CITY OF BELLEVILLE

REPORT

ON

PROPOSED SEWAGE TREATMENT PLANT

AND

INTERCEPTING SEWERS

GORE & STORRIE
CONSULTING ENGINEERS
TORONTO
ONTARIO

March 12th, 1945.

GORE & STORRIE
CONSULTING ENGINEERS
CHARLES-BAY BUILDING
1130 BAY STREET
TORONTO 5

WILLIAM STORRIE
NORMAN G. McDONALD
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JOHN W. ARGO
JOHN G. POWELL

WATER WORKS
SEWAGE DISPOSAL
MUNICIPAL AND
INDUSTRIAL ENGINEERING
POWER PLANTS

DESIGN CONSTRUCTION
SUPERVISION OF OPERATION
REPORTS VALUATIONS
ARBITRATIONS

CITY OF BELLEVILLE

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AND

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LETTER OF TRANSMITTAL

To His Worship Mayor Frank F. Follwell
and Members of Council
of the City of Belleville, Ontario.

Gentlemen: Re. Proposed Sewage Treatment Plant and Intercepting Sewers

In accordance with the instructions contained in an agreement between the City of Belleville and ourselves we have made the necessary surveys and studies on the matter of Sewage Treatment and Intercepting Sewers and now beg to submit herewith our report.

The report covers in detail the various aspects of the problem leading up to the necessity for the construction of intercepting sewers and a sewage treatment plant. Detailed reference is made to the various matters referred to in the agreement and as a result we submit the following for your information.

Conclusions

The conclusions arrived at are as follows:-

1. Since 1939 the population of the City has increased by 1,289 persons or 8.8 per cent; substantial reductions have been made in the tax rate and the outstanding debenture debt.

2. The existing system of sewers consists of what is known as the separate system, that is to say, sanitary sewage is conveyed in one sewer and storm water in another sewer.

3. The sanitary sewers are of adequate size to carry the sanitary sewage alone, but roof water from about 25 per cent of the buildings has been allowed to enter the sanitary sewers instead of being discharged to the storm sewers. This has caused cellar flooding in many locations.

4. The storm sewers discharge directly into the Moira River or the Bay. There is no available plan to show the sizes and grades of the individual storm sewers and in general very little information is available of the storm sewer system as a whole.

5. The sanitary sewers vary from 8 inches to 21 inches in diameter with a total length of approximately 28 miles. There is no sewer system in what is known as Foster Ward.

6. The water consumption during 1944 amounted to 2,593,000 gallons per day. The large industries and the Canadian National Railway used 916,000 gallons per day leaving a balance of 1,677,000 gallons per day for domestic consumption.

7. The daily average sanitary sewage flow may be taken as 2,000,000 gallons with a maximum rate of 3,000,000 and a minimum rate of 1,000,000 gallons per day.

8. The sanitary sewage from the City discharges into the Moira River without treatment of any kind resulting in objectionable conditions such as odours and a menace to bathing beaches on the Bay, particularly those east of the Moira River.

Recommendations

As a result of our studies we make the following recommendations.

1. A plan should be prepared of the existing system of storm sewers including location, size and grade of each sewer.

2. That steps be taken to reduce the amount of roof and surface storm water allowed into the sanitary sewers to prevent flooding and that ultimately all storm water be excluded from the sanitary sewers.

3. That a sewage treatment plant of the complete type be constructed on the Bay front on the easterly side of George Street having a capacity of 2,250,000 gallons per day average sanitary sewage flow.

4. That the sewage treatment plant have a capacity such as will give complete treatment to 1-3/4 times the average sanitary flow and partial treatment to 4-1/3 times the average sanitary flow. All flows in excess of 4-1/3 times the average sanitary flow will have to be discharged without treatment to the river or bay.

5. That a system of intercepting sewers be constructed as shown on the accompanying plan to collect all sewage at present being discharged into the river and also construct the necessary pumping station.

6. That a system of sewers with pumping station be constructed in the Foster Ward area, at an estimated cost of $74,500.00

7. That the separate system of sewers now established be continued, the sanitary sewer system being used to carry only sanitary sewage and the storm sewer system all storm water from the streets, lands and buildings.

