TOWN OF ADDISON

PUBLIC WORKS DEPARTMENT (214) 450-2871

Post Office Box 144 Addison, Texas 75001 16801 Westgrove

September 20, 1993

Mr. Gary Oshel, P.E.
Assistant City Engineer
City of Farmers Branch
P.O. Box 819010
Farmers Branch, Texas 75381

Re: Engineering services for the NDCWSC Sanitary Interceptor Sewer Phase II

Dear Gary:

On Addison's behalf, I have reviewed the proposed agreement and recommend that it be forwarded to the NDCWSC Board for their review and approval.

It is my understanding that Addison's financial portion of this agreement is 38.75% of the costs (a not to exceed fee of $61,505.94) and that the construction costs will be assigned in accordance with the percentages outlined in exhibit 'B' of the interlocal agreement dated March 18, 1991.

Sincerely yours,

John R. Baumgartner, P.E.
Director of Public Works

JRB/gmk

cc: Randy Moravec

FAX MESSAGE
CITY OF FARMERS BRANCH

DATE: 7-8-93

This is a 11 page transmission, including this cover page.

Our FAX telephone number is (214)241-6305.

In case of a problem with this FAX transmission or difficulty in transmitting to us please call CITY OF FARMERS BRANCH (214) 247-3131 EXT._____

TO: John Baumgartner

COMPANY: Addison, Town

FROM: Gary Oshel

SPECIAL INSTRUCTIONS:

FAX-2.CHP

SHIMEK, JACOBS & FINKLEA
CONSULTING ENGINEERS

8333 Douglas Avenue, #820 Dallas, Texas 75225 (214) 361-7900

ROSS L. JACOBS, P.E.
I. C. FINKLEA, P.E.
JAMES E. LAUGHLIN, P.E.
RONALD V. CONWAY, P.E.
JOHN W. BIRKHOFF, P.E.
MATT ARMSTRONG, P.E.
JOE R. CARTER, P.E.
GARY C. HENDRICKS, P.E.

C. L. SHIMEK, P.E.

August 27, 1993

Mr. Gary M. Oshel, P.E.
Project Manager
North Dallas County Water
Supply Corporation
Post Office Box 819010
Farmers Branch, Texas 75381-9010

Re: Sanitary Interceptor Sewer Phase II

Dear Mr. Oshel:

We are enclosing a copy of our proposal to furnish professional engineering services on the Sanitary Interceptor Sewer Phase II project. Our proposal conforms to the various sections of your Standard Form of Agreement. Our proposal includes our proposed Scope of Work, our proposed Basis of Payment and Estimated Time for Completion for the services.

Based on our review of the proposed work, our current opinion of probable construction cost is approximately $1,770,000.00. This opinion is based on utilizing large diameter PVC sanitary sewer line as the sanitary sewer line construction material. We anticipate the line size varying from 15-inch in diameter to 30-inch in diameter. Our preliminary layout includes 13,250 linear feet of proposed line, 52 manholes and two TRA meter stations.

We certainly appreciate the opportunity to be of service to the North Dallas County Water Supply Corporation on this project. We are available at your convenience to discuss any questions you may have with our proposal to accomplish the project.

Sincerely,

John W. Birkhoff, P.E.

Enclosure

I. PROJECT DESCRIPTION

The Engineer shall provide the following services:

A. DESIGN PHASE

1. Review available sanitary sewer studies of the area to obtain design flows.

2. Make site visit to determine preliminary alignment of sanitary sewer line.

3. Plot preliminary alignment on 100 scale topographic maps. Alignment will generally follow that outlined in the Owner's request for qualifications for this project.

4. Identify areas along alignment that require special design considerations such as boring and traffic control.

5. Meet with Owner to discuss preliminary horizontal alignment.

6. Provide TU Electric, Lone Star Gas, Southwestern Bell Telephone and TCI CableVision with plan of preliminary alignment. Request information on their facilities.

7. Finalize horizontal alignment. Horizontal alignment will be established with an effort to save trees which may be along proposed route.

8. Size sanitary sewer line based on maximum anticipated flows provided by Owner. It is our understanding the Owner's generated flows were calculated based on maximum FAR zoning. Design will be based on Manning's equation with the pipe flowing full.

9. Review the velocity in the pipe for a flow of 25 percent of future anticipated flows.

10. Review various types of pipe available and make recommendation to Owner of acceptable pipe materials.

11. Meet with Owner to discuss preliminary vertical alignment of sanitary sewer line. Discuss with Owner areas requiring special design considerations.

12. Finalize vertical alignment. Vertical elevations along the route will be referenced to Owner supplied benchmarks.

13. Prepare design report in letter form outlining major design decisions and design criteria and provide five copies to the Owner.

14. Prepare construction plans on 24-inch x 36-inch reproducible sheets. Drawings shall generally be at a scale of 1-inch equals 20 feet.

15. Prepare technical specifications and contract documents.

16. Utilize City of Farmers Branch standard sanitary sewer construction details provided by the Owner.

17. Formulate an opinion of probable construction cost based on final design plans.

18. All construction plan sheets will be prepared utilizing AutoCAD Release 12 on DOS Version 5.0. No specific computer aided drafting and design specifications will be utilized. One copy of electronic files of design plans will be provided to the Owner under the following conditions:

    a. The electronic files are compatible with AutoCAD Release 12, operating on an IBM compatible PC using DOS Version 5.0.

    b. Engineer does not make any warranty as to the compatibility of these files beyond the specified release of the above stated software.

    c. Because data stored on electronic media can deteriorate undetected or be modified, the Owner agrees that the Engineer will not be held liable for completeness or correctness of electronic media after an acceptance period of thirty days after delivery of these files.

    d. The electronic files are instruments of our service. Where there is a conflict between the hard copy drawings and the electronic files, the hard copy files will govern in all cases.

    e. Both parties acknowledge mutual non exclusive ownership of the electronic files and each party may use, alter, modify or delete the files without consequence to the other party.

    f. All electronic files provided to the Owner will not contain engineers seal, handwritten dates and signatures.

19. All word processing will be prepared utilizing MS-Word Version 5.5 operating on 286 computers using DOS Version 5.0. These files will not be provided to the Owner.

B. BIDDING PHASE

1. Prepare and provide to the Owner one copy of a Notice to Contractors for their use in publicly advertising the project and send notices to limited number of contractors who undertake the type of work presented in the construction plans.

2. Sell bidding documents and maintain list of those contractors holding plans. Provide at no cost one copy of the documents to Texas Contractors and Dodge Reports.

3. Issue addendum to all plan holders to interpret and clarify bidding documents.

4. Assist the Owner at the bid opening.

5. Prepare Tabulation of Bids and provide one copy to each submitting contractor and five copies to the Owner.

6. Assist the Owner in evaluating the bids received. Make recommendation of award based on engineering considerations involved.

7. Assemble contract documents providing two copies to the Owner, two copies to the Contractor and one copy for the Engineer.

C. CONSTRUCTION PHASE

1. Assist the Owner during the Preconstruction Conference.

2. Issue notice to contractor to proceed with construction on behalf of the Owner.

3. Review shop drawings, catalog data, schedules, laboratory reports, shop and mill tests of materials and equipment submitted by the contractor. This review is for the benefit of the Owner and covers only general conformance with the information given by the Contract Documents. The contractor is to review and stamp his approval on the submittals prior to submitting to Engineer and review by the Engineer does not relieve the contractor of any responsibility such as dimensions to be confirmed and correlated at the job site, appropriate safety measures to protect workers and the public, or the necessity to construct a complete and workable facility in accordance with the contract documents.

4. Make periodic visits to the site to observe the progress and quality of the executed work and to formulate an opinion in general if the work is proceeding in accordance with the intent of the design concepts and in conformance with the contract documents. (This is not full time on-site representation).

5. Issue instructions from the Owner to the Contractor, issuing necessary interpretation and clarification of contract documents, preparing change orders with Owner's approval.

6. Prepare monthly pay requests from information provided by the Owner's on-site representative. Make recommendation to Owner for issuing payment to the contractor.

7. Accompany the Owner during their final inspection of the project.

8. Prepare record drawings from information received from the Owner's on-site representative and from information received from the contractor.

D. ADDITIONAL SERVICES

1. Design Field Surveys

   a. Obtain permission to survey on private property.

   b. Conduct field surveys.

   c. Download and process field notes.

2. Set permanent horizontal control for project at six locations along project route. This will include setting points in existing permanent structures along the route.

3. Meet with business community and interested parties to present horizontal alignment. Obtain input from concerned parties.

4. Attend approximately eight North Dallas County Water Supply Corporation Board Meetings.

5. Delineate required permanent utility easements, temporary construction easements and right-of-way required for the proposed sanitary sewer line and review requirements with the Owner.

6. Prepare field note descriptions and plats required for land or easement acquisition by the Owner. Furnish the Owner two copies of each document for each property. No other on the ground survey for property work will be undertaken. Preparation of 25 descriptions and plats are included in the Scope of Work.

7. Set centerline alignment west of Midway Road and along Inwood Road with stakes and flagging every 500 feet and at changes in horizontal alignment one time for property owners to see impact of improvement.

8. Undertake geotechnical work to bore a maximum of fourteen locations with a maximum overall depth of 210 feet. The materials will be tested and the results made available to Contractors. This work will be undertaken by a geotechnical subconsultant. The results of this task will be to draw the log of borings on the construction plans for the contractors general information. Ground water levels at the time the borings are made will be recorded and shown in the construction plans.

9. Reproduction of preliminary and final documents for review by Owner, distribution to utility companies and for preparation of contract documents. Potential bidders will purchase plans for bidding purposes.

10. Provide construction staking for vertical control, horizontal control and cut states every one hundred feet along the proposed line.

SECTION 3 - PAYMENT

Owner shall pay Engineer for all services outlined in this agreement and performed by the Engineer on the basis herein described below:

Design Phase

A lump sum fee of $96,288.00. Engineering design shall be invoiced to the Owner monthly in amounts based on the Engineer's estimate of completion of design phase.

Bidding Phase

A lump sum fee of $2,300.00. Engineer shall bill Owner upon receipt of bids from contractors and recommended to Owner for award of a contract.

Construction Phase

A lump sum fee of $14,692.00. Engineer shall invoice Owner based on the actual dollar amount percentage of completion of the construction.

Additional Services

Additional services shall be as established in Section I - PROJECT DESCRIPTION, Item D, and shall be paid based on salary cost times a multiplier of 2.30 with expenses at invoice cost times a multiplier of 1.15 and computer run time at twenty five dollars per hour. A maximum not to exceed amount of $48,495.00 is established for additional services without authorization from the Owner.

Design Surveys	$15,400.00
Establishment of Permanent Horizontal Control	$ 1,450.00
Attend One Business Community Meeting	$ 550.00
Attend Eight Water Supply Corporation Meetings	$ 5,520.00
Easement and Right-of-Way Work	$ 7,350.00
Set Centerline Alignment for Property Owners	$ 1,175.00
Construction Staking	$ 2,500.00
Geotechnical Investigation (Subconsultant)	$10,000.00
Printing of Documents (Subcontractor)	$ 4,550.00
Total	**$48,495.00**

SECTION 5 - TIME FOR PERFORMANCE

a. Engineer shall perform all services as provided for under this agreement in a proper, efficient and professional manner in acccordance with the following estimated schedule:

Description of Service	Estimated Time For Completion (Time in Months)
Design Phase	5
Bidding Phase	1
Construction Phase	6

REIMBURSABLE METHODS

APPLICABILITY. Most commonly used for assignments where the exact scope of engineering work to be performed cannot be predetermined, or where the scope of services is likely to be modified during the course of the work. In addition, it is not an unusual practice to employ reimbursable methods of compensation for projects to be designed for construction; for this type of application, the Consulting Engineer normally furnishes the Client a budget, and the work is accomplished by a series of appropriations. Partial payments are usually based on monthly billings.

SALARY COST TIMES A MULTIPLIER, PLUS DIRECT NON-SALARY EXPENSES. The multiplier that is applied to salary cost* is a factor which compensates the Consulting Engineer for overhead,* plus a reasonable margin for contingencies, interest on investment capital, readiness-to-serve, and profit. The exact multiplier to be used in any case depends upon the size and complexity of the assignment, the proportionate use of key personnel, the organizational structure and experience of the consulting firm, and other factors.

For average conditions, the multiplier ranges from 3.0 to 2.0, with 2.5 times salary cost normally considered adequate. Non-salary expenses* (including subcontract expenses) are reimbursed by the Client at actual invoice cost plus an agreed service charge for handling.

SCHEDULE OF REIMBURSABLE CHARGES. An alternative reimbursable method preferred by some clients is an agreed schedule of reimbursable charges, which lists the various classification of engineering, technical, and non-technical employees, and the hourly billing rate of each classification. Non-labor expenses are billed at invoice cost, plus a service charge for handling.

PER DIEM. Personal services are often charged on a per diem basis, a method particularly well suited to court work or similar assignments involving intermittent personal services. The Consulting Engineer is compensated for all the time he devotes to the work, including travel time; and he is reimbursed for travel, subsistence, and out-of-pocket expenses incurred while away from his home office.

For services in court, or where the consulting Engineer appears as an expert, a per diem charge is considered to have been earned for each day of such appearance, even though the Consultant may not be called to testify or, if called, may complete his testimony in a fraction of the day.

Per diem charges for Consulting Engineers should be commensurate with the nature of the assignment, and with the experience and professional standing of the Consultant.

**See Definition of Terms in Appendix. Salary cost, as defined, normally ranges between 125 percent and 135 percent of direct salaries.*

PERCENTAGE OF CONSTRUCTION COST*

APPLICABILITY. Normally used for projects to be designed for construction where there is a reasonable relationship between construction cost and the engineering cost of design. The *Basic Charge* in percent covers those services described in Section II as the *Basic Services*.

The Special Services for a project to be designed for construction are usually furnished directly by the Client, or by the Consulting Engineer, on the basis of salary cost times a multiplier. For the Special Services, the multiplier varies from 3.0 to 2.0. Direct non-labor costs for Special Services are reimbursed at invoice cost plus a nominal surcharge for handling.

USE OF CURVES. The curves of median compensation which follow are a plot of the compensation for Basic Services in percent versus the construction cost of the work authorized at one time by the Client. They represent *median compensation; the appropriate compensation for any given assignment may vary above or below these curves*, depending upon the relative complexity and various other factors.** It is emphasized that the curves should only be used to compare historical composite experience with compensation determined by detailed cost analysis for any specific assignment. The curves should not be used to fix or determine such compensation.

Curves A and B, page 15, are the current version of those prepared by the American Society of Civil Engineers for general engineering works, and reflect the composite experience and judgment of Consulting Engineers throughout the United States, as indicated by responses to a detailed questionnaire.

Curve C, page 17, applies to project types which experience has demonstrated require relatively higher engineering cost per construction dollar.

Alterations and changes to existing structures and facilities necessitate substantially more engineering services than new work. Basic compensation for alteration work should be increased by at least one-third above the median compensation illustrated by the curves.

*See Definition of Terms in the Appendix.

FAX MESSAGE
CITY OF FARMERS BRANCH

DATE: 8/19/93

This is a 8 page transmission, including this cover page.

Our FAX telephone number is (214)241-6305.

