RIDEAU VALLEY
CONSERVATION AUTHORITY
BAXTER CONSERVATION AREA
KARS, ONTARIO

REPORT

JOCK RIVER CONSERVATION STUDY

Prepared for the

RIDEAU VALLEY CONSERVATION AUTHORITY

By

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SECTION NO. 1

INTRODUCTION AND TERMS OF REFERENCE

1.1 General

The Jock River, which is the largest tributary of the Rideau River, flows into the Rideau six miles above Ottawa. The drainage area of the Jock River, totalling 221 square miles, is contained in parts of eight municipalities:- the Townships of Nepean, Goulbourn, Marlborough, Beckwith, Montague, Huntley, and North Gower, and the Villages of Richmond and Stittsville.

The river is characterized by high spring flood flows and extremely low summer flows. The Rideau Valley Conservation Authority's interest in the Jock River is centred around the provision of weirs and storage facilities with a view to providing the following benefits:

(a) to increase summer flows and provide improved conditions for fish and wildlife;

(b) to ensure adequate water for stock watering;

(c) to provide community ponds for fire protection and community beautification;

(d) to improve the year-round appearance of the river and lessen the likelihood of future pollution problems resulting from expanding population in the watershed;

(e) to encourage recreational use of the area, including the possible provision of regional park of nature areas;

(f) to reduce spring flood peak flows to the Rideau and thereby lessen flooding problems in downstream municipalities -- principally Ottawa and Eastview.

The inspection report on the Rideau Valley Conservation area, prepared by the Conservation Authorities Branch of the Department of Energy and Resources Management in 1967, recommended that consideration be given to the provision of low removable weirs on the Jock River. The weirs, it was recommended, would be installed after the spring run-off and removed in the fall.

1.2 Terms of Reference

The terms of reference for the present study, as set out in the instructions from the Conservation Authority, require the preparation of a preliminary engineering report on

> "The construction of removable weirs on the Jock River to impound water to serve as community ponds and to improve the appearance of the river."

A copy was also furnished of a letter from the Ottawa Board of Control to Mr. Howard Henry, Chairman of the Rideau Valley Conservation Authority, which suggested certain objectives for consideration by the Authority. An extract from this letter is quoted in Appendix "B".

SECTION NO. 2

SURVEYS AND METHOD OF ATTACK

2.1 Surveys

The carrying out of field surveys and measurements has constituted the major part of the work involved in the present study. About 25% of the drainage area is covered by government topographic sheets at 1:25,000 scale and 10-foot contour intervals, while the remainder of the area is covered only by 1:50,000 sheets with 25-foot contour intervals. Due to the marked absence of appreciable relief in the study area and the presence of extensive marshes in the upper part of the drainage area it is evident that 10-foot or 25-foot contour intervals are of virtually no value in delineating storage areas.

In critical areas such as the Ashton Marsh or Richmond Swamp levels are needed to the nearest tenth of a foot to satisfactorily establish flooding limits. The costs of a survey by aerial methods to this accuracy would represent many times the amount of money available for the total study. Ground survey methods were used, with hundreds of miles of level circuits run. The surveying in the marshes was of the most difficult type. Summer surveying was impossible in the swamp areas so that a great deal of the surveying had to be carried out in the winter when ice support was available. Snowmobiles were used but progress was often painfully slow due to the frequent necessity to cut sight lines through the dense growths of alders which covered much of the area.

Levels were obtained to give, insofar as possible, an indication of approximate flooding limits. It is important to recognize, however, that a close delineation of flooding limits would be impossible in these marshes even if surveys costing several times the authorized amount were carried out.

The Conservation Authorities Branch had run level controls along the roads paralleling the river during the Rideau area study of 1966-67 and had established bench marks on many of the bridges crossing the Jock River. These level controls were extremely useful in the present study. Our surveys were tied into these bench marks at many locations.