Estimated Costs

In estimating the costs of the work herein recommended no allowance has been made for acquiring whatever land and rights-of-way may be found necessary. The details for each item recommended are given in the report. Summarizing the various items we get the following estimated costs:-

1. Construction Cost

(a) Intercepting sewers, pipe across river, short connecting sewers, etc.....	$ 93,000.00
(b) Pumping station at Moira River including pumping equipment, etc.....	24,000.00
(c) Sewage treatment plant complete in every respect including outlet into Bay of Quinte...	250,000.00
Total estimated cost of construction	$367,000.00

2. Annual Costs

(a) Maintenance and operation.....$11,000.00

(b) Debt charges based on 20 year debentures at 3 per cent per annum on $367,000.00..... 24,670.00

Total estimated annual cost.....$35,670.00

These annual charges will mean an increase of approximately 3 mills on the tax rate.

Acknowledgement

We wish to acknowledge with appreciation the cordial assistance received from your City Engineer, Mr. Charles A. Mott, and to all others who furnished us with information and aided us in our studies.

If we can be of further assistance in this matter or if Council requires further information concerning the report we trust you will communicate with us. Should Council wish to discuss this matter with us then we will be glad to do so at any time that may conveniently be arranged.

All of which is respectfully submitted.

GORE & STORRIE,

William Storrie

Consulting Engineers.

March 12th, 1945.

REPORT

To His Worship Mayor Frank F. Follwell,
and Members of Council
of the City of Belleville.

Gentlemen: Re. Proposed Sewage Treatment Plant and Intercepting Sewers

Under date of April 24th, 1944, an agreement was entered into between the City of Belleville and ourselves whereby we were called upon "to have a survey made of the existing system of sewers in the City of Belleville and recommendations made for extending same and constructing a sewage treatment plant for the Corporation".

Since then your City Engineer has furnished us with a contour plan of the municipality showing the levels of the ground throughout the area to be dealt with and plans showing the location, size and elevations of all existing sanitary sewers including the location of all manholes with invert and top of manhole cover elevations.

The agreement calls for our making a complete study of the whole situation and to submit a detailed report together with whatever plans may be necessary covering the following:-

1. The adequacy or otherwise of the existing sewer system.
2. The use of a combined or separate system of sewers.
3. Recommendations as to the design and construction of sewers in the future.

4. Main intercepting sewers required to collect sewage from existing sewers, including location, size and grades.

5. The necessity for constructing a sewage treatment plant or plants and the degree of treatment recommended.

6. Estimates of cost of the various works recommended to be constructed in the near future and annual cost for operation and capital charges.

Having made a detailed study of the whole situation we now submit our report.

Population and Water Consumption

The population of the City has been steadily increasing for many years and at the end of 1944 is said to be 15,967 persons. The following table shows over a period of years the population, average daily consumption of water and the daily per capita consumption of water. In studying the figures it is to be noted that the City's water purification plant was placed in operation in 1931.

Year	Population	Average Daily Water Consumption in Gallons	
		City	Per Capita
1910	10,012	1,346,000	134
1915	12,620	1,548,000	123
1920	12,240	1,742,000	143
1923	12,244	2,631,000	215
1926	12,798	3,080,000	241
1928	13,267	2,410,000	182
1930	13,267	2,643,000	199
1931	13,443	2,472,000	184
1932	13,914	2,191,000	157
1933	14,059	1,808,000	129
1934	14,012	2,315,000	165
1935	13,899	2,032,000	146
1936	14,578	2,274,000	156
1937	14,764	2,161,000	146
1938	14,589	2,142,000	147

Year	Population	Average Daily Water Consumption in Gallons City	Per Capita
1939	14,678	2,141,000	146
1940	14,876	2,186,000	147
1941	15,311	2,434,500	159
1942	14,969	2,465,000	165
1943	15,624	2,654,000	169
1944	15,967	2,596,000	163

In certain municipalities in Ontario the population has increased as much as 35 per cent during the war period. In most cases there will likely be a sudden reduction once the war is over with a tendency to return to pre-war populations.

The population increase in Belleville since 1939 has been 1,289 or 8.8 per cent. It would appear reasonable to assume that the Belleville population will not go back to any extent and certainly not in the same degree as will undoubtedly occur in many municipalities where there has been a large increase in population during the last five years.

Assessment, Tax Rate, Etc.

