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FUNCTIONAL DESIGN REPORT

SEWERAGE SYSTEM

ONEIDA INDIAN RESERVE

TRITON ENGINEERING SERVICES LIMITED

CONSULTING ENGINEERS AND TOWN PLANNERS

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ONEIDA INDIAN RESERVE

FOR THE

DEPARTMENT OF INDIAN AFFAIRS

AND

NORTHERN DEVELOPMENT

MARCH 1968

TRITON ENGINEERING SERVICES LIMITED

CONSULTING ENGINEERS AND TOWN PLANNERS

BRAMPTON C-86-C ORANGEVILLE

FUNCTIONAL DESIGN REPORT

TO THE

DEPARTMENT OF INDIAN AFFAIRS

AND NORTHERN DEVELOPMENT

ON A

SANITARY SEWERAGE SYSTEM

FOR THE

ONEIDA INDIAN RESERVE

I N D E X

TERMS AND ABBREVIATIONS

I.G.	Imperial Gallons
G.P.D.	Imperial Gallons Per Day
G.P.C.D.	Imperial Gallons Per Capita per Day
I.G.P.M.	Imperial Gallons Per Minute
U.S.G.P.M.	U.S. Gallons Per Minute
M.G.P.Y.	Million Gallons Per Year
F.P.S.	Feet Per Second
C.F.S.	Cubic Feet per Second
T.D.H.	Total Dynamic Head
P.P.M.	Parts Per Million
B.O.D.	Biochemical Oxygen Demand
∅	Diameter

On February 21, 1967 a request was forwarded by the Department of Indian Affairs and Northern Development to Triton Engineering Services Limited for a draft proposal outlining the extent and cost of providing the necessary consulting services for a proposed school. Following a discussion between the Department and Triton Engineering regarding this proposal, amendments were made and a revised proposal was forwarded on July 5, 1967 to Mr. W. H. Potts, P. Eng., Ontario Regional Engineer.

A letter of instruction dated August 3, 1967 was received by Triton Engineering Services Limited from Mr. T. L. Bonnah, Regional Superintendent of Development of Ontario, outlining the terms of reference for the school site information and requesting a Preliminary Design Report for the sewerage system.

The cost estimate, as noted in our proposal of July 5, 1967, was based on providing a Functional Design Report, which is respectfully submitted.

TRITON ENGINEERING SERVICES LIMITED

J. Ross Raymond

J. Ross Raymond, P. Eng.,
President.

BEV:jr

1. PHYSICAL SETTING

The Oneida Indian Reserve is located in the Township of Delaware, County of Middlesex, approximately 15 miles southwest of London. The reserve is approximately 8.6 square miles, or 5,500 acres, and is bound on the north and west sides by the Thames River.

2. RIVER FLOW DATA

The Thames River is a perpetually flowing stream that drains an area of 2,200 square miles and is second only to the Grand River among the drainage systems of Southwestern Ontario. Its total length, from the source of the North Branch near Brodhagen to Lake St. Clair, is about 125 miles.

Flow records are kept at several stations on the river. One is approximately 15 miles upstream from the reserve, at London, and another approximately 32 miles downstream, near Thamesville. From information contained in the Water Resources Paper No. 143 for the Water Year 1962-63, issued by the Department of Northern Affairs and National Resources, it has been established that the drainage area at the reserve is approximately 1,400 acres. This results in a mean discharge, at this location, based on a twelve year period, of 1,230 C.F.S. and a minimum instantaneous discharge of 85.8 C.F.S.

3. TOPOGRAPHY AND SOILS

The reserve is located in a physiographic region known as the Caradoc Sand Plains. This region is most unusual as the land is quite flat but is interlaced with steep-sided narrow gulches, caused by tributary streams cutting down to the base level of the Thames River.

Topographic information was obtained from air photo interpretation by our consultant, S.J.G. Bird, P. Eng., O.L.S., in conjunction with a ground survey conducted by this Company.

The soil in this area is generally consistent, being 6 to 9 feet of dense sand overlying a hard clay till.

1. RESERVE

The majority of the reserve is drained by two creeks, which are tributaries of the Thames River. These are the Turkey and the Oneida Creeks, both of which are flowing constantly, although at varying rates, during the year.

2. VILLAGE

The Village site of 69.0 acres, lies between the Oneida Creek on the west and the Turkey Creek on the south. These water-courses will enable adequate site drainage through the use of road ditches, catch basins and storm sewers. The existing storm sewer as shown on Figure 1 was completed in October of 1967. Since the completion of this portion of sewer, the ground condition has vastly improved due to a lower water table. To provide proper drainage for the residential area a minimum grade difference of 24 inches is necessary between the finished lot grade at the building line and the centreline of the proposed road. This will allow water to drain from around the houses to the road ditches, thence to the storm sewer via catch basins.

3. SCHOOL SITE

The site for the proposed school is in the Village area fronting on the main entrance road, as shown on Figure 3. The easterly edge of this parcel is adjacent to the ravine which

forms the reservoir for the domestic water system. For this reason it is imperative that the school site be graded to slope from east to west, thus preventing the majority of ground water from entering the reservoir and causing unnecessary contamination. All paved areas on the school site, such as the playground and parking area should be serviced by catch basins connected to the storm sewer system. This will require an extension to the existing storm sewer as shown on Figure 1.

The estimated cost for this section of sewer based on 1968 construction costs is $14,600.00.

1. RESERVE

The existing population residing on the reserve is approximately 1,200 people living in 205 dwellings. The land use may be catagorized as Residential, Agricultural and Vacant.

2. VILLAGE

The present population of the Village is approximately 42 persons living in 6 dwellings. The location of these dwellings are shown on Figure 3. The projected future population of the residential area, for a twenty year design period is 460 persons. This figure was attained by assuming the construction of three houses per year and an increase of 21 persons per year in the residential area.

The land use is as follows:

Residential	31.4 Acres
Community Centre	2.2 Acres
Commercial	3.3 Acres
Industrial	5.3 Acres
School	6.6 Acres
Park	7.9 Acres
Roads (7,200 feet)	12.3 Acres
TOTAL	69.0 Acres

The preceding land use was recommended in the Community Planning Report which was presented to the Oneida Band Council in March of 1966 by this firm.

We must emphasize the importance of encouraging all future house construction to be undertaken in the Village residential area. This would provide a greater value for monies spent in the construction of the services such as roads, sewers, and the water system, as well as raising the standard of living for the resident families.

One method of encouraging families to take advantage of this future urban area would be to provide some incentive, in the way of grants or subsidies, if the houses were to be constructed on serviced lots.

Land use controls should be introduced immediately to provide effective methods of controlling all future development, within the Village area. This would be accomplished by establishing definite housing standards and zoning regulations. Immediate steps should be taken and all possible assistance should be given to the Band Council and Housing Committee to draft the necessary regulations and by-laws.

