FREESE AND NICHOLS

Innovative approaches
Practical results
Outstanding service

Water and Wastewater Master Plan

Prepared for:

City of Lancaster

February 2021

Lancaster
The Shining Star of Texas

Prepared by:

FREESE AND NICHOLS, INC.

FNI Project No.: LCS18127

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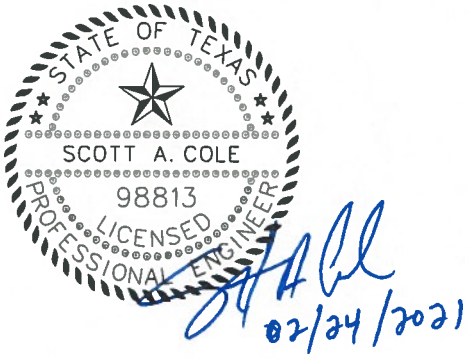

FREESE AND NICHOLS, INC.
TEXAS REGISTERED
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FNI Project No.: LCS18127

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EXECUTIVE SUMMARY

The City of Lancaster, located in north Texas in Dallas County, had approximately 37,880 residents located within its city limits in 2018. According to North Central Texas Council of Governments' (NCTCOG's) forecasts developed in 2017, the population within the city limits is expected to grow to approximately 50,849 by 2045. Accommodating this growth in an efficient and cost-effective manner is the purpose of this *Water and Wastewater Master Plan*. This report has been prepared to provide the City of Lancaster with a plan to implement short-term through long-term improvements to the water and wastewater infrastructure.

Freese and Nichols, Inc. (FNI), was retained by the City of Lancaster in November 2017 to prepare a *Water, Wastewater and Roadway Master Plan and Impact Fee Update*. This report, the *Water and Wastewater Master Plan*, documents the assessments of the water and wastewater systems through 2045, which includes a phased capital improvement plan (CIP).

1.0 POPULATION

Population and future land use are important elements in the analysis of water distribution and wastewater collection systems. Water demands and wastewater loads are dependent on the residential population and commercial development served by the systems and determine the sizing and location of system infrastructure. Projected population and employment provide the basis for future water demands and wastewater loads.

FNI reviewed the existing development agreements provided by City staff. The wastewater service area coincides with the current city limits. The current city limits include recently annexed areas in the southeastern portion of the service area. The water service area includes the current city limits except for areas that fall within Rockett Special Utility District (SUD)'s Certificate of Convenience and Necessity (CCN). Areas in the City's Extra-Territorial Jurisdiction (ETJ) are included in the 2045 water service area. While Rockett's CCN was excluded from the water service area, it is included in the wastewater service area. Thus, the difference between the water and wastewater service area forecasts is the existing and future population and employment located in Rockett's CCN area. The projected water and wastewater service area populations for each planning period are shown in **Tables ES-1** and **ES-2.**

Table ES-1: Water Service Area Demographic Projections

Year	Service Area Population[1]	Lancaster MUD #1 Wholesale Population[2]	Total Water Served Population	Employment[1]
2018	37,528	1,494	39,022	11,001
2023	39,535	1,494	41,029	13,848
2028	41,673	1,494	43,167	16,682
2045	50,677	1,494	52,171	26,939

(1) Source: NCTCOG projections by TSZ

(2) Lancaster MUD is a wholesale customer. Population Source: TCEQ Texas Drinking Water Watch.

Table ES-2: Wastewater Service Area Demographic Projections

Year	Service Area Population[1]	Lancaster MUD #1 Wholesale Population[2]	Total Wastewater Served Population	Employment[1]
2018	37,880	1,494	39,374	11,079
2023	40,010	1,494	41,504	14,021
2028	42,259	1,494	43,753	16,940
2045	51,855	1,494	53,349	27,876

(1) Source: NCTCOG projections by TSZ

(2) Lancaster MUD is a wholesale customer. Population Source: TCEQ Texas Drinking Water Watch.

2.0 WATER DEMANDS

Reviewing historical water demands provides insight needed to select the design criteria used to project future water demands. Annual average day demand, maximum day to average day peaking factors, and per-capita consumption were reviewed and provided the basis for the design criteria used to project water demands. **Table ES-3** provides a summary of population, average day demand, maximum day demand, and peak hourly demands for the City's service area.

Table ES-3: Water Service Area Demand Projections

Year	Service Area Population (1)	Service Area Employment	Average Day Demand (MGD) (2)	Maximum Day Demand (MGD) (2)	Peak Hour Demand (MGD) (2)
2018	39,022	11,001	5.92	11.25	16.88
2023	41,029	13,848	7.44	14.24	20.36
2028	43,167	16,682	7.98	15.26	21.89
2045	52,171	26,939	10.08	19.25	27.88

(1) Includes Lancaster MUD #1 wholesale population

(2) Average Day Demand includes 1.0 MGD wholesale delivery to the City of Wilmer and a Maximum Day Demand of 2.0 MGD in years 2023, 2028 and 2045 (based on amended agreement, February 2020). Peak hour demand includes the Maximum Day Demand for the City of Wilmer, but it is not increased by the peak hour factor based on the wholesale agreement.

3.0 EXISTING WATER SYSTEM

The existing water distribution system currently consists of a network of pipes ranging in size from 1.25-inches to 48-inches, two pump stations, three ground storage tanks, and three elevated storage tanks. The City purchases water from Dallas Water Utilities (DWU) and receives water at two delivery points: the Ames Pump Station (PS) and the James R. Williams PS.

4.0 WATER DISTRIBUTION SYSTEM ANALYSES

The hydraulic model developed for Lancaster's *2012 Water and Wastewater Impact Fee Evaluation,* by FNI, was converted from Innovyze H2OMap Water software to Innovyze InfoWater, due to the retirement of the H2OMap product line. This model was then updated to include water lines and other infrastructure added since 2012, updated pressure plane boundaries, and changes in system operations. Field pressure testing was conducted at eight (8) locations throughout the distribution system in February 2018 to support model validation. SCADA readings for tank levels and pump status were collected on an hourly basis during this time and were used to create diurnal demand curves. Operational data was used to determine system inputs such as tank levels and pump status. After adjusting parameters and operational schemes, the model results closely match the field pressure testing data, which indicates that the model accurately represents field conditions. Using the calibrated model, assessments of the existing and future demand scenarios were conducted to identify additional capacity shortfalls and system extensions to meet future needs, as shown in the Capital Improvements Plan, presented in **Table ES-4**.

Table ES-4: Water Capital Improvements Plan Summary

	Cost
Short Term Projects (by 2023) Total	$$6,122,300
Intermediate Projects (2024-2028) Total	$21,895,200
Long Term Projects (2029-2045) Total	$50,585,400
CIP Total	**$78,602,900**

5.0 WASTEWATER FLOWS

To estimate future wastewater flows, historical flow data was analyzed to determine the historical trends in system-wide average day wastewater flow and per-capita flow. Average day wastewater flows for the 2023, 2028, and 2045 planning periods were developed by analyzing historical wastewater flow rates and future growth areas. **Table ES-5** illustrates the historical and projected wastewater flows for the City of Lancaster.

Table ES-5: Historical and Projected Wastewater Flows

Year	Service Area Population [1]	Service Area Employment	Average Day Flow (MGD)	Peak Wet Weather Flow (MGD)[2]
2018	39,374	11,079	5.53	35.95
2023	41,504	14,021	6.03	39.20
2028	43,753	16,940	6.56	42.64
2045	53,349	27,876	8.64	56.16

[1]Lancaster MUD #1 wholesale population included.
[2]Peak Wet Weather to Average Day Peaking Factor: 6.5

6.0 EXISTING WASTEWATER SYSTEM

Lancaster's existing wastewater system consists of two lift stations, two 12-inch force mains and 168 miles of gravity sewer mains, ranging in size from 4-inches to 24-inches. The majority of the existing wastewater collection system is located north of Ten Mile Creek, and west of Keller Branch. Because of existing topography, the wastewater collection system generally flows from north to south until reaching Ten Mile Creek. The City contracts with the Trinity River Authority (TRA) for conveyance and treatment of wastewater using two interceptors (36-inches and 54-inches) that parallel Ten Mile Creek and terminate at the TRA Ten Mile Wastewater Treatment Plant (WWTP). A third interceptor parallels Red Oak Creek and terminates at TRA's Red Oak WWTP. The City currently has two small sewer lines connected to the Red Oak system.

7.0 WASTEWATER SYSTEM ANALYSES

The City's wastewater model was converted from H2OMap Sewer software to InfoSewer due to the retirement of the H2OMap platform. The model was updated using the current GIS shapefiles provide by the City. Sewer pipes with a diameter of 10-inches and above are included in the model. The model was used to simulate flows that would occur in the collection system under peak wet weather conditions. Hydraulic analyses under peak wet weather flows were conducted to identify deficiencies in the existing sewer system and establish a capital improvements plan to remedy capacity shortfalls and accommodate projected wastewater flows through 2045, as presented in **Table ES-6**. The high peak wet weather to average day factor of 6.5 indicates a significant amount of inflow and infiltration to the system that, if reduced, would likely improve system performance. The model indicates that several of the trunk mains in the more densely developed basins need more capacity under the current peak wet weather flows. To improve the wastewater collection system, the City of Lancaster needs a multi-faceted plan that includes the following prioritized items:

1. Identify and reduce inflow and infiltration (I/I) through a focused Sanitary Sewer Evaluation Survey (SSES)
2. Refine the wastewater model:
    a. Update GIS attribute data with surveyed pipe invert elevations and confirmed connectivity.
    b. Collect flow data by installing temporary flow monitors.
    c. Validate the wastewater model using the flow monitoring data.
    d. Evaluate the wastewater system with the validated model and update the recommended projects and prioritized capital improvements plan.
3. Implement recommended improvements to increase system capacity.
4. Extend sewer service to new developments as downstream capacity constraints are improved.

Table ES-6 Wastewater Capital Improvements Plan Summary

Project Name	Cost
Short Term Projects (by 2023) Total	$31,356,100
Intermediate Projects (2024-2028) Total	$50,984,500
Long Term Projects (2029-2045) Total	$38,346,500
CIP Total	**$120,687,100**

1.0 INTRODUCTION

The City of Lancaster, located in north Texas in Dallas County, had approximately 37,880 residents located within its city limits in 2018. According to North Central Texas Council of Governments' (NCTCOG's) forecasts developed in 2017, the population within the city limits is expected to grow to approximately 50,849 by 2045. Accommodating this growth in an efficient and cost-effective manner is the purpose of this *Water and Wastewater Master Plan*. This report has been prepared to provide the City of Lancaster with a plan to implement short-term through long-term improvements to the water and wastewater infrastructure.

1.1 SCOPE OF WORK

Freese and Nichols, Inc. (FNI), was retained by the City of Lancaster in November 2017 to prepare a *Water, Wastewater and Roadway Master Plan and Impact Fee Update*. This report, the *Water and Wastewater Master Plan*, documents the assessments of the water and wastewater systems, including evaluating the existing capacity and recommending a phased capital improvement plan (CIP) through the year 2045. The recommended improvements provide the City with a basis of improvements needed to meet Lancaster's future water and wastewater capacity needs. The major elements of the Water and Wastewater Master Plan include:

- Population Projections
- Water Model Update and Calibration
- Wastewater Model Update
- Water Demand and Wastewater Flow Projections
- Water Distribution and Wastewater Collection System Hydraulic Analyses
- Water and Wastewater Capital Improvements Plan
- Water and Wastewater Master Plan Report

1.2 LIST OF ABBREVIATIONS

Table 1-1 provides a list of abbreviations used throughout this report and its appendices.

Table 1-1: List of Abbreviations

Abbreviation	Description
AD	Annual Average Day Demand
CCN	Certificate of Convenience and Necessity
CIP	Capital Improvements Plan
EST	Elevated Storage Tank
ETJ	Extra Territorial Jurisdiction
FNI	Freese and Nichols, Inc.
fps	Feet per Second
GIS	Geographic Information System
gpcd	Gallons per Capita per Day
gpm	Gallons per Minute
GST	Ground Storage Tank
HGL	Hydraulic Grade Line
MD	Maximum Day
MG	Million Gallons
MGD	Million Gallons per Day
MUD	Municipal Utility District
NCTCOG	North Central Texas Council of Governments
psi	Pounds per Square Inch
PVC	Polyvinyl Chloride
q/Q	Flow in the sewer pipe divided by the maximum capacity of the sewer pipe
SCADA	Supervisory Control and Data Acquisition
SUD	Special Utility District
TCEQ	Texas Commission on Environmental Quality
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

2.0 POPULATION

Population and future land use are important elements in the analysis of water distribution and wastewater collection systems. Water demands and wastewater loads are dependent on the residential population and commercial development served by the systems and determine the sizing and location of system infrastructure. A thorough analysis of projected populations provides the basis for future water demands and wastewater loads.

2.1 HISTORICAL POPULATION

The population located within the city limits of Lancaster experienced a high annual growth rate from 2002 to 2007, at which time the growth rate began to decline likely due to the economic recession. Since 2013, the overall population within the city limits has remained nearly unchanged with an annual growth rate hovering around 0.5%. **Table 2-1** presents the historical populations for the City of Lancaster.

Table 2-1: Historical Population within the City Limits

Year	City Population[1]	Growth Rate
2002	27,550	-
2003	28,700	4.2 %
2004	29,850	4.0 %
2005	31,700	6.2 %
2006	33,550	5.8 %
2007	35,050	4.5 %
2008	35,800	2.1 %
2009	36,200	1.1 %
2010	36,361	0.4 %
2011	36,390	0.1 %
2012	36,700	0.9 %
2013	36,980	0.8 %
2014	37,150	0.5 %
2015	37,360	0.6 %
2016	37,550	0.5 %
2017	37,730	0.5 %
2018	37,880	0.4 %
15-year Average	**-**	**2.0 %**
10-Year Average	**-**	**0.6 %**
5-Year Average	**-**	**0.5 %**

[1]Populations located within the City Limits are based on U.S. Census Bureau and NCTCOG data.

2.2 PROJECTED POPULATION

The magnitude and location of population growth dictates where future water and wastewater infrastructure is required. Projecting future population is challenging, especially for relatively small geographic areas such as individual cities, because there are a variety of circumstances that can impact how fast or slow development may occur.

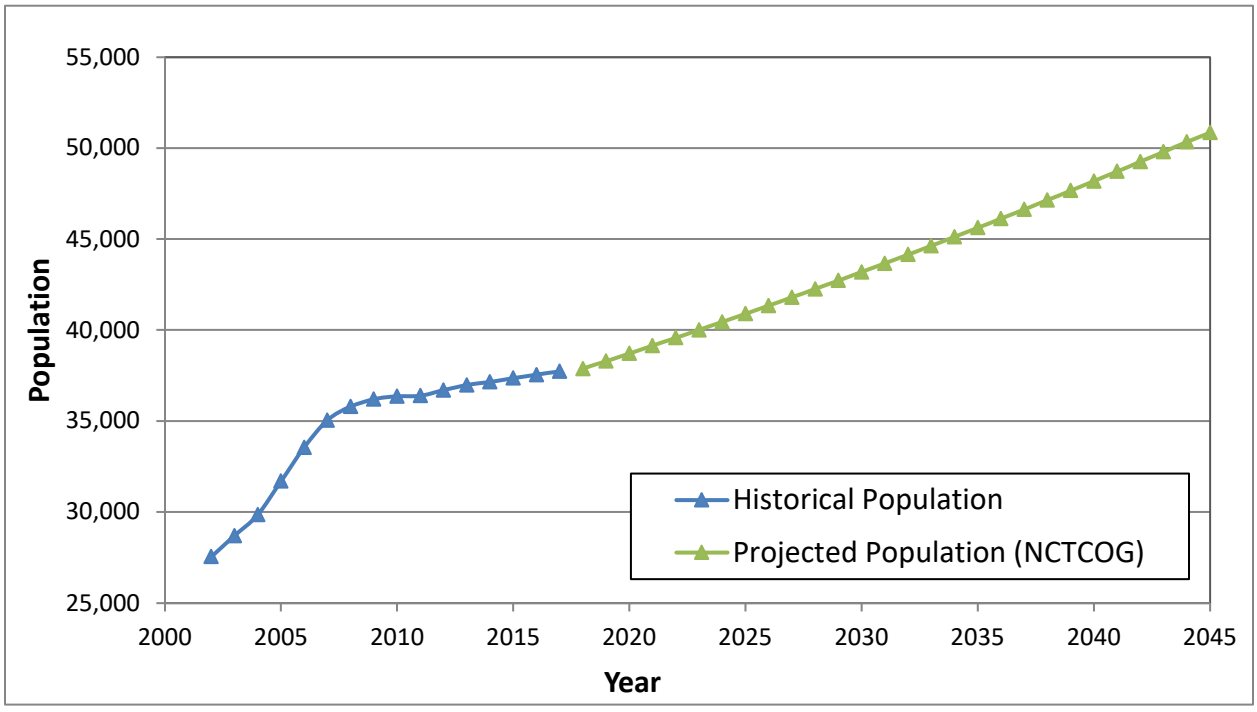
Using Traffic Survey Zones (TSZ's), the North Central Texas Council of Governments (NCTCOG) developed population and employment forecasts within the city limits of Lancaster for the year 2045. Using the 2018 population and the forecasted 2045 population, an annual growth rate is calculated to be 1.1% per year, as presented in **Table 2-2**. **Figure 2-1** shows the historical and projected population trends of the City of Lancaster.

Table 2-2: Projected Growth Rate for Population within the City Limits

Year	Population[1]	Compound Annual Growth Rate
2018	37,880	1.1 %
2045	50,849	

[11]Population located within the City Limits; population based on NCTCOG forecast data.

Figure 2-1: City of Lancaster Population Projections



Similarly, the population and employment located within the water and wastewater service areas are expected to grow over the planning period. The water service area includes the current city limits except for areas that fall within Rockett Special Utility District (SUD)'s Certificate of Convenience and Necessity (CCN). Areas in the City's extra-territorial jurisdiction (ETJ) are included in the 2045 water service area. While Rockett's CCN was excluded from the water service area, it is included in the wastewater service area. Thus, the difference between the water and wastewater service area forecasts is the existing and future population and employment located in Rockett's CCN area. The water service area population is shown in **Table 2-3** and correlates to the existing and 2045 water service area that is presented in **Figure 2-2**.

Table 2-3: Water Service Area Demographic Projections

Year	Service Area Population[1]	Lancaster MUD #1 Wholesale Population[2]	Total Water Served Population	Employment[1]
2018	37,528	1,494	39,022	11,001
2023	39,535	1,494	41,029	13,848
2028	41,673	1,494	43,167	16,682
2045	50,677	1,494	52,171	26,939

(1)Source: NCTCOG projections by TSZ

(2)Source: TCEQ Texas Drinking Water Watch.

Table 2-4 presents the population and employment projects for the wastewater service area, which correlates to the existing and 2045 wastewater service area presented in **Figure 2-3**.

Table 2-4: Wastewater Service Area Demographic Projections

Year	Service Area Population[1]	Lancaster MUD #1 Wholesale Population[2]	Total Wastewater Served Population	Employment[1]
2018	37,880	1,494	39,374	11,079
2023	40,010	1,494	41,504	14,021
2028	42,259	1,494	43,753	16,940
2045	51,855	1,494	53,349	27,876

(1)Source: NCTCOG projections by TSZ

(2)Source: TCEQ Texas Drinking Water Watch.

The projected population and employment for each TSZ is presented on **Figures 2-4** and **2-5** for the water service area and wastewater service areas, respectively.

FIGURE 2-2
CITY OF LANCASTER
EXISTING AND 2045 WATER SERVICE AREA

LEGEND

- City of Lancaster CCN
- Existing Service Area
- 2045 Service Area
- Rockett SUD
- Road
- Railroad
- Stream
- Lake/Pond
- City Limit
- ETJ Boundary

Lancaster

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Existing Service Area

CITY OF LANCASTER CCN

ROCKETT SUD

0 4,000
SCALE IN FEET

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FIGURE 2-3

CITY OF LANCASTER

EXISTING AND 2045 WASTEWATER SERVICE AREAS

LEGEND

- City of Lancaster CCN
- Existing Service Area
- 2045 Service Area
- Road
- Railroad
- Stream
- Lake/Pond
- City Limit
- ETJ Boundary

Lancaster

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Existing Service Area

CITY OF LANCASTER CCN

0 4,000

SCALE IN FEET

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FIGURE 2-4

CITY OF LANCASTER

WATER SERVICE AREA POPULATION AND EMPLOYMENT PROJECTIONS BY TSZ

TSZ ID
2018 Population (2018 Employment)
2023 Population (2023 Employment)
2028 Population (2028 Employment)
2045 Population (2045 Employment)

LEGEND

- Traffic Survey Zone
- City of Lancaster CCN
- Existing Service Area
- Rockett SUD
- 2045 Service Area
- Road
- Railroad
- Stream
- Lake/Pond
- City Limit
- ETJ Boundary

Lancaster

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TSZ Population/Employment Totals
2018 Population 38,714 (2018 Employment 11,001)
2023 Population 40,937 (2023 Employment 13,882)
2028 Population 43,159 (2028 Employment 16,741)
2045 Population 51,111 (2045 Employment 27,469)

8534
35 (3)
38 (10)
41 (18)
58 (49)

8591
0 (18)
13 (56)
26 (93)
78 (238)

8590
10 (0)
19 (28)
30 (56)
66 (151)

8642
235 (31)
259 (135)
286 (238)
386 (593)

8592
601 (535)
662 (675)
725 (814)
974 (1,300)

40689
25 (22)
26 (25)
27 (28)
31 (39)

8643
139 (662)
139 (832)
139 (1,002)
144 (1,578)

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6,720 (643)
7,112 (1,344)

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1,986 (335)

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1,610 (1,933)
3,015 (3,171)

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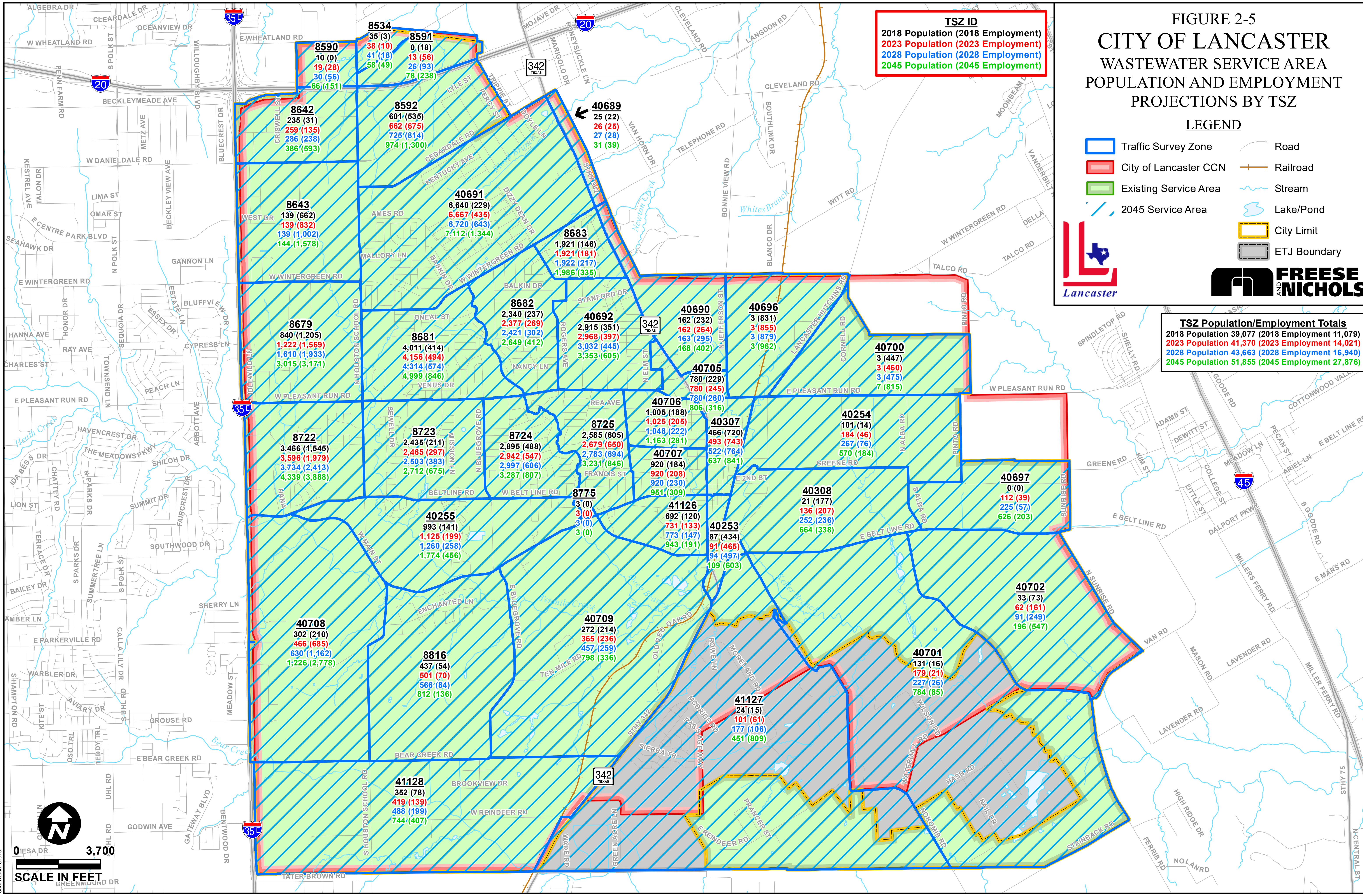


FIGURE 2-5
CITY OF LANCASTER
WASTEWATER SERVICE AREA
POPULATION AND EMPLOYMENT
PROJECTIONS BY TSZ

3.0 WATER DEMANDS

A water utility must be able to supply water to its customers at rates that fluctuate over time. Yearly, monthly, daily, and hourly variations occur in water use, with higher use typically occurring during dry years and in hot months. Water usage typically follows a diurnal pattern, or hourly variations over the course of a day, with lower demands at night and peaking in the early morning and evening.

Demand conditions most important to the hydraulic design and operation of a distribution system are annual average day demand (AD), maximum day demand (MD), and peak hour (PH) demands, which are defined as follows:

- AD use is the total annual water use divided by the number of days in the year and represents the typical water use throughout the year.
- MD is the maximum quantity of water used on any one day of the year. Water treatment facilities are typically designed based on the maximum day demand.
- Peak hour use is the highest rate at which water is required during one hour of the year. Since minimum distribution pressures are usually experienced during peak hour, the sizing and location of distribution facilities are generally determined based on this condition.

Peaking factors can be calculated by dividing the MD by the AD; the peaking factor can then be applied to future water demand forecasts to estimate future MD. A similar calculation yields the PH to MD demand peaking factor.

3.1 HISTORICAL WATER DEMANDS

Reviewing historical water demands provides insight into the City's water usage. Historical water demands from 2005 through 2018, provided by the City, are presented in **Table 3-1**. Reviewing historical water demands allows design criteria to be established in order to forecast future water demands. Historical AD and MD in million gallons per day (MGD), MD to AD peaking factors, and per-capita (or person) consumption in gallons per capita day (gpcd) provide the basis for determining the design criteria used to forecast water demands. Over the 13-year period, Lancaster's historical average day per capita

water usage rates is calculated to be 125 gpcd with a MD of 11.10 MGD in 2008. The average MD to AD peaking factor is 1.69.

Table 3-1: Historical Water Demands

Year	Population[1]	Average Day Demand (MGD)	Average Day Per Capita Rate (gpcd)	Maximum Day Demand (MGD)	Maximum Day to Average Day Peaking Factor
2005	31,700	4.28	135	6.87	1.61
2006	33,550	4.63	138	10.00	2.16
2007	33,213	3.65	110	6.80	1.86
2008	35,800	4.67	130	11.10	2.38
2009	36,200	4.35	120	7.25	1.67
2010	36,361	4.28	118	6.83	1.60
2011	36,390	4.61	127	8.10	1.76
2012	36,700	4.26	116	7.87	1.85
2013	36,980	4.40	119	6.44	1.46
2014	37,150	4.35	117	5.97	1.37
2015	37,360	4.48	120	6.67	1.49
2016	37,550	4.76	127	7.02	1.48
2017	37,730	5.42	144	7.23	1.33
		Average	**125**	--	**1.69**
		Maximum	**144**	--	**2.38**

[1]Based on Census and NCTCOG data.

Table 3-2 presents the selected water design criteria based on the historical water demands. The design criteria provide the basis of forecasting future water demands. The average per capita rate of 125 gpcd is selected as the basis for forecasting future residential water demands. Reviewing historical non-residential demands and employment in the City, an estimated average day water demand per employee is calculated to be 95 gpd/employee. Based on the historical range of peaking factors, a maximum day to average day peaking factor of 1.9 is recommended, which is slightly higher than average over the period to account for future dry, hot years. **Table 3-2** also presents the peak hour to maximum day factor based on the diurnal curve developed for this study.

Table 3-2: Water Design Criteria

Average Day Residential Demand Per Capita (gpcd)	Average Day Employment Demand Per Employee (gped)	Maximum Day to Average Day Peaking Factor	Peak Hour to Maximum Day Peaking Factor
125	95	1.9	1.5

3.2 PROJECTED WATER DEMANDS

Applying the water design criteria to the population and employment projections yields water demand projections for years 2018, 2023, 2028, and 2045. **Table 3-3** presents the projected water demands. The water demands are expected to increase by more than 160% over the next 25 years with much of that growth attributed to aggressive employment forecasts. Employment growth is forecast to increase nearly 150% while population growth has a lower, steady increase of 33% over the planning horizon.