Since 1937 the total assessment, tax rate, etc. has been as follows:-

Year	Total Assessment	Tax Rate Mills	Total Debt Amount	Total Debt Per Capita	Taxable Annual Debt Charges	Annual Tax Levy Amount	Annual Tax Levy Per Capita
1937	$10,148,460	49.9	$2,913,139	$200.08	$ -	$594,714	$40.85
1938	10,224,108	46.5	2,791,658	191.35	243,305	561,791	38.51
1939	10,260,653	45.5	2,606,445	177.57	241,010	531,212	36.19
1940	10,453,736	41.5	2,311,144	155.36	230,229	480,712	32.31
1941	10,581,253	38.5	1,887,902	125.85	189,102	454,975	30.33
1942	10,882,102	37.1	1,637,217	109.40	167,325	451,231	30.14
1943	11,049,415	37.0	1,490,850	95.29	160,326	454,843	29.08
1944					144,949		
1945					134,012		

Year	Total Assessment	Tax Rate Mills	Annual Tax Levy Amount	Annual Tax Levy Per Capita	Taxable Annual Debt Charges
1946					$125,604
1947					120,642
1948					117,787
1949					116,786
1950					100,581
1951					90,723
1952					76,451
1953					74,253

The data in the foregoing table has been taken from the Annual Reports issued by the Ontario Department of Municipal Affairs entitled "Municipal Statistics". The figures given must be considered as approximations only but are near enough to indicate the substantial reduction in tax rate and outstanding debenture debt that has taken place over the period indicated and the annual debt charges that have to be met during the next 9 years.

Topography

The City is situated on both sides of the Moira River leading to the Bay of Quinte, about 40 per cent of the population residing in the valley of the river. The area of the City excluding the river and bay is about 1,485 acres. On both sides of the valley the ground rises to a maximum elevation of about 80 feet above the normal water level of the bay. The topography is such that there is a definite slope toward the Moira River and the Bay of Quinte and surface water as well as sanitary sewage can be drained without difficulty to the river and the bay.

Existing Sewer System

There are two separate sewer systems in use in the City. The original sewer system carries all the sanitary sewage as well as the storm water drainage from about 25 per cent of the roofs. The other system carries the storm water drained from the roadways as well as from the roofs of a number of the larger buildings.

On the west side of the river there are three trunk sewers in the sanitary system, a 20 inch on Coleman Street, a 21 inch on King and Everett Streets and a 15 inch on Dundas Street leading to a junction chamber on the west bank of the river at Dundas Street which is just north of the Canadian Pacific Railway. At this junction chamber the sewage discharges directly into the river.

On the east side of the river there are two 20 inch trunk sewers, one on Front Street and the other on Dundas Street. These sewers join in a manhole at the bank of the river and discharge through a 24 inch pipe laid in the river to a point on the south side of the Canadian Pacific Railway bridge.

The populated areas within the City are fairly well served with sanitary sewers with the exception of the Foster Ward where no sewers have been constructed.

On the west side of the Moira River there are storm sewers on Bridge, Catherine, Moira and North Front Streets as well as on parts of Yeomans, Commercial and Cedar Streets. The storm sewers discharge directly into the river. On the east side of the river there are storm sewers on all but a few streets, the storm water being discharged directly to either the river or the bay.

There is no available plan of the storm sewer system to show the sizes and grades of the individual sewers.

The lengths of the various sizes of sewers making up the sanitary sewer system are as follows:-

Size Inches	Length Miles
8	7.22
9	9.75
10	5.40
12	2.06
15	1.31
18	0.84
20	1.12
21	0.37
Total	28.07

Quantity of Sanitary Sewage

The quantity of sanitary sewage varies throughout the day reaching a maximum in the forenoon and a minimum in the early hours after midnight. The quantity varies approximately with the water consumption after deducting the quantity of water which is used for lawns, gardens and in industries in which the water does not reach the sewers.

The average water consumption of the City for the year 1944 was 2,596,000 gallons per day and for the month of October in which there would be practically no water used on lawns or gardens nor any taps left running to avoid freezing the average water consumption was 2,593,000 gallons per day. During this month the Canadian National Railway used an average of 531,000 gallons per day and other large industries used an additional 385,000 gallons per day. The balance of 1,677,000 gallons per day is made up of the

domestic consumption, the leakage from the system and the use of water for flushing sewers and other such purposes. As the water taken by the Canadian National Railway is not returned to the sewers the sewage flow is estimated to be 100 gallons per capita per day plus the water used by the industries and ground infiltration into the sewers.