As will be noted in the Schedule of Revisions on Figures 1 to 3, Lots 47 to 56 will be used as part of the school site and Lot 31 will become a road allowance for the access road to the waste stabilization pond.

1. GENERAL

The site for the proposed school in the Village, is a 6.6 acre parcel of land located between the main access road and the water reservoir. The land slopes gently from the easterly edge of the property towards the road. The drainage requirements for the school site should be as outlined in Section C - Drainage.

The school property has no appreciable tree growth and is barren where the building, parking and playgrounds are located. This will reduce the cost of construction to a small extent, as clearing will not be necessary.

2. SOIL CONDITIONS

A soil investigation was conducted by Wm. Trow Associates Limited. Six test holes were sunk to a depth of 20 feet at the locations shown on Figure 3.

The subsoil conditions at the site are quite uniform, with the topsoil cover being approximately 8" thick over a layer of compact to dense sand 8 to 9 feet thick, which in turn overlies a grey hard silty clay till to the full depth of the boreholes.

The groundwater table perched in the sand above the clay till is approximately 4 feet below the surface.

A more detailed subsoil description, along with standard penetration and cone penetration values, are set out in the Soil Consultant's report of which 3 copies have been forwarded to W. H. Potts, P. Eng., the Regional Engineer for the Indian Affairs Branch.

Included in this report are recommendations with regards to excavation, foundations, slabs-on-grade and permanent drainage for the proposed school.

3. ROADS

The roads in the Village and school area are in very poor condition due to the fact that it is not feasible to spend money on road construction before the storm and sanitary sewers are installed. As construction of the services are completed in their respective phases, the sections of road involved should be rebuilt to the Indian Affairs Branch "Standard Subdivision Details".

In the latter part of 1967 a temporary road was constructed for the seven families in the Village. The section involved was approximately 360 feet on Road "B" and 340 feet on Road "C" as shown on Figure 2. This temporary road provided a connection to the abandoned railway line which has been used as a temporary access road to the Village. As Road "A" has not been constructed as yet it is impassable in the wet seasons.

Immediately after the storm and sanitary sewers have been placed to service the school, the main access road (Road "A") should be built from the Oneida School Road No. 3 to the proposed grade change opposite Lot 61. Also part of Roads "B" and "C" will have to be included in this phase to provide proper access to present and future homes. This will require a total length of 2,500 feet of gravel road to be constructed as shown on Figure 1.

The estimated cost for this road, including ditching and culverts, based on 1968 construction costs, would be $10.25 per lineal foot. As 500 feet of the 700 feet previously constructed is included in this phase, the estimate will be based on 2,000 feet of construction. Therefore the estimated cost of road construction for phase one is $20,500.00.

The water supply for the Village as shown on Figure 2 was constructed in 1967 and consists of an earth dam and open reservoir, with a capacity of approximately 1,800,000 gallons. The water enters the pump well through a sand filter bed and is then pumped into a 1,250 U.S. gallon pressure tank at the rate of 120 U.S.G.P.M. A hypochlorinator is connected to the discharge of the pump thus providing the necessary treatment. The water pressure in the distribution system is maintained from 50 to 70 P.S.I.

At the present time the water consumption is very low as there are only 6 houses connected to the system. The projected 20 year population of the Village as set forth in Section D is expected to be 460. In the calculation of the sewage flows the assumed per capita flow will be 50 G.P.C.D. initially, thence to 60 G.P.C.D. in ten years, 70 G.P.C.D. in fifteen years and 80 G.P.C.D. in twenty years.

The proposed school and community hall have been combined to estimate the water usage. The assumed quantity will be 1,000 G.P.D. initially and increasing to 2,000 G.P.D. in ten years.

The assumed consumption for the commercial and industrial shall increase to 2,000 G.P.D. in ten years, thence to 4,000 G.P.D. in fifteen years, from the present rate of 0 G.P.D.

1. DESIGN PERIOD

Design of the treatment system will be based on a 20 year period. This period has been further divided for design purposes into two 10 year terms which shall be classified as Phase 1 and Phase 2 in this report.

2. SEWAGE FLOW

The average daily sewage flow to be used in this report shall be 50 G.P.C.D. initially and increasing to 80 G.P.C.D. in twenty years.

Since the number of persons per dwelling is above average, it was felt the use of 100 G.P.C.D., to determine the domestic sewage flow, was excessive.

The proposed school and community centre have been combined for estimating the sewage flow. The flow will be assumed at 1000 G.P.D. initially and increasing to 2000 G.P.D. in ten years.

The commercial and industrial flow has also been combined. As there are no definite plans at this time for a commercial or industrial venture it will be assumed the quantity will increase from 0 G.P.D. at present to 2000 G.P.D. in ten years and doubling to 4000 G.P.D. in fifteen years.

3. INFILTRATION

The allowance for infiltration shall be taken as 500 G.P.D. per inch of diameter per mile of sewer. Based on this criteria we have estimated the infiltration to be 1,700 G.P.D. for Phase 1 and 2,500 G.P.D. for Phase 2.

ESTIMATED FLOW

	INITIAL	10 YEAR	15 YEAR	20 YEAR
63 persons @ 50 G.P.D.	3,150			
252 persons @ 60 G.P.D.		15,100		
357 persons @ 70 G.P.D.			25,000	
460 persons @ 80 G.P.D.				37,000
School and Community Centre	1,000	2,000	2,000	2,000
Commercial and Industrial	0	2,000	4,000	4,000
Infiltration	1,700	1,700	2,500	2,500
TOTAL FLOW G.P.D.	5,850	20,800	33,500	45,500

ESTIMATED POPULATION AND SEWAGE FLOW

DESIGN YEAR	POPULATION CONNECTED	SERVICES CONNECTED	G.P.D.	M.G.P.Y.
1	63	9	5,850	2.1
2	84	12	7,000	2.5
3	105	15	8,500	3.1
4	126	18	9,800	3.5
5	147	21	11,500	4.1
6	168	24	13,200	4.8
7	189	27	14,800	5.4
8	210	30	16,500	6.0
9	231	33	18,600	6.7
10	252	36	20,800	7.5
11	273	39	22,500	8.2
12	294	42	24,800	9.0
13	315	45	27,500	10.0
14	336	48	30,200	11.0
15	357	51	32,700	11.9
16	378	54	35,200	12.8
17	399	57	38,000	13.8
18	420	60	40,200	14.6
19	441	63	42,700	15.5
20	460	66	45,900	16.6

Daily flow rates will vary from a minimum approaching the infiltration rate to a maximum of approximately 4 times the average flow. Instantaneous peak flows are estimated to be 6 times the average flow.

