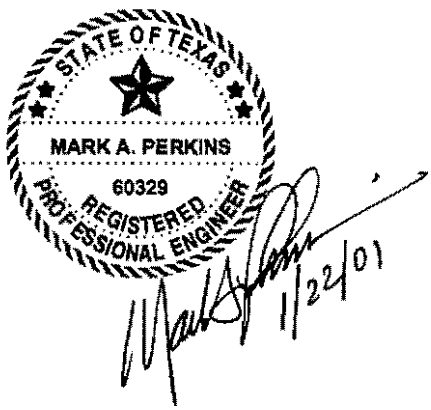
Trinity River Authority of Texas

Central Regional Wastewater System

2001 Five-Year Plan Update and Summary of Proposed Capital Improvements



January 2001

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30112300

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January 22, 2001

Mr. B. Randy Brooks, P.E.
Manager, Wastewater Services Planning
Northern Region
Trinity River Authority of Texas
P.O. Box 240
Arlington, Texas 76004-0240

Re: Central Regional Wastewater System
2001 Five-Year Plan Update

Dear Mr. Brooks:

We are pleased to present the enclosed report entitled 2001 Five-Year Plan Update and Summary of Proposed Capital Improvements for the Authority's Central Regional Wastewater System. This report summarizes the results of a number of previous planning and design efforts, and defines the proposed capital improvements program for the Central System.

Numerous construction projects totaling $74.8 million are recommended for funding under this capital improvement program. The majority of these funds (approximately $50 million) are for interceptor relief and rehabilitation improvements. This report also outlines anticipated project costs to be funded through a subsequent bond series in 2003.

The participation of numerous staff members throughout the Authority's organization has been vitally important in this planning effort and is sincerely appreciated. We appreciate the opportunity to serve the Authority on this project.

Sincerely,

ALAN PLUMMER ASSOCIATES, INC.

Mark A. Perkins, P.E.
Principal
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Enclosures

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CHAPTER I
Executive Summary

Background and History

As a scheduled milestone in the Trinity River Authority's continued long-term planning efforts for the Central Regional Wastewater System (CRWS), a "Five-Year Plan" was commissioned in 1992 to identify, prioritize and plan for major system wide improvements needed during the time period from 1992 until 1996. The 1992-1996 Five-Year Plan identified dozens of rehabilitation and upgrade needs. The Plan prioritized projects for funding through both bond sales and annual operation and maintenance expenditures.

The 1992 Five-Year Plan proposed two major bond sales for financing of major capital improvements system wide. The first of these bond sales (1992 series) funded capital improvements totaling $28.58 million and the second bond sale (Series 1995) funded capital improvements totaling $37.9 million. Projects funded under these bonds have been completed. In 1998, the Authority updated the 1992 Five Year Plan Update to reflect system needs from the years 1998 through 2002. The 1998 Five Year Plan Update outlined a program of capital improvements involving 87 "projects", to be funded through bond sales in 1998 and 2001 to meet system needs from the years 1998 through 2002. The 1998 Bond Issue funded approximately 48 projects totaling $49 million.

The majority of the projects funded through the first (1998) bond program are either completed or underway. Projects proposed for funding under the second (2001) bond program are now needed and are proposed for capital funding at this time.

This document updates the 1998 Five Year Plan Update and outlines a program of capital improvements involving 58 "projects" to be developed for the next five years. The first group of these projects (approximately 45 projects totaling $74.8 million) is proposed for funding through a Series 2001 revenue bond sale.

Objective

The objective of this report is to update the 1998 Five Year Plan Update by summarizing the need and projected cost for proposed capital improvements in the following areas:

- Interceptor relief improvements
- Rehabilitation improvements
- Erosion control
- I & I management and maintenance activities
- Treatment plant improvements
- Meter station improvements
- Other capital improvements

Capital improvements totaling approximately $ 74.8 million are recommended for funding in the Authority's proposed Series 2001 revenue bond program. Additional capital improvements totaling $89.1 million are anticipated in a future bond program expected to be initiated in approximately 2003.

Key Findings and Recommendations

The key findings and recommendations of this report are summarized below:

Population and wastewater flow projections The population and wastewater flow system rates within the Central Regional Wastewater System appear to be increasing generally in accordance with projected rates.

Interceptor Relief Improvements The Authority's 1996 comprehensive infiltration/inflow assessment identified a number of priority interceptor relief projects for implementation. Several of these projects were funded through the Series1998 bond program. Action is now recommended on a total of 17 major pipeline segments totaling approximately 30 miles during the next five years. Approximately $107.4 million is anticipated to be needed for these proposed improvements. Of this amount, approximately $45 million is recommended for inclusion in the proposed Series 2001 bond program.

Interceptor Rehabilitation Improvements Funding for rehabilitation of older interceptor pipelines totaling $7.3 million is anticipated to be needed during the next five years. Of this amount, $4.8 million is recommended for inclusion in the proposed Series 2001 bond program.

Erosion Control Improvements The Authority currently operates approximately 200 miles of major interceptor pipelines, a significant portion of which lies in or adjacent to creek and river banks. The Authority currently monitors over 30 sites where erosion of the creek banks is suspected to be advancing toward the Authority's pipelines at various rates. The Authority routinely implements corrections at a number of these sites using its own personnel and equipment. More substantial improvements are recommended for capital funding. Total erosion control improvements of $867,000 are recommended for capital funding within the next five years. It is recommended that $347,000 of this amount be included in the proposed Series 2001 bond.

I & I Management and Maintenance Activities The Authority's comprehensive 1996 inflow/infiltration assessment recommended a number of system wide planning, inspection, and major pipeline maintenance activities for implementation. A number of these activities are proposed for implementation by CRWS personnel using operation and maintenance funding. A total of $3.4 million is recommended for capital funding, with $2.4 million recommended for inclusion in the 2001 bond program.

Treatment Plant Improvements Through on-going engineering and planning efforts, and through internal efforts directed toward operational cost containment, a number of internal improvements to the Authority's CRWS treatment plant have been proposed. These recommended improvements are anticipated to total $ 36.7 million in the next five years, with approximately $ 15 million of this amount proposed for funding in the 2001 bond series. The majority of the projects proposed for initial funding are directed toward

replacement of aging equipment, continuing odor reduction, and improvements to enhance the plant's energy efficiency.

Meter Station Improvements The Authority operates approximately 128 metering stations within its 200 mile collection system. These meters are used to proportionally allocate service costs among the system's customer cities. In order to maintain the accuracy, structural integrity, and accessibility of these remote meter stations, improvements are proposed at approximately seven sites, totaling approximately $480,250 for inclusion in the Series 2001 bond program.

Other Capital Improvements Other capital improvements include long-range planning efforts and planned pipeline relocations to accommodate the needs of the Texas Department of Transportation and other entities. These improvements total $3.0 million with $1.8 million recommended for inclusion in the Series 2001 bond program.

