

DR 85-24 - COWSKIN CREEK INTERCEPTOR SEWER FEASIBILITY REPORT - The results of an investigation of alternative solutions to wastewater planning and development in Cowskin Creek drainage area

ACTION

DATE

COMMITTEE

*Consent Study - Department 12/13/65
Approved to file*

M.A.P.C.

*B.C.C./B-60-C. Specific File - Files 12/15/65
To CIP Admin. Comm.*

B.C.C./B-60-C

*Control Card for
Case is filed
under "Spec Hold"*

8524

FROM

W/W

DATE *9-13-85*

ADMINISTRATION

- Lakin
- Walter
- Doramus
- Eubanks
- Harris
- Henderson
- Wasko
- Wimbley

ADVANCE PLANS

- Stockwell
- Schwartz
- Dudark
- Ahrens
- Bechtel
- Hart
- Kelley
- Losew
- Mitchell
- Peete
- Shen

CURRENT PLANS

- Galbraith
- Lytle
- Young
- Bonanni
- Lahey
- Nagley
- Olivarez
- Smythe

ENGINEERING

- Lindebak
- Cain
- Ruiz
- Henry
- Schneider
-
-
-

GRAPHICS

- Pierce
- Commer
- Crook
- Jones
- Whitney

DR 85-24

You need to draft 3 agenda for that meeting

REMARKS

This is an item you should put on the Oct 3rd Plug Com Agenda. Also an informal agenda.

- Note & Return
- Handle
- All Staff
- Comment
- Signature
- Library
- Information
- Files
- Type

THE CITY OF WICHITA

OFFICE OF MAPD-DESIGN

DATE September 12, 1985

TO Metropolitan Area Planning Commission


FROM Mike Lindebak, City Engineer/Acting Director of Planning

SUBJECT Cowskin Creek Interceptor Sewer
Feasibility Report

Please find attached for your review, the Cowskin Creek Interceptor Sewer Feasibility Report. The report was prepared by Burns & McDonnell, Consultant Engineers. It contains the results of an investigation of alternative solutions to wastewater planning and development in the Cowskin Creek drainage area.

A formal presentation to the Metropolitan Area Planning Commission is scheduled for October 3, 1985.

Informal


Mike Lindebak, City Engineer/
Acting Director of Planning

ML:EM:gf

attachment

cc: Jack Galbraith, Chief Planner - Current Plans ✓
Bill Stockwell, Chief Planner - Advance Plans

00866pg50

RECEIVED

SEP 13 1985

METROPOLITAN PLANNING

ROUTE

WICHITA-SEDGWICK COUNTY
METROPOLITAN AREA PLANNING DEPARTMENT

September 26, 1985

TO: Wichita-Sedgwick County Metropolitan Area Planning Commission
FROM: Mike Lindebak, Director of Planning (Interim)
SUBJECT: Cowskin Creek Interceptor Sewer Feasibility Report

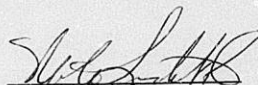
The Planning Department recently received the final draft of the engineering report dealing with the Cowskin Creek Interceptor Sewer Project. This study was prepared jointly by Burns and McDonnell and Professional Engineering Consultants. A copy of the report is enclosed.

The report investigates three basic alternative solutions to the development of wastewater facilities within the Cowskin Creek drainage basin: 1) interceptor gravity sewer, 2) pump station and force main, and 3) aerated lagoon treatment plant. The interceptor sewer was found not to be economically feasible and the satellite treatment plant was discarded because of environmental (effluent quality and plant reliability) and aircraft safety (waterfowl) reasons.

The consultants have therefore recommended that the city construct a new 7,400 gpm pump station as a backup to existing pump station No. 10, a new 48" interceptor connecting pump station No. 10 with the new pump station, and a 24" force main from the new pump station to the existing Southwest Interceptor Sewer. The recommended alternative is identified as Alt. B-1 and is illustrated on Figure V-2 with projected capital and operating costs shown on Table VI-2.

Additional sewer system improvements are recommended upstream of pump station No. 10 to serve existing and projected developing areas north of U.S. 54. Figure VI-2 shows these improvements and Table VI-4 details their costs.

This item is being placed on both your informal and regular meeting agenda for October 3.


Mike Lindebak
Director of Planning (Interim)

ML:RD:rh
Enclosure

127

THE CITY OF WICHITA

OFFICE OF MAPD-DESIGN

DATE September 12, 1985


TO Metropolitan Area Planning Commission

FROM Mike Lindebak, City Engineer/Acting Director of Planning

SUBJECT Cowskin Creek Interceptor Sewer
Feasibility Report

Please find attached for your review, the Cowskin Creek Interceptor Sewer Feasibility Report. The report was prepared by Burns & McDonnell, Consultant Engineers. It contains the results of an investigation of alternative solutions to wastewater planning and development in the Cowskin Creek drainage area.

A formal presentation to the Metropolitan Area Planning Commission is scheduled for October 3, 1985.


Mike Lindebak, City Engineer/
Acting Director of Planning

ML:EM:gf

attachment

cc: Jack Galbraith, Chief Planner - Current Plans
Bill Stockwell, Chief Planner - Advance Plans ✓

00866pg30

RECEIVED

SEP 13 1985

METROPOLITAN PLANNING

ROUTE _____

Cowskin Creek Interceptor Sewer Feasibility Report

For The
City of
Wichita, Kansas

1984

83-015-4



Burns & McDonnell
ENGINEERS ARCHITECTS CONSULTANTS

PROFESSIONAL
ENGINEERING
CONSULTANTS P.A.
Wichita, Kansas

Cowskin Creek
Interceptor Sewer
Feasibility Report

For The
City of
Wichita, Kansas

1984
83-015-4

Burns & McDonnell
ENGINEERS - ARCHITECTS - CONSULTANTS

PROFESSIONAL
ENGINEERING
CONSULTANTS P.A.

Burns & McDonnell
ENGINEERS - ARCHITECTS - CONSULTANTS

July 26, 1985

Mr. Michael Lindebak, P.E.
City Engineer
City Hall
455 North Main Street
Wichita KS 67202

Dear Mr. Lindebak:

We are pleased to submit 50 copies of the final draft of the engineering study entitled Cowskin Creek Interceptor Sewer Feasibility Report, in accordance with our Agreement for Engineering Services dated January 25, 1983.

The Agreement for Engineering Services provided for development of a feasibility report to complete Phase I of the Cowskin Creek Study Area project. This report presents the investigation of alternative solutions to wastewater planning and development in the Cowskin Creek drainage area. The most cost effective and environmentally acceptable alternative has been recommended.

The cooperation and close interaction between Professional Engineering Consultants, P.A. and City staff members has been greatly appreciated and was instrumental in providing the detail and accuracy in this report. Both PEC and Burns & McDonnell look forward to a continuing relationship with the City on this and other projects.

Respectfully yours,



Weston E. Goodnow, P.E.

Barton L. Brandenburg, P.E.

WEG/BLB/gph

Enclosure

cc: Mr. Mike Schomaker, P.E.

TABLE OF CONTENTS

Part No.		Page No.
	SUMMARY	
	Findings	S-1
	Recommendations	S-6
	Implementation	S-7
I.	INTRODUCTION	
	Purpose	I-1
	Scope	I-1
II.	EXISTING CONDITIONS	
	Population	II-1
	Land Use	II-2
	Southwest Interceptor Sewer System	II-4
	Subsystem 29	II-6
	Wastewater Pumping Stations	II-7
	Wastewater Treatment Facilities	II-8
III.	FUTURE CONDITIONS AND NEEDS	
	Population	III-1
	Land Use Trends	III-2
	Wastewater Collection and Treatment Requirements	III-4
IV.	EXISTING FACILITIES VS. FUTURE NEEDS	
	Introduction	IV-1
	Sewer Load Allocation and Hydraulic Analysis	IV-1
	Service Area Limitations	IV-9
V.	WASTEWATER TRANSPORT AND TREATMENT ALTERNATIVES	
	Interceptor Sewer Extension	V-1
	Pump Station/Force Main	V-6
	Wastewater Treatment Plant	V-12
VI.	PLAN SELECTION	
	Cost Effective Analysis	VI-1
	Cost Summary	VI-19
	Recommended Plan	VI-20
	Other Sewer System Improvements	VI-21
VII.	FINANCING AND IMPLEMENTATION	
	Project Financing	VII-1
	Local Share Financing	VII-6
	Project Implementation	VII-8
	APPENDIX	
	Kansas Department of Health and Environment letter	
	Kansas Gas and Electric Company letter	
	Table A-1 — Power Costs	

LIST OF TABLES

Table No.		Page No.
II-1	Population and Dwelling Units in 1980 by Township	II-2
IV-1	Existing Population and Land Use	IV-11
IV-2	Existing Wastewater Flow Rates	IV-12
IV-3	Population and Land Use Year 2000	IV-13
IV-4	Year 2000 Wastewater Flow Rates	IV-14
IV-5	Year 2010 Wastewater Flow Rates	IV-15
VI-1	Summary of Alternative Costs	VI-23
VI-2	Cost of Cowskin Creek Recommendations	VI-24
VI-3	Peak Flows and Sizing for Developing Areas	VI-25
VI-4	Cost of Sewers for Developing Areas	VI-25
VII-1	Estimate of Federal and Local Costs	VII-7
VII-2	100 Percent Local Financing	VII-8
A-1	Power Costs	Appendix

LIST OF FIGURES

<i>Figure No.</i>		<i>Page No.</i>
II-1	Existing Sewer System	II-13
III-1	Existing and Future Land Use	III-6
V-1	Cowskin Creek Interceptor Sewer	V-25
V-2	Site B Pumping or Treatment Options.....	V-26
V-3	Site C Pumping or Treatment Options	V-27
VI-1	Site B Aerated Lagoon Layout	VI-26
VI-2	Sewer System Improvements	VI-27

SUMMARY

SUMMARY

FINDINGS

1. The study area encompasses 67 square miles located west of the Wichita Valley Center Floodway to 167th Street West between 55th Street South and 29th Street North. At the date of the 1980 census, there were 26,194 persons living in this area.

2. Land use in the study area consists of the following proportions expressed in terms of total acreage:

Agricultural	45%
Residential	25
Commercial	2
Industrial	3
Public and Semipublic	25

3. The majority of the developed portion of the project area is served by the Wichita Sanitary Sewer System through the Southwest Interceptor Sewer to Treatment Plant No. 2. This interceptor sewer, which was constructed between 1969 and 1971, consists of pipe ranging in size from 24 inches to 60 inches.

4. Treatment facilities in the study area are West Millbrook, Miles West Wind Lakes, Frontier Village, Diamond Spur West, and Sunset Mobile Manor.

5. About 800 homes currently are served by septic tanks. The overall failure and replacement rate of the septic tank systems is 29 percent, indicating the soils in the project area are not suitable for this type of wastewater treatment.

6. Projections by the Wichita-Sedgwick County Metropolitan Area Planning Department (WSCMAPD) show that year 2000 population for the study area is estimated to be 42,624. This is a 63 percent increase over the 1980 population.

7. Future land use trends indicate there will be the following additional developed acreages by year 2000:

Residential	1600 acres
Commercial	180 acres
Industrial	301 acres

It was determined that it would be unlikely that another regional shopping center the size of Towne West Square would be constructed before year 2000 in the study area.

8. The Wichita Mid-Continent Airport has a major impact on land use and the recommendations of this study. The "Airport Noise Control and Land Use Compatibility Plan" (ANCLUC) recommends that the undeveloped land areas adjacent to the airport, particularly to the south and west, be reserved primarily for public use with limited industrial and residential zones.

In accordance with the ANCLUC report, WSCMAPD projects that most residential growth to the year 2000 will continue in and adjacent to the urbanized area north of the airport.

9. Pump Station No. 10, located at Harry and Maize Road, receives all wastewater collected by the Wichita sanitary sewer system in the Cowskin Upper Dry Creek Drainage Basin and pumps it to the Southwest Interceptor Sewer.

Current wastewater flow rates at Pump Station No. 10 are estimated to be:

Average Dry Weather	1.82 MGD
Peak Wet Weather	9.10 MGD

The capacity of Pump Station No. 10 is 5.20 MGD. Peak flows are currently estimated to be of short enough duration to prevent bypassing, although sewer surcharging and backup is inevitable.

10. Year 2000 wastewater flow rates at Pump Station No. 10 are estimated to be:

Average Dry Weather	3.55 MGD
Peak Wet Weather	13.18 MGD

Peak wet weather flows are projected to exceed pump station capacity by 7.98 MGD in year 2000. In addition, the capacity of the Southwest

Interceptor Sewer is projected to be exceeded upstream of a point at 31st Street South and Hoover.

11. By approximately year 2010, the wastewater flow rates at Pump Station No. 10 are projected to be:

Average Dry Weather	4.75 MGD
Peak Wet Weather	15.92 MGD

These flow projections are based on the assumption that development will continue such that average wastewater flow rates will increase approximately 4 percent per year over the design period. Year 2010 was selected as the design year for development and evaluation of wastewater facility alternatives to provide a design life of at least 20 years for the proposed improvements.

The year 2010 wet weather peak wastewater flows are projected to exceed the capacity of the Southwest Interceptor sewer upstream from a point at 47th Street South and Meridian Avenue.

12. In order to provide adequate sewerage service for the study area, the following wastewater transport and treatment alternatives were evaluated:

- a. An interceptor sewer constructed from the city system, following an alignment along Cowskin Creek to Pump Station No. 10.

b. Construction of a new pump station and force main to the city system. Two potential sites for the pump station were evaluated (Sites B and C).

c. Construction of a treatment plant discharging treated effluent to Cowskin Creek. The aerated lagoon and oxidation ditch type treatment systems located at either Site B or C were evaluated.

13. From a cost-effective viewpoint, an aerated lagoon at Site B (one-half mile south of Tyler and Pawnee) is the most economical. However, the Kansas Department of Health and Environment (KDHE) is concerned with construction of a satellite plant which is near the city sewer system. It is not clear whether KDHE would indeed approve the construction of the plant. Even if approved, effluent quality and plant reliability would be stringently imposed. Another consideration with construction of a lagoon type treatment facility would be the attraction of water fowl near the airport runway. Federal restrictions may rule out the possibility of a lagoon because of the danger the water fowl may have to low flying aircraft.

14. Construction of a pump station at Site B would provide for the maximum beneficial use of a sewer system for existing and developing areas north and west of the airport while minimizing the availability of sewers to areas south of the airport. The pump station/force main alternative, discharging to the city sewer system, would also conform with the KDHE

regionalization philosophy. The Site B pump station location is the least expensive alternative, except for the aerated lagoon.

15. Construction of the Cowskin Creek Interceptor Sewer represents a present worth expenditure of \$15,892,000, which is 50 percent more than the cost of constructing and operating a pump station at Site B. This margin of difference indicates that the Cowskin Creek Interceptor Sewer is not economically feasible to construct to the City system at this time. However, the interceptor sewer is still the recommended ultimate means of serving the study area.

RECOMMENDATIONS

1. It is recommended that the City construct a new pump station at Site B, sized for 7,400 gpm. This pump station would operate primarily as a peak flow pump station, providing backup to existing Pump Station No. 10. A portion of the Cowskin Creek Interceptor Sewer (48-inch) should be constructed from Site B to Pump Station No. 10. Pump Station No. 10 should continue in service until at least year 2010. A 24-inch force main should be constructed from Site B to the city system, discharging to the Southwest Interceptor Sewer at 47th Street South and Meridian. Refer to Figure V-2 for a schematic layout of these recommendations. The total construction cost for these recommendations is estimated to be \$7,178,000. Other costs such as design, contingencies, and construction administration are estimated to be \$2,416,000 for a total project cost of \$9,594,000.

2. In addition to the study of the Cowskin Creek Interceptor Sewer feasibility, several sewer system improvements upstream of Pump Station No. 10 (north of U.S. 54) will be required to transport peak flows and to provide sewer service for existing and projected developing areas. Figure VI-2 shows the location of the recommended improvements. The total construction cost for these sewers is estimated to be \$1,741,000. Other costs such as design, contingencies and construction administration are estimated to be \$532,000 for a total project cost of \$2,273,000.

IMPLEMENTATION

1. Under the Environmental Protection Agency Construction Grants Program, grants are awarded on the basis of the state priority ranking of a project and the availability of funds. The construction of improvements recommended in this study have been given a priority rating of 18.00 for Federal Fiscal Year (FFY) 1985. This priority rating gives the project an earliest expected date of application for federal funds of October 1989. It is unrealistic to expect EPA funding for recommended improvements.
2. If funding from other alternative outside sources is not available, then the entire debt service and annual operation and maintenance costs would be included in the sewer service charge paid by all users connected to the sewer system.

3. Initial priority should be given to work north of Pump Station No. 10. Completion of the parallel interceptor and trunk sewers provides adequate capacity for present and projected development, eliminates one lift station, precludes the need for additional lift stations, eliminates two treatment facilities (one inactive) and allows connection of developed unsewered areas with on-site systems.

4. Authorization of the recommended projects should be followed by engineer selection. The estimate of the project's schedule following engineer selection is as follows:

a. Phase 1 - Interceptor and Trunk Sewers North of U.S. 54:

- o Design - 1 year
- o Financing - 6 months to 1 year
- o Construction - 1 year

b. Phase 2 - Interceptor Sewer South of U.S. 54, Pump Station and Force Main:

- o Design - 1 year
- o Financing - 6 months to 1 year
- o Construction - 2 years

* * * * *

PART I - INTRODUCTION

PART I
INTRODUCTION

PURPOSE

The purpose of this report is to evaluate the existing and forecast future conditions within the Cowskin Creek project area to determine the wastewater collection and treatment needs within the urbanizing area west of Wichita. The wastewater collection needs will be evaluated along with the existing sewerage facilities in the study area. Alternative strategies for improving the total system to meet future needs will be developed to determine the most cost-effective plan of action compatible with the needs and goals of the City of Wichita.

SCOPE

The scope of this report includes the evaluation of the existing and future conditions pertinent to wastewater collection and treatment within the urbanizing area west of Wichita. The boundaries of the project area were defined by the Wichita-Sedgwick County Metropolitan Area Planning Department (WSCMAPD) as the limits of urban development adjacent to west Wichita. The existing conditions evaluated in this report include: (1) 1980 Census figures provided by WSCMAPD, (2) major components of the wastewater collection system from the records of the City of Wichita Sewer Maintenance Division and the Engineering Division, (3) condition and location of individual treatment lagoons and septic tank systems as found in the records of the Wichita-Sedgwick County Health Department, and (4) information on the location and operation of small

community wastewater treatment lagoons from the Sedgwick County Department of Public Works and from the Kansas Department of Health and Environment (KDHE).

This report studies the probable future conditions of the project area in the year 2000 according to the population projection and development analysis provided by WSCMAPD. The projected population and development figures were used to estimate the peak daily wastewater flow rates into the collection system in the year 2000 and also in the year 2010 and to determine the ability of the existing system to carry the projected flow rates. Improvement alternatives to meet the future needs of the project area were developed and were evaluated according to typical construction, operation, and maintenance costs for such facilities to determine the cost-effectiveness and feasibility of each improvement alternative.

Wastewater interceptors typically have a useful service life well beyond the approximate 20-year period which this report evaluates. Sewer systems which were constructed more than 90 years ago are still in use within the City of Wichita. However, many of the sewer lines of that age are in need of replacement or rehabilitation. Current construction materials and methods are much improved over those of 80 or 90 years ago. Sewers constructed today can be expected to remain in good condition for 50 years and longer. Considering the long service life expectancy of sewer systems, this report includes an evaluation of the possible conditions in the study area beyond the 20-year planning period.

* * * * *

PART II - EXISTING CONDITIONS

PART II
EXISTING CONDITIONS

POPULATION

The formal planning authority for the planning area is the Wichita-Sedgwick County Metropolitan Area Planning Commission. The townships of Attica, Delano, Illinois, and Waco are all partially in the planning area. There are approximately 67 sections of land in the study area. There are no incorporated municipalities, other than the City of Wichita, involved in the planning area. The City of Wichita has the obligation by subdivision authority to review all plans and specifications for sewerage improvements within the planning area.

Other public agencies involved in planning and coordination of wastewater management programs in this planning area at various governmental levels are the Wichita-Sedgwick County Health Department, Kansas Department of Health and Environment, and the United States Environmental Protection Agency, Region VII.

The metropolitan area which will have the greatest economic and population growth impact on the planning area is the City of Wichita. According to the 1980 census, Wichita had a population of 279,835 people and is the largest city in Kansas. The population growth in many parts of the planning area has been caused by the the result of a shift of persons from the corporate limits of Wichita into the more rural and suburban areas surrounding the city. The airport and related industrial parks near the airport are other factors that have caused an influx of new dwellings in the area near these employment

centers. At the date of the 1980 Census, there were 26,194 persons living in the planning area. The following table represents a summary of data by township.

Table II-1

POPULATION AND DWELLING UNITS IN 1980 BY TOWNSHIP

<u>Township Name</u>	<u>Population</u>	<u>Dwelling Units</u>
Attica (Partial)	2,697	807
Delano (Partial)	22,325	7,715
Illinois (Partial)	158	51
Waco (Partial)	1,014	351
Total	26,194	8,924

LAND USE

The existing land-use information contained in this report was obtained from WSCMAPD. It was based on previous studies and updated by review of aerial photos. Land-use acreage data are generally not available for unincorporated areas such as part of the defined planning area; however, the land-use acreages have been estimated for each category based on Figure III-1 (page number III-6). Existing land use in developed portions of the planning area is primarily residential. Almost all of the undeveloped areas within the planning area support agricultural uses.

Figure III-1 shows significant clusters of commercial development within the planning area. The only major "strip development" of commercial activity is along both sides of U.S. Highway 54 (West Kellogg).

It is significant to note that commercial development in the planning area is influenced by Wichita Mid-Continent Airport. There is a greater density of commercial establishments in the areas immediately surrounding the airport, and many of these businesses serve a larger multi-state market base because of the marketing efforts aimed at air travelers.

The majority of industrial land use is located along the Atchison, Topeka & Santa Fe Railroad trackage between U.S. Highway 54 and the airport, or adjacent to the major arterial routes of Hoover Road and Kansas Highway K-42. There are additional tracts of land being promoted for industrial land-use sites by the industrial development group of the local Chamber of Commerce. However, most of these undeveloped industrial sites are within the general confines identified above. Most of the industrial activities within the planning area do not significantly affect air or water quality, and generally can be classified in the light industrial category. The exception to this would be two major aircraft manufacturing plants which, appropriately, are located in proximity to Wichita Mid-Continent Airport and do not contribute significantly to air or noise pollution in the planning area.

In summary, the planning area generally consists of agricultural, residential, commercial, industrial, and public/semipublic land uses in the following proportions expressed in terms of total acreage:

Agricultural	45%
Residential	25%
Commercial	2%
Industrial	3%
Public and Semipublic	25%

The date for verifying these proportions is March 1985. These proportions include those parcels of land which have reached the "final plat" stages at the Metropolitan Area Planning Commission. It is presumed that the planning area has a somewhat higher-than-average proportion of public and semipublic land area due to the presence of Mid-Continent Airport and the Sedgwick County Zoo. Both of these facilities include significant amounts of acreage in the public/semipublic category.