2.2 Stream Flow Measurements

Hydrological information on the Jock River appears to be non-existent. No government gauging stations are maintained on the river, although gauging stations exist at many other locations on streams and drainage areas comparable to the Jock. The availability of daily flow records is an invaluable aid to planning flood control or conservation structures. It is suggested that it would be very worthwhile for the Rideau Valley Conservation Authority to make representations to the Department of Energy, Mines and Resources in favour of establishing one or more gauging stations on the Jock River.

Water levels and flow measurements were taken on several occasions at a number of locations along the river during the present study. In addition levels of ice damage markings on trees provided valuable information. Although the study was not authorized until the summer of 1967, river levels and flows during the spring run-off of 1967 were observed in anticipation of the work being authorized at a later date. Similar information was recorded during the summer

of 1967, during the heavy fall rains of October 1967 and during the run-off this spring. In addition the river was reconnoitered by air during this spring's peak flow and a series of oblique aerial photographs was taken by a professional photographer to record conditions along the river from the mouth to above the Ashton swamp.

2.3 Liaison With the Flood Control and Water Conservation Advisory Board

During the study period our representatives attended several of the meetings of the Flood Control and Water Conservation Advisory Board of the Rideau Valley Conservation Authority to present progress reports. At these meetings the work completed was described and the proposed work reviewed. The committee frequently suggested the direction which subsequent work would desirably follow. The committee was particularly interested in developing potential storage areas for summer flow regulation and flood control (and in the possibilities of the Richmond Swamp and Ashton Marsh for these purposes.)

The Chairman of the Board, Mr. Ayers, participated in an aerial inspection of the Jock River basin during the spring run-off on March 30, 1968.

2.4 Liaison With Conservation Authorities Branch

The assistance and advice of officials of the Conservation Authorities Branch of the Department of Energy and Resources Management has been invaluable. In July 1967 a meeting was held in Smiths Falls with Mr. John Ding, Project Engineer of the Hydraulics

Section, Mr. Peter Harvey, Head, Forestry and Land Use Section, Mr. Ken Mayall, Head, Wildlife and Biology Section, and Alex Ansell, Field Officer of the Rideau Valley Conservation Authority. The results of the Branch's own investigation in the Jock River area were discussed and the scope of our study was reviewed. Mr. Harvey's staff was to undertake to investigate and report on land use in the Ashton Marsh area and would also traverse the marsh in a number of locations to obtain a description of forest cover, water depths, etc. It was agreed that we would simply refer in our report to the fact that this study was being carried out and that the Conservation Authorities Branch report in this regard should be read in conjunction with this one.

A further meeting was held with the same officials in Toronto on April 25th, when a more detailed discussion on the study took place.

SECTION NO. 3

HYDROLOGICAL ASPECTS

As has been noted previously, no flow gauging station exists on the Jock River, so that no data on average or peak flows are available. However, during the course of the present study several series of flow measurements and river elevations have been obtained at points along the length of the river.

At about the peak of the spring run-off in 1967 (on April 2nd) a flow of 3800 cubic feet per second was measured at the Highway 16 bridge where the Jock River flows into the Rideau River. (A study of Rideau flows during this period shows that the total flow in the Rideau at Ottawa on this date was 10,100 c.f.s., indicating that the Jock contributed about 37.5% of the Rideau flow on the day concerned.) This would appear to support the view that if peak flood flows in the Jock could be reduced there would be significant improvement in the flooding problems in Ottawa and Eastview. The peak flood flow in the Rideau in 1967 was 11,000 cfs, which occurred on April 3rd. The peak 1968 flow occurred on March 30, with a rate of 13,200 cfs.

The spring run-off measured on March 30 of this year in the Jock River was comparable to that of 1967, with a flow of about 3700 cfs being recorded at the mouth of the river. It is of interest to note that the peak flood in the Jock occurred within one day of the peak flood in the Rideau River at Ottawa in both 1967 and 1968.