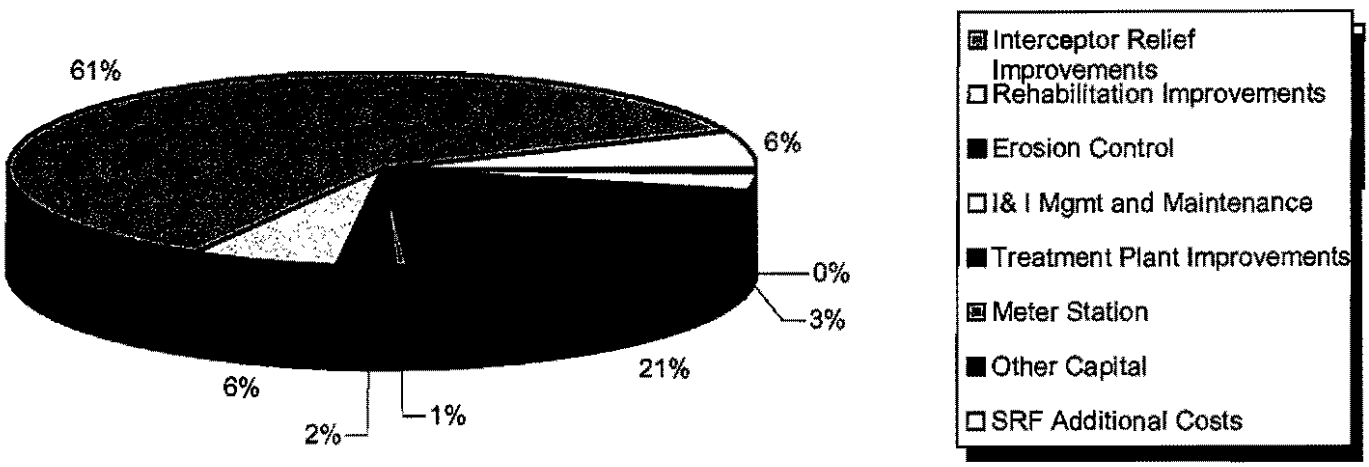
SRF Additional Costs The Series 2001 bond program includes $4,830,000 for escalation, environmental assessments, program management costs, and other costs attributable to SRF funding requirements.

Cost Distribution Summary - 2001 Bond

This report provides a detailed listing of proposed improvements to be funded through the Series 2001 bond. Capital improvements totaling approximately $74.8 million are recommended for funding in the Authority's proposed Series 2001 revenue bond program. The major improvement areas and projected costs for construction and inspection are presented in the table to the right and in the pie chart below. The improvements are detailed in subsequent chapters.

Cost Distribution Summary for 2001 Bond Series

Capital Improvements	TOTAL for 2001 Bond
Interceptor Relief Improvements	$ 45,053,400
Rehabilitation Improvements	$ 4,822,000
Erosion Control Improvements	$ 347,000
I& I Management and Maintenance Activities	$ 2,385,000
Treatment Plant Improvements	$ 15,009,000
Meter Station Improvements	$ 480,250
Other Capital Improvements	$ 1,835,000
SRF Additional Costs	$ 4,830,000
Totals	$ 74,761,650



CHAPTER II
Introduction

Background

The Trinity River Authority's Central Regional Wastewater System is a large regional wastewater system currently serving approximately one million customers in Dallas, Tarrant, Ellis, Johnson, and Denton counties of north central Texas. The service area encompasses all or portions of 20 cities in the Dallas/Fort Worth Metroplex, as well as the Dallas/Fort Worth International Airport. This system consists of an extensive regional interceptor network and a large activated sludge wastewater treatment plant currently permitted to treat a monthly average of 162 million gallons per day (MGD). In 1992, the Authority completed a planning effort commonly referred to as the "Five-Year Plan" for the Central Regional Wastewater System. Development of this plan was a scheduled milestone in the Authority's continued long-term planning efforts for the system.

The 1992 Five-Year Plan identified numerous improvements needed throughout the Authority's collection system and for the treatment plant. These improvements were prioritized for implementation under two planned bond issues. The first of these bond issues (1992 issue) funded over 50 projects totaling $28.6 million. The second bond issue (1995 issue) funded over 30 projects totaling approximately $37.9 million. All major projects identified for funding under these two bond issues have been completed, and a subsequent capital improvement program has been implemented. In 1998, the Authority updated the 1992 Five-Year Plan. The 1998 Five Year Plan Update outlined a program of capital improvements involving 87 "projects", to be funded through bond sales in 1998 and 2001 to meet system needs from the years 1998 through 2002. The 1998 Bond Issue funded approximately 48 projects totaling $49 million. Many of these projects are either completed or underway. Projects proposed for funding under the second (2001) bond program are now needed and are proposed for capital funding at this time.

Objectives

This 2001 Update to the Five Year Plan presents detailed listings of needed system improvements in a number of areas. These areas include:

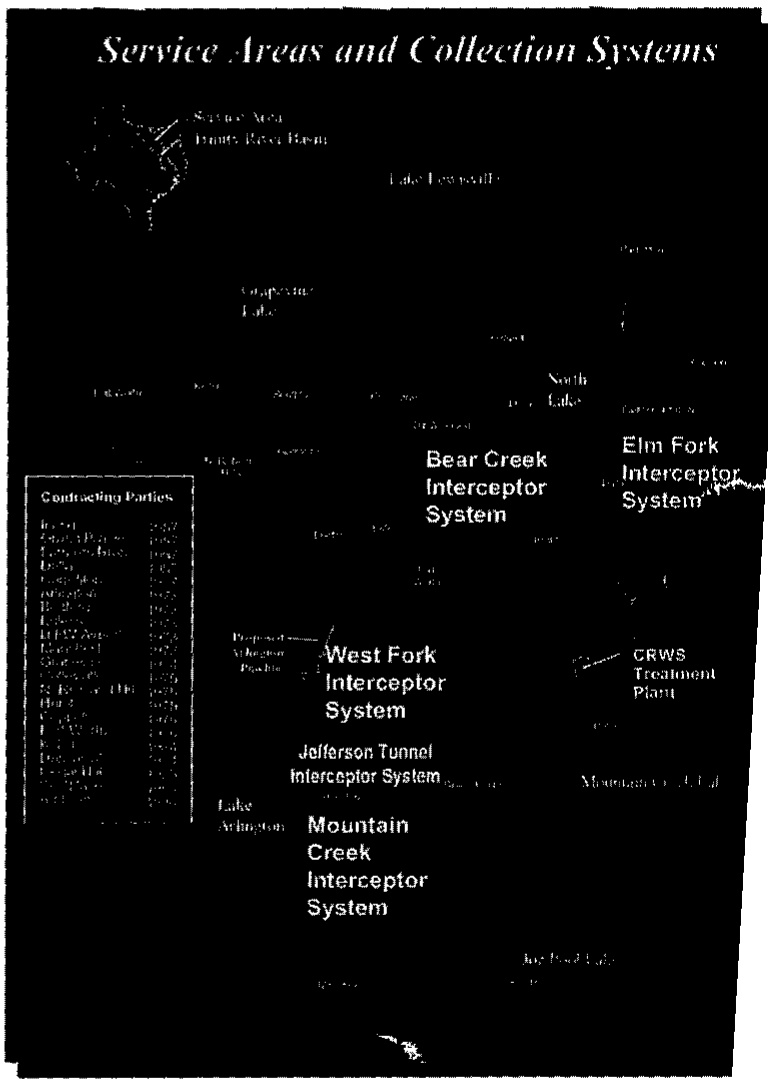
- Interceptor relief improvements
- Rehabilitation improvements
- Erosion control improvements
- Inflow and infiltration (I&I) management and maintenance activities
- Treatment plant improvements
- Meter station improvements
- Other capital improvements

Probable costs for needed improvements are presented in subsequent chapters for each of these areas. Those improvements with the highest priority are identified for funding in a proposed series 2001 revenue bond program. The remaining improvements are identified for funding in a future bond program anticipated to be implemented in approximately the year 2003.

Service Area

The Central Regional Wastewater System currently serves an area of approximately 467 square miles which encompasses portions of the Elm Fork and Lower West Fork watersheds of the Trinity River. The majority of the service area lies in Tarrant and Dallas counties, with some service to portions of Ellis, Johnson, and Denton counties.