Table IV-1 summarizes the existing population and land use by reference location shown in Figure II-1.

SOUTHWEST INTERCEPTOR SEWER SYSTEM

The majority of the developed portion of the project area is served by the Wichita sanitary sewer system (see Figure II-1). The Southwest Interceptor Sewer is the main interceptor sewer for all wastewater which enters the system from the project area. The Southwest Interceptor Sewer was constructed between 1969 and 1971 to serve the area west of the Wichita-Valley Center Floodway and east of Maize Road. The interceptor sewer originates as a 60-inch pipeline starting at Wichita Sewage Treatment Plant No. 2 which is located at Hydraulic Avenue and 55th Street South. The interceptor sewer extends west along 55th Street from Plant No. 2 to Meridian Avenue where the pipe size changes to 54 inches. The 54-inch pipeline turns north at Meridian Avenue and continues to 47th Street South, then west along 47th Street to Sheridan Avenue, then north to 31st Street South. At 31st Street South and Sheridan Avenue, the pipe size changes to 48 inches. The 48-inch pipe continues west approximately 1/2 mile to

31st Street South and West Street where it changes to 42 inches. The interceptor sewer continues along 31st Street to the west to Hoover Road crossing under Highway I-235 and the Wichita-Valley Center Floodway. The interceptor then continues north along Hoover Road as a 42-inch pipeline to Harry Street where it branches into two mains. The larger main, a 36-inch pipeline, continues north along the Big Slough drainage basin and serves most of that portion of the project area which is located east of Tyler Road. The smaller main is a 24-inch pipeline which continues west along Harry Street to a point approximately 1,000 feet east of Tyler Road. The 24-inch branch of the Southwest Interceptor Sewer along Harry Street is the receiving sewer for the 16-inch wastewater force main from Pump Station No. 10 which is located near the intersection of Harry Street and Maize Road.

Pump Station No. 10 receives all wastewater collected by the Wichita sanitary sewer system in the Cowskin-Upper Dry Creek drainage basin and pumps it to the Southwest Interceptor along Harry Street east of Tyler Road. The sewer system which discharges into Pump Station No. 10 is identified as Subsystem 29 and is part of the Westlink Sewer District. Figure II-1 shows the boundary of the Subsystem. The main sewer for Subsystem 29 is a 30-inch-diameter pipeline which generally follows the east bank of Cowskin Creek in a north-northwesterly direction to the vicinity of Maize Road and Maple Street where it branches into smaller mains which serve most of the area east of Clearwater Road and south of 21st Street North. The sewer system south of Harry Street is not extensive, but there are three residential developments south and southwest of the pump station which have public sewer systems that are connected to Pump Station No. 10.

SUBSYSTEM 29

Excluding the Southwest Interceptor Sewer, Subsystem 29 contains approximately 365,000 feet of sewer pipe ranging in size from 8 inches to 30 inches in diameter. By inspecting Figure III-1, it can be seen that there are a few developed areas within Subsystem 29 which are not served by the Wichita sanitary sewer system. The majority of these areas are septic tank communities which are discussed in this Part.

According to the population data presented earlier in this Part, there are now approximately 6,475 residential dwelling units connected to the sanitary sewers in Subsystem 29. There are also approximately 135 acres of commercially developed land in Subsystem 29 which are sewered. The estimated average daily wastewater flow rate from Subsystem 29 is 1.82 MGD with a daily peak flow rate of approximately 3.66 MGD.

Infiltration/Inflow (I/I) problems for the entire Wichita sanitary sewer system were evaluated in a study completed in 1977.* According to the 1977 I/I Report, the sanitary sewers in the Pump Station No. 10 service area (Subsystem 29) are in good condition with moderate quantities of extraneous flow entering the system. The report did not contain any recommendations for improvements to reduce I/I in the service area of Pump Station No. 10.

* Wichita, Kansas Sewerage System, Infiltration/Inflow Analysis, 1977, Shelley-Wilson Co.
WIC2.CIS

WASTEWATER PUMPING STATIONS

Pump Station No. 10 is the major wastewater pumping station in the project area. This pump station was constructed in 1970 to transport wastewater from Subsystem 29 to the Southwest Interceptor. According to "The Next Thirty Years"*** (a 1970 comprehensive sewer plan for Wichita and Sedgwick County), it was recommended Pump Station No. 10 be constructed as an interim facility until an interceptor along Cowskin Creek could be completed. This would provide gravity sewer service from Subsystem 29 to Wastewater Treatment Plant No. 2 through the Southwest Interceptor. According to "The Next Thirty Years" report, Pump Station No. 10 originally contained one 1,000-gpm pump and one pump rated at 1,800-gpm. Subsequent modifications have resulted in the installation of three pumps with a capacity of 2,500 gpm each. This has improved the reliability of the pump station and increased the firm pumping capacity to approximately 5.2 MGD. Pump Station No. 10 is in good condition and has an emergency power generator to allow the pumps to operate during power failures.

Another small pump station in the study area is located at 10000 West Pawnee and collects wastewater from a residential development known as The Park. The Park is located southeast of the intersection of Pawnee Avenue and Maize Road and as of September 1983, consisted of approximately 40 improved acres with 88 single-family dwelling units and 64 dwelling units developed as fourplexes. The Park pump station is a wet well-mounted type pump station which currently pumps

*** The Next Thirty Years, 1970, Professional Engineering Consultants.

approximately 30,000 gallons per day to Pump Station No. 10. This pump station is considered a temporary facility which may be retired when gravity sewer service is available.

There are three other small pump stations in the project area. One pump station is located approximately one-half mile west of the intersection of Maple Street and 119th Street West. The Rainbow Lakes Subdivision is served by this pump station which has adequate capacity to serve the south one-half and the northeast quarter of Section 24, Range 2 west, Township 27 south. The remaining two pump stations are located on 13th Street. One is located at Parkdale Lane, west of Maize Road. The other is located approximately 1/4-mile west of 119th Street West and serves the Cedar Park Chateau Addition. Those pump stations are also intended as temporary facilities which may be retired by future gravity sewer improvements.

WASTEWATER TREATMENT FACILITIES

The project area contains several small wastewater treatment facilities which serve either individual buildings or isolated communities located outside the City of Wichita sanitary sewer service area (see Figure II-1 for location). These facilities are all waste stabilization lagoon systems which are sized to hold the collected wastewater for a time period long enough to allow the biological matter in the sewage to stabilize. Most of the treatment facilities in the project area are designed such that the treated water evaporates and percolates at a rate that is either equal to, or greater than, the rate which wastewater enters the lagoon, thus making them nondischarging. One of the treatment lagoons, the West Millbrook facility, discharges treated wastewater

into Cowskin Creek. The majority of the treatment facilities in the project area serve either individual homes or businesses.

West Millbrook

The West Millbrook Subdivision is located southeast of the intersection of Maple Street and 119th Street West. The subdivision contains approximately 180 residential dwelling units on approximately 80 acres of land. The wastewater treatment lagoon at West Millbrook is a two-celled discharging facility with a design capacity of 0.044-MGD. The facility is operated and maintained by the West Millbrook Improvement District. According to Kansas Department of Health and Environment (KDHE) records, the facility is adequate and operation and maintenance is generally good although the facility occasionally has exceeded its discharge permit limits.

Miles West Wind Lakes

Miles West Wind Lakes is a single-family residential development of approximately 40 acres located southwest of the intersection of Maple Street and 151st Street West. Wastewater from this community is collected by a sewer system and conveyed to a nondischarging waste stabilization lagoon south of the residential area. The lagoon has a design water surface area of 0.89-acre and the facility is well maintained, according to KDHE records. There are approximately 35 single-family dwelling units within Miles West Wind Lakes.

Frontier Village

The Frontier Village treatment facility was originally designed as a three-cell discharging lagoon to serve a commercial recreation facility east of 135th

Street West and north of U.S. Highway 54. Recently, the treatment facility has been practically inoperable with minimal wastewater flow and poor maintenance as a result of the closing of most of the recreation activities. The treatment facility may be improved some time in the future to serve buildings in the area. Frontier Village owners have retained the services of an engineer to recommend improvements for making the treatment facility operational.

Other Community Facilities

There are two other small community treatment facilities in the project area, both located west of 151st Street West and along the south side of U.S. Highway 54. The developments served by these treatment facilities are mobile home parks.

Sunset Mobile Manor, the larger of the two mobile home parks, contains 180 units and has no vacant lots. Wastewater from Sunset Mobile Manor is treated in a three-cell nondischarging waste stabilization pond. One of the treatment cells is equipped with a floating aerator. The treatment facility appeared to be operating at capacity in September of 1983. Operation and maintenance appears to be adequate.

The second development, Diamond Spur West, is approximately 1/4-mile east of Sunset Mobile Manor. Diamond Spur West contains 52 mobile homes and has a capacity of 53 units. Wastewater is treated in a two-cell discharging lagoon system.

Individual Treatment Lagoons

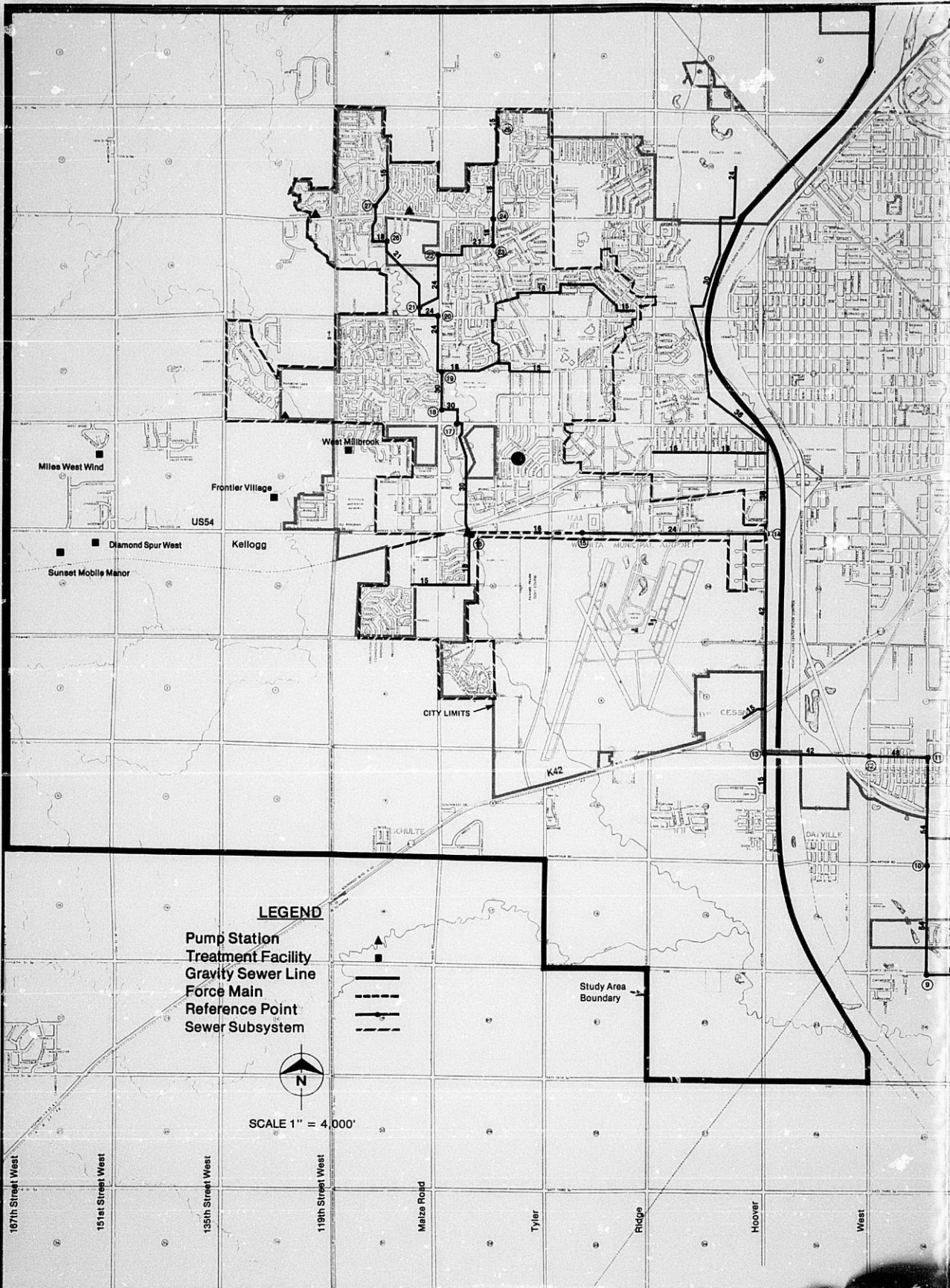
Since 1968, the Wichita-Sedgwick County Health Department has required newly platted subdivisions within the project area either to have sewer service or to have an appropriate means of on-site treatment depending upon the permeability of the soil in the platted area. Soils in the project area have been found to be poor for septic tank systems, permeability rates are very low, and existing septic tank systems have relatively high failure rates. All new residential lots within the project area which do not have sanitary sewers available are required to be at least five acres in size to provide adequate area for on-site treatment systems. Individual nondischarging waste stabilization lagoons are used to provide on-site wastewater treatment for these larger lots. There are 37 such facilities within the project area according to Wichita-Sedgwick County Health Department permit records. The Health Department reports that the individual treatment lagoons provide satisfactory treatment although the land area requirements and land costs make these systems economically unsuitable for urban communities.

Septic Tank Communities







Prior to 1968, many residences in the project area were constructed with septic tank/lateral field wastewater treatment systems. Since that time, some of the communities which originally had septic tanks have been provided with sanitary sewers. Community health department records indicate that there are presently approximately 800 houses served by septic tank systems. Of these homes, 421 have septic tank permits on record. (Others predate the time when permits were first required.) Overall, 121 of the permitted septic tanks are on record as failing and being rebuilt for an overall replacement rate of 29 percent.

Replacement rates range from zero to 57 percent within local areas in the project area. From these data, it can be seen that septic tank systems generally are not suitable for wastewater treatment in the project area.

* * * * *



LEGEND

- Pump Station 
- Treatment Facility 
- Gravity Sewer Line 
- Force Main 
- Reference Point 
- Sewer Subsystem 



SCALE 1" = 4,000'

167th Street West
 151st Street West
 135th Street West
 119th Street West
 Melze Road
 Tyler
 Ridge
 Hoover
 West

Study Area Boundary

CITY LIMITS

US54

K42

CESSA

I249

WINTA MUNICIPAL AIRPORT

West Millbrook

Frontier Village

Kellogg

Miles West Wind

Diamond Spur West

Sunset Mobile Manor

DAI VILLI

SCHULTE

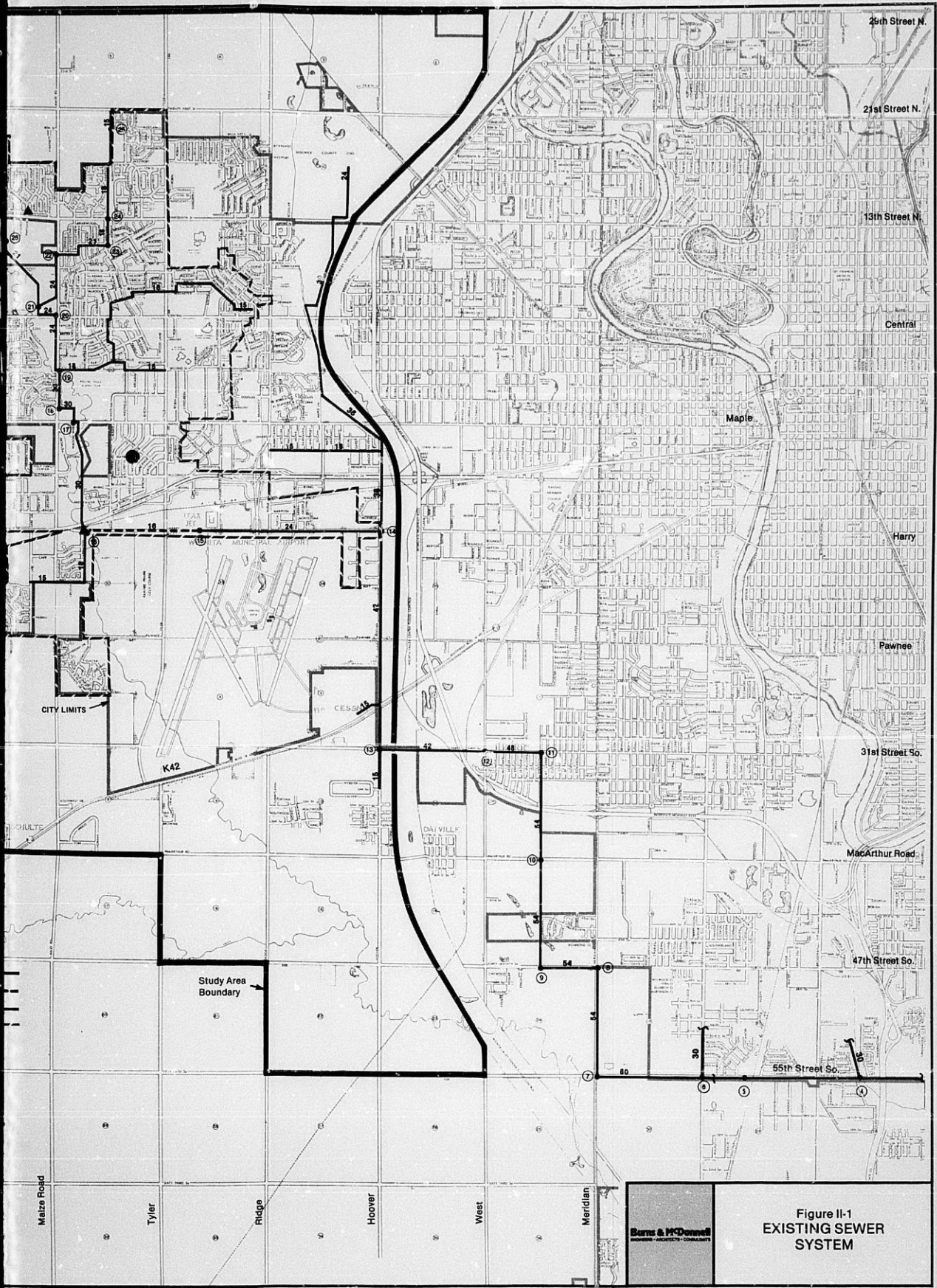
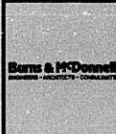


Figure II-1
EXISTING SEWER
SYSTEM



PART III – FUTURE CONDITIONS
AND NEEDS

PART III
FUTURE CONDITIONS AND NEEDS

POPULATION

In analyzing the development conditions and prospects in the project area, the following broad conclusions were reached for major land use types. These conclusions are based on data provided by the Wichita-Sedgwick County Metropolitan Area Planning Department (WSCMAPD).

1. The mix of future residential construction is expected to be 60 percent single-family dwellings, 30 percent two-family units, and 10 percent apartments.
2. Based on assumed historical densities of 4, 12, and 20 dwelling units per acre for single-family houses, duplexes, and apartments respectively, a total of 1,186 acres will be required to accommodate the anticipated residential growth in the project area.
3. Given that approximately 26 to 30 percent of suburban development is devoted to uses other than residential (i.e., streets, parks, commercial, schools, etc.), a total area of 1,600 acres (10 quarter-sections) will be required for the projected growth for the planning period.

With the incremental residential growth forecast by WSCMAPD and described above occurring in the next 20 years, the estimated year 2000 population of the project area is projected to be 42,624. This is approximately a 63 percent increase over the 1980 population of 26,194.

LAND-USE TRENDS

In addition to the 1,600 acres of residential development which are expected to occur in the project area, there could be significant amounts of other projected land-use development (see Figure III-1, page number III-6). Commercial development is expected to occur primarily along U.S. Highway 54 between Hoover Road and 119th Street West and at the intersections of all major arterials. The demand for new commercial land by year 2000 should not exceed 180 acres if the present proportions are maintained throughout the planning period. It is unlikely that another regional shopping center the size of Towne West Square will be constructed during the planning period. Many of the commercial establishments along U.S. Highway 54 serve the region because of their relationship to Mid-Continent Airport and, therefore, the intensity of commercial development adjacent to the airport is greater than intensities in the residential suburbs of the city.

Industrial development is projected to continue to occur along the Atchison, Topeka and Santa Fe (ATSF) Railroad between U.S. Highway 54 and the airport, along Hoover Road east of the airport and along K-42 Highway south of the airport. The demand for industrial land is difficult to forecast for specific geographic areas, and most of the projected industrial tracts in the planning area are of significant parcel size. The airport itself has many ideal

industrial locations available for lease and these have been included in the public and semipublic category rather than in the industrial category. It is projected that 301 acres of land will be needed to accommodate future industrial development to year 2000.

In projecting future land uses within the project area, it is important to consider the recommendations of the 1981 "Airport Noise Control and Land Use Compatibility Plan" (ANCLUC) for Wichita Mid-Continent Airport. The ANCLUC report generally recommends that the undeveloped land areas adjacent to the airport, particularly to the south and west, be reserved primarily for public use with limited industrial and residential zones in locations which are compatible with projected noise contours for the year 2000. In accordance with the ANCLUC report, WSCMAPD projects that most residential growth to the year 2000 will continue in and adjacent to the urbanized area north of the airport with little residential development occurring south and west of the airport (see Figure III-1).

Another important consideration for the future of the project area is the possibility that the actions resulting from this report or other plans may affect growth trends in the project area. The construction of sanitary sewer improvements in an area where sewer services have not been previously available can influence development of that area. Development may continue along recognized general patterns or it may be altered in type or direction of growth from general, seemingly established trends. During development and evaluation of the alternatives for wastewater collection and treatment strategies within the project area, consideration will be given to the primary and secondary

effects of each alternative. These effects may be either desirable or undesirable, whether intended or coincidental. Primary effects are generally the desired goal and the most lasting result of the action taken. Secondary effects are generally those that result subsequent to taking action and are not the direct result of the specific action.

WASTEWATER COLLECTION AND TREATMENT REQUIREMENTS

There has been some discussion of wastewater collection and treatment requirements in the preceding text. This section provides a summary and general discussion of the probable future wastewater collection and treatment requirements for the project area in the future.