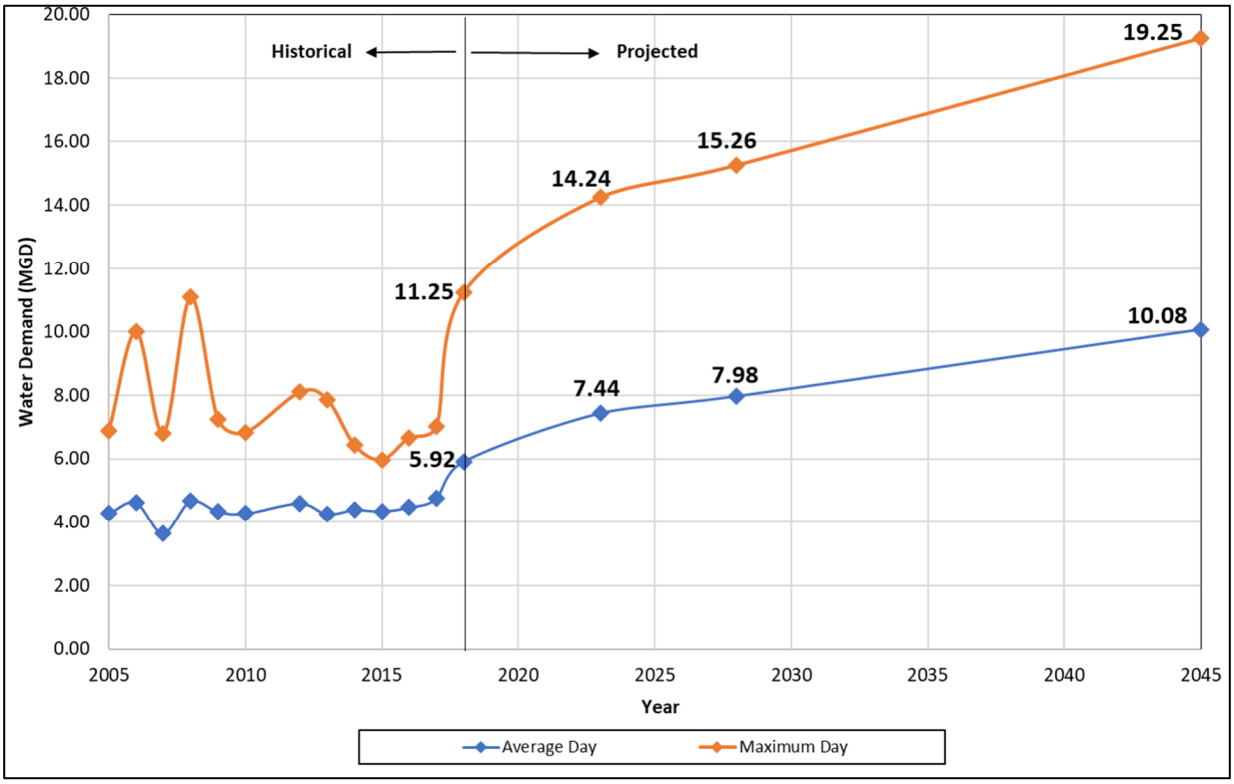
Table 3-3: Projected Water Demands

Year	Service Area Population [1]	Service Area Employment	Average Day Demand (MGD) [2]	Maximum Day Demand (MGD) [2]	Peak Hour Demand (MGD) [2]
2018	39,022	11,001	5.92	11.25	16.88
2023	41,029	13,848	7.44	14.24	20.36
2028	43,167	16,682	7.98	15.26	21.89
2045	52,171	26,939	10.08	19.25	27.88

[1] Lancaster MUD #1 wholesale population included

[2] Average Day Demand includes 1.0 MGD wholesale delivery to the City of Wilmer and a Maximum Day Demand of 2.0 MGD in years 2023, 2028 and 2045 (based on amended contract, February 2020). Peak hour demand includes the Maximum Day Demand for the City of Wilmer but is not increased by the peak hour factor based on the wholesale agreement.

Figure 3-1: Historical and Projected Water Demand



The City of Lancaster currently operates the water distribution system with two pressure planes, the Upper Pressure Plane (UPP) and the Lower Pressure Plane (LPP). The UPP generally includes the western portion of the city while the LPP consists of the eastern portion. **Table 3-4** presents the projected water demands for both the UPP and LPP.

Table 3-4: Projected Water Demands by Pressure Plane

Pressure Plane	Service Area Population[1]	Service Area Employment	Average Day Demand (MGD)[2]	Maximum Day Demand (MGD)[2]	Peak Hour Demand (MGD)
Existing (2018)					
UPP (792')	30,737	7,112	4.51	8.57	12.86
LPP(705')	8,285	3,889	1.41	2.68	4.02
Total	**39,022**	**11,001**	**5.92**	**11.25**	**16.88**
2023					
UPP (792')	32,217	9,443	4.92	9.35	14.02
LPP (705')	8,812	4,405	2.52	4.89	6.34
Total	**41,029**	**13,848**	**7.44**	**14.24**	**20.36**
2028					
UPP (792')	33,737	11,875	5.34	10.14	15.21
LPP (705')	9,430	4,807	2.64	5.12	6.68
Total	**43,167**	**16,682**	**7.98**	**15.26**	**21.89**
2045					
UPP (792')	39,046	19,518	6.73	12.78	19.17
LPP (705')	13,125	7,421	3.35	6.47	8.71
Total	**52,171**	**26,939**	**10.08**	**19.25**	**27.88**

[1] Lancaster MUD #1 wholesale population included in the UPP.
[2] City of Wilmer's wholesale demand of 1.0 MGD (AD) and 2.0 MGD (MD) included in the LPP for years 2023, 2028 ,2045. Peak hour demand includes the Maximum Day wholesale demand, but it is not increased by the peak hour factor based on the wholesale agreement.

4.0 EXISTING WATER SYSTEM

The existing water distribution system currently consists of a network of pipes ranging in size from 1.25-inches to 48-inches, two pump stations, three ground storage tanks, and three elevated storage tanks. The City purchases water from Dallas Water Utilities (DWU) and receives water at two delivery points: the Ames PS and the James R. Williams PS. **Figure 4-1** shows the City's existing water distribution system and **Figure 4-2** presents the TCEQ water system schematic for the City.

4.1 PRESSURE PLANES AND WATER STORAGE FACILITIES

Water is supplied by DWU to the UPP by the Ames PS (located at the intersections of Ames Road and Houston School Road). The Ames Road and Wintergreen Road elevated storage tanks, with capacities of 1.0-MG and 2.0-MG, respectively, serve the UPP with overflow elevations of 792 feet, which set the static hydraulic gradient.

During low demand periods, the City utilizes the Ames PS to serve the LPP through transfer valves from the UPP. Water is also supplied from DWU to the James R. Williams PS, which can provide water to the LPP during higher demand periods. The two elevated storage tanks located in the LPP include the 0.5-MG Pleasant Run Road tank and the 1.5-MG Beltline Road tank, each with an overflow elevation of 705 feet. The existing system water storage facilities are summarized in **Table 4-1** and presented schematically in **Figure 4-1**.

Table 4-1: Existing Storage Facilities

Location	Tank Name	Type	Capacity (MG)	Overflow Elevation (ft)	2018 Status During Field Data Collection
UPP	Ames Road	GST	3.0	-	Active
	Ames Road (buried)	GST	0.5	-	Active
	Ames Road	EST	1.0	792	Offline
	Wintergreen Road	EST	2.0	792	Active
LPP	James R. Williams	GST	6.0	-	Offline
	Pleasant Run	EST	0.5	705	Active
	Beltline Road	EST	1.5	705	Offline
Total Elevated Storage			**5.0**		
Total Ground Storage			**9.5**		
Total Storage			**14.5**		

FIGURE 4-1

CITY OF LANCASTER

EXISTING WATER SYSTEM

LEGEND

Existing Water System

- PS — Pump Station
- Ground Storage Tank
- Elevated Storage Tank
- 8" and Smaller Water Line
- 10" and Larger Water Line

Dallas Water Utilities

- M — Meter

- Water Supply Line
- Road
- Railroad
- Lake/Pond
- Stream
- Parcel
- Upper Pressure Plane (792)
- Lower Pressure Plane (705)
- City Limit
- ETJ Boundary

Lancaster

FREESE AND NICHOLS

DWU Meter

26.4 MGD Ames Rd
Pump Station
Firm Capacity = 18.5 MGD

1.0 MG Ames Rd
Elevated Storage Tank
(OFFLINE)
Overflow Elev.: 792'

3.5 MG Ames Rd
Ground Storage Tank (buried)

6.0 MG James R. Williams
Ground Storage Tank

DWU Meter

5.3 MGD James R. Williams
Pump Station
Firm Capacity = 3.5 MGD
(OFFLINE)

2.0 MG Wintergreen Rd
Elevated Storage Tank
Overflow Elev.: 792'

Dallas
Transfer Valve

Pleasant Run
Transfer Valve

0.5 MG Pleasant Run Rd
Elevated Storage Tank
Overflow Elev.: 705'

1.5 MG Beltline Rd
Elevated Storage Tank
(OFFLINE)
Overflow Elev.: 705'

0 4,000
SCALE IN FEET

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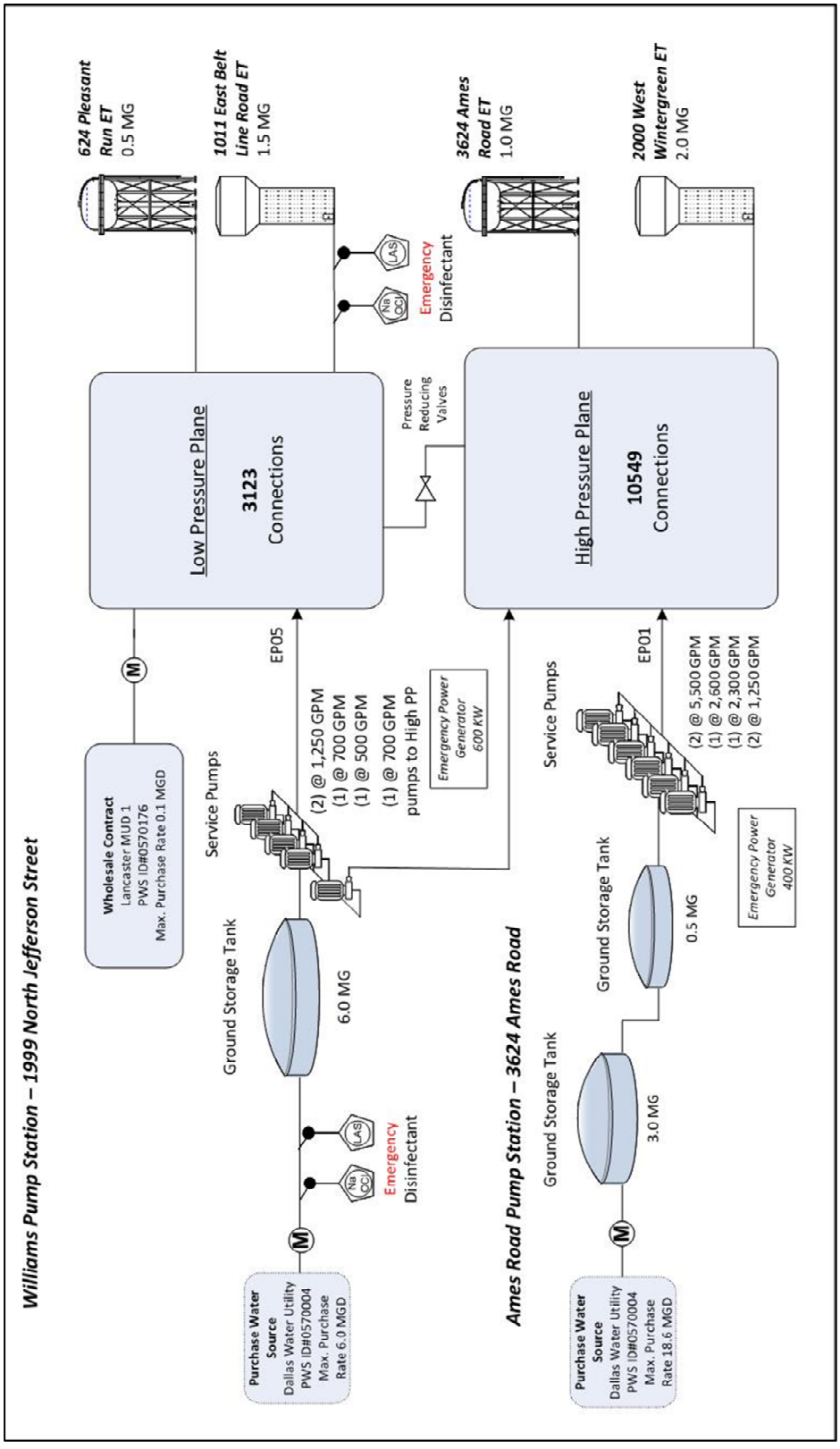


Figure 4-2: Existing Water System TCEQ Schematic

4.2 PUMPING CAPACITY

The City obtains wholesale water from DWU; the primary interconnect meter is on Wheatland Road at Houston School Road. A 24-inch diameter water main travels along Houston School Road from the meter to the Ames Road GST. From the Ames Road GST, the Ames Road PS lifts the water pressure to provide water service to the City of Lancaster. The Ames Road PS has six (6) pumps with a firm capacity of 18.5 MGD, as shown in **Table 4-2**.

A secondary delivery point for water from DWU is located at the James R. Williams GST and pump station, which serves the LPP. The Williams PS has one 700 gpm pump dedicated to providing water to the UPP if needed. The Williams PS has 4 pumps dedicated to the LPP, with a firm LPP capacity of 33.5 MGD. At the time of the field data collection efforts in January 2018, this pump station was offline.

Table 4-2: Existing Service Pumping Capacity

Location	Pump Number	Rated Capacity		Rated Head (feet)
		(gpm)	(MGD)	
Ames Road Pump Station (UPP)	1	1,250	1.8	168
	2	1,250	1.8	168
	3	2,300	3.3	168
	4	2,600	3.7	168
	5	5,500	7.9	185
	6	5,500	7.9	185
James R. Williams Pump Station (LPP)	1	500	0.7	125
	2	700	1.0	125
	3	1,250	1.8	125
	5	1,250	1.8	125
	11 (pumps to UPP)	700	1.0	175
System Total Capacity	UPP	18,400	26.4	-
	LPP	33,700	5.3	-
System Firm[1] Capacity	UPP	12,900	18.5	-
	LPP	22,450	33.5	-

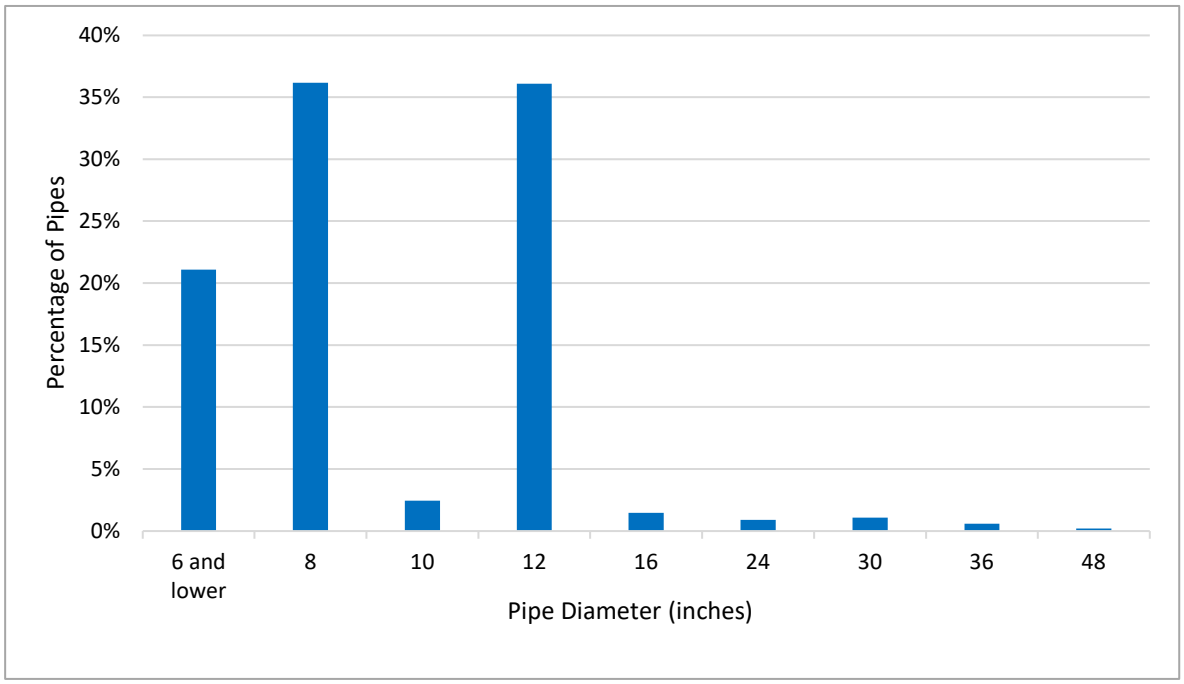
[1]Pumping capacity with the largest pump out of service.

4.3 WATER LINES

The City of Lancaster's distribution system consists of approximately 105 miles of water lines, ranging in size from 1.25-inches to 48-inches. **Figure 4-4** illustrates the percentage of pipe length by diameter based

on City-provided GIS. Roughly 36% of pipes are 8-inches in diameter and another 36% are 12-inches in diameter, accounting for most of the system piping.

Figure 4-3: Water System Percentage of Pipes by Size



5.0 WATER SYSTEM ANALYSES AND HYDRAULIC MODELING

A hydraulic water model was updated and calibrated for use in evaluating the City's water system to identify needed improvements and establish a plan to meet projected growth in water demands through 2045. Various system modifications were investigated to determine the most appropriate approach to deliver future water demands efficiently and effectively.

5.1 WATER MODEL UPDATE AND CALIBRATION

A calibrated water model serves as a key decision-making tool to assess system performance and help determine the sizing and location of system infrastructure in both the present and future planning periods. The following subsections document the model update and calibration process.

5.1.1 PHYSICAL NETWORK AND DEMAND ALLOCATION

The hydraulic model developed for Lancaster's 2012 Water and Wastewater Impact Fee Evaluation by FNI was converted from Innovyze H2OMap software to Innovyze InfoWater, due to the retirement of the H2OMap product line. This model was then updated based on the City's GIS water information to include water lines and other infrastructure added since 2012. The pressure plane boundaries were updated based on City staff input; the boundaries and valve closures had minor modifications since 2012. City staff also provided the current system operations which were incorporated into the model controls.

The pumping and storage facilities were manually added to the model based on as-built drawings and information provided by the City. Using the City's 2017 water meter billing data, the water demands were spatially assigned in the model by matching the information from the customer billing database with unique customer addresses in the parcel shapefile. FNI used the spatial join function in GIS to distribute the 2017 demands to the nearest model nodes and scaled the allocated demands to match the demands of the selected calibration day. The geocoded meter map is included in **Appendix A**.

5.1.2 FIELD TESTING

To assist with model calibration and to supplement available operational data, field pressure testing was conducted at eight locations throughout the distribution system. Data was collected from January 30 to

February 5, 2018 using temporary pressure recorders that were attached to the City's fire hydrants. The average recorded pressures ranged from 45 psi to 116 psi.

SCADA readings for tank levels and pump status were collected on an hourly basis during this period and provided the basis for the diurnal demand curve. To create the diurnal curve, a mass balance of the system demand was calculated using the sum of water pumped into the distribution system from the Ames and James R. Williams Pump Stations and adding or subtracting the change in storage provided by the ESTs. The diurnal demand curve and calibration results can be found in **Appendix A.**

5.1.3 WATER MODEL CALIBRATION

To verify that the hydraulic model accurately represents the performance of the distribution system, a model calibration analysis was performed using the data obtained during the field testing. The model calibration day was selected by reviewing daily demands, pressure data, and SCADA information to find a typical day with no irregularities; based on these factors, January 30, 2018 was selected for the calibration day. Operational data was used to establish initial tank levels and pump status. Parameters and operational controls were adjusted in the model until they represented the field pressure testing data as well as the tank level fluctuations over the 24-hour extended period simulation (EPS). The model results closely matched the field pressure testing data as shown in the comparison of field data to model results, which are presented in **Appendix A**. Once the model aligns with the field conditions, it is considered calibrated and provides an accurate representation of field conditions.

5.2 TCEQ CAPACITY REQUIREMENTS

The existing distribution system was evaluated to assess current supply, pumping, and storage capacity, residual pressures, water age, and fire flow capacity. This analysis was performed to determine if there are any existing system deficiencies and provide a baseline for the current level of service. As a public water utility, the City of Lancaster is required to meet all rules and regulations for public water systems established by the Texas Commission on Environmental Quality (TCEQ) in Title 30 Texas Administrative Code (30 TAC), Chapter 290. These requirements are based on number of connections in each pressure plane. Based on 2017 meter data, there are approximately 12,070 connections in the UPP and 3,400 connections in the LPP. **Table 5-1** presents an overall checklist for the minimum TCEQ requirements for pumping capacity, total storage capacity, and elevated storage capacity by pressure plane. As shown in

Table 5-1, the City is meeting the TCEQ capacity requirements for pumping, elevated storage, and total storage.

Table 5-1: TCEQ Capacity Checklist for the Existing System

Pressure Plane		Current Capacity	TCEQ Requirement	Actual	Meets TCEQ?
Upper Pressure Plane (792') 12,070 connections	Elevated Storage	2.5 MG	100 gallons per connection	207 gallons per connection	Yes
	Total Storage	5.5 MG	200 gallons per connection	455 gallons per connection	Yes
	Pump Station	12,900 gpm (1)	0.6 gpm per connection	1.1 gpm per connection	Yes
Lower Pressure Plane (702') 3,400 connections	Elevated Storage	2.0 MG	100 gallons per connection	588 gallons per connection	Yes
	Total Storage	8.0 MG	200 gallons per connection	2,353 gallons per connection	Yes
	Pump Station	3,150 gpm (1)	0.6 gpm per connection	0.93 gpm per connection	Yes

(1) Firm Capacity = pump station capacity with largest pump out of service

5.3 DESIGN EVALUATION CRITERIA

Design evaluation criteria provides a basis for assessing existing infrastructure performance and capacity to determine if a given facility may require expansion to meet current and future demands. The design evaluation criteria take into account TCEQ requirements as well as additional factors such as fire protection. **Table 5-2** presents FNI's proposed design evaluation criteria for the City of Lancaster's water distribution system.

Table 5-2: Proposed Design Evaluation Criteria

Category	Evaluation Parameter	FNI Recommendation	TCEQ Requirement	Reference Standard
Storage Capacity	Total Storage	12 hours of MD	200 gal/con	TCEQ 290.45(b)(1)(D)(ii)
	Elevated Storage	Peaking Volume for 4 hours (40% of PH demands)	100 gal/con	TCEQ 290.45(b)(1)(D)(iv)
Pumping Capacity	Service Pumping Requirement	60% of PH Demands	If Elevated Storage > 200 gal/con: 0.6 gpm/con	TCEQ 290.45(b)(1)(D)
	Minimum Pressure (MD)	35 psi	35 psi	TCEQ 290.44(d)
	Minimum Pressure (Fire Flow)	20 psi	20 psi	TCEQ 290.44(d)
Fire Flow Requirements	Minimum Fire Flow	1,000 gpm	-	
Velocity and Headloss	*Water Transmission Lines* (diameter larger than 16-inches)			
	Maximum Pipeline velocity (MD)	5 ft/s		AWWA M32 Manual
	Maximum headloss	4 ft/1,000 ft		AWWA M32 Manual
	Water Distribution Lines (diameter 16-inches and smaller)			
	Maximum Pipeline velocity (MD)	5 ft/s		AWWA M32 Manual
	Maximum headloss	7 ft/1,000 ft		AWWA M32 Manual

5.4 EXISTING SYSTEM HYDRAULIC MODELING ANALYSIS

A 24-hour EPS analysis was performed with 2018 maximum day demands. EPS modeling provides a tool to evaluate the system over time to assess response to hourly changes in demand, pump cycling, and tanks filling or draining. **Figures 5-1 and 5-2** present the modeled pumping and tank levels during simulated 2018 maximum day demand conditions. As observed on Figure 5-2, the LPP was served exclusively from the UPP via flow from the transfer valves at the Dallas pressure reducing valve (PRV) and the Pleasant Run PRV, thus no pumps are shown for this simulation.

Figure 5-1: 2018 Maximum Day Demand Pumping and Storage - Upper Pressure Plane

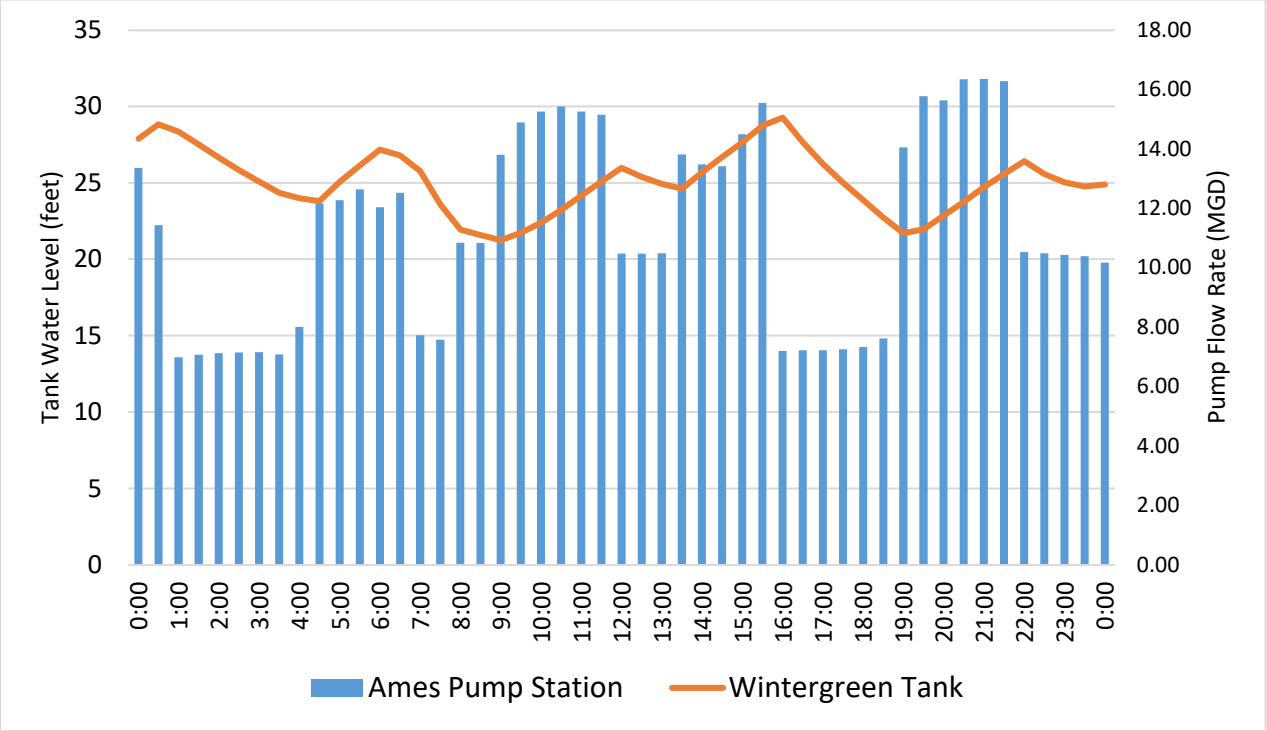
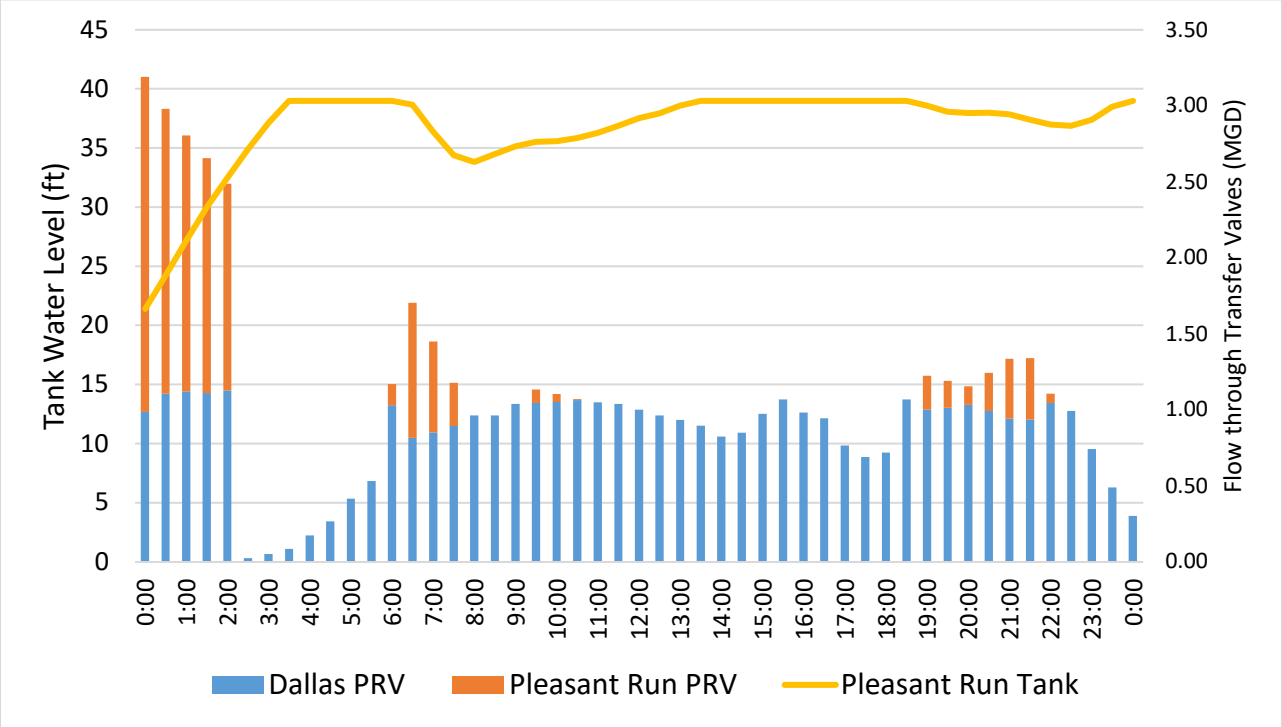


Figure 5-2: 2018 Maximum Day Demand Supply (PRVs) and Storage - Low Pressure Plane



During a maximum day EPS analysis, the peak hour demand condition is simulated through the diurnal demand pattern, where the peak hour factor is assigned. The maximum day peak hour demand represents the single hour of the year with the highest system demand. Peak hour simulations are used to assess the ability of the distribution system to maintain residual pressures because the highest demand period induces the lowest pressure due to increased headloss throughout the system.

Figure 5-3 shows the minimum pressures observed in the model at peak hour with the 2018 maximum day demand. This map highlights potential problem areas in the system as well as where reasonable pressure ranges are maintained throughout the system. The TCEQ minimum required pressure within a distribution system is 35 pounds per square inch (psi) under normal demand conditions. As seen on **Figure 5-3**, the system meets that minimum requirement with some outliers observed on the suction side of the Ames Road and James R. Williams pump stations. Most pressures are within a range between 35 to 100 psi.

To evaluate the available fire flows of the system, a fire flow analysis was conducted under existing maximum day demand conditions. TCEQ requires a minimum residual pressure of 20 psi be maintained while delivering the fire flow demand. For this analysis, a steady-state model run was utilized to calculate the available fire flow at each node in the system with a residual pressure of 20 psi. **Figure 5-4** shows the results of the fire flow simulation. The James R. Williams PS was not online for this simulation, resulting in lower available fire flow amounts, which indicates the need to have this pump station in service if a fire occurred in the northern portion of the LPP. The majority of the water system can provide at least 1,000 gpm, typical of a residential fire flow demand, while meeting the 20 psi residual pressure requirement. Areas where the available fire flow is below 1,000 gpm are due to small diameter lines in isolated areas. Upsizing smaller lines and completing piping loops can improve low fire flow. Available fire flow for large commercial and industrial land uses should be evaluated on a case-by-case basis.

Figure 5-5 presents the results of the water age analysis, which provides insights into where water may not move as rapidly through the system and may indicate areas with declining water quality. **Figure 5-5** displays a water age contour map, presenting the age of water as it enters the Ames Road storage and pump station. Dead end lines and areas located farther from the Ames Road pump station have higher water age. A flushing program to move water in lower demand areas as well as completing loops helps improve water age in the distribution system.

