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UPGRADING AND REPLACEMENT OF
SEWER AND WATER SYSTEM
CITY OF YELLOWKNIFE
EXECUTIVE SUMMARY

PREPARED FOR:
THE CITY OF YELLOWKNIFE

PREPARED BY:
THE GCG ENGINEERING PARTNERSHIP
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AUGUST, 1984



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File: 163501

August 1, 1984

City of Yellowknife
City Hall
Yellowknife, N.W.T.

ATTENTION: Mr. R. C. Milburn, P.Eng.
City Engineer

Dear Sir:

RE: City of Yellowknife
Central Business District
Upgrading and Replacement of Sanitary Sewer System

Further to our recent conversations we are enclosing twelve (12) copies of the Executive Summary for the above study which incorporate the comments received from the Department of Local Government.

We would be pleased to discuss the report with you as soon as you have had time to review it.

Yours truly

THE GCG ENGINEERING PARTNERSHIP LTD.

K. W. Foster, P.Eng.

KWF/kms

Enc.

SUMMARY AND RECOMMENDATIONS

The City of Yellowknife, the capital of the Northwest Territories, has grown since 1945 from a mining and supply centre with a population of 2,500 to its current population of approximately 12,000 people. In the phases of its development, the community has experienced high and low economic activity which was resulted in a modern northern metropolis with a highly developed central commercial core and pleasant surrounding residential neighbourhoods.

Installation of the municipal services to the Central Business District commenced in 1945. With the rapid growth of this area and the high rise type of development, it has become apparent that some services, particularly the sanitary sewer system, have reached their design capacities and are showing signs of becoming overloaded and are in poor condition. Previous studies on the utilities as submitted to the City in 1977 and 1982 have supported this conclusion.

This report contains the analysis of the problems associated with the sanitary sewer and water lateral systems within the Central Business District and recommends in particular a program of renewal for the whole of the sanitary sewer system.

Water Supply and Distribution System

Water distribution in the Central Business District and surrounding areas mainly comprise of 150mm to 200mm diameter ductile iron supply lines. The Central Business District has experienced a considerable degree of development within the last 10 years, mostly in the form of vertical development. The distribution system as it now exists did not contemplate development of this nature and as a result the demand for fire flows has been increased.

Currently, the City is upgrading the system in the Central Business District and the surrounding areas to reinforce the existing system for the present and future development planned for the areas.

In total, the system appears to be adequate to meet the demands for a population of 20,000. Towards the end of the growth period upgrading of the storage facilities would be required to meet the peak period demands.

Storm Drainage System

Storm drainage facilities in the City are generally limited to the major roadways in the Central Business District with a partial system in the Forrest Park.

The existing system is functional for the present stage of development but will require upgrading in the future for higher run-offs from paved roads, parking lots and buildings, etc.

The difficult terrain and the existing grades of roadways and alleys limits, in some cases, the drainage of the low areas and in four such instances the catchbasins have been connected into the sanitary sewer system (i.e., Block 34 south of Franklin Avenue and the catchbasin in front of the CBC Building on Forrest Drive). All other cross connections that previously existed have now been rectified to flow into the storm drainage system and the elimination of the two remaining cross connections, thereby affording complete separation of the sanitary and storm systems, is currently being investigated.

Sanitary Sewer System

The current liquid waste disposal system comprises of 200 to 250mm diameter laterals transporting effluent into 250 - 300mm diameter gravity collector sewers draining into the Central Business District Lift Station, School Draw Lift Station and Forrest Park Lift Station. These lift stations pump sewage into the Kam Lake Lift Station via the Franklin Avenue trunk sewer from where it is discharged into the Fiddler Lake Sewage Lagoon system for treatment.

The City's original lateral system for the most part comprises of 200mm diameter corrugated metal pipes installed in 1949. The system generally functioned effectively until the mid 1970's when the sewers started to show signs of collapse and corrosion of the pipes was first detected. Since 1976 the City has to date replaced approximately 1,350 metres of these sewers with pipes of similar type and diameter. Also, an underground camera survey of the network was carried out in 1977 and a field inspection program utilising randomly located test pits undertaken as part of this study.

