

SANITARY SEWER MAINTENANCE REHABILITATION & EXPANSION PLAN



City of Champaign

**ENGINEERING & DEVELOPMENT
SERVICES DIVISION**

July, 1990

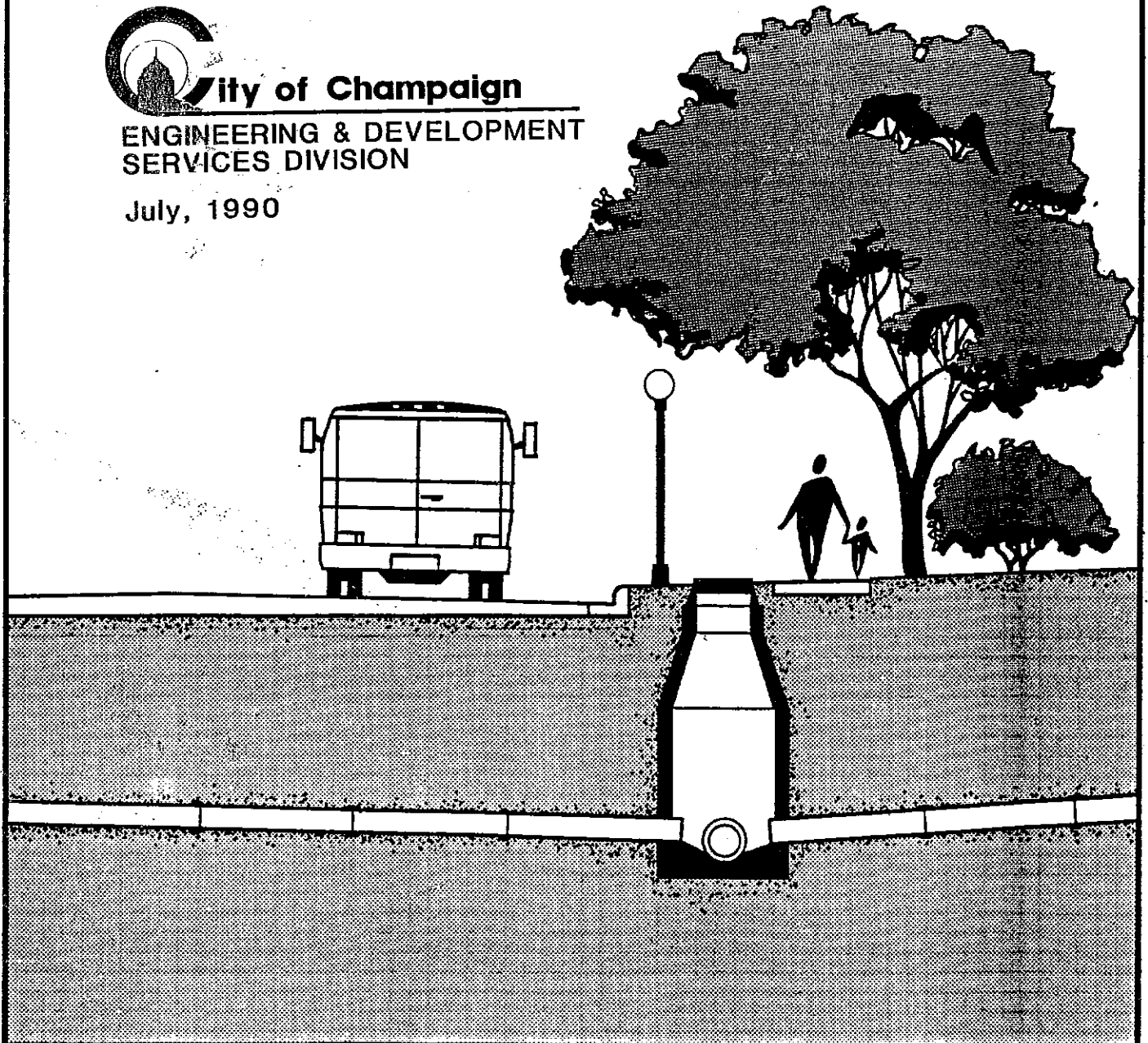


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I. INTRODUCTION

A. General

The purpose of this report was to develop a plan to maintain, expand and rehabilitate the City's sanitary sewer system. The plan was developed by establishing goals for each program (maintenance, rehabilitation and expansion), comparing the existing programs to the stated goals and developing alternatives to correct the identified deficiencies in the existing programs. However, prior to establishing the individual program goals for the maintenance, rehabilitation and expansion programs, the purpose of the sanitary sewer system and the expected service levels for the sewer system had to be defined. Currently, the City doesn't manage its sewer system with defined levels of service. The lack of defined service levels makes it very difficult to establish goals and judge performances for the individual programs.

B. Purpose & Level of Service

The purpose of the City's sanitary sewer collection system is to transport all wastewater generated by residential, commercial, and industrial properties located within the City's corporate limits to the Urbana & Champaign Sanitary District's interceptor sewer system. The City shall accomplish this purpose by providing the following level of service for the City's sanitary sewer system.

1. The City's sanitary sewer system shall be maintained at a level that eliminates public health hazards and causes minimal service interruptions to users. The City shall be responsible for performing preventive maintenance on the sanitary sewer system to remove and identify problems in the sewer system before they cause backup and surcharging in the sanitary sewer system. The City shall be responsible for aggressively eliminating all existing and future health hazards in the sanitary sewer system.
2. The City's sewer system shall be rehabilitated to a level that protects the finite capacity of the sewer system and the City's capital investment in the sewer infrastructure. The City shall be responsible for identifying, prioritizing and implementing solutions for identified structural problems within the sanitary sewer system. The City shall be responsible for making reasonable efforts to identify, evaluate, and eliminate infiltration/inflow from the City's sanitary sewer system.
3. The City shall identify expansion needs for the City's sanitary sewer system before they affect the service levels of the sewer system. The City shall be responsible for identifying undercapacity sanitary sewers in the collection system and determining the affects that future development will have on the existing sanitary sewer system.
4. The City shall manage all maintenance, rehabilitation, and expansion activities efficiently to provide a cost effective

utility to City residents and to maximize benefits to the user. The City shall be responsible for establishing the management programs to account for cost, inventory the system, and establish a historical database for the sewer utility.

5. The City shall provide a uniform sanitary sewer service to all Champaign citizens. The City shall be responsible for identifying those areas within the City which are currently not served by the City's sewer system. This shall include areas served by septic tanks and areas served by privately maintained sanitary sewer with multiple users. The City shall be responsible for assisting these potential users in acquiring City maintained sanitary sewer service. This doesn't mean that potential users will not be required to pay their fair share for sanitary sewer service but rather the City shall be proactive in trying to eliminate unsewered or privately sewerred areas within the City's corporate limits.
6. The City shall handle all service requests promptly, fairly and courteously. The City shall be responsible for establishing the necessary programs to insure that all service requests are completed in this manner.

C. Existing Sewer System

The City is responsible for maintaining the lateral sewers (typically 6" and 8" in diameter) located within their right-of-way and within dedicated easements. The Urbana & Champaign Sanitary District (UCSD) is responsible for maintaining the interceptor sewer system (typically 10" and larger in diameter sewers) throughout the City. The resident is responsible for maintaining their sewer service line (typically 4" in diameter) from their building to the City's or UCSD sewer.

The City's collection system consists of approximately 870,733 feet of sanitary sewer, 3,477 manholes and 258 cleanouts. The 870,733 feet of sewer consists of 29,754 feet of 12-inch pipe, 33,691 feet of 10-inch pipe, 766,514 feet of 8-inch pipe, and 40,774 feet of 6-inch pipe. The depreciated value of the collection system is \$19,600,000 and the replacement value is \$33,170,000. A summary of the City's sewer system pipe age is shown in Table 1. As illustrated in Table 1 over thirty-eight percent of the City's sewer system is over forty-five years old and seventy-three percent is over twenty-five years old. The useful life of a sanitary sewer is generally accepted at 100 years. There is a wide variation in the life of one sewer to the next due to differences in location, materials, usage and construction techniques.

Evaluation of the limited historical data on the City's collection system and conversations with City maintenance personnel indicated the following problems with the City's collection system:

1. 61% (534,800 feet) of the sewer pipes in the City's sanitary sewer system are located along back and side lot lines. This makes access for maintenance and rehabilitation very difficult, expensive and in some cases impossible.
2. The sanitary sewer system has problems with backup and surcharging during wet weather. It is not unusual for the sewer section to receive hundreds of service requests after/during a heavy rainstorm. The May 16, 1990 rainstorm (officially 3.13 inches in 6 hours) resulted in more than 350 sanitary and storm sewer service requests.
3. Accurate inventory information is lacking on the existing sanitary sewer system. The City has only a general idea on the location, size and number of manholes, cleanouts, and condition of pipe in the sewer system. This has caused inaccurate sewer maps and resulted in making maintenance and rehabilitation activities more difficult to perform.
4. No standardized or centralized procedure exists for collecting and storing historical data on the physical condition of the sewer system. This has resulted in the loss of past information and created very little historical data on the sewer system. Data has been kept on the number of service requests made by Champaign residents annually. Records indicate 150 and 197 service requests were made by Champaign residents in 1988 and 1989 respectively. These numbers do not reflect the service requests received by Operations after major rainfall.

**TABLE 1
CITY OF CHAMPAIGN
EXISTING SANITARY SEWER PIPE AGE**

TIME PERIOD	TOTAL FOOTAGE PERCENTAGE	
Pre-1945	332,635 l.f.	38.2%
1945-1954	52,353 l.f.	6.0%
1955-1964	250,702 l.f.	28.8%
1965-1969	58,304 l.f.	6.7%
1970-1974	41,201 l.f.	4.7%
1975-1979	74,028 l.f.	8.5%
1980-1984	29,851 l.f.	3.4%
1985-1987	31,659 l.f.	3.7%
TOTAL	870,733 l.f.	

II. SEWER MAINTENANCE

A. Definition of Sewer Maintenance

Sanitary sewer collection system maintenance can be classified as either corrective maintenance or preventive maintenance. Sanitary sewer corrective maintenance is defined as fixing something when it breaks and results from a specific service request or observed problem. Sanitary sewer preventive maintenance is defined as any activity designed to prevent the erosion of service and/or to prevent structural failures in the sanitary sewer. The City's existing sanitary sewer maintenance program is a blend of both types of sewer maintenance but is more closely aligned to a corrective maintenance program.