FIGURE 5-3

CITY OF LANCASTER

2018 MAXIMUM DAY DEMAND- MODELED MINIMUM PRESSURES AT PEAK HOUR

PRESSURE PLANES

- Upper Pressure Plane (792)
- Lower Pressure Plane (705)

MINIMUM PRESSURE

- Less than 35 psi
- 35-50 psi
- 50-80 psi
- 80-100 psi
- Greater than 100 psi

2018 Maximum Day Demand = 11.25 MGD
2018 Peak Hour Demand = 16.88 MGD

LEGEND

Dallas Water Utilities
- Meter
- Water Supply Line

Existing Water System
- Pump Station
- Ground Storage Tank
- Elevated Storage Tank
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Road
- Railroad
- Lake
- Stream
- Parcel
- City Limit
- ETJ Boundary

Lancaster

FREESE AND NICHOLS

DWU Meter

26.4 MGD Ames Rd
Pump Station
Firm Capacity = 18.5 MGD

1.0 MG Ames Rd
Elevated Storage Tank
(OFFLINE)
Overflow Elev.: 792'

3.5 MG Ames Rd
Ground Storage Tank

2.0 MG Wintergreen Rd
Elevated Storage Tank
Overflow Elev.: 792'

6.0 MG James R. Williams
Ground Storage Tank

DWU Meter

5.3 MGD James R. Williams
Pump Station
Firm Capacity = 3.5 MGD
(OFFLINE)

0.5 MG Pleasant Run Rd
Elevated Storage Tank
Overflow Elev.: 705'

1.5 MG Beltline Rd
Elevated Storage Tank
(OFFLINE)
Overflow Elev.: 705'

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FIGURE 5-4

CITY OF LANCASTER

EXISTING WATER SYSTEM
AVAILABLE FIRE FLOW
LEGEND

AVAILABLE FIRE FLOW

- Less than 500 gpm
- 500 - 1000 gpm
- 1000 - 2000 gpm
- 2000 - 3000 gpm
- Greater than 3000 gpm

2018 Maximum Day Demand = 11.25 MGD

Dallas Water Utilities
- Meter
- Water Supply Line

Existing Water System
- Pump Station
- Ground Storage Tank
- Elevated Storage Tank
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Road
- Railroad
- Stream
- Lake/Pond
- Parcel
- Existing Service Area
- City Limit
- ETJ Boundary

Lancaster

FREESE AND NICHOLS

DWU Meter

26.4 MGD Ames Rd
Pump Station
Firm Capacity = 18.5 MGD

1.0 MG Ames Rd
Elevated Storage Tank
(OFFLINE)
Overflow Elev.: 792'

3.5 MG Ames Rd
Ground Storage Tank

2.0 MG Wintergreen Rd
Elevated Storage Tank
Overflow Elev.: 792'

6.0 MG James R. Williams
Ground Storage Tank

DWU Meter

5.3 MGD James R. Williams
Pump Station
Firm Capacity = 3.5 MGD
(OFFLINE)

0.5 MG Pleasant Run Rd
Elevated Storage Tank
Overflow Elev.: 705'

1.5 MG Beltline Rd
Elevated Storage Tank
(OFFLINE)
Overflow Elev.: 705'

0 4,000
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FIGURE 5-5
CITY OF LANCASTER
EXISTING WATER SYSTEM
WATER AGE

WATER AGE

- Less than 1 day
- 1 - 3 days
- 3 - 5 days
- 5 - 7 days
- Greater than 7 days

2018 Average Day Demand = 5.92 MGD

LEGEND

Dallas Water Utilities
- Meter
- Water Supply Line

Existing Water System
- Pump Station
- Ground Storage Tank
- Elevated Storage Tank
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Road
- Railroad
- Stream
- Lake/Pond
- Parcel
- Existing Service Area
- City Limit
- ETJ Boundary

Lancaster

FREESE AND NICHOLS

DWU Meter

26.4 MGD Ames Rd
Pump Station
Firm Capacity = 18.5 MGD

1.0 MG Ames Rd
Elevated Storage Tank
(OFFLINE)
Overflow Elev.: 792'

3.5 MG Ames Rd
Ground Storage Tank

2.0 MG Wintergreen Rd
Elevated Storage Tank
Overflow Elev.: 792'

6.0 MG James R. Williams
Ground Storage Tank

DWU Meter

5.3 MGD James R. Williams
Pump Station
Firm Capacity = 3.5 MGD
(OFFLINE)

0.5 MG Pleasant Run Rd
Elevated Storage Tank
Overflow Elev.: 705'

1.5 MG Beltline Rd
Elevated Storage Tank
(OFFLINE)
Overflow Elev.: 705'

0 4,000
SCALE IN FEET

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5.5 FUTURE WATER SYSTEM EVALUATION

Water system improvements are developed to improve existing system performance as well as accommodate anticipated growth through 2045. Storage and pumping needs are first considered and then the piping network is evaluated with the hydraulic model. The results of these evaluations are presented in this section.

5.5.1 FUTURE REQUIRED STORAGE AND PUMPING CAPACITY

This section presents an evaluation of the storage and pumping capacity for the City based on criteria developed by FNI, which is typically more stringent than TCEQ requirements to take into consideration additional factors such as fire suppression, system redundancy and operational efficiencies. The design criteria used to analyze elevated storage tank capacity is the volume required to provide adequate equalization storage for peak hour demands plus emergency storage for fire protection. It is typically assumed that half of the elevated storage tank capacity is used to meet peak hourly demands that exceed the maximum day rate (equalization volume), while the other half of the tank is used for fire protection and emergency conditions (fire/emergency volume). This evaluation assumes that pumping will meet 60% of peak hour demands and elevated storage will meet the remaining 40% of peak hour demands. **Table 5-3** shows the recommended elevated storage by pressure plane.

Table 5-3: Recommended Elevated Storage Capacity

Year	Pressure Plane	Peak Demand (MGD)[1]	Peak Volume (MG)[2]	Fire Volume (MG)[3]	Total (MG)[4]	Available Elevated Storage Volume (MG)	Additional Elevated Storage Capacity Needed (MG)
2018	UPP	5.14	0.86	0.63	1.49	3.0	0
	LPP	1.61	0.27	0.63	0.90	2.0	0
2023	UPP	5.61	0.93	0.63	1.56	3.0	0
	LPP	1.74	0.29	0.63	0.92	2.0	0
2028	UPP	6.08	1.01	0.63	1.64	3.0	0
	LPP	1.87	0.31	0.63	0.94	2.0	0
2045	UPP	7.67	1.28	0.63	1.91	3.0	0
	LPP	2.68	0.45	0.63	1.08	2.0	0

[1]Equals 40% of peak hour demand

[2]Required volume to supply the peak demand for a duration of 4 hours

[3]Assuming highest fire flow required is 3,500 gpm for a 3-hour duration

[4]The greater of twice the peaking volume or the peaking volume plus fire volume

No additional elevated storage is recommended for the City through the planning horizon. However, with the 1.5-MG Ames EST reaching the end of its useful life, it is recommended that this tank be decommissioned. Even without this tank in service, the UPP has adequate elevated storage capacity through 2045.

The recommended firm pumping capacity was calculated based on meeting 60% of the peak hour demands. Firm pumping capacity is defined as the total available pumping capacity with the largest pump out of service. **Table 5-4** presents the recommended firm pumping capacity. Additional 0.5 MGD of firm capacity is recommended for the LPP, while the UPP has ample pumping capacity through the planning period.

Table 5-4: Recommended Firm Pumping Capacity

Year	Pressure Plane	Recommended Firm Pumping[1] (MGD)	Available Total Pumping Capacity (MGD)	Available Firm Pumping Capacity (MGD)	Additional Firm Pumping Capacity Needed (MGD)
2018	UPP	7.72	27.4	19.5	0
	LPP	2.41	5.3	3.5	0
2023	UPP	8.41	27.4	19.5	0
	LPP	2.60	5.3	3.5	0
2028	UPP	9.13	27.4	19.5	0
	LPP	2.81	5.3	3.5	0
2045	UPP	11.50	27.4	19.5	0
	LPP	4.03	5.3	3.5	0.5

[1]Recommended pumping is 60% of the peak hour demand

Recommended ground storage capacity was calculated based on providing storage equivalent to 8 hours of maximum day demand. **Table 5-5** presents the recommended ground storage capacity by pressure plane. A minimum of 0.76 MG of additional ground storage is recommended for the UPP by 2045, while the LPP has adequate ground storage capacity through the planning period.

Table 5-5: Recommended Ground Storage

Year	Pressure Plane	8 Hours of Maximum Day Demand (MG)	Available Ground Storage (MG)	Additional Ground Storage Capacity Needed (MG)
2018	UPP	2.86	3.5	0
	LPP	0.89	6	0
2023	UPP	3.12	3.5	0
	LPP	1.30	6	0
2028	UPP	3.38	3.5	0
	LPP	1.37	6	0
2045	UPP	4.26	3.5	0.76
	LPP	1.82	6	0

5.5.2 FUTURE WATER SYSTEM HYDRAULIC MODELING ANALYSIS

Using the recommended design criteria outlined in Table 5-2, water system improvements were developed to accommodate the anticipated residential and non-residential growth forecast through 2045. Based on the hydraulic model evaluation results for 2028 and 2045 water demands, challenges facing the water system include improving system pressures, improving water system resilience, and providing service to future growth areas where little to no infrastructure is currently available.

- Growth: New distribution system mains are required to provide service to new areas within the City's water service area. Lines were sized based on the demand forecasts for each specific area with a minimum pipe diameter of 12-inches.

- Improving System Pressures and Redundancy: The existing distribution system has some areas of low pressures as well as higher pressures that could be better managed with transitions to the pressure plane boundaries, which would also facilitate redundant water supply feeds and connectivity between the UPP and LPP. The transitions to the pressure plane boundaries will be discussed later in this section.

The 2018 water model served as the starting point to develop the 2028 and 2045 models. The forecasted demands for each future scenario were assigned in the model based on the spatial TSZ forecasts. For the 2028 and 2045 model scenarios, the John R. Williams PS is in operation and operational controls are modeled based on water levels in the Beltline EST. Similarly, pump controls were adjusted slightly in the UPP operating based on water levels in the Wintergreen EST.

With these adjustments to the model, hydraulic analyses were performed for the 2028 and 2045 maximum day demand conditions. Any areas of high velocity, high headloss, or low pressure were identified for improvements so that the system performs within the design evaluation criteria presented in **Table 5-2.** A 24-hour EPS model was simulated for both demand scenarios to verify that the recommended improvements would enhance performance of the system and that it would operate within the established design criteria. **Figures 5-6** through **5-9** present the modeled pumping and tank levels for 2028 and 2045 for both the UPP and LPP.

Figure 5-6: 2028 Maximum Day Demand Pumping and Storage - Upper Pressure Plane

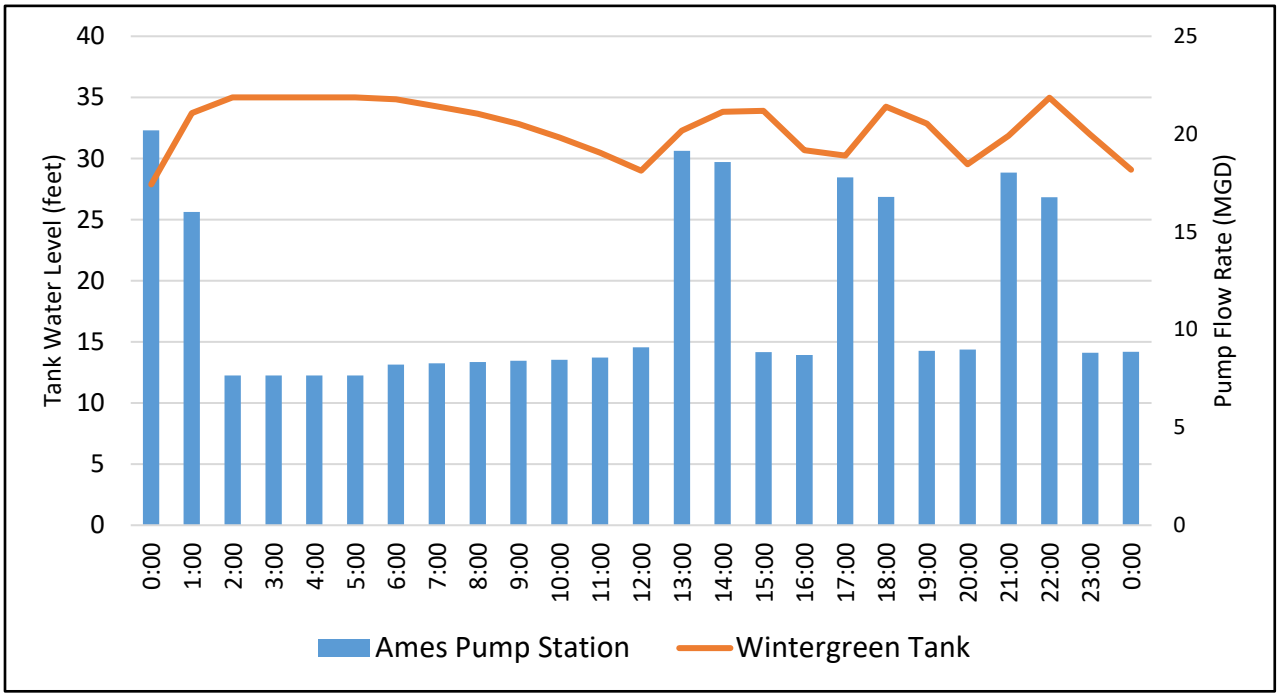


Figure 5-7: 2028 Maximum Day Demand Pumping and Storage - Lower Pressure Plane

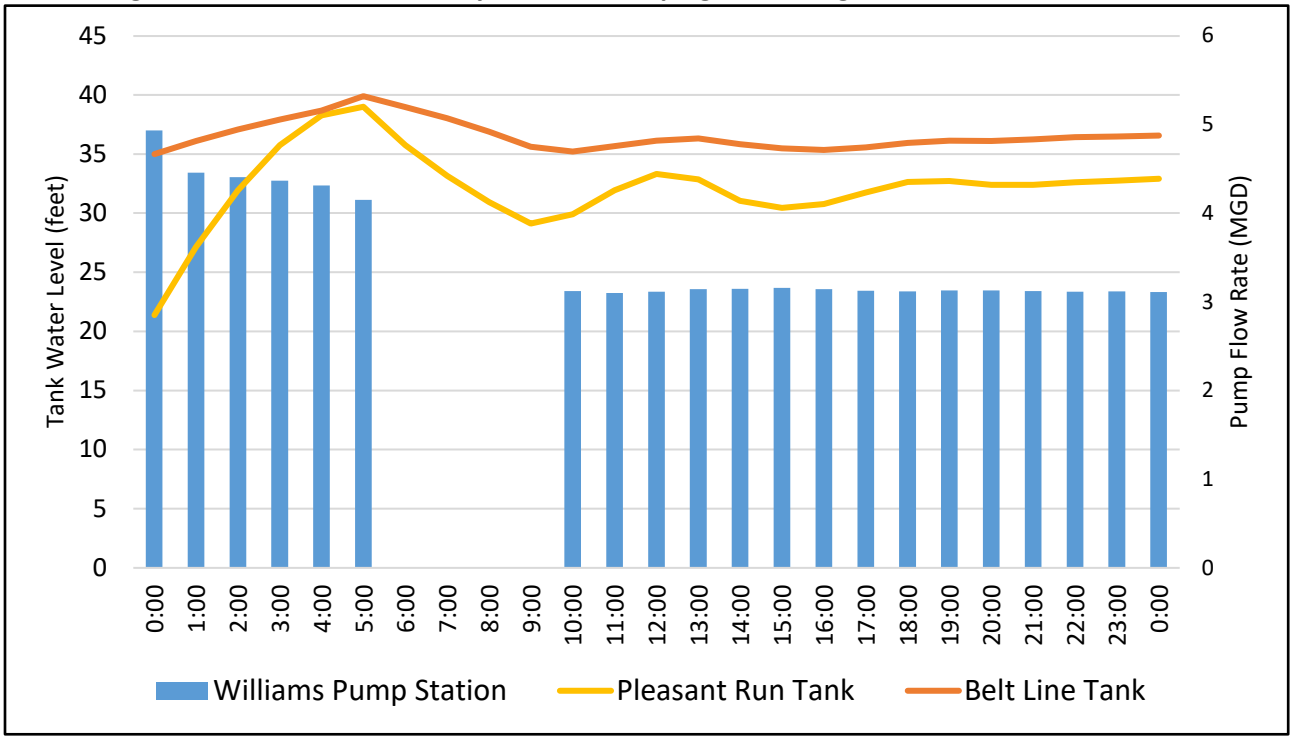


Figure 5-8: 2045 Maximum Day Demand Pumping and Storage - Upper Pressure Plane

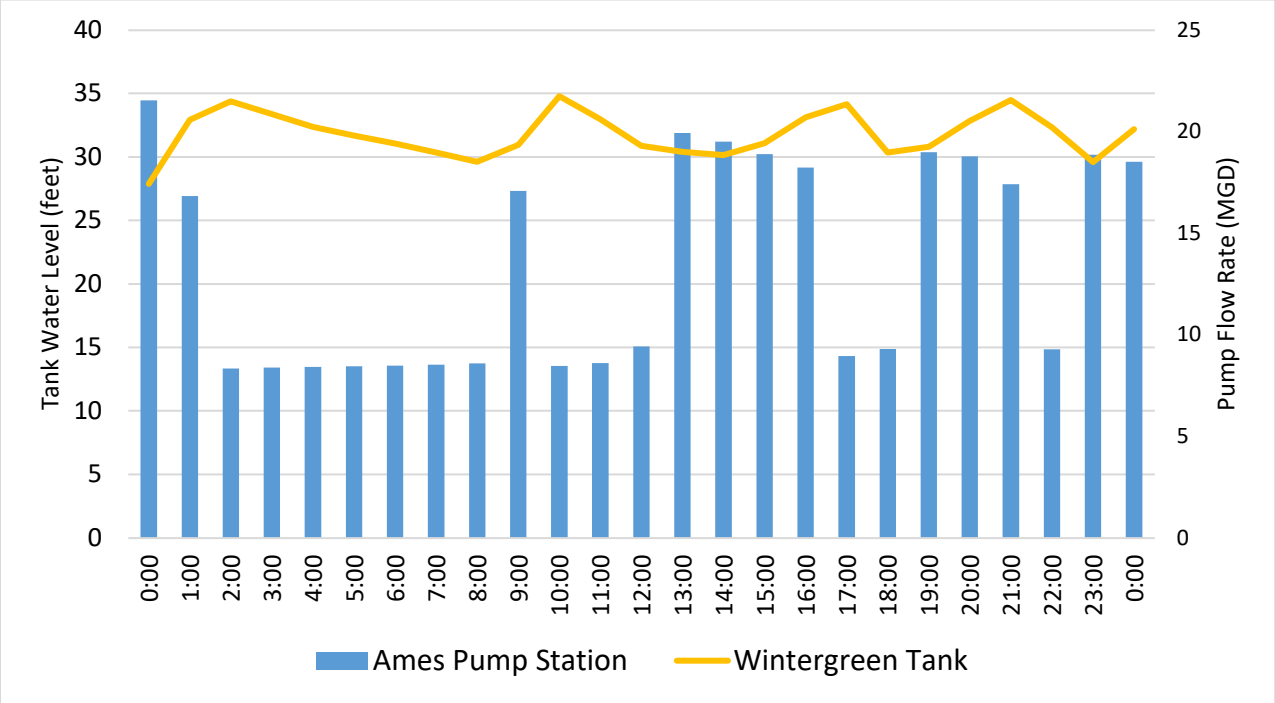
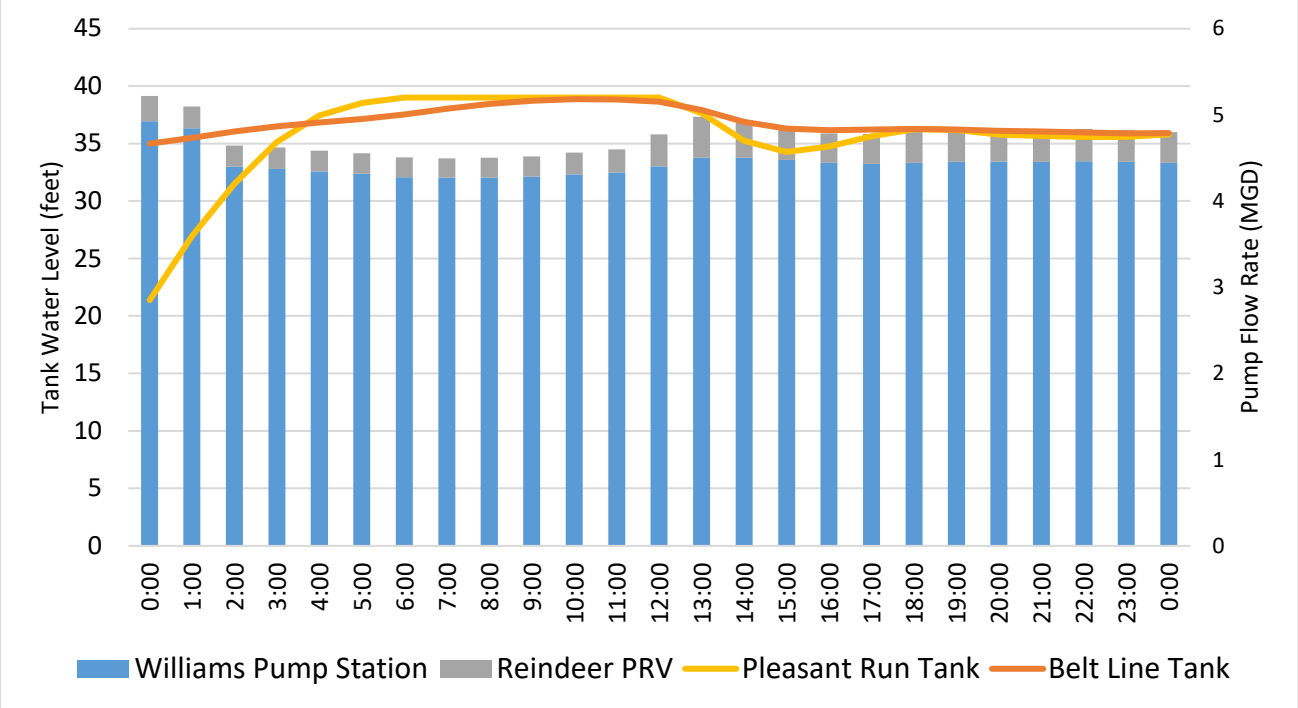


Figure 5-9: 2045 Maximum Day Demand Pumping and Storage - Lower Pressure Plane



By 2045, changes to the pressure plane boundary are recommended to balance pressures, especially to the newly served portions of the service area and provide additional system resilience through more interconnected locations. Another benefit of the new pressure plane boundary is improved water age. **Figure 5-10** presents the recommended placement of additional transfer valves and the proposed pressure plane boundary.

With the improvements in place, **Figure 5-11** shows the minimum pressures at peak hour during the 2028 maximum day demand conditions. **Figure 5-12** presents the fire flows during the 2028 maximum day demand conditions. The fire flow conditions are modeled at the average hour of the maximum day with the elevated storage tanks at 50% full. Under these conditions, the available fire flow is above 1,000 gpm throughout the system**. Figure 5-13** presents the water age analysis during the 2028 average day demand conditions.

Similarly, with 2045 improvements in place, analyses were performed for maximum day demand conditions, with **Figure 5-14** presenting the minimum pressures at the peak hour for the 2045 demand conditions. All pressures are above 35 psi, with the majority of the system operating in the 50 psi to 80 psi range. Available fire flow has improved with most junctions providing more than 3,000 gpm with a residual pressure of 20 psi, as shown in **Figure 5-15**. Water age also shows significant improvements with much of the system reflecting a water age lower than 3 days**. Figure 5-16** presents the water age analysis contour map for 2045.

FIGURE 5-10

CITY OF LANCASTER

WATER SYSTEM

2045 PRESSURE PLANES

LEGEND

2045 Proposed Improvements

- Valve
- Pump Station
- Elevated Storage Tank
- Water Line

Existing Water System

- Pump Station
- 8" and Smaller Water Line
- 10" and Larger Water Line

Dallas Water Utilities

- Meter
- Water Supply Line
- Road
- Railroad
- Lake/Pond
- Stream
- Parcel
- City Limit
- ETJ Boundary

Lancaster

FREESE AND NICHOLS

2045 PRESSURE PLANES

- Upper Pressure Plane
- Lower Pressure Plane

DWU Meter

26.4 MGD Ames Rd
Pump Station
Firm Capacity = 18.5 MGD

1.0 MG Ames Rd
Elevated Storage Tank
(DECOMMISSION and REMOVE)
Overflow Elev.: 792'

1.0 MG Proposed Ames Rd
Elevated Storage Tank

3.5 MG Ames Rd
Ground Storage Tank (buried)

2.0 MG Wintergreen Rd
Elevated Storage Tank
Overflow Elev.: 792'

6.0 MG James R. Williams
Ground Storage Tank

DWU Meter

5.3 MGD James R. Williams
Pump Station
Expand P.S. to Capacity of 5.8 MGD

Dallas
Transfer Valve

Pleasant Run
Transfer Valve

0.5 MG Pleasant Run Rd
Elevated Storage Tank
Overflow Elev.: 705'

1.5 MG Beltline Rd
Elevated Storage Tank
Overflow Elev.: 705'

0 4,000
SCALE IN FEET

Created By Freese and Nichols, Inc.
Job No.: LCS18127
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Updated: Tuesday, February 23, 2021 1:40:16 PM
User Name: 02924

FIGURE 5-11

CITY OF LANCASTER

2028 MINIMUM PRESSURES MAXIMUM DAY DEMAND AT PEAK HOUR

PRESSURE PLANES

- Upper Pressure Plane (792)
- Lower Pressure Plane (705)

2028 MINIMUM PRESSURE

- Less than 35 psi
- 35-50 psi
- 50-80 psi
- 80-100 psi
- Greater than 100 psi

2028 Maximum Day Demand = 15.26 MGD
2028 Peak Hour Demand = 21.89 MGD

LEGEND

2028 Proposed Improvements
- Water Valve
- Water Line

Dallas Water Utilities
- Meter
- Water Supply Line

Existing Water System
- Pump Station
- Ground Storage Tank
- Elevated Storage Tank
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Road
- Railroad
- Lake
- Stream
- Parcel
- City Limit
- ETJ Boundary

DWU Meter

1.0 MG Ames Rd
Elevated Storage Tank
(DECOMMISSION and REMOVE)
Overflow Elev.: 792'

26.4 MGD Ames Rd
Pump Station
Firm Capacity = 18.5 MGD

3.5 MG Ames Rd
Ground Storage Tank

2.0 MG Wintergreen Rd
Elevated Storage Tank
Overflow Elev.: 792'

DWU Meter

6.0 MG James R. Williams
Ground Storage Tank

5.3 MGD James R. Williams
Pump Station
Firm Capacity = 3.5 MGD

0.5 MG Pleasant Run Rd
Elevated Storage Tank
Overflow Elev.: 705'

1.5 MG Beltline Rd
Elevated Storage Tank
Overflow Elev.: 705'

Lancaster

FREESE AND NICHOLS

0 4,000
SCALE IN FEET

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FIGURE 5-12

CITY OF LANCASTER

EXISTING WATER SYSTEM
2028 AVAILABLE FIRE FLOW

2028 FIRE FLOW

- Less than 500 gpm
- 500 - 1000 gpm
- 1000 - 2000 gpm
- 2000 - 3000 gpm
- Greater than 3000 gpm

2028 Maximum Day Demand = 15.26 MGD

LEGEND

2028 Proposed Improvements
- Water Valve
- Water Line

Dallas Water Utilities
- Meter
- Water Supply Line

Existing Water System
- Pump Station
- Ground Storage Tank
- Elevated Storage Tank
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Road
- Railroad
- Stream
- Lake/Pond
- Parcel
- Existing Service Area
- City Limit
- ETJ Boundary

DWU Meter

26.4 MGD Ames Rd
Pump Station
Firm Capacity = 18.5 MGD

1.0 MG Ames Rd
Elevated Storage Tank
(DECOMMISSION and REMOVE)
Overflow Elev.: 792'

3.5 MG Ames Rd
Ground Storage Tank

2.0 MG Wintergreen Rd
Elevated Storage Tank
Overflow Elev.: 792'

0.5 MG Pleasant Run Rd
Elevated Storage Tank
Overflow Elev.: 705'

6.0 MG James R. Williams
Ground Storage Tank

DWU Meter

5.3 MGD James R. Williams
Pump Station
Firm Capacity = 3.5 MGD

1.5 MG Beltline Rd
Elevated Storage Tank
Overflow Elev.: 705'

Lancaster

FREESE AND NICHOLS

0 4,000
SCALE IN FEET

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FIGURE 5-13
CITY OF LANCASTER
2028 WATER AGE

2028 WATER AGE

- Less than 1 day
- 1 - 3 days
- 3 - 5 days
- 5 - 7 days
- Greater than 7 days

2028 Average Day Demand = 7.98 MGD

LEGEND

2028 Proposed Improvements
- Water Valve
- Water Line

Dallas Water Utilities
- Meter
- Water Supply Line

Existing System
- Pump Station
- Ground Storage Tank
- Elevated Storage Tank
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Road
- Railroad
- Lake
- Stream
- Parcel
- City Limit
- ETJ Boundary

Lancaster

FREESE AND NICHOLS

DWU Meter

1.0 MG Ames Rd
Elevated Storage Tank
(DECOMMISSION and REMOVE)
Overflow Elev.: 792'

26.4 MGD Ames Rd
Pump Station
Firm Capacity = 18.5 MGD

3.5 MG Ames Rd
Ground Storage Tank

2.0 MG Wintergreen Rd
Elevated Storage Tank
Overflow Elev.: 792'

6.0 MG James R. Williams
Ground Storage Tank

DWU Meter

5.3 MGD James R. Williams
Pump Station
Firm Capacity = 3.5 MGD

0.5 MG Pleasant Run Rd
Elevated Storage Tank
Overflow Elev.: 705'

1.5 MG Beltline Rd
Elevated Storage Tank
Overflow Elev.: 705'

0 4,000
SCALE IN FEET

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FIGURE 5-14

CITY OF LANCASTER

2045 MODELED MAXIMUM DAY DEMAND- MODELED MINIMUM PRESSURES AT PEAK HOUR

2045 PRESSURE PLANES

- Upper Pressure Plane
- Lower Pressure Plane

MINIMUM PRESSURE

- Less than 35 psi
- 35-50 psi
- 50-80 psi
- 80-100 psi
- Greater than 100 psi

2045 Maximum Day Demand = 19.25 MGD
2045 Peak Hour Demand = 27.88 MGD

LEGEND

2045 Proposed Improvements
- Valve
- Pump Station
- Elevated Storage Tank
- Water Line

Dallas Water Utilities
- Meter
- Water Supply Line

Existing Water System
- Pump Station
- Ground Storage Tank
- Elevated Storage Tank
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Road
- Railroad
- Lake
- Stream
- Parcel
- City Limit
- ETJ Boundary

DWU Meter

1.0 MG Ames Rd
Elevated Storage Tank
(DECOMMISSION and REMOVE)
Overflow Elev.: 792'

26.4 MGD Ames Rd
Pump Station
Firm Capacity = 18.5 MGD

3.5 MG Ames Rd
Ground Storage Tank

1.0 MG Proposed Ames Rd
Elevated Storage Tank

6.0 MG James R. Williams
Ground Storage Tank

DWU Meter

5.3 MGD James R. Williams
Pump Station
Expand P.S. to Capacity of 5.8 MGD

2.0 MG Wintergreen Rd
Elevated Storage Tank
Overflow Elev.: 792'

0.5 MG Pleasant Run Rd
Elevated Storage Tank
Overflow Elev.: 705'

1.5 MG Beltline Rd
Elevated Storage Tank
Overflow Elev.: 705'

Lancaster

FREESE AND NICHOLS

0 4,000
SCALE IN FEET

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FIGURE 5-15

CITY OF LANCASTER

EXISTING WATER SYSTEM
2045 AVAILABLE FIRE FLOW

2045 FIRE FLOW

- Less than 500 gpm
- 500 - 1000 gpm
- 1000 - 2000 gpm
- 2000 - 3000 gpm
- Greater than 3000 gpm

2045 Maximum Day Demand = 19.25 MGD

LEGEND

2045 Proposed Improvements
- Water Valve
- Pump Station
- Elevated Storage Tank
- Water Line

Dallas Water Utilities
- Meter
- Water Supply Line

Existing Water System
- Pump Station
- Ground Storage Tank
- Elevated Storage Tank
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Road
- Railroad
- Stream
- Lake/Pond
- Parcel
- Existing Service Area
- City Limit
- ETJ Boundary

Lancaster

FREESE AND NICHOLS

DWU Meter

1.0 MG Ames Rd
Elevated Storage Tank
(DECOMMISSION and REMOVE)
Overflow Elev.: 792'

26.4 MGD Ames Rd
Pump Station
Firm Capacity = 18.5 MGD

3.5 MG Ames Rd
Ground Storage Tank

1.0 MG Proposed Ames Rd
Elevated Storage Tank

6.0 MG James R. Williams
Ground Storage Tank

DWU Meter

5.2 MGD James R. Williams
Pump Station
Expand P.S. to Firm Capacity of 5.7 MGD

2.0 MG Wintergreen Rd
Elevated Storage Tank
Overflow Elev.: 792'

0.5 MG Pleasant Run Rd
Elevated Storage Tank
Overflow Elev.: 705'

1.5 MG Beltline Rd
Elevated Storage Tank
Overflow Elev.: 705'

0 4,000
SCALE IN FEET

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FIGURE 5-16

CITY OF LANCASTER

EXISTING WATER SYSTEM
2045 WATER AGE
LEGEND

2045 WATER AGE

- Less than 1 day
- 1 - 3 days
- 3 - 5 days
- 5 - 7 days
- Greater than 7 days

2045 Average Day Demand = 10.08 MGD

2045 Proposed Improvements
- Water Valve
- Pump Station
- Elevated Storage Tank
- Water Line

Dallas Water Utilities
- Meter
- Water Supply Line

Existing System
- Pump Station
- Ground Storage Tank
- Elevated Storage Tank
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Road
- Railroad
- Stream
- Lake/Pond
- Parcel
- Existing Service Area
- City Limit
- ETJ Boundary

Lancaster

FREESE AND NICHOLS

DWU Meter

26.4 MGD Ames Rd
Pump Station
Firm Capacity = 18.5 MGD

1.0 MG Ames Rd
Elevated Storage Tank
(DECOMMISSION and REMOVE)
Overflow Elev.: 792'

3.5 MG Ames Rd
Ground Storage Tank

2.0 MG Proposed Ames Rd
Elevated Storage Tank

2.0 MG Wintergreen Rd
Elevated Storage Tank
Overflow Elev.: 792'

6.0 MG James R. Williams
Ground Storage Tank

DWU Meter

5.3 MGD James R. Williams
Pump Station
Expand P.S. to Capacity of 5.8 MGD

0.5 MG Pleasant Run Rd
Elevated Storage Tank
Overflow Elev.: 705'

1.5 MG Beltline Rd
Elevated Storage Tank
Overflow Elev.: 705'

0 4,000
SCALE IN FEET

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6.0 WATER SYSTEM CAPITAL IMPROVEMENT PLAN

A water system capital improvements plan (CIP) was developed for the City of Lancaster to improve the water distribution system's capacity and to extend water service to new customers. The recommended improvements provide the capacity and reliability to meet projected water demands through the year 2045. The order of the CIP projects reflects the recommended construction timing; however, development or renewal patterns may make it necessary to construct some projects sooner than anticipated.