The figure to the right shows the treatment plant location and the approximate boundaries of this system's service area. The service area is bounded to the east and west by contractually established service areas within the cities of Dallas and Fort Worth. The system includes approximately 128 meter stations distributed throughout its 200-mile regional interceptor system.



Each customer entity operates its own internal collection system within the city boundaries and has its flow to the regional interceptor system metered (or otherwise accounted for) for proportionate allocation of system costs. The service area includes all or portions of the following entities: Addison, Arlington, Bedford, Carrollton, Cedar Hill, (partially served), Colleyville, Coppell, Dallas (partially served), DFW International Airport, Duncanville (partially served), Euless, Farmers Branch, Fort Worth (partially served), Grand Prairie, Grapevine (partially served), Hurst (partially served), Irving, Keller (partially served), Mansfield, North Richland Hills (partially served), Southlake (partially served).

Regional planning efforts conducted by the North Central Texas Council of Governments, which included input from surrounding local government entities, indicate that very few major service area boundary extensions are anticipated in the foreseeable future.

Population and Flow Projections

Population and wastewater flow projections for the Central System were developed in 1992 as part of the five-year planning effort.

The population projections for the served areas within each contracting city are detailed in the table to the right. These projections reflect final 1990 census figures and detailed service area delineations developed through the Authority's Interceptor Management Plan. Projected future populations are based on estimates prepared by the North Central Texas Council of Governments (NCTCOG). It is noted that the current service area population estimates are reasonably consistent with projections prepared in 1992. Current NCTCOG projections, however, suggest that year 2010 service area populations may be slightly higher than projected in 1992. These updated population projections have been broken down by individual sewer shed and are presented in that format in the Authority's Interceptor Management Plan.

Population Projections for CRWS Membe

City	Note	1990 Census	Projected Popul	
		1990 Census	1995	2000
Addison	1	8,477	10,686	12,895
Arlington	4	155,375	170,511	318,400
Bedford		40,970	42,422	43,874
Carrollton		81,828	93,685	105,830
Cedar Hill	1	1,526	1,993	2,460
Colleyvillle		12,654	17,900	23,490
Copell		16,799	20,131	23,463
Dallas	1	33,714	34,178	34,642
DFW International Airport		15,500	18,800	22,100
Duncanville	1	2,685	2,932	3,179
Euless		37,989	41,029	44,069
Farmers branch		24,091	24,124	24,158
FortWorth	1	5,071	5,334	5,597
Grand Prairie		99,073	107,000	115,140
Grapevine	1	13,113	16,151	19,189
Hurst	1	3,815	3,818	3,820
Irving		154,495	161,419	168,344
Keller	1	11,266	16,222	21,178
Mansfield		14,020	15,600	17,780
N. Richland Hills	1	3,424	3,884	4,34
Southlake	1	2,240	3,436	4,63
Miscellaneous	2	3,759	4,131	5,16
TOTALS		741,884	815,386	1,023,74

Notes:

1: Populations shown are for only that portion of the City served by the CR of each City served by the CRWS in 1995, 2000, 2010 is assumed to be fraction calculated for that City in 1990.

2: Populations designated as "Miscellaneous" represent those areas with associated with a particular customer(s) in the GIS database or known CRWS service area growth rates were assumed to parallel average gro the remainder of the service area.

3: Total City population data were developed by NCTCOG and are base census data.

4: Year 2000 and 2010 population projections are total city population p

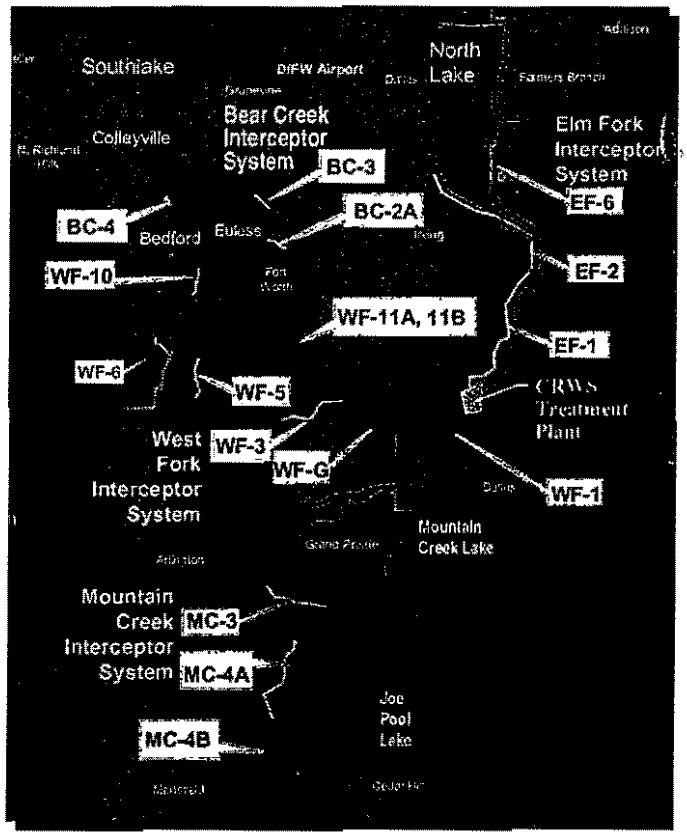
CHAPTER III
Interceptor Relief Improvements

Introduction

The Authority currently owns and operates approximately 200 miles of interceptors within the Central Regional Wastewater System. A comprehensive infiltration and inflow (I&I) assessment was completed by the Authority and its consultant (Black and Veatch, Corporation) in 1996. This comprehensive planning effort identified and prioritized interceptor relief improvements needed system-wide. The investigation formed the basis for proceeding with detailed design and easement acquisition for a number high priority projects, and continues to form the basis for proceeding with a number of major relief improvements.

2001 Bond Program Ten interceptor relief improvement projects are proposed for the 2001 bond program including relief improvements to each of the four interceptor systems. The approximate locations of the proposed improvements to be funded under the series 2001 and 2003 bonds are shown in the figure to the right.

2003 Bond Program Twelve interceptor relief improvement projects are proposed for the future 2003 bond program. These projects are continuations of projects initially funded in one of the previous bond series.



Interceptor Relief Improvements

The following table provides an opinion of probable cost for each of the proposed interceptor relief projects for both the current (Series 2001) bond program and for the proposed future (Series 2003) bond programs.