In case of a problem with this FAX transmission or difficulty in transmitting to us please call CITY OF FARMERS BRANCH (214) 247-3131 EXT._____

TO: JOHN BAUMGARTNER

COMPANY: ADDISON

FROM: GARY OSIEL

SPECIAL INSTRUCTIONS:
FOR YOUR REVIEW AND COMMENTS

FAX-2.CHP

Midway / Belt Line
Sewer Interceptor

AGREEMENT

THIS AGREEMENT is made by and between Carter & Burgess, Inc., hereinafter called "ENGINEER", and the Town of Addison, Texas, hereinafter called "OWNER".

WHEREAS, Owner desires Engineer to perform certain work and services set forth in Section 2, Scope of Services.

WHEREAS, the Engineer has expressed a willingness to perform said work and services, hereinafter referred to only as "services", specified in said Scope of Services, and enumerated under Section 2, of this Agreement.

NOW, THEREFORE, all parties agree as follows:

Section 1. General

Engineer shall furnish and pay for all labor, tools, materials, equipment, supplies, transportation and management necessary to perform all services set forth in "Section 2." hereof for the Owner in accordance with the terms, conditions and provisions of the Scope of Services. Owner may, at any time, stop any services by the Engineer upon giving Engineer written notice. Engineer shall be bound to Owner by the terms, conditions and responsibilities toward the Owner for Engineer's services set forth in this Agreement.

Section 2. Scope of Services

The following services, when authorized in writing by a Notice to Proceed, shall be performed by the Engineer in accordance with the Owner's requirements for the design of the Marsh Lane Sewer Interceptor.

I. Project Definition

A. This project consists of the design of a sanitary sewer relief system from near Marsh and Belt Line, east along Belt Line to Midway and north along Midway to Hutton Branch Creek, a length of approximately 12,700 linear feet. The system will be desinged as a gravity interceptor system (micro tunnel and cut and cover) or a combination lift station, force main and gravity (cut and cover). The preferred alternative will be recommended as a result of a feasibility study to be conducted as a part of this project. This project will consist of related survey, geotechnical investigations, environmental investigations, on-site representation, and any additional services relating to the project that may be requested in writing by the City.

II. Detailed Scope of Basic Services

A. Phase I - Data Acquisition

1. Perform records research and, based on these records, determine:

   a. Location and description of existing easements and rights-of-way (i.e., TU Electric, drainageways, water and sewer lines, etc.).

   b. Location of existing utilities (water, sewer, gas, petroleum products, fiber optics, telephone, power, cable TV).

   c. Property ownership of key parcels and easement research.

2. Review "as-built" plans and other pertinent data to determine:

   a. Location of sanitary sewer lines and manholes.

   b. Location of water lines, valves and fire hydrants.

   c. Location of storm sewer lines and channels.

3. Review previous reports and flow projections to be used for design.

4. Gather available existing geotechnical data.

5. Prepare an existing facilities map based on existing plans, City topo maps, and records which locates:

   a. Existing roadway and railroad rights-of-way and infrastructure.

   b. Existing easements.

   c. Existing utilities.

   d. Existing sanitary sewer lines and manholes.

B. Phase II - Preliminary Design

1. Evaluate physical constraints and diversion points.

2. Set preliminary alignment.

3. Meet with utility companies, and appropriate property owners about improvement alternatives and easement requirements.

4. Develop preliminary plan and profile sheets. (1" = 40' horizontal and 1" = 4' vertical)

5. Develop preliminary lift station design plans (if lift station alternative is selected).

6. Develop preliminary drop structure design.

7. Prepare construction cost estimates for recommended alternative.

C. Phase III - Final Design

1. Develop pipe material design and specification.

2. Complete plan and profile design.

3. Complete lift station design (if lift station alternative is selected).

4. Complete drop structure design.

5. Prepare construction drawings and contract documents.

   a. Plan and profile sheets (1" = 40' horizontal and 1" = 4' vertical).

   b. Lift station Plan sheets.

   c. Detail sheets.

   d. Specifications

6. Prepare estimate of construction costs and construction schedule.

7. Submit five (5) sets to City for review.

D. Phase IV - Bidding and Contract Award

1. Prepare advertisement for bids.

2. Receive and answer questions from bidders and prepare any necessary addenda.

3. Conduct pre-bid meeting.

4. Tabulate bids and evaluate apparent low bidder's financial, experience and availability report.

5. Make recommendation on contract award.

E. Phase V - Construction

1. Review shop drawings and submittals.

2. Make periodic site visits to review Contractor's general progress.

3. Provide survey control (not complete construction staking).

4. Review contractor's progress payment requests.

5. Answer questions from contractor and/or City during construction.

6. Prepare as-built plans.

F. Services Not Included

1. Detailed construction staking.

2. Restaking control monuments after acceptance by General Contractor.

3. Trench excavation safety plan.

4. Onsite representation during construction.

5. Flow monitoring or T.V. inspection of existing lines.

III. Detailed Scope of Additional Services

A. Feasibility Study

1. Size force main, develop system head curves, preliminary pump selection.

2. Establish preliminary lift station and gravity line sizes.

3. Establish preliminary alignments.

4. Develop capital cost estimates.

5. Conduct life cycle cost analysis of lift station/force main vs. gravity system alternatives.

6. Prepare letter report with recommedation.

B. Onsite Representative

1. Provide fulltime on-site construction administration services including:

   a. Lift station, force main and gravity sewer installation inspection.
   b. Equipment and system testing.
   c. Final walk-through.

2. Prepare daily log of construction activities and field conditions.

C. Surveying

1. Perform field surveys for the recommended alternative following City's concurrence to:

   a. Establish control based on adjacent monumentation.

   b. Locate existing sewer lines and manholes.

   c. Make field ties to gas and petroleum products lines (Conoco, Explorer, Lone Star Gas, etc.) as located in the field by owners of product line.

   d. Make field ties to other utilities such as power transmission towers and substations, power poles, fiber optics cables, underground utilities and vaults as located in the field by owner of the utilities.

   e. Locate existing easements, rights-of-way and property lines.

   f. Make field ties to topographic features .

   g. Make spot ties necessary for ground and pipeline profiles.

2. Prepare metes and bounds descriptions and exhibits for necessary easements up to a total of 30 exhibits.

D. Geotechnical Investigations

1. Soil borings
For micro tunnel alternative, a total to twenty-one (21) borings spaced on approximately 500' on center to a depth range of 25 to 70 feet deep with an additional three borings to be used as needed for additional information. All sample will be packaged in the field and preserved for viewing by bidders. Rock samples will be preserved in wooden rock core boxes. For lift station/force main alternate, a total of 13 borings spaced 1000' on centers ranging in depth from 10' to 20' are budgeted.

2. Piezometers
Four (4) piezometers will be installed consisting of 2-inch PVC well screen and riser pipe for monitoring groundwater levels.

3. Take up to eight wastewater grab samples and analyze pH, dissovled oxygen, total sulfides, dissolved sulfides, total suspended solids and BOD_5. Conduct sovent scan on four of the eight grab samples.

4. Prepare geotechical report.

5. Scope of services does not include material testing during construction.

E. Pipeline Corrosion Analysis

1. Develop computer model of Midway/Belt Line Interceptor with information obtained from grab samples.

2. Evaluate corrosion potential and appropriate pipe materials.

F. Environmental Investigations

Definition of Services

The objective of the Phase I ESA is to evaluate the potential for selected environmental risks to the project. The results of the Phase I ESA will be based primarily on a review of published data sources as well as a site reconnaissance along the alignment. A separate, more detailed Phase II ESA may be needed if the results of the Phase I indicate a potential for environmental risks.

1. The Phase I ESA will identify the following documented risks:

a. Proximity to documented regulatory agency sites, including leaking underground storage tanks.

b. Current and former area land-use activities associated with

potential waste disposal or industrial operations.

c. Previous on-site oil and gas well drill sites.

Scope of Work

1. Regulator Agency Site Search

Task 1 will include review of documented site listings from the following regulatory agencies.

U.S. Environmental Protection Agency Region VI (USEPA)
Texas Water Commission (TWC)
Texas Department of Health (TDH)

Documented regulatory agency sites located within a 1/2-mile radius will be compiled and plotted on a composite site map.

2. Title Search

Task 2 will include review of a title search of the site to trace the ownership and use of the property for the past 50 years up to original development. Available chain-of-title documents regrading the property, including recorded deeds and leases, will be examined for suspect previous owners or activities.

3. Historical Aerial Photograph Review

Task 3 will include the review of selected historical aerial photograph enlargements of the site typically available from the U.S.D.A. Agricultural Stabilization Conservation Service and various local aerial survey companies. The photographs will be reviewed to evaluate previous land-use characteristics along and immediately adjacent to the alignment.

4. Site Reconnaissance

Task 4 will include a walking site reconnaissance to evaluate current land conditions and to assess any anomalies identified from the aerial photograph review. A drive-by reconnaissance of properties within a 1/4 mile radius will also be conducted to identify any potentially high-risk industries or environmental features which could impact the alignment. Photographs of anomalous surface features identified from Task 3 will also be obtained. The site reconnaissance will also include observations for surficial indications of the presence of underground storage tanks, electrical equipment containing PCBs, or other hazardous materials.

5. Other Relevant Data

Task 5 will include an evaluation and review of available geological and hydrologic literature obtained for the alignment from the U.S.D.A. Soil Conservation Service, the U.S. Geological Survey, and the TWC.

6. Report

Task 6 will include an evaluation of the data obtained from Tasks 1 through 5 and the preparation of a Phase I ESA report for the site. The report will describe the various work products and will list the documented regulatory agency sites identified within a 1/2-mile radius of the project. The report will include our professional opinion regarding the potential for environmental risks and will provide recommendations for additional investigation, if risks are identified. A cost estimate and schedule for completion of any recommended additional work will be included in our report.

7. Basis for fee estimate of environmental investigation

   a. City will secure permission for site access and provide survey plats of the properties along the alignment.

   b. Environmental sampling of soil, surface water, or groundwater or analytical testing for EPA hazardous waste constituents is not included.

   c. A detailed review of regulatory agency files for individual sites/facilities of environmental concern is not included.

   d. A detailed evaluation of geologic faulting, groundwater quality, and potential wetlands areas is not included.

8. Additional Services for Environmental Investigations - (not included in this scope)

The following services are not included in the standard Phase I ESA scope of work, but can be provided by C&B at the City's request. Selection of these services may be based on recommendations set forth in the Phase I ESA report. Due to the varying time required for performing these tasks, additional services will be provided on a time and material basis. The City may set a not-to-exceed amount if desired.

   a. Indoor environmental sampling, including, but not limited to, radon, asbestos-containing building materials, urea-formaldehyde building materials, and lead-based paint.

b. Local municipal records review including, but not limited to, building inspection records, zoning maps and ordinances, and utility routing maps.

c. Identify easements and leases affecting the subject property.

d. Drinking water supply sampling for the presence of lead and copper.

e. Written confirmation from jurisdictional utility company of the presence of polychlorinated biphenyls (PCBs) in dielectric fluids in transformers.

f. Subsurface investigation to confirm the presence of underground storage tanks or related soil/groundwater impairment.

g. Subsurface investigation of on-site wastewater disposal systems.

h. In-depth interviews with previous owners/occupants or adjacent landowners, if available.

i. In-depth review of operational status and compliance history of all RCRA sites within a 1/2 mile radius of the subject property.

j. Engineering evaluation of on-site improvements, including, but not limited to, parking lots, drainage structures, buildings, heating, ventilation, and air conditioning systems, plumbing systems, electrical systems, and life safety/fire protection systems and compliance with the Americans with Disabilities Act (ADA).

k. Boundary or topographic surveys of subject property.

l. Wetlands Phase I ESA to define the presence of wetlands on the subject property.

Section 3. Payment

Owner shall pay Engineer for all services authorized in writing as properly performed by Engineer on the basis herein described, subject to additions or deletions for changes or extras agreed upon in writing.

Basis of Compensation

Payments shall be made monthly by Owner to Engineer based upon statements submitted by Engineer for work performed.

Compensation for performing basic and additional services will be on the basis of actual salary cost (defined below) times a multiplier of 2.5, however, such salary cost shall not exceed the hourly billing rate ranges set forth in Exhibit 'C' attached hereto and made a part hereof for all purposes. Direct non-labor expenses (defined below) will be charged at actual cost times 1.05. For the gravity system (micro tunnel), the maximum fee for basic services will be $200,684.00 (See attached Exhibit 'A' - Payment Schedule), and Engineer agrees to perform the basic and additional services to complete the Project for the maximum fee of $393,332.00. For the lift station/force main alternative, the maximum fee for basic services will be $130,492.00. (See attached Exhibit 'A' - Payment Schedule), and the Engineer agrees to perform the basic and additional services to complete the project for a maximum of $303,843.00.

Salary cost is defined as the cost of salaries of engineers, technicians, draftsmen, stenographers, surveymen, clerks, laborers, etc. for time directly chargeable to the project, plus social security contributions, unemployment, excise and payroll taxes, employment compensation insurance, medical and other insurance benefits, sick leave, vacation, holiday pay, and contributions to a pension or retirement plan.

Direct non-labor expenses are defined as all non-labor expenses incurred by the Engineer which are directly chargeable to this project. These expenses include the cost of supplies, transportation, equipment, travel, communications, reproductions, and similar incidentals.

Section 4. Responsibilities

a. Engineer shall be responsible for the professional quality, technical accuracy, and the coordination of all design, drawings, specifications, plans and other services furnished by Engineer under this Agreement. Engineer shall, without additional compensation, correct or review any errors or deficiencies in the design, drawings, specifications, plans and other services.

b. Neither Owner's review, approval or acceptance of, nor payment for any of the services required under this Agreement, shall be construed to operate as a waiver if any rights under this Agreement or of any cause of action arising out of the performance of this Agreement, and Engineer shall be and remain liable to Owner in accordance with applicable law for all damages to Owner caused by Engineer's negligent performance of any of the services furnished under this Agreement.

c. The rights and remedies of Owner under this Agreement are as provided by law.

Section 5. Time for Performance

a. Engineer shall perform all services as provided for under this Agreement in a proper, efficient and professional manner in accordance with the Owner's requirements. As time is of the essence for this Agreement, such services shall be completed according to the schedule shown in Exhibit 'B'.

b. In the event Engineer's performance of this Agreement is delayed or interfered with by acts of the Owner or others, Engineer may request an extension of time for the performance of same as hereinafter provided, but shall not be entitled to any increase in fee or price, or to damages or additional compensation as a consequence of such delays.

c. No allowance of any extension of time, for any cause whatever, shall be claimed or made to the Engineer, unless Engineer shall have made written request upon Owner for such extension within 14 calendar days after the cause for such extension occurred, and unless Owner and Engineer have agreed in writing upon the allowance of additional time to be made.