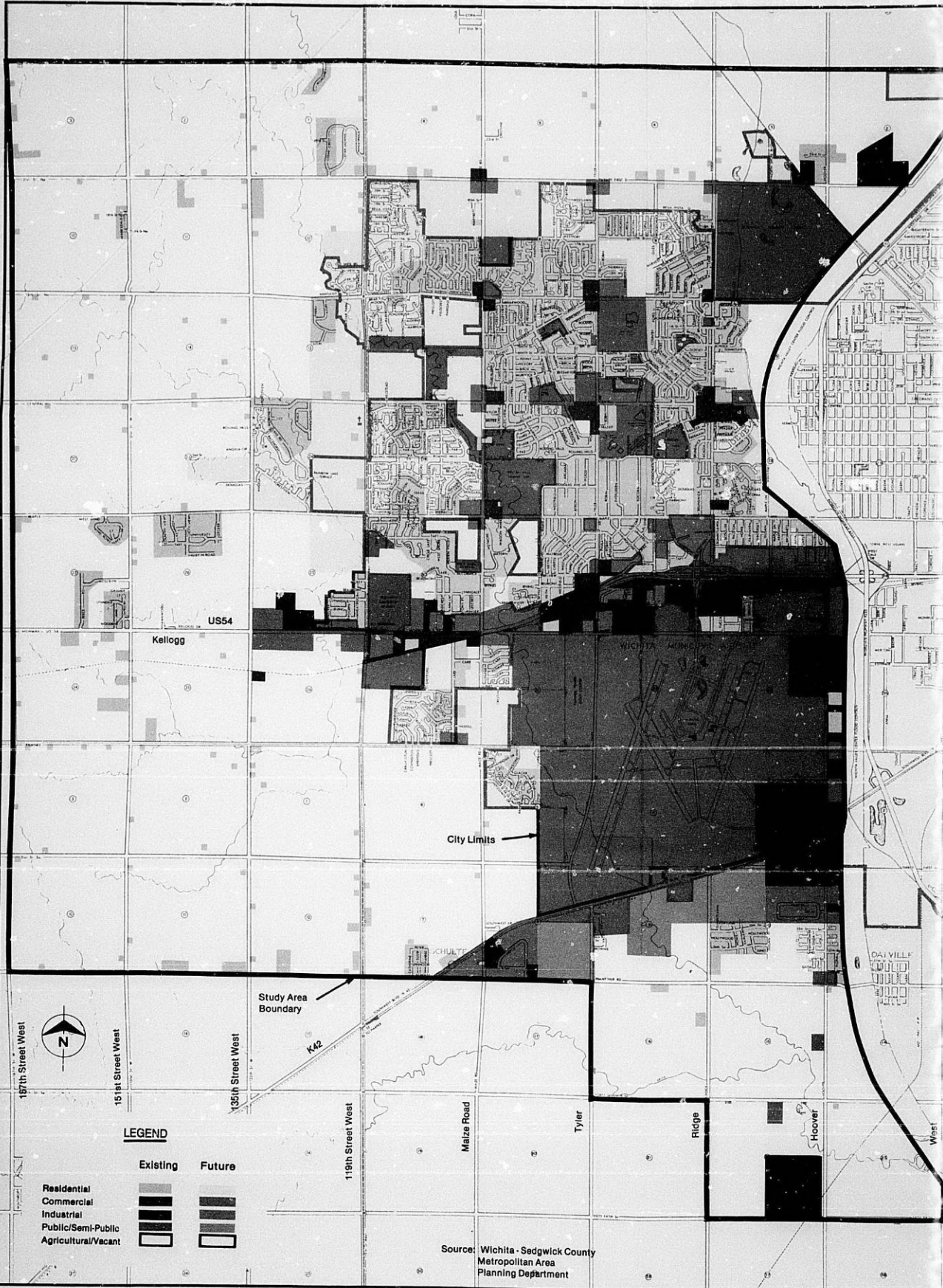
Every business or residence within the project area is required by law to have an approved and adequate means of wastewater treatment or disposal for the general protection of public health. This is the basic requirement which will continue to apply in the project area throughout the planning period. New septic tank systems are effectively banned from the project area because of the low permeability of the soils in the area.

It is probable that the entire urbanized area will eventually be served by sanitary sewers. Even if all individual systems are eliminated within urbanized areas, there may always be some individual buildings or small communities outside the urbanized area with individual on-site wastewater treatment systems.

The projected land use for the project area (Figure III-1) provides a guideline for anticipating where sanitary sewers will be needed in the future and how many

residences, businesses, and industries will need sewer service in the future. Generally, as can be seen on Figure III-1, most residential and commercial growth is expected to occur within the area east of 135th Street West and south of 21st Street North. Industrial development and major commercial land uses are expected to continue along U.S. 54 and also south of U.S. 54 west of Wichita Mid-Continent Airport. Limited residential and industrial development is anticipated south of the airport. The majority of this area is expected to be reserved for public use to protect the area from the types of developments which may be in conflict with aircraft noise. The population and land use projections by WSCMAPD indicate that no significant growth is expected in an area of approximately 24 square miles around the edge of the project area. The investigation of future needs for wastewater collection and treatment in this report will focus on the area east of 135th Street West where the most growth is anticipated. Wastewater collection alternatives will be developed and evaluated for the primary purpose of serving the area east of 135th Street West with subsequent consideration to system flexibility and expandability beyond 135th Street West and 21st Street North.

* * * * *



Kellogg

US54

City Limits

Study Area Boundary

K42

187th Street West

151st Street West

351st Street West

118th Street West

Maize Road

Tyler

Rice

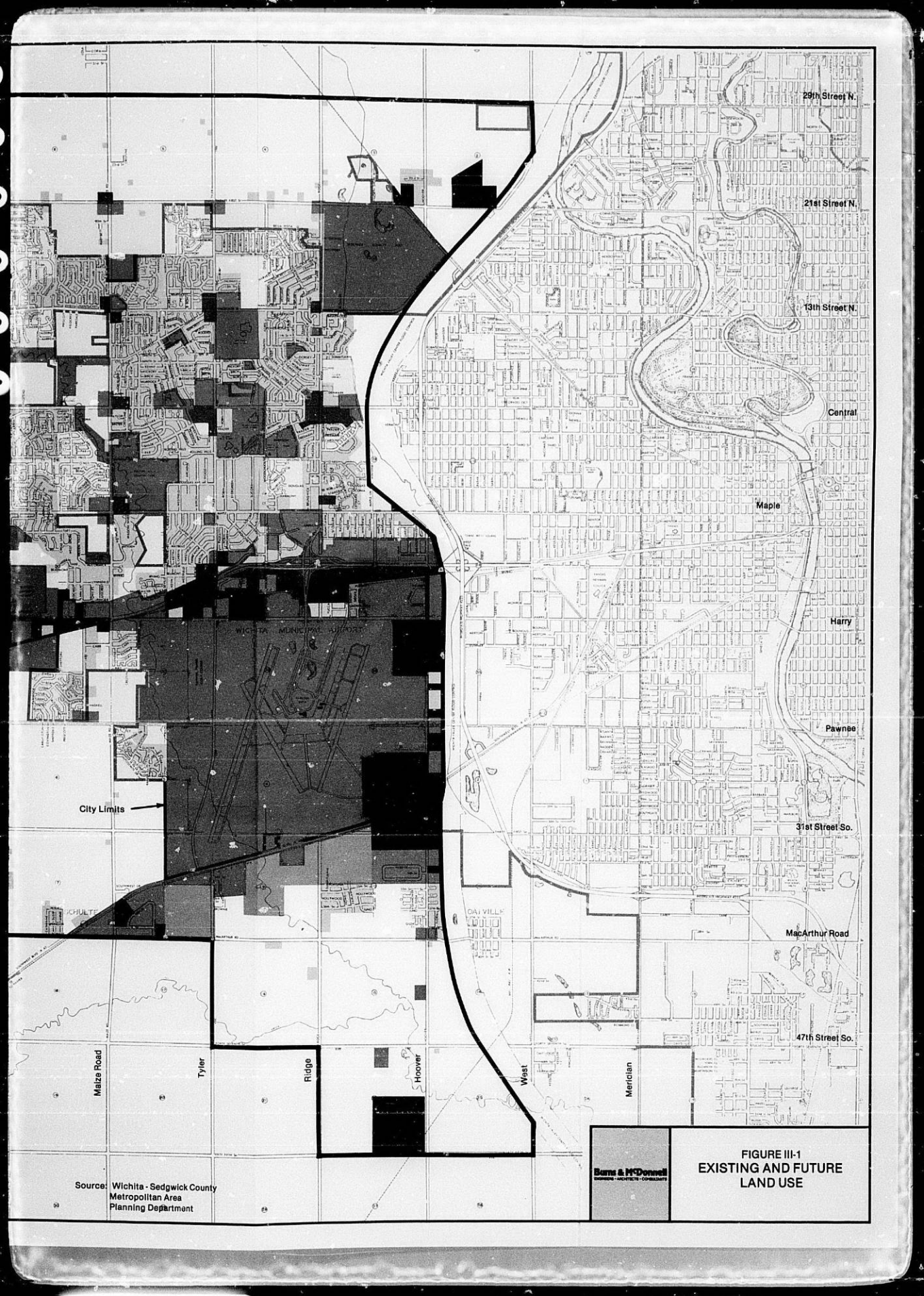
Hoover



LEGEND

	Existing	Future
Residential	[Light Gray Box]	[Light Gray Box]
Commercial	[Medium Gray Box]	[Medium Gray Box]
Industrial	[Dark Gray Box]	[Dark Gray Box]
Public/Semi-Public	[White Box]	[White Box]
Agricultural/Vacant	[White Box]	[White Box]

Source: Wichita - Sedgwick County Metropolitan Area Planning Department



City Limits

Melze Road

Tyler

Ridge

Hoover

West

Meridian

MacArthur Road

47th Street So.

31st Street So.

Pawnee

Harry

Maple

Central

13th Street N.

21st Street N.

29th Street N.

FIGURE III-1
EXISTING AND FUTURE
LAND USE

Burns & McDonnell
ENGINEERS - ARCHITECTS - CONSULTANTS

Source: Wichita - Sedgwick County
Metropolitan Area
Planning Department

PART IV – EXISTING FACILITIES
VS. FUTURE NEEDS

PART IV
EXISTING FACILITIES VS. FUTURE NEEDS

INTRODUCTION

This part of the feasibility report presents an evaluation of the capacities of the major components of the existing sewer system. The sewer system evaluation includes estimates of current and future wastewater flow rates. This evaluation will be the basis for identifying current and future needs for improvements to the sanitary sewer system.

Current population estimates and land uses form the basis for estimating wastewater flows through application of typical sewerage design criteria. Likewise, the same design criteria are applied to the projected population and land uses to estimate future wastewater flows.

SEWER LOAD ALLOCATION AND HYDRAULIC ANALYSIS

Existing Flows and Criteria

1. General

Existing (1984) flows were estimated from the current population and land use by the methodology described in this Part. Table IV-1 presents the total and incremental residential population, commercial and industrial acreage within the present service area. The map locations

in Table IV-1 correspond to the circled numbers along the interceptor sewer as shown on Figure II-1.

Population equivalent (P.E.) values for service areas are based on the data provided by WSCMAPD for each square mile section. Most sections contain part of more than one sewer service area. Population equivalents are approximately proportional to the fraction of section each service area occupies. A small portion of the population is located outside the existing and future service areas and therefore is not included in the hydraulic analysis.

2. Average Daily Flows

Table IV-2 presents the estimated existing average daily wastewater flows for the study area. The flows show an accumulated total in the interceptor sewer system at each referenced location. See Figure II-1 for the reference numbers and locations.

The average flows were estimated according to City of Wichita design policy which recommends the following average flow rate values:

Single-Family Residential	100 gpcd
Two-Family Residential	90 gpcd
Four-Family Residential & Apartment Residential	80 gpcd
Commercial Areas	3,125 gpcd
Industrial Areas	5,350 gpcd

According to the WSCMAPD figures, the service area residential mix is approximately 60 percent single-family, 30 percent two-family, and 10 percent apartments. The overall average residential wastewater contribution with this mix is approximately 95 gallons per capita per day.

Average daily wastewater flow rates for each reference location were calculated by the following equation:

$$Q = (R \times 0.000095) + (C \times 0.003125) + (I \times 0.00535)$$

where: Q = Average wastewater flow in MGD

R = Total P.E. served at referenced location

C = Total Commercial-acre equivalent

I = Total Industrial-acre equivalent

3. Peak Daily Flows

Design peaking factors (P.F.) range from 2.5 for the uppermost location in the sewer system to 1.6 where the interceptor sewer is 48 inches or more in diameter. Peaking factors between 2.5 and 1.6 were prorated proportionately to the differences in the average flow accumulation at the two extreme locations. The P.F. of 1.6 for the Wichita sewer system was reported in the 1977 I/I analysis from observed flows. The 2.5 P.F. for smaller service areas was used in the Park City Interceptor Facilities Plan.

Dry weather peak flows were calculated by multiplying the average flow rate by the corresponding peaking factor. The dry weather peak flow represents the estimated maximum wastewater flow rate which may occur on a given day without the influence of inflow or infiltration from wet weather.

4. Wet Weather Peak Flows

This is the estimated maximum infiltration/inflow rate (I/I) for the system according to the following two criteria.

First, the base I/I rate for the system upstream of Pump Station 10 was 5.2 MGD (Wilson & Co., 1977) for the 1977 system. This base rate was prorated through the 1977 upstream system according to the average daily wastewater contribution at each location. I/I rates downstream of the pump station were added to the system flow rates at the locations where they were measured in the 1977 I/I report, assuming no significant change in the system.

Second, an infiltration/inflow allowance for sewers constructed since 1977 was added where applicable according to each referenced location. This infiltration/inflow allowance is based on the City of Wichita design policy of allowing 500 gallons per day per inch diameter per mile of "new" pipe. The infiltration/inflow allowance was calculated directly for new sewers larger than 12 inches in diameter based on approximate pipe lengths as recorded in design plans or in city records.

For sewers 12 inches and smaller, the infiltration/inflow allowance was generalized on the basis of acreage using the southeast 1/4 of Section 7-T27S-R1W as a model. This 1/4-section contains approximately 24,000 linear feet of 8-inch pipe, equivalent to approximately 36-inch diameter miles. Assuming this to be typical of new and future sewer systems, the infiltration/inflow allowance for new systems in the study area was 18,000 gpd per 1/4-section.

Wet weather peak flow is the sum of the peak dry weather flow and the estimated peak I/I for the referenced location. This is the design flow rate for analyzing the existing system.

5. Pipe Capacity, Size and Flow Depth

Pipe capacities are for full pipe based on the pipe sizes and slopes shown for each sewer section applied to Manning's equation.

$$Q = \frac{1.486}{n} (A) (R)^{2/3} (S)^{1/2}$$

where: Q = Wastewater flow in cubic feet/second

n = Coefficient of pipe roughness, 0.013 assumed

A = Cross section area of pipe in square feet

R = Hydraulic radius in feet

S = Pipe slope

The pipe slope used to calculate pipe capacity is generally the minimum slope for the sewer section downstream from each referenced location.

Slopes are either as shown in available plans or as calculated from city records.

The pipe diameter is the nominal pipe size of the sewer section downstream from the referenced location. Pipe sizes for the Southwest Interceptor up to location 19 are as shown in the as-built plans. Interceptor pipe sizes elsewhere are from either design plans or from city sewer records.

Flow depth is the approximate depth of wet weather flow in the existing sewer calculated from Manning's equation. Where the flow exceeds the sewer capacity, a double asterisk is shown rather than a depth to indicate that the sewer is surcharged at that location under peak wet weather conditions. In some cases, sewer sections upstream from the overloaded sewer are surcharged even though the upstream section has adequate capacity to carry the waste flow at that location. This is due to the backwater effect of sewer overloading at the control section.

It should be remembered that the interceptor system is quite long and that the flow depths indicate a steady-state condition at peak daily flow plus maximum infiltration/inflow rate throughout the basin. Therefore, the flow depths should not be interpreted to reflect a commonly occurring event, but rather they show the theoretical maximum flow depths which can occur within each section of the sewer.

Also, the flow analysis does not reflect the effect of overloading Pump Station No. 10. The pump station capacity is shown for information purposes but the calculations assume that the pump station or a downstream sewer will manage to pass along all wastewater entering at that point.

6. Conclusion

The method of estimating current wastewater flows presented in this part approximates the average and maximum flow rates which would be expected under assumed conditions. For comparison purposes, wastewater flow measurements were obtained from the Sewer Maintenance Division of the Wichita Water Department for three key locations in the sewer system. The measured flow rates and the estimated flow rates are presented in the table below:

<u>Location Point</u>	<u>Estimated Flow</u>		<u>Date</u>	<u>Measured Flow</u>	
	<u>Average</u>	<u>Daily Peak</u>		<u>Average</u>	<u>Daily Peak</u>
14	3.02 MGD	5.07 MGD	11-83	2.75 MGD	4.73 MGD
16 (Pump Station 10)	1.82 MGD	3.66 MGD	11-84	1.45 MGD	N/A
20	0.48 MGD	1.14 MGD	1-85	0.51 MGD	1.20 MGD

The estimated flow rates are within 10 percent of the measured flow rates at locations 14 and 20 and 20 percent at Pump Station No. 10.

As a further test of the probable accuracy of the methodology used in this part, the relative increases of population and flow rates for the

study area between 1977 and 1984 were compared. By this comparison, it was noted that the residential population of the service area (that is the area west of the Wichita-Valley Center Floodway) increased by approximately 48 percent during those seven years. Comparing the calculations for the current flow rates with the measured flow rates reported in 1977, the average residential wastewater flow rate for the same area increased by approximately 75 percent in the same time period. However, nearly all of the difference between 75 percent and 48 percent can be traced to the difference in the unit flow rates used. The 1977 infiltration/inflow report flow calculations were based on a city-wide average residential unit contribution of 80 gallons per capita per day, while the residential flow rate now used is 95 gpcd. The infiltration/inflow report noted that per-capita contributions could vary from the average in some parts of the city, but the report did not attempt to identify any areas where per-capita use might be higher. The 1984 wastewater flow calculations are based on an average residential unit wastewater contribution of 95 gallons per day in accordance with the city design policy.

Future Flows and Criteria

General

Flows for year 2000 were projected using the existing contribution as determined by preceding methods and the expected future growth in population, commercial and industrial acreage as determined by the methodology described in Part III.

Table IV-3 presents the projected total and incremental residential population, commercial and industrial acreage within the study area.

Table IV-4 presents the year 2000 wastewater flow rates corresponding to the projected area growth shown in Table IV-3 and taking into account the existing flows shown in Table IV-2.

SERVICE AREA LIMITATIONS

Southwest Interceptor Sewer System

It is clearly evident from the wastewater flow projections for year 2000 (Table IV-4) that insufficient flow capacity exists in portions of the Southwest Interceptor Sewer System.

Pump Station No. 10's capacity of 5.2 MGD is 7.98 MGD short of the requirements to transport year 2000 projected flows. The interceptor sewer system itself will lack sufficient capacity from reference point No. 13 at 31st Street South and West Street up to Pump Station No. 10. In addition, the capacity of the interceptor sewer upstream of Pump Station No. 10 will be exceeded to point No. 17.

Future Development

From the year 2000 land use projections, it is projected that fill-in development is anticipated to occur within most of the study area which is already served by sewers. However, some development beyond the present sewer system is also anticipated. The area of primary growth outside the present

sewer system is west of Cowskin Creek and north of U.S. 54. The existing sewer system north of U.S. 54 primarily serves the area east of Cowskin Creek. It is not feasible to serve existing and future development west of Cowskin with the present system because of the limited capacity between points No. 16 and No. 17 and the required creek crossings.

Beyond year 2000, specific planning information is not available from WSCMAPD. Projected wastewater flows to year 2000 increase by approximately 4 percent per year. For engineering design purposes, it is assumed that the average wastewater contribution from the study area will continue to increase at approximately 4 percent per year beyond year 2000. At the assumed average growth rate, the projected future conditions illustrated on Figure III-1 will occur between the years 2010 and 2015. Table IV-5 represents the projected conditions in the existing system for approximately year 2010.

It can be seen from the wastewater flow projections for year 2010 (Table IV-5) that additional portions of the Southwest Interceptor System will have insufficient capacity.

The present capacity of Pump Station No. 10 is 10.72 MGD less than year 2010 projected flows. The Southwest Interceptor Sewer System will lack sufficient capacity from Reference Point No. 8 at 47th Street South and Meridian Avenue up to Point No. 17, with the exception of a short reach between Points 11 and 12.

* * * * *

Table IV-1
EXISTING POPULATION AND LAND USE

Map Location	Resident Population Served (P.E.)	Total P.E. Served	Commercial Area Served (Acres)	Total Commercial Area (Acres)	Industrial Area Served (Acres)	Total Industrial Area (Acres)
27	100	100	0	0	0	0
26	344	444	0	0	0	0
25	0	0	0	0	0	0
24	1,532	1,532	0	0	0	0
23	1,062	2,594	0	0	0	0
22	820	3,414	2	2	0	0
21	560	4,418	9	11	0	0
20	20	4,438	8	19	0	0
19	8,459	12,897	30	49	0	0
18	416	13,313	0	49	0	0
17	160	13,473	10	59	0	0
16 (P.S. No. 10)	1,274	14,747	76	135	0	0
15	0	14,747	0	135	55	55
14	6,735	21,482	50	185	20	75
13	290	21,772	0	185	54	129
12	0	21,772	0	185	0	129
11	29,306	51,078	0	185	40	169
10	0	51,078	0	185	0	169
9	0	51,078	0	185	0	169
8	0	51,078	0	185	0	169
7	0	51,078	0	185	0	169
6	4,625	55,703	0	185	0	169
5	0	55,703	0	185	0	169
4	2,000	57,703	0	185	0	169
3	1,900	59,603	0	185	0	169
2	0	59,603	0	185	0	169
1 (Plant No. 2)						

**Table IV-2
EXISTING WASTEWATER FLOW RATES**

Map Location	Average Flow (MGD)	Peak Factor	Dry Weather Peak (MGD)	Wet Weather Peak (MGD)	Pipe Capacity (MGD)	Pipe Size (Ft.)	Flow Depth (Ft.)*
27	.01	2.50	.03	.06	2.25	1.50	.16
26	.04	2.49	.10	.28	3.07	1.75	.36
25	.00	2.50	.00	.00	2.10	1.50	.00
24	.15	2.46	.36	.82	2.37	1.50	.61
23	.25	2.43	.60	1.35	3.83	1.75	.72
22	.33	2.41	.80	1.76	5.27	2.00	.80
21	.45	2.38	1.08	2.50	5.47	2.00	.95
20	.48	2.37	1.14	2.64	5.27	2.00	1.00
19	1.38	2.13	2.94	6.99	8.39	2.50	1.74
18	1.42	2.12	3.01	7.27	9.91	2.50	**
17	1.46	2.10	3.07	7.48	6.49	2.50	**
16 (P.S. No. 10)	1.82	2.01	3.66	9.10	5.20	—	—
15	2.12	1.93	4.09	9.52	8.83	2.00	**
14	3.02	1.68	5.07	11.33	15.55	3.50	2.22
13	3.34	1.60	5.34	11.57	18.89	4.00	1.98
12	3.34	1.60	5.34	11.57	29.67	4.00	1.74
11	6.34	1.60	10.14	18.97	28.40	4.50	2.69
10	6.34	1.60	10.14	18.37	31.14	4.50	2.54
9	6.34	1.60	10.14	18.97	31.16	4.50	2.54
8	6.34	1.60	10.14	18.97	34.80	4.50	2.37
7	6.34	1.60	10.14	18.97	38.35	5.00	2.48
6	6.77	1.60	10.84	20.57	38.29	5.00	2.60
5	6.77	1.60	10.84	20.57	51.78	5.00	2.19
4	6.96	1.60	11.14	20.88	57.20	5.00	2.09
3	7.15	1.60	11.43	21.17	80.67	5.00	1.75
2	7.15	1.60	11.43	21.17	80.80	5.00	1.75
1 (Plant No. 2)							

* Flow depth at wet weather peak flow rate.
 ** Flow exceeds pipe capacity and surcharges.

