FREESE AND NICHOLS

Innovative approaches
Practical results
Outstanding service

2016 WASTEWATER MASTER PLAN UPDATE

Prepared for:

City of College Station

November 2016

CITY OF COLLEGE STATION
Home of Texas A&M University®

Prepared by:

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TEXAS REGISTERED
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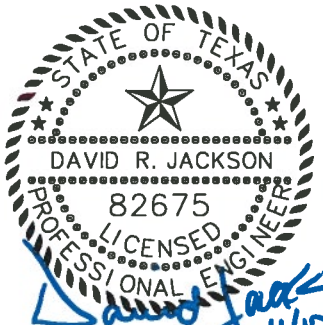

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EXECUTIVE SUMMARY

1.0 INTRODUCTION

Freese and Nichols, Inc. (FNI) was retained in 2015 by the City of College Station to prepare a Wastewater Master Plan Update. The City provides wastewater to a service area of approximately 43 square miles, and the service area is expected to grow to approximately 51 square miles by buildout. The existing wastewater service area population is 94,479 and is projected to grow to 193,987 by buildout. The focus of this Wastewater Master Plan Update was to prepare a Capital Improvements Plan (CIP) which provides capacity for expected growth, optimizes system operation, and addresses existing system capacity and maintenance issues, in accordance with Texas Commission on Environmental Quality (TCEQ) regulations. The major elements of the scope of this project included:

- Population and Wastewater Flow Projections
- Flow Monitoring and Flow Data Analysis
- Wastewater Model Update and Calibration
- Existing and Future Wastewater Collection System Analysis
- Wastewater Treatment Plant Expansion Evaluation
- Wastewater System Future Alternative Analysis
- Wastewater Line Renewal Program
- Wastewater System Capital Improvements Plan and Report

2.0 EXISTING WASTEWATER SYSTEM

The City's wastewater collection system consists of a network of 328 miles of collector mains, interceptors and force mains, 16 lift stations, and three wastewater treatment facilities. The Carters Creek Wastewater Treatment Plant (WWTP) has a current permitted capacity of 9.5 MGD average daily flow and 30 MGD peak 2-hour flow. The Lick Creek WWTP has a current permitted capacity of 2.0 MGD average daily flow and 6 MGD peak 2-hour flow. The Carter Lake Wastewater Treatment Facility (WWTF) is a lagoon system that has a current permitted capacity of 8,500 gpd average daily flow.

3.0 WASTEWATER FLOW MONITORING

FNI retained Interra Hydro, Inc., to conduct flow monitoring at 20 points and collect rainfall data in the existing wastewater system. The flow monitoring and rainfall data were used to characterize dry and wet

weather flows at key points within the wastewater system, evaluate wet weather inflow and infiltration, and calibrate the hydraulic model of the wastewater collection system. Based on the data gathered using temporary flow meters and rain gauges from May 1 through June 16, 2015, a detailed analysis of dry and wet weather periods was performed and is summarized below:

- Wet weather peaking factors greater than 4 were observed at 15 of the 20 flow meter locations, suggesting high amounts of inflow
- Surcharging above the top of the pipe was observed at 16 of the 20 flow meter locations, suggesting inadequate capacity in these portions of the collection system

Rainfall derived inflow and infiltration (RDII) rates were calculated for each flow meter basin. The results were ranked from highest to lowest and are shown in **Table ES.1**. RDII rates between 3.0 and 4.5 gal/in/LF were classified as moderate, and RDII rates greater than 4.5 gal/in/LF were classified as high.

Table ES.1: Normalized RDII Rates by Flow Meter Basin

Flow Meter Basin[1]	Average Normalized RDII Rate (gal/in/LF)
CS-8	5.0
CS-2 + CS-3[2]	4.0
CS-1 + CS-18[2]	3.8
CS-9	3.5
CS-17	3.2
CS-10	2.7
CS-16	2.4
CS-15	1.9
CS-20	1.9
CS-11	1.6
CS-4	1.1
CS-19	0.8
CS-7	0.8
CS-12	0.6
CS-14	0.3
CS-13	0.2
CS-5 + CS-6[1]	0.0

(1) Carters Creek WWTP basin flow meters in **red**, and Lick Creek WWTP basin flow meters in **blue**.
(2) Basins combined for analysis.