The sanitary sewage for the various sections of the City indicated on Plan No. 1, accompanying this report, is estimated as follows:-

Section	Population	Water Consumption Gallons	Industrial Wastes Gallons	Total Sanitary Sewage Gallons
West side of River Areas F, G, and H	6,235	623,500	57,000	680,500
East side to George Street, Areas A and B	4,156	415,600	152,000	567,600
George Street and eastwards, Areas C and D	4,418	441,800	151,000	592,800
Foster Ward south of Dundas Street, Area E	1,158	115,800	-	115,800
Totals -	15,967	1,596,700	360,000	1,956,700

For the present population the sanitary sewage may be considered to be 2,000,000 gallons per day with a maximum rate of 3,000,000 and a minimum rate of 1,000,000 gallons per day. The water discharged from roofs during heavy storms would probably amount to a rate of 100,000,000 gallons per day based on a rainfall at a rate of 2 inches per hour. Assuming that 25 per cent of the roofs are connected to the sanitary sewer system the flow of storm water into these sewers would be approximately 25,000,000 gallons per day, or 12½ times the amount of sanitary sewage. Such rates of flow will

of course only occur over the length of time of the storm and rarely for more than 30 minutes.

The infiltration of ground water into the sanitary sewer system depends to some extent upon the water level in the river but observations indicate that this would not exceed about 500,000 gallons per day.

Capacity of Existing Sewer System

The sanitary sewers throughout the City are capable of carrying the sanitary sewage and the infiltration water at all times but many such sewers are not capable of carrying the storm water discharged from the roofs of buildings which are now connected to them.

On the west side of the river the trunk sewers on Coleman, King and Dundas Streets have capacities of 4.27, 4.2 and 1.4 million gallons per day respectively, a total combined capacity of 9.87 million gallons per day. This capacity is sufficient to carry the sanitary sewage and the storm water from the roofs now connected except during extremely heavy storms.

On the east side of the river the Front Street sewer has a capacity of about 5.35 million gallons per day which is only about 50 per cent of the capacity required to carry the sanitary sewage and storm water from the roofs connected to it during extremely severe storms. The Dundas Street sewer has a capacity of 4.8 million gallons per day which is about 50 per cent of the capacity required for the sanitary sewage and the storm water from the connected roofs. The grades of this sewer from Charles Street to George Street are

very flat, in fact the portion of the 15 inch pipe between Charles Street and Anne Street slopes in the wrong direction and the carrying capacity of this sewer at William Street is only 1.2 million gallons per day or about 20 per cent of the combined sanitary sewage and roof water connected to it.

As the sizes and grades of the storm sewers are not available the capacity of this system cannot be estimated.

Sewage Treatment

At the present time the sewage from the City discharges into the Moira River at Dundas Street and due to the low current the solids settle out and form sludge banks on the bottom of the river and the floating matter collects in the many small inlets along the shore and in the marshy lands causing odours and unsanitary conditions.

The flow in the Bay of Quinte is in general in an easterly direction but following prolonged periods of strong easterly winds and low flows in the Trent and Moira Rivers the current may be reversed and the waters of the bay flow westerly through the Murray Canal. The mixing of lake and river waters carried by current reversals is indicated by the variations in hardness of the water entering the water works intake. During periods in which the current is reversed some of the polluted waters from the mouth of the Moira River may be carried through the bay bridge to pollute the waters adjacent to the water works intake.

The vegetable growth within the bay is somewhat extensive and while this is not caused by sewage pollution the growth is undoubtedly promoted by the organic matter discharged into the

bay by the City, the Town of Trenton, military camps and other sources. This organic matter serves as plant food and together with the high water temperatures during the summer months causes favourable conditions for vegetable growth resulting in the objectionable tastes which occur from time to time in the water supply.

Under present conditions the waters of the Moira River and the Bay of Quinte in the neighbourhood of the City east of the bay bridge are unsuitable for bathing because of the presence of raw sewage.