**Table IV-3
POPULATION AND LAND USE
YEAR 2000**

<u>Map Location</u>	<u>Resident Population Served (P.E.)</u>	<u>Total P.E. Served</u>	<u>Commercial Area Served (Acres)</u>	<u>Total Commercial Area (Acres)</u>	<u>Industrial Area Served (Acres)</u>	<u>Total Industrial Area (Acres)</u>
27	602	602	0	0	0	0
26	1,761	2,363	1	1	0	0
25	17	17	0	0	0	0
24	2,185	2,202	2	3	0	0
23	1,050	3,252	3	6	0	0
22	3,280	6,532	0	20	0	0
21	995	9,890	5	11	0	0
20	75	9,965	0	11	0	0
19	9,819	19,784	22	33	0	0
18	3,849	23,633	10	43	0	0
17	160	23,793	5	48	0	0
16 (P.S. No. 10)	5,305	29,098	96	144	62	62
15	0	29,098	13	157	46	108
14	9,808	38,906	181	338	31	139
13	558	39,464	27	365	291	430
12	0	39,464	224	589	0	430
11	29,306	68,770	0	589	40	470
10	0	68,770	0	589	0	470
9	0	68,770	0	589	0	470
8	0	68,770	0	589	0	470
7	0	68,770	0	589	0	470
6	4,625	73,395	0	589	0	470
5	0	73,395	0	589	0	470
4	2,000	75,395	0	589	0	470
3	0	75,395	0	589	0	470
2	1,900	77,295	0	589	0	470
1 (Plant No. 2)						

Table IV-4
YEAR 2000 WASTEWATER
FLOW RATES

Map Location	Average Flow (MGD)	Peak Factor	Dry Weather Peak (MGD)	Wet Weather Peak (MGD)	Pipe Capacity (MGD)	Pipe Size (Ft.)	Flow Depth (Ft.)
27	.06	2.50	.14	.23	2.25	1.50	.32
26	.23	2.47	.56	.96	3.07	1.75	.67
25	.00	2.50	.00	.01	2.10	1.50	.02
24	.22	2.48	.53	.90	2.37	1.50	.64
23	.32	2.46	.80	1.33	3.83	1.75	.71
22	.64	2.43	1.54	2.58	5.27	2.00	.99
21	.97	2.39	2.33	3.93	5.47	2.00	1.26
20	.98	2.39	2.34	3.96	5.27	2.00	1.29
19	1.98	2.27	4.51	7.59	8.39	2.50	1.86
18	2.38	2.23	5.30	9.15	9.91	2.50	**
17	2.41	2.23	5.36	9.25	6.49*	2.50	**
16 (P.S. No. 10)	3.55	2.10	7.43	13.18	5.20*	—	—
15	3.83	2.06	7.91	13.65	8.83*	2.00	**
14	5.50	1.87	10.30	16.84	15.55*	3.50	**
13	7.19	1.68	12.08	18.62	18.89	4.00	2.82
12	7.89	1.60	12.62	19.17	29.67	4.00	2.34
11	10.89	1.60	17.42	26.57	28.40	4.50	3.45
10	10.89	1.60	17.42	26.57	31.14	4.50	3.20
9	10.89	1.60	17.42	26.57	31.16	4.50	3.20
8	10.89	1.60	17.42	26.57	34.80	4.50	2.94
7	10.89	1.60	17.42	26.57	38.35	5.00	3.06
6	11.33	1.60	18.12	28.17	38.29	5.00	3.19
5	11.33	1.60	18.12	28.17	51.78	5.00	2.63
4	11.52	1.60	18.43	28.47	57.20	5.00	2.49
3	11.52	1.60	18.43	28.47	80.67	5.00	2.05
2	11.70	1.60	18.72	28.76	80.80	5.00	2.06
1 (Plant No. 2)							

* Full pipe flow capacity exceeded by Year 2000.
** Flow exceeds pipe capacity and surcharges.

WICH4.CC

**Table IV-5
YEAR 2010 WASTEWATER
FLOW RATES**

<u>Map Location</u>	<u>Average Flow (MGD)</u>	<u>Peak Factor</u>	<u>Dry Weather Peak (MGD)</u>	<u>Wet Weather Peak (MGD)</u>	<u>Pipe Capacity (MGD)</u>	<u>Pipe Size (Ft.)</u>	<u>Flow Depth (Ft.)</u>
27	.06	2.50	.15	.21	2.25	1.50	.31
26	.24	2.48	.60	.91	3.07	1.75	.65
25	.00	2.50	.00	.01	2.10	1.50	.02
24	.24	2.48	.60	.91	2.37	1.50	.65
23	.37	2.47	.91	1.38	3.83	1.75	.73
22	.68	2.45	1.67	2.52	5.27	2.00	.98
21	1.04	2.42	2.52	3.84	5.47	2.00	1.24
20	1.05	2.42	2.54	3.87	5.27	2.00	1.27
19	2.20	2.34	5.15	7.73	8.39	2.50	1.89
18	2.67	2.30	6.14	9.41	9.91	2.50	**
17	2.73	2.30	6.28	9.62	6.49*	2.50	**
16 (P.S. No. 10)	4.75	2.14	10.17	15.92	5.20*	—	—
15	5.30	2.10	11.13	16.89	8.83*	2.00	**
14	8.29	1.88	15.59	22.11	15.55*	3.50	**
13	11.30	1.65	18.65	25.22	18.89*	4.00	**
12	12.00	1.60	19.20	25.75	29.67	4.00	2.88
11	15.00	1.60	24.00	33.15	28.40*	4.50	**
10	15.00	1.60	24.00	33.15	31.14*	4.50	**
9	15.00	1.60	24.00	33.15	31.16*	4.50	**
8	15.00	1.60	24.00	33.15	34.80	4.50	3.51
7	15.00	1.60	24.00	33.15	38.35	5.00	3.59
6	15.44	1.60	24.70	34.75	38.29	5.00	3.74
5	15.44	1.60	24.70	34.75	51.78	5.00	3.00
4	15.63	1.60	25.01	35.06	57.20	5.00	2.83
3	15.63	1.60	25.01	35.06	80.67	5.00	2.30
2	15.81	1.60	25.30	35.34	80.80	5.00	2.31
1 (Plant No. 2)							

* Full pipe flow capacity exceeded by Year 2010.
** Flow exceeds pipe capacity and surcharges.

PART V – WASTEWATER TRANSPORT
AND TREATMENT ALTERNATIVES

PART V
WASTEWATER TRANSPORT AND TREATMENT ALTERNATIVES

INTERCEPTOR SEWER EXTENSION

Extension of new interceptor sewers into the planning area from an existing adequately sized city system is one method of service evaluated to meet future wastewater collection and treatment requirements. Two interceptor extension alternatives are described below. Each would be adequate to serve future needs. The first alternative includes construction of a new interceptor paralleling the existing Southwest Interceptor Sewer. The second alternative consists of constructing an interceptor along the Cowskin Creek drainage course. Treatment of all wastewater would be at Treatment Plant No. 2.

Parallel Southwest Interceptor Sewer

Under this alternative, a new interceptor sewer would be constructed parallel to the existing Southwest Interceptor Sewer alignment described in Part II. The parallel sewer would relieve anticipated excess flows in portions of the existing interceptor sewer. Year 2010 peak flows are expected to exceed the existing interceptor sewer's capacity upstream of the intersection of 47th Street South and Meridian (Point No. 8). Year 2030 peak flows are expected to exceed the capacity of the existing interceptor sewer upstream of the intersection of 55th Street South and Meridian Avenue (Point No. 7).

Proposed new construction would include expansion of Pump Station No. 10 and a parallel sewer to transport the expected excess flows. A parallel wastewater force main would be constructed from Pump Station No. 10, which is located near

the intersection of Harry Street and Maize Road. A new gravity sewer would parallel the existing 24-inch line along Harry Street from a point approximately 1,000 feet east of Tyler Road to Hoover Street. The parallel sewer would continue south along Hoover Street to 31st Street South, then east to the intersection of West Street and Sheridan, crossing under the Wichita-Valley Center Floodway and Interstate Highway 235. The parallel sewer would continue south to 47th Street South then east to Meridian Avenue (Point No. 8). The parallel interceptor sewer described above would provide adequate capacity to the year 2010.

In order to provide service for an extended planning period to at least year 2030, a parallel interceptor sewer would have to be extended to the intersection of 55th Street South and Meridian Avenue. The extension of the parallel interceptor sewer, combined with the parallel sewer described for providing service to the year 2010, would provide service to the year 2030.

The report "Airport Noise Control and Land Use Compatibility Plan" (ANCLUC) for Wichita Mid-Continent Airport recommends that the undeveloped land areas adjacent to the airport, particularly to the south and west, be reserved primarily for public use with limited industrial and residential zones in locations which are compatible with projected noise contours for the year 2000. The ANCLUC report specifically recommends that serious consideration be given to the construction of the Cowskin Creek Interceptor Sewer along an alignment designed to avoid opening the area south of the airport to extensive development. The report further recommends that particular attention be given to construction of new sewers parallel to the existing Southwest Interceptor

Sewer to provide sewer service to meet anticipated needs of the rapidly developing areas northwest of the airport.

Construction of the system parallel to the Southwest Interceptor Sewer would provide sewer service to the areas northwest of the airport without encouraging growth in the areas south and west of the airport. The parallel system would not, however, adequately meet the needs of existing development west of the airport. As noted earlier in this report, industrial development and major commercial land uses are expected to continue along U.S. 54 and south of U.S. 54 west of the airport. Sewer service to much of the area west of the airport would require pumping all flows back to Pump Station No. 10 or east to a parallel interceptor constructed along the Southwest Interceptor Sewer alignment previously described.

Installation of a system parallel to the existing Southwest Interceptor Sewer would require construction in existing developed areas. Construction would include disruption of street traffic and would require working around existing utilities located along the proposed alignment. Construction costs for the parallel system would be high and noise and traffic disruption would have a negative impact. Typical costs for construction in city streets is 60 percent greater than in undeveloped land.

The developed areas and subsequent high traffic areas adjacent to the airport make construction of the parallel system undesirable. Inability of the parallel system to provide gravity sewer service to areas west of the airport contributes to the negative impact of this alternative. In consideration of the above,

construction of an interceptor sewer parallel to the Southwest Interceptor Sewer was not considered further in the evaluation.

Cowskin Creek Interceptor Sewer

The Cowskin Creek Interceptor Sewer would be constructed to provide gravity sanitary sewer service for the entire planning area (Figure V-1). The interceptor sewer would collect flows presently transported by Pump Station No. 10 to the Southwest Interceptor Sewer. Proposed new construction would include retiring Pump Station No. 10 from service and constructing an interceptor sewer along Cowskin Creek from the Pump Station No. 10 site to the Southwest Interceptor at the intersection of 55th Street South and Meridian Avenue (Point No. 7). The interceptor sewer would be 48 inches in diameter to provide service to the year 2010. Year 2030 flows would require that part of the interceptor sewer be increased in size to 54 inches in diameter to provide adequate capacity. The interceptor sewer alignment would follow the Cowskin Creek drainage course and would divert around the southwestern corner of the airport, thereby avoiding tunnelling under existing runways or otherwise disrupting airport operations. The interceptor sewer would continue to follow the Cowskin Creek drainage course to the southeast, crossing under the Wichita-Valley Center Floodway via an inverted siphon along 55th Street South between West Street and Meridian Avenue. The new interceptor sewer would connect to the existing Southwest Interceptor Sewer at the intersection of 55th Street South and Meridian Avenue.

Although adequate capacity in the existing system for year 2010 flows is provided at Point No. 8, extension of the Interceptor Sewer to Point No. 7 is necessary for the following reasons.

1. Tying into the city system at Point No. 7 allows the sewer to follow the natural contour of Cowskin Creek.
2. The capacity of the city system at Point No. 7 is adequate for year 2020 flows. Thus, making it a more long-term solution consistent with the design life of the sewer.

"The Next Thirty Years," a 1970 comprehensive sewage facilities plan for Wichita and Sedgwick County, proposed two similar alternatives for providing service to the planning area. The first alternative included enlarging Pump Station No. 10 and the existing force main and construction of a parallel line along much of the existing Southwest Interceptor Sewer, as described earlier. The second alternative included construction of the Cowskin Creek Interceptor Sewer. The plan recommended that an alignment study be conducted along Cowskin Creek and that acquisition of right-of-way be initiated for the Cowskin Creek Interceptor Sewer.

Construction of the Cowskin Creek Interceptor Sewer along the proposed alignment could encourage development in the area south of the airport if other positive land use controls are not implemented. The interceptor sewer would also provide gravity sewer service for existing development west of the airport and south of

U.S. 54. Construction of the interceptor sewer could attract new businesses and encourage additional growth in the area.

The Cowskin Creek Interceptor Sewer would be constructed for the most part in undeveloped areas with few existing utilities to contend with. Most of the alignment lies in open, unimproved areas and would involve a few creek crossings and street crossings. An inverted siphon would be required to cross under the Wichita-Valley Center Floodway. Conceptual design envisions a three-barrel siphon, 1,500 feet long to be constructed across the floodway along 55th Street South between West Street and Meridian Avenue.

Construction of the Cowskin Creek Interceptor Sewer would eliminate Pump Station No. 10 and provide gravity sewer service to the entire planning area except for small temporary pumping facilities in remote areas. Location of the sewer in a largely undeveloped area would allow construction without the burden of extensive utility relocations and disruption of major traffic routes. Construction of the sewer through the undeveloped areas south of the airport may exert pressure to allow the areas to develop.

PUMP STATION/FORCE MAIN

If the Cowskin Creek Interceptor Sewer, as described previously, is not constructed the question arises how to transport and treat flows from a growing area to the city system with inadequately sized sewer and pumping capacities. The major bottleneck is Pump Station No. 10. The pump station is undersized to convey future flows. Its firm pumping capacity is 5.2 MGD while peak flows are estimated to be 15.92 MGD by year 2010. Two possibilities are obvious:

construct a new pump station to convey future flows and keep Pump Station No. 10 in service, or retire Pump Station No. 10 and construct a single, larger pump station. Other considerations include new pump station location and force main alignments. The discussion in this section will address these alternatives.

Pump Station No. 10

Several considerations are involved with leaving Pump Station No. 10 in service versus retiring it from service. Some of these considerations are presented below:

1. Construction Cost: Construction costs for a new pump station and retiring Pump Station No. 10 from service exceed the costs of leaving Pump Station No. 10 in service and constructing a new pump station to convey the additional flows beyond Pump Station No. 10 capacity.
2. Power Cost: Power costs for a single new pump station with retirement of Pump Station No. 10 from service would be about 5 to 10 percent less than leaving Pump Station No. 10 in service and constructing a new pump station for additional capacity.
3. Age: Construction of a single new pump station with retirement of Pump Station No. 10 from service offers some advantages over leaving Pump Station No. 10 in service and constructing a new pump station for additional capacity. Maintenance costs for a single new pump station would be about 5 to 10 percent less than maintenance costs for the existing pump station and a new smaller pump station.

4. 24-Inch Gravity Sewer: If Pump Station No. 10 is retired and flows diverted to another location, then the 24-inch gravity sewer from Point No. 14 to Point No. 15 will be susceptible to extra maintenance. Wastewater flows will not be sufficient to maintain the minimum self-cleaning velocity of 2 feet per second.

5. Gravity Sewers: Retiring of Pump Station No. 10 and diverting all flows to another sewer limits use of the existing gravity sewer system. Using the existing gravity sewer to the maximum extent possible significantly reduces pumping costs because of the lower horsepower requirements for pumping shorter distances. The amount is dependent upon the location of the new pump station and the length of new force main (discussed later). Removing flow currently contributed by Pump Station No. 10 will create some excess capacity in the Southwest Interceptor.

6. Flexibility-Backup: Leaving Pump Station No. 10 in service and constructing a new pump station would allow flexibility for operation of the system and would provide backup for maintenance requirements or unexpected shutdowns.

After considering the pros and cons presented in the above discussion, retiring Pump Station No. 10 was determined to be the least attractive option and was not considered further.

Pump Station Capacity

Pump station design capacities for this project are based on the following:

1. Existing capacity of Pump Station No. 10 is 3,600 gpm (5.20 MGD).
2. Estimated year 2010 design flow for the area served by the pump station is 11,000 gpm (15.92 MGD).
3. If Pump Station No. 10 is left in service, a new pump station will be constructed to pump flows in excess of Pump Station No. 10's capacity. Required design capacity = 7,400 gpm (10.72 MGD).

Pump Station Location

Three alternative sites were considered for construction of a new pump station to serve developing areas of the Cowskin Creek Basin. The first alternative considered construction of a new pump station at Site A, the existing location of Pump Station No. 10, near the intersection of Harry Street and Maize Road. A second alternative, Site B, is located along Tyler Road between Pawnee and 31st Street South. The third alternative location is Site C, located just north of K-42 between Ridge Avenue and Tyler Road. See Figures V-2 and V-3 for Sites B and C locations.

Constructing a new pump station at Site A would preclude gravity sewer service for most existing and future developments south and west of that site. Although Site A would be the location least likely to encourage development south and west of the airport, when compared to Sites B and C, the slightly less

encouragement of development is not as significant as the elimination of gravity sewer service to existing and potential development areas to the west. These areas would not be in conflict with airport land use. Because of this, Site A was not considered further.

Connection to Southwest Interceptor Sewer

As discussed earlier in the Cowskin Creek Interceptor Sewer section, connection to the existing City System involves several considerations. Point No. 8 (47th Street South and Meridian) is the nearest location in the City System which has adequate capacity downstream for future flows to year 2010. This is the recommended connection point for a force main. After year 2010, it may be necessary to extend the force main to Point No. 7 (55th Street South and Meridian). The pump station horsepower requirements will take into consideration the possibility of future higher head requirements.

Force Main Alignment

Several different force main alignments were considered in the original development of alternatives. However, in all cases the force main would discharge to Point No. 8 in the city system. The alternate alignments were narrowed down to the three most feasible alternative routes as follows:

1. South to MacArthur Road, east to the Southwest Interceptor Sewer, then south following the Southwest Interceptor Sewer to Point No. 8.

2. East paralleling K-42 (mostly on airport property) and 31st Street south to the east side of the floodway, then south to 47th Street south and east to Point No. 8.
3. Southeast along Cowskin Creek, following the Cowskin Creek Interceptor Sewer alignment to 47th Street South, then east along 47th Street South to Point No. 8.

Land Use Considerations

Construction of a pump station at Sites B or C and a force main alignment along K-42 would tend not to encourage development in the area south of the airport. Sewer service to this area would not be feasible from Site B or to a somewhat lesser extent Site C. The farthest extension of a gravity sewer would be to the southern end of airport property at Site C. The scheme of service would allow existing and future development west of the airport and to a limited extent along the north side of K-42 to be served by gravity sewers. Development, as might be encouraged by construction of the Cowskin Creek Interceptor Sewer south of the airport, would not be supported.

Future Service Area

Construction at Site B would provide gravity service for areas north of K-42 and west of the airport. Future service south of K-42, if required, would be by individual on-site systems or by small pump stations.

Construction at Site C would provide gravity service for areas north of K-42 and west of the airport. Limited access to gravity sewers may also be provided for

areas adjacent to the south side of K-42. However, this is unlikely because of the costly construction to cross under K-42. Future service for other areas south of K-42, if required, would be by individual on-site systems or by small pump stations.

WASTEWATER TREATMENT PLANT

The previous discussion of alternatives provided for collection and transportation of wastewater flows to the Southwest Interceptor Sewer for treatment at Treatment Plant No. 2.

Construction of a wastewater treatment plant with discharge to Cowskin Creek is another alternative for providing sanitary sewer service to the Cowskin Creek study area.

This alternative has the advantage of providing flexibility without the cost of transporting sewage long distances to the Southwest Interceptor Sewer. In this scheme the treatment plant would be operated on a continuous basis by treating a small amount of sewage generated from areas south of Pump Station No. 10. Pump Station No. 10 would continue in operation to transport dry weather flows to Treatment Plant No. 2. The advantages of this were discussed previously. Wet weather flows would be transported to the new treatment plant. A new pump station and treatment plant would be constructed to handle dry weather and peak wet weather flows. Pumping requirements would remain the same except pump motor sizing would be greatly reduced because of the lower head requirements.

Treatment Plant Location

Two alternative sites were considered for construction of treatment facilities to serve the Cowskin Creek Area. The first site, designated Site B, is located along Tyler Road between Pawnee and 3rd Street South. The second site, designated Site C, is located just north of K-42 between Ridge and Tyler. Both sites correspond to pump station locations of the same designations referred to in the previous section.

Effluent Limitations and Criteria

The Kansas Department of Health and Environment (KDHE) was contacted with regard to their requirements for a treatment plant discharging effluent to Cowskin Creek (see Appendix). It is clear that KDHE does not encourage a satellite treatment plant in the Cowskin Creek study area. The letter states in part:

"As we have discussed earlier by phone, KDHE does not endorse a satellite treatment plant as being considered. Our policy is to encourage regionalization of collection and treatment systems whenever possible. In this particular case, regionalization is certainly a possibility and establishment of a satellite plant is discouraged.

"Overall planning documents for the Wichita urban area do not address this issue. Without an overall county or urban area study or update, establishment of a satellite plant represents fragmented planning and development, contrary to our Department's, and likely contrary to the City and County's policies."

Regionalization by transporting all wastewater flows from the study area to the city for treatment has been discussed within the Cowskin Creek Interceptor Sewer and pump station/force main discussions. This section, which discusses the possibility of a treatment plant, is offered only as an alternative because KDHE has not specifically ruled out its possibility. However, effluent limitations imposed by KDHE are very restrictive and would require advanced wastewater treatment. Tentatively, KDHE has imposed the following criteria and limitations on discharge:

1. Five-day Biochemical Oxygen Demand (BOD₅) - 15 mg/l
2. Total Suspended Solids (TSS) - 15 mg/l
3. Ammonia Nitrogen (NH₃-N) - 0 mg/l
4. Fecal coliform - 200 mg/l
5. Treatment Plant must be highly reliable with redundant or backup units required.