Interceptor Relief Improvements										
	2001 Bond Series					2003 Bond Series				
Segment	Engineering Surveying	Land Rights	Construction	Inspection	TOTAL for 2001 Bond	Engineering Surveying	Land Rights	Construction	Inspection	TOTAL for 2003 Bond
BC-2A						$ 42,000	$ 56,000			$ 98,000
BC-3						$ 57,300	$ 76,400			$ 133,700
BC-4	$ 8,700				$ 8,700	$ 17,400	$ 34,800	$ 174,000	$ 6,960	$ 233,160
EF-1	95 bond	'95						$ 14,000,000	$ 600,000	$ 14,600,000
EF-2	95 bond	'95						$ 20,500,000	$ 840,000	$ 21,340,000
EF-6	98 bond	'98						$ 5,000,000	$ 250,000	$ 5,250,000
MC-3	$ 205,650				$ 205,650		$ 274,200	$ 1,371,000	$ 54,840	$ 1,700,040
MC-4A	98A bond	'98B	$10,000,000	$ 500,000	$10,500,000					
MC-4B	98A bond	'98B	$ 9,000,000	$ 380,000	$ 9,380,000					
WF-1	98 bond	'98	$19,600,000	$ 980,000	$20,580,000					
WF-3	98 bond	'98						$ 11,000,000	$ 550,000	$ 11,550,000
WF-5	$ 24,800				$ 24,800	$ 98,000	$ 111,220	$ 716,000	$ 30,000	$ 955,220
WF-6B	$ 36,250				$ 36,250	$ 72,500	$ 145,000	$ 725,000	$ 29,000	$ 971,500
WF-G	95 bond	'95	$ 2,200,000		$ 2,200,000					
WF-10	$ 38,000				$ 38,000		$ 51,000	$ 255,000	$ 10,200	$ 316,200
WF-11A	98A bond	'98B					$2,500,000	$ 100,000	$2,600,000	$ 5,200,000
WF-11B	98A bond	'98B	$ 2,000,000	$ 80,000	$ 2,080,000					
Totals	$ 313,400	$ -	$42,800,000	$ 1,940,000	$45,053,400	$287,200	$3,248,620	$ 53,841,000	$4,971,000	$ 62,347,820

Bear Creek Interceptor Relief Improvements

The proposed improvements for the Bear Creek Interceptor are described below.

BC-2A Bear Creek 1030B to DIV BC2 This project will provide 4317 feet of 8-inch and 15-inch parallel relief lines for the existing 18-inch pipeline.

BC-3 Bear Creek 880B to 1305B This project will provide 2525 feet of 33-inch and 15-inch relief pipeline to parallel an existing 24-inch pipeline.

BC-4 Bear Creek 2695B to 1680B This project will provide 2703 feet of 8-inch to 15-inch relief pipeline to an existing 24-inch pipeline.

Elm Fork Interceptor System Relief Improvements

The proposed improvements for the Elm Fork Interceptor System are described below.

EF-1 Elm Fork 1430E to 10M This project will provide 25,282 feet of 96-inch to 108-inch diameter relief pipeline for the existing 96-inch pipeline.

EF-2 Elm Fork 380E to 1430E This project will provide 15,300 feet of 108-inch diameter relief pipeline and 3,900 feet of 72 inch diameter relief pipeline.

EF-6 Elm Fork 1705E to 1600E This project will provide 12,904 feet of 72 inch diameter relief pipeline.

Mountain Creek Interceptor Relief Improvements

The proposed improvements for the Mountain Creek Interceptor are described below.

MC-3 Mountain Creek 1110M to 900M This project will provide13,929 feet of 15 inch to 18-inch diameter relief pipeline.

MC-4A This project will provide 18,000 feet of 42-inch diameter relief force main and 1,000 feet of 54-inch diameter relief pipeline (gravity).

MC-4B This project will provide 16,500 feet of 54-inch diameter gravity main.

West Fork Interceptor Relief Improvements

The proposed improvements for the West Fork interceptor system are described below:

WF-1 Bear Creek to Mountain Creek This project will provide capacity relief and will relieve corrosion-damaged sewers for approximately 19,600 linear feet from the Bear Creek/West Fork confluence to the treatment plant. The project will include three major junction structures and a 108-inch diameter pipeline.

WF-3 West Fork 4090W to 1530W This project will provide 11,053 feet of 18-inch to 24-inch diameter relief pipeline for the existing 27 and 33-inch pipelines.

WF-5 West Fork 1010W to 880W This project will 6,078 feet of 15-inch to 18-inch relief pipeline for the existing 15- and 21-inch pipelines.

WF-6B West Fork 740W to 800W This project will provide 4700 feet of 10-inch to 48-inch relief pipeline.

WF-G This project will provide 3,250 feet of 102-inch diameter relief pipeline.

WF-10 West Fork 3720W to 3610W This project will provide 4,732 feet of 10-inch to 15-inch relief pipeline.

WF-11A This project will provide a 72-inch to 84-inch parallel relief pipeline.

WF-11B This project will provide approximately 16,000 feet of 72-inch relief pipeline.

CHAPTER IV
Rehabilitation Improvements

The recommended rehabilitation improvements consist of both interceptor and manhole rehabilitation as well as rehabilitation of the Kirby Creek Outfall. The purpose of the rehabilitation improvements is to reduce I/I flow and to accomplish major structural repairs needed to restore structural integrity of the pipeline. The need for these improvements is based on the findings of field inspections. The table below presents engineering and surveying costs, land rights, construction costs, and inspection costs currently projected for the rehabilitation improvements. All of the rehabilitation projects are recommended for the Series 2001 bond. Two of these projects are also recommended for further funding under the next bond issue.

Rehabilitation Improvements										
	2001 Bond Series					2003 Bond Series				
Segment	Engineering Surveying	Land Rights	Construction	Inspection	TOTAL for 2001 Bond	Engineering Surveying	Land Rights	Construction	Inspection	TOTAL for 2003 Bond
*Kirby Creek Outfall (27,000 ft)**	'98A bond	'98B bond	$1,800,000	$ 72,000	$1,872,000					
Interceptor Rehabilitation	$ 90,000		$ 450,000		$ 540,000			$1,718,000		$1,718,000
MCKC Rehab 1160J to 1270J	$ 30,000		$ 200,000		$ 230,000					
MC Junc. Box @ 60M to 70M	$ 30,000		$ 200,000		$ 230,000					
*BC II & III Rehab/CO-1 & GV-4**	'98A bond		$1,500,000	$ 150,000	$1,650,000					
Jefferson Ave. (15,000 ft)	$100,000		$ 200,000		$ 300,000			$ 711,000	$28,000	$ 739,000
Totals	$250,000	$ -	$4,350,000	$ 222,000	$4,822,000			$2,429,000	$28,000	$2,457,000

*Funding to supplement 1998 bond proceeds.

Kirby Creek Outfall Rehabilitation

Internal video inspection performed on the Kirby Creek Outfall has identified the need for rehabilitation of up to 27,000 linear feet of pipe ranging in diameter from 12 to 27 inches due to structural deterioration of the pipeline. These needs were identified after completion of the Authority's 1997 Inflow/Infiltration Assessment. This amount adds to funding identified in 1998.

Interceptor Rehabilitation

The existing CRWS collection system consists of five major interceptors:

- Bear Creek Interceptor System
- Elm Fork Interceptor System
- Jefferson Tunnel Interceptor System
- Mountain Creek Interceptor System
- West Fork Interceptor System