A range of estimated flow rates are as follows:

	INITIAL	10 YEARS	20 YEARS	
MINIMUM	1.2	1.2	1.7	I.G.P.M.
AVERAGE	4.0	14.5	31.5	I.G.P.M.
MAXIMUM	16.0	58.0	126.0	I.G.P.M.
INSTANTANEOUS PEAK	24.0	87.0	190.0	I.G.P.M.

4. ORGANIC LOADING

It is estimated that the average domestic sewage from the Village will have a B.O.D. of 0.20 lbs. per capita per day or 200 P.P.M.

As there will be no industrial waste in the initial stage of operation we will assume a loading of 5 lbs./day for Phase 1 and 10 lbs./day for Phase 2.

Based on the preceding criteria, the estimated organic loading of the waste stabilization pond is as follows:

INITIAL B.O.D.

63 Population Equivalents @ 0.20 = 12.6 lb./day

10 YEAR B.O.D.

252 Population Equivalents @ 0.20 = 50.4 lb./day

Industrial (assumed) = 5.0 lb./day

55.4 lb./day

20 YEAR B.O.D.

460 Population Equivalents @ 0.20 = 92.0 lb./day

Industrial (assumed) = 10.0 lb./day

102.0 lb./day

The pond in Phase 1 has a surface area of 3 acres as shown on Figure 3. This provides for a B.O.D. loading of approximately 17 lbs. per acre per day by design year 10. In Phase 2 the second pond, will provide an additional surface area of 3 acres which will also give a B.O.D. loading of 17 lbs. per acre per day. As some authorities recommend a maximum B.O.D. loading of 20 lbs. per acre per day the preceding design should be acceptable.

1. EXTENT

A system of sanitary sewers has been developed to initially service the proposed school, a portion of the commercial area and 47 residential lots, shown as Phase 1 on Figure 3.

Phase 2, as shown on this figure, will include an additional 22 residential lots. According to our population projection the lots in Phase 1 and 2 should be serviced by the end of Design Year 20.

Phase 3 of the collection system will not be considered, as it is not considered practical to attempt a cost estimate for work beyond the 20 year design period used in this report.

2. BASIS OF DESIGN

a) Population Density

The population density of the Villages residential area, at the present time, is 28 persons per acre. As this is very compact it is expected the ratio will not increase. It must be assumed that the remainder of the residential area will be populated at this density.

b) Sewage Flows

The projected population to be served is 460 persons in 20 years.

Sewage flows are based on an average of 80 G.P.C.D. Using the relationship $\frac{\text{Peak Flow}}{\text{Average Flow}} = \frac{5}{P^{1/5}} = 5.85$ where P is the population in thousands. The peak flow will be approximately 468 gallons per capita per day. On this basis the flow per capita is .000867 C.F.S. for sewer design purposes. The allowance for infiltration is .0025 C.F.S. per acre. All storm water is to be excluded.

c) Flow Coefficients

Based on the foregoing population densities the following flow coefficients have been calculated:

(i) Residential	.0265 C.F.S./acre
(ii) Commercial and Industrial	.0433 C.F.S./total
(iii) School and Community Centre	.0216 C.F.S./total

d) Flow Factors

A roughness coefficient of n = .010 for asbestos cement pipe has been used in this design (Manning Formula) compared to .013 for concrete pipe and .010 for vitrified clay sewers. The minimum and maximum grades are therefore:

SIZE	MINIMUM GRADE	MAXIMUM GRADE
8 inch	.30%	13.0% *
10 inch	.23%	10.0% *

to produce velocities from 2.5 (min.) to 15.0 feet per second (max.).

* approximate extrapolation

3. LOCATION

The collector sewers are to be located on the Village road allowances, 5 feet to the north or east of the centre-line, as specified in the Department of Indian Affairs "Standard Subdivision Details".

4. DEPTH OF SYSTEM

The proposed sewers are at depths of from 5' to 6.5' below the finished road grade. This will not allow full basements, without the use of sump pumps, but will more than compensate in a substantial cost reduction. As building houses with full basements is not a general practise on reserves, we feel the additional cost of placing the pipe at a depth of from 8 to 12 feet is not warranted.

5. MANHOLES

Manholes are spaced at approximately 300 foot intervals and are located at the centres of all intersections, where present or future sewer lines will intersect.

6. SERVICE CONNECTIONS

Service connections will be 48 and 38 feet long on the 86 foot wide road allowances and 38 and 28 feet long on the 66 foot road allowances in order to extend to the property line.

. . . .

Service connection sizes are:

Single Residential	5 inch diameter
Double Residential	6 inch diameter
Proposed School	6 inch diameter
Commercial and Residential	as required

All lots abutting the sewer system will be serviced with the exception of the 3.3 acre commercial area. Services for this area may be added as required in the future.

Minimum service grade is 1/8 inch per foot or 1.0%.

7. MATERIALS

a) Local or Collector Sewers

In accordance with the Department's policy Contractors will be allowed to use asbestos cement, concrete or vitrified clay sewer materials, provided that design flow and infiltration requirements are met. Based on previous experience, it is felt that asbestos cement sewer pipe will be most suitable, and the design is based on this selection. Alternates will be provided for in the Form of Tender where conditions are suitable.

b) Service Connections

Individual services may be constructed of asbestos-cement, concrete or vitrified clay, provided that flow and infiltration requirements are met. All services will be connected to main sewers in wyes or tees, rather than saddles and

the ends will be fitted with a capped, cast iron test fitting to accommodate one or two private services.

c) Manholes

Manholes are to be constructed of either precast concrete sections or poured-in-place reinforced concrete, with cast iron covers.

Manhole sizes are established as follows:

LOCATION	PRECAST	POURED-IN-PLACE
Straight line flow	42" Diameter	4' x 2'-6"
Bends over 45°	48" Diameter	4' x 4'
Intersection of more than two sewers	48" Diameter	4' x 4'

Drop Manholes - 4' x 4' lower section plus drop structure with 42" diameter or 4' x 2'-6" chimney above highest obvert.

8. PIPE STRENGTH AND BEDDING REQUIREMENTS

All pipes shall be bedded as follows:

- 3/4 inch clear stone, hand-placed and compacted for 4 inches under the pipe and extending up to the centre line of the pipe.
- hand-placed compacted sand or Class "A" granular material placed to a minimum of 1 foot above the top of the pipe. This material to be placed and compacted in 6 inch layers.

Under the soil conditions anticipated, Class 1500 Asbestos-Cement pipe will be acceptable to a depth of 8 feet.

9. REINSTATEMENT

All areas where sewers are installed will be reinstated to their original condition, based on the Consultant's preliminary survey and photographic record.

10. PROVISION FOR EXPANSION

Provision for expansion has been provided beyond Phase 3, of the collection system. Stubs in manholes 2A and 7A and a 10 inch diameter pipe between the pumping manhole and manhole 2A will provide adequate capacity to service the proposed neighborhood, north of the Village.