With the above criteria in mind, the following treatment plant discussion assumes only treatment of average dry weather flows from areas south of Pump Station No. 10 and peak wet weather flows in excess of Pump Station No. 10 capacity. The great majority of dry weather flow would continue to be pumped to the city by Pump Station No. 10. It would be impractical to obtain approval for

a new treatment plant with capacity to treat flows presently being effectively treated by the city at Treatment Plant No. 2.

Sizing Criteria

The peak hydraulic or pumping capacity would be the same as for the pump station/force main to the Southwest Interceptor Sewer system as mentioned previously (7,400 gpm or 10.72 MGD). Although the treatment plant pump station would have the same capacity, lower head requirements would allow for smaller motor sizing.

The great range of flows from average to peak would in some cases require special treatment plant design considerations. Some means would need to be provided to equalize flows during wet weather periods. Waste stabilization ponds by themselves, either aerated or nonaerated, are ideal surge control facilities to attenuate and dampen the effects of high peak flows. Other treatment processes such as the oxidation ditch or package plants, which utilize activated sludge treatment, are very susceptible to solids "washing out" from the effect of high peak flows. The activated sludge process would require a separate flow equalization or storage system in order to consistently work effectively.

The design average dry weather flow was based on being able to treat the existing and future flows tributary to the pump station at Pawnee and Yellowstone. This is approximately a quarter section of residential area which is expected to contribute about 63,000 gpd by year 2010. Additional capacity would be provided to treat flow from a peak flow storage lagoon. As mentioned

above, the treatment plant pump station would have a firm pumping capacity of 10.72 MGD. This flow would either be pumped to a storage lagoon in the case of an activated sludge facility or directly to the first cell of a lagoon system.

The 1977 I/I analysis estimated that the inflow volume from subsystem 29 (which is tributary to Pump Station No. 10) amounts to 0.52-MG per inch of rain. The design rainfall event used in the report was 4 inches, a 4-inch event would contribute 2.08 MGD of inflow volume. It is assumed that all inflow would have to be diverted to the Cowskin Creek Interceptor and then to the Treatment Plant because Pump Station No. 10 would only have the capacity to transport dry weather flows by year 2010.

The inflow volume would be stored in a lagoon at the treatment plant site for later treatment when peak flows subside. This scheme would allow a reasonable peak-to-average flow ratio so that a biological system would work efficiently. A treatment plant sized for 0.25-MGD average dry weather flow would be capable of efficiently treating the normal dry weather flow of 0.063-MGD and allow capacity to drain the storage lagoon within 12 days after a 4-inch rainfall event. The storage lagoon could be drained even faster in the event of a smaller rainfall. With a lagoon type treatment plant, the pumping and secondary cells would be oversized to store the design inflow volume. No separate storage lagoon would be required.

The treatment facility would be constructed so that expansion to 0.5-MGD could be easily accomplished if additional unforeseen residential development occurs.

Also, if industrial development near K-42 and Maize Road increase significantly, treatment capacity could be expanded.

Treatment Processes

Several treatment processes were considered for providing sanitary sewage treatment in the Cowskin Creek Basin. Lagoons, land application, aerated lagoons, oxidation ditch, and packaged activated sludge plants were evaluated in this study. These processes were considered because they can produce the required effluent and, in general, require less maintenance and supervision than other methods of treatment. In addition to the major treatment schemes, raw wastewater screening and pumping would be required. Chlorination/dechlorination was considered for all schemes because of the fecal coliform limitations. Sand filtration was considered for all schemes except for the land application option because of the stringent BOD₅ and TSS limitations. The land application option would be a nondischarging system which would negate the need for a sand filter. A brief description of the characteristics of each treatment scheme is given below.

Lagoons: Lagoons, also referred to as stabilization ponds, have been widely used for the biological treatment of wastewater. Lagoons are generally classified as facultative, aerated, or anaerobic according to the type of biological activity that takes place in them. For purposes of this particular alternative, facultative ponds were considered, so called because of the presence of facultative bacteria present in the pond. Facultative bacteria comprise a group that uses free dissolved oxygen when available, but can also live in the absence of oxygen through anaerobic action.

The stabilization pond process basically consists of an earthen pond where waste organics in suspension are broken down by bacteria, releasing nitrogen and phosphorous nutrients, and carbon dioxide. These nutrients are in turn used by algae for growth, along with energy from sunlight, releasing oxygen to solution. Dissolved oxygen is then taken up by the bacteria; thus completing a symbiotic relationship. Oxygen, in addition to that produced by algae, also enters the liquid through natural surface diffusion. Settleable solids accumulate on the bottom and are actively decomposed by anaerobic bacteria.

Two main factors, the biological loading rate and total storage, are important in the design of a stabilization pond system. Kansas Department of Health and Environment "Minimum Standards of Design for Water Pollution Control Facilities" requires design for discharging lagoons to be based on a biological loading of 34 lbs BOD₅/acre/day and total storage at 120 days based on average design flow with no losses. Based on these design parameters, construction of a stabilization pond system would require a land area of about 30 acres to meet future needs for the Cowskin Creek Basin.

Due to the large land area required and the potential for creation of objectionable odors, this alternative was not considered as favorable economically nor environmentally when compared to other alternatives.

Land Application: Land application, specifically spray irrigation of wastewater, involves the application of wastewater to the land for treatment and for meeting the needs of plant growth. The land application process envisioned consists of discharging wastewater to the land to support plant growth. Because

of the plentiful groundwater aquifer in the immediate area, sale or other use of the wastewater was not considered practical. Several factors must be considered in the evaluation of land application systems for wastewater treatment. Considerations include site selection, preapplication treatment, climate, storage, loading rate, land requirements, crop selection, surface runoff control, and protection of groundwater resources.

The most important factors affecting cost and operation are: loading rate, climate, and storage requirements. KDHE "Minimum Standards of Design for Water Pollution Control Facilities" requires that wastewater application rates not exceed 40 acre-inches per year. Assuming that a land application system could be utilized for treatment of wastewater in the Cowskin Creek Basin, application at the maximum rate of 40 acre-inches per year would require an area of approximately 70 acres. In addition to the land application area, the storage lagoon would occupy a 10- to 15-acre site. Climate extremes in the Wichita area would also be a controlling factor for design. Application would most likely be limited to the growing season when temperature and weather conditions are suitable.

Cold weather conditions restrict the available application period to those times of the year when temperature is favorable and snow or excess precipitation is not present. Because of the climate restrictions on application, storage must be provided for wastewater until weather conditions are favorable for application.

Two major restrictions limit the applicability of land treatment for the Cowskin Creek study area. The nature of the system makes it desirable that it be located away from populated areas. Sprinklers produce a mist that may be transported by wind currents. Inadequately disinfected wastewater mists may contain active bacteria and viruses. Buffer zones from public access are necessary to minimize public health risks. Public response to a land application system in the Cowskin Creek area would probably be negative. Potential for groundwater contamination is also an important consideration for the system. The existence of a plentiful groundwater supply in the area would require a comprehensive groundwater monitoring program. This option was not considered further because it would be costly, require a very large site and have a negative impact on adjacent land owners.

Aerated Lagoon: Aerated lagoons are basically identical in physical construction to facultative ponds (lagoons) as discussed earlier in this section. Aerated lagoons, however, include a method for adding dissolved oxygen to the wastewater. These methods used may include pier-mounted or floating mechanical units to provide mixing, or compressed air can be introduced into the wastewater through pipes and air diffusers across the pond bottom. Generally, a more economical easily maintained long-term system is the compressed air/diffuser system.

This system would include a series of three lagoon cells, 12 feet deep, for biological treatment of the wastewater. Aeration would be provided by compressed air blowers through an air diffuser system installed along the bottom of the first two ponds. Aerobic and facultative bacteria present in the cells

metabolize the organic material in the wastewater, using oxygen supplied by the aeration system. Following treatment in the two aerated ponds, the wastewater flows to the third pond where facultative stabilization takes place, as described earlier in this section.

Land area required for an aerated lagoon system would be about 3.5 acres. The smaller land area is due to the greater water depth and more efficient transfer of oxygen. The system would be easily operated, having few mechanical parts, with the exception of the air distribution system.

Oxidation Ditch: The oxidation ditch, used extensively in Europe and the United States, is an activated sludge process. The oxidation ditch itself has a race track configuration with a trapezoidal-shaped cross section.

The oxidation ditch system proposed for this project includes an earthen peak flow storage basin, the oxidation ditch unit, and secondary clarification. The wastewater first flows to an aerated flow storage basin to help prevent operational problems caused by variations in influent wastewater flow rate and strength. The storage basin would mainly be used to reduce the impact of peak wet weather flows on treatment operations and would normally be operated only during periods of peak hydraulic loadings. The wastewater would then enter one end of the oxidation ditch and circulate around the channel with the aid of an aeration system. Several aeration mixing devices are possible.

Brush aerators
Orbal discs
Slow-speed mixer/air diffusers

All feasible equipment would be investigated. Microorganisms in the channel use the oxygen to metabolize the organic material in the wastewater. The ditch is designed such that the hydraulic detention time is about 24 hours. The sludge retention time (SRT) is normally 20 to 30 days. This long SRT is obtained by maintaining a high mixed liquor suspended solids (MLSS) concentration (3,000-5,000 mg/l) in the ditch.

Effluent from the ditch would be settled in a final clarifier. Most of the sludge collected by the clarifier would be pumped back to the ditch (return sludge) to maintain the MLSS. Several innovative intrachannel clarifiers have been developed recently. Most prominent include the BMTS and boat clarifiers. These clarifiers eliminate the need for return sludge pumping, piping and separate clarifier structures because they are located within the oxidation ditch channel. Because of the long sludge retention times, waste sludge is considered stabilized; no sludge digestion facilities are required with this type of oxidation ditch process. The liquid sludge would be transported to Treatment Plant No. 2 for disposal.

Packaged Activated Sludge Plant: Packaged activated sludge plants generally consist of a system incorporating an activated sludge system followed by final clarification, contained in a factory-built unit. Packaged systems are available with capacities ranging from 10,000 gpd up to 500,000 gpd. Installation of multiple units can increase the available capacity to over 1.0 MGD.

A packaged activated sludge system would include a factory-built unit containing all unit processes required for extended aeration activated sludge secondary wastewater treatment. The unit would include an aeration chamber utilizing diffused air aeration to provide oxygen for stabilization of the wastewater and mixing of the mixed liquor. Following aeration, the wastewater would flow into a clarification chamber. Settleable solids are returned to the aeration chamber by gravity. The sloped floor of the clarification chamber diverts the return sludge under the wall separating the clarification and aeration chambers. Effluent exits the system from the quiescent zone in the clarification chamber.

Some disadvantages of the packaged activated sludge plant are clarifier problems and short circuiting. In many cases, the clarifier unit is undersized and excessive surface overflow rates result in poor solids capture. The general configuration of the packaged system often results in poor treatment of peak flows due to short circuiting.

Due to the higher maintenance requirements, susceptibility to solids "wash out" and the high reliability required, this alternative was not considered more favorable than other alternatives.

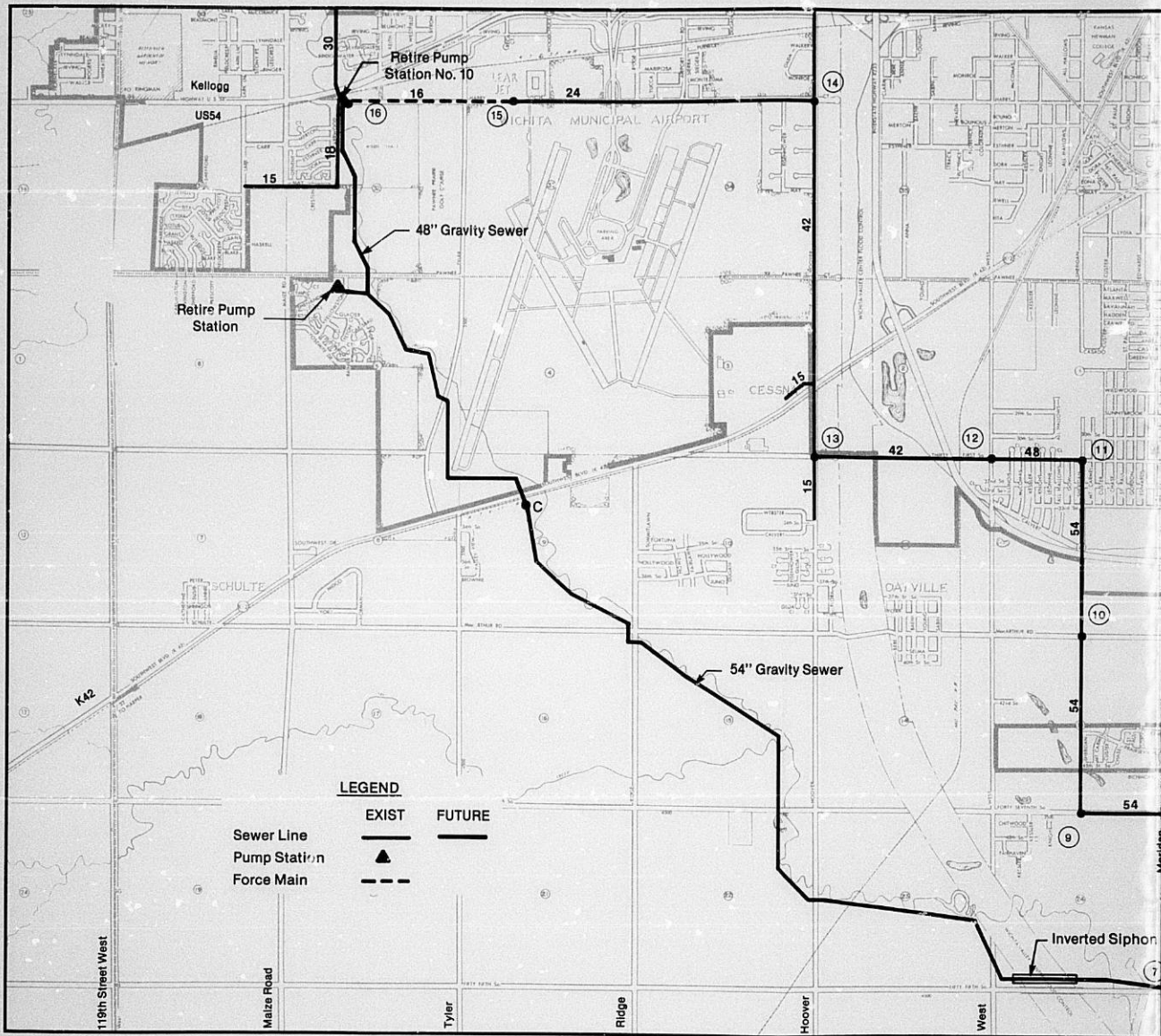
Effluent Filtration and Disinfection

Common to all treatment alternatives would be the need to provide effluent filtration and disinfection. This is required because of the stringent BOD₅, TSS, and fecal coliform requirements and because of the stipulated redundant features the treatment plant must have.

Many filtration devices are available. Some of the more common are: dual media filter, Parkson Continuous Backwash, Infilco Greenleaf Filter and Zimpro Hydro Clear. Each is capable of polishing final effluent from an activated sludge plant or lagoon. Each has its advantages and disadvantages. For purposes of this report, the Zimpro Hydro Clear unit was used in the cost analysis. It is an excellent package-type unit, manufactured and assembled at the factory ready for field installation. This filter uses an air system to help backwash the sand filter. It can also handle periodic secondary plant upsets by treating up to 200 mg/l TSS for at least 3 hours. All filtration devices will be analyzed further in preliminary design if a treatment plant is the selected option.

Disinfection is required to comply with effluent fecal coliform quality standards. Possible disinfection methods are: chlorination, ozonation and ultraviolet radiation. Ozonation and ultraviolet radiation have been shown not to be economically feasible by several previous evaluations. Chlorination remains the most common and reliable means of disinfection in use today. The system would include a chlorine building for chlorine storage and injection of solution into plant effluent.

* * * * *



LEGEND

- | | | | | |
|--------------|-------------|-------|-------------|--------|
| Sewer Line | <u> </u> | EXIST | <u> </u> | FUTURE |
| Pump Station | ▲ | | | |
| Force Main | - - - | | | |

119th Street West

Maize Road

Tyler

Ridge

Hoover

West

Kellogg

US54

Retire Pump Station

Retire Pump Station No. 10

48" Gravity Sewer

54" Gravity Sewer

Inverted Siphon

MINNAPOLIS MUNICIPAL AIRPORT

CESSNA

DAI VILLE

K42

SCHULTE

SWINGWAY RD. & S. W. 119TH ST.

SWINGWAY RD. & S. W. 119TH ST.

SWINGWAY RD. & S. W. 119TH ST.

SWINGWAY RD. & S. W. 119TH ST.

SWINGWAY RD. & S. W. 119TH ST.

SWINGWAY RD. & S. W. 119TH ST.

SWINGWAY RD. & S. W. 119TH ST.

SWINGWAY RD. & S. W. 119TH ST.

SWINGWAY RD. & S. W. 119TH ST.

SWINGWAY RD. & S. W. 119TH ST.

SWINGWAY RD. & S. W. 119TH ST.

SWINGWAY RD. & S. W. 119TH ST.

SWINGWAY RD. & S. W. 119TH ST.

SWINGWAY RD. & S. W. 119TH ST.

SWINGWAY RD. & S. W. 119TH ST.

SWINGWAY RD. & S. W. 119TH ST.

SWINGWAY RD. & S. W. 119TH ST.

SWINGWAY RD. & S. W. 119TH ST.

SWINGWAY RD. & S. W. 119TH ST.

SWINGWAY RD. & S. W. 119TH ST.

SWINGWAY RD. & S. W. 119TH ST.

SWINGWAY RD. & S. W. 119TH ST.

SWINGWAY RD. & S. W. 119TH ST.

SWINGWAY RD. & S. W. 119TH ST.

14

42

15

13

15

15

54

7

30

16

16

15

18

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

15

24

24

24

24

24

24

24

24

24

24

24

24

24

24

24

24

24

24

24

24

24

24

24

24

24

24

24

24

24

24

24

24

24

24

24

24

24

24

12

42

42

42

42

42

42

42

42

42

42

42

42

42

42

42

42

42

42

42

42

42

42

42

42

42

42

42

42

48

48

48

48

48

48

48

48

48

48

48

48

48

48

48

48

48

48

48

48

48

48

48

48

48

48

48

48

48

54

54

54

54

54

54

54

54

54

54

54

54

54

54

54

54

54

54

54

54

54

54

54

54

54

54

54

54

54

11

11

11

11

11

11

11

11

11

11

11

11

11

11

11

11

11

11

11

11

11

11

11

11

11

11

11

11

11

9

9

9

9

9

9

9

9

9

9

9

9

9

9

9

9

9

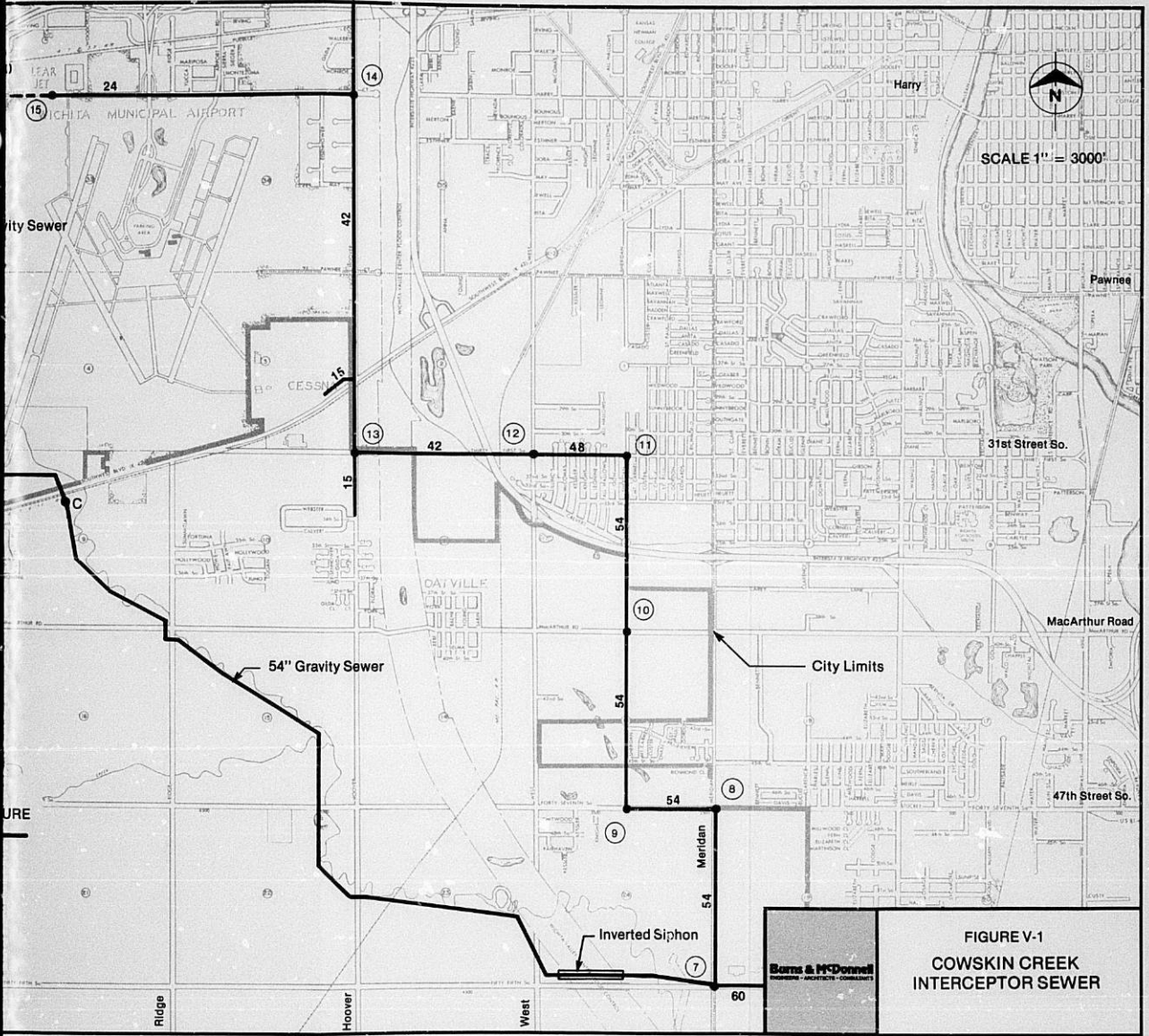
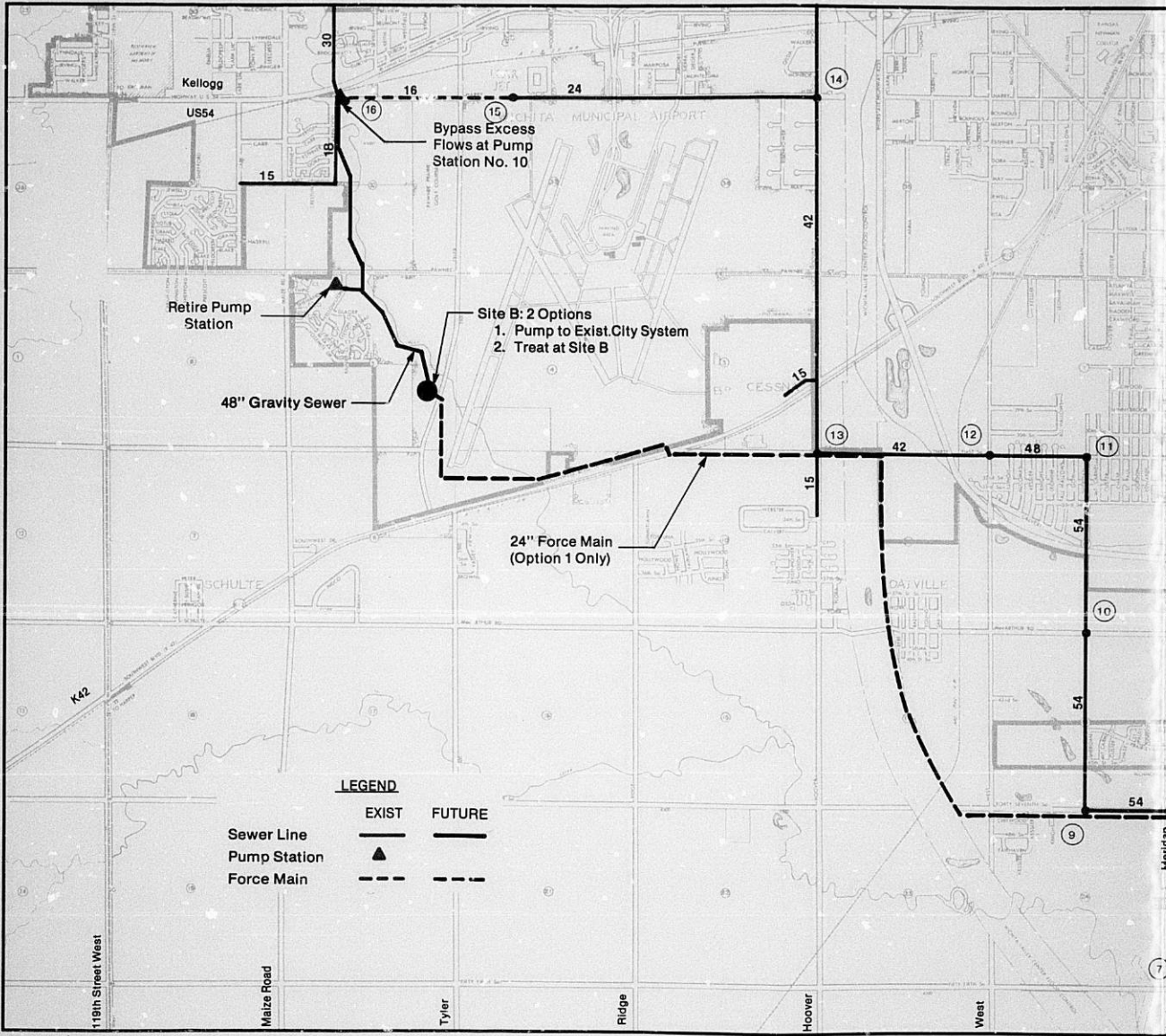


