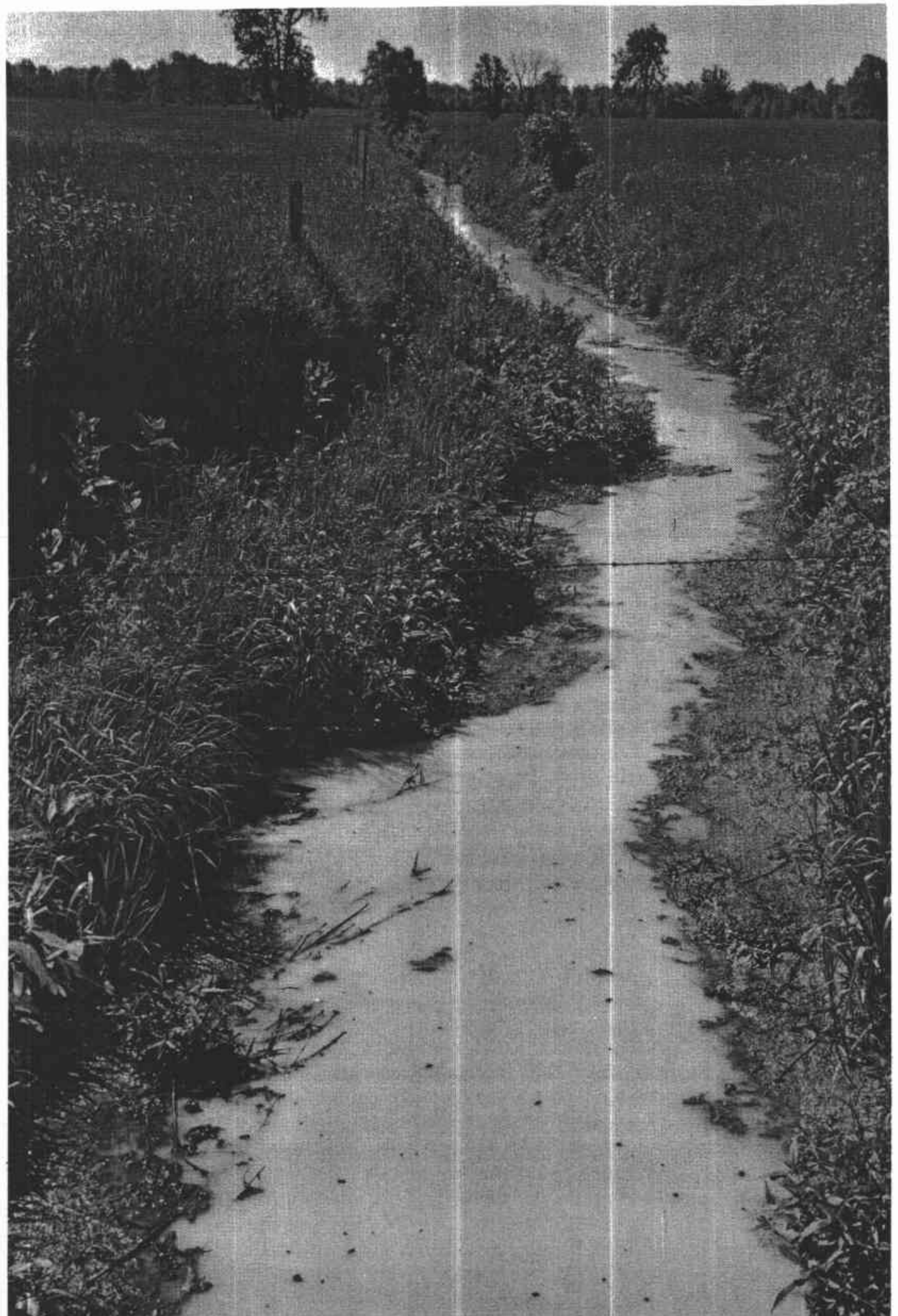
There is also a small, isolated lake, which serves as an escape area when the birds are disturbed on the river. The totals of wildfowl seen in this section of the Garry River in May 1968, included the following:

Blue-winged Teal	4
Green-winged Teal	1
Ringnecked Duck	26
Black Duck	2
Mallard	2

The area appears very suitable for wildfowl but could probably be improved by the planting of Wild Rice (Zizania aquatica), Wild Celery (Vallisneria), and Sago Pondweed (Potamogeton pectinatus).

It would also be advantageous to move some Lemna (Duckweed) into the area from other areas where it now occurs. Blasting of some of the Cattail stands on both sides of the river would also improve the wildfowl habitat. This can be done very cheaply with an ammonium nitrate-fuel oil mixture.

A sketch of the area is available to the Conservation Authority.



The Polluted Tributary A of the Rivière au Beaudet Flowing into Ontario from Quebec.