The conveyance of wastes by means of flowing water in sewers is a sanitary and economical method but those wastes should be removed from the water by some form of sewage treatment before they are discharged into the receiving body of water. There are various forms of treatment but the type required depends upon the degree to which the wastes are to be removed and the desired quality of the effluent. For discharge into any part of the Great Lakes System a high degree of treatment is required because of the great number of water supplies being taken from these lakes. The conditions in the Bay of Quinte are less favourable than in the open lake and a treatment plant capable of removing 85 to 90 per cent of the suspended solids and biochemical oxygen demand of the sewage is necessary. Such a degree of treatment can most economically be obtained by means of a plant embodying biological treatment such as the activated sludge system or by sprinkling filters.

The most suitable location for a sewage treatment plant is on the bay shore on the easterly side of George Street. If there was no storm water getting into the sanitary sewer system the

whole flow in these sewers would be conveyed to and passed through the sewage treatment plant. It is apparent, however, that it would be uneconomical to construct intercepting sewers, pumping station and a sewage treatment plant sufficiently large to treat all the roof water and it is recommended that only 4-1/3 times the average sanitary flow be taken to the sewage treatment plant and given preliminary treatment and that only 1-3/4 times the sanitary sewage flow be given complete treatment. All flows in excess of 4-1/3 times the sanitary sewage flow will have to be discharged into the river or bay. The cost involved in treating the total sanitary and storm flows would be prohibitive.

Extensions to the Sewer System

The sewage treatment plant will have to be constructed sufficiently high above maximum water level in the bay, Elevation 248, Belleville datum, to permit of the discharge by gravity of the effluent The elevations of the inverts of the sewers at the manholes at the discharge ends are from 6 to 8 feet below high water level in the bay and it will therefore be necessary to pump the sewage from this point to the treatment plant. The easterly part of the City is, however, sufficiently high that all the sewage from George Street and eastwards as far north as Pine Street, (Areas C and D on the accompanying plan), will flow by gravity to the sewage treatment plant site. The sewage from the west side of the river will have to be taken through a pipe laid under the river to the east side and a pumping station and discharge main constructed to deliver this sewage to the treatment plant along with that from the easterly part of the City to, but not including, George Street, (Areas A and B on the plan).

As previously stated about 25 per cent of the buildings discharge storm water from the roofs into the sanitary sewer system. Several of the sewers are not large enough to carry this increased flow and flooding results during heavy storms. The flooding of sanitary sewers is most objectionable because the sewage backs up into the cellars and does considerable damage in addition to creating unsanitary conditions. To avoid such flooding either additional sewers will have to be constructed or the quantity of roof water will have to be reduced. It does not seem reasonable to construct additional sewers and provide additional capacity in the pumping station and treatment plant to take care of the additional amount of clear water discharged from roofs. It would be more economical to reduce the roof water entering the sanitary sewers to the extent that the total flow would be within the capacity of the sewers and flooding would be eliminated. This can be done by installing new roof drain connections to the storm sewers.

In future no person should be permitted to install a drain connection to discharge roof water into the sanitary sewer system. The diverting of roof water connections to the storm sewers and the reduction of roof water now getting into the sanitary system should be started on the streets on which the worst flooding occurs. On Station Street all roof water should be eliminated and discharged directly into the river and on Front Street the roof area drained to the sanitary sewer should be reduced to 160,000 square feet or less.

In the area west of the river, marked "G" on the plan, the roof water should be reduced about 20 to 25 per cent while in areas marked "C" and "D", George Street and eastwards, from 60 to 75 per cent of the roof water should be diverted. Over the whole

City from 300 to 400 connections would have to be made to divert the drainage of roof water from the sanitary to the storm sewers in order to reduce the total flow in the sanitary sewers to the extent that cellar flooding will be eliminated.

The reduction of the amount of roof water getting into the sanitary sewer system should be continued over a period of years until the maximum flow is reduced to the capacity of the sewers and pumping station, thus making it unnecessary to overflow any untreated sewage into the river or bay.