FIGURE V-1
 COWSKIN CREEK
 INTERCEPTOR SEWER

Burns & McDonnell
 ENGINEERS - ARCHITECTS - CONSULTANTS



LEGEND

	EXIST	FUTURE
Sewer Line	————	————
Pump Station	▲	
Force Main	- - - -	- - - -

118th Street West

Matze Road

Tyler

Ridge

Hoover

West

Kellogg

US54

Retire Pump Station

48" Gravity Sewer

Bypass Excess Flows at Pump Station No. 10

Site B: 2 Options
1. Pump to Exist. City System
2. Treat at Site B

24" Force Main (Option 1 Only)

CHITA MUNICIPAL AIRPORT

CESS

DAVILLO

K42

14

15

16

24

15

42

13

42

12

48

11

15

54

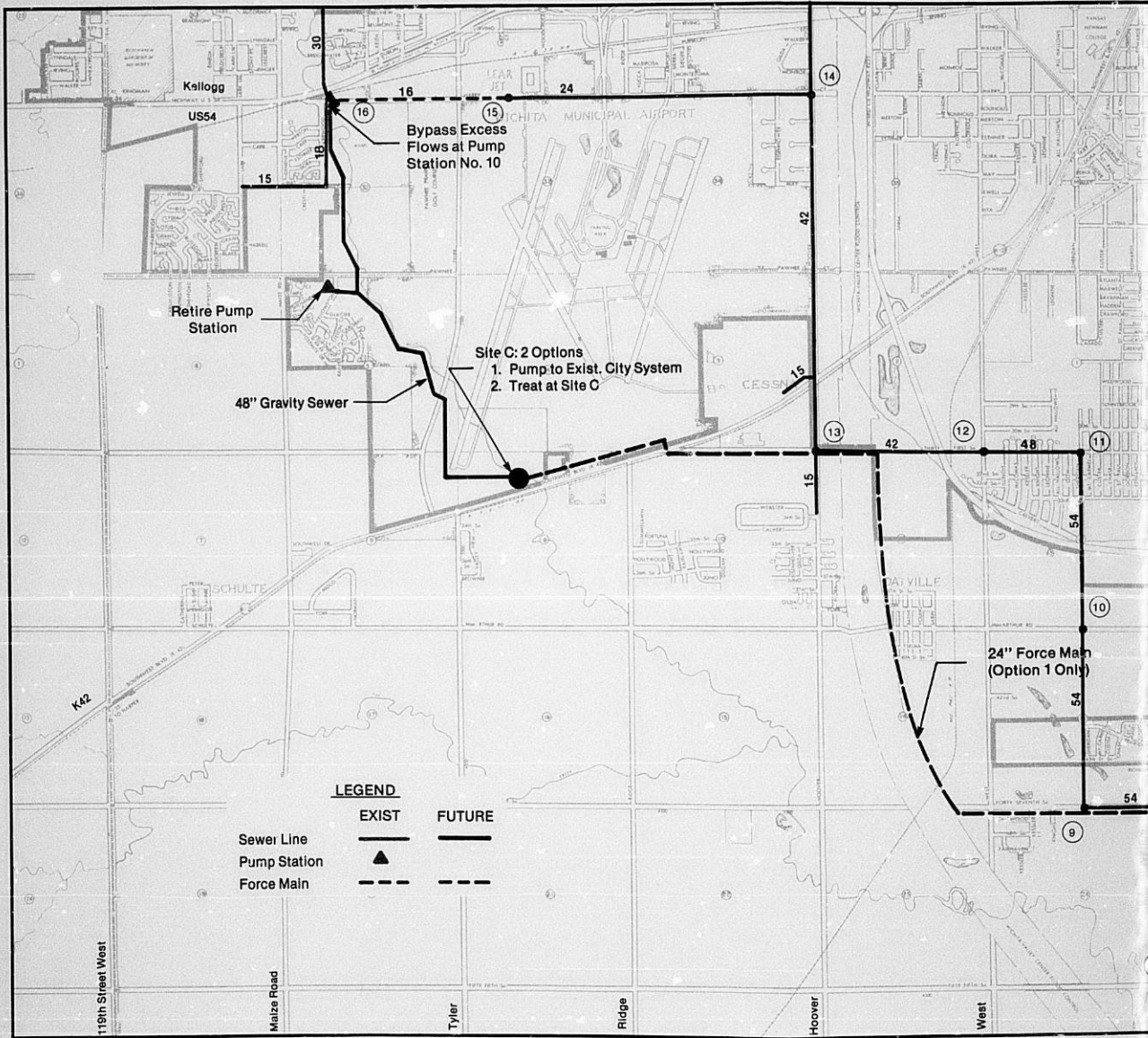
10

54

9

54

7



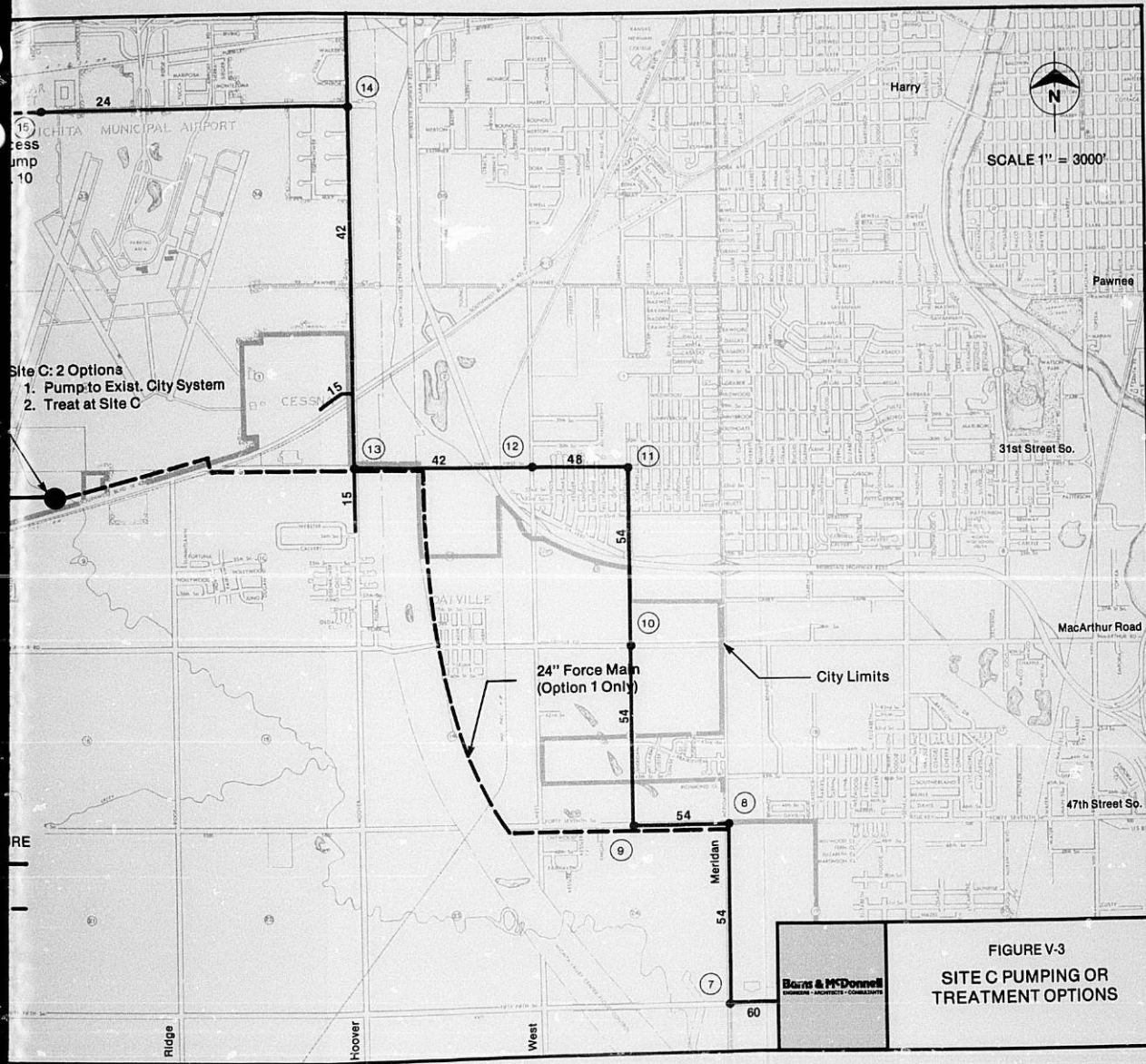


FIGURE V-3
 SITE C PUMPING OR
 TREATMENT OPTIONS

Borns & McDonnell
 ENGINEERS - ARCHITECTS - CONSULTANTS

PART VI - PLAN SELECTION

PART VI
PLAN SELECTION

COST-EFFECTIVE ANALYSIS

Interceptor Sewer (Alt. A1 and A2)

1. Discussion

Based on the discussion presented in Part V, an analysis was prepared to determine the cost of an interceptor sewer extension from the existing city system to Pump Station No. 10. The alignment to be along Cowskin Creek.

The size of the interceptor sewer was based on two different criteria. First, the size was based on transporting year 2010 flows to the city (Alt. A1). An analysis of the sewer size necessary to transport year 2010 flows allows an actual cost comparison between other alternatives. Design criteria for the other alternatives was also based on year 2010 flows. Second, the size was based on transporting year 2030 flows to the city (Alt. A2). Normally, larger interceptor sewer lines are designed to transport flows which would be expected within the next 40 years or with smaller sewer lines, the ultimate development of a drainage basin.

The analysis assumed that Pump Station No. 10 would be retired within 20 years since this is the most likely event if a gravity sewer is available. It would not be desirable to continue operating the pump

station after a new gravity sewer is available nor to design an undersized sewer which required the pump station to continue to operate.

The Cowskin Interceptor Sewer follows the alignment shown on Figure V-1.

2. Design Criteria

a. Design Flows: As mentioned previously, the design is based on year 2010 and 2030 flows. Year 2010 peak wet weather flows are estimated to be 15.92 MGD (see Table IV-5) at point 16. Very little development is anticipated before year 2010 downstream of point 16 along the Cowskin Interceptor Sewer alignment. Therefore, this is the design flow utilized for the interceptor for the entire sewer route to the city.

Year 2030 flows are based on the following assumptions.

(1) That the residential population growth of the study area from 2010 to 2030 will be approximately 4 percent per year.

(2) Approximately 90 percent of the new residential population from 2010 to 2030 will locate in the service area of the proposed facilities.

(3) Commercial and industrial growth in the study area will be approximately 30 percent by acreage between 2010 and 2030. Ninety percent of the new commercial acreage and 100 percent of the new industrial acreage will be in the service area of the proposed facilities.

(4) Flow rates for each category will be approximately the same to 2030.

Year 2030 peak wet weather flows are therefore estimated to be:

<u>Location</u>	<u>Flow</u>
Point 16	18.61 MGD
Point C	21.31 MGD

b. Pipe Slope: The design average pipe slope is based on the following:

(1) Length of Sewer: 44,000 ft.

(2) Invert of 30-inch line at Point 16 = 106.34 ft.

Invert of 60-inch at Point 7 = 70.35 ft.

Allowable drop for inverted siphon = 3.0 ft.

(3) Assume one manhole each 500 feet.

(4) Assume 0.1-foot drop through each manhole.

$$(5) \text{ Average slope} = \frac{[(106.34-70.35) - (44,000/500) (0.1)-3.0]}{44,000}$$
$$= 0.00055 \text{ ft/ft or } 0.055\%$$

c. Gravity Pipe Size: The required minimum pipe size based on Manning's $n = 0.013$, the design flows and slope, with a pipe flowing 3/4 full is as follow:

<u>Location</u>	<u>Year 2010</u>	<u>Year 2030</u>
7-16	48 inch	--
7-C	--	54-inch
C-16	--	48-inch

d. Inverted Siphon

(1) General: After consideration of the advantages and disadvantages of a pump station or inverted siphon it was decided that an inverted siphon would be required where the interceptor sewer crosses the Wichita-Valley Center Floodway. The inverted siphon design is based on using multiple barrels of different sizes to help ensure that flow in the siphon does not fall below 3 fps. This minimum velocity helps prevent solids deposition.

For the purposes of preliminary cost analysis the inverted siphon piping sizes were determined from the peak capacity of the upstream sewer line sized for year 2030 flows.

A three-barrel inverted siphon was selected because of the great range of flows. The smaller pipe was sized to convey the existing average flow. The smaller pipe and the next largest pipe was sized to convey the year 2010 peak daily flows. All three pipes were sized to convey the flow from the upstream sewer line assuming it was flowing full.

(2) Design Criteria:

- Design Flows:
 - Existing Average at Point 16 = 1.82 MGD
 - Year 2010 Peak Daily at Point 16 = 10.17 MGD
 - Capacity of 54-inch @ 0.055 % = 30 MGD
- Minimum desired velocity in siphon = 3.0 fps
- Inverted siphon length = 1500 ft
- Available drop for siphon = 3.0 ft
 - Less loss at inlet = 0.4
 - Available head loss for friction = 2.6 ft
- Approximate hydraulic gradient = 2.6 ft/1500 ft
 - = 0.0017 ft/ft or 0.17%
- Mannings n = 0.015
- Pipe sizes required: 18-inch
30-inch
42-inch

3. Cost Estimate

- a. General: All cost estimates are based on the January 1984 Engineering News Record Construction Cost index for the Kansas City area. The index used was 4195.0.

Pipe costs were based on installing Class III reinforced concrete pipe with a "T-Lock Liner" for crown corrosion protection. Included in the pipe installation is: excavation, granular bedding, backfill, testing, and seeding.

Road and railroad crossings were assumed to be 100 feet in length. Installation cost includes the excavation, boring and jacking of the casing and carrier pipe. The 48-inch sewer requires a 66-inch casing and the 54-inch sewer requires a 72-inch casing.

The stream crossings were assumed to be 80 feet in length. Installation cost includes a temporary dam (extensive stream diversion assumed not required), excavation, concrete encasement, backfill, and seeding.

Administration/legal, construction inspection, A/E design cost and contingencies were determined from percentages of the estimated construction cost. The percentages used were: 2 percent, 4 percent, 7 percent and 10 percent, respectively.

Interest during construction was projected for a 2-year construction time at a rate of 8 percent per year.

b. Year 2010 Flows (Alt. A1 - 48-inch Pipe):

<u>Item</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Extension</u>
48-inch Reinforced Concrete Pipe	40,900 lf	\$ 205	\$ 8,385,000
Road/Railroad Crossing			
(16 ea x 100 lf)	1,600 lf	524	838,000
Stream Crossings (19 ea x 80 lf)	1,520 lf	268	407,000
Manholes	89 ea	2,500	223,000
Inverted Siphon:			
Inlet and Outlet Structures	LS		101,000
Pipe (1,500 lf of 18", 30", 42")	LS		955,000
Total Construction Cost			\$10,909,000
Easement	52 AC	4,000	208,000
Administration/Legal	1	LS	218,000
Construction Inspection	1	LS	436,000
A/E Design Cost	1	LS	764,000
Interest During Construction	1	LS	873,000
Contingencies	1	LS	1,091,000
Total Other Costs			\$ 3,590,000
Total Project Cost			\$14,499,000

c. Year 2030 Flows (Alt. A2 - 48-inch and 54-inch Pipe):

<u>Item</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Extension</u>
<u>16-C</u>			
48-inch Reinforced Concrete Pipe	15,400 lf	\$ 205	\$ 3,157,000
Road/Railroad Crossing (7 ea x 100 lf)	700 lf	524	367,000
Stream Crossings (7 ea x 80 lf)	560 lf	268	150,000
Manholes	34 ea	2,500	85,000
<u>C-7</u>			
54-inch Reinforced Concrete Pipe	25,500 lf	243	\$ 6,197,000
Road/Railroad Crossing (9 ea x 100 lf)	900 lf	590	531,000
Stream Crossings (12 ea x 80 lf)	960 lf	305	293,000
Manholes	55 ea	2,500	138,000
Inverted Siphon:			
Inlet and Outlet Structures	LS		101,000
Pipe (1,500 lf of 18", 30", 42")	LS		955,000
Total Construction Cost			\$11,974,000
Easement	52 AC	4,000	208,000
Administration/Legal	1	LS	239,000
Construction Inspection	1	LS	478,000
A/E Design Cost	1	LS	838,000
Interest During Construction	1	LS	958,000
Contingencies	1	LS	1,197,000
Total Other Costs			\$ 3,918,000
Total Project Cost			\$15,892,000

Pump Station Force Main (Alt. B1 and C1)

1. Discussion

After careful analysis of all feasible alternative pumping schemes, force main alignments, etc., it was determined that the two best sites for a pump station would be at either Site B or C (Alt. B1 and C1, respectively). Site A was rejected because gravity sewer service for the area west of the airport would not be feasible. Locating a pump station downstream of Site C was rejected because it would provide the

potential for growth south of the airport. This was mentioned as undesirable land use planning in the ANCLUC Report. Also, as a pump station site is moved closer to the city system, it would less likely be an economical benefit to pump to the city rather than provide gravity sewer service.

As mentioned in Part V, several force main alignments were investigated. The alignment recommended is east along K-42 and 31st Street South until the force main reaches the east bank of the floodway. There it follows the floodway to 47th Street South and then east to Meridian (Point 8). This alignment was chosen because it would be less likely that any future development south of the airport would have the opportunity to tap into the force main. Although slightly more costly than an alignment following Cowskin Creek, the recommended route should have a more beneficial impact on land use control south of the airport.

The size of the pump station was based on keeping Pump Station No. 10 in service. Without expansion it is expected that the pump station will be able to pump almost all of the year 2010 dry weather flows. This offers the advantage of reducing pumping costs because of the lower head requirements, maintaining minimum flows in the 24-inch line along Harry Street and making use of all of the available existing system. The new pump station would then convey a minimal amount of dry weather flow and essentially all of the excess wet weather flow.

To convey wet weather and some dry weather flows to either Sites B or C, a new interceptor would be constructed from Pump Station No. 10. A diversion structure would also be constructed at Pump Station No. 10. The purpose of this structure would be to normally divert dry weather flows to the Pump Station No. 10 for pumping to the Southwest Interceptor Sewer. As the capacity of No. 10 is reached, flows would be automatically diverted to the new interceptor sewer for pumping to the city from either Site B or C. Flexibility would be built into the system so that all or a portion of the flows could be diverted to the new pump station if required. This would be desirable during a power outage, operation and maintenance problems at No. 10, or a problem in the sewer system downstream of No. 10. Also, No. 10 could act as a backup to the new pump station although to a more limited degree because of the smaller pumping capacity.

2. Design Criteria

a. Design Flow (Site B or C):

Peak Wet Weather flow at 16	= 15.92 MGD
Less Pump Station No. 10 Capacity	<u>-5.20</u>
	10.72 MGD
	or 7400 gpm

b. Force Main:

(1) Size:

- Minimum velocity > 2.5 fps
 - Maximum velocity < 6 fps
 - Use 24-inch-diameter force main
- V = 5.29 fps

- (2) Material:
 - Ductile Iron - Class 52
 - Polylined
 - Granular Bedding

c. Pump Station (Site B or C):

- (1) Trash Rack - automatic cleaning
 - 3-inch bar spacing
- (2) Firm Pumping Capacity - 10.72 MGD
(7400 gpm)
- (3) Pumps - Four horizontal nonclog centrifugal
3500 gpm each
- (4) Motor Drives - Two constant speed, direct drive
 - Two variable speed, direct drive
- (5) Motor Size - 150 hp each - Site B
 - 100 hp each - Site C
- (6) Building - Substructure: (dry and wet well)
45 ft x 30 ft x 28 ft deep,
cast-in-place concrete

Superstructure:
26 ft x 30 ft x 20 ft high,
concrete masonry
- (7) Standby Power - Site B: 500 kW
Site C: 250 kW

3. Cost Estimate

- a. General: Cost estimates for the pump station/force main alternative include a 48-inch interceptor sewer from Pump Station No. 10 to Site B or C. Unit costs for this sewer line are the same as shown for Alternative A1.