The sanitary sewer maintenance plans evaluated in this section will classify the following sanitary sewer activities as maintenance activities:

1. Television inspection of existing sanitary sewers to determine the physical condition of the pipe and/or the nature of some internal problem. Sanitary sewer maintenance will not include televising new subdivision sewers.
2. Inspections of manholes, cleanouts, right-of-way, and easement surfaces to determine locations of potential sewer problems.
3. Cleaning sanitary sewers with power rodding equipment and/or high velocity hydraulic equipment to remove grease, sand, grit, and other debris.
4. Application of chemicals to sanitary sewers to control root growth, odors, rodents and insects.
5. Daily inspection and service of sanitary sewer lift stations.
6. Response to service requests and underground utility locates.

B. Sewer Maintenance Goals

Goal setting for the maintenance program is one of the most important steps in the maintenance evaluation process. The program goals must be consistent with the purpose of the sanitary sewer system and the level of service required by the City for the sanitary sewer system. Goals used to develop the sewer maintenance program are:

1. Elimination of public health hazards, property damage, and service interruptions caused by surcharging sewers by routinely cleaning grease, debris and root obstructions from the sanitary sewers.
2. Protection of the City's capital investment in the sanitary sewer infrastructure by reducing the incidence of infrastructure failure and by maintaining maximum sewer carrying capacities.

3. Efficient utilization of available maintenance funds by prioritizing the City's maintenance needs, defining and streamlining City maintenance procedures and establishment of a cost accounting system for the City's sewer maintenance.
4. Minimize citizen inconvenience by responsibly handling and tracking all service requests.

C. Existing Maintenance Activities

The sewer section of the Public Works Department is responsible for the City's storm and sanitary sewers. The section consists of nine full-time employees, one supervisor and a 1989-90 budget of \$510,776. Typical, sanitary sewer maintenance activities include:

1. Daily inspection of the City's two sanitary sewer lift stations.
2. Responding to daily service requests for marking the location of the City's sanitary sewers. These requests are made by homeowners and contractors who need the sanitary sewers located before starting any excavation.
3. Responding to daily sanitary sewer service requests. Typically, this includes cleaning obstructions from sanitary sewers, inspecting manholes, odor control and inspecting right-of-way and easement surfaces for signs of sewer failure. The sewer section responds to service requests related to possible sewer backups in one hour or less.
4. Televising existing sanitary sewers to determine the physical condition of the pipe and/or the nature of some internal problem.
5. Televising all sewers in new subdivision within the corporate limits of the City and within the City's 1.5 mile jurisdiction.

Table 1a summarizes the annual manhour distribution for each major sanitary sewer maintenance activity. In accordance with the classification in Section II A, approximately 18% (2,200 manhours) of the total effective manhours were spent on sanitary sewer maintenance activities.

D. Existing Maintenance Deficiencies

Deficiencies in the existing maintenance program must be first clearly defined and identified before solutions can be developed and implemented. Identification and definition of deficiencies can be done by comparing the existing maintenance program to the goals and objectives described in Section II.B. This type of evaluation of the City's existing sanitary sewer maintenance program identified the following five deficient areas:

1. Insufficient manhours are being spent on preventive maintenance activities. Table 1a shows only 34.9% of the total sanitary sewer manhours (6,310) are spent on the sanitary maintenance

activities (2,200). Generally, the greater the amount of preventive maintenance performed on a sewer system, the smaller the amount of corrective maintenance.

2. Too many manhours are being spent televising sanitary sewers in new subdivisions. Table 1a shows 37.4% of the total manhours spent on sanitary sewers (6,310) is spent on televising new subdivision sewers (2,360). This activity seems to be somewhat unnecessary since there are City subdivision requirements and procedures that help to verify the quality of sewer construction in new subdivisions. These requirements and procedures include:
 - a. The developer's engineer certification that all sewers in the subdivision have been constructed in accordance with the approved plans and specifications.
 - b. Periodic inspections of the sewer construction by the City's engineering department.
 - c. Testing all newly constructed sanitary sewers for infiltration and alignment prior to acceptance by the City.
 - d. A one year maintenance bond on all sanitary sewer construction.
3. The existing maintenance program lacks a work management accounting system for tracking needs, requests, personnel, equipment, and material costs. Currently, it is impossible for the City to determine what it costs to perform individual maintenance activities. This information is vital when deciding which maintenance activities should be contracted or completed "in-house".
4. Accurate inventory information, verified in the field, is lacking on the existing sanitary sewer system. The City has only a general idea on the quantity of manholes, cleanouts and sewer pipe in the collection system. There is no information on manhole rim elevations, sewer pipe elevations, pipe slopes and pipe sizes which are needed to calculate capacity. In some areas of the community, there is no information on service tap locations or little information on sewer pipe location. Inaccurate or insufficient inventory information can cause maintenance activities to be inefficient, costly and in some cases impossible to perform.
5. The existing maintenance program doesn't have an operational/procedural manual for sewer maintenance. In reviewing maintenance records and practices inconsistencies were noted. These inconsistencies generally result from the lack of standards to guide individuals when performing job tasks. Additionally, a number of maintenance activities lacked problem definition, planning, organization and followup. An operational/procedural manual would define for City personnel standards and procedures to be used when maintaining the City's sanitary sewer system. This manual could also be used when

orienting new employees and serve as a guide in evaluating the performance of existing employees.

6. The City has never had a regular program of sanitary sewer cleaning and/or root control. The vast majority of the sanitary sewers have never been cleaned since they were installed. This has caused many problems with sewer capacity from restrictions in the sewer pipe caused by grit, dirt, roots, and debris.

E. Maintenance Tasks

The six maintenance tasks described below were identified to address the maintenance deficiencies discussed in Section II.D. The tasks scope of work ranged from a one-time activity to an annual activity that would be incorporated into the annual sanitary sewer maintenance program. In general, completion of the tasks would plan and implement a sanitary sewer preventive maintenance program and would provide the maintenance program with the necessary tools to effectively manage the sanitary sewer collection system.

1. Sewer Maps & Identification System: This task will develop an identification system that will be used to label each manhole and cleanout in the City's sanitary sewer system. The labeling system will identify the structure as sanitary, identify the structure's location in the City and will identify the tributary nature of each structure. As part of this task a map(s) will be developed that will illustrate the location of all sewers, manholes and cleanouts in the City's sanitary sewer system. The map will be developed to be compatible with the City's CAD and future GIS systems. The maps will illustrate the individual labels for each manhole/cleanout, street name, right-of-way, property lines, addresses, and sewer pipe diameter. This task can be initiated at any time.
2. Facility Management System: This task will define, describe, purchase and start-up an automated maintenance, operation and management system for the sanitary sewer system. The system will be capable of:
 - * storing the entire inventory of the City's sanitary sewer collection system,
 - * scheduling and tracking preventive maintenance,
 - * generating and tracking work orders for service requests and preventive maintenance,
 - * generating reports on inventory, preventive maintenance status, work order status, and maintenance history; and
 - * tracking costs on work orders and preventive maintenance.

The information generated by the facility management system will be used for documentation, generating maintenance reports, cost accounting, scheduling preventive maintenance, and tracking the status of maintenance activities. The facility management system could also be used to calculate existing and

maximum sewer pipe flows. This task can be initiated at any time but cannot be completed until task one has been completed.

3. **Procedural/Operational Manual:** This task will develop procedures and performance standards for all sanitary sewer maintenance activities. The procedures and performance standards will instruct the individuals performing the maintenance activities on the methodology to be used, equipment needed, records to be kept, desired work quality and necessary followup activities. This task can be initiated at any time.
4. **Work Area Definition & Prioritization:** This task will divide the City's sanitary sewer system into work areas. The dimensions of the work areas will reflect the lengths of sewers in each area, traffic congestion and manhole accessibility. The work areas will be prioritized using past sewer service requests, sewer pipe age and past sewer maintenance problems. Maintenance crews will clean, televise and control roots in the sanitary sewers in the highest priority area first before moving to the next priority area. This procedure will maximize maintenance efficiency and insure that the areas needing maintenance most will be addressed first. This task can be initiated at any time.
5. **Field Survey:** Prior to the start of any maintenance activities in a particular work area, the target work area will be surveyed to verify manhole locations and manhole accessibility. The techniques used to clean and televise sewers will require access to every manhole. Manhole access problems could require changing techniques or modifying maintenance schedules. The preliminary survey will identify the access problems and identify solutions if possible. Certain segments of the City's sanitary sewer system could be inaccessible for maintenance. This task can be initiated after task four has been completed.
6. **Annual Sewer Cleaning & Televising:** Every lineal foot of sanitary sewer and each manhole in the selected work area will be hydraulically cleaned with a high velocity jetter. Debris or obstructions in the sewers that cannot be removed hydraulically will be removed by mechanical cleaning techniques (i.e., bucket machines) or by open excavation. Roots encountered in the cleaning process will be chemically treated and removed. Upon completion of the sewer cleaning and root control, the sewers will be televised with closed circuit television and recorded on video tape. A written standardized televising log will be prepared describing sewer tap locations and structural problems in the sanitary sewer. Televising log and video tape will provide a permanent record on the cleaning, root control, and structural condition of the sewer. This information will be used later for sewer rehabilitation.

In order to develop cost estimates for this job task an assumption had to be made on the amount of sanitary sewer to be cleaned and televised each year. The City has over 870,000 l.f. of sanitary sewer (165 miles), 3500 manholes and 260 cleanouts. The annual amount will depend on the amount of

resources the City will want to dedicate to this job task. For the purposes of estimating cost, this study will assume that the City's collection system will be cleaned and televised in a systematic fashion with a predetermined amount of sewers cleaned and televised each year. It will also be assumed that the predetermined amount of sewers to be cleaned and televised each year will be 90,000 feet. This assumption will allow the City to clean and televise all sewers once every ten years which appears to be a reasonable approach based on maintenance practices in other central Illinois communities and according to published industry standards.

This task cannot be started until the other five tasks outlined above have been completed.

F. Proposed Maintenance Alternatives

1. **General:** Maintenance alternatives were identified to complete the tasks described in Section II.E. The alternatives differ from each other by the type of maintenance activity to be performed and the methodology to be used to complete the activities. To develop the alternatives the following assumptions were made:

- * All planning and organizing activities must be completed before the annual sewer cleaning and televising activity will be started.
- * The alternatives did not evaluate whether or not the City's engineering section had sufficient manpower to complete the required engineering activities identified in each alternative. The manpower evaluation will be made on the recommended alternative.
- * Engineering cost were based on actual hourly rates increased by a multiplier of 1.442.