4.0 POPULATION AND WASTEWATER FLOWS

The performance of a wastewater collection system is dependent on the amount of flow being conveyed through the system. To determine where future wastewater system improvements are necessary, existing and future wastewater flow projections must be developed. A thorough analysis of historical and projected populations, along with land use, provides the basis for projecting future wastewater flow. Projected land use and population densities were provided by the City of College Station Comprehensive Plan and through coordination with the City's Planning and Development Services Department. The projected service population and living unit equivalents (LUEs) for each planning period is shown in **Table ES.2**. Non-residential growth is accounted for in the LUE projection.

Table ES.2: Projected Service Population and LUEs

Year	Service Population	LUEs
2015	94,479	50,323
2020	107,114	56,676
2025	122,348	62,496
Buildout	193,987	97,724

Projected wastewater flows for the 2015, 2020, 2025, and buildout planning periods were developed by analyzing the historical wastewater flow rates, 2015 flow monitoring data, and projected future growth areas in the City. **Table ES.3** shows the projected average daily flow for each WWTP.

Table ES.3 Projected Wastewater Flows

Year	Carters Creek WWTP Average Daily Flow (MGD)	Lick Creek WWTP Average Daily Flow (MGD)	Total Average Daily Flow (MGD)
2015	6.83	1.56	8.39
2020	7.40	2.12	9.52
2025	7.62	3.00	10.63
Buildout	10.49	6.27	16.76

5.0 WASTEWATER MODEL DEVELOPMENT AND CALIBRATION

The wastewater model was updated in the InfoSewer software by *Innovyze®*. City staff provided the GIS shapefiles of wastewater lines and manholes that were imported into the model using the City's facility identification number as the unique ID.

FNI calibrated the hydraulic model of the wastewater system to reflect flow monitoring data for both dry and wet weather flows. A properly calibrated model serves as the foundation for any future modeling

scenarios. Dry weather calibration model results closely matched the observed data from June 1 through 5, 2015, for a majority of the flow meter sites with the difference between modeled and observed flow within 5%. The wet weather calibration was performed for rain events that occurred on May 24 and 25, 2015. Modeled wet weather flows were generally within 10% of the observed flows, indicating that the model is accurately predicting the wastewater system's response to rain events. The dry and wet weather calibration results provide a high level of confidence that the model is closely matching real world conditions and suitable to use for hydraulic analyses and CIP development.

6.0 WASTEWATER SYSTEM ANALYSES AND HYDRAULIC MODELING

Hydraulic analyses were conducted to identify deficiencies in the City's existing wastewater collection system and establish a capital improvements plan to improve the existing system and accommodate projected wastewater flows through buildout. Various combinations of improvements and modifications were investigated to determine the most appropriate approach for conveying projected flows. Parameters used in developing the improvements plan included increasing system reliability, simplifying system operations, conveying peak wet weather flows, maintaining proper velocities, and reducing surcharging and sanitary sewer overflows.

7.0 WASTEWATER TREATMENT PLANT EXPANSION EVALUATION

FNI performed a condition and capacity assessment of the City's wastewater treatment equipment to determine the current condition and treatment plant functional capacity for the Carters Creek and Lick Creek WWTPs. Based on the results of the assessment and projected wastewater loadings, improvements were recommended at the Carters Creek and Lick Creek WWTPs for three alternatives to treat future wastewater flow:

- Alternative 1: Expand both WWTPs to treat all flow in the respective basins
- Alternative 2: Maintain Carters Creek WWTP to treat a portion of Carters Creek basin flows, divert excess flow to Lick Creek WWTP and expand Lick Creek WWTP
- Alternative 3: De-rate Carters Creek WWTP to treat existing Carters Creek basin flows, divert excess flow to Lick Creek WWTP and expand Lick Creek WWTP

8.0 WASTEWATER SYSTEM FUTURE ALTERNATIVES ANALYSIS

FNI utilized data from the wastewater system analysis and the WWTP expansion evaluation to assess the three treatment alternatives and determine the most cost effective way for the City to provide

wastewater service in the Carters Creek WWTP basin. FNI determined sizing of the proposed wastewater interceptors, lift stations and treatment facilities required for each alternative with a planning level cost estimate and reviewed the City's costs to operate WWTPs and lift stations over a 30-year period for each alternative.