Power costs for the pump station and treatment plant alternatives are based on anticipated rate increases by KG&E as shown in Table

A-1 in the Appendix. KG&E projects rate increases for the next five years as follows:

1985	39.5%
1986	10.2
1987	8.9
1988	7.7
1989	8.4

For the remaining 20 year period, rates are assumed to increase at a rate of 5.0 percent per year.

Personnel, equipment and material costs were based on EPA surveys conducted nationwide and published in "Analyses of Operations and Maintenance Costs for Municipal Wastewater Treatment Systems, 1978." The following percentages of total O&M costs for pump stations were used for each O&M component.

Power	36%
Personnel	49
Equipment	13
Materials	2
Total	100%

To determine present worth costs for O&M components, with the exception of power costs, an annual inflation rate of 5.0 percent was assumed. The annual interest rate was set at 7.5 percent. For a 20 year period the present worth factor is 14.666.

Pump station costs were based on Computer Assisted Procedure for the Design and Evaluation of Wastewater Treatment Systems (CAPDET)

computer program developed for EPA and Corps of Engineers. A comparison and refinement of output costs was made with actual data from recent pump station bids.

b. Pump Station at Site B (Alt. B1)

<u>Item</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Extension</u>
48-inch Reinforced Concrete Pipe	9,300 lf	\$ 205	\$ 1,907,000
Road/Railroad Crossing (3 ea x 100 lf)	300 lf	524	157,000
Stream Crossings (6 ea x 80 lf)	480 lf	268	129,000
Manholes (1 ea x 80 lf)	21 ea	2,500	53,000
7,400 gpm Pump Station	1	LS	1,011,000
24-inch Force Main	33,500 lf	113	\$ 3,786,000
Road/Railroad Crossing (6 ea x 100 lf)	600 lf	207	124,000
Stream Crossings (1 ea x 80 lf)	80 lf	140	11,000
Total Construction Cost			\$ 7,178,000
Easement	48 AC	4,000	192,000
Administration/Legal	1	LS	145,000
Construction Admin. & Inspection	1	LS	287,000
A/E Design Cost	1	LS	502,000
Interest During Construction	1	LS	574,000
Contingencies	1	LS	718,000
Total Other Costs			\$ 2,416,000

<u>O&M Component</u>	<u>1984 Cost</u>	<u>Present Worth Cost</u>
Power	\$21,600	\$ 411,000
Personnel	29,700	436,000
Equipment	7,900	116,000
Materials	1,200	18,000
Total O&M Cost	\$60,400	\$ 981,000
Total Present Worth Cost		\$10,575,000

c. Pump Station at Site C (Alt. C1)

<u>Item</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Extension</u>
48-inch Reinforced Concrete Pipe	14,500 lf	\$ 205	\$ 2,973,000
Road/Railroad Crossing (4 ea x 100 lf)	400 lf	524	210,000
Stream Crossings (6 ea x 80 lf)	480 lf	268	129,000
Manholes	31	2,500	78,000
7,400 gpm Pump Station	1	LS	885,000
24-inch Force Main	28,300 lf	113	\$ 3,198,000
Road/Railroad Crossing (5 ea x 100 lf)	500 lf	207	104,000
Stream Crossings (1 ea x 80 lf)	80 lf	140	11,000
<u>Total Construction Cost</u>			<u>\$ 7,588,000</u>
Easement	47 AC	4,000	188,000
Administration/Legal	1	LS	152,000
Construction Admin. & Inspection	1	LS	304,000
A/E Design Cost	1	LS	531,000
Interest During Construction	1	LS	607,000
Contingencies	1	LS	759,000
<u>Total Other Costs</u>			<u>\$ 2,541,000</u>

<u>O&M Component</u>	<u>1984 Cost</u>	<u>Present Worth Cost</u>
Power	\$14,400	\$ 275,000
Personnel	20,000	293,000
Equipment	5,300	78,000
Materials	800	12,000
<u>Total O&M Cost</u>	<u>\$40,500</u>	<u>\$ 658,000</u>
<u>Total Present Worth Cost</u>		<u>\$10,787,000</u>

Treatment Plant (Alt. B2, B3, C2, C3)

1. Discussion

After analysis of feasible treatment options, it was determined that the most economical and environmentally acceptable treatment scheme would be either the aerated lagoon (Alt. B2 and C2), or the oxidation ditch (Alt. B3 and C3). The treatment plant would be either at Site B or C.

The treatment plant alternatives would consist of the same scheme as the pump station alternatives (B1 and C1), with the exception that wastewater would be treated and discharged to Cowskin Creek instead of pumped to the city system for treatment.

2. Design Criteria (Site B or C)

a. Design Flow

Peak Wet Weather Flow = 10.72 MGD
or 7400 gpm
Average Dry Weather Flow (ADWF) = 0.25 MGD
Expandable to = 0.50 MGD

b. Pump Station: Similar to pump station alternatives except:

- (1) Motor Size - 50 hp
- (2) Standby Power - 230 kW

c. Aerated Lagoon

- (1) 3-Cell

- (2) Detention time at ADWF (oversized to accommodate peak flow storage)

#1 - 11 days
#2 - 9 days
#3 - 5 days

- (3) Depth - 10 feet water depth with 2 feet freeboard.

(4) Dikes - 3:1 with 10 feet wide top.

(5) Aeration

- 3 blowers (1 standby)
- 75 hp each
- 1250 scfm each

d. Oxidation Ditch

(1) Earthen Storage Basin (aerated)

- 10 feet water depth
- 2.08 MG capacity
- dikes 3:1, with 10 feet top
- 2 blowers (1 standby), 75 hp, 1250 scfm

(2) Oxidation Ditch

- 24 hours aeration time
- 12 feet water depth
- Sloping side walls with vertical center wall
- 2 - 42-inch diameter brush aerators, 20 hp each

(3) Clarifier

- Surface overflow rate: 600 gpd/ft²
- 12 feet water depth
- Weir overflow rate: 10,000 gpd/ft

(4) Return Sludge Pumping

- 2 pumps (1 standby) 280 gpm each
- 10 hp, each

3. Cost Estimate

- a. General: Cost estimates for the treatment plant alternatives include a 48-inch interceptor sewer from Pump Station No. 10 to Site

B or C. Unit costs for this sewer line are the same as shown for Alternative A1.

Power costs for the treatment plant reflect the anticipated rate increases by KG&E as shown in Table A-1 in the Appendix and 5 percent inflation as discussed previously.

Personnel, equipment and material costs were based on similar assumptions as discussed in the pump station alternative section. The following percentages of total O&M costs for an aerated lagoon and oxidation ditch were used for each O&M component.

	<u>Aerated Lagoon</u>	<u>Oxidation Ditch</u>
Power	29%	25%
Personnel	54	61
Equipment	10	8
Materials	4	4
Chemicals	3	2
Total	100%	100%

The present worth of O&M was based on previously discussed inflation and interest rate percentages.

Treatment plant costs were estimated by using the CAPDET program and in-house estimating procedures.

For the oxidation ditch alternative, it was assumed that waste sludge would be transported to Treatment Plant No. 2 for dewatering.

The cost of hauling sludge is reflected in the cost of the truck and labor cost.

Standby power is included in the cost of the pump station.

b. Aerated Lagoon at Site B and C (Alt. B2 and C2)

Item	Cost Estimate	
	B2	C2
48-inch Reinforced Concrete Pipe (Same as Alt. B1 or C1)	\$2,246,000	\$3,390,000
7,400 gpm Pump Station	810,000	810,000
Screening	34,000	34,000
Aerated Lagoon:		
Earthwork, sterilization, fencing	234,000	234,000
Transfer structures	61,000	61,000
Blowers (includes building)	196,000	196,000
Air Piping and diffusers	122,000	122,000
Liner	70,000	70,000
Sand Filtration (includes building)	237,000	237,000
Chlorination	67,000	67,000
Total Construction Cost	<u>\$4,077,000</u>	<u>\$5,221,000</u>
Land and Easement (26 ac or 27 ac)	104,000	108,000
Administration/Legal	82,000	104,000
Construction Admin. & Inspection	163,000	209,000
A/E Design Cost	285,000	365,000
Interest During Construction	326,000	418,000
Contingencies	408,000	522,000
Total Other Cost	<u>\$1,368,000</u>	<u>\$1,726,000</u>

O&M Component	1984 Cost	Present Worth Cost
Power	\$ 38,600	\$ 735,000
Personnel	72,900	1,069,000
Equipment	13,500	199,000
Materials	5,400	79,000
Chemicals	4,000	59,000
Total O&M Cost	<u>\$134,400</u>	<u>\$2,141,000</u>
Total Present Worth Cost: B2		\$7,586,000
Total Present Worth Cost: C2		\$9,088,000

c. Oxidation Ditch at Site B and C (Alt. B3 and C3)

<u>Item</u>	<u>Cost Estimate</u>	
	<u>B3</u>	<u>C3</u>
48-inch Reinforced Concrete Pipe (Same as Alt. B1 or C1)	\$2,246,000	\$3,390,000
7400 gpm Pump Station	810,000	810,000
Screening	34,000	34,000
Peak Flow Storage Basin	242,000	242,000
Blowers, Air Piping, Building	210,000	210,000
Oxidation Ditch	140,000	140,000
Final Clarifier	91,000	91,000
Recycle Pumping	97,000	97,000
Yard Piping	78,000	78,000
Sludge Truck	70,000	70,000
Sand Filtration	237,000	237,000
Chlorination	67,000	67,000
Total Construction Cost	\$4,322,000	\$5,466,000
Land and Easement (18 ac)	72,000	72,000
Administration/Legal	86,000	109,000
Construction Admin. & Inspection	173,000	219,000
A/E Design Cost	303,000	383,000
Interest During Construction	346,000	437,000
Contingencies	432,000	547,000
Total Other Cost	\$1,412,000	\$1,767,000

<u>O&M Component</u>	<u>1984 Cost</u>	<u>Present Worth Cost</u>
Power	\$ 79,700	\$1,518,000
Personnel	194,500	2,853,000
Equipment	25,500	374,000
Materials	12,000	188,000
Chemicals	4,000	59,000
Total O&M Cost	\$316,500	\$4,992,000
Total Present Worth Cost: B3		\$10,726,000
Total Present Worth Cost: C3		\$12,225,000

COST SUMMARY

Table VI-1 presents a summary of alternative costs. Alternatives A1 and A2 are interceptor sewer options. B1 and C1 are pump station/force main options. B2 and C2 are aerated lagoon options and B3 and C3 are oxidation ditch options.

Alternative B2 (aerated lagoon at Site B) is the least cost option by present worth while A2 (48-inch and 54-inch interceptor) sewer is the most costly. Figure VI-1 shows a schematic layout of the aerated lagoon at Site B.

RECOMMENDED PLAN

Discussion

A recommended plan of action for the study area which would be totally acceptable to all concerned with this project is difficult if not impossible. The city must weigh the advantages and disadvantages of each option before implementation of improvements.

From a cost-effective view point, the aerated lagoon at Site B (Alt. B2) is the most economical. As noted before, the Kansas Department of Health and Environment (KDHE) is concerned with construction of a satellite plant which is near the city sewer system. It is not clear whether KDHE would indeed approve the construction of the plant. Even if approved, effluent quality and plant reliability would be stringently imposed. Another consideration with construction of a lagoon type treatment facility would be the attraction of water fowl near the airport runway. Federal restrictions may rule out the possibility of a lagoon because of the danger the waterfowl may have to low flying aircraft.

Construction of a pump station at Site B (Alt. B1) would provide for the maximum beneficial use of a sewer system for existing and developing areas west of the airport while minimizing the availability of sewers to areas south of the airport. The pump station/force main alternative discharging to the city sewer

system would also conform with the KDHE regionalization philosophy. The Site B pump station location is the least expensive alternative, except for the aerated lagoon.

Construction of the Cowskin Creek Interceptor Sewer (Alt. A2) represents a present worth expenditure of \$5,317,000 (50 percent) more than the cost of constructing and operating a pump station at Site B. This margin of difference indicates that the Cowskin Creek Interceptor Sewer is not economically feasible to construct to the city system at this time. However, the interceptor sewer is still the recommended ultimate means of serving the study area.

Cowskin Creek Recommendation

It is recommended that the city construct a new pump station at Site B, sized for 7,400 gpm. This pump station would operate primarily as a peak flow pump station, providing backup to existing pump Station No. 10. A portion of the Cowskin Creek Interceptor Sewer (48-inch) should be constructed from Site B to Pump Station No. 10. Pump Station No. 10 should continue in service until at least year 2010. A 24-inch force main should be constructed from Site B to the city system, discharging to the Southwest Interceptor Sewer at 47th Street South and Meridian. Refer to Figure V-3 for a schematic layout of these recommendations. Table VI-2 presents the recommended capital and operating costs.

OTHER SEWER SYSTEM IMPROVEMENTS

In addition to the study of the Cowskin Creek Interceptor Sewer feasibility, several sewer system improvements upstream of Pump Station No. 10 will be

required to transport peak flows and to provide sewer service for existing and projected developing areas. Figure VI-2 shows the location of the recommended improvements. Unit costs were developed from EPA publications and recent bidding experience. Nonconstruction items such as engineering, construction administration, etc. were assumed to be the same percentage of construction cost used previously.

Table VI-3 presents the sizing criteria for these sewers. While Table VI-4 is a summary of the estimated costs of these sewer lines. Costs include such nonconstruction items as land acquisition, inspection, interest during construction, engineering and contingencies.

* * * * *

Table VI-1
SUMMARY OF ALTERNATIVE COSTS
(x\$1000)

	ALTERNATIVES							
	A1	A2	B1	B2	B3	C1	C2	C3
Gravity Sewer	\$10,909	\$11,974	\$2,246	\$2,246	\$2,246	\$3,390	\$3,390	\$3,390
Pump Station			1,011	810	810	885	810	810
Force Main			3,921			3,313		
Treatment Plant				1,021	1,266		1,021	1,266
Total Construction Cost	\$10,909	\$11,974	\$7,178	\$4,077	\$4,322	\$7,588	\$5,221	\$5,466
Other Cost	3,590	3,918	2,416	1,368	1,412	2,541	1,726	1,767
Operation and Maintenance			981	2,141	4,992	658	2,141	4,992
Total Present Worth	\$14,499	\$15,892	\$10,575	\$7,586	\$10,726	\$10,787	\$9,088	\$12,225

A1: Interceptor Sewer - 48-inch pipe.

A2: Interceptor Sewer - 48-inch pipe and 54-inch pipe.

B1: Pump Station at Site B and force main to Southwest Interceptor Sewer.

B2: Aerated lagoon type treatment plant at Site B.

B3: Oxidation ditch type treatment plant at Site B.

C1: Pump Station at Site C and force main to Southwest Interceptor Sewer.

C2: Aerated lagoon type treatment plant at Site C.

C3: Oxidation ditch type treatment plant at Site C.

Table VI-2
COST OF COWSKIN CREEK RECOMMENDATIONS

<u>Item</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Extension</u>
48-inch Reinforced Concrete Pipe Road/Railroad Crossing (3 ea x 100 lf)	9,300 lf	\$ 205	\$1,907,000
Stream Crossings (6 ea x 80 lf)	300 lf	524	157,000
Manholes	480 lf	268	129,000
	21 ea	2,500	53,000
7,400 gpm Pump Station	1	LS	1,011,000
24-inch Force Main Road/Railroad Crossing (6 ea x 100 lf)	33,500 lf	113	3,786,000
Stream Crossings (1 ea x 80 lf)	600 lf	207	124,000
	80 lf	140	<u>11,000</u>
Total Construction Cost			\$7,178,000
Easement	48 AC	4,000	192,000
Administration/Legal	1	LS	143,000
Construction Admin. & Inspection	1	LS	287,000
A/E Design Cost	1	LS	502,000
Interest During Construction	1	LS	574,000
Contingencies	1	LS	<u>718,000</u>
Total Other Costs			\$2,416,000

<u>O&M Component</u>	<u>1984 Cost</u>	<u>Present Worth Cost</u>
Power	\$21,600	\$ 411,000
Personnel	29,700	436,000
Equipment	7,900	116,000
Materials	<u>1,200</u>	<u>18,000</u>
Total O&M Cost	\$60,400	\$ 981,000
Total Present Worth Cost		\$10,575,000

WICH4.CC

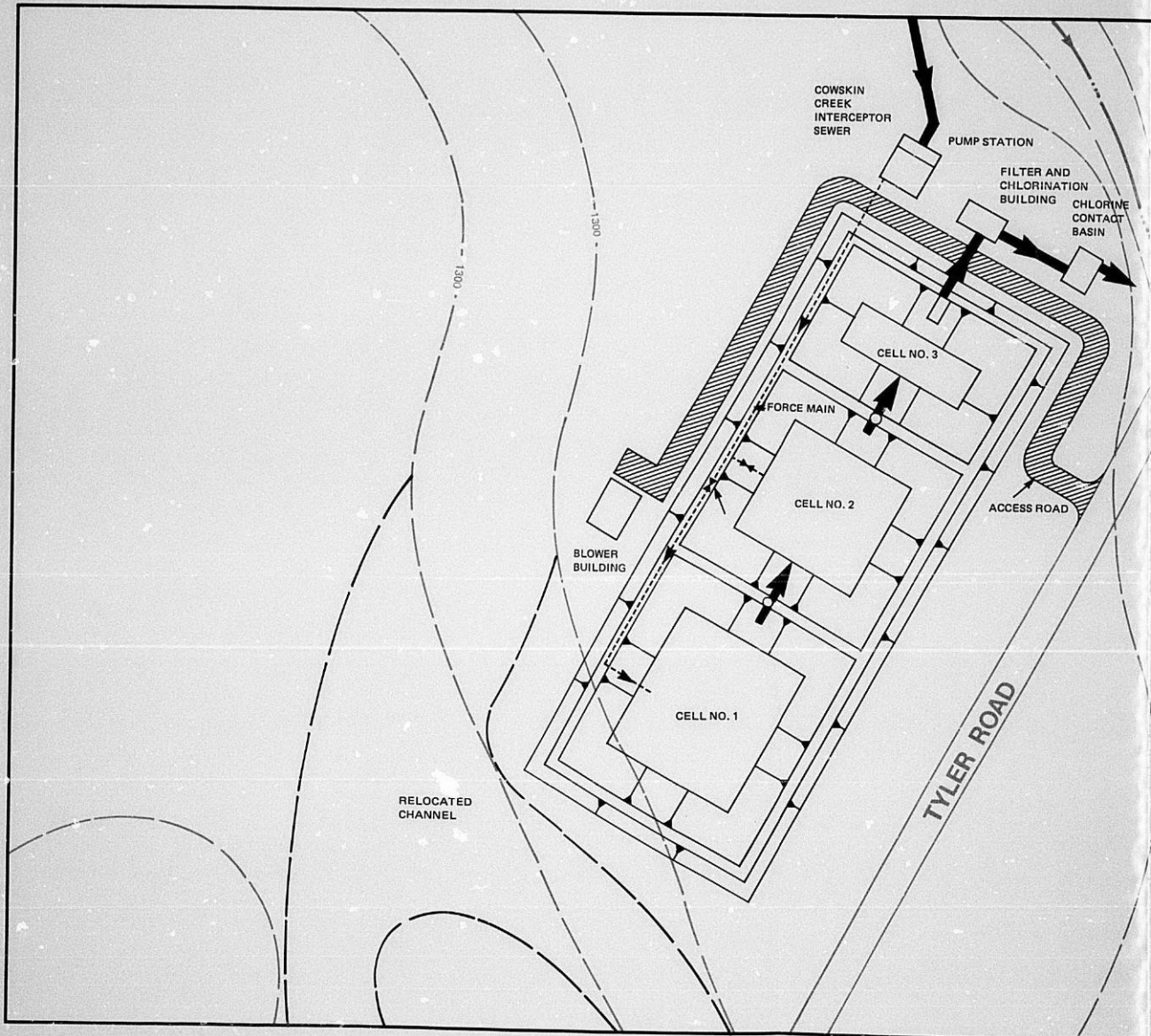
**Table VI-3
PEAK FLOWS AND SIZING
FOR DEVELOPING AREAS**

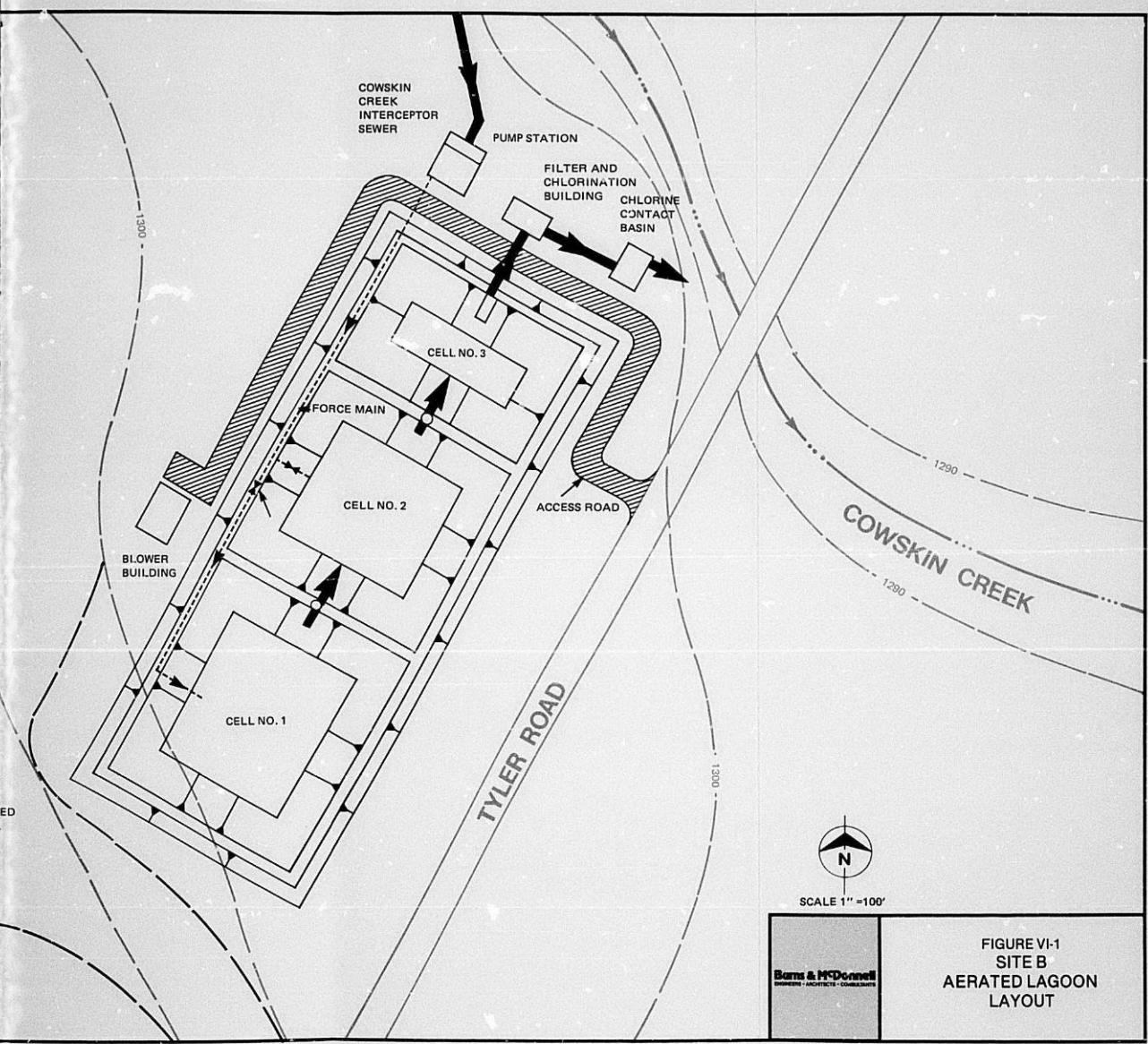
<u>Line</u>	<u>Year 2000</u>	<u>Year 2020</u>	<u>Slope</u>	<u>Pipe Size</u>	<u>Capacity at $\frac{3}{4}$ or $\frac{1}{4}$ Full</u>
A	4.57 MGD	6.09 MGD	0.045%	36"	8.5 MGD at $\frac{3}{4}$
B	2.36	2.44	0.092	21	2.9 at $\frac{3}{4}$
C	0.92	1.86	0.092	21	2.9 at $\frac{3}{4}$
D	*	*	0.114	18	1.8 at $\frac{2}{3}$
E	*	*	0.145	15	1.3 at $\frac{2}{3}$
F	0.65	1.51	0.114	18	1.8 at $\frac{2}{3}$

* Actual flows not broken down upstream of Line C.