The estimated sanitary sewage flow to the pumping station is approximately 1,250,000 gallons per day and the pumping station should therefore have a capacity of 4-1/3 times this amount or approximately 5,410,000 gallons per day. The estimated quantity of sanitary sewage from the area George Street and easterly, (Areas C and D on the plan), is 593,000 gallons per day average, or allowing a maximum of 4-1/3 times the average the flow to be provided for would be 2,600,000 gallons per day. The capacity of the Dundas Street sewer west of Charles Street is only 2 million gallons daily and therefore a new intercepting sewer will have to be constructed to carry the extra flow. This sewer should be 12 inches in diameter running from Dundas Street southerly on Newberry Street and 15 inches in diameter along the railway to George Street. The sewage flow should be intercepted on Bridge Street and diverted down George Street by the construction of a short connecting sewer. Also, the sewage flow on the east end of Pine Street which now flows northerly into the Station Street and Front Street sewer should be diverted southwards along Bleecker Street. A short 8 inch connection should also be made on Dufferin Street from Bridge Street southerly to the

first manhole. On Church Street at Bridge Street a short connection should be made to divert the sewage down Church Street to Dundas Street. At the south end of Bleecker Street the sewer has insufficient capacity and an additional sewer 12 inches in diameter should be constructed.

A trunk sewer will be required on George Street from Dundas Street to the sewage treatment plant. From Dundas Street to the south side of the Canadian Pacific Railway a 12 inch sewer with a capacity of 2.7 million gallons daily will be required and from this point to the sewage treatment plant a 30 inch sewer with a capacity of over 8 million gallons daily.

To serve the Foster Ward, Area E, 9 inch sewers will be required on each street with a 9 inch connection at the lower ends of the streets flowing to a pumping station at the sewage treatment plant site. The easterly section of this ward can be served by the laying of a 9 inch sewer on St. Paul Street discharging into the 9 inch sewer on George Street with branch sewers on Foster Avenue and Franklin Street. Sewage from the plant of Mead Johnson should be discharged to Franklin Street or pumped into the Dundas Street sewer. The sewage from the Stephens Adamson plant will have to be pumped to the Franklin Street sewer. Sewage from Reliance Industries should be pumped to the Dundas Street sewer. In short all septic tanks discharging into the bay should be eliminated and sewage discharged to sewers.

On the plan accompanying this report we have indicated a layout of sanitary sewers in the Foster Ward. The estimated cost of constructing 9 inch diameter sewers on Front, Pinnacle, Church,

John, St. Paul and George Streets together with a pumping station near the proposed sewage treatment plant is $74,500.00. It is assumed that this part of the programme will not be undertaken for some time to come but we have indicated on the plans how this area should be served.

The sewer crossing the river will have to be laid below the river channel to secure protection from moving ice. The discharge main from the pumping station to George Street will be laid with a minimum of cover on approximately the same grade as the ground surface. This also applies to the sewer on George Street from the railway to the treatment plant as the greater length of these pipes will operate under a slight pressure.

Sewage Treatment Plant

Under present conditions the estimated average sanitary sewage flow is 2,000,000 gallons per day but as the population has been steadily increasing since the year 1900 and since 1910 the average rate of increase has been 176 persons per annum and as this rate is likely to continue or increase in the future, reasonable provision should be made in a sewage treatment plant to take care of future growth. A plant capacity of 2,250,000 gallons per day average sanitary sewage flow should be provided.

The treatment plant would consist of bar racks or screens, grit channels, and sedimentation tanks with a maximum capacity of 8,700,000 gallons per day, and a secondary treatment system, such as activated sludge followed by final sedimentation, with an average capacity of 2,250,000 gallons per day and a maximum capacity of 4,000,000 gallons per day for short periods. The

effluent from the plant should be discharged through an outlet pipe 30 inches in diameter and 1,000 feet in length to a point in the bay where the depth of water is about 8 feet under normal conditions.

The coarse material screened from the sewage would either be ground and returned to the sewage flow or disposed of by burying. The grit removed by the grit channels would have to be taken to a dump and covered with sand. The solids removed from the sedimentation tanks in the form of sludge should be digested in two heated tanks having a total capacity of 50,000 cubic feet and the digested sludge elutriated or washed with water or plant effluent, treated with ferric chloride and dewatered on a vacuum filter. The dried sludge makes a fairly good fertilizer and can be disposed of as such on the farm lands or gardens around the City without causing any offensive odours.