Alternatives M1 and M2 do not reallocate existing maintenance manhours to other activities. Any plan which would implement these alternatives should investigate whether or not some reallocation would be desirable. One area of reallocation that should be evaluated is the current practice of televising new subdivision sewers.

2. **Alternative M1:** Maintenance Alternative M1 will make no changes to the City's existing corrective maintenance program. No new programs will be started to accomplish the maintenance tasks outlined in Section II E. The maintenance goals in Section II B. will not be attained and the deficiencies in the existing maintenance program identified in Section II D will remain. Alternative M1 proposes no additional City personnel and will require no new engineering staff time. Table 3 summarizes the yearly manhour distribution for major maintenance activities associated with Alternative M1. Contractual and City cost for Alternative M1 is summarized in Table 2. The annual City cost for the alternative was based

on a percentage of the 1989-90 sewer section budget of \$510,776. The percentage (18%) approximates the amount of time spent on an annual basis by the sewer section on sanitary sewer maintenance activities (See Table 1a).

3. Alternative M2: Maintenance Alternative M2 would complete all six maintenance tasks outlined in Section II.E with contractual services. Alternative M2 would accomplish the maintenance goals listed in Section II B and would address all existing maintenance deficiencies identified in Section II D. Contractual and City costs associated with Alternative M2 are summarized in Table 4.

Alternative M2 proposes to complete all maintenance activities listed in Table 4 with a combination of contractual and "in-house" services. Activities one through three would be completed by City personnel. An engineering consultant would be used to complete the items of work associated with activities four through eight and to prepare plans and specifications for activity nine. A private contractor would be selected through the competitive bidding process to complete the cleaning and televising associated with activity nine in accordance with the engineer's plans and specifications. Activities four through seven would be required only once and are therefore a one-time cost to the City. Activities eight and nine would be annual, involving the cleaning and televising of 90,000 feet of sewer per year.

Alternative M2 would add one part-time data entry clerk to the sewer section. The data entry clerk would be responsible for entering data into the computer for the facility management system (activity five). This alternative would also require City personnel to be responsible for all project management activities associated with activities four through nine. Project management activities would include consultant selection, review and construction management.

Table 5 summarizes the annual manday distribution for maintenance Alternative M2.

4. Alternative M3: Maintenance Alternative M3 would complete the majority of all maintenance activities with City personnel. Alternative M3 would accomplish the maintenance goals outlined in Section II B and address all existing maintenance deficiencies identified in Section II D. Contractual and City costs associated with Alternative M3 are summarized in Table 6. Table 7 summarizes the proposed annual manday distribution for alternative M3.

Alternative M3 proposes to complete all maintenance activities listed in Table 6 except activity five with City personnel. Activity five would be completed by an engineering consultant with the City's engineering staff performing project management duties. Data entry for activity five would be completed by adding a part-time data entry clerk to the sewer section. Activity nine would clean and televise 90,000 feet of sanitary

sewer per year. This activity would require 4,000 manhours per year and the purchase of chemical root control equipment.

In order to earmark 4,000 maintenance manhours annually for the completion of task nine without increasing existing maintenance personnel levels in the sewer section, Alternative M3 proposes two changes in the existing maintenance program.

- a. Reduce storm and sanitary sewer manhours in the rehabilitation activity by 1,640 hours per year. This reduction would eliminate some storm and sanitary sewer construction projects currently being done by the sewer section. The eliminated projects would be included in annual sewer rehabilitation projects to be done by private contractors.
 - b. Discontinue televising new subdivision sanitary sewers. Currently, all new subdivision sanitary sewers are televised by City crews. Table 1a shows that 37.4% of the total manhours spent on sanitary sewers is spent on televising new subdivision sewers. This activity is redundant since there are other methods in place that can be used to certify new subdivision sewers.
5. Alternative M4: Maintenance Alternative M4 is a blend of the maintenance programs proposed by Alternative M2 and M3. Alternative M4 would complete all maintenance activities by a combination of contractual and "in-house" services. Alternative M4 would accomplish the goals in Section II B and address all existing maintenance deficiencies identified in Section II D. Contractual and City costs associated with Alternative M4 are summarized in Table 8. Table 9 summarizes the proposed annual manday distribution for Alternative M4.

Alternative M4 proposes to complete all maintenance activities listed in Table 8 with a combination of contractual and "in-house" services. Activities four through seven would be completed by an engineering consultant with the City's engineering staff performing project management duties. Annual updates for activities four and six would be completed by the City's engineering staff. Data entry for activity five would be completed by adding a part-time data entry clerk to the sewer section. Activities one through three, eight and nine would be completed with the City personnel. Activity nine would clean and televise 90,000 feet of sanitary sewer per year. This activity would require 4,000 manhours per year and the purchase of chemical root control equipment. The 4,000 maintenance manhours estimated to complete this task would be obtained by modifying the existing maintenance practices in the same manner as proposed in Alternative M3.

**TABLE 1A
EXISTING ANNUAL MANHOUR DISTRIBUTION
SEWER SECTION**

ACTIVITY	SANITARY (Hrs.)	STORM (Hrs.)	STREETS (Hrs.)	TOTAL (Hrs.)	%
DAILY SERVICE REQUESTS	1,000	400	680	2,080	17.0
MISC. TV INSPECTION	790	350	0	1,140	9.3
NEW SUB. TV INSPECTION	2,360	0	0	2,360	19.3
SEWER REHABILITATION	1,750	3,250	0	5,000	40.9
SEWER MAINTENANCE	410	1,230	0	1,640	13.5
TOTALS	6,310	5,230	680	12,220	

NOTES:

1. While the total available manhours for the sewer section is 18,720 per year, the total effective hours is 12,220 manhours per year. Approximately 15% of the total available is used for vacation, personal leave, holidays, and sick leave. In addition, 20% of the total available is used for non-sewer related activities such as snow and ice removal, equipment cleanup and maintenance, special projects, etc.
2. It's estimated that the sewer section spends 680 manhours per year responding to service requests for the Street's Section of Operations. These requests, typically, involve removing debris from the right-of-way and/or investigating right-of-way problems.
3. The percentages in column six are based on total effective manhours per year.

**TABLE 2
MAINTENANCE COST ESTIMATE
ALTERNATIVE M1 EXISTING**

ACTIVITY	ONE TIME COST		ANNUAL COST	
	CONTRACT.	CITY	CONTRACT.	CITY
1. DAILY SERVICE REQUESTS	\$0	\$0	\$0	\$41,800
2. MISC. T.V. INSPECTION	\$0	\$0	\$0	\$33,000
3. MISC. SEWER MAINTENANCE	\$0	\$0	\$0	\$17,000
4. SEWER MAPS	\$0	\$0	\$0	\$0
5. FACILITY MANAGE. SYSTEM	\$0	\$0	\$0	\$0
6. PROCEDURAL/OPER. MANUAL	\$0	\$0	\$0	\$0
7. WORK AREA DEF. & PRIOR.	\$0	\$0	\$0	\$0
8. FIELD SURVEY	\$0	\$0	\$0	\$0
9. ANNUAL SEWER CLEANING & T.V.	\$0	\$0	\$0	\$0
TOTALS	\$0	\$0	\$0	\$91,800
TOTAL ONE-TIME MAINT. COST	\$0			
TOTAL ANNUAL MAINT. COST	\$91,800			

**TABLE 3
MAINTENANCE MANDAY ESTIMATE
ALTERNATIVE M1 EXISTING**

ACTIVITY	P.M.	P.M.	ENG.	ENG.	TECH.	TECH.	OPER.	OPER.
	ONE-TIME	ANNUAL	ONE-TIME	ANNUAL	ONE-TIME	ANNUAL	ONE-TIME	ANNUAL
1. DAILY SERVICE REQUESTS	0	0	0	0	0	0	0	125
2. MISC. T.V. INSPECTION	0	0	0	0	0	0	0	99
3. MISC. SEWER MAINTENANCE	0	0	0	0	0	0	0	51
4. SEWER MAPS	0	0	0	0	0	0	0	0
5. FACILITY MANAGE. SYSTEM	0	0	0	0	0	0	0	0
6. PROCEDURAL/OPER. MANUAL	0	0	0	0	0	0	0	0
7. WORK AREA DEF. & PRIOR.	0	0	0	0	0	0	0	0
8. FIELD SURVEY	0	0	0	0	0	0	0	0
9. ANNUAL SEWER CLEANING & T.V.	0	0	0	0	0	0	0	0
TOTALS	0	0	0	0	0	0	0	275

**TABLE 4
MAINTENANCE COST ESTIMATE
ALTERNATIVE M2 CONTRACTUAL**

ACTIVITY	ONE-TIME COST		ANNUAL COST	
	CONTRACT.	CITY	CONTRACT.	CITY
1. DAILY SERVICE REQUESTS	\$0	\$0	\$0	\$41,800
2. MISC. T.V. INSPECTION	\$0	\$0	\$0	\$33,000
3. MISC. SEWER MAINTENANCE	\$0	\$0	\$0	\$17,000
4. SEWER MAPS	\$51,500	\$5,250	\$0	\$2,000
5. FACILITY MANAGE. SYSTEM	\$61,500	\$11,000	\$5,000	\$17,250
6. PROCEDURAL/OPER. MANUAL	\$21,000	\$4,750	\$0	\$2,250
7. WORK AREA DEF. & PRIOR.	\$7,500	\$4,750	\$0	\$0
8. FIELD SURVEY	\$0	\$0	\$20,000	\$4,500
9. ANNUAL SEWER CLEANING & T.V.	\$0	\$0	\$295,000	\$7,000
TOTALS	\$141,500	\$25,750	\$320,000	\$124,800
TOTAL ONE-TIME MAINT. COST..... - \$167,250				
TOTAL ANNUAL MAINT. COST \$444,800				

**TABLE 5
MAINTENANCE MANDAY ESTIMATE
ALTERNATIVE M2 CONTRACTUAL**

ACTIVITY	P.M.	P.M.	ENG.	ENG.	TECH.	TECH.	OPER.	OPER.
	ONE-TIME	ANNUAL	ONE-TIME	ANNUAL	ONE-TIME	ANNUAL	ONE-TIME	ANNUAL
1. DAILY SERVICE REQUESTS	0	0	0	0	0	0	0	125
2. MISC. T.V. INSPECTION	0	0	0	0	0	0	0	99
3. MISC. SEWER MAINTENANCE	0	0	0	0	0	0	0	51
4. SEWER MAPS	15	5	0	0	10	5	0	0
5. FACILITY MANAGE. SYSTEM	40	5	5	5	0	0	0	0
6. PROCEDURAL/OPER. MANUAL	15	5	5	5	0	0	0	0
7. WORK AREA DEF. & PRIOR.	15	0	5	0	0	0	0	0
8. FIELD SURVEY	0	15	0	0	0	5	0	0
9. ANNUAL SEWER CLEANING & T.V.	0	15	0	5	0	15	0	0
TOTALS	85	45	15	15	10	25	0	275