An estimate may be made of probable peak flood flows by study of data available on flows of comparable streams in the Eastern Ontario area. An approximate approach may be based upon the empirical relationship which relates flow to a constant times the square of the area of the tributary drainage area. The table below gives peak recorded flows for a number of rivers and relates their flows to the drainage area and the square of the drainage area as well as the coefficient C derived from the formula

$$Q = C\sqrt{M}$$

where Q is the peak recorded flow in cfs, and
M is the drainage area in square miles

TABLE 1

RIVER DRAINAGE AREAS AND PEAK FLOWS

River	Gauging Point	Max. Recorded Flow Q, cfs	Period of Record (yr)?	Drainage Area M, in sq. mi.	$\sqrt{M}$	Coefft. C
South Nation	Spencerville	2,960	20	95	9.75	304
Castor	Russell	6,520	20	167	12.9	504
Raisin	Williamstown	4,640	8	154	12.6	370
York	Bancroft	5,120	53	323	18	285
Bonnechere	Castleford	10,200	47	918	30.3	336
Black	Waltham	8,420	13	1,030	32	263
Mississippi	Appleton	9,190	50	1,120	33.4	275
Rideau	Ottawa	19,000	23	1,490	38.6	492
Petawawa	Petawawa	14,000	52	1,590	39.8	352
Coulonge	Coulonge Chute	20,600	42	2,000	44.7	462

By comparing characteristics of the watershed of the Jock River with those of rivers included in Table 1, it is concluded that the coefficient C for the Jock would probably be in the range of 400 to 500, which would indicate a peak flood flow of 6000 to 7500 cubic feet per second for the 221 square mile watershed of the Jock. Average annual flows for adjacent rivers are in the order of 0.8 to 1.2 cfs per square mile. The estimated average flow for the Jock River is 200 cfs.

In summer the flow in the Jock frequently is reduced to virtually nil. Some farmers report local small flows in the river due to springs while upstream areas are dry. The flow responds to heavy or prolonged rains. For example, in October of 1967 there were unusually heavy and sustained rains which caused the river flow to increase to a minor flood stage. On October 23rd, 1967 the flow reached about 600 cfs at the river's mouth and water levels rose by amounts varying from 1.2 to 2.3 feet at the various gauging points along the river's length.

SECTION NO. 4

DESCRIPTION OF RIVER AND WATERSHED

4.1 General

The total length of the Jock River, from its entrance into the Rideau River to its origin in a swamp south of Franktown, is 43 miles. The watershed extends to within three miles of Mississippi Lake. (It is of interest to conjecture upon the feasibility of a summer diversion from Mississippi Lake to the headwaters of the Jock).

The river falls a total of approximately 200 feet from its source to the point of entry to the Rideau River. There are several tributary streams, none of which is large. The only tributary streams which are sufficiently significant to justify names on topographic maps are Nichols Creek and Kings Creek. Nichols Creek enters the Jock River at the swamp above Richmond at Mileage 17 (measured from the mouth of the Jock). It has a length of about nine miles and a drainage area of 20 square miles. Kings Creek, which enters the river at Mileage 19.5, has a length of 10 miles and a drainage area of 25 square miles.

The Jock River watershed consists of two essentially different main parts, with the dividing line running generally through the Village of Richmond. Below Richmond is some of the best farming land in eastern Ontario, almost totally cleared, and comprised of typically flat clay plains. Upstream of Richmond, on the other hand, there are large areas of swamp and bush. Less than 25 per cent of the upper part is cleared and many of the farms have light sandy or stoney soil.

4.2 Description of Principal Features of River

In the paragraphs below a description of the principal features which are encountered in journeying up the river from its mouth is given. This will provide the reader with an understanding of the nature of the river and will permit a better appreciation of the locations and problems associated with the structures to be considered later in the report. Location references are based on mileage distances measured from the mouth, as indicated on Figure 1.