SECTION I - SEWAGE PUMPING MANHOLE AND FORCEMAIN

1. GENERAL

The network of sewers will provide adequate flow by gravity from all parts of the Village. However, it will be necessary to lift the sewage from the pumping manhole to the proposed waste stabilization pond as the pond could not be situated to allow a gravity flow from the sewer system.

2. DESCRIPTION OF PUMPING MANHOLE

A pumping manhole, equipped with two submersible raw sewage pumps, was selected as the most economical means of pumping sewage for this installation. A field erected or pre-fabricated sewage pumping station for this project would cost from 25,000.00 to 50,000.00 dollars, if selected.

This manhole will be constructed of 60 inch diameter pre-cast reinforced concrete pipe sections on a reinforced concrete base. The addition of proper benching will ensure the complete removal of solids from the pumping manhole.

The top shall be pre-cast reinforced concrete with steel access covers to facilitate the removal of the sewage pumps.

The pumps are equipped with lifting chains and will slide on a metal guide bar which is fastened in the manhole and extends for the full heighth of the structure. This allows maintenance to be performed on the pumps and motors without entering the manhole.

3. BASIS OF DESIGN

a) Sewage pumps of the submersible type that are easily removable for cleaning and servicing are recommended.

b) Pumps should be interchangeable dual units that operate on alternate cycles.

c) Pump capacity should be 4 times the average daily flow to accommodate peak flows.

d) Minimum flow in the forcemain should be 2 1/2 feet/second to prevent solids from settling in the line.

e) The minimum capacity of the pumping manhole should be such that one pump will operate for a full minute before the low liquid level is attained which will stop the pump.

f) Control of the pumps through liquid level switches should be adjusted so that one pump will operate at least every half hour based on average flow.

4. PUMP SELECTION

As stated in Section G "Sewage Design Data", the maximum flow is expected to be 16 I.G.P.M. initially and 126 I.G.P.M. in 20 years. The pump selection has been based on these flows.

The total dynamic head was obtained as follows:

Static Head	10.0 feet
Station Loss	2.0 feet
Friction Loss	11.0 feet
T.D.H.	23.0 feet

Therefore the pump rating should be 125 I.G.P.M. @ 23.0 T.D.H. with a minimum H.P. of 3.5.

The following method of pump operation is recommended:
Normal - one "lead" pump with a second as "standby". Automatic alternation with a high liquid level switch to operate both pumps in parallel, in the event a sustained peak flow is encountered for an abnormal period of time.

5. LOCATION

The pumping manhole will be located on the west edge of the road allowance of Road "C" immediately north of the drainage area, as shown on Figure 3.

Advantages of this location are:

1. It will not be necessary to cross the ravine in the proposed fill section with a gravity sewer pipe. This would be costly, as settlement will occur, which would ultimately damage the pipe.

2. A hydro pole can be located adjacent to the structure to provide power to the equipment and support a weatherproof control panel.

3. The proximity of the manhole to the waste stabilization pond and the collection system is favourable.

6. STANDBY POWER

While no records are kept by local hydro offices of power outages, it is probable that a few outages of less than 1 hours duration will occur each year.

It is our opinion that standby power will not be required at this installation.

7. OVERFLOW

An overflow will be provided from the pumping manhole to the Oneida Creek to prevent flooding of the collector system during prolonged power outages. Sewage flow would be at a minimum during a power outage, as the domestic water system would also be in a shut-down condition.

If a prolonged power outage occurs and the overflow is required, the solids will settle in the manhole thereby permitting only a liquid overflow. This effluent discharged into the Oneida Creek will not affect any residents. The creek flows to the Thames River in a deep wooded ravine for a distance of approximately one mile. There are no houses or domestic animals in the area of this ravine.

On reaching the Thames River the dilution factor is such that the downstream effect would be negligible.

8. FORCEMAIN

Considering the pumps specified for this installation, a 4"Ø forcemain has been selected. Because of its low cost and ease of installation, a plastic (PVC) pipe is recommended for this forcemain. Velocity of the sewage will be approximately 3.8 feet/second well above the minimum 2.5 feet/second.

9. ELECTRICAL

The electrical service for the pumping manhole should be 550 Volt 3 Phase if at all possible. As the school will require 3 Phase power this should become available. A continuation of the hydro pole line on Road "C" up to the pumping station will be required. A separate pole will be required adjacent to the manhole to support the weather-proof control panel and meter box.

1. GENERAL

The most suitable type of sewage treatment system is the aerobic oxidation pond or waste stabilization pond. Because of its relatively low initial cost, ease of operation and maintenance, this is the most feasible system for the Oneida Village.

2. LOCATION

The location of the pond, as shown on Figure 3, has been chosen for the following reasons:

a) The pond is 500 feet from the nearest dwelling that may be constructed in the 20 year design period, and is 1400 feet from the nearest existing house.

b) The pond access road, for the most part, will be constructed on the road allowance of Road "C". This will eliminate the need to purchase additional land for this road.

c) The prevailing wind is from the northwest, this should minimize any chance of odour nuisance in the Village.

d) The Village is protected from the pond site by a thick bush. This screening will not be disturbed during or after the construction of the sanitary sewerage system, other than the clearing necessary for the pond and access road.

e) The distance between the pond site and the collection system is minimal.

The initial topographic survey to determine suitable pond sites, was conducted by S.J.G. Bird, P. Eng., O.L.S. with the use of airphotos. The final selection was based on information compiled from a ground survey completed by this firm.

3. SHAPE

The shape was selected to conform with the existing topography. The corners have a radius of 150 feet at the surface elevation, to minimize accumulation of solids.

4. SOIL CONDITIONS

The soil conditions are similar to the conditions at the school site with approximately 8 inches of topsoil over a layer of compact to dense sand 7 to 9 feet thick, which in turn, overlies a grey hard silty clay till.

It is recommended that a complete soils investigation be conducted on the site by a qualified soils consultant before final design is completed.

5. DYKES

The proposed dykes have a 10-foot level top so that maintenance vehicles may safely travel thereon. It is proposed that the side slopes be 4 horizontal to 1 vertical on the insides and 3 horizontal to 1 vertical on the outsides.

The flat slope on the inside is to minimize the chances of erosion and also to simplify grass cutting.

The dykes will be constructed of the material excavated from the pond area. This material will be placed and compacted in thin layers to minimize exfiltration through the sides. The dykes will have a clay liner to 1 foot above the high water level compacted in 6 inch layers. Experience has shown that after the ponds have been in operation for a short time, the dykes and bottom seal themselves and exfiltration is no longer a problem.

The topsoil material excavated from the pond area will be placed on the surface of the dykes and grass will be planted on the top and slopes. Any topsoil available in excess of the amount required for dressing the slopes, will be placed in the outside slopes of the dykes.