Section 6. Documents

a. All instruments of service (including plans, specifications, drawings, reports, designs, computations, computer programs, estimates, surveys, other data or work items, etc.) prepared under this Agreement shall be submitted for approval of the Owner. All instruments of service shall be professionally sealed as may be required by law or by Owner.

b. Such instruments of service, together with necessary supporting documents, shall be delivered to Owner, and Owner shall have unlimited rights, for the benefit of Owner, in all instruments of service, including the right to use same on any other work of Owner without additional cost to Owner. If, in the event Owner uses such instruments of service on any work of Owner other than that specified in the Scope of Services, defined in Section 2, provided Engineer completes this Agreement, under those circumstances Owner hereby agrees to protect, defend, indemnify and hold harmless the Engineer, their officers, agents, servants and employees (hereinafter individually and collectively referred to as "Indemnities"), from and against suits, actions, claims, losses, liability or damage of any character, and from and against costs and expenses, including, in part, attorney fees incidental to the defense of such suits, actions, claims, losses, damages or liability on account of injury, disease, sickness, including death, to any person or damage to property including, in part, the loss of use resulting therefrom, arising from any inaccuracy, such use of such instruments of service with respect to such other work except where Engineer participates in such other work.

c. Engineer agrees to and does hereby grant to Owner a royalty-free license to all such instruments of service which Engineer may cover by copyright and to all designs as to which Engineer may assert any rights or establish any claim under the design patent or copyright laws. Engineer, after completion of the project, agrees to furnish the originals of all such instruments of service to the Owner. The license granted herein by Engineer shall survive termination of this Agreement for any reason.

Section 7. Termination

a. Owner may suspend or terminate this Agreement for cause or without cause at any time by giving written notice to the Engineer. In the event suspension or termination is without cause, payment to Engineer, in accordance with the terms of this Agreement, will be made on the basis of services reasonably determined by Owner to be satisfactorily performed to date of suspension or termination. Such payment will be due upon delivery of all instruments of service to Owner.

b. Should the Owner require a material modification of its contract with Engineer, and in the event Owner and Engineer fail to agree upon such modification to this Agreement, Owner shall have the option of terminating this Agreement and the Engineer's services hereunder at no additional cost other than the payment to Engineer, in accordance with the terms of this Agreement, for the services reasonably determined by Owner to be properly performed by the Engineer prior to such termination date.

Section 8. Insurance

a. Engineer shall provide and maintain Workman's Compensation and Employer's Liability Insurance for the protection of Engineer's employees, as required by law. Engineer shall also provide and maintain in full force and effect during the term of this Agreement, insurance (including, but not limited to, insurance covering the operation of automobiles, trucks and other vehicles) protecting Engineer and Owner against liability from damages because of injuries, including death, suffered by any person or persons there than employees of Engineer, and liability for damages to property, arising from or growing out of Engineer's operations in connection with the performance of this Agreement.

b. Such insurance covering personal and bodily injuries or death shall be in the sum of not less than Two Hundred Fifty Thousand Dollars ($250,000.00) for one (1) person, and not less than Three Hundred Thousand Dollars ($300,00.00) for any one (1) occurrence. Insurance covering damages to property shall be in the sum of not less than Three Hundred Thousand dollars ($300,000.00) for any one (1) occurrence, and Three Hundred Thousand Dollars ($300,000.00) aggregate.

c. Engineer shall also provide and maintain Professional Liability Insurance coverage to protect Engineer and Owner from liability arising out of the performance of professional services, if any, under this Agreement. Such coverage shall be in the sum of not less than $1,000,000.00.

d. A signed Certificate of Insurance, satisfactory to Owner, showing compliance with the requirements of this Section shall be furnished to Owner before any services are performed under this Agreement, and shall further indicate that each and every policy for liability insurance coverage as required herein includes a "Contractual Liability Coverage" endorsement covering the Agreement under "Section 9." hereof. Such Certificate of Insurance shall provide for ten (10) days written notice to Owner prior to the cancellation or modification of nay insurance referred to therein.

e. Owner shall be named as an "additional insured" party on the insurance policies.

Section 9. Indemnification For Injury and Performance

Engineer further specifically obligates itself to Owner in the following respects, to wit:

The Engineer hereby agrees to protect, defend, indemnify and hold harmless the Owner, their officers, agents, servants and employees (hereinafter individually and collectively referred to as "Indemnities"), from and against suits, actions, claims, losses, liability or damage of any character, and from and against costs and expenses, including, in part, attorney fees incidental to the defense of such suits, actions, claims, losses, damages or liability on account of injury, disease, sickness, including death, to any person or damage to property including, in part, the loss of use resulting therefrom, arising from any act, error, omission or neglect of the Engineer, its officers, employees, servants, agents or subcontractors, or anyone else under the Engineer's direction and control, and arising out of, occurring in connection with, resulting from or caused by the performance or failure of performance of any work or services called for by this Agreement, or from conditions created by the performance or non-performance of any work or services called for by this Agreement, or from conditions created by the performance or non-performance of said work or services. In the event one or more of the Indemnities is determined by a court of law to be jointly or derivatively negligent or liable for such damage or injury, the Engineer shall be obligated to indemnify Owner as provided herein on a proportionate basis in accordance with the final judgement, after all appeals ar exhausted, determining such joint or derivative negligence or liability.

The Engineer is not responsible for the actions of the Owner's contractor to perform the construction of the improvements covered under this Agreement.

Acceptance and approval of the final plans by the Owner shall not constitute nor be deemed a release of this responsibility and liability of Engineer, its employees, associates, agents and Engineers for the accuracy or competency of their designs,

working drawings and specifications, or other documents and work; nor shall such approval be deemed to be an assumption of such responsibility by the Owner for any defect in the designs, working drawings and specifications, or other documents prepared by Engineer, its employees, contractor, agents and Engineers.

Section 10. Indemnification For Unemployment Compensation

Engineer agrees that it is an independent contractor and not an agent of the Owner, and that Engineer is subject, as an employer, to all applicable Unemployment Compensation Statutes, so as to relieve Owner of any responsibility or liability from treating Engineer's employees as employees of Owner for the purpose of keeping records, making reports or payments of Unemployment Compensation taxes or contributions. Engineer further agrees to indemnify and hold Owner harmless and reimburse it for any expenses or liability incurred under said Statutes in connection with employees of Engineer.

Section 11. Indemnification For Performance

Engineer shall defend and indemnify Owner against and hold Owner and the premises harmless from any and all claims, suits or liens based upon or alleged to be based upon the non-payment of labor, tools, materials, equipment, supplies, transportation and management costs incurred by Engineer in performing this Agreement.

Section 12. Assignment

Engineer shall not assign or sublet this Agreement, or any part thereof, without the prior written consent of Owner.

Section 13. Applicable Laws

Engineer shall comply with all Federal, State, County and Municipal laws, ordinances, regulations, safety orders, resolutions and building codes relating or applicable to services to be performed under this Agreement.

Section 14. Default of Engineer

In the event Engineer fails to comply or becomes disabled and unable to comply with the provisions of this Agreement as to the quality or character of the service or time of performance, and the failure is not corrected within ten (10) days after written notice by Owner to Engineer, Owner may, at its sole discretion without prejudice to any other right or remedy:

a. Terminate this Agreement and be relieved of the payment of any further consideration to Engineer except for all work determined by Owner to be satisfactorily completed prior to termination. Payment for work satisfactorily completed shall be for actual costs, including reasonable salaries and travel expenses of Engineer to and from meetings called by Owner at which

Engineer is required to attend, but shall not include any loss of profit of Engineer. In the event, of such termination, Owner may proceed to complete the services in any manner deemed proper by Owner, either by the use of its own forces or by resubletting to others. In either event, the Engineer shall be liable for all costs in excess of the total contract price under this Agreement incurred to complete the services herein provided for and the costs so incurred may be due or that may thereafter become due to Engineer under and by virtue of this Agreement.

b. Owner may, without terminating this Agreement or taking over the services, furnish the necessary materials, equipment, supplies and/or help necessary to remedy the situation, at the expense of the Engineer.

Section 15. Adjustments in Services

No claims for extra services, additional services or changes in the services will be made by
Engineer without a written agreement with Owner prior to the performance of such services.

Section 16. Execution Becomes Effective

This Agreement will be effective upon execution of the contract by and between Engineer and Owner.

Section 17. Agreement Amendments

This Agreement contains the entire understanding of the parties with respect to the subject matter hereof and there are no oral understandings, statements, or stipulations bearing upon the meaning or effect of this Agreement which have not been incorporated herein. This Agreement may only be modified, amended, supplemented or waived by a written instrument executed by the parties except as may be otherwise provided therein.

Section 18. Written Notices

All notices, demands and communications hereunder shall be in writing and may be served or delivered personally upon the party for whom intended, or mailed to the party for whom intended at the address set forth on the signature page of this Agreement. The address of a party may be changed by notice given pursuant to this Section.

Section 19. Gender and Number

The use of any gender in this Agreement shall be applicable to all genders, and the use of singular number shall include the plural conversely.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement on this the 13th day of April, 19 94.

OWNER:

Town of Addison, Texas

By: Ron Whitehead
Ron Whitehead
City Manager

5300 Beltline Road
P.O. Box 144
Addison, Texas 75001-0144

ENGINEER:

BY: Phil Deaton
J. Phillip Deaton, P.E.
Vice President

7950 Elmbrook Drive
Suite 250
Dallas, Texas 75247

Witness:

C Moran
City Secretary

SIGN HERE

Witness:

John Lindner

Approved by Council on April 12, 1994.

ADDITIONAL SERVICES

A. Onsite Representative

B. Surveying

C. Geotechnical Investigations

D. Landscape Architecture

E. Environmental Investigations

EXHIBIT "A"
PAYMENT SCHEDULE
TOWN OF ADDISON

MIDWAY/BELT LINE WASTEWATER INTERCEPTOR

I.	BASIC SERVICES - GRAVITY SEWER ALTERNATIVE		
	A.	Phase I - Data Acquisition/Facility Map	$ 9,792.00
	B.	Phase II - Preliminary Design	78,468.00
	C.	Phase III - Final Design	96,440.00
	D.	Phase IV - Bidding and Contract Award	3,360.00
	E.	Phase V - Construction	12,624.00
		SUBTOTAL:	$200,684.00
II.	ADDITIONAL SERVICES - GRAVITY SEWER ALTERNATIVE		
	A.	Feasibility Study	$ 15,800.00
	B.	On-site Representation	85,994.00
	C.	Surveying	48,732.00
	D.	Geotechnical Investigations	32,955.00
	E.	Pipeline Corrosion Analysis	6,680.00
	F.	Environmental Investigations	3,415.00
		SUBTOTAL:	$193,576.00
		TOTAL GRAVITY SEWER ALTERNATIVE	$393,332.00
III.	BASIC SERVICES - LIFT STATION/FORCE MAIN ALTERNATIVE		
	A.	Phase I - Data Acquisition/Facility Map	8,280.00
	B.	Phase II - Preliminary Design	46,144.00
	C.	Phase III - Final Design	61,044.00
	D.	Phase IV - Bidding and Contract Award	3,360.00
	E.	Phase V - Construction	11,664.00
		SUBTOTAL:	$130,492.00

IV. ADDITIONAL SERVICES - LIFT STATION/FORCE MAIN ALTERNATIVE

A.	Feasibility Study	15,800.00
B.	On-site Representation	85,994.00
C.	Surveying	48,732.00
D.	Geotechnical Investigations	12,730.00
E.	Pipeline Corrosion Analysis	6,680.00
F.	Environmental Investigations	3,415.00
	SUBTOTAL:	$173,351.00
	TOTAL LIFT STATION/FORCE MAIN ALTERNATIVE	$303,843.00

EXHIBIT "B"
SCHEDULE
TOWN OF ADDISON
MIDWAY/BELT LINE WASTEWATER INTERCEPTOR

ACTIVITY	ACTIVITY COMPLETION DATE
Notice to Proceed	May 1, 1994
Data Acquisition	June 1, 1994
Feasibility Study	July 15, 1994
Preliminary Design	October 1, 1994
City Review	October 14, 1994
Prepare Easements	November 1, 1994
Obtain Easements	January 1, 1995
Final Design	January 16, 1995
City Review	February 1, 1995
Advertise Bids	February 10, 1995
Receive Bids	March 10, 1995
Contract Award	March 31, 1995
Begin Construction	April 14, 1995
Complete Construction	September 1, 1996
As-Built Plans	Septebmer 8, 1996

EXHIBIT "C"
BILLING RANGES
TOWN OF ADDISON

MIDWAY/BELT LINE WASTEWATER INTERCEPTOR

POSITION	HOURLY BILLING RATE RANGE
Principal	$95 - $100
Project Manager	65 - 80
Registered Professional Land Surveyor	45 - 78
Senior Technician	52 - 60
Technician	39 - 48
Drafter	27 - 40
Secretary	27 - 40
Party Chief	33 - 45
Instrumentman	25 - 30
Rodman	19 - 22
Survey Technician	40 - 56

Mileage - $0.275/mile
Blue Lines - $0.09/S.F.

MIDWAY/BELT LINE WASTERWATER INTERCEPTOR
GRAVITY SEWER ALTERNATIVE
TOWN OF ADDISON

PRELIMINARY COST ESTIMATE

	DESCRIPTION	QUANT.	UNIT	UNIT PRICE	AMOUNT
1.	24" Sanitary Sewer by Micro Tunnel, Complete in Place with Shaft Excavation and Shoring @ 400′ O.C.	9,000	LF	$400.00	$3,600,000.00
2.	Drop Structures	8	EA	15,000.00	120,000.00
3.	Concrete Remove and Replace at Drop Structures (15′ x 25′) each x 25 Shafts	1,050	SY	50.00	52,500.00
4.	24" Sanitary Sewer by Open Cut	3,000	LF	135.00	405,000.00
5.	36" Steel Casing by Bore	300	EA	300.00	90,000.00
6.	5′ Diameter Manhole	12	SY	3,000.00	36,000.00
7.	Pavement Removal/Replacement	500	SY	45.00	22,500.00
	TOTAL				$4,326,000.00

MIDWAY/BELTLINE INTERCEPTOR
GRAVITY SEWER ALTERNATIVE
TOWN OF ADDISON

MAN-HOUR ESTIMATE

Basic Services

Phase I - Data Acquisition

	P.M./P.E. ($80/hr)	TECH. ($58/hr)	Drafter ($40/hr)	Secretary ($40/hr)
• Review existing reports/plans	16	-0-	-0-	-0-
• Coordinate with utility companies and collect plans	12	24	-0-	-0-
• Gather existing geotechnical data	6	-0-	-0-	-0-
• Prepare existing facilities map	12	40	40	-0-
• Review existing flow data and projections	10	-0-	-0-	-0-
	$4,480.00	3,712.00	$1,600.00	-0-
			Subtotal:	$9,792.00

Phase II - Preliminary Design

• Evaluate easement requirements	30	30	-0-	-0-
• Establish diversion points	24	24	-0-	-0-
• Evaluate existing easements, utilities, and set preliminary alignment	60	60	40	-0-
• Develop preliminary plan and profile sheets	160	240	240	12
• Preliminary design drop shafts	60	80	120	6
• Preliminary design detail sheets	20	60	60	-0-
• Prepare cost estimates	16	12	-0-	10
	29,600.00	29,348.00	18,400.00	1,120.00
			Subtotal:	$78,468.00