When compared to the 2012 CIP, the project list is different. Some 2012 projects have been constructed while others are no longer needed due to lower overall demands. Many of those remaining have been downsized due to reduced water demand forecasts. The benefit of routinely updating the master plan allows the longer-term projects to be reassessed with changing conditions. Below is a summary of projects and the drivers for each of them during the planning period:

- Planned Improvement in 2021:
    - Two developer-driven and funded projects that are planned for construction in 2021 include a 12-inch connection in the upper pressure plane and a 12-inch pipeline extension along E. Belt Line Road
- By 2023:
    - Complete 12-inch water line loops in the UPP to reduce velocities, improve available fire flows and reduce water age.
    - Decommission 1.0-MG Ames EST due to age and condition.
- By 2028:
    - Add 12-inch connection between UPP and LPP on Belt Line Road with a new transfer valve, which provides additional connectivity between the pressure planes and improves resiliency.

- Complete 12-inch water line loop along Ten Mile Road west of Lancaster Hutchins to build connectivity on the southside of the system.
- Add a 12-inch water line and new transfer valve along Lancaster-Hutchins Road to build capacity for additional supply needs from James R. Williams pump station to the LPP. Adding the transfer valve on the south side of Belt Line Road begins to establish new pressure plane boundaries.
- Complete 12-inch, 20-inch and 24-inch piping improvements in the UPP to add capacity and complete loops for redundancy and improved fire flows.

- By 2045:
  - Complete 12-inch piping improvements and extensions to serve new growth areas in the southern and western portions of Lancaster's service area.
  - Add 1.0 MG of ground storage at the Ames Road pump station.
  - Expand James R. Williams PS capacity by 0.5 MGD.

Table 6-1 presents the CIP summary. A planning level, conceptual estimate of costs that includes both engineering and construction was developed for each project. Costs are presented in 2020 dollars. Details for the cost estimates are included in **Appendix B** for reference. Estimated costs do not include survey, easements, or land acquisition. Projects are grouped by time horizon: short-term (by 2023), intermediate-term (by 2028), and longer-term (by 2045). The recommended projects are presented on **Figure 6-1**. Locations shown for new piping and other improvements are generalized for hydraulic analysis; specific alignments and facility sites will be determined as part of the design process.

Table 6-1: Water System Capital Improvements Plan

#	Project Name	Cost
Short Term Projects (by 2023)		
1	12-inch water lines to complete loops in the Upper Pressure Plane; decommission Ames Road 1.0 MG EST	$1,058,500
2	12-inch water line along Sunnymeadow Road	$2,128,800
3	12-inch water line along North Elm Street; Pleasant Run EST site improvements	$2,152,600
4	12-inch water line along Beltline from Rolling Hills to I-35E, Idlewild Lane	$782,400
	Short Term Total	**$6,122,300**
Intermediate Projects (2024-2028)		
5	12-inch water line along Beltline Road and Transfer Valve	$267,400
6	12-inch water line along Ten Mile Road west of Lancaster Hutchins	$3,038,800
7	12-inch along Lancaster-Hutchins Road and Transfer Valve	$3,387,500
8	20- and 24-inch water line along Houston School Road	$3,777,800
9	12-inch water lines north of Interstate 20 to Campus District	$3,573,400
10	12-inch water lines along Telephone Road	$2,278,400
11	12-inch water line along Nokomis Road from Belt Line Road to Ferris Road	$5,571,900
	Intermediate Total	**$21,895,200**
Long Term Projects (2029-2045)		
12	12-inch water line along Parkerville Road from I35E to W Main Street	$2,407,700
13	12-inch water line along East Third Street from Lancaster Hutchins to Cornell Road	$1,367,200
14	12-inch water line along Alba Road from Pleasant Run to Third Street	$1,333,000
15	12-inch water line east of Beltline Road EST along Belt Line Road	$2,529,100
16	12-inch water line along Pinto Road from Pleasant Run Road to Greene Road	$1,614,000
17	12-inch water line along Greene Road	$4,021,500
18	12-inch water line along Sunrise Road from Belt Line Road to Van Road	$2,673,500
19	12-inch water line along Van Road from Sunrise to Ferris Road	$1,336,800
20	12-inch water line along Ferris Road from Nokomis to Watermill then to Van Road	$2,851,900
21	12-inch water line along Watermill Road	$3,132,900
22	12-inch water line along Wilson Road	$3,292,400
23	12-inch water line along Moreland Road and New Transfer Valve	$4,482,400
24	12-inch water line Along Dallas Avenue and New Transfer Valve	$3,373,600
25	12-inch water line along E. Reindeer Road	$3,912,800
26	12-inch water line along Nokomis from Watermill Road to Stainback Road	$3,364,600
27	12-inch water line along Stainback from Nokomis to Ferris Road	$1,754,500
28	12-inch water line along Ferris Road from WaterMill/Van Road to Stainback Road	$2,358,400
29	12-inch water line along Bear Creek Road	$2,053,600
30	Ames Pump Rd - New 1.0 MG Ground Storage Tank	$1,952,500
31	James R. Williams PS Capacity Expansion (0.5 MGD)	$773,000
	Long Term Total	**$50,585,400**
	CIP Total	**$78,602,900**

FIGURE 6-1

CITY OF LANCASTER

WATER SYSTEM

CIP WATER LINES AND VALVES

PRESSURE PLANES

- Upper Pressure Plane
- Lower Pressure Plane

LEGEND

2021 Planned Improvement
- Water Line (by Developers)

2023 Proposed Improvements
- Water Line

2028 Proposed Improvements
- Water Valve
- Water Line

2045 Proposed Improvements
- Water Valve
- Pump Station
- Ground Storage Tank
- Water Line

Existing Water System
- Pressure Reducing Valve
- Closed Water Valve
- Pump Station
- Ground Storage Tank
- Elevated Storage Tank
- 8" and Smaller Existing Water Line
- 10" and Larger Existing Water Line

Dallas Water Utilities
- Meter
- Water Supply Line
- Road
- Railroad
- Stream
- Lake
- Parcel
- City Limit
- ETJ Boundary
- County Boundary

Lancaster

FREESE AND NICHOLS

1.0 MG Ames Rd
Elevated Storage Tank
(DECOMMISSION and REMOVE)
Overflow Elev.: 792'

26.4 MGD Ames Rd
Pump Station
Firm Capacity = 18.5 MGD

2021 Planned Improvement
Water Line

1.0 MG Proposed Ames Rd
Ground Storage Tank

3.5 MG Ames Rd
Ground Storage Tank (buried)

6.0 MG James R. Williams
Ground Storage Tank

5.3 MGD James R. Williams
Pump Station
Expand P.S. to Capacity of 5.8 MGD

2.0 MG Wintergreen Rd
Elevated Storage Tank
Overflow Elev.: 792'

Dallas
Pressure Relief Valve

Pleasant Run
Pressure Relief Valve

0.5 MG Pleasant Run Rd
Elevated Storage Tank
Overflow Elev.: 705'

New
Pressure Relief Valve

Closed
Water Valve

1.5 MG Beltline Rd
Elevated Storage Tank
Overflow Elev.: 705'

2021 Planned Improvement
Water Line

New
Pressure Relief Valve

Moreland
Pressure Relief Valve

Reindeer
Pressure Relief Valve

DALLAS COUNTY
ELLIS COUNTY

0 4,000
SCALE IN FEET

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7.0 WASTEWATER FLOWS

Wastewater flows in a municipal collection system vary by time of day, wastewater discharge source, and weather conditions. Annual average daily flow is defined as the total wastewater flow over a one-year period divided by the number of days in that year. The collection system must be able to convey the peak wet weather wastewater flows, which are often influenced by the weather.

7.1 HISTORICAL WASTEWATER FLOWS

To estimate future wastewater flows, historical flow data was analyzed to identify trends in system-wide wastewater flow rates and per-capita flow rates. Historical wastewater flows from 2014 through 2017 were provided by the City. **Table 7-1** presents the average annual daily flows, average day flow per capita and peak daily flows for these years along with rainfall. The city's per-capita flow rate averaged 126 gpcd, with a significantly higher rate of 156 gpcd in 2015, which had higher rainfall than average. The higher per capita rate on a wet year provides insights into possible challenges with inflow and infiltration (I/I) due to rainfall.

Table 7-1: Historical Wastewater Flows Based on TRA System Daily Flows

Year	Service Area Population[1]	Average Day Flow (MGD)	Average Day Flow Per Capita (gpcd)	Peak Daily Flow (MGD)	Annual Rainfall (in)
2014[(2)]	37,150	4.06	109	9.88	21.3
2015	37,360	5.82	156	18.84	62.6
2016	37,550	4.79	128	16.84	35.5
2017	37,730	4.19	111	10.48	36.6
Average		**4.72**	**126**	--	**39.0**
Maximum		**5.82**	**156**	--	**62.6**

(1) Based on Census and NCTCOG data.

(2) Data available from March – December 2014.

Collection system flow monitoring was not performed as part of this study. Flow monitoring would provide insights into I/I, establish the basis for peak wet weather peaking factors, and support model validation.

To determine an overall peaking factor for purposes of estimating peak wet weather flows, preliminary data from a concurrent TRA study monitoring for the Ten Mile Creek parallel interceptors was requested. An analysis of flow monitoring data for locations within Lancaster's system upstream of TRA's interceptors was performed, resulting in a range of peaking factors. Based on the weighted average, the peaking factor is estimated to be 6.5, which aligns well with the 6.0 peaking factor used in the 2012 Impact Fee Study. The data and resulting peaking factor are based on preliminary data, which will be refined in 2021. Once the study is completed, it may have implications for the City to consider regarding wet weather peaking factors and I/I reduction.

7.2 PROJECTED WASTEWATER FLOWS

Average day wastewater flows for the planning period were developed by applying the wastewater design criteria to the wastewater service area population and employment forecasts. Design criteria for wastewater flows are shown in **Table 7-2**.

Table 7-2: Wastewater Design Criteria

Average Day Residential Flow Per Capita (gpcd)	Average Day Employment Flow Per Capita (gped)	Peak Wet Weather to Average Daily Peaking Factor
115	90	6.5

Applying the wastewater design criteria to the population and employment projections yields wastewater flow projections for years 2018, 2023, 2028 and 2045. **Table 7-3** presents the projected wastewater flows. The wastewater flows are expected to increase by more than 150% over the planning period, with much of that growth attributed to aggressive employment forecast. Employment growth is expected to increase by 150% while population growth is steady, with a 33% increase over the planning period.

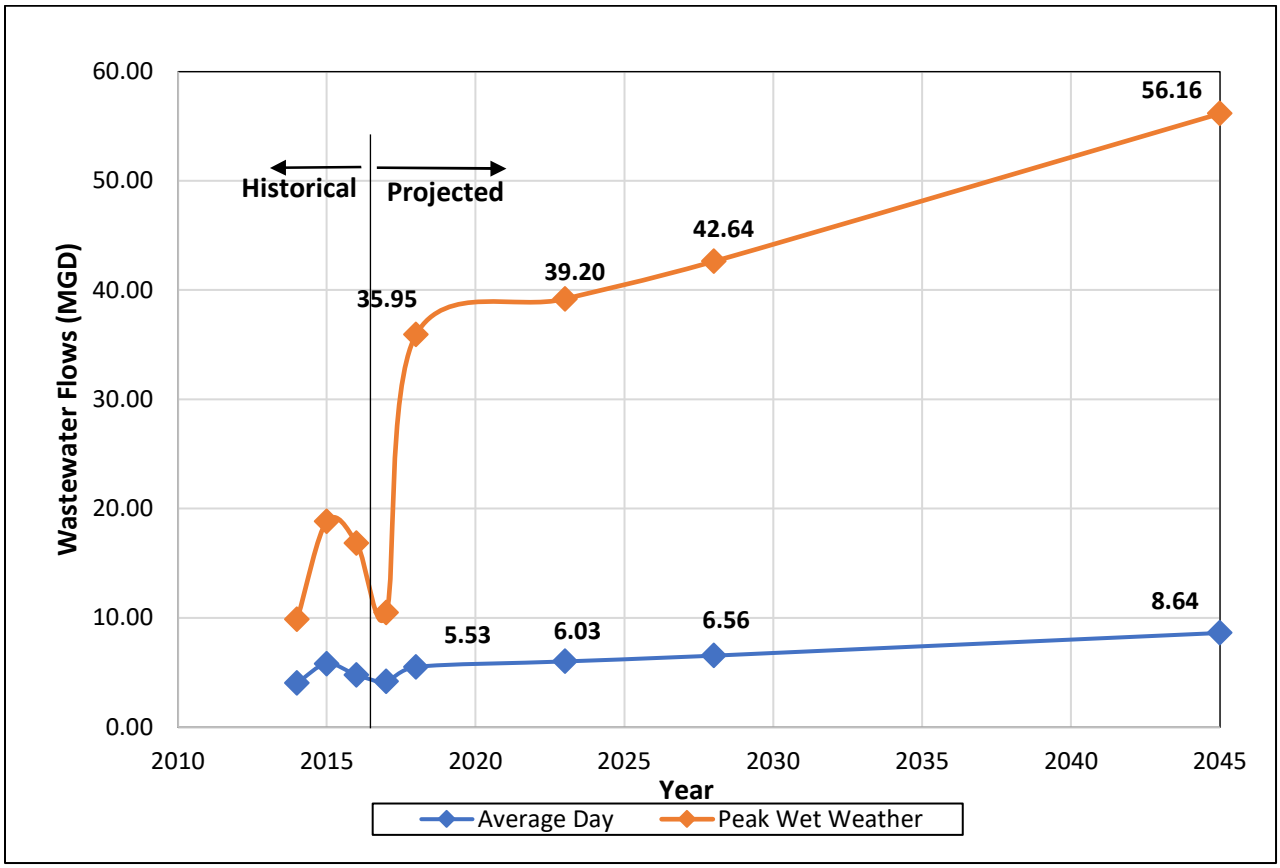
Table 7-3: Projected Wastewater Flows

Year	Service Area Population [(1)]	Service Area Employment	Average Day Flow (MGD)	Peak Wet Weather Flow (MGD)
2018	39,374	11,079	5.53	35.95
2023	41,504	14,021	6.03	39.20
2028	43,753	16,940	6.56	42.64
2045	53,349	27,876	8.64	56.16

[(1)]Lancaster MUD #1 wholesale population included.

Figure 7-1 illustrates the historical and projected wastewater flows for the City of Lancaster.

Figure 7-1: Historical and Projected Wastewater Flows



Another important consideration for wastewater planning is to understand where wastewater is generated and how it can be most effectively conveyed to treatment. The City of Lancaster's existing wastewater service area extends over 2 major river basins and 13 sewer sub-basins, which is expected to expand to 16 sewer sub-basins by 2045. **Figure 7-2** presents the sewer sub-basins; for each sewer sub-basin, the wastewater flows are projected. The flows are projected using a combination of the population and employment forecasts by TSZ zones, which are then aggregated to sewer basins using GIS tools. The design criteria are then applied to calculate the wastewater flows in each sewer basin. The projected wastewater flows for each sewer basin over the planning period are presented in **Table 7-4**.

FIGURE 7-2

CITY OF LANCASTER

EXISTING AND 2045 SEWER SUB-BASINS

LEGEND

- Road
- Railroad
- Stream
- Lake/Pond
- City of Lancaster CCN
- ETJ Boundary

Lancaster

FREESE AND NICHOLS

FLOYD BRANCH
KELLER BRANCH
MILL BRANCH
CHESIER BRANCH
DEEP BRANCH
HALLS BRANCH
TEN MILE 1
TEN MILE 2
TEN MILE 3
TEN MILE 4
TEN MILE 5
TEN MILE 6
TEN MILE 7
CREEKWOOD BRANCH
ENCHANTED FOREST
RED OAK

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Table 7-4: Projected Wastewater Flows by Sewer Basin

Sewer Basin	Service Area Population [1]	Service Area Employment	Average Day Flow (MGD)	Peak Wet Weather Flow (MGD)
Existing (2018)				
Chesier Branch	3,007	1,878	0.51	3.32
Creekwood Branch	190	84	0.03	0.20
Deep Branch	13,841	1,911	1.76	11.44
Enchanted Forest	219	31	0.03	0.20
Floyd Branch	218	166	0.05	0.33
Halls Branch	5,074	1,892	0.75	4.88
Keller Branch	6,470	1,963	0.92	5.98
Mill Branch	7,866	2,368	1.12	7.28
Red Oak	490	136	0.07	0.46
Ten Mile 1	112	78	0.02	0.13
Ten Mile 2	1,704	136	0.21	1.37
Ten Mile 3	183	436	0.06	0.39
Total	**39,374**	**11,079**	**5.53**	**35.95**
2023				
Chesier Branch	3,354	2,432	0.60	3.90
Creekwood Branch	261	255	0.06	0.39
Deep Branch	14,197	2,212	1.83	11.90
Enchanted Forest	254	40	0.03	0.20
Floyd Branch	241	225	0.05	0.33
Halls Branch	5,172	2,025	0.78	5.07
Keller Branch	6,623	2,165	0.96	6.24
Mill Branch	8,330	3,230	1.25	8.13
Red Oak	594	286	0.09	0.59
Ten Mile 1	173	254	0.04	0.26
Ten Mile 2	1,798	171	0.22	1.43
Ten Mile 3	404	711	0.11	0.72
Ten Mile 4	103	15	0.01	0.07
Total	**41,504**	**14,021**	**6.03**	**39.20**

Sewer Basin	Service Area Population [1]	Service Area Employment	Average Day Flow (MGD)	Peak Wet Weather Flow (MGD)
2028				
Chesier Branch	3,710	2,986	0.70	4.55
Creekwood Branch	331	426	0.08	0.52
Deep Branch	14,602	2,518	1.90	12.35
Enchanted Forest	288	48	0.04	0.26
Floyd Branch	267	284	0.06	0.39
Halls Branch	5,285	2,165	0.80	5.20
Keller Branch	6,727	2,421	0.99	6.44
Mill Branch	8,823	4,084	1.38	8.97
Red Oak	715	443	0.12	0.78
Ten Mile 1	234	432	0.07	0.46
Ten Mile 2	1,882	201	0.23	1.50
Ten Mile 3	660	864	0.15	0.98
Ten Mile 4	135	21	0.02	0.13
Ten Mile 5	94	47	0.02	0.13
Total	**43,753**	**16,940**	**6.56**	**42.64**
2045				
Chesier Branch	5,074	4,868	1.02	6.63
Creekwood Branch	589	1,005	0.15	0.98
Deep Branch	16,460	3,543	2.21	14.37
Enchanted Forest	415	77	0.05	0.33
Floyd Branch	366	499	0.09	0.59
Halls Branch	5,854	2,664	0.91	5.92
Keller Branch	7,562	3,440	1.18	7.67
Mill Branch	10,831	7,023	1.88	12.22
Red Oak	1,162	1,074	0.23	1.50
Ten Mile 1	455	1,032	0.15	0.98
Ten Mile 2	2,063	233	0.26	1.69
Ten Mile 3	1,128	1,111	0.23	1.50
Ten Mile 4	453	103	0.06	0.39
Ten Mile 5	255	348	0.06	0.39
Ten Mile 6	136	238	0.04	0.26
Ten Mile 7	546	618	0.12	0.78
Total	**53,349**	**27,876**	**8.64**	**56.16**

[1]Lancaster MUD #1 wholesale population included in the Ten Mile 2 Sewer Basin

8.0 EXISTING WASTEWATER SYSTEM

The City of Lancaster's existing wastewater service area extends over two major river basins and consists of two lift stations and associated force mains and a network of gravity mains, which flow into TRA's parallel interceptors along Ten Mile Creek. TRA's interceptors convey wastewater to the TRA Ten Mile Creek Wastewater Treatment Plant (WWTP). Most of the City's existing wastewater collection system is located north of Ten Mile Creek and west of Keller Branch. Because of existing topography, the wastewater collection system generally flows from north to south until reaching Ten Mile Creek. TRA's Red Oak Creek interceptor flows in the southwestern portion of the service area and terminates at TRA's Red Oak WWTP. The City has two small sewer lines connected to the Red Oak basin. The existing wastewater system is shown on **Figure 8-1**.

8.1 WASTEWATER TREATMENT PLANT

The City of Lancaster does not own or operate a wastewater treatment plant. Treatment services are provided by the Trinity River Authority.

8.2 LIFT STATIONS

The City owns and operates two lift stations. Lift Station #1 is located at N. Dallas Avenue near Altamoore Drive. This lift station has a firm capacity of 0.6 MGD. The Wheatland Road Lift Station is at the far north border of the Lancaster service area and provides a firm capacity of 0.6 MGD. Lift Station #2 is located near Telephone Road and North Dallas Avenue with a firm capacity of 0.5 MGD; information on the active depth and volume was not available for this lift station. The City's existing wastewater system lift stations are summarized in **Table 8-1**.

Table 8-1: Existing Lift Stations

Lift Station Name	No. of Pumps	Total Capacity (MGD)	Firm Capacity (MGD)	Wet Well Diameter (ft)	Active Depth (ft)	Active Volume (ft^3)
Lift Station #1	2	1.2	0.6	10	9	710
Lift Station #2	2	1.0	0.5	10	-	-
Wheatland Road Lift Station	2	1.2	0.6	10	9	710

FIGURE 8-1

CITY OF LANCASTER

EXISTING WASTEWATER SYSTEM

LEGEND

Existing Wastewater System

- Lift Station
- 8" and Smaller Wastewater Line
- 10" and Larger Wastewater Line
- Force Main
- TRA Wastewater Line
- Road
- Railroad
- Stream
- Lake/Pond
- City of Lancaster CCN
- City Limit
- ETJ Boundary

Lancaster

FREESE AND NICHOLS

Wheatland Rd Lift Station
Firm Capacity = 0.6 MGD

Lift Station #1
Firm Capacity = 0.6 MGD

Lift Station #2
Firm Capacity = 0.5 MGD

FLOYD BRANCH
MILL BRANCH
CHESIER BRANCH
KELLER BRANCH
HALLS BRANCH
DEEP BRANCH
CREEKWOOD BRANCH
ENCHANTED FOREST
RED OAK
TEN MILE 1
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TEN MILE 7

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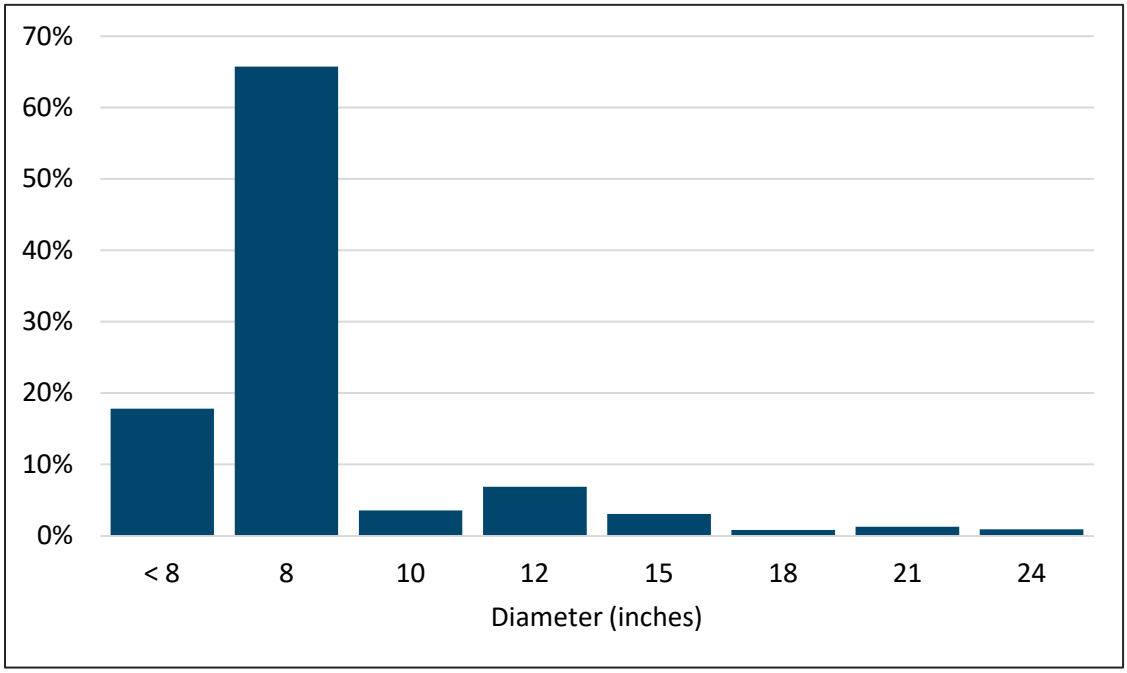
8.3 COLLECTION SYSTEM

The City's wastewater collection system consists of a network of 168 miles of gravity mains with diameters ranging from 4-inches to 24-inches, two lift stations, and two miles of 12-inch force mains. Four sewer sub-basins contain most of the existing wastewater collection system: Mill Branch, Deep Branch, Halls Branch, and Keller Branch. Most of the system is comprised of 8-inch diameter gravity sewer lines. **Figure 8-2** illustrates the percentage of main length by diameter based on GIS shapefiles provided by the City.

Figure 8-2: Sewer System Piping by Diameter



The City has 14 outfalls to TRA's Ten Mile Creek parallel interceptors that flow from west to east through Lancaster's city limits along Ten Mile Creek. The City has two outfalls to the TRA's Red Oak interceptor along the southwestern corner of the city limits.

9.0 WASTEWATER SYSTEM ANALYSES

The wastewater system model was updated in order to conduct hydraulic analyses, identify existing collection system deficiencies, and establish a plan to address any deficiencies and accommodate projected wastewater flows through 2045. Various combinations of improvements and system modifications were investigated to determine the most appropriate approach for conveying projected flows.

Wastewater is conveyed to the TRA's Ten Mile Creek or Red Oak WWTP for treatment and effluent management. The wastewater collection system analysis is limited to the City's sewer infrastructure and does not provide a capacity analysis of the TRA interceptor or its WWTPs. The TRA's Ten Mile Creek interceptors are currently being evaluated in a separate TRA study, which once completed may have implications for the City to consider regarding peaking factors and I/I assessment.

9.1 WASTEWATER MODEL UPDATE

A wastewater model provides information on system hydraulics and where additional capacity may be needed for both the present and future planning periods. Flow data collection and model verification were not part of the project scope. As a result, the current wastewater model is not validated with field data; therefore, the model results provide a theoretical indication of capacity needs. To improve and enhance confidence in the wastewater model, the following activities are recommended prior to or in conjunction with the next master planning update:

- Conduct a survey to obtain manhole and pipe invert elevations on pipes 10-inches and larger, as well as any smaller yet critical pipes for connectivity.
- Update invert elevations and connectivity within the GIS.
- Install temporary flow monitors at key points in the system to collect field data for model validation.