On the basis of the camera survey, the field inspection pits and the City's pipe replacement records it is evident that the sanitary sewer system throughout the study area is in extremely critical condition with the pipes being badly corroded and in imminent danger of collapse. The action of the corrosion is from the outside as well as the inside of the pipe where the protective coating has deteriorated with time. In addition the grades along some sections of pipe are inadequate to meet the flow requirements and the system is exhibiting signs of overloading. The situation has been further aggravated by pipe obstructions at several locations as well as infiltration through the corroded laterals and service connections.

To date the City's Public Works Department has managed to keep the service operational by replacing the collapsed pipe sections, which have occurred and continue to occur in a random manner, with new pipe of similar type and size. However, the maintenance costs in such cases have been high without significant gain in upgrading of the existing system.

The remaining service life of these sewers has been estimated in the time frame of zero to five years. As yet, pipe failures have occurred over relatively short sections and have been repaired without too great an impact or inconvenience. However, because of the critical condition of the pipes throughout the network the potential exists for an immediate collapse of major proportions and should such an event occur the impact on the central area would be extremely serious.

N/S

The material used for the sewer pipes when originally constructed, namely coated corrugated metal pipe, is not normally used for sanitary sewers under the ground conditions encountered in Yellowknife. This type of material could have reasonably been expected to deteriorate over a period of time and would have to be replaced much sooner than if the sewers had been constructed of more conventional materials.

It is therefore recommended that a replacement program for the whole of the core area be implemented immediately and completed within five years.

On this basis and recognizing that the work could not be accommodated in a single construction season it became necessary to formulate a staged program. In developing the most suitable staging arrangement it was necessary to take into account several factors prominent amongst which were:

- the degree and extent of corrosion of the existing pipes,
- flow and operating problems,
- the drainage area of individual sections of the system,
- reasonable workload for each construction season,
- minimization of disruption to traffic movements and functioning of the CBD,
- availability of funding,

Having considered all of the above factors it was determined that a three stage program appeared to offer the best overall arrangement with the work being broken down into three distinct areas as shown on Figure 1.

Area 1 - This area encompassed the high density commercial and residential district and is bound to the north by Franklin Avenue (50th), to the east by 46 Street, to the south by 52 Avenue and to the west by 57 Street.

Area 2 - This area is essentially commercial, institutional and residential and is bounded to the north by 49 Avenue, to the east by 41 Street, to the south by Franklin Avenue (50th) and to the west by 52 Street.

Area 3 - This area is essentially residential and is bound to the north by 51 Avenue, to the east by 51 Street, to the south by transmission line right-of-way and to the west by 57 Street.

It is believed that a rehabilitation program based on the above would permit each stage to be cost effectively constructed in a single construction season with the estimated costs of each phase being as outlined below:

Stage 1	\$2,811,000.00
Stage 2	2,492,000.00
Stage 3	<u>1,775,000.00</u>
TOTAL	<u>\$7,078,000.00</u>

The above costs have been formulated on the basis of using polyethelene pipe for the replacement sewers.

In addition to the above, it is also recommended that where corrugated metal sewers are in service outside the central area an ongoing monitoring program be established to evaluate the condition and performance of these facilities.

The City has experienced some problems with the water mains in the Central Business District and discussions with City Staff has indicated that the problem relates to the joints of the watermain where bolts have been deteriorating. Since, generally, the sewer and watermains in this area are laid in parallel it would be possible to review the condition of these watermain joints by widening the sewer excavation during the reconstruction works. Defective bolts could be replaced at that time and providing that the pipe material of the watermains proves to be sound these repairs should not exceed \$1,000,000.

City of
Yellowknife

**CENTRAL BUSINESS
DISTRICT
SEWER REPLACEMENT
STUDY**

**ULTIMATE
SEWER SYSTEM
2001**

- SANITARY SEWERS TO BE REPLACED
- STAGE 1
- STAGE 2
- STAGE 3

FIGURE 1

NOTE:
ALL PROPOSED SANITARY SEWERS
ARE 250 # UNLESS SHOWN OTHERWISE.

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