Phase III - Final Design

	P.M./P.E. ($80/hr)	TECH. ($58/hr)	Drafter ($40/hr)	Secretary ($40/hr)
• Pipe material design & specifications	40	-0-	-0-	6
• Complete drop shaft design	100	100	160	4
• Complete P&P sheets	320	320	300	4
• Complete detail sheets	20	40	100	-0-
• Prepare specifications	40	-0-	-0-	24
• Prepare cost estimates	24	40	-0-	-0-
	$43,520.00	29,000.00	22,400.00	1,520.00
			Subtotal:	$96,440.00

Phase IV - Bidding/Contract Award

• Prepare advertisement	4	-0-	-0-	4
• Conduct Pre-Bid meeting	6	-0-	-0-	2
• Addenda preparation/questions	16	-0-	-0-	4
• Receive and evaluate bids/recommend award	10	-0-	-0-	2
	$2,880.00	-0.00-	-0.00-	480.00
			Subtotal:	$3,360.00

Phase V - Construction

• Review shop drawings and submittals	16	-0-	-0-	-0-
• Periodic onsite review of progress	48	-0-	-0-	-0-
• Answering questions	36	-0-	-0-	-0-

Phase V - Construction (continued)

	P.M./P.E. ($80/hr)	TECH. ($58/hr)	Drafter ($40/hr)	Secretary ($40/hr)
• Review contractor's progress pay request	24	-0-	-0-	24
• Prepare as-built plans	4	8	24	-0-
	$10,240.00	464.00	$960.00	960.00
			Subtotal:	$12,624.00

Basic Services $200,684.00

MIDWAY/BELTLINE WASTEWATER INTERCEPTOR
GRAVITY SEWER ALTERNATIVE
TOWN OF ADDISON

ADDITIONAL SERVICES

A. ADDITIONAL SERVICES

Phase I - Feasibility Study (F.M. vs. Gravity)

	P.M./P.E. ($80/hr)	TECH. ($58/hr)	Drafter ($40/hr)	Secretary ($40/hr)
• Establish design criteria and flows (interim, ultimate)	6	-0-	-0-	-0-
• Size F.M, develop system curves	18	-0-	-0-	-0-
• Pump curves and selection	10	-0-	4	-0-
• Size lift station/layout	24	20	16	-0-
• Define preliminary alignments and line sizes	12	12	-0-	-0-
• Identify easement requirement and evaluate cost	12	10	-0-	2
• Develop present worth cost analysis (capital, O&M)	24	12	-0-	4
• Prepare letter report	24	6	16	6
	$10,400.00	3,480.00	1,440.00	480.00

Subtotal: 15,800.00

B. ON-SITE REPRESENTATION

Phase V - Construction Representative

	Onsite Representative ($62/hr)
• Fulltime onsite representative (8 month period)	1,387
	$85,994

Subtotal: $85,944.00

*The total construction time for this project is estimated to be 15 months. However, with the anticipated milestone dates presented herein and in Carter & Burgess' contact for the Marsh Lane Interceptor, there is an anticipated overlap period in construction of 7 months. During that period we propose that a single on-site representative can monitor both projects concurrently. In the event the construction of these two projects does not follow this anticipated schedule, this amount of the contract will be adjusted accordingly by the Town of Addison.

C. SURVEYING

Phase I

	RPLS ($75/hr)	TECH. I ($52/hr)	TECH.II ($40/hr)	Crew ($85/hr)	Secretary ($40/hr)
• Deed Sketch	-0-	-0-	80-	-0-	-0-
• Deed Research	-0-	48	-0-	-0-	-0-
	-0-	2,496.00	3,200.00	-0-	-0-

Subtotal: $5,696.00

Phase II

• Field Note Reduction	-0-	30	-0-	-0-	-0-
• Computations	-0-	48	-0-	-0-	-0-
• Analyzation	12	48	-0-	-0-	-0-
• CADD Mapping (30 Parcels)	6	60	-0-	-0-	-0-
• Field Note Descriptions (30)	6	48	-0-	-0-	-0-
• Word Processing	-0-	-0-	-0-	-0-	6
• Easement Research	-0-	-0-	80	-0-	-0-

• Horizontal/Vertical Control	-0-	4	-0-	32	-0-
Phase II (continue)					
• Locate/Tie Corners	-0-	-0-	-0-	60	-0-
• Tie Improvements	-0-	-0-	-0-	100	-0-
• Profile Alignment	-0-	-0-	-0-	40	-0-
• Locate Utilities	8	-0-	-0-	60	-0-
	$2,400.00	12,376.00	3,200.00	24,820.00	240.00
				Subtotal:	$43,036.00
Surveying				**Total:**	$48,732.00

D. GEOTECHNICAL INVESTIGATIONS

MIDWAY/BELTLINE WASTEWATER INTERCEPTOR
GRAVITY SEWER ALTERNATIVE
TOWN OF ADDISON

ITEM	BUDGET	SCHEDULE
FIELD SERVICES		
Borings	$ 19,415.00	3 Weeks
Piezometer	$ 600.00	
Wastewater	$ 1,250.00	
LABORATORY TESTING		
Geotechnical	$ 1,700.00	1.5 Weeks
Wastewater	$ 1,030.00	
ENGINEERING REPORT	$ 8,460.00	2 Weeks
PLAN REVIEW	$ 500.00	
TOTAL	**$ 32,955.00**	6.5 Weeks

E. PIPELINE CORROSION ANALYSIS

	P.M./P.E. ($80/hr)	TECH. ($58/hr)	Drafter ($40/hr)	Secretary ($40/hr)
• Conduct corrosion analysis model	48	10	12	0
• Evaluate pipe material	12	10	-0-	6
	4,800.00	1,160.00	480.00	240.00
			Subtotal:	$6,680.00

F. ENVIRONMENTAL INVESTIGATIONS

Schedule of Fees

POSITION	HOURLY RATE	EST. HOURS	COST
Staff Environmental Engineers/Scientist	$70.00	12	840.00
Geologist/Field Specialist	$60.00	18	1,080.00
Environmental Technician	$50.00	6	300.00
Drafting/CADD	$45.00	6	270.00
Clerical	$35.00	5	175.00
Regulatory Review	$250.00	-	250.00
Title Search	$300.00	-	300.00
Photos	$200.00	-	200.00
Environmental Investigations		TOTAL:	3,415.00

ADDITIONAL SERVICES	$193,576.00
TOTAL BASIC AND ADDITIONAL SERVICES (GRAVITY AND SEWER)	$393,332.00

MIDWAY/BELT LINE WASTEWATER INTERCEPTOR
LIFT STATION AND FORCE MAIN ALTERNATIVE
TOWN OF ADDISON
PRELIMINARY COST ESTIMATE

DESCRIPTION	QUANT.	UNIT	UNIT PRICE	AMOUNT
1. 24" Sanitary Sewer by Cut and Cover	4,000	LF	$125	$500,000.00
2. 21" Sanitary Sewer by Cut and Cover	2,800	LF	120	336,000.00
3. 18" Sanitary Sewer by Cut and Cover	2,700	LF	110	297,000.00
4. 36" Steel Casing by Bore	300	LF	300	90,000.00
5. 30" Steel Casing by Bore	500	LF	275	137,500.00
6. 5' Diameter Manhole	18	EA	3,000	54,000.00
7. 14" Force Main	3,500	LF	65	227,500.00
8. 3.5 MGD Lift Station	1	EA	250,000	250,000.00
9. Air Release Valve	2	EA	2,500	5,000.00
10. Pavement Removal Replacement	1,000	SY	45	45,000.00
TOTAL				$1,942,000.00

MIDWAY/BELTLINE INTERCEPTOR
LIFT STATION/FORCE MAIN ALTERNATIVE
TOWN OF ADDISON

MAN-HOUR ESTIMATE

Basic Services

Phase I - Data Acquisition

	P.M./P.E. ($80/hr)	TECH. ($58/hr)	Drafter ($40/hr)	Secretary ($40/hr)
• Review existing reports/plans	12	-0-	-0-	-0-
• Coordinate with utility companies and collect plans	6	36	-0-	-0-
• Gather existing geotechnical data	2	-0-	-0-	-0-
• Prepare existing facilities map	12	24	40	-0-
• Review existing flow data and projections	8	-0-	-0-	-0-
	$3,200.00	3,480.00	1,600.00	-0-
			Subtotal:	$8,280.00

Phase II - Preliminary Design

• Evaluate easement requirements	16	16	-0-	-0-
• Identify diversion points	8	16	-0-	-0-
• Evaluate existing easements, utilities, and set preliminary alignment	12	80	80	-0-
• Develop preliminary plan and profile sheets	40	120	160	-0-
• Preliminary mechanical design	16	40	60	8
• Preliminary structural design	16	20	60	8
• Preliminary electrical design	8	20	20	8
• Prepare cost estimate	16	16	-0-	10
	$10,560.00	19,024.00	15,200.00	1,360.00
			Subtotal:	$46,144.00

Phase III - Final Design

	P.M./P.E. ($80/hr)	TECH. ($58/hr)	Drafter ($40/hr)	Secretary ($40/hr)
• Pipe material design & specifications	16	-0-	-0-	4
• Complete mechanical design	40	40	60	2
• Complete structural design	48	60	60	2
• Complete electrical design	20	18	24	-0-
• Complete P&P sheets & specifications	120	160	240	24
• Prepare contract documents	40	20	-0-	12
• Prepare cost estimates	20	40	-0-	-0-
	$24,320.00	19,604.00	15,360.00	1,760.00
			Subtotal:	$61,044.00

Phase IV - Bidding/Contract Award

• Prepare advertisement	4	-0-	-0-	4
• Conduct Pre-Bid meeting	6	-0-	-0-	2
• Addenda preparation/questions	16	-0-	-0-	4
• Receive and evaluate bids/recommend award	10	-0-	-0-	2
	$2,880.00	-0.00-	-0.00-	480.00
			Subtotal:	$3,360.00

Phase V - Construction

• Review shop drawings and submittals	16	-0-	-0-	-0-
• Periodic onsite review of progress	36	-0-	-0-	-0-
• Answering questions	36	-0-	-0-	-0-

Phase V - Construction (continued)

	P.M./P.E. ($80/hr)	TECH. ($58/hr)	Drafter ($40/hr)	Secretary ($40/hr)
• Review contractor's progress pay request	24	-0-	-0-	24
• Prepare as-built plans	4	8	24	-0-
	$9,280.00	464.00	960.00	960.00
			Subtotal:	$11,664.00

Basic Services $130,492.00

MIDWAY/BELTLINE WASTEWATER INTERCEPTOR
LIFT STATION/FORCE MAIN ALTERNATIVE
TOWN OF ADDISON

ADDITIONAL SERVICES

A. ADDITIONAL SERVICES

Phase I - Feasibility Study (F.M. vs. Gravity)

	P.M./P.E. ($80/hr)	TECH. ($58/hr)	Drafter ($40/hr)	Secretary ($40/hr)
• Establish design criteria and flows (interim, ultimate)	6	-0-	-0-	-0-
• Size F.M, develop system curves	18	-0-	-0-	-0-
• Pump curves and selection	10	-0-	4	-0-
• Size lift station/layout	24	20	16	-0-
• Define preliminary alignments and line sizes	12	12	-0-	-0-
• Identify easement requirement and evaluate cost	12	10	-0-	2
• Develop present worth cost analysis (capital, O&M)	24	12	-0-	4
• Prepare letter report	24	6	16	6
	10,400.00	3,480.00	1,440.00	480.00

Subtotal: 15,800.00

B. ON-SITE REPRESENTATION

Phase V - Construction Representative

	Onsite Representative ($62/hr)
• Fulltime onsite representative (8 month period)*	1,387
	$85,994

Subtotal: $85,994.00

*The total construction time for this project is estimated to be 15 months. However, with the anticipated milestone dates presented herein and in Carter & Burgess' contract for the Marsh Lane Interceptor, there is an anticipated overlap period in construction of 7 months. During that period we propose that a single on-site representative can monitor both projects concurrently. In the event the construction of these two projects does not follow this anticipated schedule, this amount of the contract will be adjusted accordingly by the Town of Addison.

C. SURVEYING

Phase I

	RPLS ($75/hr)	TECH. I ($52/hr)	TECH.II ($40/hr)	Crew ($85/hr)	Secretary ($40/hr)
• Deed Sketch	-0-	-0-	80-	-0-	-0-
• Deed Research	-0-	48	-0-	-0-	-0-
	-0-	2,496.00	3,200.00	-0-	-0-
				Subtotal:	$5,696.00

Phase II

• Field Note Reduction	-0-	30	-0-	-0-	-0-
• Computations	-0-	48	-0-	-0-	-0-
• Analyzation	12	48	-0-	-0-	-0-
• CADD Mapping (30 Parcels)	6	60	-0-	-0-	-0-
• Field Note Descriptions (30)	6	48	-0-	-0-	-0-
• Word Processing	-0-	-0-	-0-	-0-	6
• Easement Research	-0-	-0-	80	-0-	-0-
• Horizontal/Vertical Control	-0-	4	-0-	32	-0-
• Locate/Tie Corners	-0-	-0-	-0-	60	-0-
• Tie Improvements	-0-	-0-	-0-	100	-0-
• Profile Alignment	-0-	-0-	-0-	40	-0-
• Locate Utilities	8	-0-	-0-	60	-0-
	2,400.00	12,376.00	3,200.00	24,820.00	240.00
				Subtotal:	$43,036.00
Surveying				Total:	$48,732.00

D. GEOTECHNICAL INVESTIGATIONS

MIDWAY/BELTLINE WASTEWATER INTERCEPTOR
LIFT STATION/FORCE MAIN
TOWN OF ADDISON

ITEM	BUDGET	SCHEDULE
FIELD SERVICES		
Borings	$ 5,625.00	2 Weeks
Piezometer	$ 600.00	
Wastewater	$ 1,250.00	
LABORATORY TESTING		
Geotechnical	$ 925.00	1 Weeks
Wastewater	$ 1,030.00	
ENGINEERING REPORT	$ 2,800.00	2 Weeks
PLAN REVIEW	$ 500.00	
TOTAL	**$12,730.00**	5 Weeks

E. PIPELINE CORROSION ANALYSIS

	P.M./P.E. ($80/hr)	TECH. ($58/hr)	Drafter ($40/hr)	Secretary ($40/hr)
• Conduct corrosion analysis model	48	10	12	0
• Evaluate pipe material	12	10	-0-	6
	$4,800.00	1,160.00	480.00	240.00
			Subtotal:	$6,680.00

7. ENVIRONMENTAL INVESTIGATIONS

Schedule of Fees

POSITION	HOURLY RATE	EST. HOURS	COST
Staff Environmental Engineers/Scientist	$70.00	12	840.00
Geologist/Field Specialist	$60.00	18	1,080.00
Environmental Technician	$50.00	6	300.00
Drafting/CADD	$45.00	6	270.00
Clerical	$35.00	5	175.00
Regulatory Review	$250.00	-	250.00
Title Search	$300.00	-	300.00
Photos	$200.00	-	200.00
Environmental Investigations		TOTAL:	3,415.00

ADDITIONAL SERVICES $173,351.00

TOTAL BASIC AND ADDITIONAL SERVICES
(LIFT STATION/FORCE MAIN) $303,843.00

Design Report
For

MIDWAY/BELT LINE SEWER INTERCEPTOR

TOWN OF ADDISON

PRELIMINARY - FOR REVIEW ONLY

These documents are for Design Review and not intended for Construction, Bidding or Permit Purposes. They were prepared by, or under the supervision of:

JOHN H. LINDNER, P.E. 64694, 7/28/94

Type or Print Name **PE#** **Date**

July 1994

Submitted By:

Carter & Burgess, Inc.
7950 Elmbrook Drive #250
Dallas, Texas 75247

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDIX

I. INTRODUCTION

The purpose of this report is to evaluate the feasibility of alternative means of conveying wastewater flows from the Hutton Branch drainage basin and a majority of the Rawhide Creek drainage basin in Addison into the Marsh Lane Interceptor. These drainage areas consist of Midway, A1, A2 and A3, as shown on Figure 1, which are currently served through the cities of Carrollton and Farmers Branch. Wastewater flows from these areas will be conveyed by the proposed Marsh Lane Interceptor, currently in final design by Carter & Burgess, into the 60-inch diameter sewer tunnel currently being constructed for the North Dallas County Water Supply Corporation (NDCWSC). All Town of Addison flow conveyed by this proposed system will be metered by a single meter station located at Farmers Branch Creek and Marsh Lane.