A validated model provides more reliable results and can be used to assess system dynamics.

9.1.1 PHYSICAL NETWORK

The hydraulic model developed for Lancaster's *2012 Water and Wastewater Impact Fee Evaluation* by FNI was converted from Innovyze H2OMap Sewer software to Innovyze InfoSewer, due to the retirement of the H2OMap product line. The City provided updated GIS shapefiles of the sewer system, which were used to update the model. While the gravity main shapefile included most pipe diameters, the manhole shapefile lacked rim elevations and pipe invert elevations. The wastewater model includes pipes 10-inches and larger lines as well as critical 6-inch and 8-inch lines.

The invert elevations for these mains were derived from known outfall inverts as the control points, such as the discharge to the TRA Ten Mile Creek parallel interceptors. A combination of ground contours and TCEQ minimum slopes were used to develop pipeline profiles while minimizing the depth of the manhole. Higher slopes were used if manhole depths became unreasonable. Surveying manholes to collect the invert elevation and GPS location is recommended before the next master plan update; the survey also provides an opportunity to perform a condition assessment of the manholes.

9.1.2 WASTEWATER FLOW LOADS - MODEL ALLOCATION

The 13 existing sewer sub-basins were divided into smaller polygons for wastewater load allocation and assignment. Water billing data from 2017 was available in the form of a meter shapefile, which allowed spatial distribution of water demands. The water demand contained within each sewer sub-basin boundary was applied to critical main nodes and intersections in the hydraulic model as wastewater flow loads. Demands from water meters in areas without existing wastewater infrastructure were excluded from the load allocation.

The total wastewater flows per sewer sub-basin, calculated using TSZ populations, were superimposed on the basin polygons. The allocated wastewater loads were scaled to match the calculated wastewater flow per sewer sub-basin based on project population and employment for the planning year. Wastewater loads for existing 2018, 2028 and 2045 conditions were assigned within the model.

9.2 EXISTING WASTEWATER SYSTEM ANALYSIS

The existing collection system was evaluated to assess the ability of the system to adequately convey wastewater to the TRA interceptor. This analysis was performed to identify existing system deficiencies.

The critical flow condition used to analyze the wastewater collection system was peak wet weather. While wastewater flow, depth, and velocity are important parameters to consider, due to the lack of field-verified invert elevations, design criteria for this study focused on the gravity sewer's flow capacity.

A steady state model analysis was conducted for the peak wet weather loading for 2018. The modeled flow in a gravity sewer (q) divided by the maximum carrying capacity of that main (Q), or q/Q, is an output of the model that provides an indication of each gravity sewer's capacity. The following describes various results for q/Q, or capacity results from the model:

- A gravity sewer pipe with a modeled q/Q greater than 1.0 (or 100%): indicates that the wastewater flow exceeds the capacity of the wastewater line. Pipes in this category have a high priority for replacement.
- A gravity sewer pipe with a modeled a q/Q between 0.8 (or 80%) and 1.0 (100%), is placed in next highest category for replacement, as it may need to be replaced with a larger pipe soon.
- A gravity sewer pipe with a modeled q/Q between 0.6 (60%) to 0.8 (80%) of capacity is placed on a "watch" list and may be moved up to a higher priority soon.

Figure 9-1 presents the 2018 model results and indicates areas where the system has capacity deficiencies based on the q/Q capacity evaluation. The highest priority areas are shown in red ($q/Q > 1$) and the next highest priority is shown in orange ($0.8 < q/Q < 1.0$).

The challenge with having limited invert data is that the model results are theoretical based on slopes that may be lower than those in the field. Once invert elevation data is field obtained, the model can be updated, and some capacity concerns may be eliminated.

FIGURE 9-1

CITY OF LANCASTER

2018 WASTEWATER SYSTEM WITH IMPROVEMENTS MODELED CAPACITY DEFICIENCIES AT PEAK WET WEATHER FLOW = 35.95 MGD

LEGEND

Modeled Gravity Sewer Capacity Results (q/Q)

- Less than 0.6
- 0.6-0.8
- 0.8-1.0
- Greater than 1.0 (Surcharging)

Existing Wastewater System

- Lift Station
- Force Main
- 8" and Smaller Wastewater Line
- 10" and Larger Wastewater Line
- TRA Wastewater Line
- Road
- Railroad
- Stream
- Lake/Pond
- Parcel
- City Limit
- ETJ Boundary

Lancaster

FREESE AND NICHOLS

Wheatland Rd Lift Station
Firm Capacity = 0.6 MGD

Lift Station #1
Firm Capacity = 0.6 MGD

Lift Station #2
Firm Capacity = 0.5 MGD

FLOYD BRANCH
MILL BRANCH
CHESIER BRANCH
KELLER BRANCH
HALLS BRANCH
DEEP BRANCH
TEN MILE 1
TEN MILE 2
TEN MILE 3
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TEN MILE 7
CREEKWOOD BRANCH
ENCHANTED FOREST
RED OAK

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Updated: Monday, February 15, 2021 5:10:50 PM
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9.3 FUTURE WASTEWATER SYSTEM ANALYSIS

Wastewater system improvements were developed to accommodate the anticipated residential and employment growth through the planning horizon of 2045. The highest growth is anticipated in the Mill Branch, Chesier Branch, and Deep Branch basins. Based on the 2018 model results, each of these basins requires additional capacity to convey existing peak wastewater flows. Under the future wastewater loads, the existing capacity issues worsen, and new deficiencies emerge.

To serve the future growth, the City must address existing capacity deficiencies while sizing improvements to accommodate future growth. Currently the City has a high peak wet weather flow rates; if the peak wet weather flows are managed with a programmatic approach to I/I reduction, it may be possible to defer identified capacity increases to a later time.

9.3.1 DESIGN CRITERIA FOR GRAVITY LINES

When determining the size of proposed wastewater lines, TCEQ provides specific design criteria. TCEQ 217.53 (l)(1) dictates that collection systems must be designed to maintain a minimum velocity of 2 fps. Maintaining these velocities discourages the settling of solids. In accordance with this, TCEQ has established minimum slope guidelines in 217.53 (l)(2)(A). The size and spacing of manholes are also governed by TCEQ guidelines. These requirements are shown in **Table 9-1**: Minimum Slope, Manhole Size, and Spacing . Additionally, TCEQ 217.53 (j)(3) states, "an owner must ensure that the collection system has capacity to prevent a surcharge."

Table 9-1: Minimum Slope, Manhole Size, and Spacing by Pipe Diameter

Gravity Main Size (inches)	Minimum Slope (feet/100 ft)	Manhole Size (inches)	Manhole Spacing (feet)	Gravity Main Size (inches)	Minimum Slope (feet/100 ft)	Manhole Size (inches)	Manhole Spacing (feet)
6	0.50	48	500	24	0.08	60	800
8	0.33	48	500	27	0.06	72	800
10	0.25	48	500	30	0.055	72	800
12	0.20	48	500	36	0.045	72	1,000
15	0.15	60	500	42	0.045	72	1,000
18	0.11	60	800	48	0.045	72	1,000
21	0.09	60	800	54	0.045	72	2,000

9.3.2 DESIGN CRITERIA FOR LIFT STATIONS AND FORCE MAINS

TCEQ design criteria 217.61 (c) states "The firm pumping capacity of a lift station must handle the peak flow." Firm pumping capacity is defined as the maximum pumping capacity with the largest pumping unit out of service. TCEQ 217.67 (a) also states that force mains shall be sized to convey the lift station pumping capacity at a minimum velocity of 3 feet/second for duplex lift stations and 2 feet/second with one pump operating at a lift station with three or more pumps. Recommended lift station firm pumping capacities and force main sizes are based on these TCEQ criteria.

TCEQ slope requirements, manhole spacing, and manhole sizing were utilized for new lines in undeveloped areas. If proposed lines are constructed at a different slope than the modeled lines, the proposed line size should be evaluated based on the updated capacity. Any new lift stations or lift station expansions are sized to convey approximately 125% of the projected peak hourly wastewater flow.

9.4 WASTEWATER SYSTEM IMPROVEMENTS

Steady state hydraulic analyses were performed on the wastewater collection system under future peak wet weather loadings to identify capacity limitations and recommend improvements. With the 2045 loadings, the model indicates additional capacity deficiencies in the existing system, including the upper reaches of Deep Branch, Keller Branch, Halls Branch, and Mill Branch. The model results indicate the following areas require improvements to address capacity deficiencies:

- Address the bottleneck between two large pipes (21-inch and 18-inch) in the upper portion of the Deep Branch basin.
- Address the capacity deficiencies in the Deep Branch trunk sewer upstream of the TRA interceptor. The Deep Branch basin has the highest overall wastewater flow contribution in the City and the model indicates the highest surcharging conditions and capacity limitations with both the parallel mains along Deep Branch under peak wet weather flow.
- Install a relief line to the TRA interceptor within the Mill Branch basin to increase capacity for this basin and reduce surcharging conditions in the existing 12-inch main to the TRA interceptor.
- Improve capacity from Crescent Medical Center to the TRA interceptor in the Chesier Basin and reduce surcharging in existing mains.

- Upsize the conveyance mains in the Keller Basin between Lift Station #1 and the TRA interceptor to reduce loadings and flows, preventing surcharge conditions.
- Increase the firm pumping capacity of Lift Station #1 and Wheatland Lift Station to 2 MGD.
- Increase capacity upstream of the TRA interceptor for the Halls Branch basin to reduce surcharging.

Future model results are presented with improvements in **Figures 9-2** and **9-3**. New gravity sewer mains are presented to extend sewer service to the eastern and southern portions of the City by 2045. With the recommended improvements in place, capacity issues are reduced and mitigated by 2045.

FIGURE 9-2

CITY OF LANCASTER

2028 WASTEWATER SYSTEM WITH IMPROVEMENTS MODELED CAPACITY DEFICIENCIES AT PEAK WET WEATHER FLOW = 42.64 MGD

LEGEND

Modeled Gravity Sewer Capacity Results (q/Q)

- Less than 0.6
- 0.6-0.8
- 0.8-1.0
- Greater than 1.0 (Surcharging)

Existing Wastewater System

- Lift Station
- Force Main

- 8" and Smaller Wastewater Line
- 10" and Larger Wastewater Line
- TRA Wastewater Line
- Road
- Railroad
- Stream
- Lake/Pond
- Parcel
- City Limit
- ETJ Boundary

Lancaster

FREESE AND NICHOLS

Wheatland Rd Lift Station
Firm Capacity = 0.6 MGD

Lift Station #2
Firm Capacity = 0.6 MGD

Lift Station #2
Firm Capacity = 0.5 MGD

FLOYD BRANCH
MILL BRANCH
DEEP BRANCH
KELLER BRANCH
HALLS BRANCH
TEN MILE 1
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CREEKWOOD BRANCH
ENCHANTED FOREST
RED OAK

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FIGURE 9-3

CITY OF LANCASTER

2045 WASTEWATER SYSTEM WITH IMPROVEMENTS MODELED CAPACITY DEFICIENCIES AT PEAK WET WEATHER FLOW = 56.16 MGD

LEGEND

Modeled Gravity Sewer Capacity Results (q/Q)

- Less than 0.6
- 0.6-0.8
- 0.8-1.0
- Greater than 1.0 (Surcharging)

Existing Wastewater System

- Lift Station
- Force Main
- 8" and Smaller Wastewater Line
- 10" and Larger Wastewater Line
- TRA Wastewater Line
- Road
- Railroad
- Stream
- Lake/Pond
- Parcel
- City Limit
- ETJ Boundary

Lancaster

FREESE AND NICHOLS

Wheatland Rd Lift Station
Firm Capacity = 0.6 MGD

Lift Station #1
Firm Capacity = 0.6 MGD

Lift Station #2
Firm Capacity = 0.5 MGD

FLOYD BRANCH
MILL BRANCH
CHESIER BRANCH
DEEP BRANCH
KELLER BRANCH
HALLS BRANCH
TEN MILE 1
TEN MILE 2
TEN MILE 3
TEN MILE 4
TEN MILE 5
TEN MILE 6
TEN MILE 7
CREEKWOOD BRANCH
ENCHANTED FOREST
RED OAK

0 4,000
SCALE IN FEET

Created By Freese and Nichols, Inc.
Job No.: LCS18127
Location: H:\W_WW_PLANNING\01_DELIVERABLES\08_DRAFT_REPORT\(Figure_9-3)-2045_Capacity_Deficiencies.mxd
Updated: Tuesday, February 16, 2021 5:24:19 PM
User Name: 03898

10.0 WASTEWATER SYSTEM CAPITAL IMPROVEMENT PLAN

A wastewater system capital improvements plan was developed for the City of Lancaster to improve the collection system's ability to convey flow to the TRA interceptor and mitigate capacity deficiencies under existing and projected wastewater loads. The recommended improvements increase the system's capacity and reliability to meet projected wastewater flows through 2045. When compared to the 2012 CIP, the project list is similar. The most significant differences are the capacity deficiencies identified in the Deep Branch basin, which now is the highest priority for improvements.

To improve the wastewater collection system, the City of Lancaster needs a multi-faceted plan that includes the following prioritized items:

1. Identify and reduce inflow and infiltration (I/I) through a focused Sanitary Sewer Evaluation Survey (SSES).
2. Refine the wastewater model:
    a. Update GIS attribute data with surveyed pipe invert elevations and confirmed connectivity.
    b. Collect flow data by installing temporary flow monitors.
    c. Validate the wastewater model using the flow monitoring data.
    d. Evaluate the wastewater system with the validated model and update the recommended projects and prioritized capital improvements plan.
3. Implement recommended improvements to the existing collection system to increase capacity.
4. Extend sewer service to new developments as downstream capacity constraints are improved.

Transitioning to a field-verified and validated wastewater model provides Lancaster with a tool that reliably identifies the location and severity of capacity issues and allows refinement of recommended improvements.

With Lancaster's high peak wet weather flows, a focused SSES program to identify and reduce I/I in the collection system is recommended. Removing rainwater from the collection system and reducing peak wet weather flows has the potential to defer recommended improvements, reduce pipe sizes, or

eliminate the need for the project. The result would also be reduced flows and associated costs for treatment capacity with TRA.

The prioritized CIP projects are summarized in **Table 10-1**. The CIP project list seeks to balance existing system capacity issues with desired growth and system extensions. The order of the CIP projects reflects the recommended construction timing; however, development or renewal patterns may make it necessary to construct some projects sooner than anticipated.

A planning level, conceptual estimate of costs that includes both engineering and construction for each project was developed for each project. Costs are presented in 2020 dollars. The detailed cost estimates are included in **Appendix C** for reference. Estimated costs do not include survey, easements, or land acquisition. Projects are grouped by planning horizon: short-term (by 2023), intermediate-term (by 2028), and longer-term (by 2045).

The recommended projects are presented on **Figure 10-1**. Locations shown for new piping and other improvements are generalized for hydraulic analysis; specific alignments and facility sites will be determined as part of the design process.

Table 10-1 Wastewater System Capital Improvements Plan Summary

ID#	Project Name	Cost
Short Term Projects (by 2023)		
1	21-inch line along Deep Branch Creek from Nancy Lane to W. Pleasant Run Road to remove 8- and 12-inch bottleneck	$938,700
2	42-inch and 36-inch line along Deep Branch Creek from TRA Interceptor to W. Main Street, 21-inch along W. Main Street	$8,851,700
3	36-inch and 30-inch lines along Deep Branch Creek from W. Main Street crossing at Belt Line Road and north to near Maplecrest Drive	$6,385,200
4	21-inch line from TRA Interceptor to W. Redbud Lane; 15-inch and 12-inch from north to W. Pleasant Run	$6,172,300
5	36-inch Relief Sewer along W. Main Street from W. Belt Line to TRA Interceptor	$9,008,200
	Short Term Total	**$31,356,100**
Intermediate Projects (2024-2028)		
6	30-inch along Houston School Road from W. Pleasant Run to W. Belt Line Road	$4,101,500
7	24-inch and 21-inch line along Houston School Road from W. Wintergreen Road to W. Pleasant Run	$5,094,000
8	21-inch line from W. Wintergreen Road to West Drive	$2,345,700
9	Expand Wheatland Road LS Firm Capacity to 2.0 MGD; 21-inch and 15-inch line at W. Danieldale Road towards West Drive	$3,237,500
10	18-inch and 15-inch line along Halls Branch from TRA Interceptor to E. Main St	$5,913,800
11	24-inch Line along Keller Branch from TRA Interceptor to E. Pleasant Run	$11,325,900
12	24-inch line along Keller Branch from E. Pleasant Run Road to E Wintergreen Road	$5,180,200
13	21-inch and 18-inch line along N. Dallas Avenue from E. Wintergreen Road to Balmorhea Drive; Expand LS #2 firm capacity from 0.5 MGD to 1.0 MGD	$4,443,200
14	Expand Lift Station #1 Capacity to 2 MGD; Increase pipe capacity upstream of the Lift Station #1	$1,961,100
15	18-inch line along I-35 Access Road from Gateway Drive to TRA interceptor	$3,068,400
16	18-inch line from Crescent Medical Center to Rolling Hills Place	$846,700
17	New 15-inch line Extending SE from the Wheatland Road LS toward I-20	$2,201,800
18	New 8-inch line Extending South along Ten Mile Road	$1,264,700
	Intermediate Total	**$50,984,500**
Long Term Projects (2029-2045)		
19	Upsize existing 8- and 15-inch to 21-inch line in the Ten Mile 3 Sub-basin from TRA Interceptor to Ferris Road at Lancaster Airport	$2,484,700
20	New 15-inch line along Ferris Road from Lancaster Airport to E. Belt Line Road to parallel the 2021-planned 15-inch main	$1,504,800
21	New 12-inch line along S. Alba Road from E. Beltline Road to Green Road	$1,730,700
22	New 8-inch line in the Ten Mile 3 Basin along E Belt Line Road	$745,400
23	New 12-inch lines in the Ten Mile 3 Basin along Greene Road, extending to Ten Mile 7 basin.	$1,005,500

ID#	Project Name	Cost
24	New 12-inch and 8-inch lines along Greene Road from N. Alba Road, extending beyond Cornell Road	$1,697,700
25	New 8-inch lines along Cornell Road from Greene Road to Wintergreen Road	$1,486,900
26	New 10- and 8-inch Lines along N. Alba Road from Greene Road to north of E. Pleasant Run Road	$1,613,200
27	New 12 -inch line along W Belt Line Road to N Houston School Road	$695,200
28	New 12-inch lines in the Ten Mile 5 Basin along Nokomis Road to Nokomis Cir	$844,700
29	New 12-inch lines in the Ten Mile 5 Basin along Nokomis Road from Nokomis Cir, along E. Reindeer Road to Dasher Street	$4,949,300
30	New 8-inch line Extending South along S. Bluegrove Road	$934,400
31	8-inch line in Creekwood Branch	$1,143,700
32	8-inch lines along Houston School Road and Parkerville Road	$1,668,500
33	12-inch line along Moreland Road from S. Dallas Avenue in Ten Mile 6 Basin	$1,738,000
34	12-inch line along Water Mill Road and Nokomis Road in Ten Mile 4 Basin	$4,047,800
35	12-inch line along S. Dallas Avenue to E. Reindeer Road in Red Oak Basin	$3,774,900
36	8-inch line in the Red Oak Basin	$1,995,900
37	Upsize existing 8-inch along Deep Branch from Bayport Drive to Ames Road with 15-inch line	$2,603,100
38	12-inch line along Floyd Branch from Connecticut Ave to Interurban Rd	$807,300
39	21-inch line upstream of the Wheatland PS to convey flow from Upper Mill Branch	$522,600
40	New 12-inch line in Deep Branch basin from TRA to W. Main Street	$657,800
	Long Term Total	**$38,346,500**
	CIP Total	**$120,687,100**

FIGURE 10-1

CITY OF LANCASTER

WASTEWATER SYSTEM
CAPITAL IMPROVEMENTS PLAN

LEGEND

2021 Planned Improvements
- Wastewater Line

2023 Proposed Improvements
- Wastewater Line

2028 Proposed Improvements
- Wastewater Line

2045 Proposed Improvements
- Wastewater Line

Existing Wastewater System
- LS — Lift Station; LS #2 Wet Well
- 8" and Smaller Wastewater Line
- 10" and Larger Wastewater Line
- Force Main
- TRA Wastewater Line
- Road
- Railroad
- Stream
- Lake/Pond
- Parcel
- City Limit
- ETJ Boundary

Lancaster

FREESE AND NICHOLS

Wheatland Rd Lift Station
Firm Capacity = 0.6 MGD
Expand Firm Capacity to 2.0 MGD

Lift Station #1
Firm Capacity = 0.6 MGD
Expand Firm Capacity to 2.0 MGD

Lift Station #2
Firm Capacity = 0.5 MGD
Expand Firm Capacity to 1.0 MGD

FLOYD BRANCH
MILL BRANCH
CHESIER BRANCH
CREEKWOOD BRANCH
DEEP BRANCH
ENCHANTED FOREST
HALLS BRANCH
KELLER BRANCH
RED OAK
TEN MILE 1
TEN MILE 2
TEN MILE 3
TEN MILE 4
TEN MILE 5
TEN MILE 6
TEN MILE 7

0 4,000
SCALE IN FEET

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APPENDIX A:
Water Model Calibration Data

DRAFT FIGURE A-1

CITY OF LANCASTER

PRESSURE RECORDER LOCATIONS

LEGEND

- Pressure Recorder
- Dividing Valve
- Transfer Valve
- Pump Station
- Ground Storage Tank
- Elevated Storage Tank
- 8" and Smaller Water Line
- 10" and Larger Water Line

Dallas Water Utilities

- Meter
- Dallas Water Utilties Supply Line
- Road
- Railroad
- Stream
- Lake
- Parcel
- Upper Pressure Plane (792')
- Lower Pressure Plane (705')
- City Limit
- ETJ Boundary
- Other City Limit

FREESE AND NICHOLS

Lancaster

DWU Meter

PR #1
ID: 206052
3230 Springfield Ave

0.5 MG Ames Rd
Elevated Storage Tank
(OFFLINE)
Overflow Elev.: 792'

Ames Rd
Pump Station

3.0 MG Ames Rd
Ground Storage Tank

2.0 MG Wintergreen Rd
Elevated Storage Tank
Overflow Elev.: 792'

PR #2
ID: 203271
2654 Rutgers Dr

6.0 MG James R. Williams
Ground Storage Tank

James R. Williams
Pump Station
(OFFLINE)

PR #7
ID: 205935
Cornell Rd & Lancaster Hutchins Rd

Dallas
Transfer Valve

Pleasant Run
Transfer Valve

0.5 MG Pleasant Run Rd
Elevated Storage Tank
Overflow Elev.: 705'

PR #3
ID: 203435
500 Rolling Hills Pl #28

PR #6
ID: 205933
110 W Belt Line Rd

1.5 MG Beltline Rd
Elevated Storage Tank
(OFFLINE)
Overflow Elev.: 705'

PR #8
ID:205932
Ferris Rd & Belt Line Rd

PR #4
ID: 205931
222 S Houston School Rd

PR #5
ID: 205543
Bear Creek & Blue Grove

Dallas
Hutchins
DeSoto
Glenn Heights
Red Oak
Wilmer
Ferris

0 2,000 4,000
SCALE IN FEET

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City of Lancaster
Pressure and Level Calibration Summary
January 30, 2018

Pressure Recorder	Pressure Plane	Within 10 PSI (%)	Within 5 PSI (%)	Within 3 PSI (%)
PR #1	Upper (792')	100%	100%	80%
PR #2	Upper (792')	100%	100%	88%
PR #3	Upper (792')	100%	100%	84%
PR #4	Upper (792')	100%	100%	88%
PR #5	Upper (792')	100%	92%	84%
PR #6	Upper (792')	100%	100%	84%
PR #7	Lower (705')	100%	100%	100%
PR #8	Lower (705')	100%	100%	100%
Total Average		**100%**	**99%**	**89%**
Upper Pressure Plane Average		**100%**	**99%**	**85%**
Lower Pressure Plane Average		**100%**	**100%**	**100%**

Table B-2

Storage Tank Level Calibration Summary

Elevated Storage Tank	Pressure Plane	Within 5 Feet (%)	Within 3 Feet (%)	Within 1 Feet (%)
Wintergreen EST	Upper (792')	100%	100%	64%
Pleasant Run EST	Lower (705')	100%	100%	100%
Average		**100%**	**100%**	**82%**