6. SIZE

1) General

Based on a 20 year design period total population of 460 and a surface area requirement of one acre per 100 population, the surface area proposed is 3 acres for Phase 1 and an additional 3 acres for Phase 2.

A maximum liquid depth of 5 feet is proposed with 3 feet of freeboard above the high water level.

With side slopes of four horizontal to one vertical, and a depth of 5 feet, the area of the floor of the pond will be approximately 2.5 acres.

It is our understanding that no dimension of a pond be greater than 1000 feet to protect against wave action. The longest dimension of the proposed ponds is approximately 440 feet (diagonal) at the high water level.

2) Detention Time

As discussed in Section G "Sewage Design Data", the average daily flow expected in Design Year 20 is 43,000 Imperial Gallons of domestic sewage plus 2,500 Imperial Gallons of infiltration for a total of 45,500 Imperial Gallons.

The total volume of the proposed ponds is approximately 8,100,000 gallons.

Therefore, when the ponds are operating in series, the theoretical detention time for the Design Year is a minimum of 180 days or approximately 6 months.

The detention time will be much longer during the years before the design population is reached. For example, with a population of 210 (estimated for design year 8) the detention period will be at least 490 days (approximately 16 months).

7. LIQUID LEVEL CONTROL AND EFFLUENT CHAMBER

This will be a concrete structure situated at the southwest corner of the pond in the dyke.

The effluent will enter this chamber via an 8 inch diameter pipe. The water will rise in the effluent chamber to discharge over a weir and flow from here to the receiving stream by gravity. The stop logs in the effluent chamber will be adjustable to control the water level in the pond from a depth of 2 to 5 feet.

The discharge line to the receiving stream will be an 8 inch diameter pipe. The grade of this pipe is such that it will carry all future flows.

8. ACCESS ROAD

It is proposed to use Lot 31 as a right-of-way for the pond access road. This will eliminate additional land purchases.

This road will be a granular road with a twenty foot cleared portion in the bush area and a twelve foot travelled width. The road will end at the pond site as shown on Figure 3. It is felt that no other roads are necessary on the site as vehicles will be able to drive on the grass all year except for a wet period in the spring.

A ramp will be constructed leading to the top of the dyke thus providing access for vehicles and maintenance equipment.

9. MISCELLANEOUS CONSTRUCTION

1) Grass

Hydraulic seeding of the top and outside slope of the dykes is recommended to prevent erosion.

2) Fence

The complete site must be fenced to prevent children from playing near the pond. A six foot chain link fence with three strands of barbed-wire, and a twelve foot gate at the access road, is proposed.

3) Signs

Signs will be erected along the fence to warn would-be trespassers of the dangers involved.

10. PROPERTY REQUIREMENTS

The land required for the waste stabilization ponds will be approximately 10 acres. This will provide the required area for the twenty year design period.

11. RECEIVING STREAM

The ponds will discharge into the Oneida Creek which flow into the Thames River.

As the detention time for the pond is 180 days at the 20 year design period it will only be necessary to discharge the pond when the creek is running full. The flow rates for the Thames River are mentioned in the River Flow Data of Section B, "Geography".

12. OPERATION

As the initial flow entering the system will be considerably less than the design flow, it will be necessary to charge the ponds with water to the minimum depth of two feet. This may be accomplished by pumping water from the receiving stream or using water from the domestic water system, at controlled intervals, or a combination of both. Since the waste stabilization pond method of treatment does not work effectively at liquid depths less than two feet due to the growth of weeds, it is recommended that the pond be charged immediately following construction.

If it should become necessary to drain the pond for maintenance purposes, this could be accomplished by adjustments in the effluent chamber. The pond would drain in a relatively short period due to the size and grade of the outfall pipe. This would minimize the length of time the overflow from the pumping manhole would be in service.

As was previously mentioned, it is recommended that no discharge be allowed at times of low flows in the Oneida Creek. The detention time, in the pond, is such that at the end of the 20 year design period it will only be necessary to lower the pond twice a year. This should be done in the spring and fall during the creek's high flow periods.

It is recommended that samples of the effluent (treated sewage) be taken at regular intervals, particularly during the early years of operation, to ensure that adequate treatment is being provided.

The weirs in the effluent chamber will enable the operator to estimate the quantity of sewage being treated.

13. MAINTENANCE

The major maintenance problems at the pond site will be the cutting of the grass and road grading. Once the system is functioning properly, it is anticipated that the operation will be comparatively maintenance free for the 20 year design period.

As the Village will have sewer and water facilities, it is our opinion that the Band Council appoint a salaried commissioner to be trained in the operation and maintenance of these services.

14. FUTURE EXPANSION

Should the treatment works require expansion beyond the 20 year design period, the logical site for an additional waste stabilization pond would be immediately south of the two 3 acre ponds.

Alternately, by the time expansion is required, after the 20 year design period, we would anticipate that a more efficient method of treatment (eg. mechanical aeration) will have been fully developed and proven, and that such a system could be combined with the existing ponds to provide adequate treatment without further expansion.

The following cost estimate is intended to reflect the probable cost of the proposed works based on 1968 prices. Construction scheduled later than 1968 would require review due to current rising construction costs.

PHASE I

Collection System

Sewers 190 feet 10"Ø	$ 2,000.	
1930 feet 8"Ø	17,410.	
Manholes 5 - 48"Ø 4 - 42"Ø	2,750.	
Services 5 single, 22 double	3,300.	$25,460.

Pumping Manhole and Forcemain

Manhole	$ 1,200.	
Pumps and Equipment	3,800.	
Forcemain	3,000.	
Overflow	900.	$ 8,900.

Access Road (12' wide x 1370' long)

Clearing and Grubbing (.25 acres)	$ 250.	
Stripping Topsoil (450 c.y.)	450.	
Granular "B" (610 c.y.)	2,200.	
136' - 48"Ø C.S.P.	2,170.	
Fill for C.S.P. - 4420 c.y.	4,420.	$ 9,490.

Pond Construction (No. 1)		
Clearing and Grubbing -(60 acres)	$ 5,400.	
8000 c.y. excavation and berm construction	8,000.	
Outfall Structures	1,000.	
Outfall Sewer (450 feet)	2,700.	
Fence (1750 feet)	5,250.	$22,350.
Sub-Total		$66,200.
Engineering and Contingencies		9,930.
Total Estimated Cost of Phase I		$76,130.
PHASE II		
Collection System		
Sewers 1025 feet 8"Ø	$ 8,450.	
Manholes 2 - 48"Ø 2 - 42"Ø	900.	
Services 4 single, 9 double	3,300.	$12,650.
Road Construction		
1260 feet	$12,900.	$12,900.
Pond Construction (No. 2)		
Clearing and Grubbing (6 acres)	$ 5,400.	
12,000 c.y. excavation	12,000.	
Outlet Structures and Cross Connection	1,500.	
Fence (800 feet)	2,400.	$21,300.
Sub-Total		$46,850.
Engineering and Contingencies		7,030.
Total Estimated Cost of Phase II		$53,880.