TABLE 6
MAINTENANCE COST ESTIMATE
ALTERNATIVE M3 CITY

ACTIVITY	ONE-TIME COST		ANNUAL COST	
	CONTRACT.	CITY	CONTRACT.	CITY
1. DAILY SERVICE REQUESTS	\$0	\$0	\$0	\$41,800
2. MISC. T.V. INSPECTIONS	\$0	\$0	\$0	\$33,000
3. MISC. SEWER MAINTENANCE	\$0	\$0	\$0	\$17,000
4. SEWER MAPS	\$0	\$24,450	\$0	\$3,150
5. FACILITY MANAGE. SYSTEM	\$61,000	\$11,000	\$5,000	\$17,250
6. PROCEDURAL/OPER. MANUAL	\$0	\$10,600	\$0	\$750
7. WORK AREA DEF. & PRIOR.	\$0	\$5,400	\$0	\$0
8. FIELD SURVEY	\$0	\$0	\$0	\$12,100
9. ANNUAL SEWER CLEANING & T.V.	\$30,000	\$0	\$0	\$183,750
TOTALS	\$91,000	\$51,450	\$5,000	\$308,800
TOTAL ONE-TIME MAINT. COST	\$142,450			
TOTAL ANNUAL MAINT. COST	\$313,800			

TABLE 7
MAINTENANCE MANDAY ESTIMATE
ALTERNATIVE M3 CITY

ACTIVITY	P.M.	P.M.	ENG.	ENG.	TECH.	TECH.	OPER.	OPER.
	ONE-TIME	ANNUAL	ONE-TIME	ANNUAL	ONE-TIME	ANNUAL	ONE-TIME	ANNUAL
1. DAILY SERVICE REQUESTS	0	0	0	0	0	0	0	125
2. MISC. T.V. INSPECTIONS	0	0	0	0	0	0	0	99
3. MISC. SEWER MAINTENANCE	0	0	0	0	0	0	0	51
4. SEWER MAPS	15	5	18	5	114	6	0	0
5. FACILITY MANAGE. SYSTEM	40	5	5	5	0	0	0	0
6. PROCEDURAL/OPER. MANUAL	10	3	36	0	6	0	0	0
7. WORK AREA DEF. & PRIOR.	10	0	10	0	6	0	0	0
8. FIELD SURVEY	0	10	0	12	0	48	0	0
9. ANNUAL SEWER CLEANING & T.V.	0	10	0	5	0	15	0	500
TOTALS	75	33	69	27	126	69	0	775

**TABLE 8
MAINTENANCE COST ESTIMATE
ALTERNATIVE M4 CONTRACTUAL/CITY**

ACTIVITY	ONE-TIME COST		ANNUAL COST	
	CONTRACT.	CITY	CONTRACT.	CITY
1. DAILY SERVICE REQUESTS	\$0	\$0	\$0	\$41,800
2. MISC. T.V. INSPECTIONS	\$0	\$0	\$0	\$33,000
3. MISC. SEWER MAINTENANCE	\$0	\$0	\$0	\$17,000
4. SEWER MAPS	\$51,500	\$5,250	\$0	\$2,000
5. FACILITY MANAGE. SYSTEM	\$61,000	\$8,500	\$5,000	\$17,250
6. PROCEDURAL/OPER. MANUAL	\$21,000	\$4,750	\$0	\$2,250
7. WORK AREA DEF. & PRIOR.	\$7,500	\$4,750	\$0	\$0
8. FIELD SURVEY	\$0	\$0	\$0	\$12,100
9. ANNUAL SEWER CLEANING & T.V.	\$30,000	\$0	\$0	\$183,750
TOTALS	\$171,000	\$23,250	\$5,000	\$309,150
TOTAL ONE-TIME MAINT. COST	\$194,250			
TOTAL ANNUAL MAINT. COST	\$314,150			

**TABLE 9
MAINTENANCE MANDAY ESTIMATE
ALTERNATIVE M4 CONTRACTUAL/CITY**

ACTIVITY	P.M.	P.M.	ENG.	ENG.	TECH.	TECH.	OPER.	OPER.
	ONE-TIME	ANNUAL	ONE-TIME	ANNUAL	ONE-TIME	ANNUAL	ONE-TIME	ANNUAL
1. DAILY SERVICE REQUESTS	0	0	0	0	0	0	0	125
2. MISC. T.V. INSPECTIONS	0	0	0	0	0	0	0	99
3. MISC. SEWER MAINTENANCE	0	0	0	0	0	0	0	51
4. SEWER MAPS	15	5	0	0	10	5	0	0
5. FACILITY MANAGE. SYSTEM	30	5	5	5	0	0	0	0
6. PROCEDURAL/OPER. MANUAL	15	5	5	5	0	0	0	0
7. WORK AREA DEF. & PRIOR.	15	0	5	0	0	0	0	0
8. FIELD SURVEY	0	10	0	12	0	48	0	0
9. ANNUAL SEWER CLEANING & T.V.	0	10	0	5	0	15	0	500
TOTALS	75	35	15	27	10	68	0	775

III. SEWER REHABILITATION

A. Definition of Sewer Rehabilitation

Sewer rehabilitation is defined as any activity designed to repair or restore a sanitary sewer and/or manhole to a particular service level. The service level is defined by a performance standard consistent with the rehabilitation goals. The purpose of most rehabilitation activities is to remove infiltration and/or inflow from the sanitary sewer or to correct a structural defect in the sewer. Typical rehabilitation activities include:

1. Sewer Pipe Excavation and Replacement: Excavation and replacement of defective sanitary sewer segments is an effective method for minimizing infiltration and inflow. This method is also used to correct structural defects and alignment problems in existing pipelines. It is usually the most costly method and causes the most inconvenience to the public.
2. Sewer Pipe Point Repairs: Point repairs may be used to correct problems in a pipeline segment. This method can be used to totally correct the defects within a line segment or it can be an initial step in the use of other rehabilitation methods. Point repairs are similar to excavation and replacement techniques. However, point repairs are usually limited to the replacement of only a short portion of a pipeline on service connection, instead of the entire length.
3. Chemical Grouting Sewer Pipe and Manholes: Chemical grouting is the most commonly used method for sealing leaking joints in otherwise structurally sound sewer pipes and manholes. Using special techniques and tools, chemical grouts can be applied to pipeline joints and manhole walls to seal leaks.
4. Sliplining Sewer Pipes: Sliplining involves sliding a flexible liner pipe of slightly smaller diameter into an existing circular pipe line and then reconnecting the service connections to the new liner. Sliplining an existing pipeline segment usually can be completed in less time and at considerably lower cost than conventional excavation and sewer replacement.
5. Coating Manhole Walls: Coatings can be used on the interior surface of manhole walls to protect them from corrosion, to remove infiltration/inflow and to improve the wall's structural integrity. The most common process is shotcrete which applies a mixture of fine aggregate, cement, and water to the manhole wall.
6. Manhole Rehabilitation: Manhole rehabilitation is usually used to correct structural deficiencies or to eliminate the entrance of surface water or groundwater into the manhole. Many methods to rehabilitate manholes are available, the most common are:

- * Replacing existing manhole covers
- * Resetting manhole frames
- * Resealing manhole frames to the manhole walls

B. Sewer Rehabilitation Goals

Before a sewer rehabilitation program can be developed, the goals for the programs must first be defined. The program goals must be consistent with the purpose of the sanitary sewer system and the level of service required by the City for the sanitary sewer system. Goals used to develop the sewer rehabilitation program were:

1. Protection of the finite capacity of the City's sanitary sewer system by identifying and eliminating from the City's sewer system reasonable quantities of infiltration/inflow (I/I) and by educating and assisting City residents in eliminating I/I from their service sewer system.
2. Minimize citizen inconveniences by responsibly handling and tracking all rehabilitation projects.
3. Collection of data to assist in identifying rehabilitation needs by inventoring and inspecting the components of the sanitary sewer system.
4. Protection of the City's capital investment in the sanitary sewer infrastructure by rehabilitating the sanitary sewer system to a level consistent with the City's sanitary sewer performance standards.
5. Efficient utilization of available rehabilitation funds by identifying and prioritizing the City's rehabilitation needs and by determining and implementing the most cost effective solutions for those needs.

C. Existing Rehabilitation Program

Currently, the City has two programs which are responsible for rehabilitation activities on the City's sanitary sewer system. The first program utilizes City personnel from the sewer section in the Public Works Department. Typical, rehabilitation projects include point repairs and manhole reconstruction. This program is responsible for only small construction projects and identifies the majority of its projects from service requests.

The second rehabilitation program was designed to address the larger sewer rehabilitation needs i.e. replacement of large sections of sewer pipe, chemical grouting, lining manholes and sliplining. The program is managed by the engineering section of Public Works and uses contractual services to complete the rehabilitation projects. To date, the program has concentrated on inspecting and rehabilitating sanitary manholes. Typically, the annual funding level for this program has been set at approximately \$30,000 per year.

D. Deficiencies in Existing Rehabilitation Program

Deficiencies in the existing rehabilitation program must be first clearly defined and identified before solutions can be developed and implemented. Identification and definition of deficiencies can be done by comparing the existing rehabilitation program to the goals and objectives described in Section III B. This type of evaluation of the City's existing sanitary sewer rehabilitation program identified the following five deficient areas.

1. The City's current rehabilitation program identifies rehabilitation needs without an organized and planned sewer inspection and prioritization process. To undertake rehabilitation projects without first identifying all needs and without prioritizing those needs can result in spending funds on low priority projects.
2. The existing rehabilitation program doesn't have defined performance standards for all components of the sanitary sewer system. Without standards for comparison, identification of rehabilitation needs are subjective and inconsistent.
3. Accurate inventory information on the existing sanitary sewer system is lacking. This has caused inaccurate sewer maps and resulted in making rehabilitation decisions difficult.
4. The City has never had a regular program of televising sanitary sewers or inspecting manholes. This has resulted in very little information on the physical condition of sewer pipes and manholes. This information is necessary for any type of rehabilitation project.