(a) Mileage 0 - 2.5 (Heart's Desire - Jockvale)

On the west side of the river within a mile of the mouth is the area known as Heart's Desire, which contains about 50 medium to high price houses built mainly in the past 10 years. On the east side of the river is a large cemetery (Capital Memorial Gardens). The riverbed rises rapidly in this area, as is shown on the plan and profile at Figure 2. In a distance of 2½ miles the river rises 38 feet. The river bottom consists of large boulders here, with bedrock not far below.

A bridge crosses the river at Mileage 1.6 and another bridge is found at Mileage 2.2, at the Greenbank Road. Above this bridge, at Mileage 2.4 is the end of this section of rapid rise. The water elevation at this point was at El. 292.9 in late May of this year.

There is very little land in this 2½ mile stretch flooded during peak spring flows, as the banks are generally high and fairly steep.

(b) Mileage 2.5 to 5.5 (Fallowfield Stretch, Greenbank Road to Moodie Drive)

From the head of the rapids section at Mileage 2.4 the river maintains a uniform level for 2.8 miles until another rapid section is reached at Mileage 5.2, just downstream of the Moodie Drive bridge at Mileage 5.3. This section of rapids has a drop, under normal low flow conditions, of 1.2 feet.

The rapids are adjacent to the farmhouse of Michael Casey, whose land extends across to the south side of the river from the main part of his farm which is on the north.

This stretch of the river is tree-lined and attractive. The only spring flooding noted in this reach of the river was along a small strip of the south bank between Mileage 2.5 and 2.9 and for 3/4 mile back along a creek entering from the north at Mileage 2.5.

In the ridge which extends south of the river at Moodie Drive are some very large gravel and sand pits. Large boulders are evident at the rapids section below Moodie Drive and drilling logs of adjacent wells indicate that bedrock will be found close below the stream bed here.

(c) Mileage 5.5 to 10.5 (Twin Elm Stretch, Moodie Drive to Richmond)

There is no appreciable slope on the water surface in this stretch of the river during summer flow conditions. Its elevation in late May was 294.0. The water depths vary from 18 inches to over 8 feet along this stretch. It can be journeyed by canoes or other small boats but it tends to become weed-clogged for much of its width as summer wears on.

Bridges exist at Twin Elm (Mileage 8.3) and at the Nepean-Goulbourn boundary (Mileage 10.1).

In addition there are half a dozen private bridges used by farmers to reach parts of their farms which extend across the river. These bridges consist generally of rock and timber cribs at the shore ends with log stringers and plank decks supported on timber piles for the central portion. A typical private bridge, shown on the photograph at Figure A-17, has a span of 53 feet between end piers, a height from plank deck to water level of 4'-3", and a clearance of 3 feet from log stringers to water level. Typical peak spring water levels are 8 to 9 feet higher than summer levels so that it is apparent water will be over 4 feet above the elevation of the bridge decks. The private crossings are all between Mileages 6 and 8.

Each spring there is a certain amount of flooding along the banks of this stretch of the river. The water regularly inundates low land on the east side of the river at Twin Elm, often reaching 500 to 600 feet from the riverbank and crossing the access road to two farm houses. Also, there is regular flooding of pasture land in the area just north of Richmond. In a normal spring a maximum of about 250 acres of land may be inundated in this part of the river.

(d) Mileage 10.5 to 13.0 (Village of Richmond)

The Jock River flows diagonally through the middle of the Village of Richmond. Richmond is by far the largest centre of population in the Jock River watershed. It has a

population of 1350, with a large number of new homes under construction. There seems little doubt that rapid population growth in the village may be expected due to its proximity to Ottawa and its attractive setting. The Jock River is one of Richmond's major assets.

The South Carleton District High School in Richmond has 1400 pupils. A small package treatment plant treats the sewage from the school before it is discharged into the river. There are no sanitary sewers in the village at present. However, the village is proceeding towards installing a sanitary sewer system as a provincial project under the administration of the Ontario Water Resources Commission. It is expected that the system will be installed in 1969. The wastes from the village and high school will be handled by a seasonal retention lagoon to be located east of the village. This type of treatment was selected to protect the Jock River during the low flow period. There will be no effluent discharged to the river during the summer recreational period. When the new system is installed the water quality in the Jock should be greatly improved.