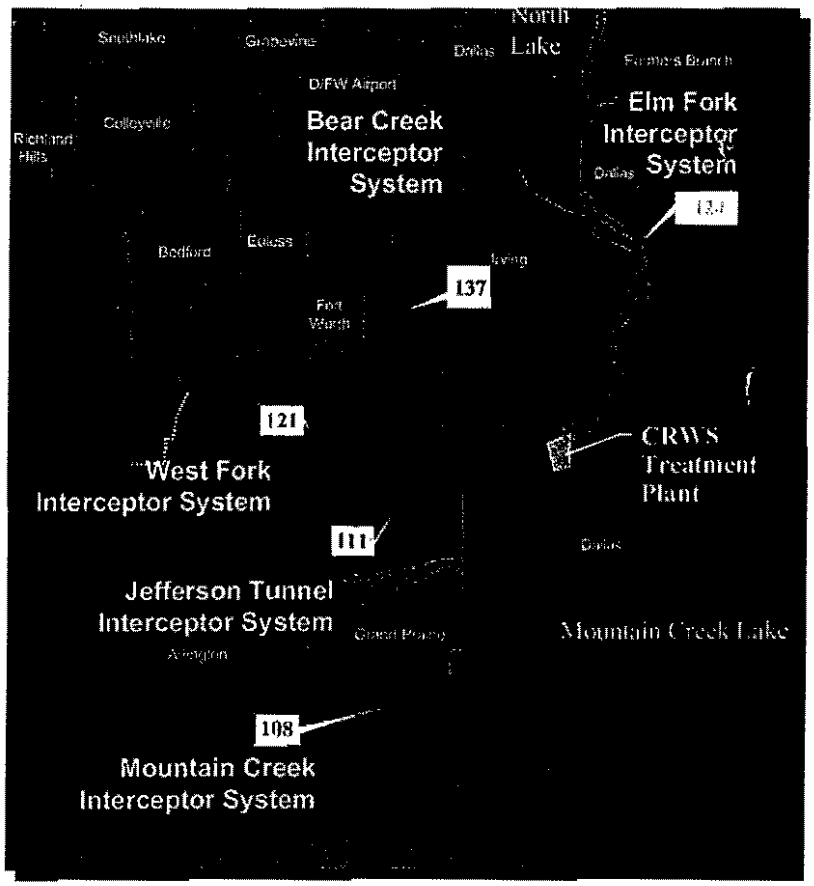
These systems have a combined total of approximately 200 miles of pipelines ranging in diameter from 12 to 102 inches. The majority of these interceptors have been constructed of reinforced concrete pipe.

The Authority has made substantial progress toward systematic video inspection of its interceptor system as was recommended in the 1992 Five-Year Plan. Through a coordinated effort using both Authority personnel and outside contractors, the Authority has completed video inspection of many miles of its interceptor system. These video inspection efforts have confirmed the need for a number of rehabilitation projects. The I/I Assessment identified a total of 1,721 interceptor I/I defects which are recommended for rehabilitation. Additional projects (such as cleaning of interceptor pipelines) have also been identified as high-priority tasks, but will be funded through the system's annual operation and maintenance budget.

CHAPTER V
Erosion Control Improvements

The Central Regional Wastewater System (CRWS) includes a wastewater collection network of approximately 200 miles of pipelines ranging in size from 12 inches in diameter to 102 inches in diameter. In order to provide economical, gravity-flow service to the system's customer cities, many of these pipelines have been located adjacent to natural streams, rivers, and drainage ditches. Erosive forces due to development, flooding, unstable soils, and other factors regularly alter the configuration of streambanks throughout the North Texas region. When erosion causes the streambanks to advance toward a buried pipeline, the pipelines can fail structurally if corrective actions are not taken in a timely manner.

The CRWS staff regularly monitors ground conditions along the entire collection network. At present, 37 erosion sites have been identified for monitoring following major storm events and for possible future corrective action. The Authority's staff has prioritized the erosion sites based on the extent of erosion damage, the likely cost and complexity of the repair, and the severity of any potential major slope failures.



Five erosion sites are proposed for funding under the 2001 and 2003 bond programs. The locations of these sites are shown in the figure to the right. In addition to these erosion control efforts, a number of the sites exhibiting advanced erosion have corrective construction scheduled as part of interceptor relief or rehabilitation work in adjacent areas.

For each of the sites for which action is proposed under the current bond series, a brief description of the erosion problems at the site are presented in the table below. The table also presents the proposed funding amounts for each site. A number of additional sites are slated for continued monitoring or for repair by TRA crews using operation and maintenance funding.

Erosion Control Improvements										
	2001 Bond Series					2003 Bond Series				
Project Description	Engineering Surveying	Land Rights	Construction	Inspection	TOTAL for 2001 Bond	Engineering Surveying	Land Rights	Construction	Inspection	TOTAL for 2003 Bond
108 NFFC/Sta 78+25/shallow cover	$ 7,500	$10,000	$ 50,000	$ 2,000	$ 69,500					
121 WFXJC Sta. 92+00	$ 7,500	$10,000	$ 50,000	$ 2,000	$ 69,500					
111 WFXIAI Sta 73+00 & 62+72 54+06	'98 bond	'98 bond	$ 100,000	$ 4,000	$ 104,000					
*124 DCURD exposed pipe, replacement in progress**	'92 bond							$500,000	$20,000	$ 520,000
137 BCIIIA Sta 40+00	'98 bond	'98 bond	$ 100,000	$ 4,000	$ 104,000					
TOTAL	$15,000	$20,000	$ 300,000	$12,000	$ 347,000			$500,000	$20,000	$ 520,000

*To be constructed with EF-2 Interceptor Capacity Relief Project.

CHAPTER VI
I/I Management and Maintenance Activities

The comprehensive Inflow/Infiltration (I/I) Assessment completed by the Authority in 1996 recommended a continuing program of inspection and I/I management activities as well as a number of interceptor "maintenance" activities. The table below lists the engineering and surveying costs, land rights costs, construction costs, and inspections costs currently projected for the rehabilitation improvements. These costs are outlined in further detail in the 1996 report entitled Infiltration/Inflow Assessment - Phase II - Infiltration/Inflow Management Plan.

I&I Management and Maintenance Activities										
	2001 Bond Series					2003 Bond Series				
Project Description	Engineering Surveying	Land Rights	Construction	Inspection	TOTAL for 2001 Bond	Engineering Surveying	Land Rights	Construction	Inspection	TOTAL for 2003 Bond
I/I Management Activities	$ 900,000				$ 900,000	$ 975,000				$ 975,000
Collection System GIS	$ 450,000				$ 450,000					
Interceptor Maintenance($2.5M BC II Rehab)	$ 70,000		$ 945,000	$ 20,000	$ 1,035,000					
Totals	$1,420,000	$ -	$ 945,000	$ 20,000	$ 2,385,000	$ 975,000				$ 975,000

The I/I Assessment developed a list of recommended activities to help focus future I/I management efforts. These activities include long-range engineering and planning, system modeling improvements, inventory and inspection database upgrades, digital photo mapping, coordination of I/I management activities with customer city control programs, and initiation of a system-wide geographic information system. It is anticipated that many of the recommended activities will be implemented by TRA personnel using O&M funds.

CHAPTER VII
Treatment Plant Improvements

The Central Regional Wastewater System (CRWS) treatment plant is an advanced secondary facility currently permitted to treat 162 million gallons per day (MGD) The last major expansion of the facility was completed in 1990. Design of the next major expansion is anticipated to begin approximately in year 2005. Treatment plant improvements funded through the series 2001 and 2003 bonds are generally aimed at rehabilitation or replacement of aging structures, improving the plant's operating efficiency, or controlling odors for the benefit of the surrounding community. Major improvements proposed for funding in the next five years are listed in the following table:

Treatment Plant Improvements										
	2001 Bond Series					2003 Bond Series				
Project Description	Engineering	Land Rights	Construction	Inspection	TOTAL for 2001 Bond	Engineering	Land Rights	Construction	Inspection	TOTAL for 2003 Bond
PS 6/6A Bar Screens	$ 250,000		$ 2,800,000	$ 80,000	$ 3,130,000					
Effluent Filters Rehab	$ 80,000		$ 1,875,000	$ 36,000	$ 1,991,000					
RAS & 60" X-connection						$ 50,000		$ 400,000	$ 16,000	$ 466,000
Replace RAS pumps						$ 20,000		$ 260,000	$ 16,000	$ 296,000
Sludge Stabilization (Class A)	$ 100,000		$ 1,500,000	$ 40,000	$ 1,640,000					
4th Belt Press						$ 30,000		$ 400,000	$ 30,000	$ 460,000
Control System Automation	$ 200,000		$ 2,800,000	$ 40,000	$ 3,040,000	$ 200,000		$ 2,300,000	$ 20,000	$ 2,520,000
Stage V/VI Odor Control	$ 400,000	$ 40,000	$ 2,500,000	$100,000	$ 3,040,000			$ 2,000,000	$ 80,000	$ 2,080,000
Low Voltage Elec. System						$ 200,000		$ 1,500,000	$100,000	$ 1,800,000
Chemical Usage Evaluation	$ 25,000				$ 25,000					
Fine Bubble Mem. Diffusers			$ 140,000	$ 30,000	$ 170,000					
Capacity Evaluation & Master Plan Update	$ 238,000				$ 238,000	$ 750,000		$10,000,000	$250,000	$11,000,000
Gravity Disch./Flow PS 7&7A	$ 50,000				$ 50,000			$ 1,500,000	$ 50,000	$ 1,550,000
Energy Conservation Eval.	$ 100,000				$ 100,000					
PS 6 Raw Water Pump Study	$ 100,000				$ 100,000			$ 1,260,000	$ 50,000	$ 1,310,000
Sludge Blend Tank	$ 75,000		$ 1,000,000	$ 60,000	$ 1,135,000					
Purchase Rail Spur		$350,000			$ 350,000					
Blower Bldg.- replace gas motors						$ 20,000		$ 146,000	$ 10,000	$ 176,000
Totals	$1,618,000	$390,000	$12,615,000	$386,000	$15,009,000	$ 1,270,000		$19,766,000	$622,000	$21,658,000

Pump Station 6/6A Bar Screens

Raw wastewater is lifted into the treatment facilities by two major pumping facilities: Pump Station 6 (constructed in 1979) and Pump Station 6A (constructed in 1990). Previously, the Pump Station 6 pumps were protected from debris by three 10-foot wide screens, all of which were deteriorating due to their age and to the corrosive operating environment. The series 1998 bond provided funds to replace several of these bar screens with fine screens constructed of corrosion-resistant materials.

Pump Station 6A previously had two "coarse" (4-inch opening size) screens for pump protection prior to wastewater being lifted into a bank of finer "climber-type" screens located at the plant's headworks structure. The coarse screen arrangement at PS 6A, however, provided inadequate screening if the flow was transferred into the older treatment facilities (flow routed to the above ground fine screens can only be routed to the newer "Phase III" facilities). The series 1998 bond provided funds to replace the coarse screens with fine screens (1/2-inch openings ±) to allow operation options for dry and wet weather flow events in order to reduce energy costs through blending of discharges from Pump Stations 6 and 6A.

The series 2001 bond will provide funds to complete the installation of two fine screens at Pump Station 6 and one fine screen at Pump Station 6A. These improvements are needed to meet permit requirements.

To address budget constraints, CDM has provided an outline (Technical Memorandum No. 4) for phasing improvements based on available capital funds, operational needs and constraints, and the necessity for improvements. Phase I will include structural modifications to PS 6 and the installation of two new fine screens that include a washer, compactor and a screenings conveyance system. No modifications to PS 6A are included in Phase I. The opinion of probable cost for Phase I is approximately $2.4 million and was funded through the 1998 bond series. Phase II, which will be funded through the 2001 bond series, will include installation of the third screen in PS 6, structural modifications to PS 6A, and the installation of two new fine bar screens with a washer, compactor and screenings conveyance system in PS 6A. Phasing the project in this manner will allow time for budgeting additional capital funds for Phase II while simultaneously completing Phase I, which will meet the primary goal of eliminating the existing caternary screens and the confined space entry requirements associated with PS 6.

Effluent Filter Rehabilitation

A major rehabilitation of Effluent Filters 9-16 was performed as part of the Phase III expansion of the plant and improvements. Effluent filters 1-8 are rarely used at the present time, but require rehabilitation of media, underdrains, controls, and other miscellaneous components in order to provide reliable service as plant flows continue to increase. Effluent Filters 17-23 which were installed as part of the Phase III expansion require new underdrains.

The series 2001 bond will provide funds for the rehabilitation of Effluent Filters 1-8 and for new underdrains for Effluent Filters 17-23. These improvements are necessary to ensure reliable long-term operation of these filters.

RAS Cross Connection for Pump Stations 13 and 13A

Return Activated Sludge Pump Station 13 (constructed under Phase I & II) currently operates separately from RAS Pump Station 13A (constructed under Phase III). Pump Station 13 provides service to Aeration Basins 1-6 while Pump Station 13A serves Aeration Basins 7-12. At present, the normal operating mode during dry weather is to operate only Aeration Basins 7-12, with minimal or no flow being treated in Aeration Basins 1-6.

Providing a 60-inch cross connection between the return sludge force mains for Pump Stations 13 and 13A would enable rapid seeding of any of the plant's aeration basins from either return pump station, thus enhancing the ability of the plant to place additional treatment units in service quickly to respond to changing wastewater conditions.

The series 2003 bond will provide funds for the design and construction of a 60-inch diameter RAS cross connection for the Return Activated Sludge Pump Stations

Replace RAS Pumps at Pump Station 13

The three 31 mgd horizontal centrifugal return activated sludge pumps at Pump Station 13 are twenty years old. The series 2003 bond will replace these older pumps with newer, more efficient, pumps.

Sludge Stabilization Reactor

The series 2001 bond provides funding for the design and installation of sludge stabilization equipment to produce Class A biosolids.

Fourth Sludge Dewatering Belt Press

The 1998 bond series provided funding for design and construction of three belt filter presses for sludge dewatering. Presently about 75% of the sludge is dewatered by these three belt presses, while 25% of the sludge is dewatered by the older Phase III filter presses. Processing the sludge with the older filter presses, while effective, is twice as expensive as dewatering the sludge with the newer belt filter presses. The series 2003 bond will provide funding to purchase and install the fourth belt filter press. This will allow for all sludge solids to be processed by the newer belt filter presses.

Control System Automation

In order to take advantage of energy and labor cost savings that can be afforded through selected automation improvements, the series 2001 bond includes funding for an engineering evaluation and design of the automation improvements identified to provide a rapid return on investment. It is proposed that funding for installation of these improvements (after determination of a specific construction budget) also be funded through the 2001 bond series.

Stage V and VI Odor Control Evaluation

The Authority proposes to continue its proactive, long-term program of odor control at the Central Regional Wastewater facility. Odor control evaluations were conducted in 1989, 1995, and in 1999 each identifying a number of specific areas in the plant to be targeted for odor control improvements. All such areas targeted for improvements under previous bond programs have been addressed (the improvements targeted in 1999 are scheduled for completion later this year), and the Authority proposes to continue with this program as was originally planned by identifying the next phase of plant processes to receive action. The series 2001 bond and series 2003 bond will provide funding to design and construct the Stage V and VI odor control improvements which will cover remaining primary clarifier effluent troughs, the Pump Station 6 wet well, and connect the belt presses and the Phase III grit basin outlet works to the foul air collection system. In addition, minor foul air collection improvements are proposed at the sludge blend tanks and other locations, and an odor/corrosion assessment of the collection system is proposed.

Low Voltage Electrical System Improvements

A number of high priority improvements, primarily to the "high voltage" switchgear and transmission system within the plant, were identified and completed through previous bond funds. An allowance for funding the engineering evaluation of the "low voltage" (480 volts) electrical system components is included in the series 2003 bond. An allowance for funding construction of those identified improvements to the low voltage electrical system is also included in the bond, as it is anticipated that several major motor control centers (some of which are now nearing 20 years of age) will need to be rehabilitated. Several of these motor control centers operate in moist, corrosive environments. Replacement of the motor control centers can afford the opportunity to install automated controls and current monitoring technology which will enhance energy costs savings as well as maintenance record keeping.