1. CAPITAL COST

Part of the capital cost of a sewage collection and treatment system may be eligible for a loan from Central Mortgage and Housing Corporation. Under terms of Part VIB of the National Housing Act a loan may be obtained to cover 2/3 of the cost of:

a) Sewage Treatment System

b) Pumping Station and Forcemain

c) Trunk Sewer

As there will be no part of the collection system that can be classified as a trunk sewer, the loan will only be based on the cost of a) and b) above.

Under the terms of the Act, repayment of 25% of the principal and interest on the amount borrowed may be waived as a grant to the community.

2. C.M.H.C. LOAN ESTIMATE - PHASE I

Pumping Manhole and Forcemain	$ 8,900.00
Waste Stabilization Pond	22,350.00
Estimated Cost of Eligible Portion	$31,250.00
Estimated C.M.H.C. Loan	$20,830.00
Estimated C.M.H.C. Grant	$ 5,210.00
Balance to be Financed	$10,420.00
Sewage Collection System	$25,600.00
Net Capital Cost to be Financed	$36,020.00

3. OPERATING AND MAINTENANCE

The cost of operation and maintenance of the system will be approximately $200.00 to $300.00 per year.

A small surcharge on the water bill could be levied to defray the operating and maintenance costs or alternately the proposed school could assume the full costs.

1. It should be emphasized to builders constructing houses on the newly provided lots, that satisfactory surface drainage from the dwelling is only achieved by maintaining grade at the building line 2 feet above road centre line.

2. The school foundation construction should follow the recommendations of the soil consultant's report.

3. To help prevent contamination from entering the water supply reservoir, finished grading at the school site should drain runoff to the west. Catch basins would carry this surface flow to a proposed extension to the storm sewer system. The estimated cost of this extension, including catch basins on the roadway, is $14,600.00 based on 1968 prices.

4. Encouragement should be given to families on the reservation to build future housing in Oneida Village. This could be done by various forms of grants and subsidies.

5. Housing must be developed in a systematic manner in the Village in order to provide maximum benefits to the inhabitants and the most economical progress. Land use controls such as building and zoning by-laws should be enforced. It is of course important that serviced lots be constructed on in preference to unserviced lots where possible.

6. As recommended in this report, road reconstruction at an estimated cost of $20,500.00 (1968 prices) should be undertaken upon completion of sewer construction.

7. Due to the present low water usage, we recommend that the mains be flushed to waste in the storm sewer system from end of line hydrants every week. This will create an artificial usage and help maintain fresh water in the system.

8. We recommend the construction of a sewage system for Oneida Village as outlined in this report. Construction of the collector system, pumping manhole, and treatment facilities should be phased as indicated. For optimum co-ordination Phase I of the sewage system should be built at the same time as the school.

9. The lots that would be provided with a sanitary sewer service should also be serviced by watermain and storm sewer which will involve extensions to those systems. Phase II of the sewage system would not be constructed until all available serviced lots were built on.

10. Builders should be made familiar with the fact that sump pumps would be required to provide sanitary service to full basements under the presently proposed system.

11. A property requirement of 10 acres is necessary for the construction of waste stabilization ponds over the design period.

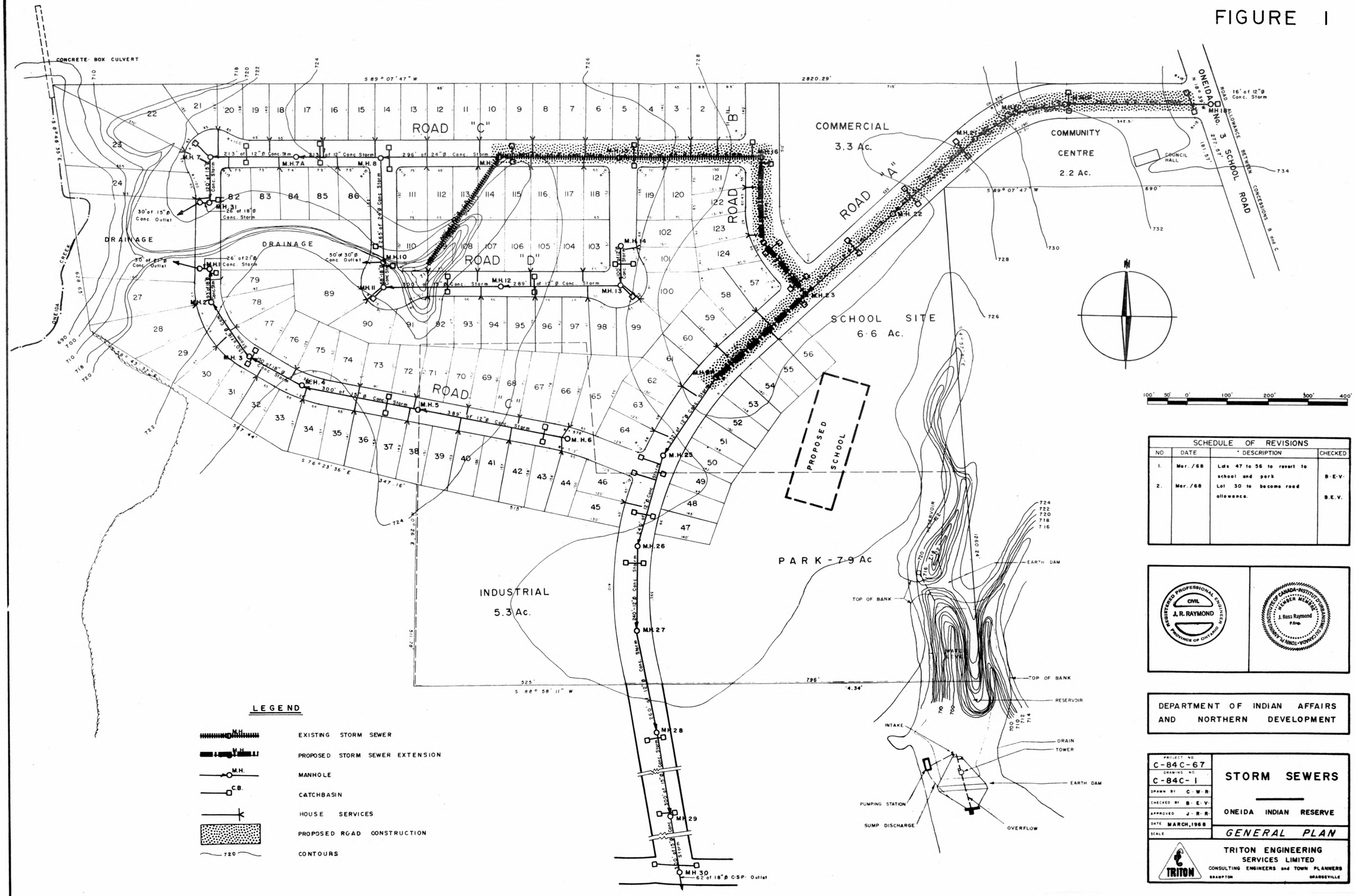
12. A soils investigation of the proposed waste stabilization pond site is required prior to construction.