The quiescent water of the Twin Elm stretch of the river extends ¼ mile into the village before encountering a section of rapids about 800 feet long. The fall in this section is 2.9 feet. Above these rapids the river pool extends another half mile through the village at an elevation (in late May) of about 297.0. From here to the upper (south) edge of the village the river rises in a series of rapids and pools a further 10 feet to about elevation 307.4. Bedrock is exposed in most of this upper stretch. A low concrete weir provides a pool used as a source of irrigation water by a commercial gardener at Mileage 12.0. In dry

summer periods the riverbed is completely dry in certain sections of the river in this area, as the small flow disappears and flows through channels in the rock below.

Spring flooding regularly occurs in the low area lying below the Chenier subdivision in the east part of the village, and along the south bank east of the bridge on McBean Street. Spring peak river levels are generally 6 to 7 feet higher than normal summer levels.

(e) Mileage 13.0 to 17.0 (Richmond Swamp)

Above Richmond is a large area of swamp. (A dam existed many years ago at the upper edge of Richmond which flooded a large area.) No one now alive in Richmond can remember the dam but some local residents say that it had been built in the 1820's or 30's to operate mills and that it went out in a flood over 100 years ago. Some say the dam was "30 feet high and flooded 3000 acres."

Examination along the river reveals the presence of dykes which show the location of the dam to have been at Mileage 12.8. Outcropping rock is evident in the riverbed and sides of the channel. The top of the dyke is at elevation 317.8, while the river bottom is at elevation 306, showing that the dam was probably about 11 feet high with a crest elevation of around 317 feet (Geodetic Elevation). This is the same elevation as the nearby top of tracks of the Canadian Pacific Railway line which now passes through the swamp in a direction parallel to the river.

A map of Goulbourn Township dated 1818 examined in the National Archives shows the dam location and indicates a lake covering all of the present swamp area in the southeastern part of the township. The Jock River at that time was known as the "Goodwood River."

From the old dam site the river rises in a series of rapids from El. 307.4 feet to El. 310.8 at Mileage 13.2. From this point the channel becomes deep and can be navigated by canoe or motorboat for 2 to 3 miles. The fishing (mainly pike) is excellent here. Beaver have built dams at many of the culverts crossing under the railway tracks east of the river. A beaver dam at the railway culvert at Mileage 13.5 has resulted in the water level east of the track being 2 feet higher than the river level west of the track.

(f) Mileage 17.0 - 31.7 (Dwyer Hill - Ashton)

In this section the river follows a meandering course through a mixed farming area. There is a steady rise of almost 100 feet between Mileage 17 and Ashton. The river is characteristically shallow in this section, with frequent rapids and stretches of exposed flat limestone rock in the bed. Cattle use the river for drinking. There are only minor areas of flooding in spring.

At Ashton (an unincorporated community at the south boundary of Goulbourn Township) a concrete dam was built in 1954 in the narrow rocky channel to form a pond. The dam is underneath the bridge crossing the river on the Goulbourn - Beckwith boundary. Although there had been some intimation from township officials that the dam was

not in good condition, an examination indicates it to be essentially sound. An interview with a local man who assists in looking after the dam revealed that there have been some problems with the sluice gates due to boys wedging timbers into the gates so that closing was difficult. However, it appears that the problem is mainly one associated with operation rather than any major structural defect.

The Ashton dam was established chiefly to provide a reservoir for fire fighting.

Upstream of Ashton the river passes through a region of farmland and small swamps before reaching the road between Concessions VIII and IX of Beckwith Township which is the commencement of the Ashton Marsh.