E. Rehabilitation Tasks

The four rehabilitation tasks described below were identified to address the deficiencies and problems with the existing sewer system and existing rehabilitation program. In general, completion of the tasks would plan and organize an annual sanitary sewer rehabilitation program for the City's sanitary sewer system. Actual construction projects for these identified rehabilitation needs would depend on project priority and available funds. Additionally, completion of the tasks would provide the City with sanitary sewer performance standards, complete sanitary sewer inventory information and an infiltration/inflow identification program.

1. Performance Standards. This task will develop performance standards for the City's sanitary sewers, manholes, and cleanouts. In general, the performance standards will address:
 - * Minimum sewer pipe/manhole diameter.
 - * Minimum sewer pipe slope.
 - * Acceptable construction materials and standards for sewer pipe, manholes, manhole frames and covers, and cleanout.
 - * Parameters for determining structural deficiencies in sewer pipes and manholes i.e. offset joints, sewer sags,

longitudinal and transverse cracks, allowable infiltration/inflow, etc.

- * Parameters for determining deficiencies in sewer pipe capacity.

The condition of each sewer component will be compared to the performance standards and those components not meeting the standard will be replaced or rehabilitated.

This task can be completed at any time but must be completed before any other rehabilitation tasks can be started.

2. Infrastructure Inventory and Inspection: This task will inventory and evaluate the physical condition of each component of the sanitary sewer system. In general, the task will require each manhole to be inspected and all sewer pipe to be televised. Specifically, the inventory evaluation will include:

- * Identifying and evaluating the manhole cover and frame.
- * Identifying the physical location of manholes, i.e. streets, parkway, etc.
- * Identifying the type of construction material used for the corbel, manhole wall, bench and sewer pipe.
- * Determining the elevation of the manhole rim and influent/effluent pipes in the manhole.
- * Evaluate the physical condition of the sewer pipe.
- * Determining the diameter of the sewer pipe, slope of the sewer pipe and location of service laterals.
- * Identifying and evaluating I/I sources in the sewer pipe, sewer pipe joints, service lateral connections, sewer pipe/manhole connection, manhole walls and manhole frames/cover.

All inventoried items, inspections, and evaluations will be compared to the performance standards and any deficiencies will be earmarked for rehabilitation or replacement.

Inspection/inventory of the City's sanitary sewer system must be done in a systematic fashion with a predetermined amount of sewers inspected/inventoried each year. Evaluation of the physical condition of the City's existing sanitary sewer system will require that all sewer pipe be cleaned and televised. In order to avoid duplication of efforts this task will be completed after task six in Section II E has been completed and after task one in this section has been completed. This sequence of activities will limit the inspection/inventory of sewer pipe to 90,000 feet per year.

3. Identify, Plan, and Organize Rehabilitation Projects: This task will evaluate the appropriate rehabilitation method to be used to repair the identified deficiencies in the sanitary sewer system. Factors that will be considered when selecting a particular rehabilitation method will be:

- * Cost
- * Potential I/I Reduction and Migration
- * Traffic Disruption
- * Long-Term Effectiveness of the Rehabilitation Method

- * Safety

- * Maintaining Wastewater Flows

After identifying and evaluating the appropriate rehabilitation method, the rehabilitation work will be organized into projects, cost estimates will be developed, the projects prioritized and a schedule developed for implementing the rehabilitation projects. This task will be initiated after task two above has been completed.

4. Annual Rehabilitation Project: This task will design, bid, construct, and manage the annual sanitary sewer rehabilitation project. This activity will be initiated after the rehabilitation projects have been identified, organized, and prioritized. The annual rehabilitation project will include as many projects as available funds will allow with the highest priority projects being done first. The annual rehabilitation project could include either one or a combination of the following types of rehabilitation methods:

- * Excavation & Replacement of Sanitary Sewer Pipe

- * Replacement of Manhole Covers and Frames

- * Resetting and Adjusting Manhole Frames

- * Point Repairs of Sewer Pipe and Manholes

- * Sliplining Sanitary Sewers

- * Chemical Grouting Sanitary Sewers and Manholes

- * Interior Coating of Manhole Walls

This task will be initiated after task three has been completed.

F. Proposed Rehabilitation Alternatives

1. General: Rehabilitation alternatives were identified to complete the tasks described in Section III E. The alternatives differ from each other by the changes made in the City's existing rehabilitation program and the methodology used to accomplish the tasks discussed in Section III E. To develop the alternatives the following assumptions were made:

- * Task two will evaluate 90,000 feet of sewer and 350 manholes annually for rehabilitation needs.

- * Tasks one through four must be completed in sequential order.

- * Task two includes no cost for televising and cleaning sanitary sewers. These activities are maintenance activities and assumed to be completed in the maintenance program.

- * Alternatives did not evaluate whether or not the City's engineering section had sufficient manpower to complete the required engineering activities identified in each alternative. The manpower evaluation will be made on the recommended alternative.

- * Engineering costs were based on actual hourly rates increased by a multiplier of 1.442.

2. Alternative R1: The rehabilitation program proposed by Alternative R1 will require no changes to the City's existing rehabilitation program. No new programs will be started to accomplish the rehabilitation tasks discussed in Section III E.

The rehabilitation goals in Section III B will not be attained and the deficiencies in the existing rehabilitation program identified in Section III D will remain. Alternative R1 proposes no additional City personnel or additional project management time. Table 11 summarizes the yearly rehabilitation manday distribution for Alternative R1. Contractual and City costs for Alternative R1 are summarized in Table 10. The cost shown in Table 10, item one, for the annual sewer rehabilitation by City forces was based on a percentage of the 1989-90 sewer section budget of \$510,776. The percentage (14%) approximates the amount of time spent on an annual basis by the sewer section on sanitary sewer rehabilitation activities. The annual sewer rehabilitation to be completed by contractual forces was estimated at \$30,000 per year (item 2, Table 10). This estimate is historically the amount budgeted for rehabilitation activities.

3. Alternative R2: Rehabilitation Alternative R2 would complete the majority of all rehabilitation activities with contractual services.

Alternative R2 would accomplish the rehabilitation goals established in Section III B and address all existing rehabilitation deficiencies identified in Section III D. Contractual and City costs associated for Alternative R2 are summarized in Table 12.

Alternative R2 proposes to complete all rehabilitation activities listed in Table 12 except activity one with contractual services. Activities three through five would be completed by an engineering consultant with the City's engineering staff performing project management duties. The plans and specifications associated with activity two would be completed by the City's engineering staff. A contractor would be selected through the competitive bidding process to complete the rehabilitation work associated with activity two in accordance with the City's plans and specifications.

Activity one listed in Table 12 would be completed by City personnel. This activity would involve projects of an emergency nature that could not wait to be included in the annual rehabilitation contract. Mandays for activity one was estimated at 126 days per year. Currently, it's estimated that the Sewer Section spends 218.5 mandays per year on activity one. This represents a reduction of 740 hours per year in the existing rehabilitation program. Table 13 summarizes the yearly manday distribution for Alternative R2.

The costs presented in Table 12 for item two was an estimate. Actual funding needs for this task could be larger and will be evaluated as the program develops.

4. Alternative R3: Rehabilitation Alternative R3 is identical to the rehabilitation program proposed by Alternative R2 except that Alternative R3 proposed to complete activities three through five on Table 14 with City personnel. Alternative R3

would accomplish the rehabilitation goals established in Section III B and address all existing rehabilitation deficiencies identified in Section III D. Contractual and City costs associated with Alternative R3 are summarized in Table 14. Table 15 summarizes the yearly manday distribution for Alternative R3.

The costs presented for activity two on Table 14 was an estimate. Actual funding needs for this task could be larger and will be evaluated as the program develops.

**TABLE 10
REHABILITATION COST ESTIMATE
ALTERNATIVE R1 EXISTING**

ACTIVITY	ONE-TIME COST		ANNUAL COST	
	CONTRACT.	CITY	CONTRACT.	CITY
1. ANNUAL SEWER REHAB/CITY	\$0	\$0	\$0	\$71,500
2. ANNUAL SEW. REHAB/CONT.	\$0	\$0	\$30,000	\$0
3. SEWER PREF. STANDARDS	\$0	\$0	\$0	\$0
4. INFRA. INSPECT.& INVENT.	\$0	\$0	\$0	\$0
5. PLAN & ORGAN. REHAB. PROJ.	\$0	\$0	\$0	\$0
TOTALS	\$0	\$0	\$30,000	\$71,500
TOTAL ONE-TIME REHAB. COST	\$0			
TOTAL ANNUAL REHAB. COST	\$101,500			

**TABLE 11
MAINTENANCE MANDAY ESTIMATE
ALTERNATIVE R1 EXISTING**

ACTIVITY	P.M.	P.M.	ENG.	ENG.	TECH.	TECH.	OPER.	OPER.
	ONE-TIME	ANNUAL	ONE-TIME	ANNUAL	ONE-TIME	ANNUAL	ONE-TIME	ANNUAL
1. ANNUAL SEWER REHAB/CITY	0	0	0	0	0	0	0	219
2. ANNUAL SEW. REHAB/CONT.	0	0	0	0	0	0	0	0
3. SEWER PREF. STANDARDS	0	0	0	0	0	0	0	0
4. INFRA. INSPECT.& INVENT.	0	0	0	0	0	0	0	0
5. PLAN & ORGAN. REHAB. PROJ.	0	0	0	0	0	0	0	0
TOTALS	0	0	0	0	0	0	0	219

**TABLE 12
REHABILITATION COST ESTIMATE
ALTERNATIVE R2 CONTRACTUAL**

ACTIVITY	ONE-TIME COST		ANNUAL COST	
	CONTRACT.	CITY	CONTRACT.	CITY
1. ANNUAL SEWER REHAB/CITY	\$0	\$0	\$0	\$42,200
2. ANNUAL SEW. REHAB/CONT.	\$0	\$0	\$187,150	\$12,850
3. SEWER PREF. STANDARDS	\$11,000	\$4,750	\$0	\$1,250
4. INFRA. INSPECT & INVENT.	\$0	\$0	\$45,000	\$4,750
5. PLAN & ORGAN. REHAB. PROJ.	\$0	\$0	\$46,000	\$4,750
TOTALS	\$11,000	\$4,750	\$278,150	\$65,800
TOTAL ONE-TIME REHAB. COST	\$15,750			
TOTAL ANNUAL REHAB. COST	\$343,950			