In April 1993, the Rawhide Creek Lift Station went into operation. The purpose of this lift station and force main was to transport a majority of the Rawhide Creek drainage basin to the east into the City of Dallas' collection system. This was necessary because continued growth in Addison was exceeding the contractual amount of flow the City of Farmers Branch would accept. This temporary lift station will be abandoned with the completion of the Midway/Beltline, Marsh Lane and NDCWSC Tunnel Sewer interceptor projects.

This design report will evaluate the feasibility of the following:

- Alternate 1 - All gravity system (tunneling and cut and cover)
- Alternate 2 - Combination of lift station, force main and gravity system (cut and cover).

A complete gravity system alternative requires a considerable length of tunnel construction due to the excessive depths associated with crossing the ridge between the Hutton Branch and Rawhide Creek drainage basins. The feasibility will be based on a 50 year life cycle cost comparison between these two alternatives.

Each alternative was evaluated on the following criteria:

a. Present and future wastewater flows;
b. Alignment of each system;
c. Construction, operational and maintenance costs;
d. Disruption to the public and to traffic;
e. Right of way acquisition.

II. WASTEWATER DESIGN FLOWS

A. Existing Design Flows - Avg. Daily, Peak

Wastewater flows from the Midway drainage basin consist currently of flows metered at the Midway Meter Station (shown on Figure 1) and flows in the Kellway Circle area, which is located just south of Hutton Branch and east of Midway Road.

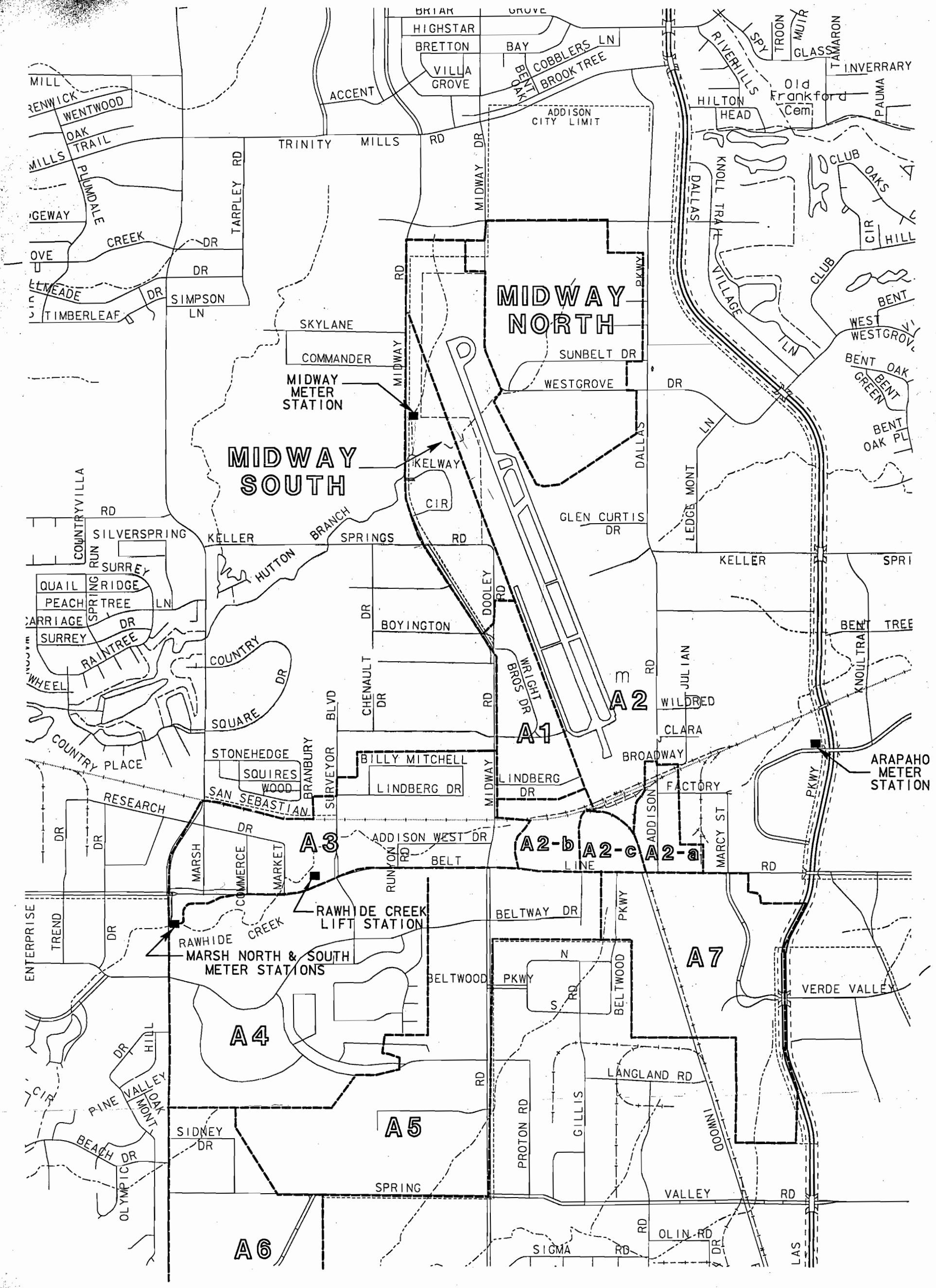
Wastewater flows from drainage basins A1, A2 and A3 were metered entirely by the Marsh North Meter Station prior to April 1993. Since that time, as previously discussed, a large portion of this flow has been pumped from the Rawhide Creek Lift Station (shown on Fig. 1) to the east into the City of Dallas collection system and is metered by the Arapaho Meter Station.

The existing average daily flows shown in the table below are based on annual average flow data for 1992 and 1993. The peak flows are based on a peaking factor 2.67 presented in the Addison Drainage Basin Analysis Report, April 1990, prepared by Ginn, Inc.

For a lift station and force main alternative, the total flow from the Midway drainage basin (Midway Meter Station and Kellway Circle) represents the flow that must be pumped. Flow from areas A1, A2 and A3 will enter the gravity portion of the proposed system.

TABLE 1
EXISTING FLOWS
(YEAR 1993)

Drainage Basin	Average Daily Flow (MGD)	Peak Flow (MGD)
Midway		
•Midway Meter Station	.13	.35 → ?
•Kellway Circle	.01	.03
A1, A2 & A3		
•Rawhide Creek Lift Station	.45	1.20
•Marsh North Meter Station	.04	0.11
TOTAL	**0.63**	**1.69**



DRAINAGE AREAS
FIGURE 1

SCALE: 1" =1500'

B. **Ultimate Design Flows - Avg. Daily, Peak**

Ultimate wastewater flows of the affected drainage areas were provided in the Addison Drainage Basin Analysis Report developed by Ginn, Inc. in April 1990. These flows were based on population projections, flow meter records and projected per capita flows. Table 2 shows the ultimate projected flows at the affected drainage areas. The weighted peaking factor of 1.9 is used in the report for peak flow calculations.

TABLE 2
ULTIMATE FLOW (YEAR 2028)

Drainage Areas	Land Area (Acres)	Equivalent Population	Ave. Daily Discharge (MGD)	Peak Discharge (MGD)
A1	67.48	3376	0.14	0.21
A2	80.75	8558	0.34	0.68
A3	208.46	13,558	0.55	0.97
Midway	263.98	35,342	1.38	2.91
TOTAL	620.67	60,834	2.41	4.77

C. Lift Station Flows

As previously mentioned, the drainage area that must be served by a lift station, if a completely gravity system is selected, is the Midway drainage area.

The ultimate flows shown on Table 3 are projected to be achieved in the year 2028. The Ginn report stated that the projected flows to the year 2028 would increase linearly from the average daily flow in 1988 to the projected average daily flow in 2028. This relationship was adjusted to match the actual discharges metered at the Midway Metering Station in 1993. This value was then increased at equal increments to the projected ultimate discharge in the year 2028. Figure 2 and Table 3 show the projected peak discharges at the Midway Meter Station by year to the year 2028 is provided on the following pages.

III. SEWER ALIGNMENT

A. Sewer Alignment

The general alignment for the Midway/Belt Line Sewer has been studied in previous reports including the Rawhide Creek Lift Station and Force Main Routing Study prepared by Carter & Burgess and the Evaluation of Strategic Alternatives for Transporting Wastewater to the TRA System prepared by Espey Huston. This alignment is shown on Figure 3.

Along this alignment, the drainage divide between the Hutton Branch Creek and the Rawhide Creek drainage areas is located where Dooley Road and Wright Brothers Drive intersect Midway Road. Therefore, in order to serve the Midway drainage area, two primary alternatives exist:

- Construct an all gravity system utilizing tunnel methods due to excessive depth of cuts.
- Construct a lift station and force main to serve the Midway drainage area with a gravity system beginning at the drainage divide.

The same general alignment can be used for both alternatives. However, due to differing methods of construction, each alternative will have significantly different impacts on the following considerations:

- Ease and cost of right-of-way acquisition
- Existing utilities impacted
- Impact on traffic
- Impact on businesses
- Constructability
- Construction cost
- Operation and maintenance costs

FIGURE 2

PEAK FLOW PROJECTION
MIDWAY METER STATION

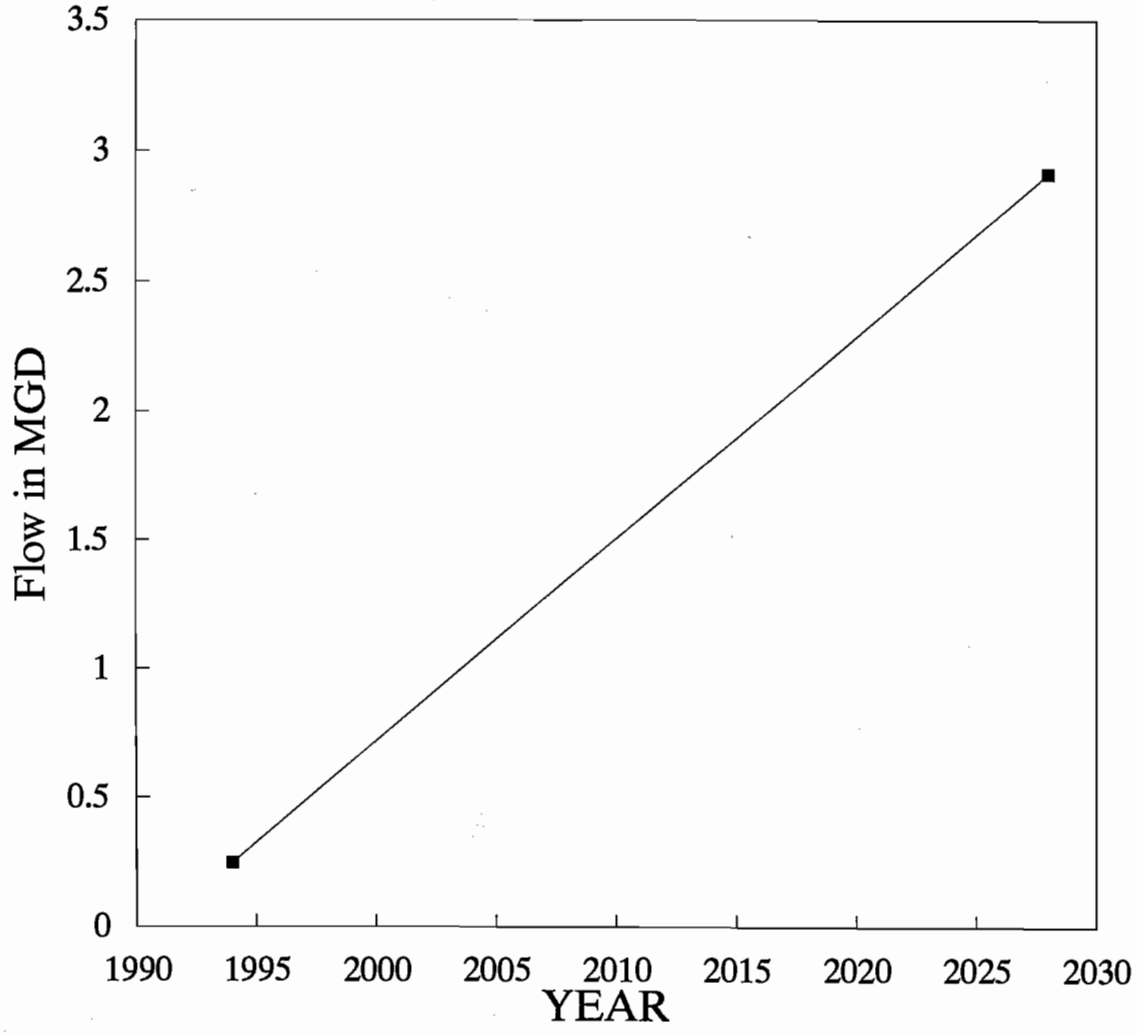
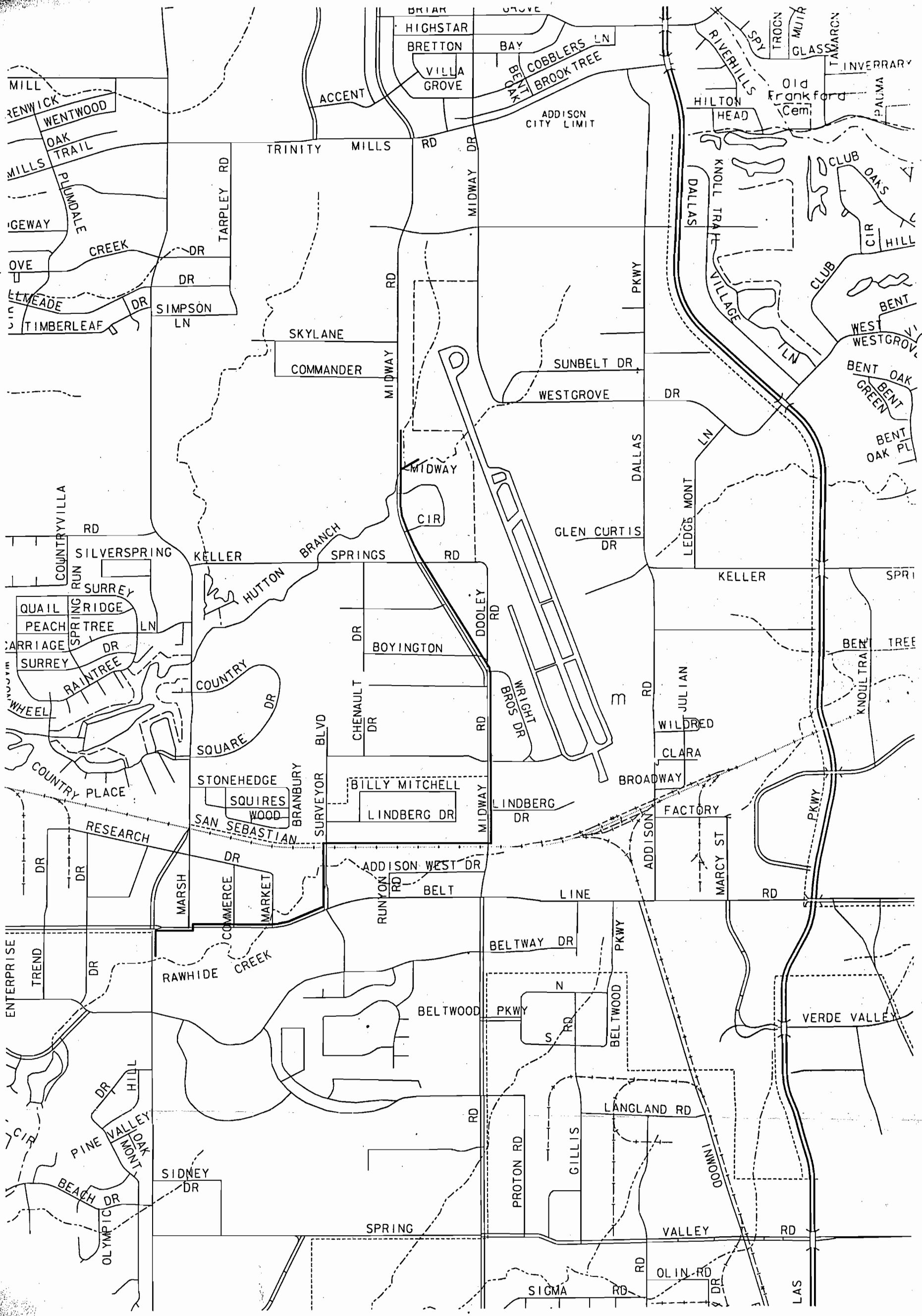