(g) Mileage 31.7 to 38.4 (Ashton Marsh)

Above the bridge along the concession road between Ashton and Black's Corners the Jock River winds through an extensive swamp area which has been designated the Ashton Marsh for the purpose of this report. The marsh extends through five concessions and ends within a mile of Franktown.

During the rainy period of late October 1967, the river level through the marsh was higher than normal, permitting the river to be traversed easily by canoe. This is a wilderness area which is virtually inaccessible in summer except by boat.

Half a dozen beaver dams were encountered along the route. The photos at Figures A-9 to A-11 give an indication of the appearance of the area. A lone Canada Goose which preceded

the canoe by 20 to 25 feet for over a mile of the trip can be seen in Figure A-9. Alders were abundant along with cedar, black spruce and willows.

The Ashton Marsh will be described further in a later section.

Above the Ashton Marsh the Jock can no longer be termed a river as it flows in the form of a small creek from a limited area of swamp southeast of Franktown.

SECTION NO. 5

POSSIBLE CONSTRUCTION PROJECTS

5.1 General

During the course of liaison with the Advisory Board throughout the period of study there was a shift in the required direction of the investigation to put more emphasis on the search for large storage areas which could provide significant summer flow regulation and flood control rather than on the investigation only of sites for removable weirs for community ponds. The Board recognized that small ponds formed by removable summer weirs would have no flood control benefit and only a minor effect on summer flows.

To find suitable locations for permanent impoundment areas in this watershed is difficult and it is not surprising that the Conservation Authorities Branch inspection report concluded that no reservoir sites were available.

In the succeeding paragraphs consideration is given to a number of sites for removable weirs or permanent impoundments. The sites have been divided into two groups. The "primary" sites have been given first consideration for reasons such as local requests, larger populations affected, or obvious suitability. The "secondary" group of dam sites includes an alternative to one primary site as well as several sites which are possibilities but which would be opposed by some affected parties.

5.2 Removable Weirs

The removable weirs which would be used on the Jock would be of the type providing for a reinforced concrete base and wing walls, with a removable centre section of wooden planking. The planking and supports would be removed each fall before freeze-up and would be reinstalled after the spring flood crest had passed.

Supports for the planking would be provided by timber frames bolted to a concrete sill, or steel soldier beams set into pockets in the concrete base. Figure 3 illustrates the two types of support. Examples of the timber frame type are the weirs at Petrolia and Ball's Falls (see photograph at Figure A-12) while the soldier beam supports are used on a weir on the South Nation River at Chesterville.

5.3 Soil Testing

Detailed soil investigations have been carried out to determine the soil and bedrock conditions at the primary dam sites. Boreholes were put down from the river ice during the past winter. The voluminous soils report by Messrs. H. Q. Golder and Associates Ltd., Soil and Foundation Engineers, has not been included in this report for reasons of space and the limited interest it will have for the average reader. However, a copy of the full soils report has been provided to Mr. Alex Ansell, Field Officer for the Rideau Valley Conservation Authority, and will be available for examination in the Authority's office in Kemptville by any interested person. A copy has also been furnished to the Conservation Authorities Branch of the Department of Energy Resources Management in Toronto.

An abstract of the soils report is attached at Appendix "A". Reference is also contained to soil conditions in the discussions of the individual dam sites in succeeding paragraphs.

5.4 Primary Sites

(a) Heart's Desire Removable Weir

The three largest communities fronting on the Jock River are Richmond, Ashton, and the Heart's Desire subdivision. Because of the steep slope of the riverbed in the Heart's Desire area there are few sections of the river which are naturally deep in this vicinity. The Heart's Desire residents consider that their area should be an obvious location for a summer pond.

Surveys in the Heart's Desire section of the river have shown that the best location for a weir in this area will be at a point 1/3 mile up from the Prescott Highway bridge at the river's mouth. The weir would have a width of 130 feet, and would back the water up for 5/8 mile at an elevation of 268 feet (Geodetic). A removable weir in this location will provide an excellent community pond for recreational and fire protection purposes. It will impound approximately 10 million gals. of water. A plan of the weir site may be seen at Figure 4.