Figure B-2
Pressure Recorder #1 (792')
3230 Springfield Avenue
January 30, 2018

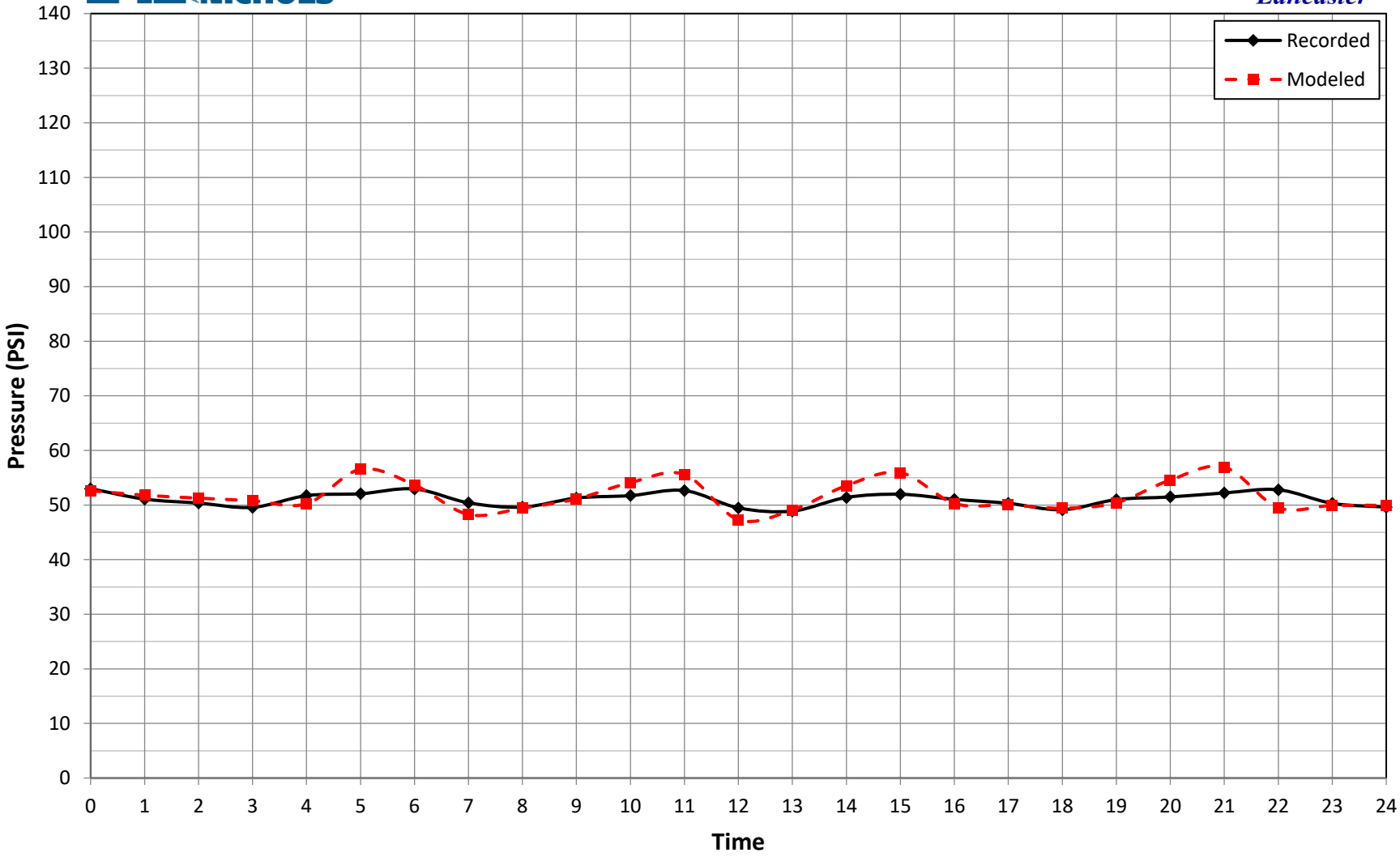

Figure B-3
Pressure Recorder #2 (792')
2654 Rutgers Drive
January 30, 2018

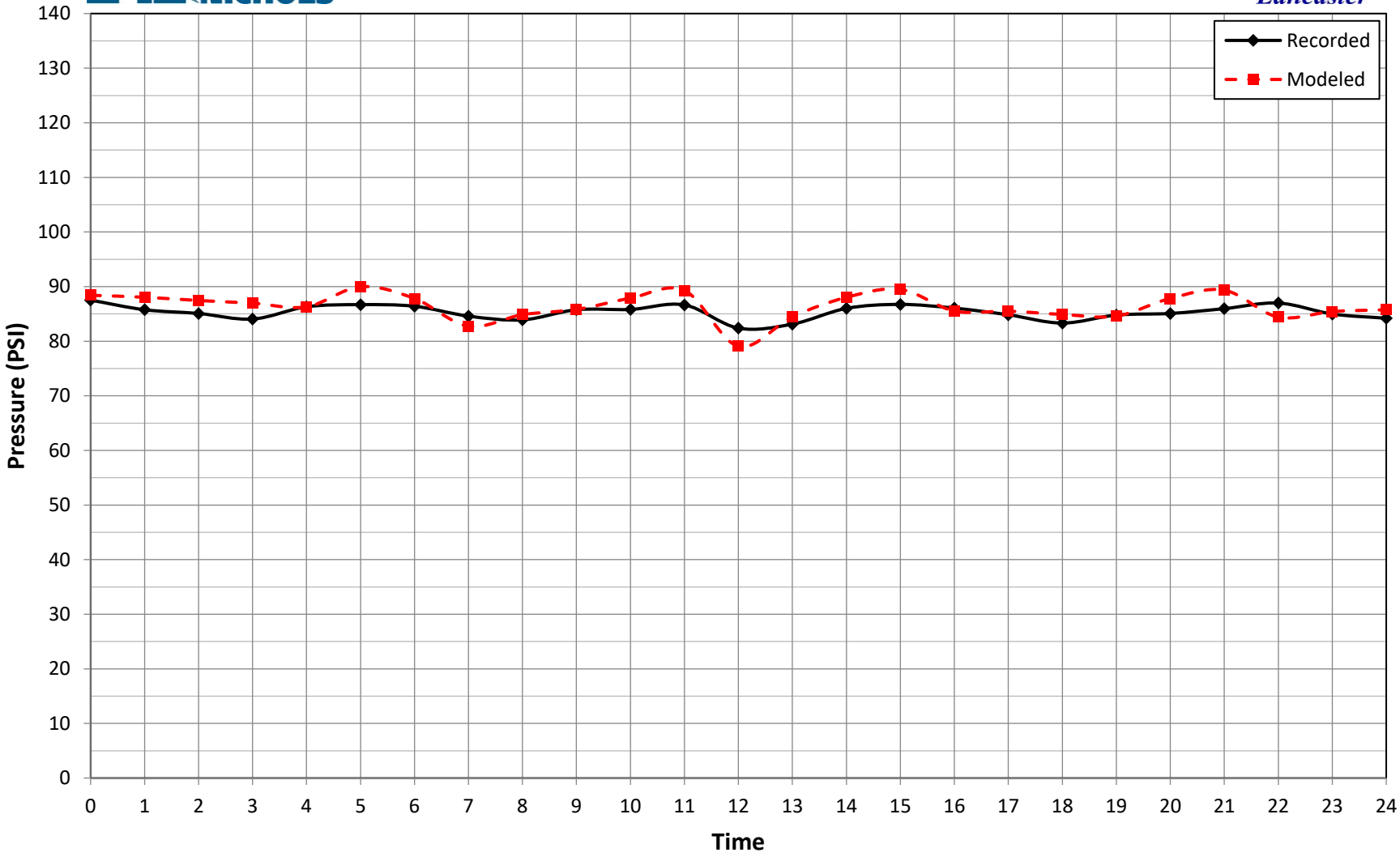

Figure B-4
Pressure Recorder #3 (792')
500 Rolling Hills Place
January 30, 2018

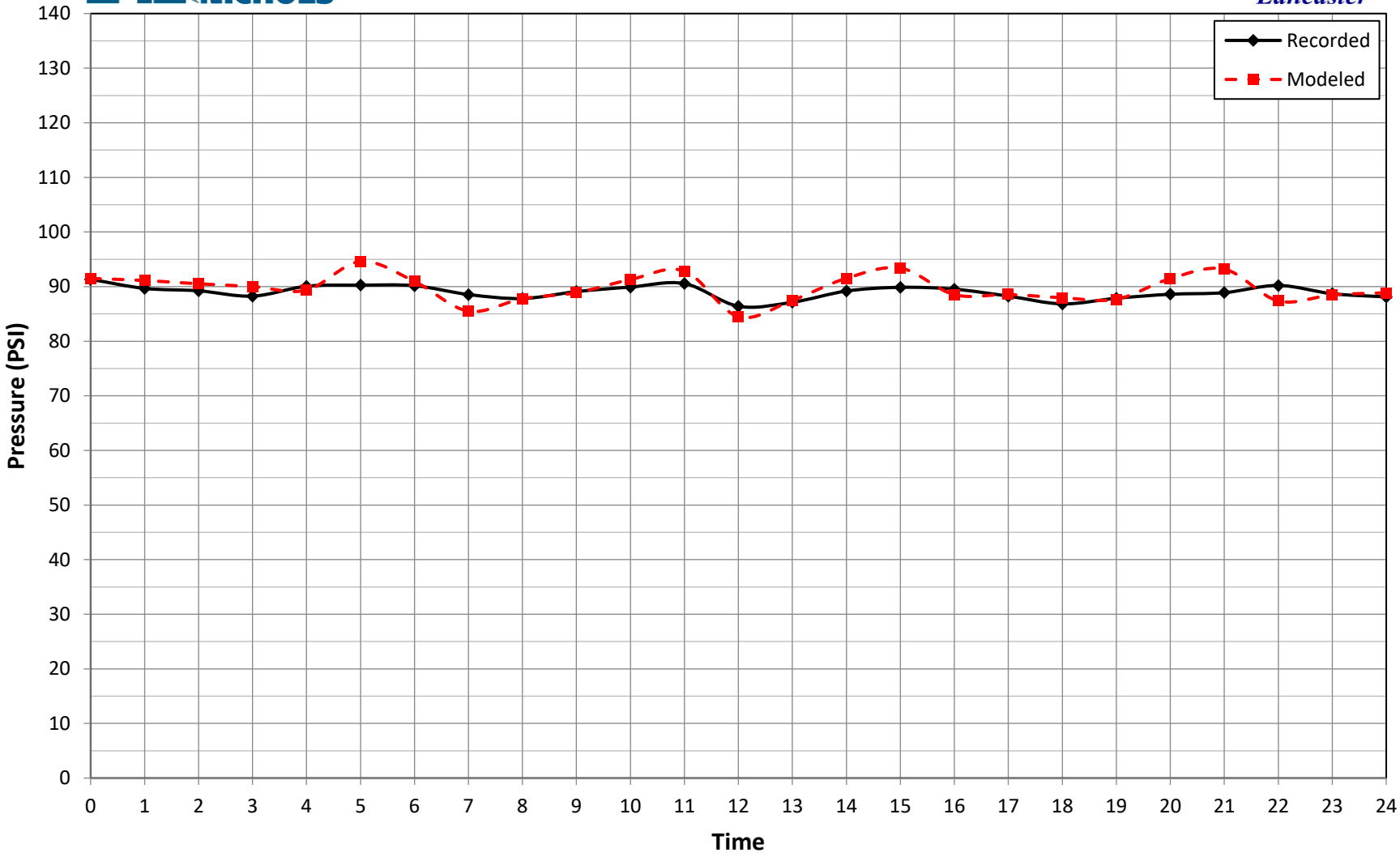

Figure B-5
Pressure Recorder #4 (792')
222 South Houston School Road
January 30, 2018

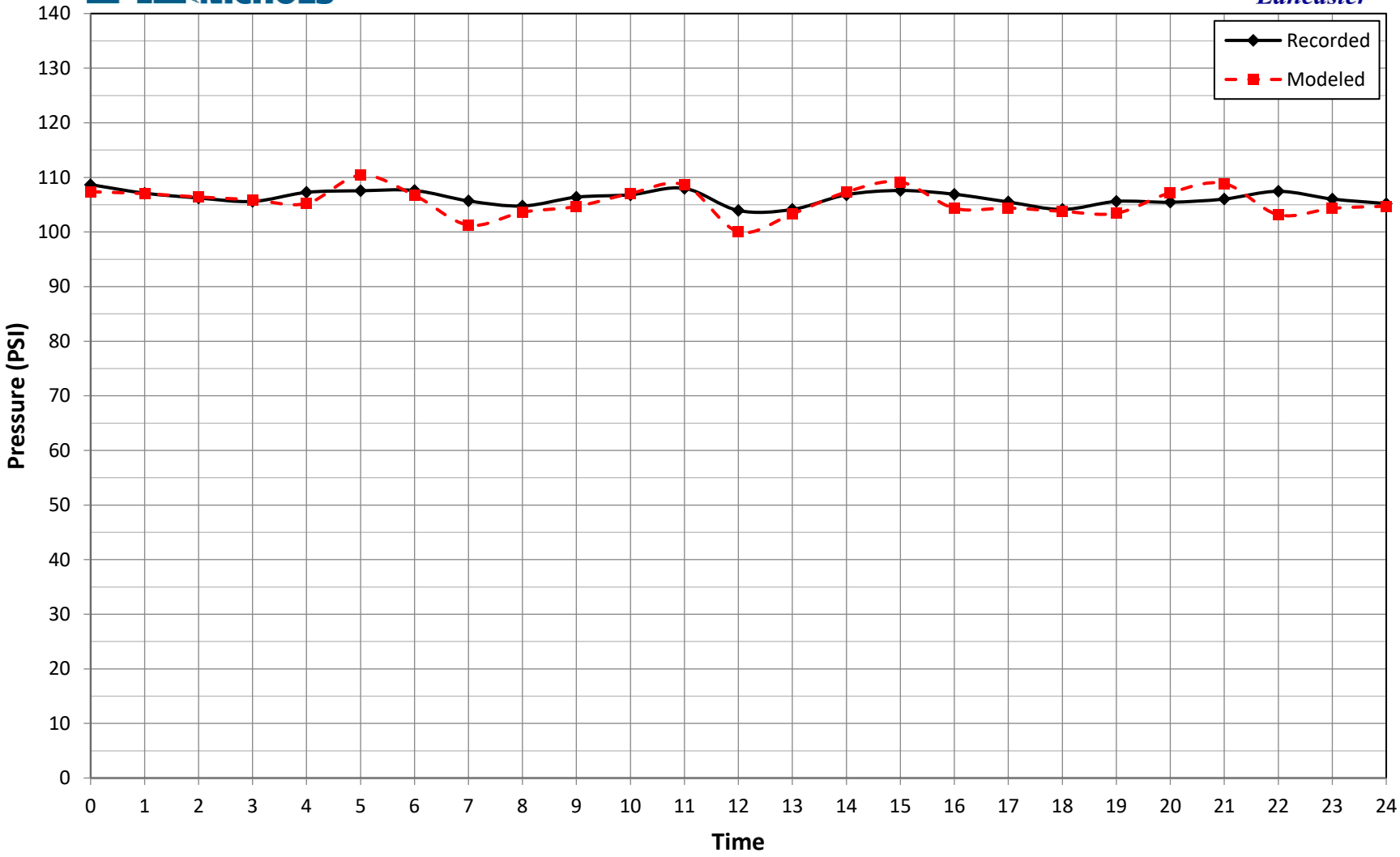

Figure B-6
Pressure Recorder #5 (792')
Bear Creek Road at South Bluegrove Road
January 30, 2018

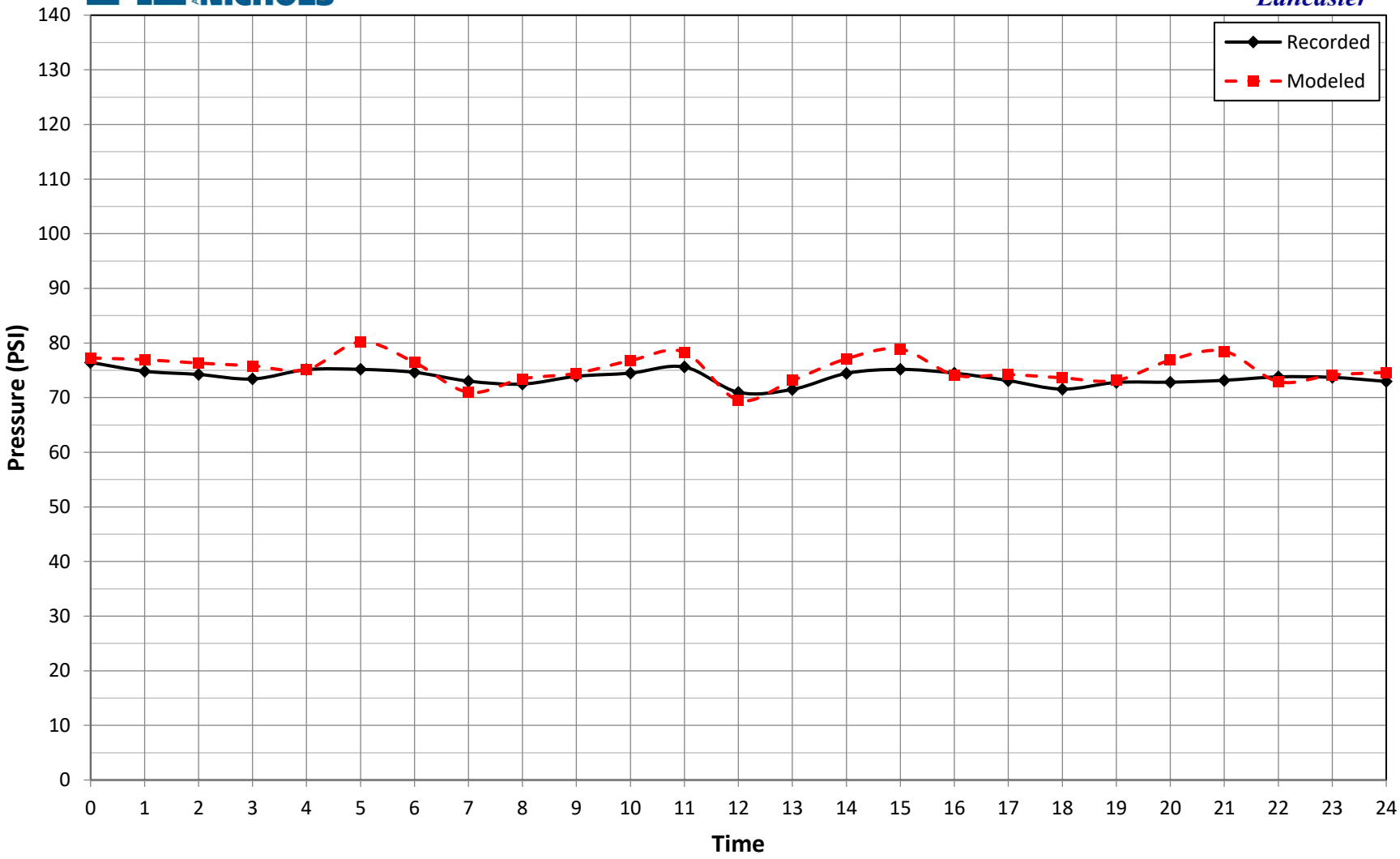

Figure B-7
Pressure Recorder #6 (792')
Open Field on Belt Line Road
January 30, 2018

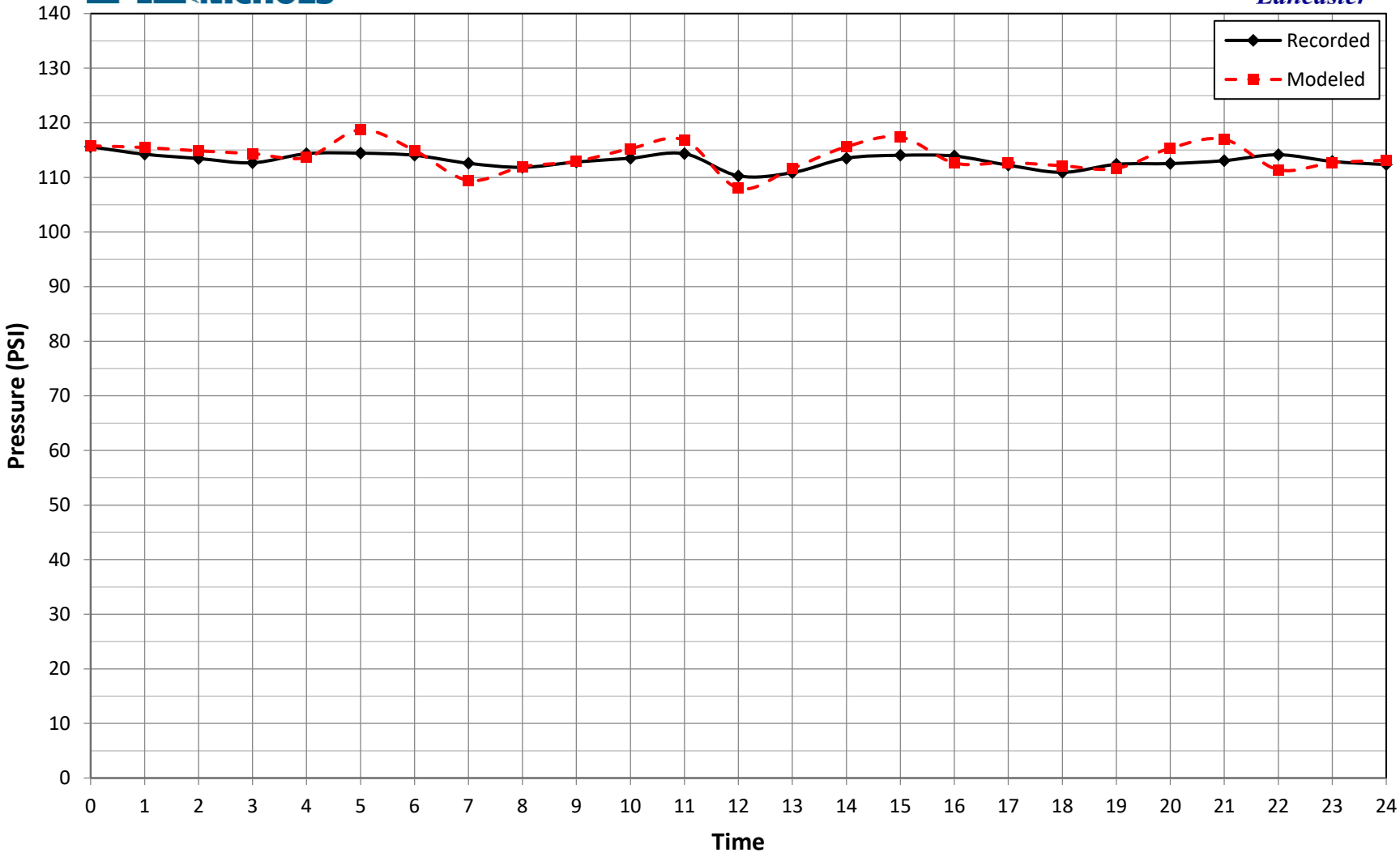

Figure B-8
Pressure Recorder #7 (702')
North Lancaster Hutchins Road at Cornell Road
January 30, 2018

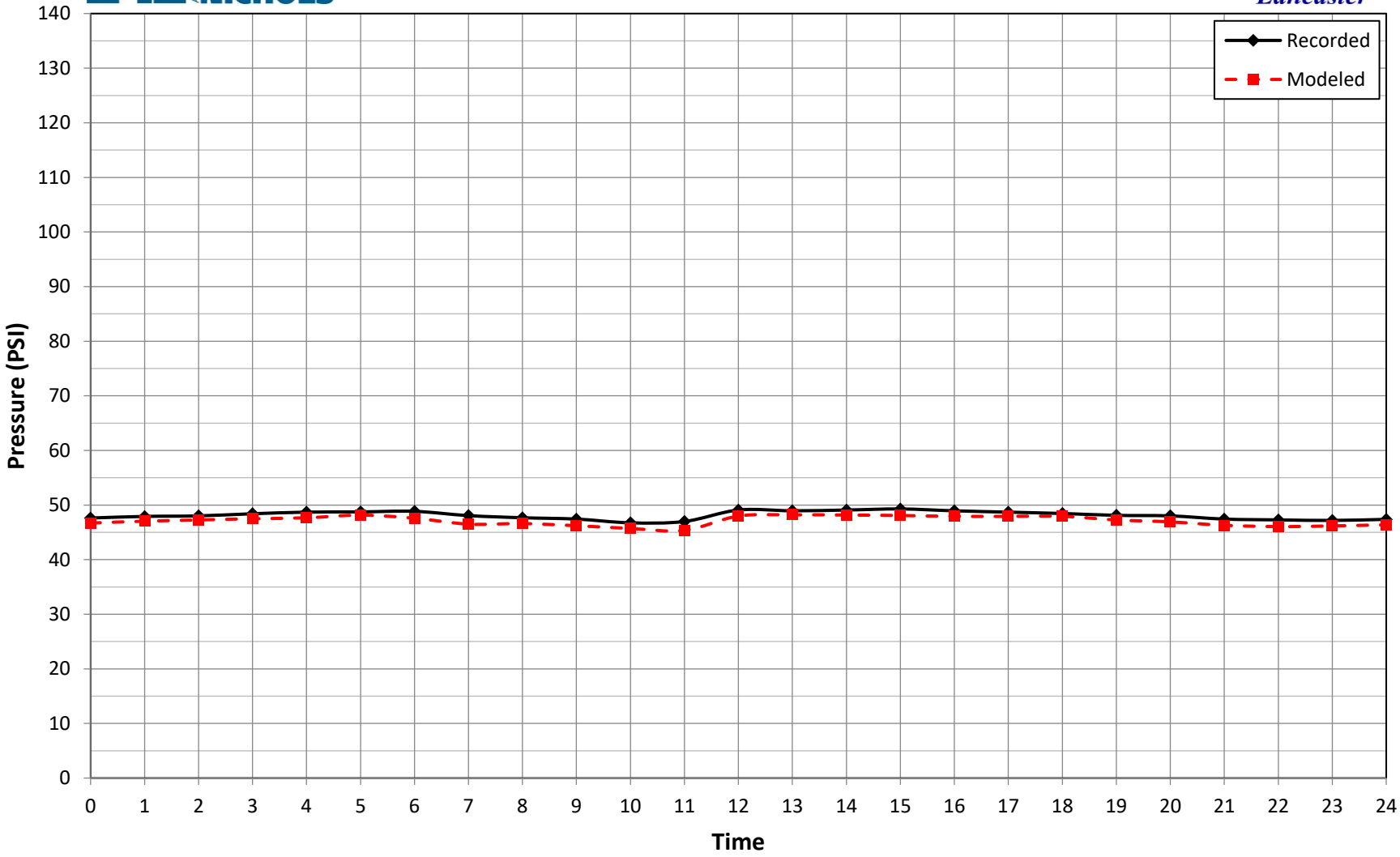

Figure B-9
Pressure Recorder #8 (702')
East Belt Line Road at Ferris Road
January 30, 2018

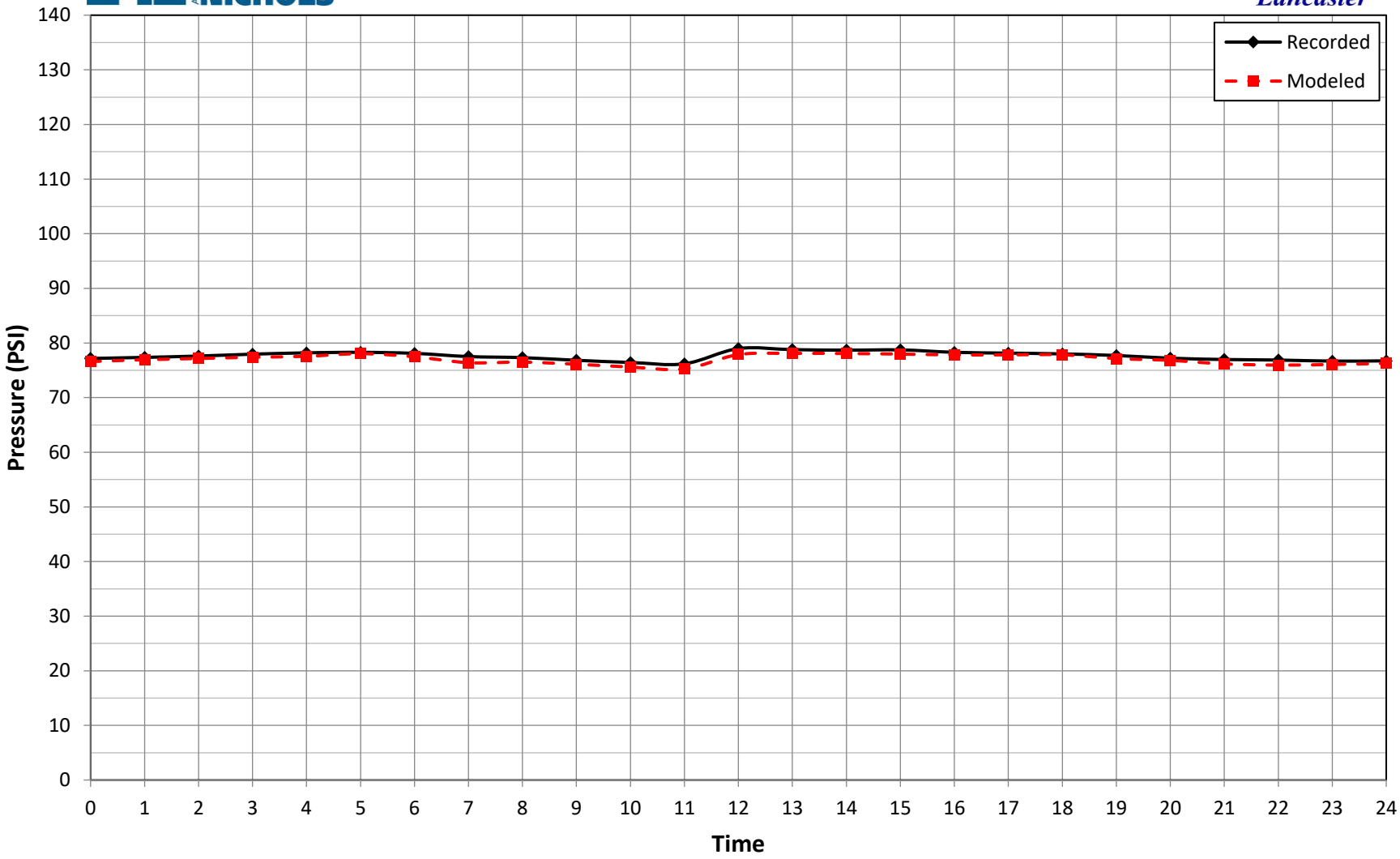

Figure B-10
2.0 MG Wintergreen EST Level (792')
January 30, 2018

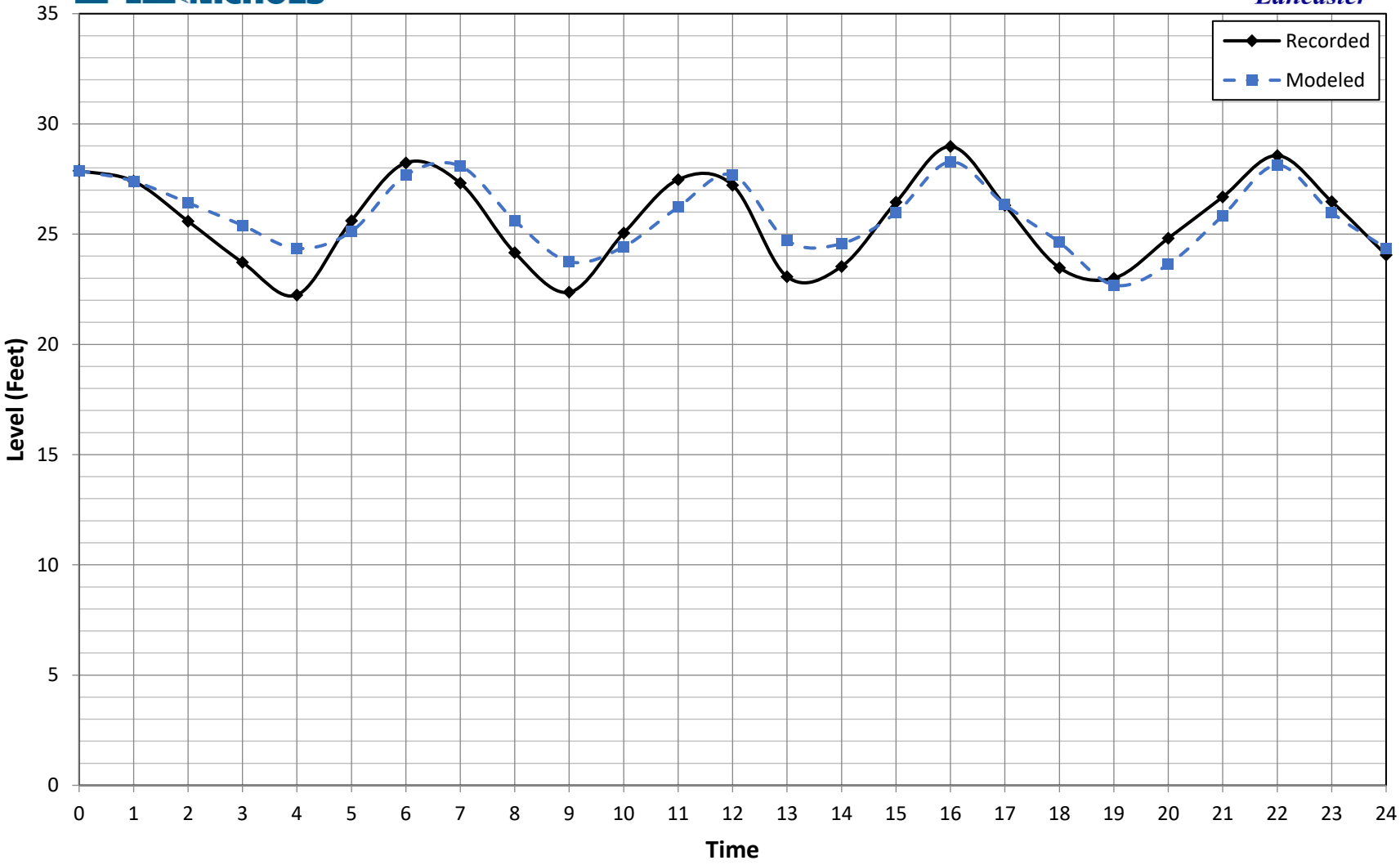

Figure B-11
0.5 MG Pleasant Run EST Level (702')
January 30, 2018

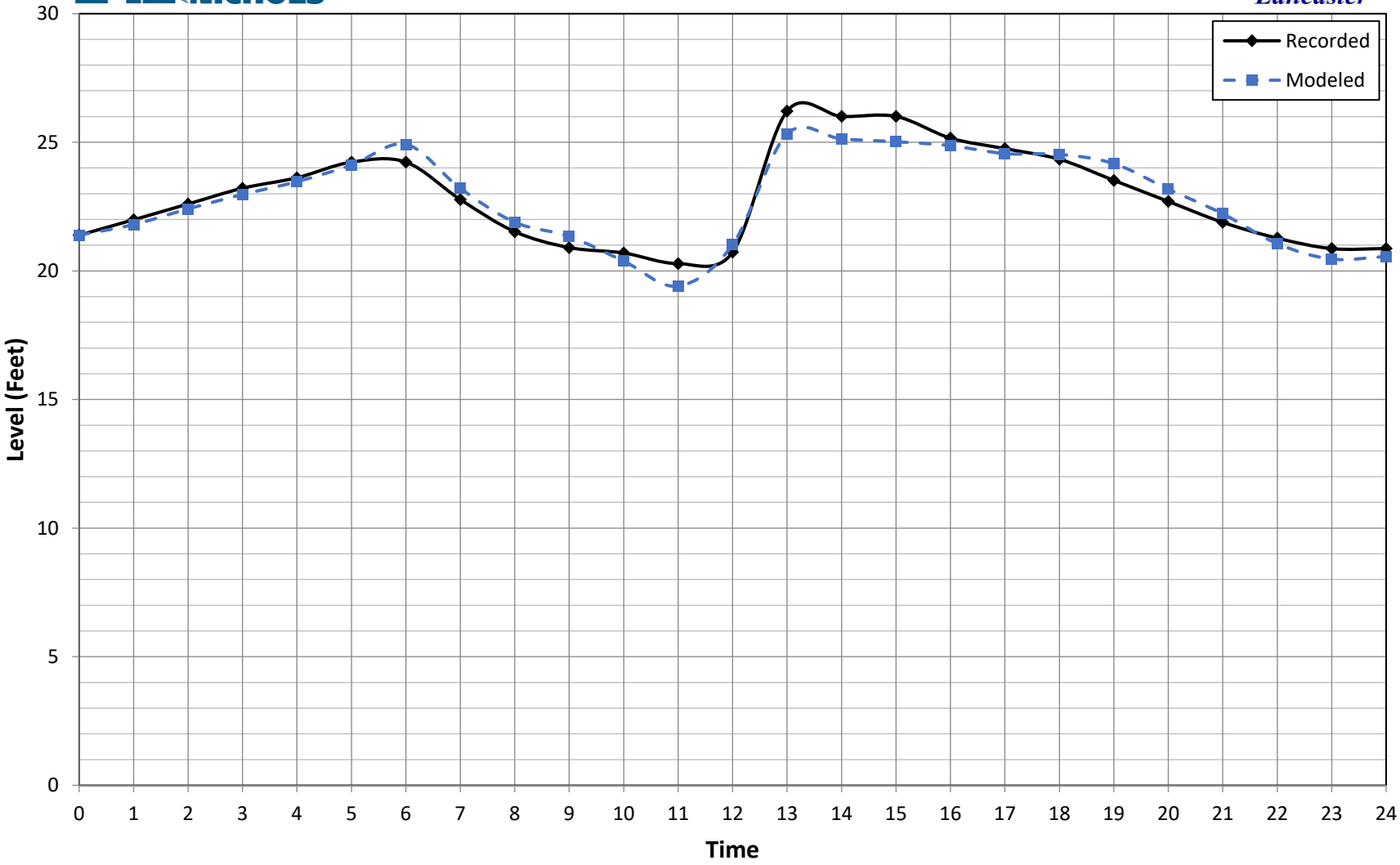

FIGURE A2

CITY OF LANCASTER

EXISTING WATER SYSTEM GEOCODED METERS

LEGEND

Existing Water System

- Water Meter
- Pump Station (PS)
- Ground Storage Tank
- Elevated Storage Tank
- 8" and Smaller Water Line
- 10" and Larger Water Line