Table 3
Midway Meter Station
Peak Flow Projections

TABLE 3

Year	Discharge (MGD)
1994	0.38
1995	0.404
1996	0.482
1997	0.561
1998	0.640
1999	0.718
2000	0.797
2001	0.876
2002	0.954
2003	1.033
2004	1.112
2005	1.190
2006	1.269
2007	1.348
2008	1.426
2009	1.505
2010	1.584
2011	1.663
2012	1.741
2013	1.820
2014	1.899
2015	1.977
2016	2.056
2017	2.135
2018	2.213
2019	2.292
2020	2.371
2021	2.449
2022	2.528
2023	2.607
2024	2.685
2025	2.764
2026	2.843
2027	2.921
2028	3.000



ALIGNMENT OF SEWER
FIGURE 3

SCALE: 1" =1500'

The proposed alignment is shown in more detail at the back of this report on the Town of Addison's 1"=100' scale sewer maps. The proposed sanitary sewer will start at the point of connection with a proposed 24 inch line. The 24 inch sewer is currently under design as part of the Marsh Lane Interceptor for the Town of Addison by Carter & Burgess, Inc. This point is located in an easement on the east side of Marsh Lane approximately 85 feet north of the Marsh North Metering Station. The proposed Midway/Belt Line sewer will run within the easement north approximately 260 feet along Marsh Lane to the intersection with Belt Line Road, then continue east along the south side of Belt Line Road within an existing 5 foot easement which would need to be increased to 15 feet a distance of approximately 600 feet. At this point, the sewer would cross Belt Line Road and continue east along the north side of the road for approximately 1950 feet to Surveyor Road. An easement will have to be acquired along this section. The sewer then continues north in the pavement of Surveyor Road for approximately 1000 feet to the St. Louis and Southwestern Railroad. The parkway of Surveyor is very congested with existing utilities and does not offer space for construction of this sewer line.

Within the north and south right-of-way of the railroad there are several existing underground utilities that include petroleum products lines, Sprint Fiber Optics and other utilities. Among the other existing utilities is a 60-inch water main and a 8-inch force main sanitary sewer in railroad right-of-way. The Town of Addison owns a 50 foot drainage easement on the south side of the railroad tracks and a 40 foot railroad and utility easement on the north side of the tracks. The existing 8-inch Rawhide Creek force main located along the north edge of the railroad could be abandoned and removed. The proposed sanitary sewer could be placed in the alignment of the force main. The flow in this force main will be collected at the Rawhide Creek Lift Station located approximately 400 feet east of the intersection of Beltline Road and Surveyor Blvd. There is adequate space to construct the proposed sewer in the abandoned alignment along the northside of the St. Louis and Southwestern Railroad for approximately 2480 feet to the west edge of Midway Road. The sewer would then be bored under Midway Road to the right lane of northbound Midway Road. To reduce the impact on the large number of businesses along this stretch of Midway Road, the sewer will run north in the inside lane for a distance of approximately 4820 feet to the northern curb of Keller Springs Road. At this point, Midway Road is located in the City of Carrollton. Therefore, the sewer will be placed outside the east curb and continue north for a distance of approximately 2100 feet to the Midway Meter Station on the east side of Midway Road. This will require easement acquisition in this area and/or use of the drainage right-of-way north of Kellway Circle.

For a lift station/force main alternative, it is desirable to locate the lift station near the low point of the system near Hutton Branch Creek and Kellway Circle to minimize the depth of the structure. The alignment plan sheets show a proposed location on Kellway Circle to avoid siting a lift station structure on Midway road where it would be more noticeable. This requires several small diameter sewer lines to intercept flow at the Midway Meter Station and the Kellway Circle area and convey flow to the lift station.

IV. LIFT STATION / FORCE MAIN SYSTEM ALTERNATIVE

One alternative for conveying Hutton Branch and Rawhide Creek drainage basin flow into the Marsh Lane Interceptor is with a combination lift station, force main and gravity system.

A. Force Main Sizing

The length of force main required on this project is approximately 2,500 linear feet. The selection of the force main was based on the following factors:

1. Provide a velocity capable of resuspending settled solids.
2. Cause minimum friction head loss within the design flow range so that the selected pumps can operate efficiently.

Using the above mentioned design criteria and given the disparity between initial peak flows (0.38 MGD) and ultimate peak flows (2.91 MGD), it is necessary to consider two parallel force mains. Since design flows are going to steadily increase, it is not desirable to optimize pipe size or pump selection on initial condition flows. For example, in order to obtain velocities above 3.5 FPS with the initial flow of 0.38 MGD, a 4-inch force main would be required. However, this would have to be paralleled within a few years.

It is more desirable to install a force main initially that will serve design flows for a 10 year period, if possible. From Table 3, this results in a design flow initially of about 1.0 MGD, which allows for an 8-inch force main to be installed. It does require a larger pump to be installed initially than that which is absolutely necessary in order to maintain velocities of 3.5 FPS minimum. However, it allows installation of a pump that will be in service closer to its useful life as opposed to installation of a temporary "throw away" pump. Therefore, the proposed phasing for a lift station alternative is as follows:

- Phase I - 8-inch force main with 1.0 MGD pumping capacity.
- Phase II- parallel 8-inch with a 12-inch force main and install 3.0 MGD pumping capacity.

Head requirements for the lift station are composed of two components, static head and frictional head losses within the pipe. The maximum static head is the difference in elevation between the "pump off" elevation in the wet well and the elevation at the point of discharge provided that there are no intermediate high points in the main that exceed the hydraulic grade line, the frictional head loss within the pipe is determined by the Hazen-Williams equation as follows:

$$h_f = \left(\frac{149 \times Q}{C \times D^{2.63}}\right)^{1.85}$$

where hf = frictional head loss in feet per 1000 feet of pipe
Q = discharge in gallons per minute
C = roughness coefficient
D = pipe diameter in inches

The selection of force main sizes is summarized in Table 4. It was determined that during Phase 1, when design flow is 1 MGD a 8 inch force main should be in service in order to maintain a velocity of at least 3.5 feet per second. During Phase 2, a parallel 12-inch force main will be put into service to handle the design flow. Profile for the proposed force main and gravity system is provided in Appendix A.

B. **Pump Selection**

The pumping requirements comprised of static head and friction headloss through the force main. The pumping units were selected to operate properly and efficiently under both new pipe (C=140) and old pipe (C=100) conditions. Figures 4 and 5 show the system head curve for different "C" values. Table 5 summarizes the selection of pumps for the two phases. Two 1.0 mgd pumps operating alternately at constant speeds were selected for the initial phase to provide a firm capacity of 1.0 mgd. For the final phase, two 1.8 mgd pumps and one 1.2 mgd pump operating at constant speed were considered. The 1.2 mgd pump was selected to meet the low flow and average flow conditions, and the 1.8 mgd pump would meet any additional pumping capacity required. The second 1.8 mgd. pump would operate as a back up. This combination of pumps would provide an optimal pumping capacity for the lift station while providing a firm capacity of 3.0 mgd with the largest pump out of service.

C. **Lift Station Sizing**

As discussed in the previous section, the range of peak flow to the lift station varies from 0.35 mgd in 1994 to 3.0 mgd in 2028. The design of the pump station was considered in two phases to optimize the operation of the pump station. In the initial phase (1994-2001), the pumps were selected to discharge a design flow rate of 700 gpm (1.0 mgd). During the second phase (2002-2044), the design flow rate was 2100 gpm (3.0 mgd). The design flow rate represents an estimated peak flow condition that has to be pumped from the lift station (Sta. 129+09 Elevation = 579.00) to the point of connection with the gravity system (Sta. 99+02 and Elevation = 637.47), approximately 3100 feet apart.

TABLE 4

FORCE MAIN SIZES (Length = 3100 ft.)

Q = 1.0 MGD

Pipe Size (Inches)	Velocity (fps)	Static Head (feet)	C = 140 Friction Loss (feet)	C = 140 Total Head (feet)	C = 120 Friction Loss (feet)	C = 120 Total Head (feet)
6	7.88	58.50	102.76	161.26	136.68	195.18
8	4.43	58.50	25.12	83.62	33.43	91.93
10	2.84	58.50	8.56	67.06	11.38	69.88

Q = 3.0 MGD

Pipe Size (Inches)	Q	Velocity (fps)	Static Head (feet)	C = 140 Friction Loss (feet)	C = 140 Total Head (feet)	C = 120 Friction Loss (feet)	C = 120 Total Head (feet)
8" & Parallel 10"	1.07	4.74	58.5	28.42	87.42	37.90	96.40
	1.93	5.48	58.5	28.76	87.26	38.10	96.60
8" & Parallel 12"	0.77	3.39	58.5	15.62	74.12	20.78	79.28
	2.24	4.40	58.5	15.46	73.96	20.56	79.06