In the digestion process there would be generated about 20,000 cubic feet per day of combustible gas. This gas has a heat value of over 600 B.t.u. per cubic foot and can be utilized for heating the digestion tanks and buildings either by burning under a boiler or in gas engines in which the cooling water for the jackets and exhaust is circulated through coils in the digestion tanks and radiators. The quantity of gas which would be available would be sufficient to supply a gas engine to generate an average of about 50 horsepower or about 50 per cent of the plant requirements. It would therefore be necessary to purchase electrical power from the Public Utilities Commission. Although the cost of electric power in Belleville is exceptionally low it would be economical to install one gas engine to drive either an air compressor or electric generator.

Existing Roof Connections

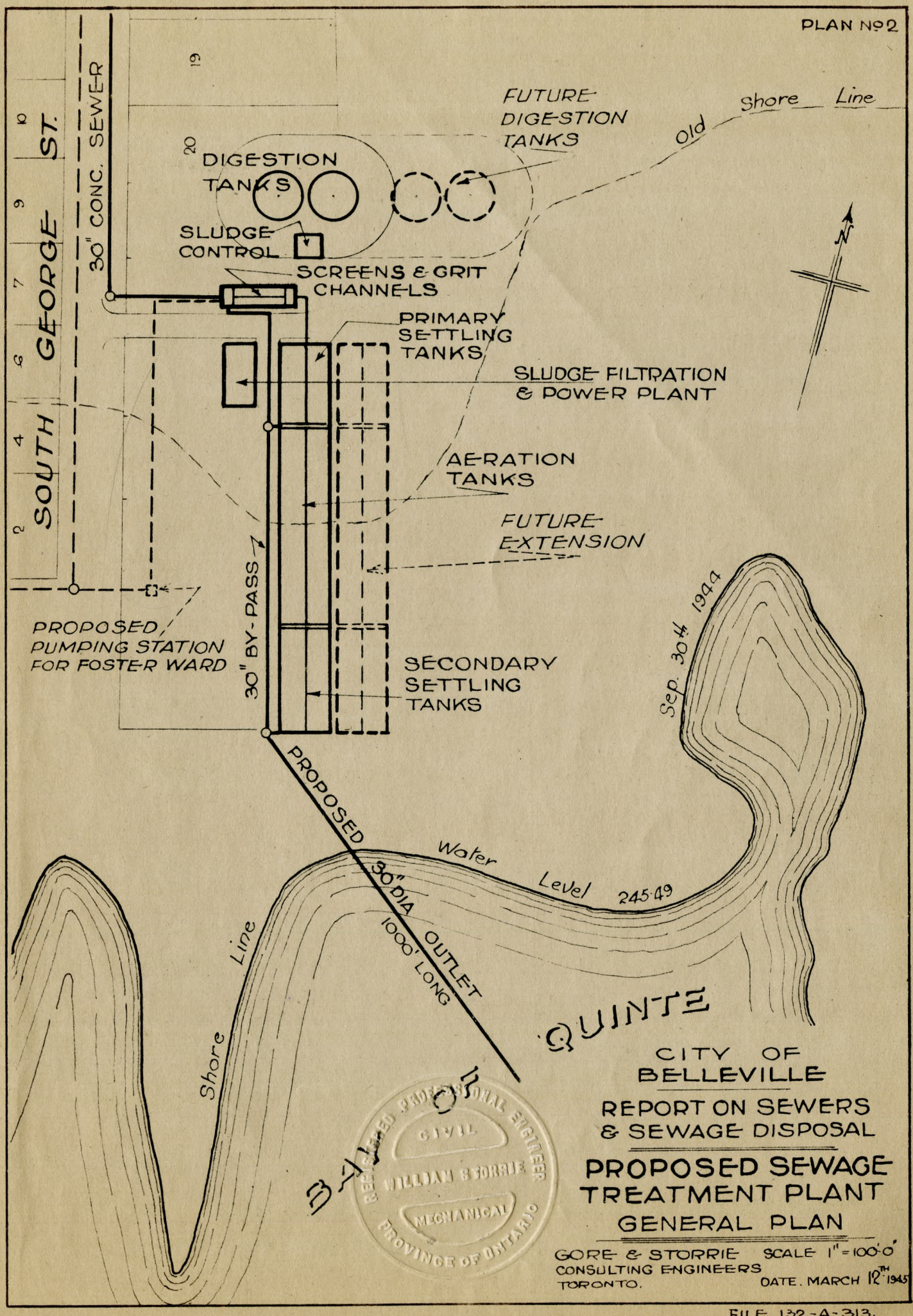
There are from 300 to 400 connections to the sanitary sewers which carry roof water as well as sanitary sewage. A policy of gradually separating the roof drainage from the sanitary house connection should be established. Wherever such connections exist and the street pavement has to be replaced then at such times the change-over should be made. Changing such connections would probably cost $100.00 per house.