CHAPTER IV

POLLUTION

1. Loch Garry Area

The condition of the water of Loch Garry was examined on June 7, 1968. At this time the water near the shore, alongside the seventh cottage to the east (of those cottages fronting on the lake on its northwest shore), showed a coliform count of 110,000 per ml. In September, 1968, the area was again sampled and the coliform count was at that time negligible. The count of 110,000 per ml. compares poorly with the Ontario Water Resources Commission's objective of a maximum count of 2,400 for waters used for swimming. Other points were satisfactory to the Department of Health.

The lot sizes of 15 of the cottages are as follows:

2 lots - 12,800 sq. feet

5 lots - 12,000 sq. feet

8 lots - 8,400 sq. feet

Two of the recommendations of the Health Officer in his report on this area were:

a. It is believed that the minimum lot sizes should be 15,000 square feet where sewage and water facilities are to be provided on the lot. Depending upon the location of the cottage, this area could be significantly larger since a sewage system may not be located nearer than 50 feet to the lake.

b. The Township of Kenyon has no subdivision control in this area. Such control would be beneficial in ensuring adequate protection for the lake from contamination.

2. Other Areas

The Garry River was sampled for pollution at the Bishop Street bridge, in Alexandria, on August 30, 1968. At this point the coliform count, measured by the Division of Laboratories of the Ontario Water Resources Commission, was 19,000 per ml. (Lab. No. 221480). This area should be sampled again, the source of the pollution located, and the situation corrected.

The effluent of the Alexandria sewage lagoons was grey-brown and very foamy, when it was examined in June, 1968. The volume of flow was approximately equal to the flow of the Delisle River.

There appears to be no separation of storm drains and sewers in Alexandria and, at a time of heavy rain, the sewers are overloaded and raw sewage empties directly into the Garry River rather than into the lagoons.

However, even on a dry day the situation is not satisfactory. A sample from the Delisle River, below the effluent of the lagoons, taken on August 30, 1968, showed a count of 61,000 coliforms per ml., while one taken above the effluent on the same day, on the same river, had a coliform count of 12,000. This is not a situation that can be easily remedied. Indeed, the major purpose of the lagoons is to greatly reduce the Biochemical Oxygen Demand of the sewage and without chlorination there may not be a reduction in the coliform count to the Ontario Water Resources Commission's objective of 2,400 coliforms per ml.

There is another important occurrence of pollution in the area that has been added to the Authority. This is the very great pollution of tributary A of the Rivière au Beaudet, in Ontario, which is believed to originate at the cheese and butter factory at Dalhousie Station, Quebec. Extensive quantities of whey and, it is believed, sewage, pass westwards across the provincial boundary and enter the Riviere au Beaudet about one mile west of the border. This matter has already been the subject of correspondence between the Ontario Water Resources Commission and the Director General of the Quebec Water Board. The Quebec Water Board has asked the local municipality and that particular dairy industry to submit plans for collection and treatment of the wastes. On May 28th, 1968, the tributary of the Rivière au Beaudet was sampled; following are the results.

TABLE 15. POLLUTION TEST – RIVIÈRE AU BEAUDET

5-Day B.O.D.	Solids Total	Solids Suspension	Solids Dissolved	Chemical Oxygen Demand
170	562	68	496	332

These figures represent a very high degree of pollution. When this report was written no further developments had taken place concerning this problem.

It is recommended that the Authority co-operate with the Ontario Water Resources Commission in taking regular samples of the water in the heavily polluted tributary of the Rivière au Beaudet, so that appropriate action can be continued by the Commission.

Severe pollution (from whey), of a roadside ditch and waterway in Lot 23, Concession VI, Lancaster Township was observed in May 1968. The factory involved in the pollution was not located, but the pollution obviously came from a local cheese factory.

The North Lancaster Cheese Factory had an effluent which entered tributary A of Sutherland Creek.

The Conservation Authority should examine the cases cited, and pass any additional information on to the Ontario Water Resources Commission for action.

3. Cattle Pollution

Where cattle erode a stream bank they commonly pollute the stream as well. This condition was noted in the following places.

Charlottenburgh Township

Concession VI	Lots D to F and L
Concession IV	Lot L

Lancaster Township

Concession III	Lots 38, 17, 12, 11, 10, 21 (manure pile on bank)
Concession I	Lots 27, 26 and 9
Concession VII	Lots 37, 35, 34, 33, 31, 23, 20, 17
Concession II	Lots 35, 16, 14, 13, 12, 11, 10, 9, 25 (severe)
Concession V	Lots 9, 10, 11, 32 (severe pollution)

Kenyon Township

Concession VIII	Lots 2 and 3

There are doubtless many other places where cattle pollute the streams. This is a problem that is common all over the agricultural parts of Ontario and there is no simple solution. Where land owners wish to avoid silting or fowling a stream course, the only alternatives are to fence the stream bank or plant it with suitable species, such as *Salix fragilis*, and give the cattle an alternative water supply.