FIGURE 4

SYSTEM HEAD CURVE FOR 8 INCH MAIN

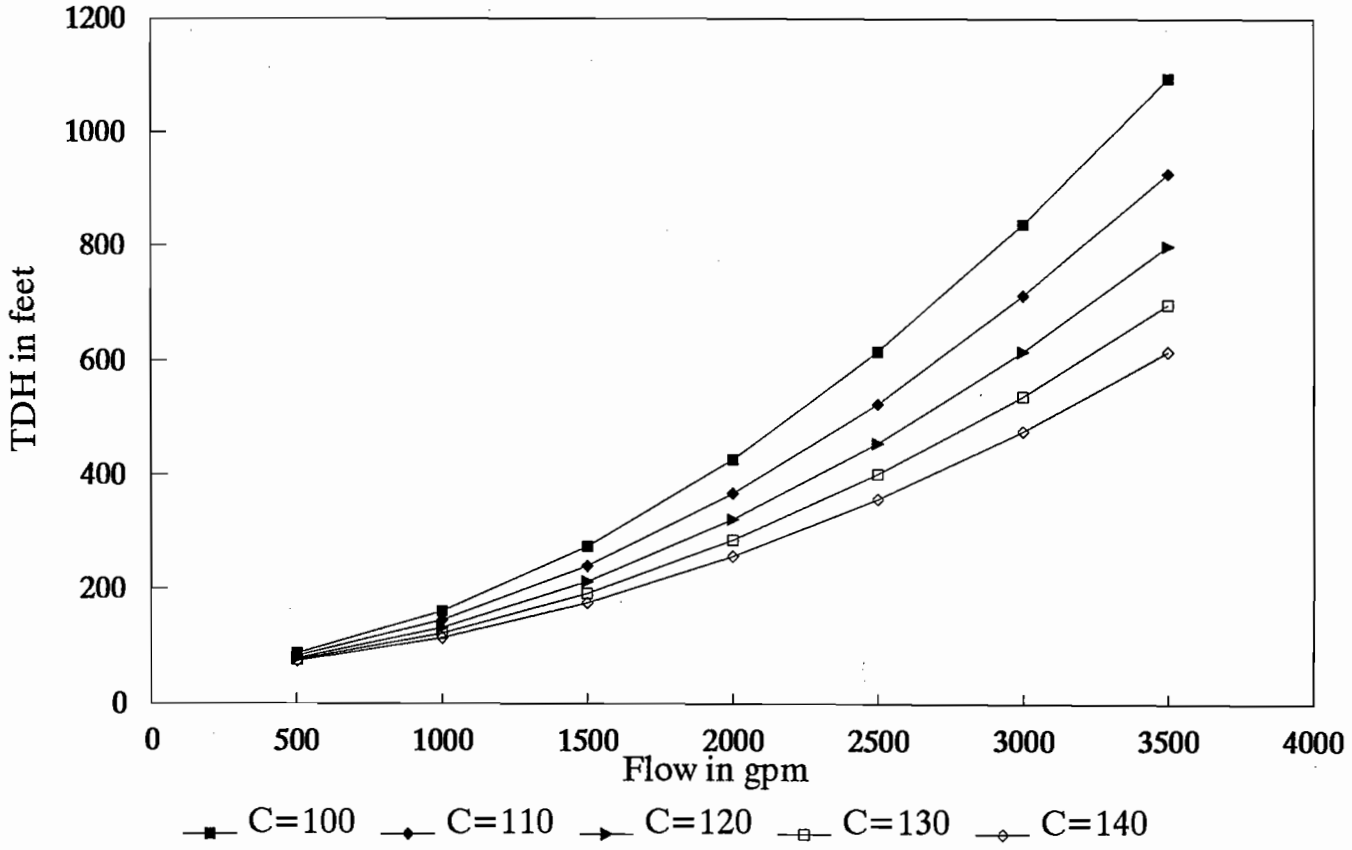


FIGURE 5

SYSTEM HEAD CURVE FOR 12 INCH MAIN

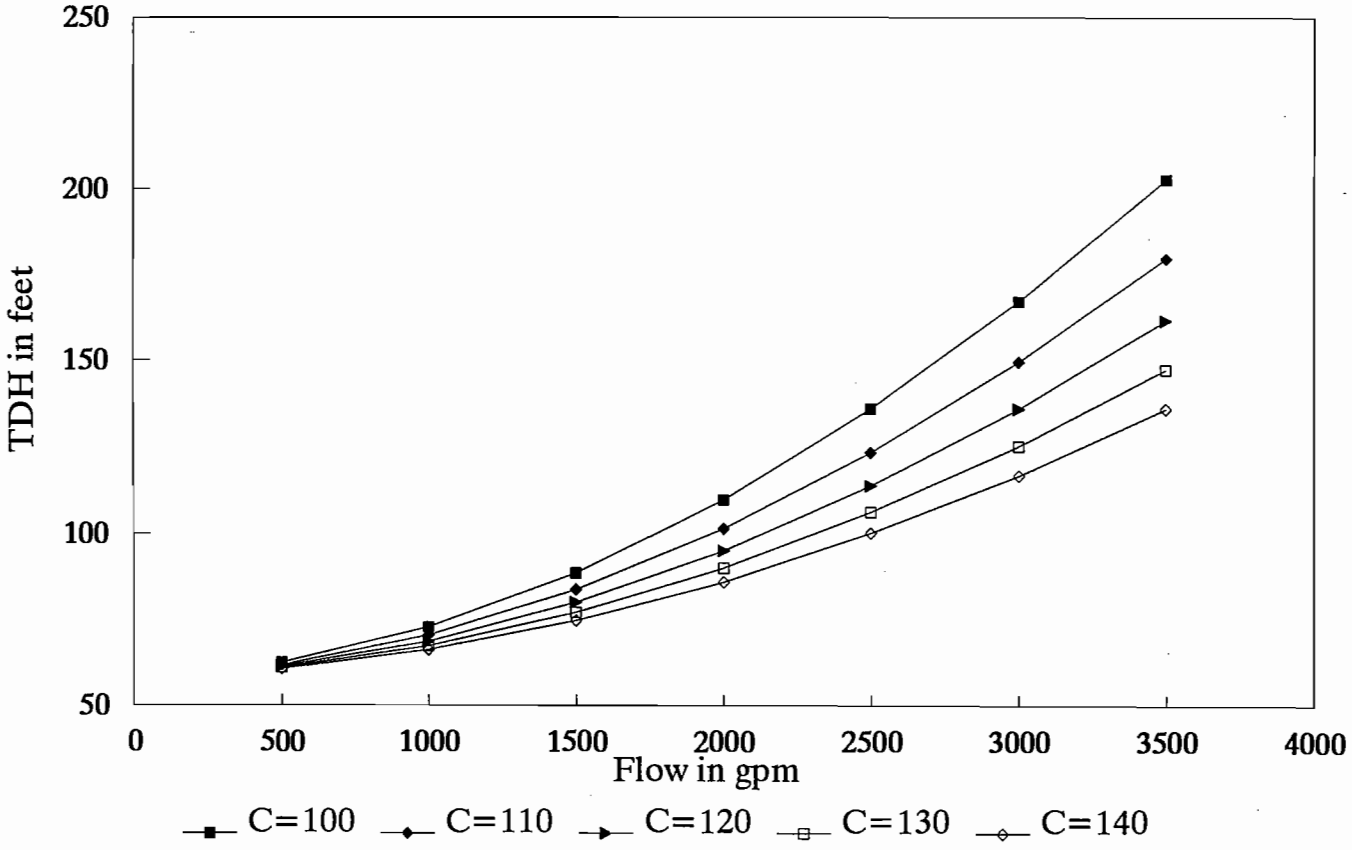


TABLE 5					
Phase 1	**Design Flow (MGD)**	**No. of Pumps**	**Pump Capacity (Each)**	**Head (Feet)**	**HP**
1994-2001	1.0	2	694 gpm	92	30
Phase 2	**Design Flow (MGD)**	**No. of Pumps**	**Pump Capacity**	**Head (Feet)**	**(HP)**
2002-2028	3.0	2	1249 gpm	94	50
		1	833 gpm	94	40

A wet pit/dry pit type of lift station was considered instead of a submersible lift station because it is typically easier to operate and maintain.

The wet well volume was based on requirements to prevent short-cycling of the pump and motor, to provide sufficient suction head for the pumping unit, and allow free discharge of the influent line. The most critical requirement was that of preventing frequent pump starts in order to prolong the life of the units. For pumping units that operate between 20 and 100 horsepower (the range of units required for this lift station), the time between starts of the motor or the "cycle time" should not be less than fifteen minutes.

The cycle time is a function of the pumping rate and the quantity of flow entering the station. The minimum wet well volume required for a single pump can be determined as follows:

$$V = TQ/4$$

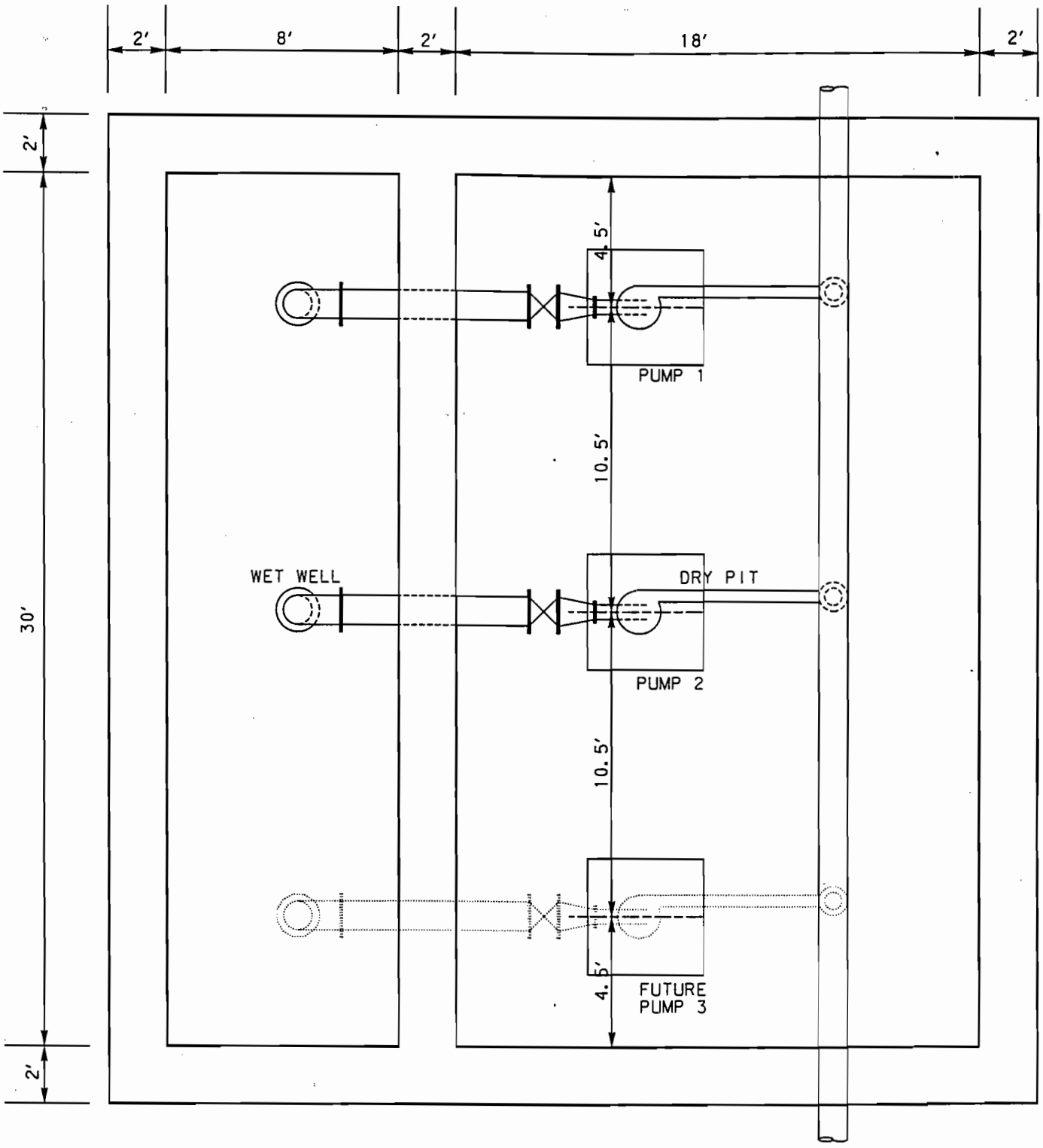
where,

V = Volume of wet well required in gallons,
T = minimum cycle time in minutes (15 minutes in this case),
Q = pump capacity in gallons/minute.

The volume of the wetwell was designed for a peak flow of 3.0 mgd with one 1.2 mgd pump and 1.8 mgd pump operating in combination to provide the design flowrate. The dimensions of the wet well and the operating depths for the pump combination are shown in Figures 6 and 7. In the sizing of the wet well, consideration was also given to the detention time of the wastewater at low flow conditions to avoid septic conditions to develop. During the initial phase, for the 1.0 mgd pump with an operating depth of 1.4 feet and an inflow of 0.07 mgd (minimum recorded flow), the detention time will be 52 minutes.

D. **Gravity Sewer Sizing**

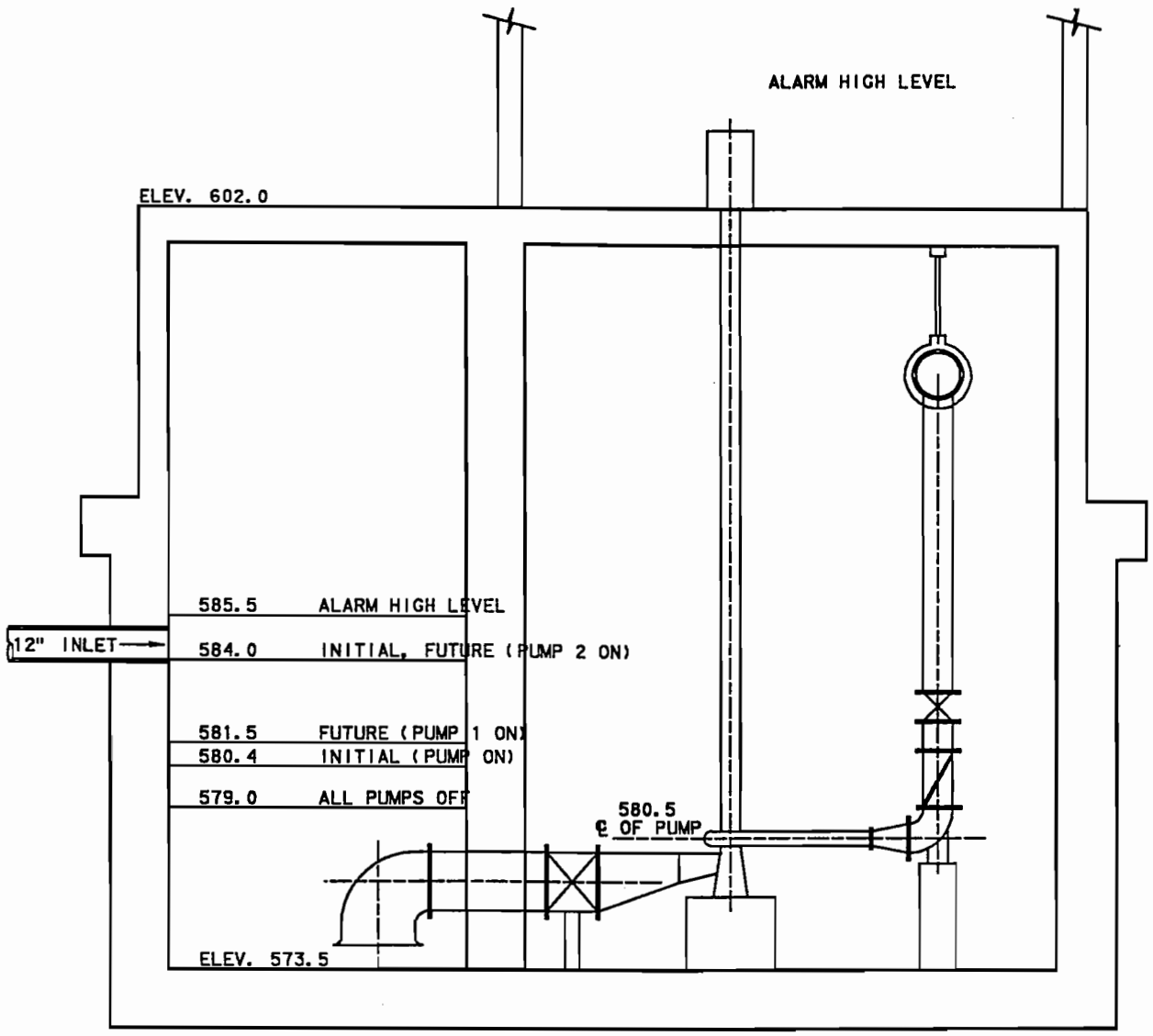
The proposed sewer is designed as a gravity system from Station 137+03 at elevation 604.30 to the point of discharge at elevation 551.76. The design of the gravity sewer is based on the following factors. (1) Maintaining a minimum velocity of 2.0 feet per second to prevent solids settling in the pipe during low flow periods and to prevent occurence of velocities greater than 10 feet per second at peak flows. (2) Provide a slope to minimize depth of cuts while maintaining adequate velocities along the length of the pipe. The gravity sewer design is based on Manning's Equation described as follows:



LIFT STATION PLAN

FIGURE 6

SCALE: 1" =5'



LIFT STATION SECTION

FIGURE 7

SCALE: 1"=6'

$$V = \frac{1.49}{n} R^{2/3} S^{1/2}$$

where

$$v = \text{velocity of flow in } \frac{ft}{sec}$$

$$n = \text{Manning's roughness coefficient}$$

$$r = \text{Hydraulic radius of pipe in feet}$$

$$s = \text{Slope of pipe in } \frac{ft}{ft}.$$

A Manning's "n" value of 0.013 was used in the design calculation. A profile of the combination lift station, force main and gravity sewer is provided in Appendix B.

V. GRAVITY ALTERNATIVE

The second alternative evaluated was a complete gravity system constructed by a combination of micro tunneling through the incline at Midway Road and open cut construction. The system would consist of 10,300 feet of 24" sanitary sewer pipe installed by micro tunnel and 3,400 feet by open cut. Permanent drop structures would be constructed at a maximum of 800 feet on center and at connections of some of the existing sanitary sewers. Micro tunneling would extend from station 124+00 to station 21+00 and reach depths up to 70 feet. At the station 21+00 the sanitary sewer would be installed by cut and cover construction for 2200 feet at a depth of less than 20 feet. A complete preliminary profile is provided in Appendix B.

A. Gravity Sewer Sizing

The sewer was designed as discussed in Section IV., using Manning's equation. A Manning's "n" value of 0.013 was used in the design. A pipe profile for this alternative is provided in Appendix C.