**Table VI-4
COST OF SEWERS
FOR DEVELOPING AREAS**

<u>Line</u>	<u>Size</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Extension</u>
A	36-inch	3,400 lf	\$132	\$ 449,000
B	21	2,800	70	196,000
C	21	6,800	70	476,000
D	18	3,500	61	214,000
E	15	3,000	50	150,000
F	18	4,200	61	256,000
Total Construction Cost				\$1,741,000
Easement		16 AC	\$4,000	\$ 64,000
Administration/Legal		1	LS	35,000
Construction Admin. & Inspection		1	LS	67,000
A/E Design Cost		1	LS	122,000
Interest During Construction		1	LS	70,000
Contingencies		1	LS	174,000
Total Other Costs				\$ 532,000
Total Project Cost				\$2,273,000






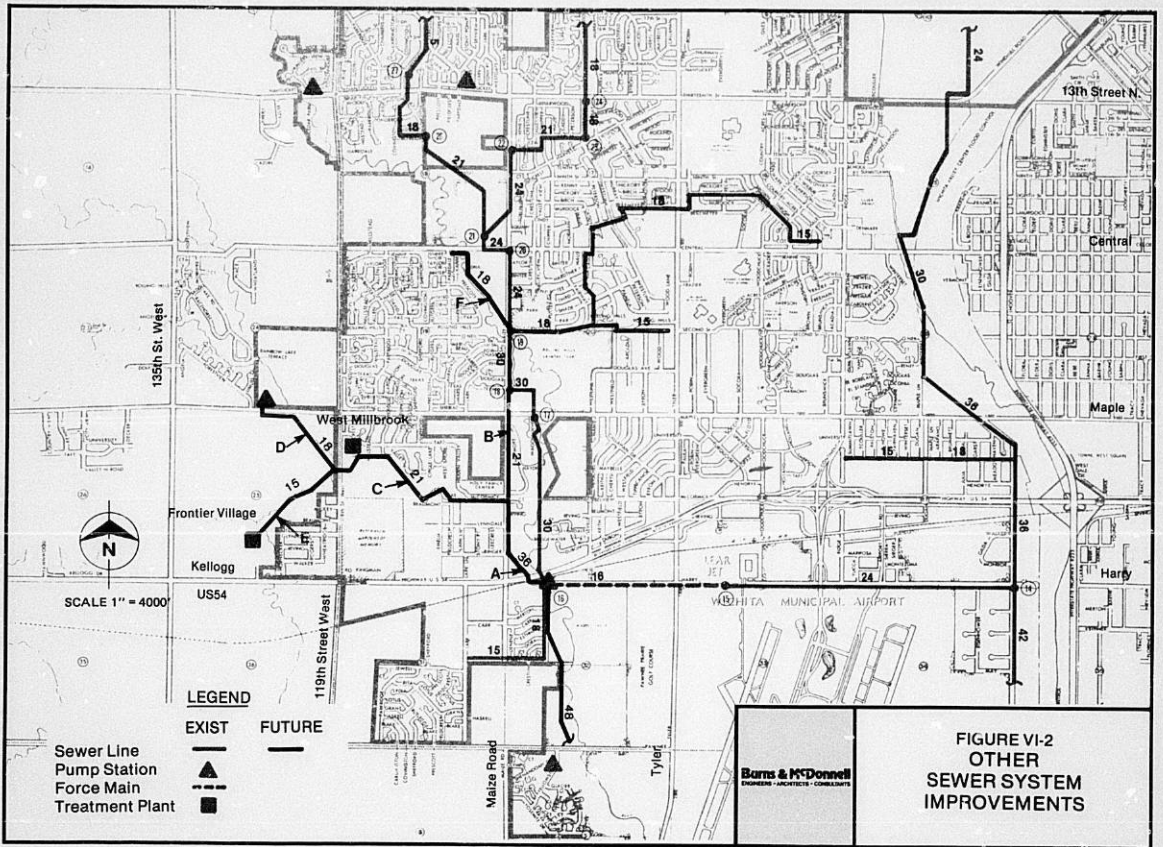

 SCALE 1" = 100'



FIGURE VI-1
 SITE B
 AERATED LAGOON
 LAYOUT



PART VII – FINANCING AND
IMPLEMENTATION

PART VII
FINANCING AND IMPLEMENTATION

PROJECT FINANCING

In view of recent plans by federal and state agencies to reduce expenses, arranging financing for the recommendations in this report will require exploring all available options. Even though it is expected that funding levels will be reduced, various grants and loans from federal and state agencies for wastewater projects will continue to be awarded. It should be pointed out that certain sources of funds can only be used for specified projects. For example, grants from the U.S. Environmental Protection Agency can be used to construct interceptor sewers and treatment plants, but not collection systems (unless the collection system is considered to be "innovative" or "alternative" technology). Other restrictions apply to different funding sources.

In addition to outside sources of funds, local financing for part or all of certain proposals will be necessary, therefore, consideration should be given to various options for local financing.

The following is an explanation of various existing federal and state funding programs for wastewater facilities, as well as options for local funding.

U. S. Environmental Protection Agency

Over the last ten years, the U.S. Environmental Protection Agency (EPA) has administered an extensive construction grants program for wastewater facilities. Currently, grants are available amounting to 55 percent of eligible project costs. If a project qualifies as innovative or alternative technology under EPA's criteria, the level of funding is increased to 75 percent. In general, these funds are available for interceptors and treatment facilities, although collection systems can be funded also if they utilize innovative or alternative technology. Interceptor sewers, pump stations and treatment facilities serving future growth generally receive lower priority.

Urban Development Action Grants (UDAG)

This federal funding mechanism is targeted to create jobs and expand the local tax base by supplementing the investment of private dollars with public sector investment. The regulations require the investment of three private dollars for every federal dollar. Realistically, at least six private dollars must be invested for each federal dollar if the City is to be successful in obtaining a UDAG grant. Due to the nature of the funding, a sizable commercial or industrial project is required to be successful in obtaining funds.

Federal Interest-Free Loan

Pending before Congress is the National Infrastructure Act (H.R. 5949). This act would authorize a fund of \$3 billion dollars per annum for 10 years to provide interest-free loans to states and local governments. The loans would be repaid over a 20-year period to a sinking fund in the Department of the Treasury. Action on this bill is expected in early 1985. For Wichita this

means paying the full cost for a 100 percent loan but it would be interest free. It's possible the final form of the bill may require some kind of local funds downpayment.

Community Development Block Grants

Community Development Block Grants utilize funds received from the Department of Housing and Urban Development and are targeted for communities or parts of communities with low average per capita income and for communities within a designated Community Development group area. Each year, requests for funds are reviewed for specific projects. Available funds are distributed according to criteria administered by the Community Development Department staff. Wastewater collection systems may be funded by block grants, however, interceptors and treatment facilities are ineligible for this funding. The current primary use of funds is for augmentation of other funding mechanisms such as benefit districts. A very rigorous review is conducted on proposed new sewer projects requesting a high percentage of Community Development Block Grant funding.

Local Funds

In most cases, at least a portion of the project costs must be financed through local funding sources. It may be desirable or necessary in some cases to finance the total cost of a project through local funding sources.

Certain alternatives are available for local funding of project costs. Most involve some mechanism to sell bonds for the purpose of obtaining the needed capital. Listed below are specific methods of local sewer financing.

1. General Improvement Bonds

Under the provisions of KSA (Kansas Statutes Annotated) 12-631b (Griffith Act), general improvement bonds may be sold to pay for the construction cost of another sewer in a watershed where the existing sewer is over 20 years old and found to be inadequate. The statute requires the construction of a new sewer to be less costly than other means of correcting the inadequacy. The city's governing body has the authority to determine if the cost shall be borne by the city at large or whether the cost should be assessed against the sewer district. General improvement bonds may be repaid through property taxes. The local practice in Wichita is for sewer fees to pay for the debt of sewer G.O. bonds.

2. Revenue Bonds

Another method of financing is the sale of revenue bonds which are retired from funds received from sewage service charges. Since revenue bonds are repaid from the sewer service charge, it may be difficult to increase the sewer service charge sufficiently to not only provide for the improvements recommended by this report but also to meet bond coverage requirements.

3. Benefit Districts

An improvement district (benefit district) can be initiated by property owner petition. Over 50 percent of the property owners within a proposed district must sign the petition. Any improvements made in such a district are assessed against the property owners. The city may pay

such portion of the cost of the improvement as the governing body may determine, but not more than 90 percent of the improvement cost.

Because it is usually more difficult to form benefit districts serving large areas, this financing method is unlikely to be used for interceptors and main sanitary sewers.

4. Privatization

The concept of privatization is based on public/private partnerships. Privatization allows the private sector to take advantage of investment tax credits, depreciation, other tax benefits, construction efficiencies and time savings when it undertakes construction projects. The public sector shares in these advantages by receiving a needed service at a lower cost. The economics of privatization, as measured by user fees, compare favorably to grant-funded approaches.

The key to privatization is that both sides gain, but neither benefits at the expense of the other. The private sector gets a business opportunity, enhanced by the use of tax benefits. The public sector gets a needed service at a lower cost than otherwise possible and, if desired, eventual ownership of the facility that provides the service. When private sector construction and operational savings are combined with available tax benefits, the lower project costs which result can be shared with the local community in the form of lower user fees, while providing a fair return on the investment to the private sector.

Privatization is a relatively new concept in the public utilities field. Cutbacks in federal grants and state support for capital intensive facilities projects are forcing public officials to take a closer look at creative and innovative financing approaches. Privatization is one alternative for providing cost effective services to the public, however, it is limited to only the treatment plant or pump station portions of the recommended improvements.

LOCAL SHARE FINANCING

With USEPA Funding of Capital Costs

Although current indications are that USEPA funding will not be available to Wichita for the recommended projects until 1989 or later, it is always possible that schedules and funding levels may change to the benefit of the city.

EPA funding after September 1984, will pay 55 percent of the eligible costs of the proposed project. The remaining costs will be paid by the City of Wichita, Kansas. Ineligible costs include easements, land acquisition, and certain legal and administrative costs associated with bond sales and grant administration. A portion of the design engineering costs will be recovered by the city if an EPA grant is approved for project construction. Although it is very doubtful that EPA funds will be available for the recommended improvements, an estimate of the federal and local shares is given in Table VII-1. Eligible costs are determined by the Kansas Department of Health and Environment, and it is possible some of the proposed improvements in

this Facility Plan, such as capacity for future growth, may be determined to be ineligible.

Table VII-1

ESTIMATE OF FEDERAL AND LOCAL COSTS*

Total Estimated Cost	\$9,594,000
Less Land Acquisition and Ineligible Legal, Engineering and Administrative Costs	884,000
Total Estimated Grant Eligible Cost	<u>\$8,710,000</u>
Less Federal Share at 55 Percent of Eligible Costs	<u>-4,791,000</u>
Total Local Share Cowskin Creek Recommendations Only	<u>\$3,919,000</u>

Under the Construction Grants Program, grants are awarded on the basis of the state priority ranking of a project and the availability of funds. The construction of improvements recommended in the Cowskin Creek Facility Plan have been given a priority rating of 18.00 for Federal Fiscal Year (FFY) 1985. This priority gives this project an expected date of application for federal funds of October 1989. Therefore it is unrealistic to expect EPA funding for the recommended improvements.

Without Outside Funding of Capital Costs

If funding from other alternative outside sources is not used, then the local capital costs are as shown in Table VII-2. The annual principal and interest payments are estimated to be based on a 20-year repayment schedule with a 7.5 percent annual interest rate.

Table VII-2

100 PERCENT LOCAL FINANCING

Total Estimated Cost	\$9,594,000
Annual Principal and Interest Payments	\$ 941,000

If all projects are implemented, the additional annual operation and maintenance costs (1984) amount to approximately \$60,400. This cost is normally included with the sewer service charge paid by all users connected to the sewer system and will increase with inflation.

PROJECT IMPLEMENTATION

General

Implementation of the selected plan will require a schedule of tasks and timing of events to facilitate planning, design, and land acquisition, right-of-ways, and financing. The overall recommendations of this report can be divided basically into two phases: (1) parallel interceptor and trunk sewer construction north of existing Pump Station No. 10 and, (2) interceptor construction south to Site B including the proposed pump station and force main work.

It is feasible to schedule the work on the phase north of U.S. 54 as a one contract project. This will facilitate preparation of final design in a single overall effort which can coordinate planning, hydraulic design criteria, location surveys, easement preparation and acquisition, contract document preparation, reviews, administration and financing. Line extensions to

Millbrook are in the city's current capital improvements program and will be compatible with this phasing schedule.

Work south of Pump Station No. 10 could be administered as one project but it is recommended that separate contracts be considered for the interceptor, pump station, and force main due to their different construction trade disciplines. Again, a single overall effort can coordinate this phases' planning, hydraulic design criteria, location surveys, site and easement preparation and acquisition, contract document preparation, reviews, administration and financing.

Priority for Implementation

Initial priority for work on the two basic phases of the project should be given to work north of Pump Station No. 10. Completion of the parallel interceptor and trunk sewers provides adequate capacity for present and projected development, eliminates one lift station, precludes the need for additional lift stations, eliminates two treatment facilities (one inactive) and allows connection of developed unsewered areas with on-site systems. Adequate initial capacity exists at Pump Station No. 10 for the additional flows anticipated at completion of this phase.

Project Scheduling

Application for project financing utilizing various grants and loans from federal or state agencies requires preparation of final plans and construction contract documents using local funding. Grants may be available to finance the design phase of wastewater facilities after completion and approval of design.

Authorization of the projects should be followed by engineer selection. Our estimate of the project's schedule following engineer selection is as follows:

1. Interceptor and Trunk Sewers North of U.S. 54:

a. Design Phase: 1 year

Includes preparation of final design criteria, route selection, surveys, ownership and easement description preparation, final design, construction contract preparation, construction cost estimate and reviews.

b. Financing Phase: 6 months to 1 year

Application for available grants and loans. Simultaneous acquisition of easements. Bid and award.

c. Construction Phase: 1 year

2. Interceptor South of U.S. 54, Pump Station and Force Main:

a. Design Phase: 1 year

Includes preparation of final design criteria, route and site selection, surveys, ownership and easement description preparation, construction cost estimates and reviews.

b. Financing Phase: 6 months to 1 year

Application for available grants and loans. Simultaneous acquisition of pump station site and easements. Bid and award.

c. Construction Phase: 2 years

* * * *

APPENDIX

30 file
83-05-11



State of Kansas . . . John Carlin, Governor

DEPARTMENT OF HEALTH AND ENVIRONMENT

Barbara J. Sabol, Secretary

Forbes Field
Topeka, Kansas 66620
913-862-9360



April 23, 1984

Mr. Barton L. Brandenburg, P.E.
Burns & McDonnell
4800 E. 63rd St.
P. O. Box 173
Kansas City, MO 64141

Re: Cowskin Creek Feasibility Report
Wichita, KS

Dear Bart:

In your March 16, 1984, letter you requested guidance from the Kansas Department of Health and Environment (KDHE) concerning wastewater handling options in the Cowskin Creek area. In particular, you requested information regarding effluent requirements and general design guidance.

As we have discussed earlier by phone, KDHE does not endorse a satellite treatment plant as being considered. Our policy is to encourage regionalization of collection and treatment systems whenever possible. In this particular case, regionalization is certainly a possibility and establishment of a satellite plant is discouraged.

Overall planning documents for the Wichita urban area do not address this issue. Without an overall county or urban area study or update, establishment of a satellite plant represents fragmented planning and development, contrary to our Department's, and likely contrary to the City and County's policies.

Our third concern addresses the proposed receiving stream, Cowskin Creek. This creek has a very low gradient with little aeration, is in an urban area, and therefore would demand stringent effluent limits. We have not modeled Cowskin Creek, but tentatively predict advanced waste treatment would be required. Effluent limits for BOD and TSS could be less than 15 mg/l, disinfection and complete nitrification would also be required. As previously discussed, any plant at this location would need to be highly reliable and redundant or backup units would be required, if a plant was even considered.



Mr. Bart Brandenburg
April 23, 1984
Page 2

In summary, KDHE's guidance is that connection to or expansion of the existing Wichita collection and treatment system be utilized to service the Cowskin Creek area.

Sincerely yours,

Division of Environment

Karl Muedener

Karl Muedener, P.E., Chief
Technical Services Section

jaw
cc: South Central District



KANSAS GAS AND ELECTRIC COMPANY

May 25, 1984

Mr. Barton L. Brandenburg
Burns & McDonnell
P. O. Box 173
Kansas City, MO 64141

Dear Mr. Brandenburg:

We can serve pump station B or pump station C with three phase 277/480 volt service from the 12-8 circuit out of Oatville Substation. No starters will be required, however, the starting of these motors will need to be sequenced so that no two motors 75 HP or larger can be started simultaneously.

We will require an "up and down" cost and a monthly minimum for either service. The up and down cost will not be billed to the city, but 10 percent of their monthly bill will be applied to the up and down cost. Should the city decide to cancel service before this "up and down" has been paid, we will bill them for the balance.

I have estimated the "up and down," the monthly minimum, and the demand for each location:

	<u>KW</u> <u>Demand</u>	<u>Kwh/Mo</u>	<u>Monthly</u> <u>Minimum</u>	<u>Up &</u> <u>Down</u>
Site C w/aerated lagoon	394	60,800	\$1,893	\$3,114
Site C w/oxidation ditch	461	131,800	\$2,337	\$3,114
Site B w/aerated lagoon	506	63,200	\$2,393	\$18,669
Site B w/oxidation ditch	574	134,200	\$3,216	\$18,669



Mr. Barton L. Brandenburg
May 25, 1984
Page Two

There will be some costs billed to the city for building underground to the site instead of overhead:

- Site C:
1. \$2.35 per foot of underground primary
 2. Customer will do all ditching and backfill
 3. Customer will provide the concrete pad for the transformer.
- Site B:
1. \$2.35 per foot of underground primary
 2. Customer will do all ditching and backfill
 3. Customer will provide the concrete pad for the transformer.
 4. Customer will pay for eight terminal cabinets at \$450 each.

All of the costs included in this letter are estimates. When we are provided with more descriptive site plans, we can give you some firm costs.

I have enclosed some information regarding future power cost that I hope will help you with your projections. If you have any questions, please call me at 1-316-261-6738 or call Bill Fey at 1-316-261-6737.

Sincerely,

Don Hill
Commercial/Industrial
Marketing Consultant

DH/cv

Enclosures

cc: David Bumstead

205
 WICHA1; 14-NOV-84; 14:03;

Table A-1
 POWER COSTS

	Site B Pump Station	Site C Pump Station	Aerated Lagoon	Oxidation Ditch	
Total Running Horsepower	450	300	225	315	
Demand Factor	1	1	1	1	
Kilowatt Demand	336	224	168	235	
Avg. kWh Usage Per Month	7,700	5,300	57,000	63,000	
Energy Usage (kWh) Charge	\$371	\$265	\$2,545	\$2,810	
Winter Demand Charge	\$1,378	\$913	\$681	\$960	
Summer Demand Charge	\$1,659	\$1,099	\$820	\$1,155	
Avg. Winter Monthly Bill	\$1,749	\$1,179	\$3,226	\$3,770	
Avg. Summer Monthly Bill	\$2,030	\$1,365	\$3,365	\$3,965	
1984	Base Year	\$21,565	\$14,437	\$38,603	\$79,691
1985	39.5%	\$30,083	\$20,139	\$53,851	\$111,168
1986	10.2%	\$33,151	\$22,193	\$59,343	\$122,508
1987	8.9%	\$36,101	\$24,168	\$64,625	\$133,411
1988	7.7%	\$38,881	\$26,029	\$69,601	\$143,683
1989	8.4%	\$42,147	\$28,216	\$75,448	\$155,753
1990	5.0%	\$44,255	\$29,627	\$79,220	\$163,540
1991	5.0%	\$46,467	\$31,108	\$83,181	\$171,717
1992	5.0%	\$48,791	\$32,663	\$87,340	\$180,303
1993	5.0%	\$51,230	\$34,296	\$91,707	\$189,318
1994	5.0%	\$53,732	\$36,011	\$96,292	\$198,784
1995	5.0%	\$56,481	\$37,812	\$101,107	\$208,724
1996	5.0%	\$59,305	\$39,702	\$106,162	\$219,160
1997	5.0%	\$62,271	\$41,688	\$111,470	\$230,118
1998	5.0%	\$65,384	\$43,772	\$117,044	\$241,624
1999	5.0%	\$68,654	\$45,961	\$122,896	\$253,705
2000	5.0%	\$72,086	\$48,259	\$129,041	\$266,390
2001	5.0%	\$75,690	\$50,671	\$135,493	\$279,710
2002	5.0%	\$79,475	\$53,205	\$142,268	\$293,695
2003	5.0%	\$83,449	\$55,865	\$149,381	\$308,380
2004	5.0%	\$87,621	\$58,659	\$156,850	\$323,799
Total 20 Year Energy Costs	\$1,135,316	\$760,044	\$2,032,320	\$4,195,489	
Total 20 Year Present Worth	\$410,658	\$274,917	\$735,115	\$1,517,570	