Taking into account cumulative cost and infrastructure requirements, Alternative 1 is not recommended due to it having the highest cost and largest amount of flow being treated at Carters Creek. **Alternative 3 is the recommended option because it has the highest amount of wastewater flow being diverted away from the Carters Creek WWTP and conveyed to the Lick Creek WWTP.**

9.0 WASTEWATER LINE RENEWAL PROGRAM

In addition to the wastewater system CIP, the City tasked FNI to update the City's wastewater line rehabilitation prioritization program, which was originally developed as part of the 2011 Wastewater Master Plan. The program is based on a combination of physical data (pipe age, pipe material, and repair data) and customer data (critical locations and limited access areas) to prioritize candidates for replacement. Aging wastewater lines made of easily corroded material can be subject to leakage, loss in carrying capacity due to debris, and maintenance difficulties. Therefore, replacing wastewater lines in poor condition can potentially reduce inflow and infiltration and maintenance issues. Thirty-four renewal CIP projects were developed city-wide.

10.0 CAPITAL IMPROVEMENTS PLAN

A CIP was developed for the City of College Station to promote a high level of wastewater service that promotes residential and commercial development. The recommended improvements will provide the required capacity and reliability to meet projected wastewater flows through buildout conditions. Capital costs were calculated for recommended CIP projects. The costs are in 2016 dollars and include an allowance for engineering, surveying, and contingencies. **Tables ES.4** and **ES.5** summarize the cost of the wastewater system capacity and condition CIPs by planning period. **Table ES.6** summarizes the recommended WWTP improvements needed at the Carters Creek and Lick Creek WWTPs.

Table ES.4: Capacity CIP Summary

Phase	Project Number	Project Description	Project Drivers	Cost
2016-2021	1	54/60-inch Bee Creek Interceptor Phase 2	Capacity	$7,061,000
	2	42/48-inch Bee Creek Interceptor Phase 3	Capacity	$5,512,000
	3	54-inch Lick Creek Interceptor Phase 1	Capacity	$2,757,000
	4	54-inch Lick Creek Interceptor Phase 2 and Slip Line	Capacity	$9,938,000
	5	*Expand Lick Creek WWTP Capacity to 5 MGD*	*Capacity*	*$29,949,000*
	6	*Priority 1 Carters Creek WWTP Rehabilitation*	*Condition and Capacity*	*$13,712,000*
	7	42/48-inch Medical District Interceptor Phase 1	Capacity and Development	$9,320,000
	8	*4 MGD Diversion Lift Station and 24-inch Force Main*	*Capacity and Diversion*	*$11,490,000*
	9	42-inch Northeast Interceptor Phase 1	Capacity and Condition	$3,502,000
	10	48-inch Northeast Interceptor Phase 2	Capacity and Condition	$2,578,000
	11	36-inch Northeast Interceptor Phase 3	Capacity and Condition	$5,588,000
	12	24/30-inch Northeast Interceptor Phase 4	Capacity and Condition	$3,428,000
	13	30/36-inch Southwood Valley Interceptor Phase 1	Capacity and Condition	$3,287,000
	14	15/18/24-inch Southwood Valley Interceptor Phase 2	Capacity and Condition	$1,962,000
	15	Hensel Park Lift Station Expansion to 6 MGD	Capacity and Condition	$4,683,000
			Treatment Subtotal	**$43,661,000**
			Diversion Subtotal	**$11,490,000**
			Collection System Subtotal	**$59,616,000**
			Total 2016 - 2021	**$114,767,000**
2022-2026	16	24/27-inch Alum Creek Interceptor	Capacity and Development	$9,019,000
	17	3 MGD Peach Creek Lift Station and 16-inch Force Main	Capacity and Development	$4,166,000
	18	12/21/24-inch Royder Road Interceptor	Capacity and Development	$4,087,000
	19	18/21/24-inch Medical District Interceptor Phase 2	Capacity and Condition	$3,457,000
	20	*Expand Lick Creek WWTP Capacity to 8 MGD*	*Capacity*	*$24,717,000*
	21	*Diversion Lift Station Expansion to 10 MGD*	*Capacity and Diversion*	*$2,496,000*
	22	*Priority 2 Carters Creek WWTP Rehabilitation*	*Capacity and Condition*	*$5,580,000*
	23	*Decommission Carter Lake WWTF*	*Capacity and Condition*	*$2,184,000*
			Treatment Subtotal	**$32,481,000**
			Diversion Subtotal	**$2,496,000**
			Collection System Subtotal	**$20,729,000**
			Total 2022-2026	**$55,706,000**
2027-Buildout	*24*	*Expand Lick Creek WWTP Capacity to 12 MGD*	*Capacity*	*$29,231,000*
	25	*Diversion Lift Station Expansion to 16 MGD and parallel 24-inch Force Main*	*Capacity and Diversion*	*$8,468,000*
	26	Peach Creek Lift Station Expansion to 6 MGD	Capacity and Development	$2,481,000
	27	12/18-inch Peach Creek Gravity Lines	Capacity and Development	$4,022,000
	28	36-inch Southgate interceptor	Capacity and Condition	$6,621,000
	29	10/12/15-inch Eastgate Gravity Lines	Capacity and Condition	$1,605,000
	30	18/21/27-inch Harvey Mitchell Gravity Lines and Luther Street Lift Station Expansion	Capacity and Condition	$4,482,000
	31	18/21/24-inch Bee Creek Trunk Line Phase 4	Capacity and Condition	$3,149,000
	32	12/15/18-inch Arrington Road Gravity Lines	Capacity and Condition	$2,335,000
			Treatment Subtotal	**$29,231,000**
			Diversion Subtotal	**$8,468,000**
			Collection System Subtotal	**$24,695,000**
			Total 2027 - Buildout	**$62,394,000**
			Grand Total	**$232,867,000**