Energy Management

Chemical Usage Evaluation The series 2001 bond will provide funding for a plant-wide chemical usage evaluation to assess the feasibility of a more efficient chemical usage at the facility.

Conversion from Fine Bubble Diffusers to Rubber Membrane Diffusers
Funds are included in the series 2001 bond to install 19,200 flexible membrane diffusers in the Phase I and Phase II aeration basins. These will replace the existing ceramic diffusers. Flexible membrane diffusers have been shown to provide a substantial energy savings at this facility.

Capacity Evaluation and Master Plan Update
Upon completion of projects currently under construction, the plant's capacity will be rated at 162 million gallons per day. Current Texas Natural Resource Conservation Commission Rules and Permit provisions call for expansion planning to begin when flows reach 75 percent of capacity, and for construction to begin when flows reach 90 percent of capacity. Planning for future phase expansion was completed in the late 1980s. It is recommended, however, that the plant site master plan be updated in 2001, in order that the Authority can be

prepared to proceed with design and construction when flows approach 90 percent of capacity. It is anticipated that this will occur in the next three to five years.

Gravity Discharge Around PS 7/7A The series 2001 bond will provide funds to evaluate the feasibility of diversion of a portion of the plant effluent around PS 7/7A for disinfection and discharge. If the treated wastewater currently being pumped from Pump Stations 7 and 7A were instead allowed to gravity flow through a new pipe around the pump stations, the plant would realize a substantial energy savings. Potential technical hurdles, however, include a very deep pipeline beneath the plant's protective levee, as well as a need to provide chlorination contact time at the pipe's depth. It is anticipated that construction, if proven feasible, will be funded in the year 2003.

Energy Conservation Evaluation The CRWS Plant's annual power cost is approximately $3 million. The series 2001 bond will provide the funds necessary to conduct an energy management audit of the plant to determine where additional energy savings may be realized.

Pump Station 6 Raw Wastewater Pump The series 2003 bond will provide funds to evaluate the efficiency of the seven raw influent pumps at Pump Station 6. These 20-year-old pumps are rated at 41 mgd. It is anticipated that at least three of the pumps will need to be replaced. The series 2003 bond includes funds to replace three of the existing pumps with three new variable speed pumps.

Sludge Blend Tank

The existing Phase I and II sludge blend tanks have extensive corrosion in their interior headspaces. The present holding capacity of the existing sludge blend tanks is 250,000 gallons. The series 2001 bond will provide funds for engineering and construction necessary to convert a one million gallon digester to a sludge blend tank. It is anticipated that the larger capacity of the converted sludge blend tank will provide enough storage to allow operators to dewater sludge five days a week instead of the current seven days per week.

Purchase Railroad Spur

The series 2001 bond will provide funds for purchasing the property upon which the plant's existing railroad spur is located to ensure reliable future chemical deliveries of chlorine, iron salts, polymer, and sulfur dioxide. The plant receives a large discount when purchasing process chemicals through rail delivery rather than truck delivery.

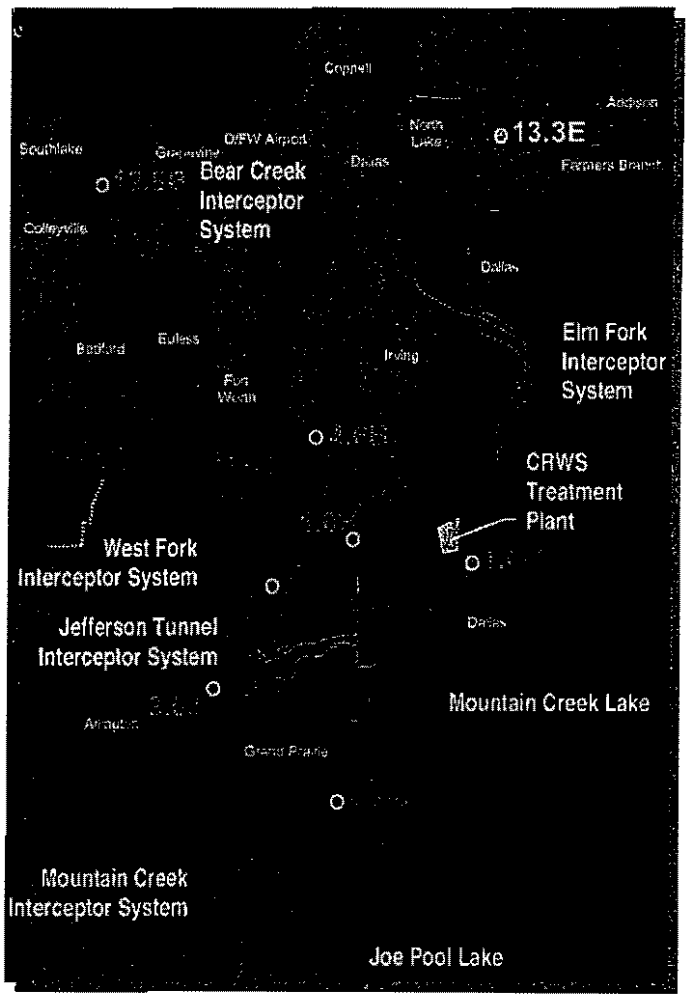
Replace Gas Engines at Blower Building

The plant currently has three gas engine driven motors located in Blower Building II. Two blowers do not provide enough air to meet the plant's process needs; however, three blowers produce more air than is needed. The series 2003 bond will provide funds for replacing the gas-fired engines in Blower Building II with electric motors.

CHAPTER VIII
Meter Station Improvements

The Central Regional Wastewater System meters wastewater flow from each of the customer cities discharging into its interceptor system. The flow measurements are used to determine the proportionate use of the system by each contracting party. This proportion is applied to the total system costs to determine each party's prorated share of these costs. As a secondary benefit, these measurements enable the CRWS to observe flow conditions in individual interceptor segments and identify where potential relief interceptors may be needed.

The Authority currently operates and maintains 128 metering stations within the Central Regional Wastewater System. The majority of these flow meters consist of Parshall flumes (or similar primary devices), with ultrasonic flow measurement instrumentation. Approximately two-thirds of the meters currently have telemetry capability. The remainder are monitored in the field on a regular basis by Authority personnel.



The Authority staff responsible for operation and maintenance of these meter stations has developed and maintained a list of improvements needed to maintain flow measurement accuracy, reliability, personnel safety, accessibility, and structural integrity of the metering system. The figure to the right presents the meter station sites for which improvements are slated for the Series 2001 bond.

The following table presents the engineering and surveying costs, land rights costs, construction costs and inspection costs currently projected for the meter station improvements to be funded in the 2001 bond series.