13. The 10 acres of property should be fenced as outlined in this report as soon as any treatment facilities are constructed.

14. In accordance with the operational and maintenance sub-sections of this report, the waste stabilization pond should be charged with 2 feet of water upon construction, and a water and sewage works Commissioner responsible for those systems, should be appointed.

15. It is recommended that Indian Affairs Branch submit a copy of this report along with a covering letter of inquiry to Central Mortgage and Housing Corporation to determine financing eligibility under the terms of the Federal Pollution Abatement Programme.

FIGURE 1



LEGEND

- EXISTING STORM SEWER
- PROPOSED STORM SEWER EXTENSION
- MANHOLE
- CATCHBASIN
- HOUSE SERVICES
- PROPOSED ROAD CONSTRUCTION
- CONTOURS

SCHEDULE OF REVISIONS			
NO	DATE	DESCRIPTION	CHECKED
1.	Mar./68	Lots 47 to 56 to revert to school and park	B·E·V·
2.	Mar./68	Lot 30 to become road allowance.	B.E.V.

REGISTERED PROFESSIONAL ENGINEER — CIVIL — J.R. RAYMOND — PROVINCE OF ONTARIO

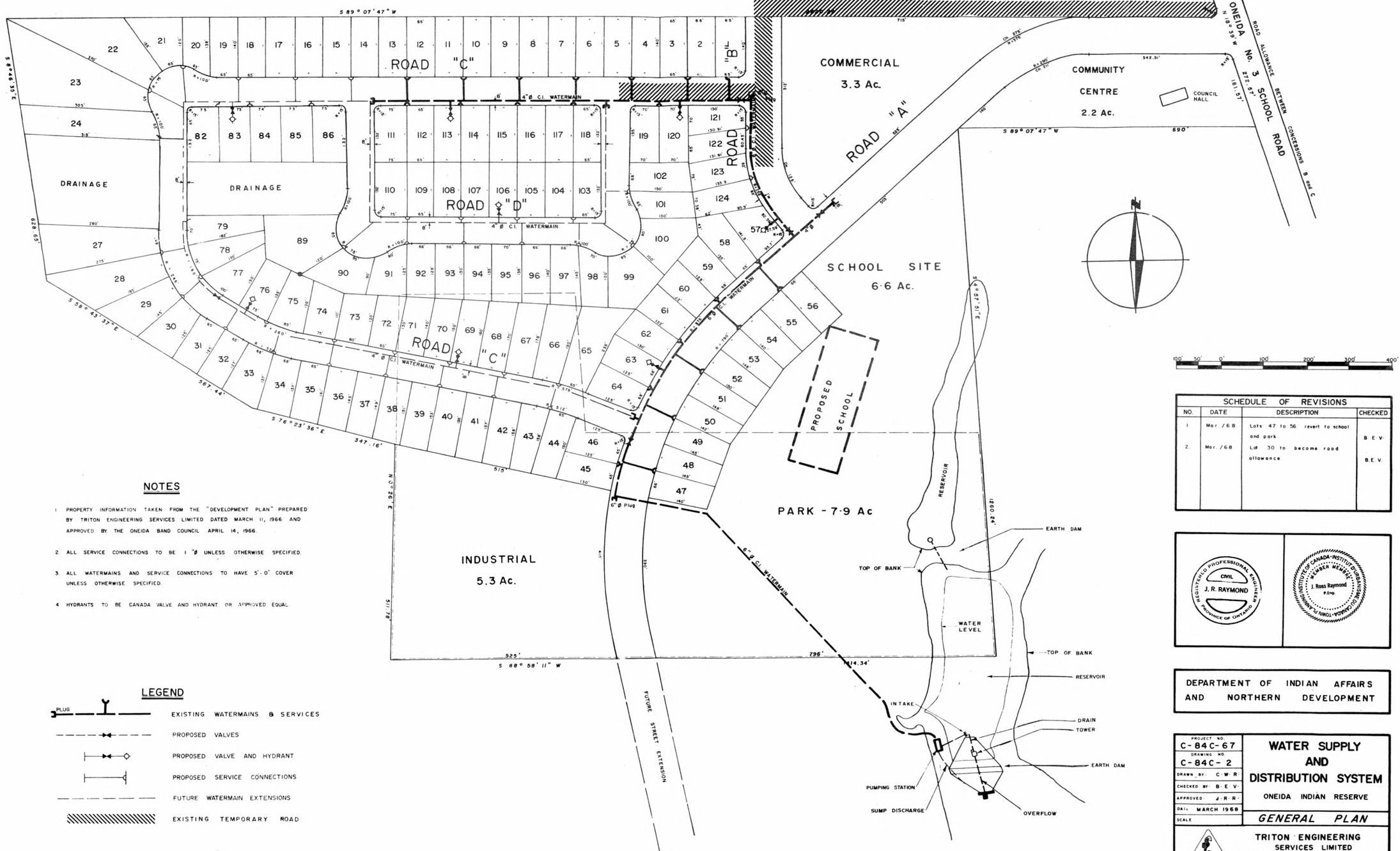
INSTITUTE OF CANADA-INSTITUT D'URBANISME DU CANADA-TOWN PLANNING — MEMBER MEMBRE — J. Ross Raymond P.Eng.

DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT

PROJECT NO. C-84C-67	STORM SEWERS
DRAWING NO. C-84C-1	
DRAWN BY C·W·R·	ONEIDA INDIAN RESERVE
CHECKED BY B·E·V·	
APPROVED J·R·R·	GENERAL PLAN
DATE MARCH, 1968	
SCALE	

TRITON ENGINEERING SERVICES LIMITED
CONSULTING ENGINEERS and TOWN PLANNERS
BRAMPTON ORANGEVILLE

FIGURE 2



NOTES

1. PROPERTY INFORMATION TAKEN FROM THE "DEVELOPMENT PLAN" PREPARED BY TRITON ENGINEERING SERVICES LIMITED DATED MARCH 11, 1966 AND APPROVED BY THE ONEIDA BAND COUNCIL APRIL 14, 1966.
2. ALL SERVICE CONNECTIONS TO BE 1 "ø UNLESS OTHERWISE SPECIFIED.
3. ALL WATERMAINS AND SERVICE CONNECTIONS TO HAVE 5'-0" COVER UNLESS OTHERWISE SPECIFIED.
4. HYDRANTS TO BE CANADA VALVE AND HYDRANT OR APPROVED EQUAL.