**TABLE 13
REHABILITATION MANDAY ESTIMATE
ALTERNATIVE R2 CONTRACTUAL**

ACTIVITY	P.M.	P.M.	ENG.	ENG.	TECH.	TECH.	OPER.	OPER.
	ONE-TIME	ANNUAL	ONE-TIME	ANNUAL	ONE-TIME	ANNUAL	ONE-TIME	ANNUAL
1. ANNUAL SEWER REHAB/CITY	0	0	0	0	0	0	0	126
2. ANNUAL SEW. REHAB/CONT.	0	20	0	25	0	19	0	0
3. SEWER PREF. STANDARDS	15	5	5	0	0	0	0	0
4. INFRA. INSPECT & INVENT.	0	15	0	5	0	0	0	0
5. PLAN & ORGAN. REHAB. PROJ.	0	15	0	5	0	0	0	0
TOTALS	15	55	5	35	0	19	0	126

**TABLE 14
REHABILITATION COST ESTIMATE
ALTERNATIVE R3 CITY FORCES**

ACTIVITY	ONE-TIME COST		ANNUAL COST	
	CONTRACT.	CITY	CONTRACT.	CITY
1. ANNUAL SEWER REHAB/CITY	\$0	\$0	\$0	\$42,200
2. ANNUAL SEW. REHAB/CONT.	\$0	\$0	\$187,150	\$12,850
3. SEWER PREF. STANDARDS	\$0	\$7,000	\$0	\$1,250
4. INFRA. INSPECT & INVENT.	\$0	\$0	\$0	\$12,300
5. PLAN & ORGAN. REHAB. PROJ.	\$0	\$0	\$0	\$37,500
TOTALS	\$0	\$7,000	\$187,150	\$106,100
TOTAL ONE-TIME REHAB. COST	\$7,000			
TOTAL ANNUAL REHAB. COST	\$293,250			

**TABLE 15
REHABILITATION MANDAY ESTIMATE
ALTERNATIVE R3 CITY FORCES**

ACTIVITY	P.M.	P.M.	ENG.	ENG.	TECH.	TECH.	OPER.	OPER.
	ONE-TIME	ANNUAL	ONE-TIME	ANNUAL	ONE-TIME	ANNUAL	ONE-TIME	ANNUAL
1. ANNUAL SEWER REHAB/CITY	0	0	0	0	0	0	0	126
2. ANNUAL SEW. REHAB/CONT.	0	20	0	25	0	19	0	0
3. SEWER PREF. STANDARDS	10	5	18	0	6	0	0	0
4. INFRA. INSPECT & INVENT.	0	15	0	12	0	41	0	0
5. PLAN & ORGAN. REHAB. PROJ.	0	40	0	100	0	50	0	0
TOTALS	10	80	18	137	6	110	0	126

IV. SEWER EXPANSION

A. Definition of Sewer Expansion

Sewer expansion is defined as any sewer activity that either extends sanitary sewer service into unsewered areas or replaces an existing sanitary sewer with a larger capacity sewer or install a parallel sewer.

B. Sewer Expansion Goals

Before a sewer expansion program can be developed, the goals for the program must first be defined. The program goals must be consistent with the purpose of the sewer system and the level of service required by the City for the sanitary sewer system. Goals used to develop the sewer expansion program were:

1. The City shall provide a uniform sanitary sewer service to all Champaign residents by identifying areas in the City that are either unsewered or served by privately maintained sewers. The City shall assist these residents in acquiring City maintained sanitary sewer services. This doesn't mean that residents will not be required to pay their fair share for sanitary sewer service but rather the City shall be proactive in trying to eliminate unsewered or privately sewerred areas within the City's corporate limits.
2. The City shall provide sufficient capacity in the sanitary sewer system to serve the wastewater needs for developed areas within the City by identifying the location of existing undercapacity sanitary sewers and increase the capacity by installing new parallel sewers or replacing these sewers with larger capacity sewers.
3. The City shall be an active participant in the extension of sanitary sewers into undeveloped areas by encouraging the Urbana & Champaign Sanitary District to master plan interceptor routes throughout the Facility Planning Area and by assisting developers in the planning, design, and construction of the sanitary sewers.

C. Existing Expansion Program

The City's existing expansion program doesn't address all the expansion needs of the City. When comparing the City's existing expansion program to the goal statements in Section IV B, five areas for expansion needs were identified. The five expansion areas are summarized below and classified in terms of the degree of development and sewer availability. Additionally, each area is compared to the existing expansion program to identify deficiencies that need to be addressed.

1. Developed Unsewered Area: This area of expansion would extend sanitary sewers into areas that are currently in the City's corporate limits and are presently served by individual septic tanks. The City's existing program for this type of need is

primarily designed to address individual inquiries made by residents served by septic tanks and who are within two hundred feet of the City's sanitary sewer system. This expansion program needs to be more aggressive. The City needs to identify the unsewered areas, determine sewer availability and then educate residents on the benefits and costs associated with sanitary sewer service.

2. **Undeveloped Unsewered Areas:** This area of expansion is designed to extend sanitary sewers into areas that are unsewered and undeveloped and are either newly annexed to the City or have an annexation agreement with the City. The City's existing expansion program has been very active in this area with the City assisting developers in planning, design, financing, and construction of new sanitary sewers.

Planning for sanitary sewer extensions to undeveloped areas has been hindered by the lack of sanitary sewer master plans. The City needs to work with the Urbana & Champaign Sanitary District in developing master plans for areas outside the current City limits but within the District's Facilities Planning area. The City also needs to work with the Urbana & Champaign Sanitary District to insure that the District takes a role in constructing the interceptor sewers that will be part of these master plans. Additionally, City economic development funds for sanitary sewer extensions must be continuously monitored. Funding levels from economic development may not be sufficient to fund all sanitary sewer projects in the future. Other funds must be made available or provisions must be made to borrow from other funds for the City to meet all expansion needs.

3. **Undeveloped Sewered Areas:** This area of expansion replaces existing undercapacity sewers with larger capacity or parallel sewers that will be extended into areas that are unsewered and undeveloped and are either newly annexed to the City or have an annexation agreement with the City. The City has no existing policies or procedures for this type of expansion project. Additionally, the City has no background information on existing sewer capacities. Due to the lack of basic inventory information on the existing sanitary sewer (i.e. pipe diameter and slope) and existing wastewater flow information, the City cannot predict whether a proposed development will cause a problem in the existing sewer system.
4. **Developed Sewered Areas:** This area of expansion replaces existing undercapacity sewers with larger capacity or parallel sewers to serve existing development. A project example would be the campustown area where the replacement of lower density housing with higher density housing has caused capacity problems in the existing sanitary sewer system. To date, the City's existing expansion program hasn't addressed this type of project. Projects have been funded to study capacity problems in certain geographic areas but the projects have never been started.

5. Privately Sewered Areas: This area of expansion project replaces existing private sanitary sewers that serve multiple users with sewers built to City standards and maintained by the City. Typically, privately maintained sanitary sewers were not built to City standards (i.e. pipe diameter and slope), were not located in easements and historically have not been maintained properly. To date, the City's existing expansion program hasn't addressed this type of project. The City has never done an investigation to determine the number or location of all multiple user privately maintained sanitary sewers nor made any efforts to eliminate them from the sewer system.

D. Expansion Tasks

Summarized below are the five existing expansion program deficiencies identified in Section IV C.

1. The City is not proactive in trying to eliminate areas within the City that are currently served by septic tanks or privately maintained sanitary sewers.
2. Planning for sanitary sewer extensions has been hindered by the lack of sanitary sewer master plans.
3. Funding levels for economic development may not be sufficient to fund all undeveloped and unsewered expansion projects in the future.
4. The existing and ultimate capacity of existing sewer segments is unknown.
5. No City procedures and/or policies exist on how to address expansion projects that pertain to existing undercapacity sewers that need to be either extended into unsewered areas or are inadequate to serve existing needs.

Two of the above deficiencies (one and four) will require tasks to be completed to rectify the deficient area and bring the program into compliance with the goals. The activities associated with those tasks are summarized below. The other three deficiencies require policy decisions (three and five) or coordination with other governmental agencies (two). The tasks involved with these deficiencies are difficult to quantify but should be minor in scope and therefore have not been addressed here.

- a. This task will incorporate into the sewer facility management system a hydraulic model to predict capacities in each existing sewer segment. The model will base existing wastewater flows on water usage records and shall be capable of summing all existing wastewater usage upstream of the segment in question. The model shall express existing wastewater flows in terms of average daily flow, maximum average daily flow and peak daily flow increased by an appropriate factor for infiltration and inflow. The model shall also be able to determine maximum capacity of any

existing sewer segment in the sanitary sewer system. This task will assume that accurate inventory information exists on the existing sanitary sewer system and the information has been incorporated into an useable database. This task is primarily a one-time expense that will require minimal annual expenditures to update records.

- b. This task will attempt to locate all areas within the City that are presently served by either septic tanks or sanitary sewers that are privately maintained by multiple users. The task will concentrate on areas which have multiple residents currently not served by City sewers and not on those isolated instances where a single resident is not served. Once the areas have been identified the task will develop sewer service alternatives and will contact the affected residents to discuss the alternatives and to gauge their interest. The task will assume that accurate inventory information exists on the sanitary sewer system and will utilize this information to locate potential unsewered areas and/or privately sewerred areas. This task will be an annual expenditure that will be completed after the sanitary sewers have been inventoried.

E. Expansion Alternatives

Two expansion program alternatives were identified to complete the tasks described in Section IV D.

Alternative E1 would require no changes to the City's existing program. No new programs would be started to accomplish the expansion tasks discussed in Section IV D. Expansion goals one and two in Section IV B would not be attained and a majority of the deficiencies in the existing expansion program would remain. Alternative E1 would require no additional City personnel and would require no project management time. Alternative E1 would have no cost associated with the City's maintenance, rehabilitation, and expansion plan.

Alternative E2 proposes to enhance the existing City sewer expansion program. The alternative proposes to complete task one and two (Section IV D) with a combination of City personnel and contractual services. The majority of task one would be completed with contractual services with the City's personnel performing project management activities and the annual update requirements. Task two would be completed entirely by the City's engineering section. Task one and two in this section would be started after task two in Section III E has been completed. Alternative E2 used several assumptions to develop specific details and cost data for the alternative. These assumptions are summarized below:

1. Data entry associated with task one would be completed by the part-time data entry clerk explained in Alternative M2, M3 & M4.
2. The areas evaluated by tasks one and two would coincide with the same geographic areas evaluated in annual sewer maintenance and rehabilitation program.

3. Alternative E2 did not evaluate whether or not the engineering section had sufficient manpower to complete the required engineering activities. The manpower evaluation will be made on the recommended alternative.
4. Engineering cost were based on actual hourly rates increased by a multiplier of 1.442.

Alternative E2 would accomplish the expansion goals stated in Section IV B and would address all deficiencies discussed on Section IV C. Contractual and City costs for Alternative E2 are summarized in Table 16. Table 17 summarizes the yearly manhour distribution for Alternative E2.