The borings encountered sand and silt under the bouldery riverbed for a depth of 5 to 7 feet before reaching bedrock. The weir base should be founded on bedrock in this location. A proposed cross-section is shown on Figure 4.

(b) Village of Richmond Removable Weir (Mileage 10.9)

During the summer the river in Richmond becomes very shallow and choked with weeds. The village authorities have tried to promote construction of a dam on several occasions and had an estimate prepared about 15 years ago. The desired location is at the downstream boundary of the village opposite

the cemetery. Reeve Edgar Gamble cut a notch in a tree when the receding flood waters were at a level which the village authorities would like to see maintained throughout the summer. The notch marks the desired level. This level would keep the river filled to the top of its banks and would also back the water up in the two creeks which pass through the village. The river pond would extend through the village to the rapids at the upper end of the built-up area.

The proposed weir site is at a point which has a width of about 100 feet, with clay banks rising fairly sharply at each side.

The soil borings encountered sandy silt in the river bottom to depths of 2½ to 5 feet before striking grey limestone rock. The rock level is about 5 feet below summer water level and about 11 feet below the proposed crest of the weir.

Figures 5 and 6 show a plan and section of the proposed weir site. A weir could be built at the location proposed but the depth to suitable bedrock would result in a fairly thick and expensive foundation.

A possible alternative site for the Richmond weir is considered under the section on secondary sites.

(c) Dam at the Ashton Marsh (Mileage 31.7)

(i) General

The swampy land lying on both sides of the river commencing in Concession VIII of Beckwith Township is one of the few areas in the Jock watershed which holds promise of providing

a reservoir area of sufficient size to have an appreciable effect on summer flows. A description of the area, which has been called the Ashton Marsh, is contained in Paragraph 4.2(g).

The area is uninhabited and may be considered as being among the lowest-valued land in the Jock drainage area. It is entirely covered by alders and small tree growth.

By providing a control structure at the outlet of the Marsh above the bridge it will be possible to retain water in this section of the river. Parts of the gravelled concession road north of the marsh would require building up if the road embankment were to function as a dyke. For each additional foot of storage provided the storage area and volume rise strikingly but, of course, the cost of dykes and structures also rise rapidly.

(ii) Height of Storage, Capacity of Reservoir and Effect on Flow

Following the availability of field survey data discussions were held with officials of the Conservation Authorities Branch in Toronto to obtain their opinion on whether the use of the Ashton Marsh area as a reservoir site would fit in with the results of the Branch's extensive biological, forestry and land use studies of the area. The reaction of the division heads to the proposal was enthusiastic, as was that of members of the Flood Control and Water Conservation Advisory Board when it was reviewed with them.

When alternative storage heights were discussed there was a strong feeling in favour of providing the maximum practicable height and therefore the greatest possible storage capacity.

It was proposed that the aim should be a crest height of elevation 431.5 feet (Geodetic).

The table below gives preliminary estimates of the flooded area and storage volume above normal low water which would result for various reservoir elevations in the Ashton Marsh area. The fourth column gives the rate of continuous flow which could be provided to the river during all of July and August (62 days) if the stored volume were released uniformly, and there were no recharge due to rains.

TABLE 2

EFFECT OF RESERVOIR LEVEL ON STORAGE AREA, VOLUME & SUMMER FLOW

ASHTON MARSH RESERVOIR

Reservoir Level Elevation (Geodetic)	Approximate Surface Area	Storage in Acre-feet	Equivalent Jul - Aug Flow
430.5	2240 ac.	3350	27 c.f.s.
431.5	3600 ac.	6000	49 c.f.s.

(iii) Function and Operation of Ashton Reservoir

The Conservation Authorities Branch experts considered that the proposed Ashton Marsh reservoir would be an excellent multiple use facility, i.e. providing for summer flow and storage, flood control to a limited extent, and wildlife encouragement. Mr. Mayall, Head of the Wildlife and Biology Section, said that good rearing conditions for wildfowl required

large areas covered with shallow water (6" - 18") in May and June. The Ashton project would be ideal in this respect.