B. Method of Construction

Construction of the gravity system depends on the depth of sewer along the designated alignment discussed earlier. The profile of the proposed sewer is provided in Appendix C. Sewer at a depth greater than 20 feet was assumed to be installed by tunneling. Tunneling is anticipated to be performed from Sta. 124+00 to Sta. 21+00. At Sta. 21+00 the sewer will be at depths less

than 20 feet and the pipe installed by cut and cover construction. At road and railroad crossings the sewer will be bored under to reduce pavement cuts.

VI. LIFE CYCLE COST EVALUATION

In order to compare the two design alternatives, microtunnel or lift station, it was necessary to analyze the operating and maintenance costs as well as capital costs of each system over a 50 year period. All costs analyzed were related to construction, operation and maintenance of each system. The alternatives were compared based on total life cycle cost and present worth cost analysis. The cost for the lift station comprise of capital cost and annual costs, which include power cost, O&M cost and equipment replacement cost. For the micro tunnel alternative, the life cycle cost is essentially the construction cost. Maintenance costs for the gravity feed system are considered negligible and were not considered in the cost analysis.

A. Lift Station/Force Main System Alternative

1. Capital Costs

Capital cost for this alternative includes construction of the lift station and the force main with all the required appurtences. The construction estimate for the lift station is provided in Table 6. The total construction cost for the force main/gravity sewer alternative was estimated to be $2,763,118. The details of the cost estimate are presented in Table 7.

2. Annual Costs

a. Pumping Power Cost --Cost of electricity used is 7¢/kilowatt hour, based on current local rates of similar lift stations. Horsepower requirement (i.e., kilowatts) is based on total dynamic pumping head for average flow conditions. The annual volume pumped is increased from the existing annual average flow (Section 2.1) in equal yearly increments to the ultimate average design flow in the year 2028 and maintained constant thereafter. The cost of electricity is increased at a rate of 4% per year. Appendix C provides the calculations used to determine the power cost per year based on the projected average flow per year. The estimated annual power cost for the life cycle of the project is presented in Table 8. The energy cost or the "pumping cost" for the 50 year design period are estimated to be $4,751,104.

TABLE 6
CONSTRUCTION ESTIMATE
FOR LIFT STATION

ITEM	QUANTITY	UN	DESCRIPTION	COST/UNIT	TOTAL COST
1	1900	CY	EXCAVATION	$5.00	$ 9,500.00
2	2000	SF	SHORING	10.00	20,000.00
3	100	CY	CONC. FLOOR	200.00	20,000.00
4	228	CY	CONC. WALLS	350.00	79,800.00
5	45	CY	CONC. TOP SLAB	350.00	15,750.00
6	10	CY	CONC. BEAMS	400.00	4,000.00
7	2	EA	1.0 MGD PUMP	15,000.00	30,000.00
8	1	LS	DEWATERING	10,000.00	10,000.00
9	765	SF	SUPER STRUCTURE	70.00	53,550.00
10	1	LS	STAIRS AND PLATFORMS	3,000.00	3,000.00
11	1	LS	HVAC SYSTEM	7,000.00	7,000.00
12	1	LS	SITE WORK	7,000.00	7,000.00
13	1	LS	ELECTRICAL AND INSTRUM	20,000.00	20,000.00
14	1	LS	PIPING AND VALVES	25,000.00	25,000.00
			TOTAL		**$ 304,600.00**

TABLE 7
CONSTRUCTION ESTIMATE FOR
LIFT STATION AND FORCE MAIN ALTERNATIVE

ITEM NO.	QUANTITY	UNIT	DESCRIPTION	COST/UNIT	TOTAL COST
1	3925	LF	FURNISH AND INSTALL 24" DIAMETER GRAVITY SEWER PIPE @ 10'-15' DEPTH	$125.00	$490,625.00
2	2790	LF	FURNISH AND INSTALL 21" DIAMETER GRAVITY SEWER PIPE @ 10'-15' DEPTH	$120.00	$334,800.00
3	3200	LF	FURNISH AND INSTALL 18" DIAMETER GRAVITY SEWER PIPE @ 10'-20' DEPTH	$115.00	$368,000.00
4	3100	LF	FURNISH AND INSTALL 12" DIAMETER FORCE MAIN COMPLETE	$65.00	$201,500.00
5	3100	LF	FURNISH AND INSTALL 8" DIAMETER FORCE MAIN COMPLETE	$55.00	$170,500.00
6	300	LF	FURNISH AND INSTALL 36" STEEL CASING BY BORE	$300.00	$90,000.00
7	500	LF	FURNISH AND INSTALL 30" STEEL CASING BY BORE	$275.00	$137,500.00
8	20	EA	FURNISH AND INSTALL 5.0' DIAMETER MANHOLES @ 5'-10' DEPTH COMPLETE	$3,000.00	$60,000.00
9	2	EA	FURNISH AND INSTALL COMPLETE AIR RELEASE VALVES	$2,200.00	$4,400.00
10	7000	SY	REMOVE AND REPLACE PAVEMENT	$50.00	350,000.00
11	1	LS	FURNISH AND INSTALL 3.5 MGD LIFT STATION COMPLETE WITH PUMPS, PIPING, VALVES, ELECTRICAL AND INSTRUMENTATION COMPLETE	$304,600.00	304,600.00
			SUBTOTAL		**2,511,925.00**
			10% CONTINGENCY		**251,192.50**
			TOTAL CONSTRUCTION COST		**$ 2,763,117.50**

NOTE: ITEM NUMBER 4, THE 12" FORCE MAIN IS ESTIMATED AT A LOWER RATE SINCE IT WOULD BE INSTALLED IN THE SAME EXCAVATION AS ITEM NUMBER 5 THE 8" FORCE MAIN.

b. Operation and Maintenance Costs--Cost for lift station maintenance was calculated based on 5 percent of the total equipment cost per year. The maintenance costs were projected for a 50 year period at an inflation rate of 4.5% per year. The lift station maintenance cost do not include pump replacement cost. Annual labor cost for the operation of the lift station was calculated based on 8 hours of maintenance per week at a rate of $45 per hour. Operational cost was increased at a rate of 6% per year. The annual maintenance and operational cost from year 1994 to 2044 is provided in Table 8. The life cycle cost of maintenance and operations are estimated at $646,934 and $5,795,792 respectively.

c. Equipment Replacement Costs

As discussed in Section IV, the 2 initial 1.0 MGD pumps must be replaced with higher two-1.8 MGD and one-1.2 MGD pumps to meet the increased flow to the lift station in the future. Pumps must be replaced in the year 2001. It is assumed that the pumps have a life time of 20 years and have to be replaced in the years 2021 and 2041 during the 50 year period. The present cost for equipment replacement was estimated to be $86,900. An inflation rate of 4.0% per year was applied to the present cost of the pumps to estimate the cost of replacing the equipment.

B. Gravity Alternative

The construction cost for this alternative include the cost of installing pipe by tunnelling at depths greater than 20 feet and by cut and fill at stretches of lower depths. The details of the cost estimate is provided in Table 9. The total cost of construction was estimated at $4,974,772.

C. Opinion of Probable Cost

The capital cost for the lift station/gravity sewer alternative and the microtunnel alternative are $2,763,118 and $4,974,772, respectively. The total project life cycle cost for capital cost, O&M costs, energy cost and replacement cost for the lift station alternative is $14,972,622.

A present worth cost analysis was done to compare the two alternatives. The analysis period for the project was 50 years and an interest rate 6% was applied to the total life cycle annual costs. Details of the analysis are presented in Table 10. The present worth expense for the lift station alternative was $3,425,952 and for the microtunnel alternative was $4,974,772.

TABLE 8

LIFT STATION – GRAVITY SEWER ALTERNATIVE
ANNUAL COST ESTIMATE FOR POWER, O&M COSTS

Present Worth Interest Rate	6.0%
Replacement Inflation Rate	4.5%
Operation Cost Inflation Rate	6.0%
Maintenance Cost = % of Equipment Cost	4.0%
Maintenance cost inflation rate	4.5%
Total Eqipment Cost	$71,500
Equipment Replacement Cost	$86,900

	Year	Power Cost	Maintenance Cost	Operations Cost	Total Annual Cost
1	1994	$1,633	$2,860	$18,771	$23,265
2	1995	$2,259	$2,989	$19,898	$25,145
3	1996	$2,943	$3,123	$21,092	$27,157
4	1997	$3,689	$3,264	$22,357	$29,310
5	1998	$4,503	$3,411	$23,698	$31,612
6	1999	$5,389	$3,564	$25,120	$34,074
7	2000	$6,353	$3,724	$26,628	$36,705
8	2001	$7,399	$4,730	$28,225	$40,355
9	2002	$8,534	$4,943	$29,919	$43,396
10	2003	$9,765	$5,166	$31,714	$46,644
11	2004	$11,096	$5,398	$33,617	$50,111
12	2005	$12,537	$5,641	$35,634	$53,812
13	2006	$14,094	$5,895	$37,772	$57,761
14	2007	$15,775	$6,160	$40,038	$61,973
15	2008	$17,589	$6,437	$42,440	$66,467
16	2009	$19,545	$6,727	$44,987	$71,259
17	2010	$21,653	$7,030	$47,686	$76,369
18	2011	$23,923	$7,346	$50,547	$81,816
19	2012	$26,365	$7,677	$53,580	$87,622
20	2013	$28,992	$8,022	$56,795	$93,809
21	2014	$31,816	$8,383	$60,203	$100,402
22	2015	$34,850	$8,760	$63,815	$107,425
23	2016	$38,107	$9,155	$67,644	$114,905
24	2017	$41,603	$9,567	$71,702	$122,872
25	2018	$45,354	$9,997	$76,004	$131,355
26	2019	$49,375	$10,447	$80,565	$140,387
27	2020	$53,686	$10,917	$85,398	$150,001
28	2021	$58,303	$11,408	$90,522	$160,234
29	2022	$63,249	$11,922	$95,954	$171,124
30	2023	$68,543	$12,458	$101,711	$182,712
31	2024	$74,208	$13,019	$107,814	$195,041
32	2025	$80,269	$13,605	$114,282	$208,156
33	2026	$86,750	$14,217	$121,139	$222,106

	Year	Power Cost	Maintenance Cost	Operations Cost	Total Annual Cost
34	2027	$93,679	$14,857	$128,408	$236,943
35	2028	$104,279	$15,525	$136,112	$255,916
36	2029	$109,493	$16,224	$144,279	$269,996
37	2030	$114,968	$16,954	$152,936	$284,857
38	2031	$120,716	$17,717	$162,112	$300,545
39	2032	$126,752	$18,514	$171,838	$317,104
40	2033	$133,090	$19,347	$182,149	$334,585
41	2034	$209,616	$20,218	$193,078	$422,912
42	2035	$220,097	$21,127	$204,662	$445,887
43	2036	$231,102	$22,078	$216,942	$470,122
44	2037	$242,657	$23,072	$229,959	$495,687
45	2038	$254,790	$24,110	$243,756	$522,656
46	2039	$267,529	$25,195	$258,381	$551,106
47	2040	$280,906	$26,329	$273,884	$581,119
48	2041	$294,951	$27,513	$290,317	$612,782
49	2042	$309,699	$28,752	$307,736	$646,187
50	2043	$325,184	$30,045	$326,201	$681,430
51	2044	$341,443	$31,397	$345,773	$718,613
Life Cycle Cost		$4,751,104	$646,934	$5,795,792	$11,193,831
Present Worth		$257,930	$35,121	$314,644	$607,695

TABLE 9
CONSTRUCTION ESTIMATE
MICRO TUNNEL GRAVITY SYSTEM

ITEM NO.	QUANTITY	UNIT	DESCRIPTION	COST/UNIT	TOTAL COST
1	10,240	LF	FURNISH AND INSTALL 24" DIAMETER SEWER BY MICRO TUNNEL COMPLETE WITH SHAFT EXCAVATION & SHORING AT 400' O.C.	$ 375.00	$3,840,000.00
2	14	EA	FURNISH AND INSTALL JACKING PITS AND 6' M.H.	$6,000.00	$ 84,000.00
3	2180	LF	FURNISH AND INSTALL 24" DIAMETER GRAVITY SEWER PIPE @ 10'-20' DEPTH	$ 125.00	$ 272,500.00
4	1300	LF	FURNISH AND INSTALL 15" DIAMETER PIPE @ 10'-20' DEPTH	$ 70.00	$ 91,000.00
5	250	LF	FURNISH AND INSTALL 36" DIAMETER STEEL CASING BY BORE	$ 300.00	$ 75,000.00
6	9	EA	FURNISH AND INSTALL 5.0' DIAMETER MANHOLES @ 10' - 15' DEPTH COMPLETE	$ 2,780.00	$ 25,020.00
7	3000	SY	REMOVE AND REPLACE PAVEMENT	$ 45.00	$ 135,000.00
			SUBTOTAL		**4,522,520.00**
			10% CONTINGENCY		**452,252.00**
			TOTAL CONSTRUCTION COST		**$4,974,772.00**

An annual payment analysis was also conducted for the two alternatives. The annual capital disbursement or payment was estimated at an interest rate of 4.5% for a period of 20 years. The annual bond payment for the lift station alternative is $212,418 and for the microtunnel option is $382,441. For comparison of the two alternatives, allocation for power and operations and maintenance and replacement costs were made. The annual cost allocation were estimated at 45% for 50 years. The total annual capital allocation for the lift station/gravity sewer alternative is $245,959 and for the microtunnel alternative is $382,441. An annual payment schedule for the two alternatives from 1994 to 2044 is presented in Table 11. For the micro tunnel alternative, debt retirement was considered and for the lift station/gravity sewer alternative, total payment included debt reitrement, power and O&M costs, and annual allocation for equipment replacement.

TABLE 10

COMPARISON OF OPINION OF PROBABLE COST FOR THE TWO ALTERNATIVES

	LIFT STATION/GRAVITY SEWER	MICRO TUNNEL
LIFE CYCLE COST ANALYSIS		
Initial Capital Cost	$2,763,118	$4,974,772
Life Cycle Replacement Cost for 50 years	$1,015,674	–
Life Cycle Annual Cost for 50 years	$11,193,831	–
Total Life Cycle Cost	$14,972,622	$4,974,772
PRESENT WORTH COST ANALYSIS		
Present Worth Cost for Capital Cost	$2,763,118	$4,974,772
Present Worth Cost for O&M	$607,695	–
Present Worth Cost for Replacements	$55,139	–
Total Present Worth Cost	$3,425,952	$4,974,772
ANNUAL PAYMENT ANALYSIS		
Initial Capital Cost	$2,763,118	$4,974,772
Interest rate for bond	4.50%	4.50%
No:of years	20.00	20.00
Capital recovery factor	0.0769	0.0769
Annual Bond Payment for 20 years	$212,418	$382,441
Present Worth Cost for O&M	$607,695	–
Interest rate	4.50%	
No:of years	50.00	
Capital recovery factor	0.0506	
Annual O&M Cost Allocation for 50 years	$30,751	–
Present Worth Cost for Replacements	$55,139	–
Interest rate	4.50%	
No:of years	50.00	
Capital recovery factor	0.0506	
Annual Replacement Cost Allocation for 50 years	$2,790	–
Total Annual Payment	$245,959	$382,441

APPENDIX A