Table ES.5: Condition CIP Summary

Project Number	Project Description	Cost
1	Ridgefield Rehabilitation	$2,094,000
2	College Heights Rehabilitation	$1,861,000
3	Southwood Valley Rehabilitation Phase 2	$2,198,000
4	Southwood Valley Rehabilitation Phase 3	$2,213,000
5	Brentwood Rehabilitation	$3,312,000
6	Raintree Rehabilitation Phase 1	$1,971,000
7	Plantation Oaks Rehabilitation	$1,574,000
8	Prairie View Heights Rehabilitation	$1,319,000
9	McCulloch Rehabilitation Phase 1	$2,124,000
10	Autumn Chase Rehabilitation	$3,036,000
11	Regency South Rehabilitation	$2,274,000
12	Southwood Rehabilitation	$3,035,000
13	Carters Grove Rehabilitation	$2,102,000
14	Woodson Village Rehabilitation	$2,636,000
15	Culpepper Plaza Rehabilitation	$1,905,000
16	Redmond Terrace Rehabilitation	$3,324,000
17	University Park Rehabilitation	$1,841,000
18	Camelot Rehabilitation	$2,087,000
19	Alpine Rehabilitation	$2,128,000
20	The Knoll Rehabilitation	$2,210,000
21	Raintree Rehabilitation Phase 2	$2,590,000
22	Harvey Hillsides Rehabilitation	$2,497,000
23	Foxfire Rehabilitation Phase 1	$1,891,000
24	Eastgate Rehabilitation Phase 6	$1,738,000
25	Deacon Rehabilitation	$3,180,000
26	Emerald Forest Rehabilitation	$3,468,000
27	Southwood Valley Rehabilitation Phase 1	$3,052,000
28	Foxfire Rehabilitation Phase 2	$3,199,000
29	Marion Pugh Rehabilitation	$3,248,000
30	Bee Creek Rehabilitation	$2,805,000
31	Northgate Rehabilitation	$2,311,000
32	Timber Ridge Rehabilitation	$3,619,000
33	Eastgate Rehabilitation Phase 4	$1,880,000
34	Eastgate Rehabilitation Phase 5	$1,990,000
	Grand Total	**$82,712,000**

Table ES.6: Recommended WWTP Improvements

WWTP Improvements Phase	Detailed Description of Improvements
Carters Creek WWTP Phase 1 (2020)	Rehab ATAD odor system for the new diversion lift station Priority 1 rehabilitation (new blowers and UV equipment) Filter addition to improve UV
Carters Creek WWTP Phase 2 (2030)	Remaining condition assessment items
Lick Creek WWTP Phase 1 (2020)	Condition improvements Expand influent lift station with coarse screens Fine screens and grit improvements New aeration basin New final clarifiers RAS/WAS improvements Add blowers New filters and UV equipment Additional centrifuge
Lick Creek WWTP Phase 2 (2030)	Condition improvements Add influent pumps New headworks fine screens and grit New aeration basin & finals RAS/WAS improvements Additional blowers Add filters and UV modules Mechanical thickening New Parshall flume Odor control improvements
Lick Creek WWTP Phase 3 (2040)	Add influent pumps Add headworks equipment New aeration basin New final clarifiers Additional blowers Add filters and UV modules Expand solids facilities