It is envisaged that operation of the Ashton reservoir would be carried out along the following general lines. The control structure would be opened wide before the spring run-off in order to maintain as low a level as practicable, and would remain this way for the first part of the run-off. When the flow in the Jock and Rideau Rivers was seen to be approaching peak or dangerous levels the control structure would be closed, cutting off all flow from the headwaters of the Jock and thereby reducing the flood peak. The reservoir would remain full during April, May and June, with normal flow spilling over the crest during this period. Then the stored water would be released to the river at a uniform rate over the dry summer months. Normally the reservoir level would be low in the fall, but if heavy rains such as occurred in October 1967 should prevail the reservoir could be partially refilled for the fall migratory bird period.

(iv) Control Structure

It is evident that the outlet structure for the Ashton Marsh project must function throughout the year and be designed so as to control the outflow and levels over a wide range. For this reason the type of removable timber weir structure considered at the other locations would not be applicable here.

It is proposed that a reinforced concrete control structure incorporating stop logs with hand-operated hoisting devices be provided. A sluice gate for controlled flow will be incorporated. The general arrangement of the proposed structure is shown on the drawing at Figure 7.

The soil borings at the site show that about 6 feet of dense sandy silt till material exist in the riverbed above the limestone bedrock. It is proposed that the control structure be founded on the bedrock.

(v) Dyking

The perimeter of the Ashton reservoir when full will be in the order of 60,000 feet. By far the greatest part of this perimeter (about 90 %) will be bordered by naturally rising land and will require no special attention. However, at the lower end a certain amount of dyking will be needed to retain the highest level and to prevent the inundation of sections of travelled roads.

At Figure 8 profiles of a portion of the road between Concessions VIII and IX (Beckwith Township) and of the ground southeast of the road are shown in relation to the proposed reservoir high water level. Estimates have been made of the cost of building up the road level with gravel including widening the embankment, providing a clay blanket on the side slope and a guard rail on top, as compared with the cost of building a new dyke southeast of the road using available local glacial till material. The dyke would have an 8-foot top, side slope of 3 to 1 outside and 4 to 1 inside, and 2½ feet of freeboard. The estimates show that the provision of a new dyke will be less expensive than adapting the road embankment for a dyke. A total length of about 4200 feet of dyke will be needed along the Concession Road and 2100 feet of low dyking will be necessary adjacent to the small township road running southeast from the north corner of the marsh area.

The drawing at Figure 9 shows the extent of dyking proposed.

(vi) Clearing

Discussions were held with Conservation Authorities Branch officials regarding clearing the undergrowth and forest cover from the reservoir. At one time this would have been standard procedure but the thinking has shifted to some extent in recent years. Usually the complaint was that leaving the trees resulted in the area being unsightly. However in the Ashton case the area is well shielded and this would not, it was considered, be an important factor. Mr. Ansell quoted figures he had obtained from Ontario Hydro on reservoir clearing costs as $300. per acre for clearing slashed or small timbered land and $500. per acre where heavier timber was involved. It was evident that clearing at these prices would make the project prohibitively expensive. The Department of Lands and Forests will have some jurisdiction in this regard and it was hoped that this department would concur with the Conservation Authorities Branch that clearing would not be a requirement for the Ashton project.

Mr. Ansell suggested that a limited amount of clearing be carried out around the control structure and that channels be cut through the area for duck hunting. A sum has been provided in the estimate for this purpose.

(vii) Subsidiary Pond For Migrating Waterfowl

Department of Energy and Resources Management officials suggested at a meeting this spring that the Conservation Authority should give consideration to the provision of a constant level pond near the proposed Ashton reservoir to provide for migrating waterfowl. It was felt that the additional pond would complement the scheme and provide for an integrated conservation area.