**TABLE 16
EXPANSION COST ESTIMATE
ALTERNATIVE E2**

<u>ACTIVITY</u>	<u>ONE-TIME COST</u>		<u>ANNUAL COST</u>	
	<u>CONTRACT.</u>	<u>CITY</u>	<u>CONTRACT.</u>	<u>CITY</u>
1. HYDRAULIC MODEL	\$30,000	\$5,000	\$0	\$4,000
2. UNSEW. AREAS/PRIV. SEWERS	\$0	\$0	\$0	\$4,750
TOTAL	\$30,000	\$5,000	\$0	\$8,750
TOTAL ONE-TIME EXPAN. COST	\$35,000			
TOTAL ANNUAL EXPAN. COST			\$8,750	

**TABLE 17
EXPANSION MANDAY ESTIMATE
ALTERNATIVE E2 CONTRACTUAL/CITY**

<u>ACTIVITY</u>	<u>P.M.</u>	<u>P.M.</u>	<u>ENG.</u>	<u>ENG.</u>	<u>TECH.</u>	<u>TECH.</u>	<u>OPER.</u>	<u>OPER.</u>
	<u>ONE-TIME</u>	<u>ANNUAL</u>	<u>ONE-TIME</u>	<u>ANNUAL</u>	<u>ONE-TIME</u>	<u>ANNUAL</u>	<u>ONE-TIME</u>	<u>ANNUAL</u>
1. HYDRAULIC MODEL	20	5	0	10	0	5	0	0
2. UNSEW. AREAS/PRIV. SEWERS	0	5	0	10	0	10	0	0
TOTAL	20	10	0	20	0	15	0	0

V. RECOMMENDATIONS

A. Alternative Section

The purpose of this report was to develop a plan to maintain, expand, and rehabilitate the City's sanitary sewer system. To develop the plan, one alternative had to be selected from each group of alternatives presented for the Maintenance (Section II), Rehabilitation (Section III) and Expansion (Section IV) programs. To select the alternative an evaluation process was done. Each alternative was compared to a predetermined set of selection criteria and was rated on a scale of 0 to 5. A rating of zero indicated little agreement with the selection criteria while a rating of five indicated a strong agreement with the selection criteria. The rating values were totaled and the alternative with the highest value was selected as the recommended alternative. Table 18 summarizes the alternative rating score for each selection criteria. The selection criteria listed in Table 18 is summarized below.

1. The alternative will require no increase in the current annual level of funding for the sewer activity.
2. The alternative will provide the level of service defined in Section I.
3. The alternative will meet the goals established for the sewer activity.
4. The alternative will require no additional City personnel nor reallocation of existing manpower resources.

Maintenance alternative four (M4), rehabilitation alternative two (R2) and expansion alternative two (E2) were chosen as the recommended alternatives and therefore will serve as the foundation for the sanitary sewer plan. However, as indicated in Table 18, maintenance alternatives M2, M3, M4 and rehabilitation alternatives R2, R3 had essentially the same rating values. M4 was chosen as the recommended alternative because of its low total annual maintenance cost and its lower City staffing requirements for one-time activities. R2 was chosen as the recommended alternative because of its lower staffing requirements for annual activities. During the evaluation process, if alternatives appeared to be equal, alternative selection would be based on City staffing requirements i.e. the alternative with the lower staffing requirements would be chosen.

B. Proposed Plan

The recommended alternatives M4, R2, and E2 will be used as the basis for the sanitary sewer maintenance, rehabilitation, and expansion plan. The major tasks included in these alternatives and incorporated into the overall plan are summarized below. More detail information on the job tasks, cost estimates, and manday estimates can be found within other sections of this report.

1. Maintenance Tasks

- a. On a daily basis, City personnel would respond to service requests and would perform miscellaneous sewer maintenance and TV inspections associated with these requests. The annual cost and City manpower requirements for this task are \$91,800 and 275 mandays, respectively.
- b. An identification system would be developed for the City's sanitary sewer system. The identification system would label every manhole and cleanout in the sanitary sewer system. This task would also incorporate the labeling system into the City's sewer maps and would incorporate the sewer maps into the City's CADD system. This task would be primarily a one-time activity performed by contractual services with City personnel performing project management duties. Annual updates of the maps would be required and would be done by City staff. The one-time activities with this task would be performed during the first year of the plan's implementation. The one-time cost and City manpower requirements for this task are \$56,750 and 25 mandays, respectively. Annual cost and City manpower requirements for this task are \$2,000 and 10 mandays, respectively.
- c. An automated and computerized facility management system would be purchased for the sanitary sewer system. The system would be capable of:
 - * storing the entire inventory of the City's sanitary sewer collection system,
 - * scheduling and tracking preventive maintenance,
 - * generating and tracking work orders for service requests and preventive maintenance,
 - * generating reports on inventory, preventive maintenance status, work order status, and maintenance history; and
 - * tracking costs on work orders and preventive maintenance.

The majority of this task would be a one-time activity performed primarily by contractual services with City personnel performing project management duties. Annual updates for the system would be required and performed by a combination of City staff and contractual services.

The one-time activities associated with this task would be performed during the first year of the plan's implementation. The one-time cost and City manpower requirements for this task are \$69,500 and 35 mandays, respectively. Annual cost and City manpower requirements for this task are \$22,250 and 10 mandays, respectively.

- d. Procedural/operational manual would be developed to guide maintenance procedures. The manual would instruct the individuals performing the maintenance activity on the methodology to be used, equipment needed, records to be kept, desired work quality and necessary followup activities. The majority of this task is a one-time

activity that would be performed by contractual services with City personnel performing project management duties. Annual updates for the manuals would be required and performed by City personnel. The one-time activities associated with this task would be performed during the first year of the plan's implementation. The one-time cost and City manpower requirements for this task are \$25,750 and 20 mandays, respectively. Annual cost and City manpower requirements for this task are \$2,250 and 10 mandays, respectively.

- e. The City's sanitary sewer system would be divided into work areas. The work areas would be prioritized based on past sewer maintenance problems and sewer pipe age. The highest priority work areas would be the first sewers maintained and rehabilitated by the proposed plan. This task is a one-time activity that would be performed by contractual services with City personnel performing project management duties. The one-time activities associated with this task would be performed during the first year of the plan's implementations. The one-time cost and City manpower requirements for this task are \$12,250 and 20 mandays, respectively.
- f. Prior to the start of any maintenance activities in a particular work area, the target work area would be surveyed to verify manhole locations and manhole accessibility. The survey would identify access problems and would identify solutions to these problems. This task would be an annual activity that would be performed by City personnel during the second year of the plan's implementation. The annual cost and City manpower requirements for this task are \$12,100 and 70 mandays, respectively.
- g. Annually, the City would clean, televise and remove roots in 90,000 feet of sanitary sewer. The 90,000 feet of sewer would be located in a work area that has been prioritized and surveyed for access problems. This task is an annual activity that would be performed by City personnel starting the second year of the plan's implementation. Implementing this task would require the City to eliminate televising new subdivision sewers and curtail repairs done by City personnel to storm and sanitary sewers. The resources for these tasks would be reallocated to this sewer task. The one-time cost associated with this task is the purchase of the root vaporizing equipment (\$30,000). Annual cost and City manpower requirements for this task are \$183,750 and 530 mandays, respectively.

2. Rehabilitation Tasks

- a. City personnel would continue to complete some rehabilitation projects on the sanitary sewer system. The rehabilitation work would be limited to only emergency work. This task would be completed by City personnel with annual cost and City manpower requirements of \$42,200 and

126 mandays, respectively. The 126 mandays represents a decrease of approximately 92 mandays in the resources currently used for this task. The reallocated resources would be used in the annual sewer maintenance project.

- b. Performance standards would be developed for all components of the City's sanitary sewer system, i.e. sewers, manholes, cleanouts, etc. All sewer components would be compared to the performance standards and those components not meeting the standards would be rehabilitated. The majority of this task is a one-time activity that would be performed by contractual services with City personnel performing project management duties. Annual updates for the standards would be required and performed by City personnel. The one-time activities associated with this task would be performed during the first year of the plan's implementation. The one-time cost and City manpower requirements for this task are \$15,750 and 20 mandays, respectively. Annual costs and City manpower requirements for this task are \$1,250 and 5 mandays, respectively.
- c. Annually, a portion of the City's existing sanitary sewer system would be inspected and inventoried. The plan proposes to inspect and inventory 90,000 feet of sewer annually. At this rate, the entire City's sewer system would be inspected in ten years. The portion of the sewer system that would be inventoried and inspected would be the same portion of the sewer system cleaned and televised in the annual maintenance project. The televising logs produced in the annual maintenance project would be used to complete this job task. Generally, the sewer inspection and inventory would include:

- * Identifying and evaluating the manhole cover and frame.
- * Identifying the physical location of manholes, i.e. streets, parkway, etc.
- * Identifying the type of construction material used for the corbel, manhole wall, bench and sewer pipe.
- * Determining the elevation of the manhole rim and influent/effluent pipes in the manhole.
- * Evaluate the physical condition of the sewer pipe.
- * Determining the diameter of the sewer pipe, slope of the sewer pipe and location of service laterals.
- * Identifying and evaluating I/I sources in the sewer pipe, pipe/manhole connection, manhole walls and manhole frames/cover.

All inventoried items would be inspected for conformance with the performance standards and any deficiencies would be earmarked for rehabilitation. This task would also identify infiltration/inflow sources in the City's sanitary sewer system. This task would be an annual activity that would be performed by contractual services with City personnel performing project management duties. The task would start during the second year of the plan's implementation. Annual

cost and City manpower requirements for this task are \$49,750 and 20 mandays, respectively.

- d. The rehabilitation needs identified during the inspection and inventory of the sanitary sewer system would be evaluated, organized into projects and prioritized. The prioritized list of rehabilitation projects would be used to determine the annual sewer rehabilitation project. This task would be an annual activity performed by contractual services with City personnel performing project management duties. The task would start once the rehabilitation needs in a geographic area have been identified. Annual cost and City manpower requirements for this task are \$50,750 and 20 mandays, respectively.
- e. Annually, the City's engineering department would prepare plans and specifications for a sewer rehabilitation project. A contractor would be selected through the competitive bidding process to complete the work outlined in the project plans and specifications. The City's engineering staff would choose the rehabilitation project or projects from a prioritized project list. Consequently, this task cannot be started until rehabilitation needs have been identified and prioritized. Annual cost and City manpower requirements for this task are \$200,000 and 64 mandays, respectively.