Meter Station Improvements					
	2001 Bond Series				
Project Description	Engineering Surveying	Land Rights	Construction	Inspection	TOTAL for 2001 Bond
1.0B Improve access	$ 3,000	$ 10,000	$ 20,000	$ 800	$ 33,800
4.6B Improve access	$ 3,000	$ 15,000	$ 20,000	$ 800	$ 38,800
12.8B Replace Gates	$ 750		$ 5,000	$ 200	$ 5,950
13.3E Improve rain access; upsize primary element	$ 12,000	$ 15,000	$ 80,000	$ 3,200	$ 110,200
9.0J Relocate meter & piping for flow imp.	$ 7,500		$ 50,000	$ 2,000	$ 59,500
6.0W Improve access		$ 10,000	$ 25,000	$ 1,000	$ 36,000
1382 NE Lakeview MS (moved to O&M)	$ 20,000	$ 20,000	$150,000	$ 6,000	$ 196,000
Totals	$ 46,250	$ 70,000	$350,000	$14,000	$ 480,250

CHAPTER IX
Other Capital Improvements

The table below presents projected costs for a number of system-wide planning and management activities associated with the proposed Series 2001 and 2003 bond programs. Funding for future long-term system planning is suggested for each bond program, as is an appropriate escalation allowance to account for anticipated inflationary pressures during the period in which the bond program will be implemented.

Other Capital Improvements										
Segment	2001 Bond Series					2003 Bond Series				
	Engineering Surveying	Land Rights	Construction	Inspection	TOTAL for 2001 Bond	Engineering Surveying	Land Rights	Construction	Inspection	TOTAL for 2003 Bond
Long Range Planning	$ 75,000				$ 75,000	$75,000				$ 75,000
TXDOT Pipeline Adjustments	$ 200,000		$1,500,000	$ 60,000	$ 1,760,000		$ 50,000	$1,000,000	$40,000	$ 1,090,000
Totals	$ 275,000		$1,500,000	$ 60,000	$ 1,835,000	$75,000	$ 50,000	$1,000,000	$40,000	$ 1,165,000

CHAPTER X
Cost Summary

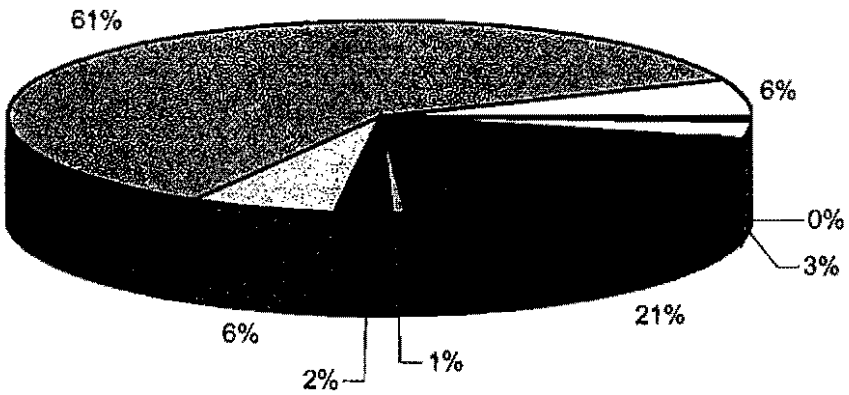
The table below summarizes the cost associated with each category of improvements proposed for both the current (Series 2001) bond program and for the proposed future (Series 2003) bond program.

Our opinion of probable capital costs (including easement acquisition, engineering/surveying, construction, and inspection) for all improvements proposed for funding in the Series 2001 bond program is $74.8 million. This includes $4,830,000 for additional costs associated with SRF funding requirements (environmental assessments, program management and administration, and other cost considerations). A future bond sale (capital costs totaling approximately $89.1 million) is envisioned in approximately the year 2003. The proposed interceptor relief improvements comprise approximately 61% of the total proposed Series 2001 bond program. It is anticipated that interceptor system improvements will comprise the majority of the anticipated Series 2003 bond program as well.

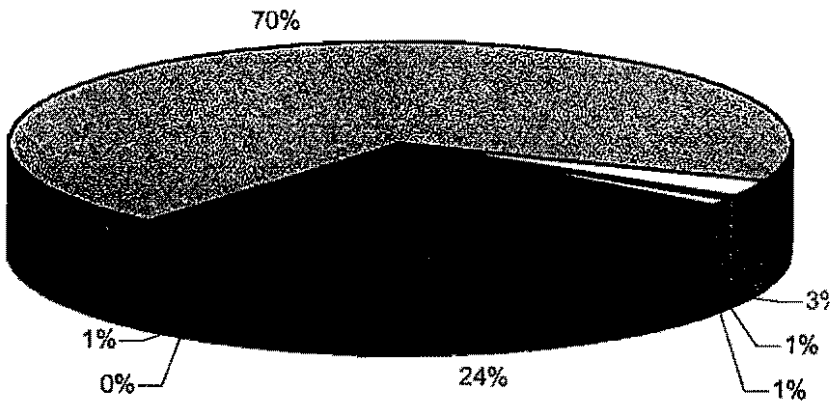
OPINION OF PROBABLE CAPITAL COSTS

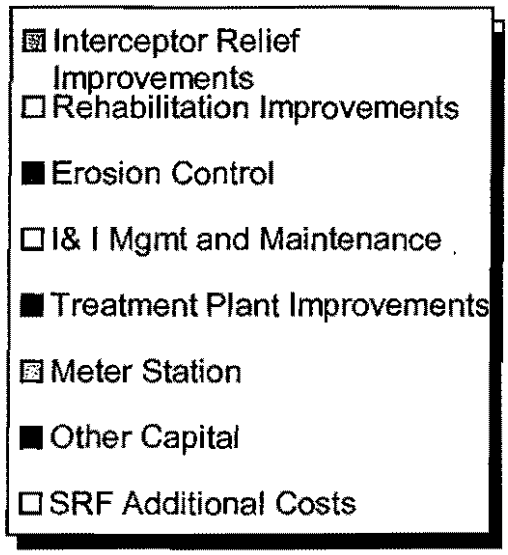
Improvements	2001 Bond Series					2003 Bond Series				
	Engineering Surveying	Land Rights	Construction	Inspection	TOTAL for 2001 Bond	Engineering Surveying	Land Rights	Construction	Inspection	TOTAL for 2003 Bond
Interceptor Relief Improvements	$ 313,400		$42,800,000	$1,940,000	$ 45,053,400	$ 287,200	$3,248,620	$53,841,000	$4,971,000	$ 62,347,820
Rehabilitation Improvements	$ 250,000	$ -	$ 4,350,000	$ 222,000	$ 4,822,000			$ 2,429,000	$ 28,000	$ 2,457,000
Erosion Control	$ 15,000	$ 20,000	$ 300,000	$ 12,000	$ 347,000			$ 500,000	$ 20,000	$ 520,000
I& I Mgmt and Maintenance	$1,420,000		$ 945,000	$ 20,000	$ 2,385,000	$ 975,000				$ 975,000
Treatment Plant Improvements	$1,618,000	$390,000	$12,615,000	$ 386,000	$ 15,009,000	$1,270,000		$19,766,000	$ 622,000	$ 21,658,000
Meter Station	$ 46,250	$ 70,000	$ 350,000	$ 14,000	$ 480,250			$ -	$ -	$ -
Other Capital	$ 275,000		$ 1,500,000	$ 60,000	$ 1,835,000	$ 75,000	$ 50,000	$ 1,000,000	$ 40,000	$ 1,165,000
SRF Additional Costs					$4,830,000					
Totals	$3,937,650	$480,000	$62,860,000	$2,654,000	$ 74,761,650	$2,607,200	$3,298,620	$77,536,000	$5,691,000	$ 89,122,820

Series 2001 Bond



Series 2003 Bond





The figure below graphically depicts historical and projected annual average daily flows for the Central Regional Wastewater System. The projected and actual flows are presented for the years 1993 through 1999. Projected flows developed through the Authority's short-term internal planning efforts are presented through the year 2001. It is noted that a significant flow increase has recently been experienced (as planned) as a result of diversion of flows from the western portion of the City of Arlington into the system.