Estimated Costs

Under present conditions construction costs vary a great deal on account of the difficulty of securing labour and materials and it is impossible to closely estimate work to be carried out after the war is over. Based on available information the cost of the various parts of the proposed work is estimated as follows:-

Item No.	Description	Estimated Cost
1.	Short connection in the existing sewers at Pine Street and Bleecker Avenue, south end of Bleecker Avenue, Dufferin Street at Bridge Street, George Street at Bridge Street and Church Street at Bridge Street.....	$ 3,400.00
2.	A 12 inch sewer on Newberry Street and a 15 inch sewer along the Canadian Pacific Railway to George Street.....	13,000.00
3.	A pipe across the Moira River at Dundas Street, 18 inches in diameter and a connection from both sides of the river to a proposed pumping station.....	18,000.00
	Carry Forward.....	$ 34,400.00

PLAN No 2



GORE & STORRIE SCALE 1" = 100'-0"
CONSULTING ENGINEERS
TORONTO. DATE. MARCH 12TH 1945

FILE 132-A-313.

Item No.	Description	Estimated Cost
	Brought Forward.....	$ 34,400.00
4.	A pumping station on the east side of the river at Dundas Street with a capacity of 5,400,000 gallons per day and consisting of three pumps each with a capacity of 2,700,000 gallons per day driven by two-speed electric motors automatically controlled.	24,000.00
5.	A discharge main from the pumping station across the railway tracks at Front Street and along the south side of the railway right-of-way to George Street. The first part of this main, about 650 feet, should be of 20 inch cast iron and the balance of the main 24 inch concrete pressure pipe.....	29,000.00
6.	On George Street a 12 inch sewer from Dundas Street to the south side of the railway and a 30 inch concrete pressure pipe from this point to the sewage treatment plant.....	29,600.00
7.	The sewage treatment plant having a normal average capacity of 2,250,000 gallons per day consisting of bar racks, or screens, grit channels, preliminary settling tanks, aeration tanks, final settling tanks, 30 inch outlet into the lake, sludge digestion tanks, elutriation, dewatering equipment and power plant.....	250,000.00
	Total estimated cost.....	$367,000.00

Annual Costs

A large proportion of the annual costs of the above extensions consists of interest and principal payments on debentures. It is expected that interest rates after the war will be comparatively low and if the works are paid for by the sale of 20 year debentures bearing interest at the rate of 3 per cent per annum the annual payments including principal and interest for the period of 20 years will be $24,670.00.

The operating costs consist of electric power purchased from the local Commission, chemicals used in the sludge drying process,

labour for operating the sewage treatment plant and the maintenance and repairs of the sewage treatment plant, pumping station and sewers. The annual operating costs are estimated as follows:-

Item No.	Description	Estimated Cost
1.	Electric power purchased, assuming one gas engine is used	$ 2,100.00
2.	Chemicals, lubricating oil and other supplies	1,000.00
3.	Labour	6,300.00
4.	Maintenance and repairs	1,600.00
	Total estimated annual operating costs	$11,000.00

Combining the annual costs for maintenance and operation with that for debenture debt we get the following:-

Annual cost of maintenance and operation	$11,000.00
Annual cost of debt charges based on 20 year debentures at 3 per cent on $367,000.00	24,670.00
Total estimated annual cost	$35,670.00

These annual costs will mean an increase of approximately 3 mills on the tax rate.

Plans Accompanying Report

The following plans are submitted:-

Plan No. 1 - Existing sanitary sewer system and proposed extensions including intercepting sewers.

Plan No. 2 - Tentative layout of proposed sewage treatment plant.

All of which is respectfully submitted.

GORE & STORRIE.

William Storrie

Consulting Engineers.