Dallas Water Utilities

- Meter (M)

- Water Supply Line
- Road
- Railroad
- Lake/Pond
- Stream
- Parcel
- Upper Pressure Plane (792)
- Lower Pressure Plane (705)
- City Limit
- ETJ Boundary

Lancaster

FREESE AND NICHOLS

DWU Meter

26.4 MGD Ames Rd
Pump Station
Firm Capacity = 18.5 MGD

0.5 MG Ames Rd
Elevated Storage Tank
(OFFLINE)
Overflow Elev.: 792'

3.0 MG Ames Rd
Ground Storage Tank (buried)

2.0 MG Wintergreen Rd
Elevated Storage Tank
Overflow Elev.: 792'

6.0 MG James R. Williams
Ground Storage Tank

DWU Meter

5.3 MGD James R. Williams
Pump Station
Firm Capacity = 3.5 MGD
(OFFLINE)

Dallas
Transfer Valve

Pleasant Run
Transfer Valve

0.5 MG Pleasant Run Rd
Elevated Storage Tank
Overflow Elev.: 705'

1.5 MG Beltline Rd
Elevated Storage Tank
(OFFLINE)
Overflow Elev.: 705'

0 4,000
SCALE IN FEET

Created By Freese and Nichols, Inc.
Job No.: LCS18127
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APPENDIX B:
Water System
Capital Improvements Plan

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**

Construction Project Number: 1 — **Phase: SHORT**

Project Name:	**12-inch water lines to complete loops in the Upper Pressure Plane; decommission Ames Road 1.0 MG EST**

Project Description:

12-inch water lines to complete loops in the Upper Pressure Plane

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	2,000	LF	$ 174	$ 348,000
2	Water Pavement Repair	2,000	LF	$ 80	$ 160,000
3	Demolition of Existing Elevated Tank	1	LS	$ 200,000	$ 200,000
				SUBTOTAL:	**$ 708,000**
		CONTINGENCY		30%	$ 212,400
				SUBTOTAL:	**$ 920,400**
		ENG/SURVEY		15%	$ 138,100
				SUBTOTAL:	**$ 1,058,500**
				Estimated Project Total:	**$ 1,058,500**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**
Construction Project Number: 2 — **Phase: SHORT**

Project Name: **12-inch water line along Sunnymeadow Road**

Project Description:

12-inch water line along Sunnymeadow Road

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	4,220	LF	$ 174	$ 734,280
2	20" Boring and Casing	800	LF	$ 440	$ 352,000
3	Water Pavement Repair	4,220	LF	$ 80	$ 337,600
				SUBTOTAL:	**$ 1,423,900**
		CONTINGENCY		30%	$ 427,200
				SUBTOTAL:	**$ 1,851,100**
		ENG/SURVEY		15%	$ 277,700
				SUBTOTAL:	**$ 2,128,800**
				Estimated Project Total:	**$ 2,128,800**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**

Construction Project Number: 3 — **Phase: SHORT**

Project Name: **12-inch water line along North Elm Street; Pleasant Run EST site improvements**

Project Description:

12-inch water line along N. Elm Street from Pleasant Run to Main Street, Along Main Street to Dallas Avenue, Along Dallas Avenue to Beltline Road; Pleasant Run EST site improvements

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	3,700	LF	$ 174	$ 643,800
2	Water Pavement Repair	3,700	LF	$ 80	$ 296,000
3	Misc. Tank Site Work	1	LS	$ 500,000	$ 500,000
				SUBTOTAL:	**$ 1,439,800**
		CONTINGENCY		30%	$ 432,000
				SUBTOTAL:	**$ 1,871,800**
		ENG/SURVEY		15%	$ 280,800
				SUBTOTAL:	**$ 2,152,600**
				Estimated Project Total:	**$ 2,152,600**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**

Construction Project Number: 4 — **Phase: SHORT**

Project Name:	**12-inch water line along Beltline from Rolling Hills to I-35E; replace 2-inch water line along Idlewild Ln**

Project Description:

12-inch water line to complete loop between Rolling Hills and I-35E along Beltline; replace 2-inch pipe along Idlewild from Green to Gateway Road with 8 inch line

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	2,060	LF	$ 174	$ 358,440
2	Water Pavement Repair	2,060	LF	$ 80	$ 164,800
				SUBTOTAL:	**$ 523,300**
		CONTINGENCY		30%	$ 157,000
				SUBTOTAL:	**$ 680,300**
		ENG/SURVEY		15%	$ 102,100
				SUBTOTAL:	**$ 782,400**
				Estimated Project Total:	**$ 782,400**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**
Construction Project Number: 5 — **Phase: MEDIUM**

Project Name: **12-inch water line along Beltline Road and Transfer Valve**

Project Description:

12-inch water line along Beltline Road to connect pressure planes at Annette Road; and Transfer Valve

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	310	LF	$ 174	$ 53,940
2	Water Pavement Repair	310	LF	$ 80	$ 24,800
3	Pressure Reducing Valve Station	1	LS	$ 100,000	$ 100,000
				SUBTOTAL:	**$ 178,800**
		CONTINGENCY		30%	$ 53,700
				SUBTOTAL:	**$ 232,500**
		ENG/SURVEY		15%	$ 34,900
				SUBTOTAL:	**$ 267,400**
				Estimated Project Total:	**$ 267,400**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**

Construction Project Number: 6 — **Phase: MEDIUM**

Project Name: **12-inch water line along Ten Mile Road west of Lancaster Hutchins**

Project Description:

12-inch water line along Ten Mile Road west of Lancaster Hutchins

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	6,270	LF	$ 174	$ 1,090,980
2	20" Boring and Casing	1,000	LF	$ 440	$ 440,000
3	Water Pavement Repair	6,270	LF	$ 80	$ 501,600
				SUBTOTAL:	**$ 2,032,600**
		CONTINGENCY		30%	$ 609,800
				SUBTOTAL:	**$ 2,642,400**
		ENG/SURVEY		15%	$ 396,400
				SUBTOTAL:	**$ 3,038,800**
				Estimated Project Total:	**$ 3,038,800**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**
Construction Project Number: 7 — **Phase: MEDIUM**

Project Name: **12-inch along Lancaster-Hutchins Road and Transfer Valve**

Project Description:

12-inch along Lancaster-Hutchins Road from Pleasant Run to Beltline Road to replaces existing 6 inch; transfer valve on southside of Beltline Road

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	8,180	LF	$ 174	$ 1,423,320
2	20" Boring and Casing	200	LF	$ 440	$ 88,000
3	Water Pavement Repair	8,180	LF	$ 80	$ 654,400
4	Pressure Reducing Valve Station	1	LS	$ 100,000	$ 100,000
				SUBTOTAL:	**$ 2,265,800**
		CONTINGENCY		30%	$ 679,800
				SUBTOTAL:	**$ 2,945,600**
		ENG/SURVEY		15%	$ 441,900
				SUBTOTAL:	**$ 3,387,500**
				Estimated Project Total:	**$ 3,387,500**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**

Construction Project Number: 8 — **Phase: MEDIUM**

Project Name: **20- and 24-inch water line along Houston School Road**

Project Description:

20- and 24-inch water line along Houston School Road from Pleasant Run to Main Street

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	24" WL & Appurtenances	3,850	LF	$ 348	$ 1,339,800
2	20" WL & Appurtenances	2,212	LF	$ 290	$ 641,480
3	Water Pavement Repair	3,850	LF	$ 80	$ 308,000
4	36" Boring and Casing	300	LF	$ 792	$ 237,600
				SUBTOTAL:	**$ 2,526,900**
		CONTINGENCY		30%	$ 758,100
				SUBTOTAL:	**$ 3,285,000**
		ENG/SURVEY		15%	$ 492,800
				SUBTOTAL:	**$ 3,777,800**
				Estimated Project Total:	**$ 3,777,800**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**

Construction Project Number: 9 — **Phase: MEDIUM**

Project Name: **12-inch water lines north of Interstate 20 to Campus District**

Project Description:

12-inch water lines north of Interstate 20 to Campus District

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	11,070	LF	$ 174	$ 1,926,180
2	20" Boring and Casing	1,000	LF	$ 440	$ 440,000
3	Water Pavement Repair	300	LF	$ 80	$ 24,000
				SUBTOTAL:	**$ 2,390,200**
		CONTINGENCY		30%	$ 717,100
				SUBTOTAL:	**$ 3,107,300**
		ENG/SURVEY		15%	$ 466,100
				SUBTOTAL:	**$ 3,573,400**
				Estimated Project Total:	**$ 3,573,400**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**

Construction Project Number: 10 — **Phase: MEDIUM**

Project Name: **12-inch water lines along Telephone Road**

Project Description:

12-inch water lines along Telephone Road from Connecticut to Pepperidge and along Hwy 342 from Telephone Road to Wintergreen

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	6,000	LF	$ 174	$ 1,044,000
2	Water Pavement Repair	6,000	LF	$ 80	$ 480,000
				SUBTOTAL:	**$ 1,524,000**
		CONTINGENCY		30%	$ 457,200
				SUBTOTAL:	**$ 1,981,200**
		ENG/SURVEY		15%	$ 297,200
				SUBTOTAL:	**$ 2,278,400**
				Estimated Project Total:	**$ 2,278,400**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**

Construction Project Number: 11 — **Phase: MEDIUM**

Project Name: **12-inch water line along Nokomis Road from Belt Line Road to Ferris Road**

Project Description:

12-inch water line along Nokomis Road from Belt Line Road to Ferris Road

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	14,240	LF	$ 174	$ 2,477,760
2	Water Pavement Repair	14,240	LF	$ 80	$ 1,139,200
3	20" Boring and Casing	250	LF	$ 440	$ 110,000
				SUBTOTAL:	**$ 3,727,000**
		CONTINGENCY		30%	$ 1,118,100
				SUBTOTAL:	**$ 4,845,100**
		ENG/SURVEY		15%	$ 726,800
				SUBTOTAL:	**$ 5,571,900**
				Estimated Project Total:	**$ 5,571,900**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**

Construction Project Number: 12 — **Phase: LONG**

Project Name: **12-inch water line along Parkerville Road from I35E to W Main Street**

Project Description:

12-inch water line along Parkerville Road from I35E to W Main Street

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	6,340	LF	$ 174	$ 1,103,160
2	Water Pavement Repair	6,340	LF	$ 80	$ 507,200
				SUBTOTAL:	**$ 1,610,400**
		CONTINGENCY		30%	$ 483,200
				SUBTOTAL:	**$ 2,093,600**
		ENG/SURVEY		15%	$ 314,100
				SUBTOTAL:	**$ 2,407,700**
				Estimated Project Total:	**$ 2,407,700**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**

Construction Project Number: 13 — **Phase: LONG**

Project Name: **12-inch water line along East Third Street from Lancaster Hutchins to Cornell Road**

Project Description:

12-inch water line along East Third Street from Lancaster Hutchins to Cornell Road

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	3,600	LF	$ 174	$ 626,400
2	Water Pavement Repair	3,600	LF	$ 80	$ 288,000
				SUBTOTAL:	**$ 914,400**
		CONTINGENCY		30%	$ 274,400
				SUBTOTAL:	**$ 1,188,800**
		ENG/SURVEY		15%	$ 178,400
				SUBTOTAL:	**$ 1,367,200**
				Estimated Project Total:	**$ 1,367,200**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**

Construction Project Number: 14 — **Phase:** LONG

Project Name: 12-inch water line along Alba Road from Pleasant Run to Third Street

Project Description:

12-inch water line along Alba Road from Pleasant Run to Third Street

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	3,510	LF	$ 174	$ 610,740
2	Water Pavement Repair	3,510	LF	$ 80	$ 280,800
				SUBTOTAL:	**$ 891,600**
		CONTINGENCY		30%	$ 267,500
				SUBTOTAL:	**$ 1,159,100**
		ENG/SURVEY		15%	$ 173,900
				SUBTOTAL:	**$ 1,333,000**
				Estimated Project Total:	**$ 1,333,000**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**

Construction Project Number: 15 — **Phase:** LONG

Project Name: 12-inch water line east of Beltline Road EST along Belt Line Road

Project Description:

12-inch water line east of Beltline Road EST along Belt Line Road

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	6,660	LF	$ 174	$ 1,158,840
2	Water Pavement Repair	6,660	LF	$ 80	$ 532,800
				SUBTOTAL:	**$ 1,691,700**
		CONTINGENCY		30%	$ 507,600
				SUBTOTAL:	**$ 2,199,300**
		ENG/SURVEY		15%	$ 329,900
				SUBTOTAL:	**$ 2,529,200**
				Estimated Project Total:	**$ 2,529,200**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**

Construction Project Number: 16 — **Phase: LONG**

Project Name: **12-inch water line along Pinto Road from Pleasant Run Road to Greene Road**

Project Description:

12-inch water line along Pinto Road from Pleasant Run Road to Greene Road

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	4,250	LF	$ 174	$ 739,500
2	Water Pavement Repair	4,250	LF	$ 80	$ 340,000
				SUBTOTAL:	**$ 1,079,500**
		CONTINGENCY		30%	$ 323,900
				SUBTOTAL:	**$ 1,403,400**
		ENG/SURVEY		15%	$ 210,600
				SUBTOTAL:	**$ 1,614,000**
				Estimated Project Total:	**$ 1,614,000**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**

Construction Project Number: 17 — **Phase: LONG**

Project Name: **12-inch water line along Greene Road**

Project Description:

12-inch water line along Greene Road from Alba Road to Sunrise Road, along Sunrise Road to Beltline Road

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	10,590	LF	$ 174	$ 1,842,660
2	Water Pavement Repair	10,590	LF	$ 80	$ 847,200
				SUBTOTAL:	**$ 2,689,900**
		CONTINGENCY		30%	$ 807,000
				SUBTOTAL:	**$ 3,496,900**
		ENG/SURVEY		15%	$ 524,600
				SUBTOTAL:	**$ 4,021,500**
				Estimated Project Total:	**$ 4,021,500**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**

Construction Project Number: 18 — **Phase: LONG**

Project Name: **12-inch water line along Sunrise Road from Belt Line Road to Van Road**

Project Description:

12-inch water line along Sunrise Road from Belt Line Road to Van Road

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	7,040	LF	$ 174	$ 1,224,960
2	Water Pavement Repair	7,040	LF	$ 80	$ 563,200
				SUBTOTAL:	**$ 1,788,200**
		CONTINGENCY		30%	$ 536,500
				SUBTOTAL:	**$ 2,324,700**
		ENG/SURVEY		15%	$ 348,800
				SUBTOTAL:	**$ 2,673,500**
				Estimated Project Total:	**$ 2,673,500**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**

Construction Project Number: 19 — **Phase: LONG**

Project Name: **12-inch water line along Van Road from Sunrise to Ferris Road**

Project Description:

12-inch water line along Van Road from Sunrise to Ferris Road

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	3,520	LF	$ 174	$ 612,480
2	Water Pavement Repair	3,520	LF	$ 80	$ 281,600
				SUBTOTAL:	**$ 894,100**
		CONTINGENCY		30%	$ 268,300
				SUBTOTAL:	**$ 1,162,400**
		ENG/SURVEY		15%	$ 174,400
				SUBTOTAL:	**$ 1,336,800**
				Estimated Project Total:	**$ 1,336,800**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**

Construction Project Number: 20 — **Phase: LONG**

Project Name: **12-inch water line along Ferris Road from Nokomis to Watermill then to Van Road**

Project Description:

12-inch water line along Ferris Road from Nokomis to Watermill then to Van Road

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	7,510	LF	$ 174	$ 1,306,740
2	Water Pavement Repair	7,510	LF	$ 80	$ 600,800
				SUBTOTAL:	**$ 1,907,600**
		CONTINGENCY		30%	$ 572,300
				SUBTOTAL:	**$ 2,479,900**
		ENG/SURVEY		15%	$ 372,000
				SUBTOTAL:	**$ 2,851,900**
				Estimated Project Total:	**$ 2,851,900**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**

Construction Project Number: 21 — **Phase: LONG**

Project Name: **12-inch water line along Watermill Road**

Project Description:

12-inch water line along Watermill Road from Ferris Road to Wilson Road, continuing to Nokomis Road

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	8,250	LF	$ 174	$ 1,435,500
2	Water Pavement Repair	8,250	LF	$ 80	$ 660,000
				SUBTOTAL:	**$ 2,095,500**
		CONTINGENCY		30%	$ 628,700
				SUBTOTAL:	**$ 2,724,200**
		ENG/SURVEY		15%	$ 408,700
				SUBTOTAL:	**$ 3,132,900**
				Estimated Project Total:	**$ 3,132,900**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**

Construction Project Number: 22 — **Phase: LONG**

Project Name: **12-inch water line along Wilson Road**

Project Description:

12-inch water line along Wilson Road from Nokomis to Water Mill Road

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	8,670	LF	$ 174	$ 1,508,580
2	Water Pavement Repair	8,670	LF	$ 80	$ 693,600
				SUBTOTAL:	**$ 2,202,200**
		CONTINGENCY		30%	$ 660,700
				SUBTOTAL:	**$ 2,862,900**
		ENG/SURVEY		15%	$ 429,500
				SUBTOTAL:	**$ 3,292,400**
				Estimated Project Total:	**$ 3,292,400**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**
Construction Project Number: 23 — **Phase: LONG**

Project Name: **12-inch water line along Moreland Road and New Transfer Valve**

Project Description:

12-inch water line along Moreland Road from S. Dallas Avenue to Reindeer/Nokomis intersection, includes new transfer valve

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	11,410	LF	$ 174	$ 1,985,340
2	Water Pavement Repair	11,410	LF	$ 80	$ 912,800
3	Pressure Reducing Valve Station	1	LS	$ 100,000	$ 100,000
				SUBTOTAL:	**$ 2,998,200**
		CONTINGENCY		30%	$ 899,500
				SUBTOTAL:	**$ 3,897,700**
		ENG/SURVEY		15%	$ 584,700
				SUBTOTAL:	**$ 4,482,400**
				Estimated Project Total:	**$ 4,482,400**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**

Construction Project Number: 24 — **Phase: LONG**

Project Name: **12-inch water line along Dallas Avenue and Reindeer Road and New Transfer Valve**

Project Description:

12-inch water line Along Dallas Avenue from Bear Creek Road to East Reindeer Road , then along E. Reindeer Road to new transfer valve

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	8,490	LF	$ 174	$ 1,477,260
2	Water Pavement Repair	8,490	LF	$ 80	$ 679,200
3	Pressure Reducing Valve Station	1	LS	$ 100,000	$ 100,000
				SUBTOTAL:	**$ 2,256,500**
		CONTINGENCY		30%	$ 677,000
				SUBTOTAL:	**$ 2,933,500**
		ENG/SURVEY		15%	$ 440,100
				SUBTOTAL:	**$ 3,373,600**
				Estimated Project Total:	**$ 3,373,600**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**

Construction Project Number: 25 — **Phase: LONG**

Project Name: **12-inch water line along E. Reindeer Road**

Project Description:

12-inch water line along E. Reindeer Road from new transfer valve to Nokomis

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	9,910	LF	$ 174	$ 1,724,340
2	Water Pavement Repair	9,910	LF	$ 80	$ 792,800
3	Pressure Reducing Valve Station	1	LS	$ 100,000	$ 100,000
				SUBTOTAL:	**$ 2,617,200**
		CONTINGENCY		30%	$ 785,200
				SUBTOTAL:	**$ 3,402,400**
		ENG/SURVEY		15%	$ 510,400
				SUBTOTAL:	**$ 3,912,800**
				Estimated Project Total:	**$ 3,912,800**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**

Construction Project Number: 26 — **Phase: LONG**

Project Name: **12-inch water line along Nokomis from Watermill Road to Stainback Road**

Project Description:

12-inch water line along Nokomis from Watermill Road to Stainback Road

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	8,860	LF	$ 174	$ 1,541,640
2	Water Pavement Repair	8,860	LF	$ 80	$ 708,800
				SUBTOTAL:	**$ 2,250,500**
		CONTINGENCY		30%	$ 675,200
				SUBTOTAL:	**$ 2,925,700**
		ENG/SURVEY		15%	$ 438,900
				SUBTOTAL:	**$ 3,364,600**
				Estimated Project Total:	**$ 3,364,600**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**

Construction Project Number: 27 — **Phase: LONG**

Project Name: **12-inch water line along Stainback from Nokomis to Ferris Road**

Project Description:

12-inch water line along Stainback from Nokomis to Ferris Road

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	4,620	LF	$ 174	$ 803,880
2	Water Pavement Repair	4,620	LF	$ 80	$ 369,600
				SUBTOTAL:	**$ 1,173,500**
		CONTINGENCY		30%	$ 352,100
				SUBTOTAL:	**$ 1,525,600**
		ENG/SURVEY		15%	$ 228,900
				SUBTOTAL:	**$ 1,754,500**
				Estimated Project Total:	**$ 1,754,500**

City of Lancaster

DRAFT Capital Improvement Cost Estimate — **JANUARY 2021**
Construction Project Number: 28 — **Phase: LONG**

Project Name: **12-inch water line along Ferris Road from WaterMill/Van Road to Stainback Road**

Project Description:

12-inch water line along Ferris Road from WaterMill/Van Road to Stainback Road

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	6,210	LF	$ 174	$ 1,080,540
2	Water Pavement Repair	6,210	LF	$ 80	$ 496,800
				SUBTOTAL:	**$ 1,577,400**
		CONTINGENCY		30%	$ 473,300
				SUBTOTAL:	**$ 2,050,700**
		ENG/SURVEY		15%	$ 307,700
				SUBTOTAL:	**$ 2,358,400**
				Estimated Project Total:	**$ 2,358,400**

City of Lancaster

DRAFT Capital Improvement Cost Estimate					**JANUARY 2021**
Construction Project Number:	**29**				**Phase: LONG**
Project Name:	**12-inch water line along Bear Creek Road**				
Project Description:					
12-inch water line along Bear Creek from Houston School Road to Blue Grove Road					
1	12" WL & Appurtenances	5,570	LF	$ 174	$ 969,180
2	Water Pavement Repair	5,055	LF	$ 80	$ 404,400
				SUBTOTAL:	**$ 1,373,600**
		CONTINGENCY		30%	$ 412,100
				SUBTOTAL:	**$ 1,785,700**
		ENG/SURVEY		15%	$ 267,900
				SUBTOTAL:	**$ 2,053,600**
				Estimated Project Total:	**$ 2,053,600**

City of Lancaster

DRAFT Capital Improvement Cost Estimate					**JANUARY 2021**
Construction Project Number:	**30**				**Phase: LONG**
Project Name:	**Ames Pump Rd - New 1.0 MG Ground Storage Tank**				

Project Description:

Ames Road - New 1.0 MG Ground Storage Tank

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	1.0 MG Ground Storage Tank	1	LS	$ 1,000,000	$ 1,000,000
2	Pump Station Site Work & Yard Piping	1	LS	$ 306,000	$ 306,000
				SUBTOTAL:	**$ 1,306,000**
		CONTINGENCY		30%	$ 391,800
				SUBTOTAL:	**$ 1,697,800**
		ENG/SURVEY		15%	$ 254,700
				SUBTOTAL:	**$ 1,952,500**
				Estimated Project Total:	**$ 1,952,500**

City of Lancaster

DRAFT Capital Improvement Cost Estimate		**JANUARY 2021**
Construction Project Number:	**31**	**Phase: LONG**
Project Name:	**James R. Williams PS Capacity Expansion (0.5 MGD)**	
Project Description:		**Vicinity Map**

James R. Williams PS Capacity Expansion (0.5 MGD) Assumes replacing one pump with higher capacity pump

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	0.5 MGD Pumps	1	LS	$ 250,000	$ 250,000
2	Pump Station Piping & Appurtenances	1	LS	$ 267,000	$ 267,000
				SUBTOTAL:	**$ 517,000**
		CONTINGENCY		30%	$ 155,100
				SUBTOTAL:	**$ 672,100**
		ENG/SURVEY		15%	$ 100,900
				SUBTOTAL:	**$ 773,000**
				Estimated Project Total:	**$ 773,000**

Appendix C
Wastewater System
Capital Improvements Plan

City of Lancaster, TX

Capital Improvement Cost Estimate	**FEBRUARY 2021**
Construction Project Number: 1	**Phase: SHORT**
Project Name:	**21-inch along Deep Branch Creek from Nancy Lane to W. Pleasant Run Road to remove 8- and 12-inch bottleneck**

Project Description:

Upsize 8-inch-12-inch bottleneck to 21 inch from Nancy Ln to W Pleasant Run Rd to improve capacity and reduce surgcharing conditions, and accommodate future growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	21" Pipe < 8 feet deep	1,900	LF	$ 315	$ 598,500
2	60" Diameter Manhole	2	EA	$ 6,000	$ 14,250
3	Sewer Pavement Repair	200	LF	$ 75	$ 15,000
				SUBTOTAL:	**$ 627,800**
		CONTINGENCY		30%	$ 188,400
				SUBTOTAL:	**$ 816,200**
		ENG/SURVEY		15%	$ 122,500
				SUBTOTAL:	**$ 938,700**
				Estimated Project Total:	**$ 938,700**

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 2 — **Phase: SHORT**

Project Name: **42-inch and 36-inch Line along Deep Branch Creek from TRA Interceptor to W. Main Street, 21-inch along W. Main Street**

Project Description:

Upsize 24 inch pipe to 42- and 36 inch from TRA interceptor to W. Main St ; 21-inch along W. Main Street to relieve the parallel 10-15-inch main on the east side of Deep Branch. Project improves capacity in this sub-basin, which sees the highest loadings in Lancaster, and reduces surcharged conditions under peak wet weather flows, and accommodate future growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	36" Pipe > 16 feet deep	2,400	LF	$ 900	$ 2,160,000
2	72" Diameter Manhole	6	EA	$ 7,500	$ 48,000
3	Sewer Pavement Repair	600	LF	$ 75	$ 45,000
4	42" Pipe 8- 16 feet deep	4,000	LF	$ 840	$ 3,360,000
5	21" Pipe 8- 16 feet deep	720	LF	$ 420	$ 302,400
6	60" Diameter Manhole	1	EA	$ 6,000	$ 5,400
				SUBTOTAL:	**$ 5,920,800**
		CONTINGENCY		30%	$ 1,776,300
				SUBTOTAL:	**$ 7,697,100**
		ENG/SURVEY		15%	$ 1,154,600
				SUBTOTAL:	**$ 8,851,700**
				Estimated Project Total:	**$ 8,851,700**

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 3 — **Phase: SHORT**

Project Name:	**36-inch and 30-inch Lines along Deep Branch Creek from W. Main Street crossing Belt Line Road and north to near Maplecrest Drive**

Project Description:

Upsize 24 inch pipe to 30 inch and 36 inch from W. Main Street to Belt Line Road to improve capacity

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	36" Pipe 8- 16 feet deep	4,200	LF	$ 720	$ 3,024,000
2	72" Diameter Manhole	7	EA	$ 7,500	$ 50,297
3	Sewer Pavement Repair	400	LF	$ 75	$ 30,000
4	30" Pipe 8- 16 feet deep	1,400	LF	$ 600	$ 840,000
5	27" Pipe 8- 16 feet deep	605	LF	$ 540	$ 326,700
				SUBTOTAL:	**$ 4,271,000**
		CONTINGENCY		30%	$ 1,281,300
				SUBTOTAL:	**$ 5,552,300**
		ENG/SURVEY		15%	$ 832,900
				SUBTOTAL:	**$ 6,385,200**
				Estimated Project Total:	**$ 6,385,200**

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 4 — **Phase: SHORT**

Project Name:	**21-inch Line from TRA Interceptor to W. Redbud Lane; 15-inch and 12-inch from north to W. Pleasant Run**

Project Description:

Upsize existing 12-inch line to 21-inch Line from TRA Interceptor to W. Redbud Lane; 15-inch and 12-inch from north to W. Pleasant Run to improve capacity and accommodate future growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	21" Pipe 8- 16 feet deep	5,100	LF	$ 420	$ 2,142,000
2	60" Diameter Manhole	13	EA	$ 6,000	$ 79,050
3	Sewer Pavement Repair	1,100	LF	$ 75	$ 82,500
4	15" Pipe 8- 16 feet deep	2,700	LF	$ 300	$ 810,000
5	12" Pipe 8- 16 feet deep	2,800	LF	$ 240	$ 672,000
6	48" Diameter Manhole	6	EA	$ 5,000	$ 28,000
7	18" Pipe > 16 feet deep	700	LF	$ 450	$ 315,000
				SUBTOTAL:	**$ 4,128,600**
		CONTINGENCY		30%	$ 1,238,600
				SUBTOTAL:	**$ 5,367,200**
		ENG/SURVEY		15%	$ 805,100
				SUBTOTAL:	**$ 6,172,300**
				Estimated Project Total:	**$ 6,172,300**

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 5 — **Phase: SHORT**

Project Name: **36-inch Relief Sewer along W. Main Street from W. Belt Line to TRA Interceptor**

Project Description:

New relief sewer to reduce flows and improve capacity constraints and surgcharging on the existing 21-inch sewer along Mill Branch south of W. Beltline Road to the TRA interceptor.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	36" Pipe 8- 16 feet deep	8,200	LF	$ 720	$ 5,904,000
2	72" Diameter Manhole	8	EA	$ 7,500	$ 61,500
3	Sewer Pavement Repair	800	LF	$ 75	$ 60,000
				SUBTOTAL:	**$ 6,025,500**
		CONTINGENCY		30%	$ 1,807,700
				SUBTOTAL:	**$ 7,833,200**
		ENG/SURVEY		15%	$ 1,175,000
				SUBTOTAL:	**$ 9,008,200**
				Estimated Project Total:	**$ 9,008,200**

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 6 — **Phase: MEDIUM**

Project Name: **30-inch along Houston School Road from W. Pleasant Run to W. Belt Line Road**

Project Description:

Upsize 18-inch pipe to 30-inch along Houston School Road from south of W Belt Line Road to W. Pleasant Run Road to improve capacity and accommodate future growth. Remove bottleneck on Atteberry Lane, just to the east of South Houston Road by replacing 8-inch with 15-inch to improve capacity.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	30" Pipe 8- 16 feet deep	4,300	LF	$ 600	$ 2,580,000
2	60" Diameter Manhole	6	EA	$ 6,000	$ 35,850
3	Sewer Pavement Repair	500	LF	$ 75	$ 37,500
4	15" Pipe 8- 16 feet deep	300	LF	$ 300	$ 90,000
				SUBTOTAL:	**$ 2,743,400**
		CONTINGENCY		30%	$ 823,100
				SUBTOTAL:	**$ 3,566,500**
		ENG/SURVEY		15%	$ 535,000
				SUBTOTAL:	**$ 4,101,500**
				Estimated Project Total:	**$ 4,101,500**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**
Construction Project Number: 7 — **Phase: MEDIUM**