3. Expansion Tasks

- a. A hydraulic model would be incorporated into the facility management system that would assist in calculating wastewater flows in sanitary sewers. The majority of this task would be a one-time activity performed primarily by contractual services with City personnel performing project management duties. Annually, City personnel would evaluate segments of the existing sewer system for undercapacity sewers. The one-time activities associated with this task would be incorporated in the facility management system task. The annual activities would be started after segments of existing sewer system has been inventoried and inspected for rehabilitation needs. The one-time cost and City manpower requirements for this task are \$35,000 and 20 mandays, respectively. Annual cost and City manpower requirements for this task are \$4,000 and 20 mandays, respectively.
- b. Annually, unsewered areas and areas sewerred by private sanitary sewers would be identified as the City's sewer system is inspected and evaluated for rehabilitation needs. This task would identify these areas and would develop alternatives for providing these residents with a City maintained sewer. This is an annual activity that would be completed by City personnel and would be started after segments of the sewer system has been inspected and inventoried for rehabilitation needs. Annual cost and City manpower requirements for this task are \$4,750 and 25 mandays, respectively.

- e. The proposed plan would set aside annually \$100,000 to fund expansion needs in the sanitary sewer system. No specific projects have been identified. Projects would be identified as the proposed sewer plan is implemented.

C. Staffing and Budget

1. Staffing: Table 19 summarizes the annual City manday requirements to implement the recommended sanitary sewer maintenance, rehabilitation, and expansion plan. Implementation of the proposed sanitary sewer plan would require the reallocation of existing City staff resources and would also require two new City staff positions.

Reallocation of existing City staff resources would occur in two areas.

- a. The City's sewer section currently televises all newly constructed sanitary sewers within the City's corporate limits and 1.5 mile jurisdictional limit. The sewers are televised to insure they were constructed to City standards. The proposed sewer plan would discontinue this practice. The manhours (2,360) currently utilized for this activity would be reallocated to the annual sewer maintenance project. Its intended that other subdivision certification processes, already in place, would help insure that new sanitary sewers would be built in conformance with City standards.
- b. The City's sewer section currently spends approximately 1,750 manhours and 3,250 manhours per year rehabilitating sanitary and storm sewers, respectively. Implementation of the proposed sanitary sewer plan would reallocate 1,640 manhours per year from these activities to the annual sewer maintenance project. This reduction would eliminate some storm and sanitary sewer rehabilitation projects being done by the sewer section. The eliminated projects would be included in annual sewer rehabilitation projects to be done by private contractors.

The two City positions that would be eventually required as the proposed sewer plan is implemented includes a full-time Engineer I and a part-time data entry clerk.

- a. Engineer I: Table 19 indicates the proposed sewer plan has a substantial need for project management, engineering and technician mandays. All alternatives investigated for the proposed plan allocated costs for project management, engineering, and technician mandays. However, the alternatives did not evaluate whether or not the City had sufficient staff to complete these activities. The existing engineering staff can allocate only twenty-five engineering/project management mandays and eighty-seven technician mandays to these activities. No time is available in the Operation's Division of Public Works from either the division manager or the

sewer section supervision. This leaves a large deficit in project management/engineering mandays for every year of the plan and a small deficit in technician mandays in the third year and thereafter. The technician manday deficit could be eliminated by hiring summer interns to complete the maintenance field survey (Maintenance - task eight, Tables 19 & 20) starting in the second year. The purpose of the field survey is to locate manholes and to identify manhole accessibility problems in the target area for the annual preventive maintenance program. With some direction and supervision, the summer interns should be able to complete this activity successfully. However, the project management/engineering deficit is too large and will require the addition of one Engineer I to the City's engineering staff. The engineer would report to the Assistant City Engineer for the environment and would be associated with the maintenance, rehabilitation, and expansion plan. Its estimated this position would work half-time on the maintenance, rehabilitation, and expansion plan and the other half-time would be dedicated to working on the Boneyard Creek and future drainage CIP projects. The annual recurring cost for this position including salary, fringe benefits, commodities, contractals, and transfers would be \$43,500 with an initial capital investment for furniture and computer of \$7,000. The cost for this individual would be charged equally to the sanitary sewer program and the CIP drainage projects.

- b. Data Entry Clerk: Implementation of the proposed sanitary sewer plan would add one part-time data entry clerk to the Sewer Section. The data entry clerk would report to the sewer supervisor and would be responsible for entering data into the computer for the sanitary sewer facility management system (FSM). The data entry clerk would be hired after the FSM system has been purchased and installed.

In addition, to the two new positions described above the proposed sewer plan could be implemented and managed more efficiently if the Operation's Division of Public Works was re-organized and a new division manager was added to the Operation's Division of Public Works.

Currently, Public Works has one division manager for the streets, concrete, forestry, and sanitary/storm/sewer section. The re-organization would create a new division manager and place him in charge of the sanitary/storm sewer section. The division manager would report directly to the Public Works Director and would be responsible for managing the daily activities in the sewer section. Specifically, the division manager would become the lead person in the sewer section managing work orders, planning daily and monthly work schedules, answering citizen service requests, handling personnel matters and evaluations. The creation of the division manager would allow the sewer section

supervisor to spend more time in the field doing "hands on" supervision.

This type of supervision will be vital if the maintenance, rehabilitation, and expansion plan is to succeed. The new division manager would also perform some of the planning activities associated with the sanitary sewer maintenance, rehabilitation, and expansion plan thereby reducing the project management manday deficit illustrated in Table 19. Additionally, the new division manager would be responsible for creating new programs in the sewer section to increase the productivity, efficiency, and effectiveness of the section. Programs would include establishing staff training and safety programs, evaluating maintenance procedures, evaluating staff and equipment needs. The current organizational structure doesn't allow the current division manager and supervisor the time to evaluate and develop these programs.

The annual recurring cost for the division manager including salaries, fringe benefits, commodities, contractals, and transfers would be \$64,000 with a one-time cost for recruitment, furniture, computer, and vehicle of \$29,000. Fifty percent of the one-time and annual cost for this position would be charged to the sanitary sewer program. The remaining fifty percent would be charged to the general operating fund until the storm sewer maintenance, rehabilitation, and expansion plan has been developed and funded.

In order to prevent further complication of the proposed sanitary sewer plan, the Public Works reorganizational issue and the additional division manager will be investigated further at a later date.

As illustrated in the above discussion no staffing increases have been planned for the City's sewer section. All manhours from the sewer section that would be needed to implement the proposed sewer plan would be obtained from reallocated resources and discontinuation of some existing maintenance activities. As the proposed sewer plan is implemented staffing needs for the sewer Section will be monitored and any additional staffing needs will have to be incorporated into the proposed plan.

2. Budget

Table 20 summarizes the yearly cost per activity for the recommended maintenance, rehabilitation, and expansion plan. Approximately, fifty percent of the cost for the new division manager has been allocated to the proposed plan. One hundred thousand dollars has been allocated for unspecified expansion projects. In addition, two hundred dollars has been allocated for unspecified rehabilitation projects. The adequacy of the allocated dollar amount for expansion and rehabilitation will be addressed as these needs are identified and prioritized. It is entirely possible this dollar amount may be insufficient as the plan is implemented.

**TABLE 18
ALTERNATIVE RATING SUMMARY**

CRITERIA	M1	M2	M3	M4	R1	R2	R3	E1	E2
1. COST	5	1	3	3	5	2	3	5	4
2. LEVEL OF SERVICE	0	5	5	5	0	5	5	2	5
3. GOALS	0	5	5	5	0	5	5	2	5
4. STAFF	5	4	2	3	5	3	2	5	4
TOTALS	10	15	15	16	10	15	15	14	18

**TABLE 20
COST ESTIMATE
MAINTENANCE, REHABILITATION
& EXPANSION PLAN**

ITEM	EXISTING	1st. YEAR	2nd YEAR	3rd. YEAR	4th. YEAR
A. GENERAL					
1. DIVISION MANAGER	\$0	\$46,500	\$32,000	\$32,000	\$32,000
TOTAL GENERAL	\$0	\$46,500	\$32,000	\$32,000	\$32,000
B. MAINTENANCE					
1. DAILY SERVICE REQUESTS	\$41,800	\$41,800	\$41,800	\$41,800	\$41,800
2. MISC. T.V. INSPECTIONS	\$131,700	\$33,000	\$33,000	\$33,000	\$33,000
3. MISC. SEWER MAINTENANCE	\$17,000	\$17,000	\$17,000	\$17,000	\$17,000
4. SEWER MAPS	\$0	\$56,750	\$2,000	\$2,000	\$2,000
5. FACILITY MANAGE. SYSTEM	\$0	\$71,500	\$22,250	\$22,250	\$22,250
6. PROCEDURAL/OPER. MANUAL	\$0	\$25,750	\$2,250	\$2,250	\$2,250
7. WORK AREA DEF. & PRIOR.	\$0	\$12,250	\$0	\$0	\$0
8. FIELD SURVEY	\$0	\$0	\$12,100	\$12,100	\$12,100
9. ANNUAL SEWER CLEANING & T.V.	\$0	\$130,000	\$183,750	\$183,750	\$183,750
TOTAL MAINTENANCE	\$190,500	\$388,050	\$314,150	\$314,150	\$314,150
C. REHABILITATION					
1. ANNUAL SEWER REHAB/CITY	\$71,500	\$42,200	\$42,200	\$42,200	\$42,200
2. ANNUAL SEW. REHAB/CONTRACT	\$30,000	\$100,000	\$100,000	\$200,000	\$200,000
3. SEWER PREF. STANDARDS	\$0	\$15,750	\$1,250	\$1,250	\$1,250
4. INFRA. INSPECT & INVENT.	\$0	\$0	\$49,750	\$49,750	\$49,750
5. PLAN & ORGAN. REHAB. PROJ.	\$0	\$0	\$50,750	\$50,750	\$50,750
TOTAL REHABILITATION	\$101,500	\$157,950	\$243,950	\$343,950	\$343,950
D. EXPANSION					
1. HYDRAULIC MODEL	\$0	\$35,000	\$4,000	\$4,000	\$4,000
2. UNSEW. AREAS/PRIV. SEWERS	\$0	\$0	\$4,750	\$4,750	\$4,750
3. EXPANSION PROJECTS	\$0	\$0	\$100,000	\$100,000	\$100,000
TOTAL EXPANSION	\$0	\$35,000	\$108,750	\$108,750	\$108,750
TOTAL	\$292,000	\$627,500	\$698,850	\$798,850	\$798,850