LEGEND

- EXISTING WATERMAINS & SERVICES
- PROPOSED VALVES
- PROPOSED VALVE AND HYDRANT
- PROPOSED SERVICE CONNECTIONS
- FUTURE WATERMAIN EXTENSIONS
- EXISTING TEMPORARY ROAD

SCHEDULE OF REVISIONS

NO.	DATE	DESCRIPTION	CHECKED
1	Mar./68	Lots 47 to 56 revert to school and park	B.E.V.
2.	Mar./68	Lot 30 to become road allowance	B.E.V.

REGISTERED PROFESSIONAL ENGINEER — CIVIL — J. R. RAYMOND — PROVINCE OF ONTARIO

ASSOCIATE OF CANADA · INSTITUT DU BARREAU CANADIEN — MEMBER MEMBRE — J. Ross Raymond P.Eng.

DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT

PROJECT NO.	C-84C-67
DRAWING NO.	C-84C-2
DRAWN BY	C.W.R.
CHECKED BY	B.E.V.
APPROVED	J.R.R.
DATE	MARCH 1968
SCALE	

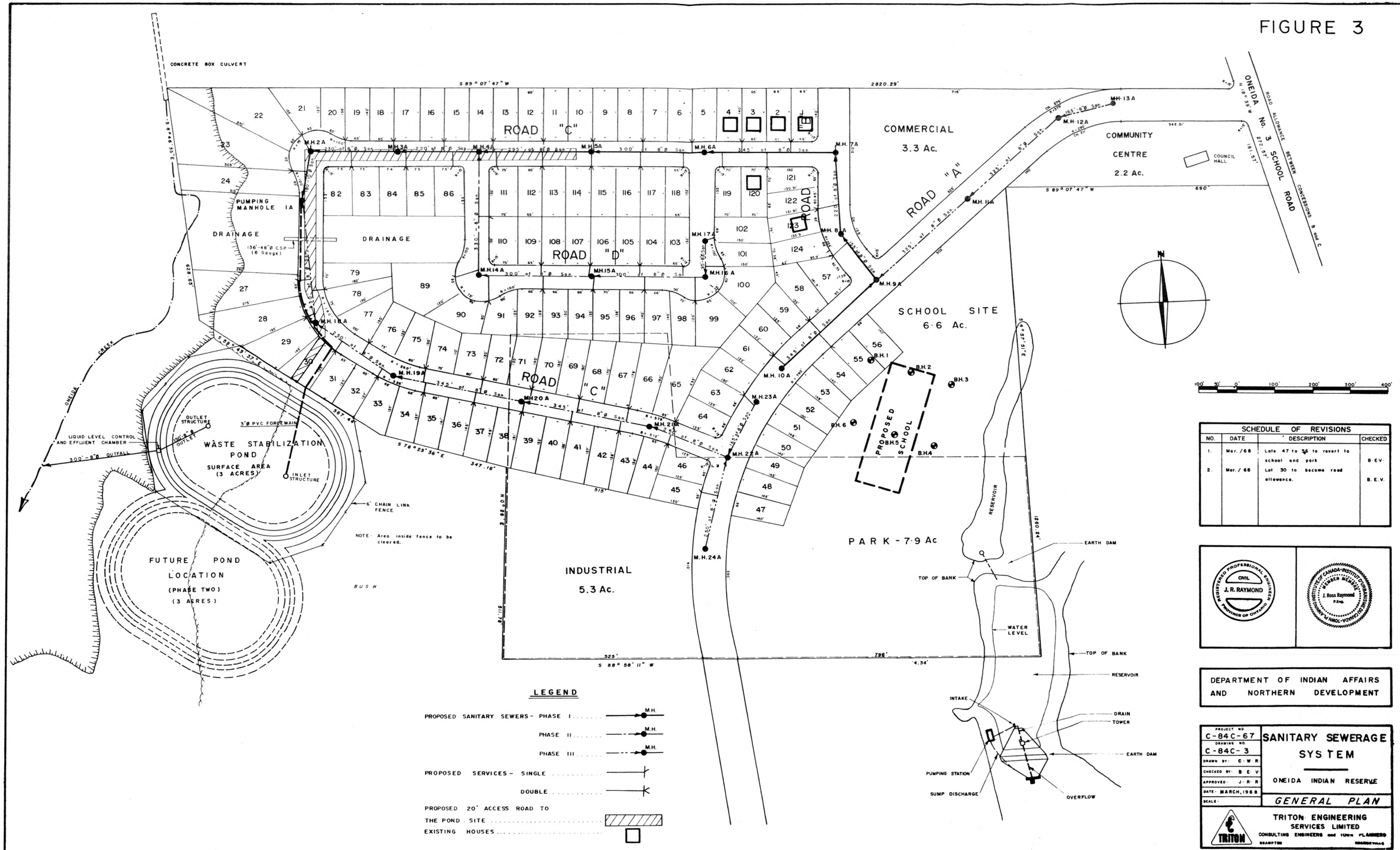
WATER SUPPLY AND DISTRIBUTION SYSTEM

ONEIDA INDIAN RESERVE

GENERAL PLAN

TRITON ENGINEERING SERVICES LIMITED
CONSULTING ENGINEERS and TOWN PLANNERS
BRAMPTON ORANGEVILLE

FIGURE 3



LEGEND

PROPOSED SANITARY SEWERS - PHASE I ..... M.H.

PHASE II ..... M.H.

PHASE III ..... M.H.

PROPOSED SERVICES - SINGLE .....

DOUBLE .....

PROPOSED 20' ACCESS ROAD TO THE POND SITE .....

EXISTING HOUSES .....

SCHEDULE OF REVISIONS

NO.	DATE	DESCRIPTION	CHECKED
1.	Mar./68	Lots 47 to 56 to revert to school and park	B.E.V.
2.	Mar./68	Lot 30 to become road allowance.	B.E.V.

REGISTERED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO — CIVIL — J. R. RAYMOND

INSTITUTE OF CANADA — MEMBER — J. Ross Raymond P.Eng.

DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT

PROJECT NO. C-84C-67	SANITARY SEWERAGE SYSTEM
DRAWING NO. C-84C-3	ONEIDA INDIAN RESERVE
DRAWN BY: C.W.R.	GENERAL PLAN
CHECKED BY: B.E.V.	
APPROVED: J.R.R.	
DATE: MARCH, 1968	
SCALE:	

TRITON ENGINEERING SERVICES LIMITED
CONSULTING ENGINEERS and TOWN PLANNERS
BRAMPTON