Project Name:	**24-inch and 21-inch Line along Houston School Road from W. Wintergreen Road to W. Pleasant Run**

Project Description:

Upsize 15-inch line to 24-inch and 21-inch from W. Wintergreen Road to W. Pleasant Run Road to improve capacity and accommodate future growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	24" Pipe 8- 16 feet deep	3,900	LF	$ 480	$ 1,872,000
2	60" Diameter Manhole	9	EA	$ 6,000	$ 54,750
3	Sewer Pavement Repair	700	LF	$ 75	$ 52,500
4	21" Pipe 8- 16 feet deep	3,400	LF	$ 420	$ 1,428,000
				SUBTOTAL:	**$ 3,407,300**
		CONTINGENCY		30%	$ 1,022,200
				SUBTOTAL:	**$ 4,429,500**
		ENG/SURVEY		15%	$ 664,500
				SUBTOTAL:	**$ 5,094,000**
				Estimated Project Total:	**$ 5,094,000**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**
Construction Project Number: 8 — **Phase: MEDIUM**

Project Name: **21-inch Line from W. Wintergreen Road to West Drive**

Project Description:

Upsize 10 inch pipe to 21-inch between W. Wintergreen Road and West Drive to improve capacity and accommodate future growth

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	21" Pipe 8- 16 feet deep	3,600	LF	$ 420	$ 1,512,000
2	60" Diameter Manhole	5	EA	$ 6,000	$ 27,000
3	Sewer Pavement Repair	400	LF	$ 75	$ 30,000
				SUBTOTAL:	**$ 1,569,000**
		CONTINGENCY		30%	$ 470,700
				SUBTOTAL:	**$ 2,039,700**
		ENG/SURVEY		15%	$ 306,000
				SUBTOTAL:	**$ 2,345,700**
				Estimated Project Total:	**$ 2,345,700**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 9 — **Phase: MEDIUM**

Project Name:	**Expand Wheatland Road LS Firm Capacity to 2.0 MGD; 21-inch and 15-inch line at W. Danieldale Road towards West Drive**

Project Description:

Expand Wheatland Road LS firm capacity from 0.6 MGD to 2.0 MGD to improve capacity and accommodate future growth. Upsize 8-inch bottleneck south of forcemain to 21-inch and 15-inch at W. Danieldale Road.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	21" Pipe 8- 16 feet deep	3,300	LF	$ 420	$ 1,386,000
2	60" Diameter Manhole	5	EA	$ 6,000	$ 31,950
3	Sewer Pavement Repair	100	LF	$ 75	$ 7,500
4	1.4 MGD Lift Station Expansion	1	EA	$ 560,000	$ 560,000
5	15" Pipe 8- 16 feet deep	600	LF	$ 300	$ 180,000
				SUBTOTAL:	**$ 2,165,500**
		CONTINGENCY		30%	$ 649,700
				SUBTOTAL:	**$ 2,815,200**
		ENG/SURVEY		15%	$ 422,300
				SUBTOTAL:	**$ 3,237,500**
				Estimated Project Total:	**$ 3,237,500**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 10 — **Phase: MEDIUM**

Project Name: **18-inch and 15-inch line along Halls Branch from TRA Interceptor to E. Main St**

Project Description:

Upsize 12-inch and 15-inch pipes to 18-inch from TRA interceptor to E. 5th Street, and 15-inch from E. 5th Street to E. Pleasant Run to improve capacity and accommodate future growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	15" Pipe 8- 16 feet deep	5,700	LF	$ 300	$ 1,710,000
2	60" Diameter Manhole	19	EA	$ 6,000	$ 111,150
3	Sewer Pavement Repair	1,100	LF	$ 75	$ 82,500
4	18" Pipe 8- 16 feet deep	5,700	LF	$ 360	$ 2,052,000
				SUBTOTAL:	**$ 3,955,700**
		CONTINGENCY		30%	$ 1,186,800
				SUBTOTAL:	**$ 5,142,500**
		ENG/SURVEY		15%	$ 771,400
				SUBTOTAL:	**$ 5,913,900**
				Estimated Project Total:	**$ 5,913,900**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 11 — **Phase: MEDIUM**

Project Name: **24-inch Line along Keller Branch from TRA Interceptor to E. Pleasant Run**

Project Description:

Upsize 12-inch and 15-inch pipes to 24-inch from interceptor to E Belt Line Road to improve capacity and reduce surcharging conditions, and accommodate future growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	24" Pipe 8- 16 feet deep	13,700	LF	$ 480	$ 6,576,000
2	60" Diameter Manhole	17	EA	$ 6,000	$ 102,750
3	Sewer Pavement Repair	1,400	LF	$ 75	$ 105,000
4	18" Pipe 8- 16 feet deep	2,200	LF	$ 360	$ 792,000
				SUBTOTAL:	**$ 7,575,800**
		CONTINGENCY		30%	$ 2,272,800
				SUBTOTAL:	**$ 9,848,600**
		ENG/SURVEY		15%	$ 1,477,300
				SUBTOTAL:	**$ 11,325,900**
				Estimated Project Total:	**$ 11,325,900**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 12 — **Phase: MEDIUM**

Project Name: **24-inch Line along Keller Branch from E. Pleasant Run Road to E Wintergreen Road**

Project Description:

Upsize 15-inch line to 24- inch line between E. Peasant Run Road and E. Wintergreen Road to improve capacity and reduce surcharging conditions, and accommodate future growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	24" Pipe 8- 16 feet deep	7,000	LF	$ 480	$ 3,360,000
2	60" Diameter Manhole	9	EA	$ 6,000	$ 52,500
3	Sewer Pavement Repair	700	LF	$ 75	$ 52,500
				SUBTOTAL:	**$ 3,465,000**
		CONTINGENCY		30%	$ 1,039,500
				SUBTOTAL:	**$ 4,504,500**
		ENG/SURVEY		15%	$ 675,700
				SUBTOTAL:	**$ 5,180,200**
				Estimated Project Total:	**$ 5,180,200**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 13 — **Phase: MEDIUM**

Project Name:	**21-inch and 18-inch Line along N. Dallas Avenue from E. Wintergreen Road to Balmorhea Drive; Expand LS #2 firm capacity from 0.5 MGD to 1.0 MGD**

Project Description:

Upsize 12-inch to 18-inch pipe along N. Dallas Avenue from E. Wintergreen Road to Balmorhea Drive to remove existing bottleneck created by smaller diameter pipe; and upsize the existing 18-inch to 21-inch along South Lancaster Road, just north of E. Wintergreen Road to improve capacity and accommodate future growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	21" Pipe 8- 16 feet deep	600	LF	$ 420	$ 252,000
2	60" Diameter Manhole	8	EA	$ 6,000	$ 45,000
3	Sewer Pavement Repair	600	LF	$ 75	$ 45,000
4	18" Pipe > 16 feet deep	5,400	LF	$ 450	$ 2,430,000
5	0.5 MGD Lift Station Expansion	1	EA	$ 200,000	$ 200,000
				SUBTOTAL:	**$ 2,972,000**
		CONTINGENCY		30%	$ 891,600
				SUBTOTAL:	**$ 3,863,600**
		ENG/SURVEY		15%	$ 579,600
				SUBTOTAL:	**$ 4,443,200**
				Estimated Project Total:	**$ 4,443,200**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 14 — **Phase: MEDIUM**

Project Name:	**Expand Lift Station #1 Capacity to 2 MGD; Increase pipe capacity upstream of the Lift Station #1**

Project Description:

Expand capacity at LS #1 firm capacity from 0.6 MGD to 2 MGD to accommodate existing and future flows; Upsize 8 inch -10 inch pipe to 18-inch, 15-inch and 12-inch from Interurban Road to LS #1 to improve capacity and reduce surcharing conditions.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	1.4 MGD Lift Station Expansion	1	EA	$ 560,000	$ 560,000
2	15" Pipe 8- 16 feet deep	1,600	LF	$ 300	$ 480,000
3	60" Diameter Manhole	4	EA	$ 6,000	$ 21,881
4	Sewer Pavement Repair	200	LF	$ 75	$ 15,000
5	18" Pipe 8- 16 feet deep	358	LF	$ 360	$ 128,700
6	12" Pipe 8- 16 feet deep	420	LF	$ 240	$ 100,848
7	48" Diameter Manhole	1	EA	$ 5,000	$ 5,253
				SUBTOTAL:	**$ 1,311,700**
		CONTINGENCY		30%	$ 393,600
				SUBTOTAL:	**$ 1,705,300**
		ENG/SURVEY		15%	$ 255,800
				SUBTOTAL:	**$ 1,961,100**
				Estimated Project Total:	**$ 1,961,100**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate	**FEBRUARY 2021**
Construction Project Number: 15	**Phase: MEDIUM**
Project Name:	**18-inch line along I-35 Access Road from Gateway Drive to TRA interceptor**

Project Description:

Upsize 6-inch and 8-inch pipes to 18-inch along I-35 Access Road to TRA Interceptor to improve capacity and relieve the existing 12-inch main along Chesier Branch to the TRA Interceptor.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	18" Pipe 8- 16 feet deep	6,300	LF	$ 360	$ 2,268,000
2	60" Diameter Manhole	8	EA	$ 6,000	$ 47,250
3	Sewer Pavement Repair	600	LF	$ 75	$ 45,000
				SUBTOTAL:	**$ 2,360,300**
		CONTINGENCY		30%	$ 708,100
				SUBTOTAL:	**$ 3,068,400**
		ENG/SURVEY		0%	$ -
				SUBTOTAL:	**$ 3,068,400**
				Estimated Project Total:	**$ 3,068,400**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 16 — **Phase: MEDIUM**

Project Name: **18-inch from Crescent Medical Center to Rolling Hills Place**

Project Description:

Replaces 6-inch and 8-inch pipes to improve capacity, and accommodate future growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	18" Pipe 8- 16 feet deep	1,500	LF	$ 360	$ 540,000
2	60" Diameter Manhole	2	EA	$ 6,000	$ 11,250
3	Sewer Pavement Repair	200	LF	$ 75	$ 15,000
				SUBTOTAL:	**$ 566,300**
		CONTINGENCY		30%	$ 169,900
				SUBTOTAL:	**$ 736,200**
		ENG/SURVEY		15%	$ 110,500
				SUBTOTAL:	**$ 846,700**
				Estimated Project Total:	**$ 846,700**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 17 — **Phase: MEDIUM**

Project Name: New 15-inch Line Extending SE from the Wheatland Road LS toward I-20

Project Description:

New 15-inch gravity line extending to into Floyd Branch Basin towards I-20 and continuing east along I-20, discharges to the Wheatland Road Lift Station.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	15" Pipe 8- 16 feet deep	4,600	LF	$ 300	$ 1,380,000
2	60" Diameter Manhole	9	EA	$ 6,000	$ 55,200
3	Sewer Pavement Repair	500	LF	$ 75	$ 37,500
				SUBTOTAL:	**$ 1,472,700**
		CONTINGENCY		30%	$ 441,900
				SUBTOTAL:	**$ 1,914,600**
		ENG/SURVEY		15%	$ 287,200
				SUBTOTAL:	**$ 2,201,800**
				Estimated Project Total:	**$ 2,201,800**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 18 — **Phase: MEDIUM**

Project Name: **New 8-inch Line Extending South along Ten Mile Road**

Project Description:

New 8-inch line extending south from interceptor along Ten Mile Road to accommodate future growth

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	8" Pipe 8- 16 feet deep	4,700	LF	$ 160	$ 752,000
2	60" Diameter Manhole	9	EA	$ 6,000	$ 56,400
3	Sewer Pavement Repair	500	LF	$ 75	$ 37,500
				SUBTOTAL:	**$ 845,900**
		CONTINGENCY		30%	$ 253,800
				SUBTOTAL:	**$ 1,099,700**
		ENG/SURVEY		15%	$ 165,000
				SUBTOTAL:	**$ 1,264,700**
				Estimated Project Total:	**$ 1,264,700**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 19 — **Phase: LONG**

Project Name:	**Upsize existing 8- and 15-inch to 21-inch line in the Ten Mile 3 Sub-basin from TRA Interceptor to Ferris Road at Lancaster Airport**

Project Description:

Upsize and extend existing 15-inch and 8-inch pipes to an 18-inch pipe from the TRA Interceptor to Ferris Road at Lancaster Airport to accommodate future growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	21" Pipe 8- 16 feet deep	2,800	LF	$ 420	$ 1,176,000
2	60" Diameter Manhole	4	EA	$ 6,000	$ 21,000
3	Sewer Pavement Repair	300	LF	$ 75	$ 22,500
				SUBTOTAL:	**$ 1,219,500**
		CONTINGENCY		30%	$ 365,900
				SUBTOTAL:	**$ 1,585,400**
		ENG/SURVEY		15%	$ 237,900
				SUBTOTAL:	**$ 1,823,300**
				Estimated Project Total:	**$ 1,823,300**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 20 — **Phase: LONG**

Project Name:	**New 15-inch Line along Ferris Road from Lancaster Airport to E. Belt Line Road to parallel the 2021-planned 15-inch main**

Project Description:

New 15-inch pipe to parallel the planned (2021 by developers) 15-inch main along Ferris Road towards E. Belt Line Road to accommodate growth in Ten Mile 3 and Ten Mile 7 Basins.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	15" Pipe 8- 16 feet deep	3,200	LF	$ 300	$ 960,000
2	60" Diameter Manhole	4	EA	$ 6,000	$ 24,000
3	Sewer Pavement Repair	300	LF	$ 75	$ 22,500
				SUBTOTAL:	**$ 1,006,500**
		CONTINGENCY		30%	$ 302,000
				SUBTOTAL:	**$ 1,308,500**
		ENG/SURVEY		15%	$ 196,300
				SUBTOTAL:	**$ 1,504,800**
				Estimated Project Total:	**$ 1,504,800**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 21 — **Phase: LONG**

Project Name: New 12-inch along S. Alba Road from E. Beltline Road to Green Road

Project Description:

New 12-inch along S. Alba Road from E. Belt Line Road to Green Road to extend service in the Ten Mile 3 Basin.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" Pipe 8- 16 feet deep	3,300	LF	$ 240	$ 792,000
2	48" Diameter Manhole	8	EA	$ 5,000	$ 38,000
3	Sewer Pavement Repair	400	LF	$ 75	$ 30,000
4	18" Pipe 8- 16 feet deep	800	LF	$ 360	$ 288,000
5	60" Diameter Manhole	2	EA	$ 6,000	$ 9,600
				SUBTOTAL:	**$ 1,157,600**
		CONTINGENCY		30%	$ 347,300
				SUBTOTAL:	**$ 1,504,900**
		ENG/SURVEY		15%	$ 225,800
				SUBTOTAL:	**$ 1,730,700**
				Estimated Project Total:	**$ 1,730,700**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 22 — **Phase: LONG**

Project Name: New 8-inch Line in the Ten Mile 3 Basin along E Belt Line Road

Project Description:

New 8-inch gravity line in Ten Mile-3 extending west from Ferris Road along E. Belt Line Road, extends service to accommodate future growth

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	8" Pipe 8- 16 feet deep	2,800	LF	$ 160	$ 448,000
2	48" Diameter Manhole	6	EA	$ 5,000	$ 28,000
3	Sewer Pavement Repair	300	LF	$ 75	$ 22,500
				SUBTOTAL:	**$ 498,500**
		CONTINGENCY		30%	$ 149,600
				SUBTOTAL:	**$ 648,100**
		ENG/SURVEY		15%	$ 97,300
				SUBTOTAL:	**$ 745,400**
				Estimated Project Total:	**$ 745,400**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 23 — **Phase: LONG**

Project Name:	**New 12-inch Lines in the Ten Mile 3 Basin along Greene Road, extending to Ten Mile 7 basin.**

Project Description:

New 12-inch gravity line in the Ten Mile-3 Basin along Green Road from N. Alba Road to Pinto Road, extending service to the Ten Mile 3 and Ten Mile 7 basins to accommodate future growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" Pipe 8- 16 feet deep	2,600	LF	$ 240	$ 624,000
2	48" Diameter Manhole	5	EA	$ 5,000	$ 26,000
3	Sewer Pavement Repair	300	LF	$ 75	$ 22,500
				SUBTOTAL:	**$ 672,500**
		CONTINGENCY		30%	$ 201,800
				SUBTOTAL:	**$ 874,300**
		ENG/SURVEY		15%	$ 131,200
				SUBTOTAL:	**$ 1,005,500**
				Estimated Project Total:	**$ 1,005,500**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 24 — **Phase: LONG**

Project Name: **New 12-inch and 8-inch Lines along Greene Road from N. Alba Road, extending beyond Cornell Road**

Project Description:

New 12-inch and 8-inch pipe along Greene Road from N. Alba Road, extending west beyond Cornell Road to the basin boundary to accommodate future growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" Pipe 8- 16 feet deep	3,300	LF	$ 240	$ 792,000
2	48" Diameter Manhole	7	EA	$ 5,000	$ 33,000
3	Sewer Pavement Repair	300	LF	$ 75	$ 22,500
4	8" Pipe 8- 16 feet deep	1,800	LF	$ 160	$ 288,000
				SUBTOTAL:	**$ 1,135,500**
		CONTINGENCY		30%	$ 340,700
				SUBTOTAL:	**$ 1,476,200**
		ENG/SURVEY		15%	$ 221,500
				SUBTOTAL:	**$ 1,697,700**
				Estimated Project Total:	**$ 1,697,700**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 25 — **Phase: LONG**

Project Name: **New 8-inch Gravity Lines along Cornell Road from Greene Road to Wintergreen Road**

Project Description:

8-inch gravity lines in Ten Mile-3 along Cornell Road from Greene Road to Wintergreen Road to extend service and accommodate future growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	8" Pipe 8- 16 feet deep	6,900	LF	$ 160	$ 1,104,000
2	48" Diameter Manhole	15	EA	$ 5,000	$ 76,000
3	Sewer Pavement Repair	700	LF	$ 75	$ 52,500
				SUBTOTAL:	**$ 1,232,500**
		CONTINGENCY		30%	$ 369,800
				SUBTOTAL:	**$ 1,602,300**
		ENG/SURVEY		15%	$ 240,400
				SUBTOTAL:	**$ 1,842,700**
				Estimated Project Total:	**$ 1,842,700**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 26 — **Phase: LONG**

Project Name: New 10- and 8-inch Gravity Lines along N. Alba Road from Greene Road to north of E. Pleasant Run Road

Project Description:

10- and 8-inch gravity lines along Alba Road from Greene Road to north of E. Pleasant Run Road to extend service and accommodate future growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	10" Pipe 8- 16 feet deep	3,500	LF	$ 200	$ 700,000
2	48" Diameter Manhole	12	EA	$ 5,000	$ 58,000
3	8" Pipe < 8 feet deep	2,300	LF	$ 120	$ 276,000
4	Sewer Pavement Repair	600	LF	$ 75	$ 45,000
				SUBTOTAL:	**$ 1,079,000**
		CONTINGENCY		30%	$ 323,700
				SUBTOTAL:	**$ 1,402,700**
		ENG/SURVEY		15%	$ 210,500
				SUBTOTAL:	**$ 1,613,200**
				Estimated Project Total:	**$ 1,613,200**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 27 — **Phase:** LONG

Project Name: New 12 -inch Line along W Belt Line Road to N Houston School Road

Project Description:

12-inch gravity line in Mills Branch Basin extending east along W Belt Line Road to North Houston School Road to accommadate growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" Pipe 8- 16 feet deep	1,800	LF	$ 240	$ 432,000
2	48" Diameter Manhole	4	EA	$ 5,000	$ 18,000
3	Sewer Pavement Repair	200	LF	$ 75	$ 15,000
				SUBTOTAL:	**$ 465,000**
		CONTINGENCY		30%	$ 139,500
				SUBTOTAL:	**$ 604,500**
		ENG/SURVEY		15%	$ 90,700
				SUBTOTAL:	**$ 695,200**
				Estimated Project Total:	**$ 695,200**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 28 — **Phase:** LONG

Project Name: New 12-inch Lines in the Ten Mile 5 Basin along Nokomis Road to Nokomis Cir

Project Description:

12-inch lines in Ten Mile-5 extending south from the TRA interceptor along Nokomis Road to extend service and accommodate future growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" Pipe 8- 16 feet deep	2,200	LF	$ 240	$ 528,000
2	48" Diameter Manhole	4	EA	$ 5,000	$ 22,000
3	Sewer Pavement Repair	200	LF	$ 75	$ 15,000
				SUBTOTAL:	**$ 565,000**
		CONTINGENCY		30%	$ 169,500
				SUBTOTAL:	**$ 734,500**
		ENG/SURVEY		15%	$ 110,200
				SUBTOTAL:	**$ 844,700**
				Estimated Project Total:	**$ 844,700**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 29 — **Phase: LONG**

Project Name:	**New 12-inch Lines in the Ten Mile 5 Basin along Nokomis Road from Nokomis Cir, along E Reindeer Road to Dasher Street**

Project Description:

12-inch lines in Ten Mile-5 extending south from the TRA interceptor along Nokomis Road and E Reindeer Road to Dasher Street to extend service and accommodate future growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" Pipe 8- 16 feet deep	12,800	LF	$ 240	$ 3,072,000
2	48" Diameter Manhole	28	EA	$ 5,000	$ 141,000
3	Sewer Pavement Repair	1,300	LF	$ 75	$ 97,500
				SUBTOTAL:	**$ 3,310,500**
		CONTINGENCY		30%	$ 993,200
				SUBTOTAL:	**$ 4,303,700**
		ENG/SURVEY		15%	$ 645,600
				SUBTOTAL:	**$ 4,949,300**
				Estimated Project Total:	**$ 4,949,300**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate		**FEBRUARY 2021**
Construction Project Number:	**30**	**Phase: LONG**
Project Name:	**New 8-inch Line Extending South along S. Bluegrove Road**	

Project Description:

New 8” line extending south from TRA interceptor along S. Bluegrove Road to extend service and accommodate future growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	8" Pipe 8- 16 feet deep	3,500	LF	$ 160	$ 560,000
2	48" Diameter Manhole	7	EA	$ 5,000	$ 35,000
3	Sewer Pavement Repair	400	LF	$ 75	$ 30,000
				SUBTOTAL:	**$ 625,000**
		CONTINGENCY		30%	$ 187,500
				SUBTOTAL:	**$ 812,500**
		ENG/SURVEY		15%	$ 121,900
				SUBTOTAL:	**$ 934,400**
				Estimated Project Total:	**$ 934,400**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 31 — **Phase: LONG**

Project Name: **8-inch Line in Creekwood Branch**

Project Description:

8-inch lines from TRA Interceptor south along Houston School Road and Parkerville Road to extend service and accommodate future growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	8" Pipe 8- 16 feet deep	4,300	LF	$ 160	$ 688,000
2	48" Diameter Manhole	9	EA	$ 5,000	$ 47,000
3	Sewer Pavement Repair	400	LF	$ 75	$ 30,000
				SUBTOTAL:	**$ 765,000**
		CONTINGENCY		30%	$ 229,500
				SUBTOTAL:	**$ 994,500**
		ENG/SURVEY		15%	$ 149,200
				SUBTOTAL:	**$ 1,143,700**
				Estimated Project Total:	**$ 1,143,700**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 32 — **Phase: LONG**

Project Name: **8-inch Lines along Houston School Road and Parkerville Road**

Project Description:

8-inch lines along Houston School Road, south of Parkerville Road to extend service and accommodate future growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	8" Pipe 8- 16 feet deep	6,300	LF	$ 160	$ 1,008,000
2	48" Diameter Manhole	13	EA	$ 5,000	$ 63,000
3	Sewer Pavement Repair	600	LF	$ 75	$ 45,000
				SUBTOTAL:	**$ 1,116,000**
		CONTINGENCY		30%	$ 334,800
				SUBTOTAL:	**$ 1,450,800**
		ENG/SURVEY		15%	$ 217,700
				SUBTOTAL:	**$ 1,668,500**
				Estimated Project Total:	**$ 1,668,500**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 33 — **Phase: LONG**

Project Name: **12-inch gravity line along Moreland Road from S. Dallas Avenue in Ten Mile 6 Basin**

Project Description:

12-inch gravity line in Ten Mile 6 extending southeast from South Dallas Avenue along Moreland Road to extend service and accommodate future growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" Pipe 8- 16 feet deep	4,500	LF	$ 240	$ 1,080,000
2	48" Diameter Manhole	9	EA	$ 5,000	$ 45,000
3	Sewer Pavement Repair	500	LF	$ 75	$ 37,500
				SUBTOTAL:	**$ 1,162,500**
		CONTINGENCY		30%	$ 348,800
				SUBTOTAL:	**$ 1,511,300**
		ENG/SURVEY		15%	$ 226,700
				SUBTOTAL:	**$ 1,738,000**
				Estimated Project Total:	**$ 1,738,000**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 34 — **Phase: LONG**

Project Name: **12-inch gravity line along Water Mill Road and Nokomis Road in Ten Mile 4 Basin**

Project Description:

12-inch gravity line in Ten Mile 4 Basin extending southwest of the TRA interceptor along Watermill Road and southeast along Nokomis Road to extend service and accommodate future growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" Pipe 8- 16 feet deep	10,500	LF	$ 240	$ 2,520,000
2	48" Diameter Manhole	21	EA	$ 5,000	$ 105,000
3	Sewer Pavement Repair	1,100	LF	$ 75	$ 82,500
				SUBTOTAL:	**$ 2,707,500**
		CONTINGENCY		30%	$ 812,300
				SUBTOTAL:	**$ 3,519,800**
		ENG/SURVEY		15%	$ 528,000
				SUBTOTAL:	**$ 4,047,800**
				Estimated Project Total:	**$ 4,047,800**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 35 — **Phase: LONG**

Project Name: **12-inch gravity line along S. Dallas Avenue to E. Reindeer Road in Red Oak Basin**

Project Description:

12-inch gravity line along East Reindeer Road and South Dallas Avenue in Red Oak Basin flowing southwest towards the Red Oak interceptor to extend service and accommodate future growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" Pipe 8- 16 feet deep	9,800	LF	$ 240	$ 2,352,000
2	48" Diameter Manhole	20	EA	$ 5,000	$ 98,000
3	Sewer Pavement Repair	1,000	LF	$ 75	$ 75,000
				SUBTOTAL:	**$ 2,525,000**
		CONTINGENCY		30%	$ 757,500
				SUBTOTAL:	**$ 3,282,500**
		ENG/SURVEY		15%	$ 492,400
				SUBTOTAL:	**$ 3,774,900**
				Estimated Project Total:	**$ 3,774,900**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 36 — **Phase: LONG**

Project Name: **8-inch gravity line in the Red Oak Basin**

Project Description:

8-inch gravity line in the Red Oak Basin that extends north from the Red Oak interceptor along Meadow Lane and continues east and west along Bear Creek Road

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	8" Pipe 8- 16 feet deep	7,500	LF	$ 160	$ 1,200,000
2	48" Diameter Manhole	15	EA	$ 5,000	$ 75,000
3	Sewer Pavement Repair	800	LF	$ 75	$ 60,000
				SUBTOTAL:	**$ 1,335,000**
		CONTINGENCY		30%	$ 400,500
				SUBTOTAL:	**$ 1,735,500**
		ENG/SURVEY		15%	$ 260,400
				SUBTOTAL:	**$ 1,995,900**
				Estimated Project Total:	**$ 1,995,900**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 37 — **Phase: LONG**

Project Name:	**Upsize existing 8-inch along Deep Branch from Bayport Drive to Ames Road with 15-inch line**

Project Description:

Upsize existing 8-inch along Deep Branch from Bayport Drive to Ames Road with a 15-inch line to improve capacity and accommodate growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	15" Pipe 8- 16 feet deep	4,400	LF	$ 300	$ 1,320,000
2	18" Pipe 8- 16 feet deep	900	LF	$ 360	$ 324,000
3	60" Diameter Manhole	10	EA	$ 6,000	$ 59,550
4	Sewer Pavement Repair	500	LF	$ 75	$ 37,500
				SUBTOTAL:	**$ 1,741,100**
		CONTINGENCY		30%	$ 522,400
				SUBTOTAL:	**$ 2,263,500**
		ENG/SURVEY		15%	$ 339,600
				SUBTOTAL:	**$ 2,603,100**
				Estimated Project Total:	**$ 2,603,100**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 38 — **Phase: LONG**

Project Name: 12-inch line along Floyd Branch from Connecticut Ave to Interurban Rd

Project Description:

Replace 6-inch and 8-inch pipes with 12-inch along Floyd Branch to improve capacity.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" Pipe 8- 16 feet deep	2,100	LF	$ 240	$ 504,000
2	48" Diameter Manhole	4	EA	$ 5,000	$ 21,000
3	Sewer Pavement Repair	200	LF	$ 75	$ 15,000
				SUBTOTAL:	**$ 540,000**
		CONTINGENCY		30%	$ 162,000
				SUBTOTAL:	**$ 702,000**
		ENG/SURVEY		15%	$ 105,300
				SUBTOTAL:	**$ 807,300**
				Estimated Project Total:	**$ 807,300**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 39 — **Phase: LONG**

Project Name:	**Replace 15-inch pipe with 21-inch upstream of the Wheatland PS to improve capacity and accommodate growth.**

Project Description:

Replace 15-inch pipe with 21-inch upstream of the Wheatland PS to improve capacity and accommodate growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	21" Pipe 8- 16 feet deep	800	LF	$ 420	$ 336,000
2	60" Diameter Manhole	1	EA	$ 6,000	$ 6,000
3	Sewer Pavement Repair	100	LF	$ 75	$ 7,500
				SUBTOTAL:	**$ 349,500**
		CONTINGENCY		30%	$ 104,900
				SUBTOTAL:	**$ 454,400**
		ENG/SURVEY		15%	$ 68,200
				SUBTOTAL:	**$ 522,600**
				Estimated Project Total:	**$ 522,600**

Comments:

City of Lancaster, TX

Capital Improvement Cost Estimate — **FEBRUARY 2021**

Construction Project Number: 40 — **Phase:** LONG

Project Name: New 12-inch pipe in Deep Branch basin from TRA to W. Main Street

Project Description:

New 12-inch gravity line from TRA Interceptor to W. Main Street to accommodate growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" Pipe 8- 16 feet deep	1,700	LF	$ 240	$ 408,000
2	48" Diameter Manhole	3	EA	$ 5,000	$ 17,000
3	Sewer Pavement Repair	200	LF	$ 75	$ 15,000
				SUBTOTAL:	**$ 440,000**
		CONTINGENCY		30%	$ 132,000
				SUBTOTAL:	**$ 572,000**
		ENG/SURVEY		15%	$ 85,800
				SUBTOTAL:	**$ 657,800**
				Estimated Project Total:	**$ 657,800**

Comments: