Innovative approaches
Practical results
Outstanding service

Utility Master Plan

Prepared for:

City of Alvin

Prepared by:

FREESE AND NICHOLS, INC.

11200 Broadway Street, Suite 2332

Pearland, Texas 77584

832-456-4700

FNI Project No.: AVN14161

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EXECUTIVE SUMMARY

1.0 INTRODUCTION

The City of Alvin is a community located in southeast Texas, within Brazoria County. The City currently provides water and wastewater service to over 26,000 people. The population within the service area is projected to grow by almost 13,000 people in the next 20 years. Accommodating this growth in an efficient and cost effective manner, while also focusing on the maintenance of existing water and wastewater system assets, is the purpose of this 2015 Utility Master Plan. This report has been prepared to provide the City of Alvin a planning tool that will serve as a guide for short-term and long-term improvements to the infrastructure within the water and wastewater systems.

2.0 POPULATION

Population and projected 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 historical and projected populations provides the basis for future water demands and wastewater loads.

Based on historical trends, an annual growth rate of 2% was used to project the 2020, 2025 and 2035 population. **Table ES-1** presents the water and wastewater service population projections for each planning period.

Table ES-1: City of Alvin Projected Population

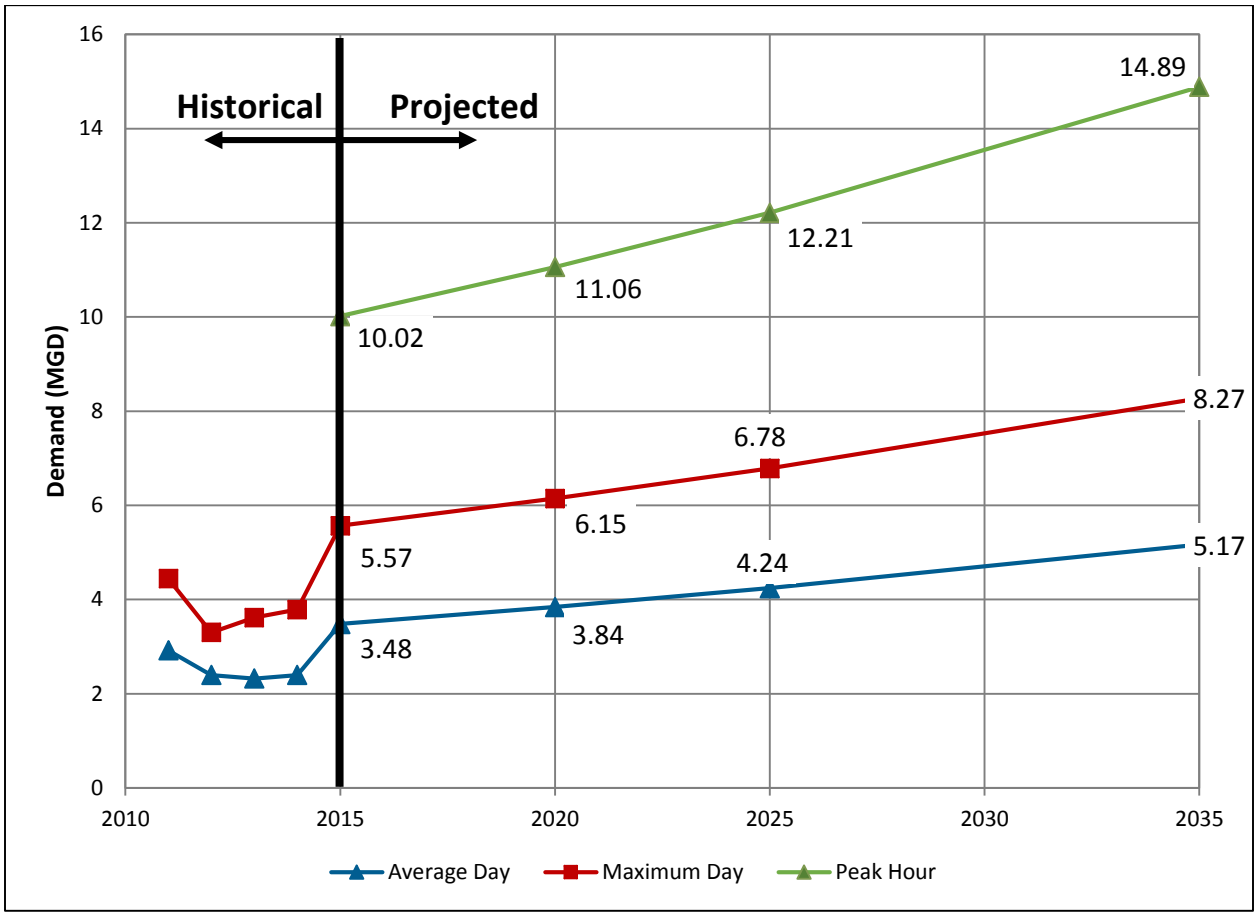
Year	Service Population
2015	26,759
2020	29,544
2024	32,618
2035	39,762

3.0 WATER DEMANDS

Reviewing historical water demands provides insight into selecting 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 a basis for determining the design criteria used to

project water demands. **Figure ES-1** illustrates the historical and projected water demands for the City of Alvin.

Figure ES-1: Historical and Projected Water Demands



4.0 DESCRIPTION OF EXISTING WATER SYSTEM

The City of Alvin's water distribution system consists of 146 miles of water lines. Pipeline diameters range in size from 1-inch to 12-inches. The City relies on five groundwater wells to provide water to its residents. Three water plants distribute groundwater throughout the City. Six ground storage tanks and two active elevated storage tanks also make up the distribution system facilities.

5.0 WATER SYSTEM ANALYSES AND HYDRAULIC MODELING

A hydraulic model was developed as a tool in the evaluation of the City of Alvin's water distribution system. FNI selected the *H_2OMap Water* software package by Innovyze® for modeling the water system. The model network was developed from the City's geographic information system (GIS) and design plans. The calibration process involved adjusting system operational parameters, roughness values, demand

allocation, and peaking factors to match a known condition. The 24-hour period occurring on March 20, 2014 was selected for calibration. The results suggest a good correlation between recorded and modeled values and provide confidence in the accuracy of the model.

Hydraulic analyses were conducted to identify deficiencies in the City of Alvin's existing water distribution system and to establish a capital improvements plan (CIP) to improve the existing system and meet projected water demands through 2035. The existing distribution system was evaluated to assess current supply, pumping, and storage capacity, residual pressures, and fire flow capacity. Results show that the City currently meets minimum supply, storage, service pumping, and pressure Texas Commission on Environmental Quality requirements. The majority of the water system can provide at least 1,500 gpm; however, locations with a fire flow requirement above 1,500 gpm do not have adequate fire flow available.

Water system improvements were developed to accommodate the anticipated residential and non-residential growth over the next 20 years. Challenges facing the water system include providing additional supply and transmission capacity, meeting service pumping requirements, and providing adequate fire flow capacity. This is achieved by constructing improvements to improve water distribution system capacity and connectivity, such as new larger water lines, new water plant and connecting dead end water lines.

6.0 WATER SYSTEM CAPITAL IMPROVEMENTS PLAN

A CIP was developed for the City of Alvin to maintain high quality water service that promotes residential and commercial development. The recommended improvements will provide the required capacity and reliability to meet projected water demands through year 2035. **Table ES-2** and **Table ES-3** summarizes the costs of the water system capacity and rehabilitation CIP for the City of Alvin. Detailed cost estimates are included in **Appendix A**.

Table ES-2: Water System Capital Improvements Plan Summary

Phase	Project	Water System Capacity Capital Improvements Plan	Cost
2020	1	Fairway Drive and South Street Water Line Improvements	$ 4,022,400
	2	Water Plant No. 6 Ground Storage Tank Replacement	$ 3,159,000
	3	Water Plant No. 4 Ground Storage Tank Replacement	$ 2,106,000
Total 2015 - 2020			**$ 7,181,400**
2025	4	Water Plant No. 3 Ground Storage Tank Replacement	$ 2,106,000
	5	East Water Plant	$ 5,304,000
Total 2020 - 2025			**$ 7,410,000**
2035	6	East Water Plant Pump Expansion	$ 78,000
	7	WWTP Water Line Improvements	$ 1,565,100
Total 2025 - 2035			**$ 1,643,100**
		Total	**$ 16,234,500**

Table ES-3: Water System Rehabilitation Capital Improvements Plan Summary

Project	Water System Rehabilitation Capital Improvements Plan	Cost
A	Water Line Improvements Phase 1	$ 3,064,600
B	Water Line Improvements Phase 2	$ 2,531,900
C	Water Line Improvements Phase 3	$ 3,063,900
D	Water Line Improvements Phase 4	$ 2,795,300
E	Water Line Improvements Phase 5	$ 2,444,000
F	Water Line Improvements Phase 6	$ 2,592,800
G	Water Line Improvements Phase 7	$ 3,114,800
H	Fire Hydrant Connection Retrofitting	$ 397,800
	Total	**$ 20,005,100**

7.0 EXISTING WASTEWATER SYSTEM

The City of Alvin's wastewater system consists of 42 lift stations and associated force mains, a wastewater treatment plant and a network of gravity mains and force mains ranging from 3-inches to 42-inches. The majority of the system is comprised of 6 inch and 8 inch wastewater lines that commonly serve

subdivisions, neighborhoods, and small commercial areas throughout the City. The main interceptors south of the Highway 35 Bypass are 27 inch and 33 inch lines.

8.0 WASTEWATER FLOW MONITORING

FNI conducted flow monitoring at eight locations in the Alvin wastewater system. The collected flow data was used to characterize dry and wet weather flow at key points within the wastewater system, evaluate wet weather inflow/infiltration (I/I), and calibrate the hydraulic model of the collection system.

The flow monitoring results indicated large amounts of I/I in portions of the wastewater system. The eight flow monitors were utilized to identify seven wastewater basins for this study. Calculating the discrete I/I per flow monitor basin can help identify which basins should be prioritized for future condition assessment work. The amount of inflow and infiltration within each basin has been categorized as high, moderate, or low. These categories, as well as basin priority rankings for condition assessment work, are presented in **Table ES-4**.

Table ES-4: Summary of Basin Inflow and Infiltration

Basin	Flow Monitor ID	Basin Priority Ranking	Basin I/I (Gal/LF)
Northwest	NW-01	1	**14.5**
Southern	SO-01 & SO-02	2	**13.8**
Northeast	NE-01	3	**12.5**
West Central	WC-01	4	**9.2**
Central	CE-01	5	**5.0**
Western	WE-01	6	**2.3**
East Central	EC-01	7	**2.1**

Categories of Inflow and Infiltration

(Gal/LF)	Description
I/I Greater than 4.0	*High* amount of I/I
I/I Between 2.2 - 3.9	*Moderate* amount of I/I
I/I Less than 2.2	*Low* amount of I/I

9.0 WASTEWATER FLOW PROJECTIONS

FNI analyzed flow data provided by the City from 2010 through 2014 to determine the historical trends in system-wide average day wastewater flow and per-capita flow. The citywide per-capita flow rate ranged

from a low of 94 gpcd in 2014 to 122 gpcd in 2010. The average flow rate to the plant over the past 5 years was 2.69 MGD, which equates to an average per capita of 107 gpcd.

Projected wastewater flows for the 2020, 2025 and 2035 planning periods were developed by analyzing the historical wastewater flow rates, 2014 flow monitoring data, and projected residential and commercial developments in the City. FNI developed projected wastewater flows for each of the seven wastewater basins. **Table ES-5** shows the projected population and average day flow for each planning period. Peak wet weather flows are discussed in more detail in **Section 9.0**.

Table ES-5: Summary of Wastewater Flow Projections

Year	Population	Average Day Flow (MGD)
2015	26,759	2.46
2020	29,544	2.75
2025	32,618	3.08
2035	39,762	3.95

10.0 WASTEWATER SYSTEM ANALYSES AND HYDRAULIC MODELING

FNI selected *InfoWorks® ICM* (ICM) hydraulic modeling software by Innovyze® to build and calibrate the hydraulic model of the Alvin wastewater system. The wastewater model consists of gravity pipes 8-inches and larger, all lift stations and associated force mains, and the WWTP head works and influent lift station.

As part of the system analyses, a condition assessment was conducted on twelve of the City's key lift stations. The condition assessment included a visual inspection of each lift station, performed by FNI engineering personnel, and individual condition ratings of five component groups. The lift stations were grouped into three condition ratings based on their final condition scores: Moderate, Poor and Very Poor. None of the lift stations visited by FNI were considered to be in good condition. The results of the lift station condition assessment were used to develop rehabilitation projects.

Various combinations of improvements and modifications were investigated to determine the most appropriate approach for conveying projected wastewater flows. Parameters used in developing the wastewater capital improvements plan included increasing system reliability, simplifying system operations, conveying peak wet weather flows, maintaining proper velocities, and reducing surcharging and sanitary sewer overflows.

11.0 WASTEWATER SYSTEM CAPITAL IMPROVEMENTS PLAN

A wastewater capital improvements plan was developed for the City of Alvin to improve the wastewater collection system's ability to convey flow to the wastewater treatment plant. The recommended improvements provide the capacity and reliability to meet projected wastewater flows through year 2035. **Table ES-6** summarizes the costs of the wastewater system capital improvements plan for the City of Alvin. Detailed cost estimates are included in **Appendix B**.

Table ES-6: Summary of Wastewater Capital Improvements Plan

Phase	Project	Wastewater Collection System Capital Improvements Plan	Cost
2020	1	Replacement 54" Eastside Interceptor	$ 12,991,700
	2	Lift Station 30 Expansion and Highway 35 Bypass Gravity Mains	$ 8,975,200
	3	Peak Flow Storage Basin at WWTP	$ 1,287,000
		Capital Improvements Total	$ 23,253,900
	R1	Northwest Basin Sanitary Sewer Evaluation Survey (SSES)	$ 47,100
	R2	Northeast Basin Sanitary Sewer Evaluation Survey (SSES)	$ 48,200
	R3	Lift Station 17 Rehabilitation	$ 780,000
	R4	Lift Station 14 Rehabilitation	$ 780,000
		Rehabilitation and SSES Totals	$ 1,655,300
Total 2015 - 2020			**$ 24,909,200**
2025	4	Lift Station 23 Expansion	$ 7,176,500
	5	Wastewater SCADA System	$ 2,373,600
	6	Lift Station 16 Expansion and Replacement Gravity Mains	$ 7,253,400
	7	Lift Station 1 Expansion and Highway 6 Replacement Gravity Mains	$ 3,150,000
	8	Lift Stations 22 and 33 Expansion	$ 1,232,400
	9	Lift Station 15 Expansion and Replacement Gravity Mains	$ 1,889,900
	10	Lift Station 35 Expansion	$ 645,900
	11	Lift Station 36 Expansion	$ 435,300
	12	New Martha's Vineyard Lift Station and Force Main	$ 879,200
		Capital Improvements Total	$ 25,036,200
	R5	West Central Basin Sanitary Sewer Evaluation Survey (SSES)	$ 64,700
	R6	Southern Basin Sanitary Sewer Evaluation Survey (SSES)	$ 56,600
	R7	Lift Station 2 Rehabilitation	$ 390,000
		Rehabilitation and SSES Totals	$ 511,300
Total 2020 - 2025			**$ 25,547,500**
2035	13	Lift Station 31 Expansion	$ 3,223,500
	14	Lift Station 8 Expansion	$ 1,519,200
		Capital Improvements Total	$ 4,742,700
	R8	Central Basin Sanitary Sewer Evaluation Survey (SSES)	$ 44,900
	R9	Lift Station 34 Rehabilitation	$ 546,000
	R10	Lift Station 11 Rehabilitation	$ 624,000
	R11	Lift Station 3 Rehabilitation	$ 561,600
		Rehabilitation and SSES Totals	$ 1,776,500
Total 2025 - 2035			**$ 6,519,200**
		Total	**$ 56,975,900**

1.0 INTRODUCTION

The City of Alvin is a community located in southeast Texas, within Brazoria County. The City currently provides water and wastewater service to over 24,000 people. The population within the service area is projected to grow by almost 13,000 people in the next 20 years. Accommodating this growth in an efficient and cost effective manner, while also focusing on the maintenance of existing water and wastewater system assets, is the purpose of this 2015 Utility Master Plan. This report has been prepared to provide the City of Alvin a planning tool that will serve as a guide for short-term and long-term improvements to the infrastructure within the water and wastewater systems.

1.1 SCOPE OF WORK

Freese and Nichols, Inc. (FNI) was retained in 2014 by the City of Alvin to prepare a Utility Master Plan. The goals of the Utility Master Plan were to evaluate the integrity of the existing water and wastewater systems and to recommend a phased capital improvements plan (CIP) through the year 2035. The recommended improvements will serve as a basis for the design, construction, and financing of facilities required to meet Alvin's water and wastewater capacity and system renewal needs. The major elements of the scope of this project included:

- Population Projections
- Water Demand and Wastewater Flow Projections
- Temporary Flow Monitoring and Pressure Testing
- Water and Wastewater Model Development and Calibration
- Lift Station Condition Assessment
- Water and Wastewater Hydraulic Analyses
- Integrated Water and Wastewater Capital Improvements Plan
- Utility Master Plan Report

1.2 LIST OF ABBREVIATIONS

Abbreviation	Actual
AD	Average Day
AADF	Annual Average Day Flow
CCTV	Closed-Circuit Television
CIP	Capital Improvement Program
d/D	Depth to Diameter Ratio
EPS	Extended Period Simulation
EST	Elevated Storage Tank
ETJ	Extraterritorial Jurisdiction
FNI	Freese and Nichols, Inc.
Gal/LF	Gallons per Linear Foot
GIS	Geographic Information System
gpad	Gallons per Acre per Day
gpcd	Gallons per Capita per Day
HGL	Hydraulic Grade Line
I/I	Inflow and Infiltration
LF	Linear Feet
LS	Lift Station
MD	Maximum Day
MG	Million Gallons
MGD	Million Gallons per Day
PF_D	Dry Weather Peaking Factor
PF_W	Wet Weather Peaking Factor
PH	Peak Hour
psi	Pounds per Square Inch
SCADA	Supervisory Control and Data Acquisition
SSES	Sanitary Sewer Evaluation Survey
SSO	Sanitary Sewer Overflow
TBRG	Tipping Bucket Rain Gauge
TCEQ	Texas Commission on Environmental Quality
TWDB	Texas Water Development Board
USGS	United States Geological Survey
WWTP	Wastewater Treatment Plant

2.0 POPULATION

Population and projected 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 historical and projected populations provides the basis for future water demands and wastewater loads.

2.1 SERVICE AREA

The existing water and wastewater service area consists of the current city limits, approximately 15 square miles. The future service area for the 2015 Alvin Utility Master Plan includes the existing city limits and a portion of the extra-territorial jurisdiction (ETJ) surrounded by the Alvin city limits and a portion of the ETJ extending west of the city limits to County Road 99. **Figure 2-1** shows the service area evaluated.

2.2 HISTORICAL POPULATION

The Texas Water Development Board (TWDB) provided yearly population data from 2004 through 2009 and 2010 through 2014 population data is based on two percent population growth since the U.S. Census in 2010. The data indicated an increasing growth rate with an average annual growth of 1.46% over the last 10 years. **Table 2-1** presents the historical populations for the City of Alvin. The significant decrease in population from 2009 to 2010 is likely due to TWDB overestimating the City population in the years between the 2000 Census and the 2010 Census.

Table 2-1: Historical Population

Year(1)	Population	Growth Rate
2004	22,678	1.85%
2005	22,892	0.94%
2006	23,449	2.43%
2007	23,894	1.90%
2008	24,362	1.96%
2009	24,877	2.11%
2010	24,236	-2.58%
2011	24,721	2%
2012	25,215	2%
2013	25,719	2%
2014	26,234	2%
	Overall Average	1.46%

(1) 2003 – 2009 population from TWDB, 2010 population from U.S. Census, and 2010 through 2013 based on 2% population growth since 2010.

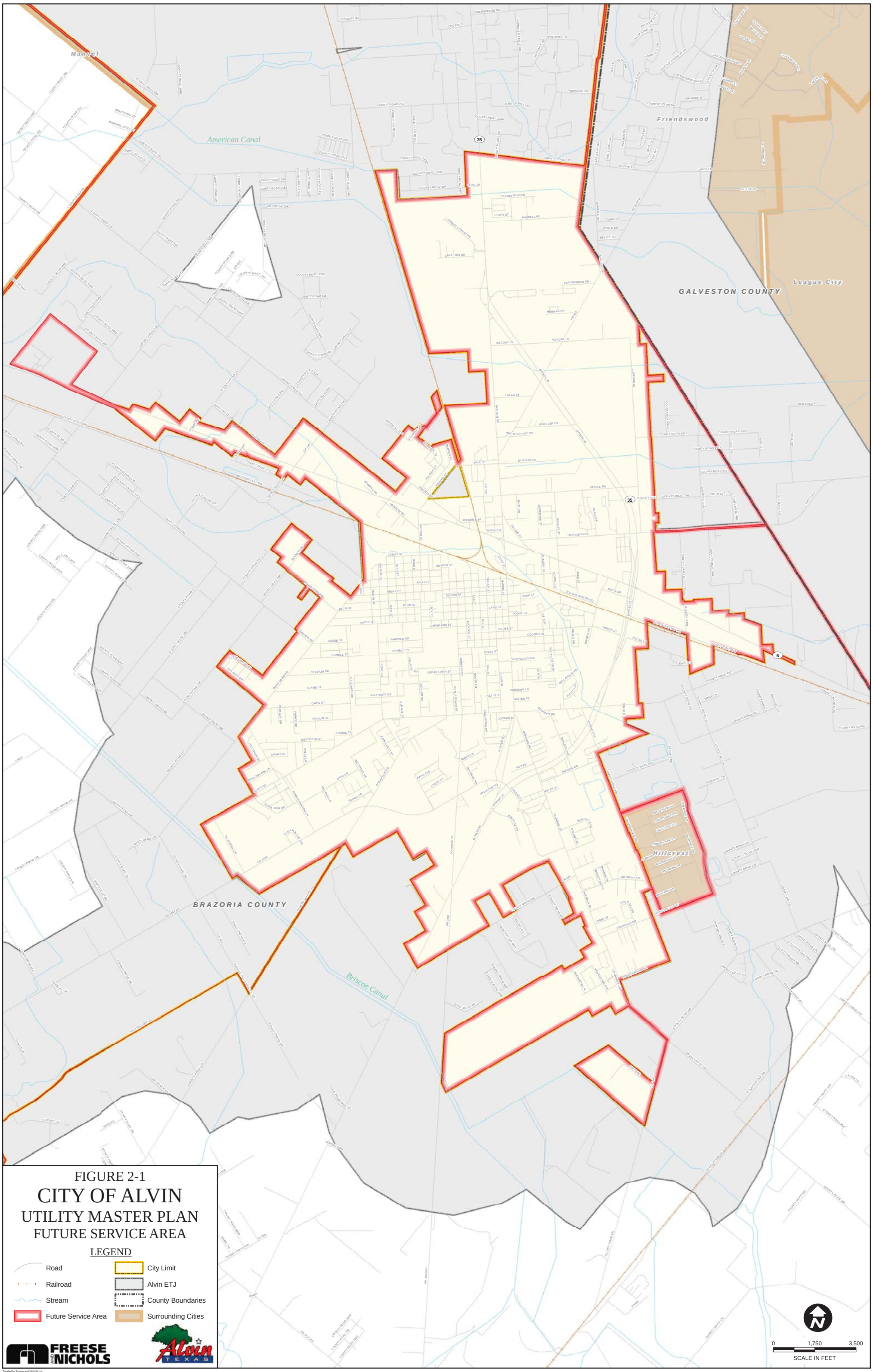


FIGURE 2-1

CITY OF ALVIN

UTILITY MASTER PLAN

FUTURE SERVICE AREA

LEGEND

- Road
- Railroad
- Stream
- Future Service Area
- City Limit
- Alvin ETJ
- County Boundaries
- Surrounding Cities

FREESE AND NICHOLS

Alvin TEXAS

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2.3 PROJECTED POPULATION

The magnitude and distribution of the growth in population will dictate where future water and wastewater infrastructure is required. It is important to note that projecting future population is challenging, especially for relatively small geographic areas such as individual cities because it can be difficult to predict how fast or slow development will occur when there are a variety of circumstances that can impact it.

Future population projections for each planning year were developed based on the population forecasts in the City's 2014 Comprehensive Plan, input from City staff on proposed developments, and FNI's analysis. Based on our analysis and historical trends, an annual growth rate of 2% was used to project the future population. **Table 2-2** presents the projected water and wastewater service population for each planning period.

Table 2-2: Population Projections with 2% Growth

Year	Population(1)	Number of Water Connections
2015	26,759	11,338(2)
2020	29,544	12,574
2025	32,618	13,882
2035	39,762	16,922

(1) Population based on 2% growth since 2010.
(2) 2014 number of connections from TCEQ and assumed linear increase since 2014.

The total population for each planning year was distributed throughout the City using future developments as identified by the City's Comprehensive Plan and meetings with City staff. Information on future developments are included in **Table 2-3** and **Table 2-4**.

The City notified FNI of areas where residential and non-residential developments are expected to occur. **Figure 2-2** shows the location of planned developments and vacant-developable parcels (also known as infill). The City provided information on the number of units for Mustang Crossing, Kendall Lakes, and Martha's Vineyard subdivisions. The developable acreage (excluding area in the floodplain) was used to estimate the number of units for the remaining developments. The 2010 U.S. Census density of 2.82 people per unit was used to determine the population resulting from each development. The timing of development and development of infill property is anticipated to support 2% population growth through 2035.

Table 2-3: Future Residential Development

Name[1]	Land Use	Density[2] (LUE per acre)	Area (acres)	Number of LUEs[3]	Percent Developed			Expected Population			Expected LUEs		
					2020	2025	2035	2020	2025	2035	2020	2025	2035
Mustang Crossing	Single Family	-	4	66	100%	100%	100%	155	155	155	66	66	66
Kendall Lakes	Single Family	-	-	800	50%	75%	100%	940	1,410	1,880	400	600	800
Forest Heights #5	Multi-Family	10	29	289	10%	50%	100%	68	340	679	29	144	289
Heritage South	Single Family	4	32	129	10%	50%	100%	30	151	303	13	64	129
Martha's Vineyard	Single Family	-	140	250	0%	50%	100%	0	294	588	0	125	250
Midtown Park Section 2	Single Family	4	46	184	10%	55%	100%	43	238	432	18	101	184
Potential Development North Bypass	Multi-Family	10	28	284	10%	55%	100%	67	366	666	28	156	284
Infill	Single Family	4	1,033	4,131	0%	0%	35%	0	0	3,398	0	0	1,446
Population Due to Future Residential Developments								**1,303**	**2,954**	**8,101**	**555**	**1,257**	**3,447**

(1) Future developments identified by City of Alvin.

(2) LUE = Living Unit Equivalent (equivalent to one single family residential dwelling unit). FNI assumed 4 LUEs per acre for single family residential land use, 10 LUEs per acre for mixed use land use, and 4 LUEs per acre for commercial.

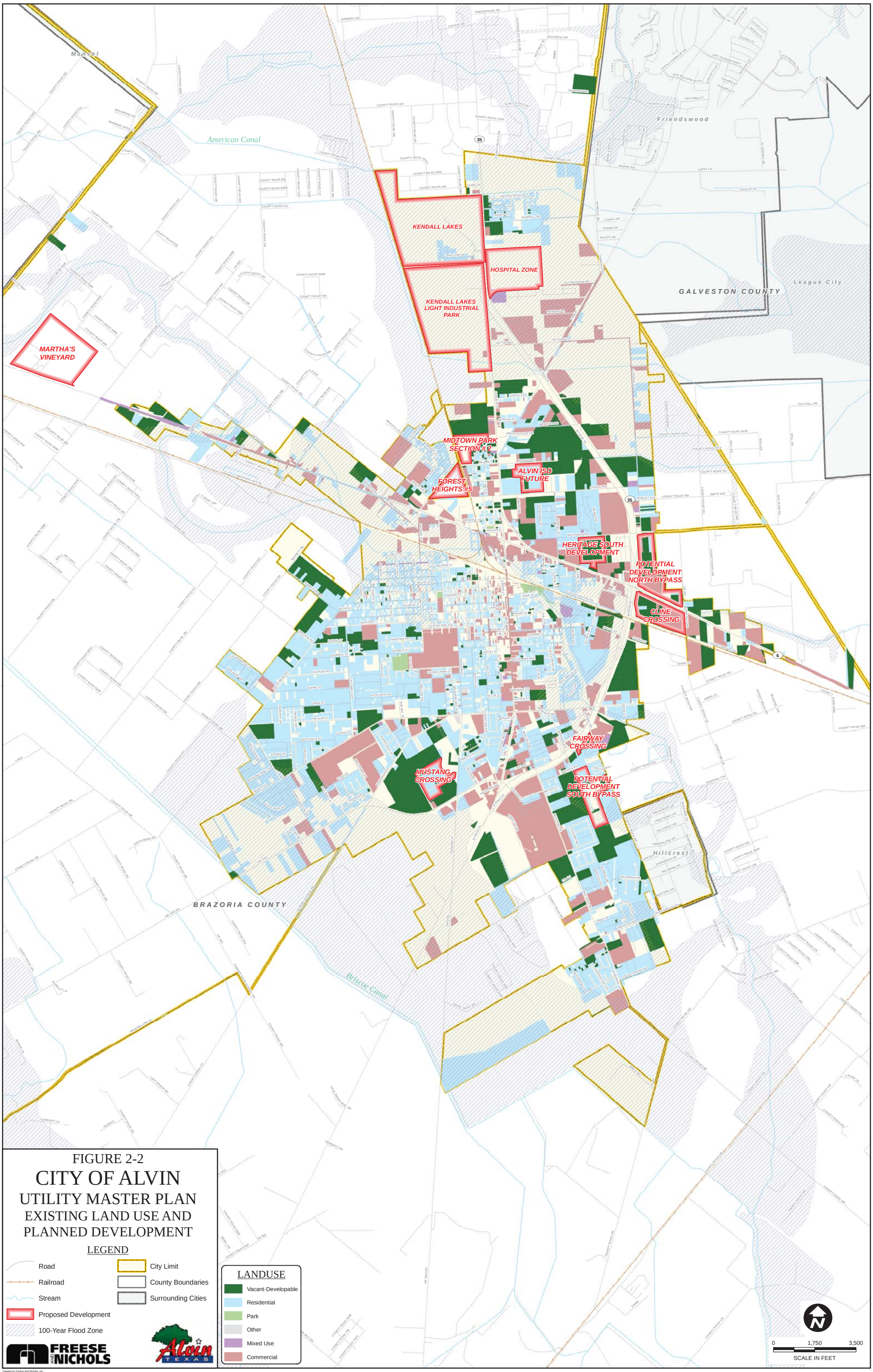
(3) City of Alvin provided number of LUEs for Mustang Crossing, Kendall Lakes, and Martha's Vineyard.

Table 2-4: Future Non-Residential Development

Name[1]	Land Use	Density[2] (LUE per acre)	Area (acres)	Number of LUEs	Percent Developed			Expected LUEs		
					2020	2025	2035	2020	2025	2035
Kendall Lakes Light Industrial Park	Commercial	4	278	1,114	30%	60%	100%	339	668	1,114
Fairway Crossing	Commercial	4	7	27	30%	60%	100%	8	16	27
Potential Development South Bypass	Commercial	4	49	198	30%	60%	100%	60	119	198
Hospital Zone	Commercial	4	102	406	30%	60%	100%	124	244	406
Cline Crossing	Commercial	4	23	93	30%	60%	100%	28	56	93
Alvin ISD Future	Institutional	4	32	130	30%	60%	100%	39	78	130
Acreage and LUEs Due to Future Non-Residential Developments								**598**	**1,180**	**1,967**

(1) Future developments identified by City of Alvin.

(2) FNI assumed 4 LUEs per acre for single family residential land use, 10 LUEs per acre for multi-family land use, and 4 LUEs per acre for commercial.



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3.0 WATER DEMANDS

A water utility must be able to supply water at rates that fluctuate over time. Yearly, monthly, daily, and hourly variations in water use occur, with higher use typically occurring during dry years and in hot months. Also, water use typically follows a diurnal pattern, being low at night and peaking in the early morning and late afternoon. Flow rates most important to the hydraulic design and operation of a water treatment plant and distribution system are average day (AD), maximum day (MD), and peak hour (PH) demands. Average day use is the total annual water use divided by the number of days in the year. The average day demand rate is used as a basis for estimating maximum day and peak hour demands. Maximum day demand is the maximum quantity of water used on any one day of the year. Water supply facilities are typically designed based on the maximum day demand. Peak hour use is the peak rate at which water is required during any one hour of the year. Since minimum distribution pressures are usually experienced during peak hour, the sizes and locations of distribution facilities are generally determined based on this condition.

3.1 HISTORICAL WATER DEMANDS

Reviewing historical water demands provides insight into selecting design criteria used to project future water demands. Historical monthly water usage records were analyzed from 2003 through 2013. The City provided recent water usage data consisting of daily production and monthly consumption. Historical annual average day demand in million gallons per day (MGD), maximum day to average day peaking factors, and per-capita consumption in gallons per capita day (gpcd) are summarized in **Table 3-1**. The historical water usage shows that the City of Alvin has a relatively low average per-capita consumption and maximum day demand peaking factor compared to other cities in the area. This is likely due to lower irrigation demands caused by a higher percentage of multi-family homes and lower percentage of homes with automatic sprinkler systems.

Table 3-1: Historical Water Usage

Year	Population	Average Day Demand (MGD)	Average Per-Capita (gpcd)	Maximum Day Demand (MGD)	MD:AD Peaking Factor
2003	22,267	2.34	105	-	-
2004	22,678	2.28	100	-	-
2005	22,892	2.42	106	-	-
2006	23,449	2.29	98	-	-
2007	23,894	2.23	93	-	-
2008	24,362	2.37	97	-	-
2009	24,877	-	-	-	-
2010	24,236	-	-	-	-
2011	24,721	2.92	118	4.44	1.52
2012	25,215	2.40	95	3.30	1.38
2013	25,719	2.32	90	3.62	1.56
	Average	2.40	100	3.79	1.49

3.2 PROJECTED WATER DEMANDS

Water demands were projected for 2015, 2020, 2025, and 2035 conditions. The evaluation of historical data provided a basis for determining the design criteria used to project water demands. Average day per capita water usage ranged from 90 gpcd to 118 gpcd, with an average of 100 gpcd over the last 11 years. Based on the review of this data and the need to plan for low rainfall (dry) years with minimal water restrictions, FNI recommends using an average day demand of 130 gpcd. In selecting a peaking factor to project maximum day demands, FNI reviewed historical peaking factors and the years in which those peaking factors occurred, as just using the highest values for per-capitas and peaking factors may not be representative. Historical water usage data indicated the maximum day to average day peaking factor ranged from 1.38 to 1.56 over the last 3 years; therefore, FNI recommends using a maximum day to average day peaking factor of 1.6. A peak hour to maximum day peaking factor of 1.8 to project future peak hour demands was selected based on data recorded during pressure testing. **Figure 3-1** illustrates the historical and projected water demands for the City of Alvin. The projected population and water demands are summarized for each planning period in **Table 3-2.**

Figure 3-1: Historical and Projected Water Demands

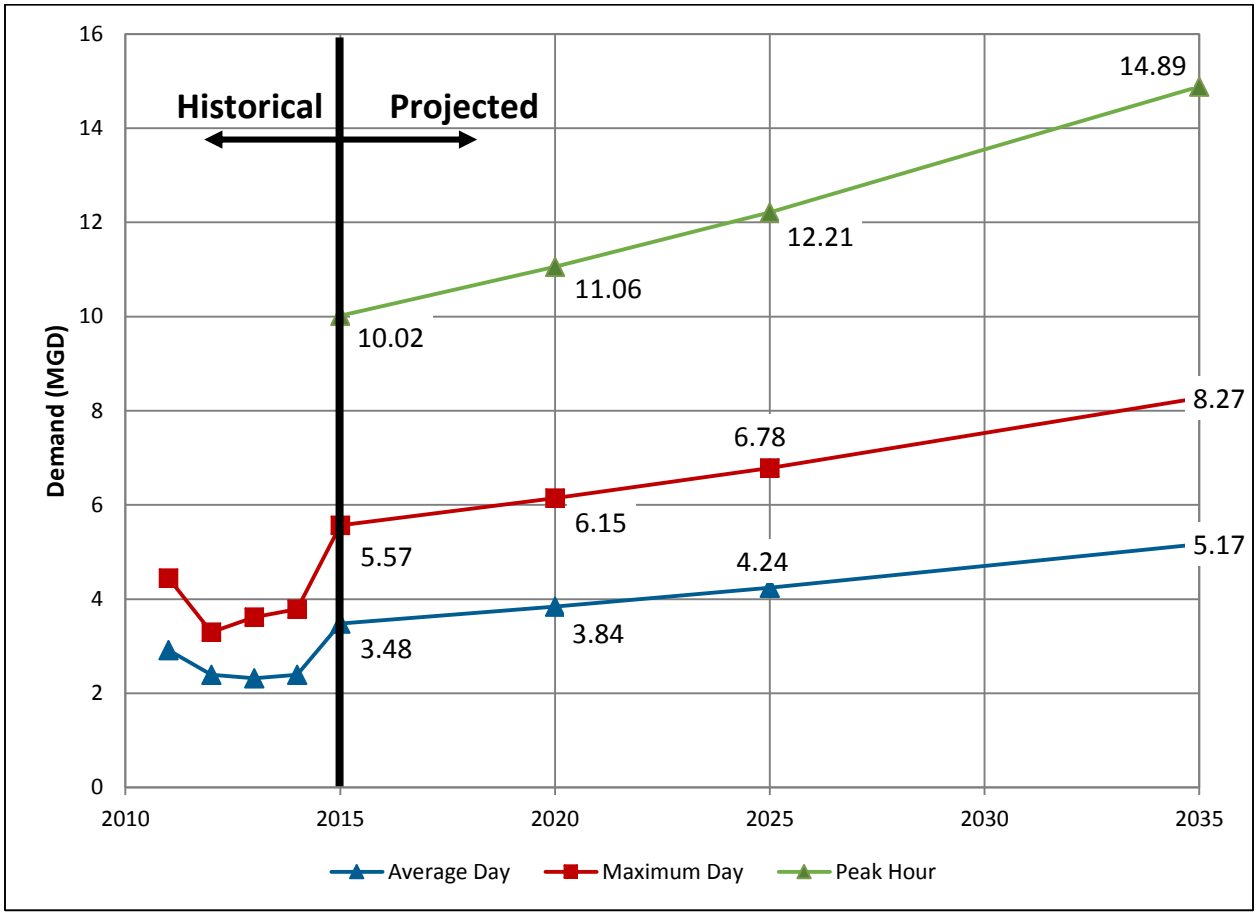

Table 3-2: Future Water Demand Projections

Year	Population	Average Per-capita (gpcd)	Average Day Demand (MGD)	MD:AD Peaking Factor	Maximum Day Demand (MGD)	PH:MD Peaking Factor	Peak Hour Demand (MGD)
2015	26,759	130	3.48	1.60	5.57	1.80	10.02
2020	29,544	130	3.84	1.60	6.15	1.80	11.06
2025	32,618	130	4.24	1.60	6.78	1.80	12.21
2035	39,762	130	5.17	1.60	8.27	1.80	14.89

4.0 DESCRIPTION OF THE EXISTING WATER SYSTEM

The City of Alvin's water distribution system consists of a network of water lines, three water plants with associated groundwater wells, ground storage tanks and pump stations, two active elevated storage tanks, and one emergency interconnection with the City of Hillcrest Village. **Figure 4-1** shows the existing water distribution system for the City of Alvin.

4.1 PRESSURE PLANES

The distribution system has only one pressure plane. Ground elevations generally range from 25 feet to 47 feet. The pressure plane operates at a static hydraulic gradient of 178.3 feet established by the Northside and Verhalen ESTs.

4.2 GROUNDWATER SUPPLY

The City relies on five groundwater wells to provide water to its residents. Groundwater is stored in ground storage tanks (GSTs) at the City's water plants before distribution. A summary of existing groundwater supply is shown in **Table 4-1**.

Table 4-1: Existing Groundwater Wells

Well Number	Capacity (gpm)	Capacity (MGD)
3	1,300	1.87
4	840	1.21
6	1,205	1.74
7	1,104	1.59
8	1,525	2.20
TOTAL	**5,974**	**8.60**

4.3 WATER LINES

The City of Alvin's distribution system consists of 146 miles of water lines. Pipeline diameters range in size from 1-inch to 12-inches. **Figure 4-2** illustrates the percentage of pipe length by diameter. The majority of the pipes are PVC, along with asbestos cement and cast iron. **Figure 4-3** shows a summary of the pipe material based on the City's geographic information system (GIS) data. A small portion of the water lines list "unknown" in the material field in the GIS. Additionally, the installation date is not defined in the GIS data. Research of as-built drawings and field investigation would be required to populate these attributes.

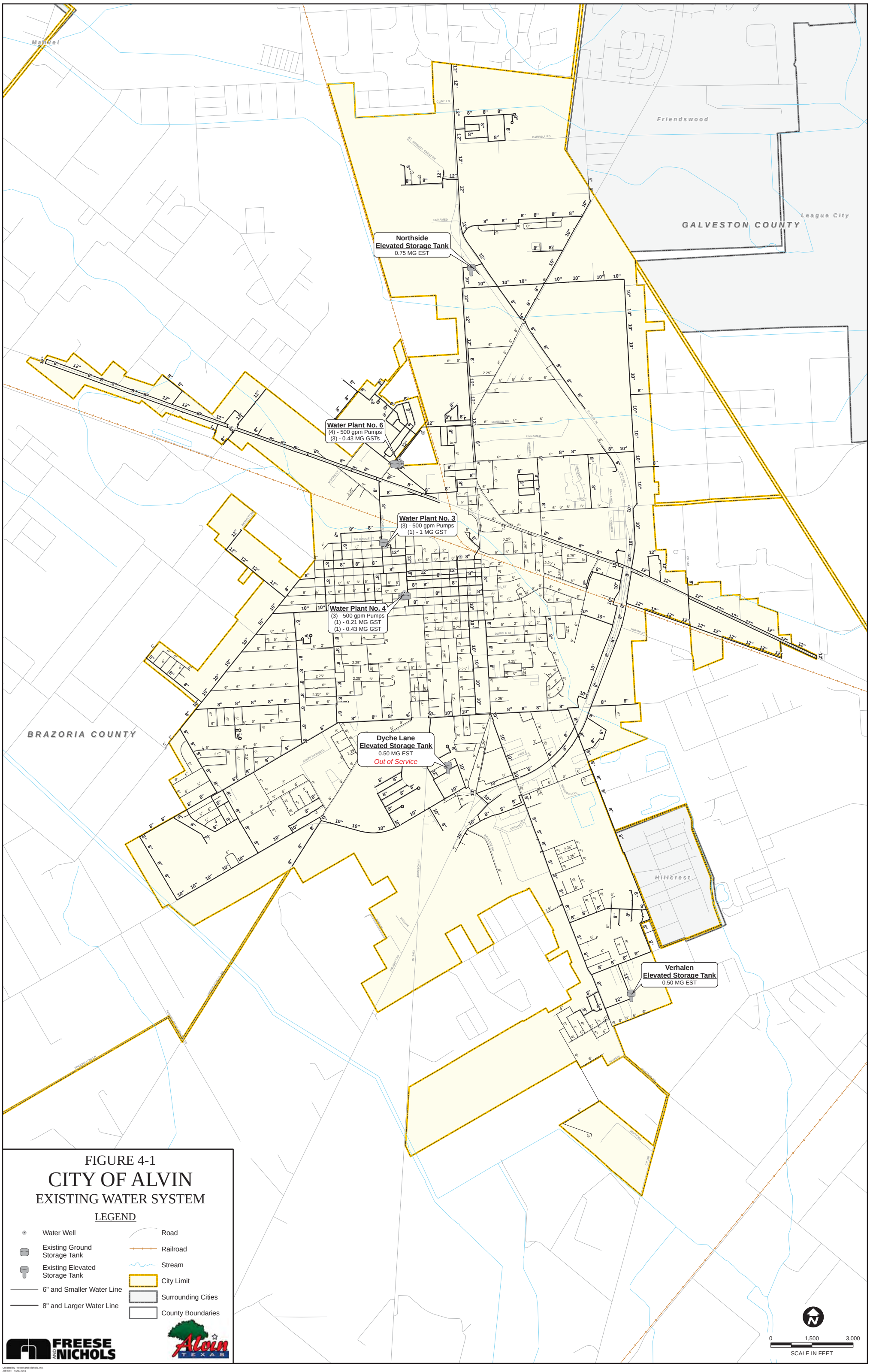

FIGURE 4-1

CITY OF ALVIN

EXISTING WATER SYSTEM

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Figure 4-2: Pipe Diameter by Length

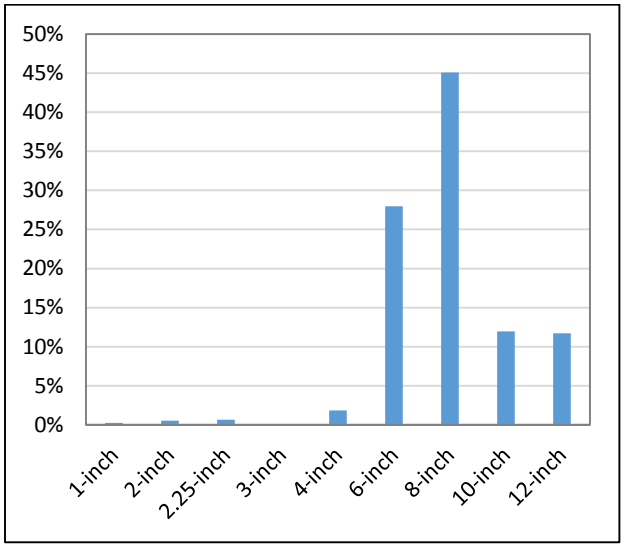
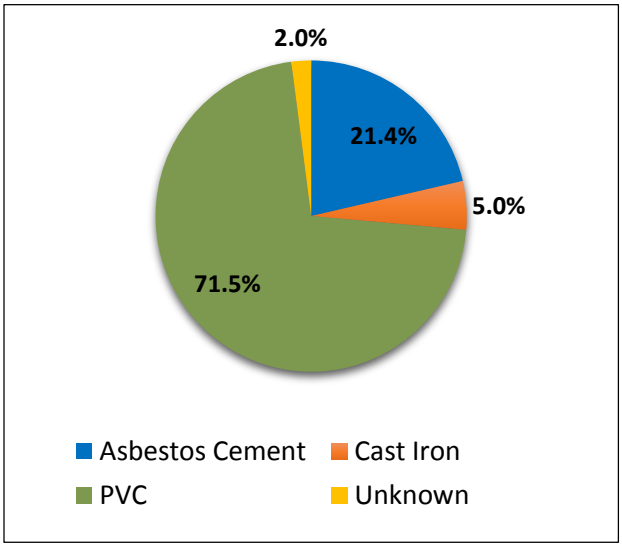


Figure 4-3: Pipe Material by Length



4.4 PUMP STATIONS

Water Plant No. 3, 4 and 6 distribute groundwater throughout the City. The City's distribution system has a total pumping capacity of 7.20 MGD and a firm pumping capacity of 6.48 MGD. **Table 4-2** provides a summary of the pumping facilities within Alvin's distribution system.

Table 4-2: Existing Pumping Facilities

Facility Name	Pump Number	Rated Capacity (gpm)	Rated Capacity (MGD)	Rated Head (feet)
Water Plant No. 3	1	500	0.72	120
	2	500	0.72	120
	3	500	0.72	120
	TOTAL	1,500	2.16	-
Water Plant No. 4	1	500	0.72	120
	2	500	0.72	120
	3	500	0.72	120
	TOTAL	1,500	2.16	-
Water Plant No. 6	1	500	0.72	120
	2	500	0.72	120
	3	500	0.72	120
	4	500	0.72	120
	TOTAL	2,000	2.88	-
System Total		**5,000**	**7.20**	-
System Firm(1)		***4,500***	***6.48***	-

(1) Capacity with the largest pump out of service.

4.5 STORAGE FACILITIES

The City currently utilizes six steel construction GSTs within the distribution system. One GST is located at Water Plant No. 3, two GSTs are located at Water Plant No. 4, and three GSTs are located at Water Plant No. 6. Additionally, two active elevated storage tanks (ESTs) are located throughout the distribution system: 0.5 MG Verhalen EST and 0.75 million gallon (MG) Northside EST. The inactive 0.5 MG Dyche Lane EST was taken offline due to operational issues. **Table 4-3** presents a summary of the City's existing ground storage tanks, and **Table 4-4** shows the elevated storage facilities.

Table 4-3: Existing Ground Storage Tanks

Water Plant No.	Tank Name	Capacity (MG)
3	GST 1	1
4	GST 1	0.21
	GST 2	0.43
6	GST 1	0.43
	GST 2	0.43
	GST 3	0.43
Total Ground Storage		**2.93**

Table 4-4: Existing Elevated Storage Tanks

Tank Name	Sidewater Depth (feet)	Overflow Elevation (feet)	Capacity (MG)
Northside	37	178.3	0.75
Verhalen	37	178.3	0.50
Total Elevated Storage			**1.25**

5.0 WATER SYSTEM ANALYSES AND HYDRAULIC MODELING

Hydraulic analyses were conducted utilizing the water model to identify deficiencies in the City of Alvin's existing water distribution system and to establish a capital improvements plan to improve the existing system and meet projected water demands through 2035. Various combinations of improvements and system modifications were investigated to determine the most appropriate approach for meeting projected demands. Parameters used in developing the capital improvements plan included increasing system reliability, meeting required fire flows, and maintaining proper residual pressures.

5.1 WATER MODEL DEVELOPMENT

The hydraulic model is one of the most critical elements in the analysis of water distribution systems. A calibrated water model serves as a key decision making tool to help determine the sizing and location of system infrastructure in both the present and future planning periods. The following subsections document the development and calibration of the water system hydraulic model to be used as part of the Utility Master Plan for the City of Alvin. The procedures used for model construction are presented, as well as the results of the calibration process.

5.1.1 Field Testing

To assist with model calibration and to supplement available operational data, field pressure testing was conducted March 17 – 26, 2014. A total of seven temporary pressure recorders were installed throughout the distribution system. Locations of the pressure recorders are illustrated on **Figure C-1** in **Appendix C**. Minimum, maximum, and average pressure was recorded every 5 minutes at each location using Telog© brand pressure recorders. Complete data from all recorders was collected from March 18th at 12:00 AM through March 25th at 12:00 AM. **Appendix C** includes the pressure recorder data from the field testing period.

5.1.2 Physical Network

The water model was developed using *H2OMap Water* software by Innovyze®. City staff provided the GIS shapefiles of water lines that were imported into the model. The model contains 1,738 links with diameters ranging in size from 1-inch to 12-inches. FNI added links to connect ground and elevated storage tanks to the distribution system, and added piping at water plants. Initial Hazen-Williams roughness coefficients for pipes were assigned based on the pipe material and are listed in **Table 5-1.**

Because installation year was not available in the GIS, the roughness coefficient was not dependent on pipe age.

Table 5-1: Initial Hazen-Williams C-Value Assignments

Pipe Material	C-Value
Cast Iron, Copper, Unknown	100
Asbestos Cement, GP	120
PVC	130

All pumping and storage facilities were manually added to the model based on as-built drawings and information provided by the City. All pumps were assigned a design point curve based on information from as-built drawings and model calibration. Variable area tank curves were developed to accurately model changes in tank volume. There are 1,409 junctions, 10 pumps, and 8 storage tanks in the model. Model nodes in the distribution system were assigned an elevation based on the one-foot ground contour data provided by the City. Elevations for facilities (tanks and pumps) were assigned using as-built drawings and one-foot contour elevations.

5.1.3 Demand Allocation

FNI allocated demands to the model using water customer billing accounts. The active water meters were spatially located and the associated consumption was assigned to the nearest model node. The water demands were divided into two categories: residential and non-residential usage. The information from the customer billing database was joined to the parcel shapefile by the unique customer address. FNI used the spatial join function in GIS to distribute March 2014 demands to the model nodes.

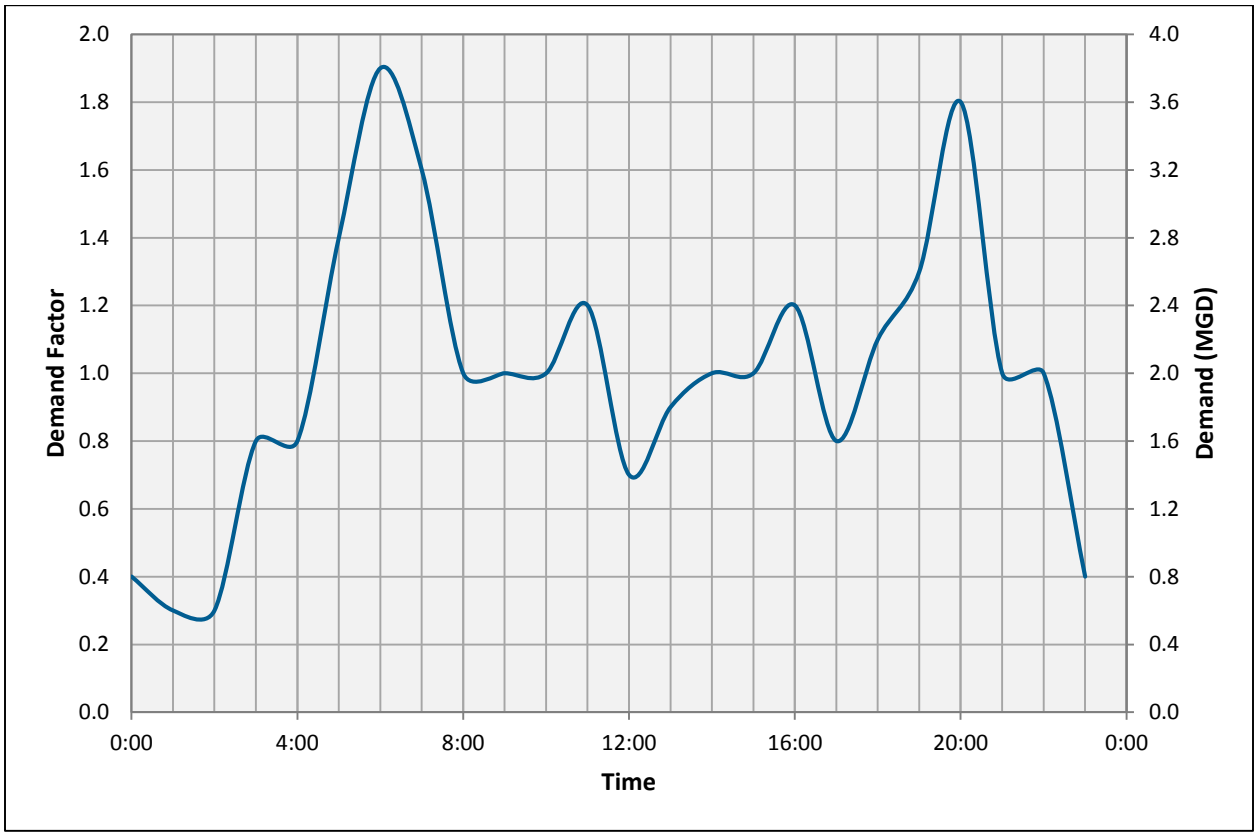
5.2 EXTENDED PERIOD SIMULATION (EPS) CALIBRATION

In order to verify that the hydraulic model accurately represents actual distribution system operation, a model calibration analysis was performed. The calibration process involves adjusting system operational parameters, roughness values, demand allocation, and peaking factors to match a known condition. The 24-hour period occurring on March 20, 2014 was selected for calibration. This day was selected because March 20, 2014 represented a weekday with no irregularities in system operations. This section provides a summary of the calibration process, the adjustments made during the calibration, and the modeled results versus the actual recorded values.

5.2.1 Calibration Process

The City provided water production reports during the pressure testing period. The reports included total daily groundwater well flow and booster pump operating durations. Tank levels, derived from field pressure testing, and flow data was utilized to calculate an overall diurnal curve by examining water going into (supply) and out of (demand) the distribution system. The calculated total system demand for March 20, 2014 was 2.0 MGD with an estimated peak of 3.8 MGD and a minimum demand of 0.6 MGD. During calibration, the diurnal curve was adjusted in specific areas to better represent the demand experienced in system. **Figure 5-1** shows the calculated system diurnal curve for March 20, 2014.

Figure 5-1: March 20, 2014 Diurnal Curve



5.2.2 Calibration Controls and Adjustments

During the EPS calibration, adjustments were made to the model in order to match the known conditions of March 20, 2014. The operational controls were based on the durations provided in the water production reports and discussions with City Public Services staff. Time of day controls were used for the pumps at Water Plant No. 3 and 4 to match the water production reports and typical system operations. Pressure controls, based on the junction immediately downstream of the pumps, were used for the pumps at Water Plant No. 6 and settings were adjusted to match

known conditions. Going forward, the model controls will be based on parameters such as pressures or tank levels, unless a certain item has a regularly specified time of day control.

5.2.3 Pump Controls

The pumping on/off status provided by the City for each pump in the system allowed FNI to replicate system operations by entering on/off times or on/off pressures in pounds per square inch (psi) in the model. **Table 5-2** provides a summary of the pump operations during the calibration day.

Table 5-2 Pump Operations on March 20, 2014 Calibration Scenario

Water Plant No.	Pump Name	Setting
3	1	On all day
	2	On all day
	3	Off all day
4	1	On at 7:00 am and off at 3:00 pm
	2	Off all day
	3	Off all day
6	1	On when pressure at downstream node is below 55 psi, off when pressure at downstream node is above 61 psi
	2	Off all day
	3	Off all day
	4	Off all day

On/off times for Pump 1 at Water Plant No. 4 were adjusted to better match the observed pressures. Pressure control settings for Pump 1 at Water Plant No. 6 were adjusted to match the observed pressures and pump operational duration from the water production report.

5.2.4 Calibration Results

The results of the EPS calibration are summarized on the graphs included in **Appendix E**. The graphs show modeled pressures versus recorded data at pressure recorder locations. Calibration statistics are presented in **Table 5-3**. Each monitored location includes 24 data points (one for each hour of the calibration) where the recorded and modeled values were compared. The percentages presented in the tables are determined by the number of points that fall within the given measurement range (i.e. 100% at Pressure Recorder #1 indicates all of the 24 modeled points fall within 3 psi of the recorded values). The results suggest a good correlation between recorded and modeled values and provide confidence in the accuracy of the model.

Table 5-3 Pressure Calibration Statistical Summary

Pressure Recorder	Within 5 psi	Within 3 psi
1	100%	100%
2	100%	100%
3	100%	100%
4	100%	96%
5	100%	100%
6	100%	100%
7	100%	100%
Average	100%	99%

5.3 EXISTING WATER SYSTEM ANALYSIS

The existing distribution system was evaluated to assess current supply, pumping, and storage capacity, residual pressures, and fire flow capacity. This analysis is performed to determine if there are any existing system deficiencies and also to provide a baseline for the current level of service. The parameters that were evaluated are discussed in the following sections.

5.3.1 Water Supply, Service Pumping and Storage Capacity Analysis

As a public water utility, the City of Alvin must comply with the rules and regulations for public water systems set forth by the Texas Commission on Environmental Quality (TCEQ) in Chapter 290. The City obtained an alternative capacity requirement (ACR) for water supply resulting in a TCEQ requirement of 0.39 gpm per connection in a letter dated February 23, 2011. A comparison of the City's existing water supply to TCEQ requirements is shown in **Table 5-4**. The City is currently exceeding the TCEQ ACR for water supply.

Table 5-4: Existing System TCEQ Alternative Capacity Water Supply Requirements

2015 Number of Connections	Water Supply (MG)	
	Required (0.39 gpm per connection)	Existing
11,388	6.40	8.60

The City is required to meet the TCEQ elevated storage capacity requirement of 100 gallons per connection and total storage capacity requirement of 200 gallons per connection. A comparison of the City's existing storage to TCEQ requirements is shown in **Table 5-5**. The City is currently exceeding all TCEQ requirements for storage. The City is also currently designing a new EST.

Table 5-5: Existing System TCEQ Storage Requirements

May 2014 Connections	Total Storage (MG)		2014 Elevated Storage (MG)	
	Required	Existing	Required	Existing
11, 388	2.28	4.18	1.14	1.25

In addition to storage requirements, the City is also required to meet the service pumping capacity requirements presented in **Table 5-6**. Since the elevated storage capacity in the water system is less than 200 gallons per connection, criterion 2(b) from **Table 5-6** applies to the water system for pumping capacity. Model results included in **Section 5.3.2** show that the City of Alvin is able to meet peak hourly demands with the largest pump out of service and maintain a minimum pressure of at least 35 psi throughout the water system.

Table 5-6: TCEQ Service Pumping Requirements

	Condition	Service Pumping Capacity Requirement
1	If providing at least 200 gallons per connection of elevated storage	Two service pumps with a minimum combined capacity of 0.6 gpm per connection at each pressure plane.
2	If providing less than 200 gallons per connection of elevated storage	**The lesser of (a) or (b):**
		(a) Total pumping capacity of 2.0 gpm per connection
		(b) Total capacity of at least 1,000 gpm and the ability to meet peak hourly demands with the largest pump out of service

Note: Capacity requirement from 30 TAC §290.45(b)(2)(F)

5.3.2 Hydraulic Analysis

A hydraulic analysis was performed under existing demand conditions to evaluate residual pressure throughout the distribution system. A 24-hour EPS was performed with 2014 maximum day demands. EPS modeling provides a means to evaluate the system over time to assess response to hourly changes in demand, pump cycling, and tanks filling or draining. During a maximum day EPS analysis, the peak hour demand is also simulated through the use of hourly peaking factors based on the typical diurnal demand pattern. 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 typically induces the lowest pressure due to increased headloss throughout the system. The TCEQ minimum required pressure within a distribution system is 35 psi under normal operating conditions. A review of existing pressures throughout the system did not indicate any areas of low pressure. **Figure 5-2** shows the minimum pressure observed in the model under existing demand conditions.

To evaluate the fire suppression capabilities 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. In addition to TCEQ minimum pressure requirements, the City of Alvin has specific fire flow requirements shown in **Table 5-7**.

Table 5-7: City of Alvin Fire Flow Requirements

Location	Range of Flow Required(1) (gpm)	Flow Duration(1) (hours)
Apartments	1,250 - 1,500	2
Stanton's Shopping Center	4,000	4
RiceTech	4,000	4
Diversified Storage	4,000	4
First United Methodist Church	5,000	4
Alvin Chemical	4,000 - 5,000	-

(1) From City of Alvin Fire Marshal Matt Cornell.

For this analysis, a steady-state model run was utilized to calculate the available fire flow at each node in the system with a pressure of 20 psi. **Figure 5-3** shows the results of the fire flow simulation. The majority of the water system can provide at least 1,500 gpm, which is a typical residential fire flow demand. However, locations with a fire flow requirement above 1,500 gpm do not have adequate fire flow available. Available fire flows below 1,500 gpm are due to small diameter lines in isolated areas. Upsizing of smaller lines and looping are two methods to improve low fire flow, especially near areas with fire flow requirements above 4,000 gpm. Recommendations are shown in **Section 6.2**.

5.4 FUTURE WATER SYSTEM ANALYSIS

Water system improvements were developed to accommodate the anticipated residential and non-residential growth over the next 20 years. Challenges facing the water system include providing additional supply and transmission capacity, meeting service pumping requirements, and providing adequate fire flow capacity. Key observations and recommendations resulting from modeling and evaluation of the water system are discussed in the following sections.

5.4.1 Water Supply, Service Pumping and Storage Capacity Analysis

Table 5-8 shows the City's water supply capacity versus TCEQ water supply ACR for future planning periods. It is recommended that the City plan to construct a new 1,000 gpm water plant near FM 517 and SH 35 Bypass to meet future water supply needs.

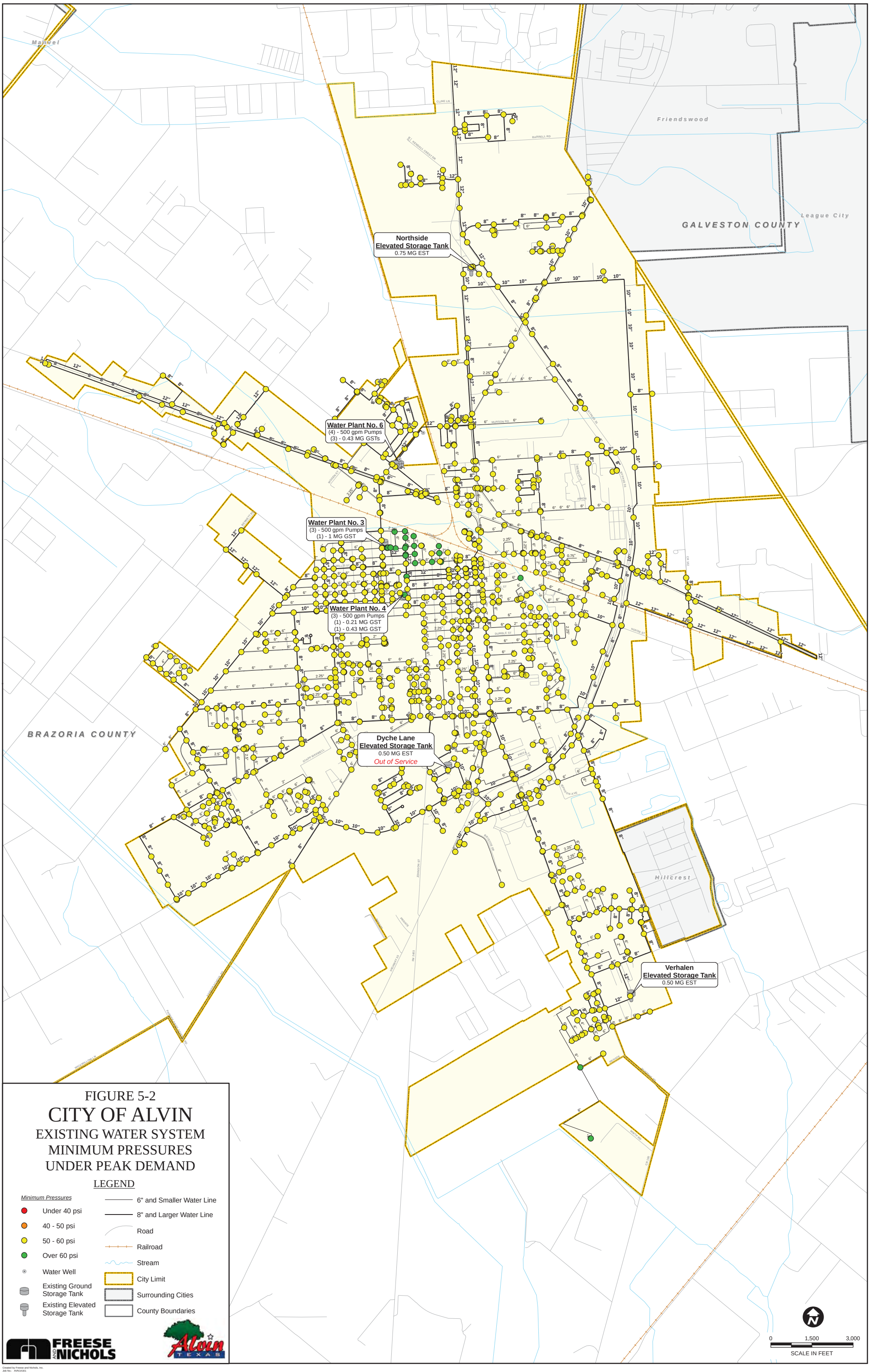


FIGURE 5-2

CITY OF ALVIN

EXISTING WATER SYSTEM MINIMUM PRESSURES UNDER PEAK DEMAND

LEGEND

Minimum Pressures

- Under 40 psi
- 40 - 50 psi
- 50 - 60 psi
- Over 60 psi
- Water Well
- Existing Ground Storage Tank
- Existing Elevated Storage Tank
- 6" and Smaller Water Line
- 8" and Larger Water Line
- Road
- Railroad
- Stream
- City Limit
- Surrounding Cities
- County Boundaries

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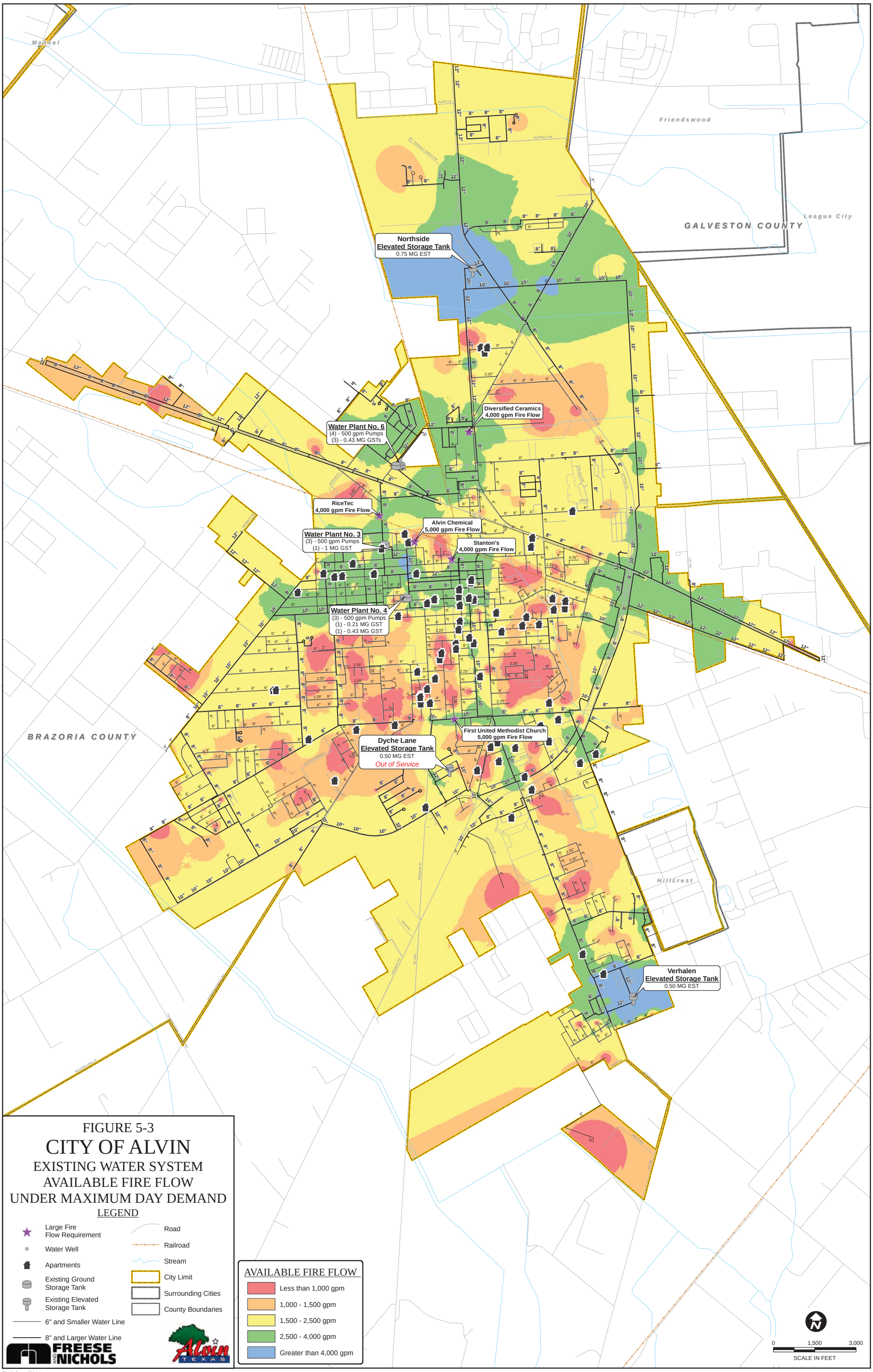

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Table 5-8: Future System TCEQ Alternative Capacity Water Supply Requirements

Planning Period	Connections	TCEQ ACR (MGD)	Recommended Water Supply (MGD)
2020	12,574	7.06	8.60(1)
2025	13,882	7.80	10.00(2)
2035	16,922	9.50	10.00

(1) 2020 water supply is based on the City's existing water supply capacity.
(2) New 1,000 gpm groundwater well by 2025.

Table 5-9 shows the City's storage capacity versus TCEQ requirements for future planning periods. The new Dyche Lane 0.5 MG EST is currently under design and will ensure the City is in compliance with TCEQ storage capacity requirements.

Table 5-9: Future System TCEQ Storage Requirements

Planning Period	Connections	Total Storage (MG)		Elevated Storage (MG)	
		Required	Recommended (1)	Required	Recommended(2)
2020	12,574	2.51	4.18	1.26	1.75
2025	13,882	2.78	4.18	1.39	1.75
2035	16,922	3.38	4.18	1.69	1.75

(1) 2020-2035 total storage is based on the City's existing total storage capacity.
(2) New Dyche Lane 0.5 MG EST under design in 2015.

Since the elevated storage capacity in the water system is projected to be less than 200 gallons per connection, criterion 2(b) from **Table 5-6** applies to the water system for pumping capacity. Model results included in **Section 5.4.2** show that the City of Alvin will be able to meet peak hourly demands with the largest pump out of service and maintain a minimum pressure of at least 35 psi throughout the water system through 2035 with the new East Water Plant.

5.4.2 Water System Improvements

FNI identified water system improvements to accommodate future growth while optimizing the existing system operations and infrastructure. Major improvements to the distribution system include improved distribution system connectivity between water plants and ESTs and increased available fire flow capacity. Specific capital improvement projects to accomplish the above are discussed in detail in **Section 6.0**.

Hydraulic analyses of the maximum day EPS and fire flow were evaluated to ensure CIP projects addressed existing and future water system problems. **Figure 5-4** shows the minimum pressure observed in the model under 2035 demand conditions. The results show that the City's water system with recommended improvements is able to maintain at least 50 psi of pressure under 2035 maximum day demand conditions. **Figure 5-5** shows the results of the 2035 fire flow simulation. The majority of the water system can provide at least 2,000 gpm and large fire flow requirements are met for the users specified in **Table 5-7**.

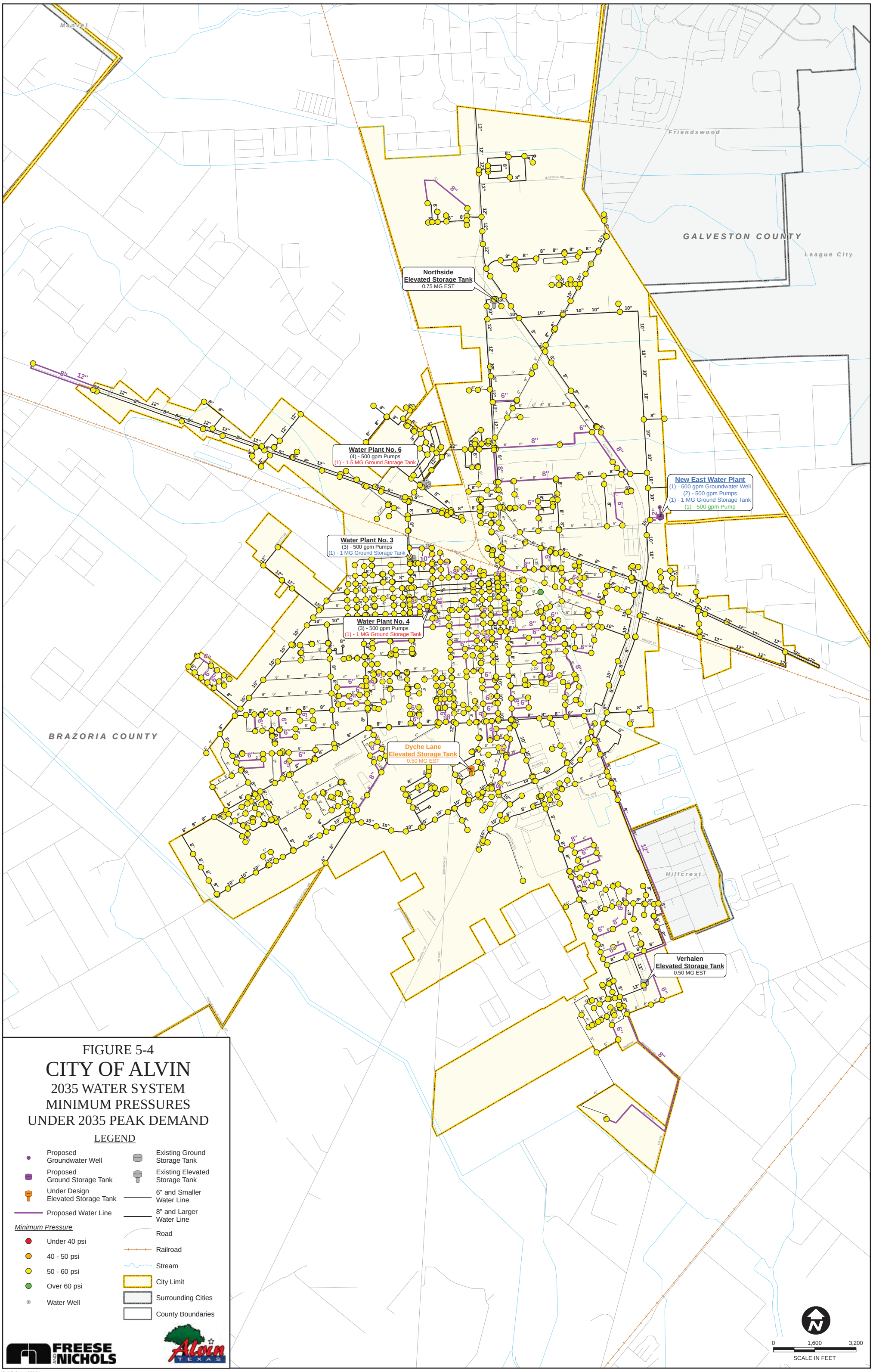

FIGURE 5-4

CITY OF ALVIN

2035 WATER SYSTEM MINIMUM PRESSURES UNDER 2035 PEAK DEMAND

LEGEND

- Proposed Groundwater Well
- Proposed Ground Storage Tank
- Under Design Elevated Storage Tank
- Proposed Water Line

Minimum Pressure

- Under 40 psi
- 40 - 50 psi
- 50 - 60 psi
- Over 60 psi
- Water Well

- Existing Ground Storage Tank
- Existing Elevated Storage Tank
- 6" and Smaller Water Line
- 8" and Larger Water Line
- Road
- Railroad
- Stream
- City Limit
- Surrounding Cities
- County Boundaries

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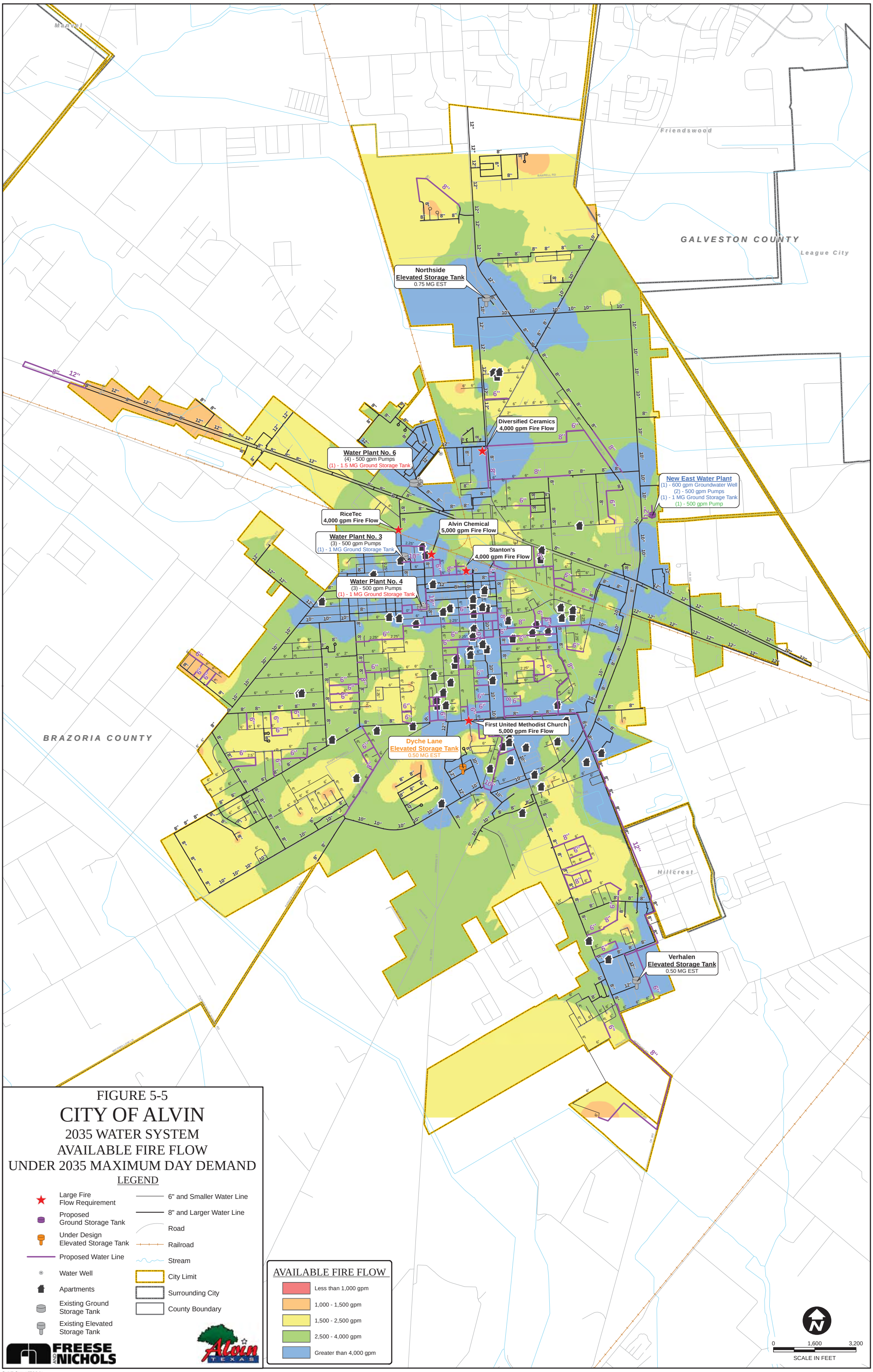

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6.0 WATER SYSTEM CAPITAL IMPROVEMENTS PLAN

A CIP was developed for the City of Alvin to maintain high quality water service that promotes residential and commercial development. The recommended improvements will provide the required capacity and reliability to meet projected water demands through year 2035. The recommended capacity related projects for the water system are presented on **Figure 6-1**. The recommended water line rehabilitation related projects for the water system are presented on **Figure 6-2**.

Locations shown for new lines and other recommended improvements were generalized for hydraulic analyses. Specific alignments and sites will be determined as part of the design process. Water lines to be constructed by developers are indicated with purple and were included and correctly sized for the hydraulic analysis. It is recommended that these projects be constructed generally in the order listed. However, development or renewal patterns may make it necessary to construct some projects sooner than anticipated. Capital costs were calculated for the recommended improvements. The costs are in 2015 dollars and include an allowance for engineering, surveying, and contingencies. Costs do not include easements or land acquisition. The following sections describe how the CIP projects contribute to major operational changes and water system improvements.

6.1 WATER SYSTEM CAPACITY IMPROVEMENTS

Project 1 consists of the construction of new 12-inch water lines along South Street and Fairway Drive to parallel existing 8-inch water lines by 2020. This project also includes a new 10-inch water line along FM 1462 connecting existing 10-inch water lines. Project 1 will increase transmission capacity between the new Dyche Lane and Verhalen ESTs, therefore allowing the water level in the Verhalen EST to be similar to that of the Dyche Lane EST. This project will allow the City to maintain desired water system pressure in the southern area of the City.

Project 2 consists of the decommissioning of three existing 0.43 MG steel GSTs and construction of a new concrete 1.5 MG GST at Water Plant No. 6 by 2020. **Project 3** consists of the decommissioning of existing 0.21 and 0.43 MG steel GSTs and construction of a new 1.0 MG GST at Water Plant No. 4 by 2020. **Project 4** consists of the decommissioning of the existing 1.0 MG steel GST and construction of a new concrete 1 MG GST at Water Plant No. 3 by 2025. Steel storage tanks and prone to corrosion, structural steel repair, roof replacement, and require regular maintenance, such as re-coating approximately every ten years.

Concrete GSTs allow for consolidation of multiple GSTs into a single low maintenance tank. The life cycle cost of steel tank maintenance far outweighs the initial capital cost of a new concrete GST.

Project 5 consists of the construction of 1,000 gpm groundwater well, two new 500 gpm service pumps and new 1 MG GST to create the new East Water Plant by 2025. It is recommended that the water plant be expanded by 2035 to accommodate anticipated growth. **Project 6** consists of the installation of a new 500 gpm service pump at the East Water Plant by 2035. These projects will increase water supply and service pumping capacity to meet TCEQ minimum requirements.

Project 7 consists of the construction of new 8-inch water lines to connect existing 6-inch and 8-inch dead end water lines and replace existing 6-inch water lines near the City's WWTP by 2035. This project will increase the available fire flow capacity in the area by connecting and replacing small dead end water lines. Detailed cost estimates are included in **Appendix A**.

6.2 WATER SYSTEM REHABILITATION

Rehabilitation **Projects A** through **G** consist of the construction of new 12-inch, 10-inch, 8-inch, and 6-inch water lines to replace existing small water lines throughout the City. Detailed project descriptions are included in **Appendix A**. These projects will increase available fire flow capacity, improve water quality, and increase water system connectivity between the City's water plants and the new Dyche Lane and Verhalen ESTs. Detailed cost estimates are included in **Appendix A**.

Project H consists of the installation of new 5-inch Hydrant Storz connectors to replace existing hydrant connectors and hydrant rehabilitation. This project will standardize fire protection equipment throughout the City and improve hydrant performance. **Table 6-1** summarizes the costs of the water system capacity CIP for the City of Alvin. **Table 6-2** summarizes the costs of the water system rehabilitation CIP for the City of Alvin. Detailed cost estimates are included in **Appendix A**.

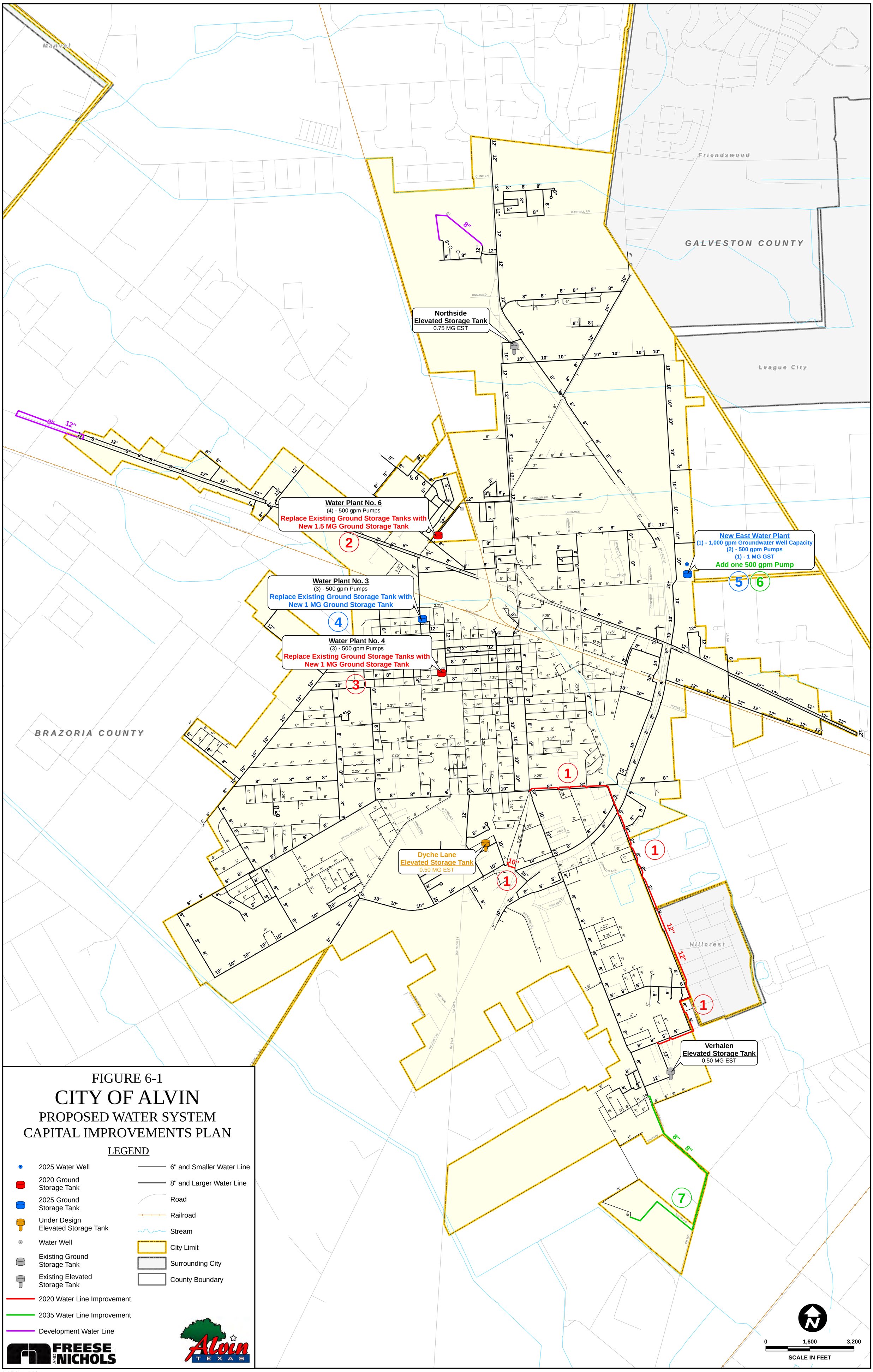

FIGURE 6-1

CITY OF ALVIN

PROPOSED WATER SYSTEM CAPITAL IMPROVEMENTS PLAN

LEGEND

- 2025 Water Well
- 2020 Ground Storage Tank
- 2025 Ground Storage Tank
- Under Design Elevated Storage Tank
- Water Well
- Existing Ground Storage Tank
- Existing Elevated Storage Tank
- 2020 Water Line Improvement
- 2035 Water Line Improvement
- Development Water Line
- 6" and Smaller Water Line
- 8" and Larger Water Line
- Road
- Railroad
- Stream
- City Limit
- Surrounding City
- County Boundary

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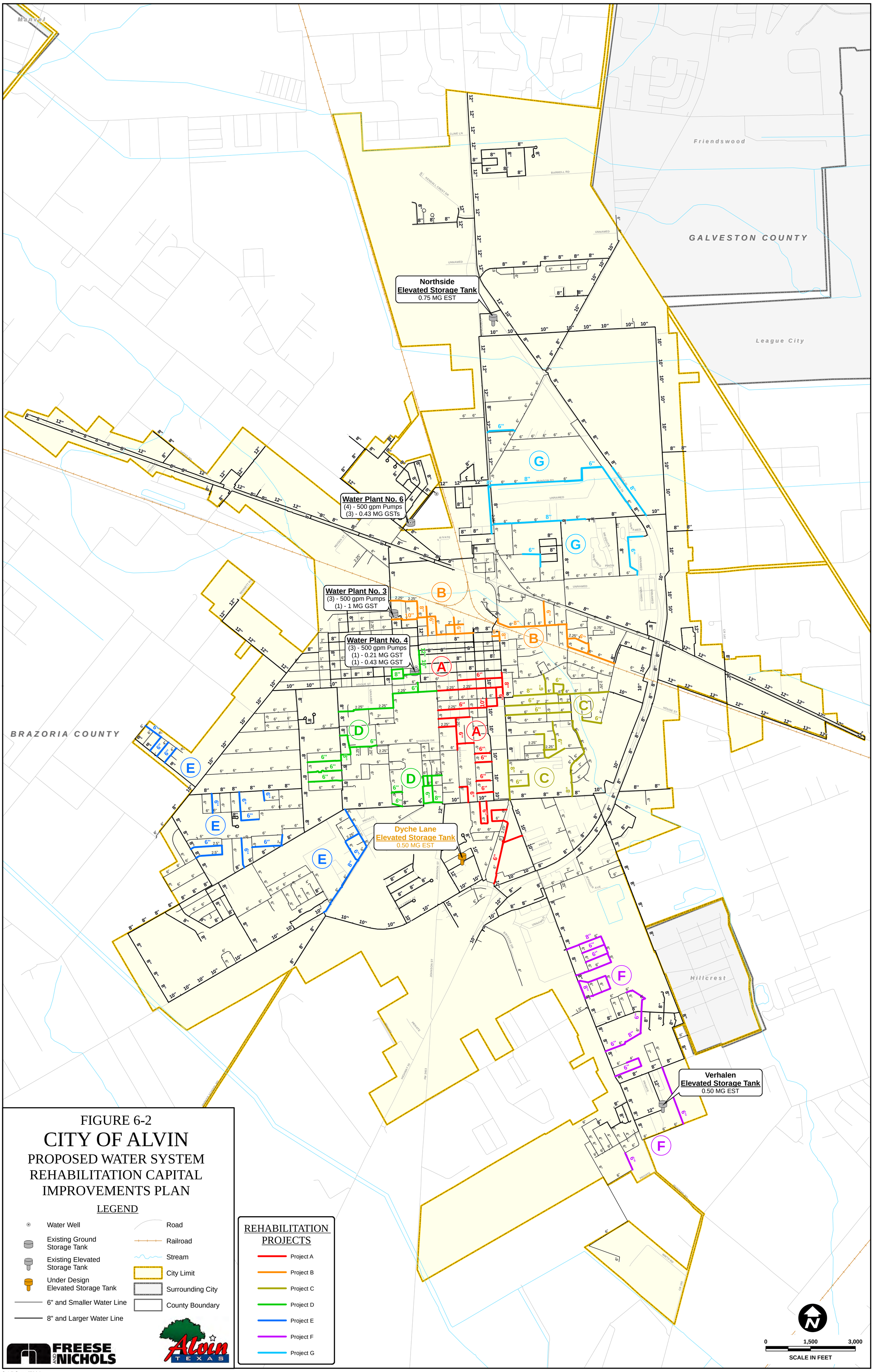

FIGURE 6-2

CITY OF ALVIN

PROPOSED WATER SYSTEM REHABILITATION CAPITAL IMPROVEMENTS PLAN

LEGEND

- Water Well
- Existing Ground Storage Tank
- Existing Elevated Storage Tank
- Under Design Elevated Storage Tank
- 6" and Smaller Water Line
- 8" and Larger Water Line
- Road
- Railroad
- Stream
- City Limit
- Surrounding City
- County Boundary

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Table 6-1: Water System Capacity Capital Improvements Plan Summary

Phase	Project	Water System Capacity Capital Improvements Plan	Cost
2020	1	Fairway Drive and South Street Water Line Improvements	$ 4,022,400
	2	Water Plant No. 6 Ground Storage Tank Replacement	$ 3,159,000
	3	Water Plant No. 4 Ground Storage Tank Replacement	$ 2,106,000
Total 2015 - 2020			**$ 7,181,400**
2025	4	Water Plant No. 3 Ground Storage Tank Replacement	$ 2,106,000
	5	East Water Plant	$ 5,304,000
Total 2020 - 2025			**$ 7,410,000**
2035	6	East Water Plant Pump Expansion	$ 78,000
	7	WWTP Water Line Improvements	$ 1,565,100
Total 2025 - 2035			**$ 1,643,100**
		Total	**$ 16,234,500**

Table 6-2: Water System Rehabilitation Capital Improvements Plan Summary

Project	Water System Rehabilitation Capital Improvements Plan	Cost
A	Water Line Improvements Phase 1	$ 3,064,600
B	Water Line Improvements Phase 2	$ 2,531,900
C	Water Line Improvements Phase 3	$ 3,063,900
D	Water Line Improvements Phase 4	$ 2,795,300
E	Water Line Improvements Phase 5	$ 2,444,000
F	Water Line Improvements Phase 6	$ 2,592,800
G	Water Line Improvements Phase 7	$ 3,114,800
H	Fire Hydrant Connection Retrofitting	$ 397,800
	Total	**$ 20,005,100**

7.0 EXISTING WASTEWATER SYSTEM

The City of Alvin's wastewater system consists of 42 lift stations and associated force mains, a wastewater treatment plant and a network of gravity mains and force mains ranging from 3-inches to 42-inches. The existing wastewater system is shown on **Figure 7-1.**

7.1 WASTEWATER TREATMENT PLANT

The City of Alvin owns and operates one wastewater treatment plant (WWTP). The plant has a current permitted capacity of 5.0 MGD annual average day flow (AADF) and 15 MGD peak 2-hour flow. The flow to the treatment plant is conveyed through parallel 27 inch and 33 inch gravity mains that converge into a single 42 inch pipe before entering the WWTP at the mechanical bar screen and influent lift station.

7.2 LIFT STATIONS

The City owns and maintains 42 lift stations including the influent lift station at the wastewater treatment plant. FNI assembled a lift station inventory using data obtained from City staff, the City's *1999 Carter & Burgess WWMP Report*, 2 foot contours, field data obtained from ADS, and as-built drawings. This lift station inventory was provided to City staff as a separate deliverable as part of the 2015 Utility Master Plan.

7.3 COLLECTION SYSTEM

The City of Alvin's existing wastewater system consists of 144 miles of collector mains, interceptors and force mains. Pipeline diameters range in size from 3 inches to 42 inches. The majority of the system is comprised of 6 inch and 8 inch wastewater lines that commonly serve subdivisions, neighborhoods, and small commercial areas throughout the City. The main interceptors south of the Highway 35 Bypass are 27 inch and 33 inch lines.

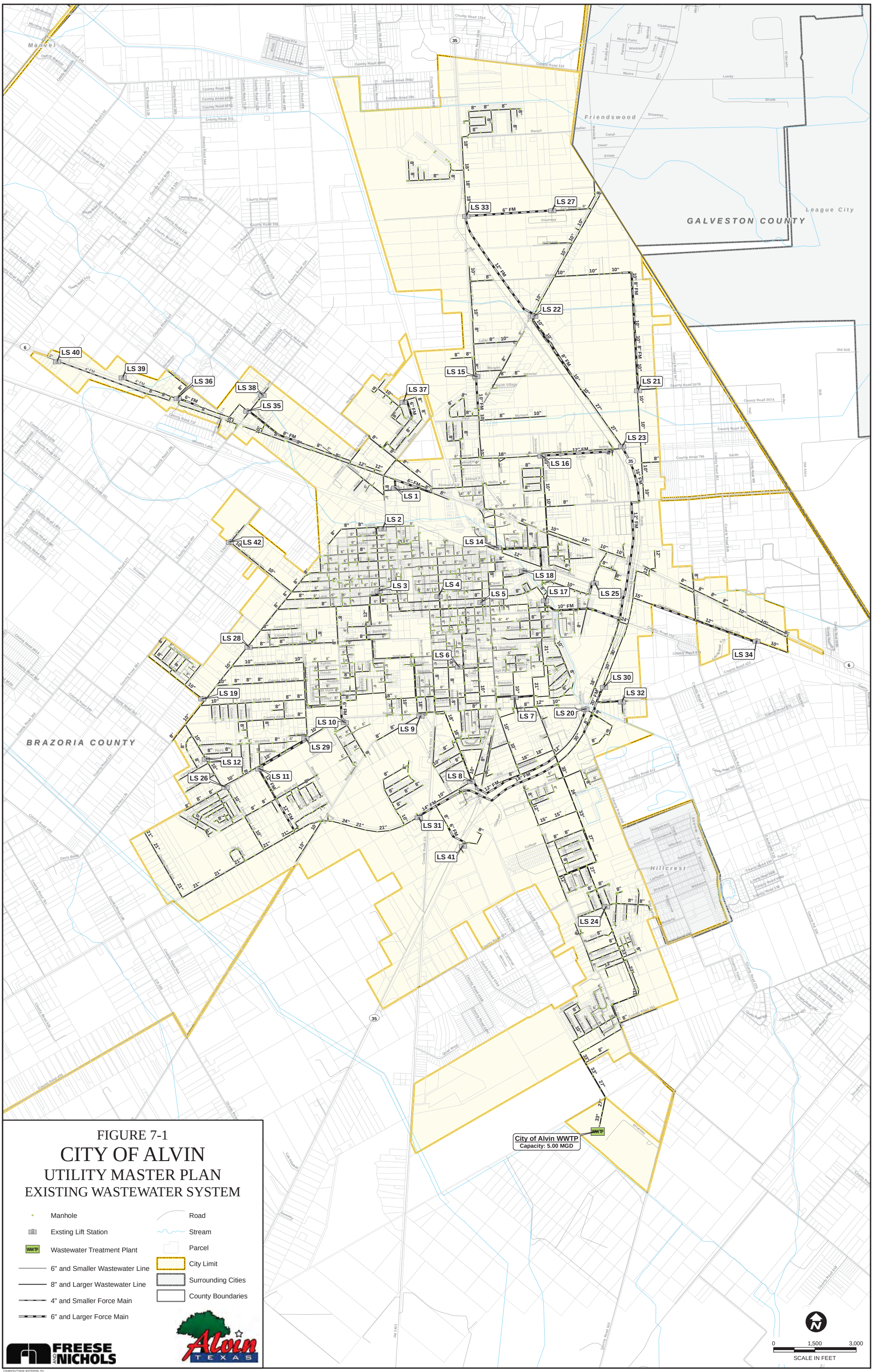

FIGURE 7-1

CITY OF ALVIN

UTILITY MASTER PLAN

EXISTING WASTEWATER SYSTEM

- Manhole
- Exsting Lift Station
- Wastewater Treatment Plant
- 6" and Smaller Wastewater Line
- 8" and Larger Wastewater Line
- 4" and Smaller Force Main
- 6" and Larger Force Main
- Road
- Stream
- Parcel
- City Limit
- Surrounding Cities
- County Boundaries

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8.0 WASTEWATER FLOW MONITORING

8.1 INTRODUCTION

FNI retained ADS Environmental Services (ADS) to conduct flow monitoring and record rainfall throughout the City of Alvin. The goal of this task was to gather wastewater flow data for use in the wastewater system study. The data will be used to characterize dry weather and wet weather flow at key points within the wastewater system, evaluate wet weather infiltration/inflow (I/I), and calibrate the hydraulic model of the collection system.

8.2 DATA COLLECTION

Dry weather and wet weather performance within the existing wastewater system was evaluated by installing sewer flow monitors to observe and document existing flow conditions. Rainfall data was simultaneously collected with a rain gauge. A total eight flow monitors and one rain gauge were used for this study. All flow monitors and the rain gauge were installed and maintained by ADS.

8.2.1 Field Testing Period

ADS flow monitors were installed on two separate days in May, 2014. Four of the meters were installed on Thursday, May 8th and the remaining four meters were installed on Thursday, May 15th. The rain gauge was installed on May 8th, 2014. The flow monitoring period started on May 15th, 2014 and continued through July 8th, 2014 for a total of 55 days, as shown on **Figure 8-1.**

Figure 8-1: Field Testing Period

8.2.2 Flow Monitor and Rain Gauge Placement

Flow monitoring locations were chosen to support the goals of the wastewater system study and overall Utility Master Plan project. FNI provided initial recommendations for flow monitor placement, and final locations were chosen by ADS field personnel following site investigations. The 8 flow meter locations were used to delineate 7 sewer basins within the existing Alvin wastewater system. Due to interconnected gravity mains, the sewer network defined by flow monitors SO-01 and SO-02 was combined into one basin. The locations of the flow monitors are provided in **Table 8-1**. The sewer basins, flow monitors, and rain gauge locations are shown on **Figure 8-2**. A schematic of the flow monitor network and sewer basins is shown on **Figure 8-3**. Site installation reports with more detailed location information for the flow monitors and rain gauge are provided in **Appendix E**.

Table 8-1: Flow Monitor Locations

Basin Name	Flow Monitor ID	GIS Manhole ID	Line Diameter (in)
Northwest	NW-01	5-E-17	18
Northeast	NE-01	1-I-12	30
West-Central	WC-01	2-A-3	24
Central	CE-01	3-E-54A	18
East-Central	EC-01	1-J-4	24
Western	WE-01	4-A-5	24
Southern	SO-01	1-B-17	33
	SO-02	1-C-2	27

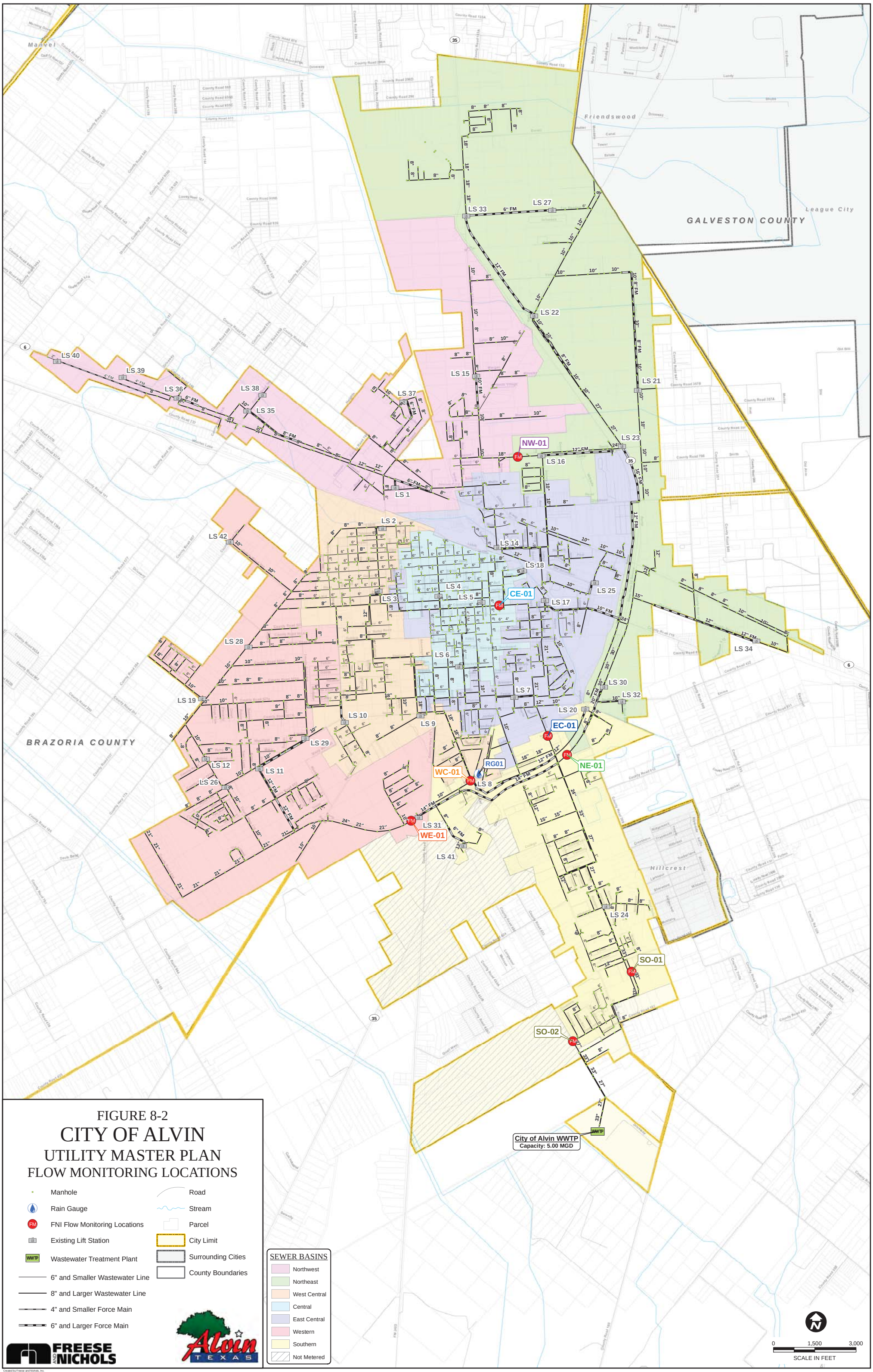

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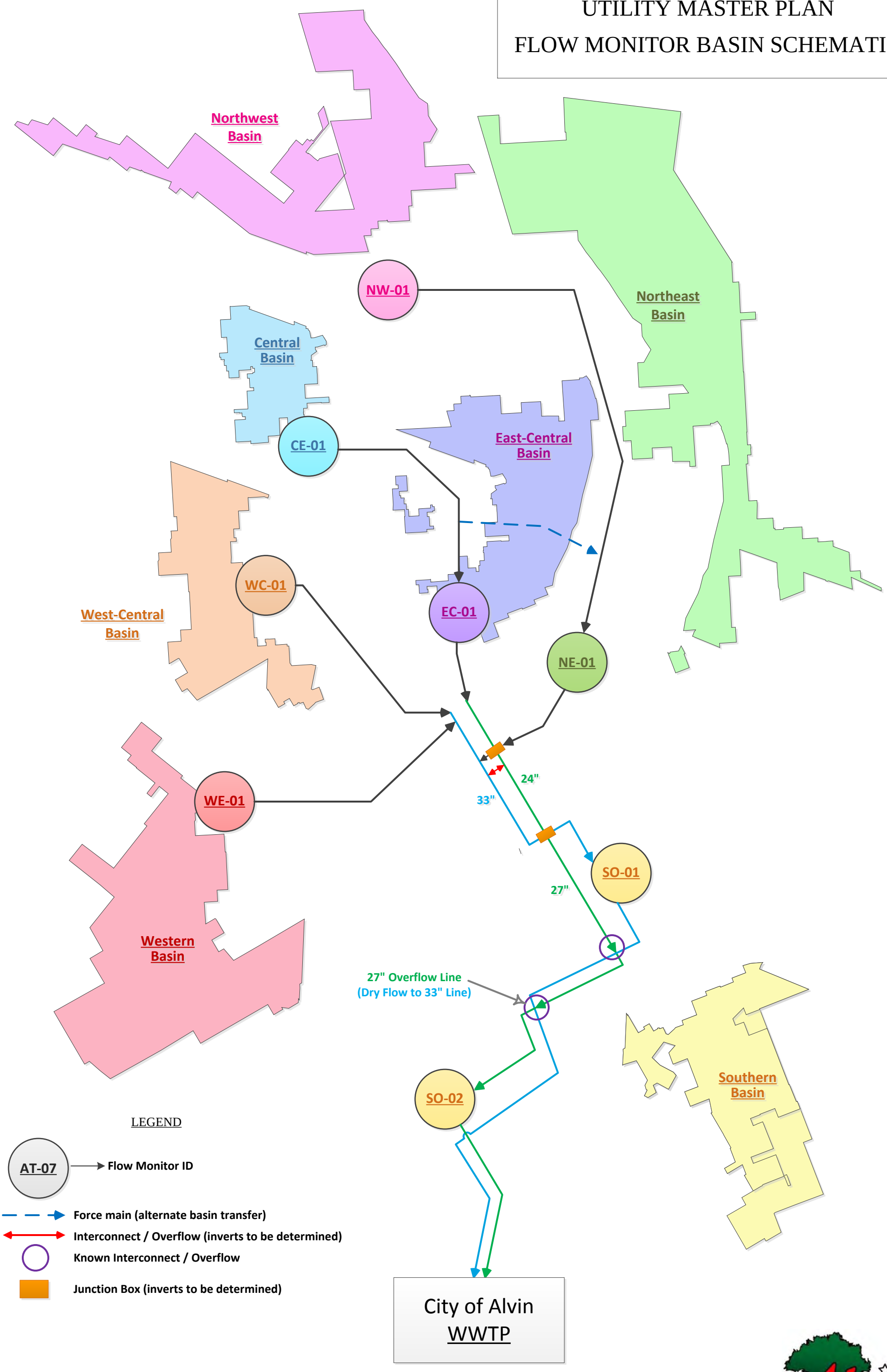
FIGURE 8-3

CITY OF ALVIN

UTILITY MASTER PLAN

FLOW MONITOR BASIN SCHEMATIC



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8.2.3 Flow Monitor and Rain Gauge Equipment

Sewer flow monitoring was performed using area-velocity flow monitors manufactured, installed, and maintained by ADS. Flow monitors were mounted near the top of each manhole and were connected to flow, depth, and velocity sensors positioned in the incoming sewer pipe. Each flow monitor was equipped with an ultrasonic depth sensor mounted at the crown of the sewer line and a velocity sensor mounted at or near the invert of the sewer line. A pressure depth sensor was also mounted at or near the invert to measure surcharge depths. For each flow monitor location, the following procedures were followed:

- *Site Investigation* – ADS reviewed available sewer maps and verifies preliminary flow monitor locations. A trained field crew investigated each identified location to confirm whether suitable hydraulic conditions exist. Where needed, flow monitoring sites were relocated upstream or downstream from the suggested location in order to obtain better hydraulic conditions, provide better access, or mitigate safety concerns.
- *Equipment Installation* – Following final site selection, flow monitors were installed using a stainless steel band with attached sensors (ultrasonic depth, velocity, and pressure depth).
- *Sensor Calibration* – Prior to exiting the manhole, independent measurements of flow, depth, and velocity were obtained and compared to the recorded measurements by the flow monitor. These measurements were used to compute any depth and velocity adjustments needed to fine-tune the recorded measurements by the flow monitor.
- *Routine Maintenance* – Each temporary flow monitor location was visited weekly to collect data. During each visit, the flow data was reviewed on-site to verify data quality, the flow monitor battery was checked, and the sensors were cleaned, if necessary. Independent flow depth and velocity measurements were obtained to confirm the accuracy of the flow monitor.

Rainfall during the study period was captured using a standard tipping bucket rain gauge (TBRG). This type of rain gauge is the most common technology available and operates by funneling rainfall to a bucket assembly that is divided into two equal compartments. When one compartment has collected a known amount of rainfall, the bucket tips and drains its contents. As the first compartment tips, the second compartment is positioned under the funnel, and the time that the tip occurs is recorded. Each tip of the bucket generates an electronic pulse that is recorded by an ADS RainAlert II data logger.

8.2.4 Flow Monitor and Rain Gauge Data

Flow monitor and rain gauge data was collected in 15 minute time step intervals. Hydrographs for each flow monitor site are provided in **Appendix F**. These hydrographs display flow rate data vs. time for the duration of the field testing period, along with the observed rainfall intensities. Diurnal patterns were developed for each flow monitor basin. These diurnals represent the dry weather flow patterns within each flow monitor basin, and are also provided in **Appendix F**.

8.3 FLOW MONITORING DATA EVALUATION

The flow monitor and rain gauge data was evaluated by ADS and reviewed by FNI. The following sections summarize the dry weather flow data and the wet weather flow and rain gauge data throughout the field testing period.

8.3.1 Rain Gauge Data Evaluation

A total of five storms were observed during the flow monitoring period (May 15th – July 8th). This rainfall, and associated measured flow responses, was used to calibrate the hydraulic model to observed wet weather conditions. Storm durations and total rainfall amounts for the observed storms during the field testing period are provided in **Table 8-2**. The observed 15-minute rainfall intensities are plotted with the flow monitor data on the hydrographs in **Appendix F**.

Table 8-2: Storm Event Data During Flow Monitoring

Storm Date	Duration (min)	Duration (hours)	Total Rain (in)
5/27/2014	660	11	0.85
5/28/2014	780	13	2.47
5/30/2014	2,160	36	0.81
7/5/2014	180	3	1.01
7/6/2014	480	8	0.65

8.3.2 Flow Rates and Peaking Factors

Dry weather flow conditions are characterized by evaluating flow monitor data observed during normal conditions, excluding wet weather events and the periods associated with the recovery from these events. The average dry weather and maximum dry weather flow rates are determined from the dry weather diurnal pattern for each flow monitor location and are summarized in **Table 8-3**. The resulting dry weather

peaking factor (PF_D) is also provided. The 2-hour peak wet weather flow rate for each flow monitor location is also provided, along with the corresponding wet weather peaking factor (PF_W).

Table 8-3: Dry Weather and Wet Weather Flow Rates

Flow Monitor ID	Average Dry Weather Flow (MGD)	Maximum Dry Weather Flow (MGD)	2-hr Peak Wet Weather Flow (MGD)	Dry Weather Peaking Factor - PF_D Max Dry Flow / Average Dry Flow	Wet Weather Peaking Factor - PF_W Peak Wet Flow / Average Dry Flow
NW-01	0.19	0.24	2.48	1.3	13.1
NE-01	0.64	0.85	3.34	1.3	5.2
WC-01	0.34	0.46	3.51	1.4	10.3
CE-01	0.27	0.32	1.44	1.2	5.3
EC-01	0.39	0.61	2.02	1.6	5.2
WE-01	0.68	0.88	2.35	1.3	3.5
SO-01	1.65	2.08	7.34	1.3	4.4
SO-02	0.11	0.14	2.98	1.3	N/A (1)

(1) The pipe monitored by SO-02 functions as a wet weather overflow line; therefore, a peaking factor would not be a representative value.

Peaking factors are commonly used to estimate maximum flow rates based on average flow rates and play a key role in sewer design. The highest peaking factor observed during this project was a value of 13.2 at flow monitor NW-01, which occurred during the storm event that began on May 28, 2014.

8.3.3 Depth-to-Diameter Ratios

The maximum flow depths observed during dry weather and wet weather and their corresponding flow depth-to-diameter (d/D) ratios observed during the study period are provided in **Table 8-4**. Depth-to-diameter ratios are used to identify capacity issues in wastewater systems.

8.3.4 Rain Dependent Inflow and Infiltration (I/I)

Rain dependent I/I is defined as extraneous flow that enters a sewer system both during and after wet weather. Inflow normally occurs during storm events and immediately thereafter. Wet weather infiltration can be identified as a delayed reaction to rainfall primarily due to rainfall percolation through the soil.

Table 8-4: Dry Weather and Wet Weather Depth-to-Diameter Ratios

Flow Monitor ID	Field Verified Pipe Inner Diameter (in)	Max Dry Depth (in)	Dry Weather d / D	Max Wet Depth (in)	Wet Weather d / D	Surcharge Depth (ft)
NW-01	16.75	4.1	24%	101	601%	7.0
NE-01	28.75	7.7	27%	100	349%	5.9
WC-01	23	8.1	35%	96	418%	6.1
CE-01	16.75	6.0	36%	24	144%	0.6
EC-01	23	6.5	28%	94	409%	5.9
WE-01	23	7.1	31%	134	581%	9.3
SO-01	32	12.8	40%	107	335%	6.3
SO-02	26	3.1	12%	73	279%	3.9

Discrete I/I per flow monitor basin was calculated by plotting the flow responses to the observed storm events and subtracting out any upstream basin flows. The I/I for a 2.5-inch storm (largest observed storm during the field testing period) was then calculated for each basin. Each sewer basin's I/I was calculated as a volume in MG, which was then divided by the linear footage of gravity mains in that basin to calculate I/I as gal/LF of pipe. The results of the I/I analysis are presented in **Table 8-5**.

Table 8-5: Summary of I/I by Wastewater Basin

Basin	Flow Monitor ID	Basin I/I (MG)	Linear Footage of Gravity Mains	Basin I/I (Gal/LF)
Northwest	NW-01	1.07	73,667	14.5
Northeast	NE-01	1.04	82,968	12.5
West-Central	WC-01	0.99	107,133	9.2
Central	CE-01	0.36	71,929	5.0
East-Central	EC-01	0.24	115,826	2.1
Western	WE-01	0.30	130,973	2.3
Southern (1)	SO-01 & SO-02	1.32	95,584	13.8

(1) Flows from the two monitor sites in the Southern Basin were combined to calculate this basin's I/I.

8.4 CONCLUSIONS

The flow monitor and rain gauge data provided information that was the basis for the wastewater modeling and CIP development portions of the Alvin Utility Master Plan. The results of the data analysis are presented below.

8.4.1 Hydraulic Model Calibration

The 15-minute data collected from the temporary flow monitors and rain gauge is suitable to calibrate the hydraulic model. The week of May 19th provides good data for dry weather calibration. Storm events from late May and early July each provide good data for wet weather calibration. The hydraulic model was calibrated to dry weather flows from the week of May 19th, and wet weather flows from the May 27 and May 28, 2014 storms.

8.4.2 Dry Weather Performance Summary

Observed peaking factors and d/D ratios indicate that under dry weather flow conditions, the existing wastewater system has adequate capacity to convey sewer flows.

8.4.3 Wet Weather and Rain-Dependent I/I Summary

Wet weather flows indicate large amounts of I/I in portions of the wastewater system. Every flow monitor location surcharged during the 2.5-inch rain event. Only flow monitor sites SO-01 and SO-02 surcharged as a result of the (comparatively) smaller rain events in early July.

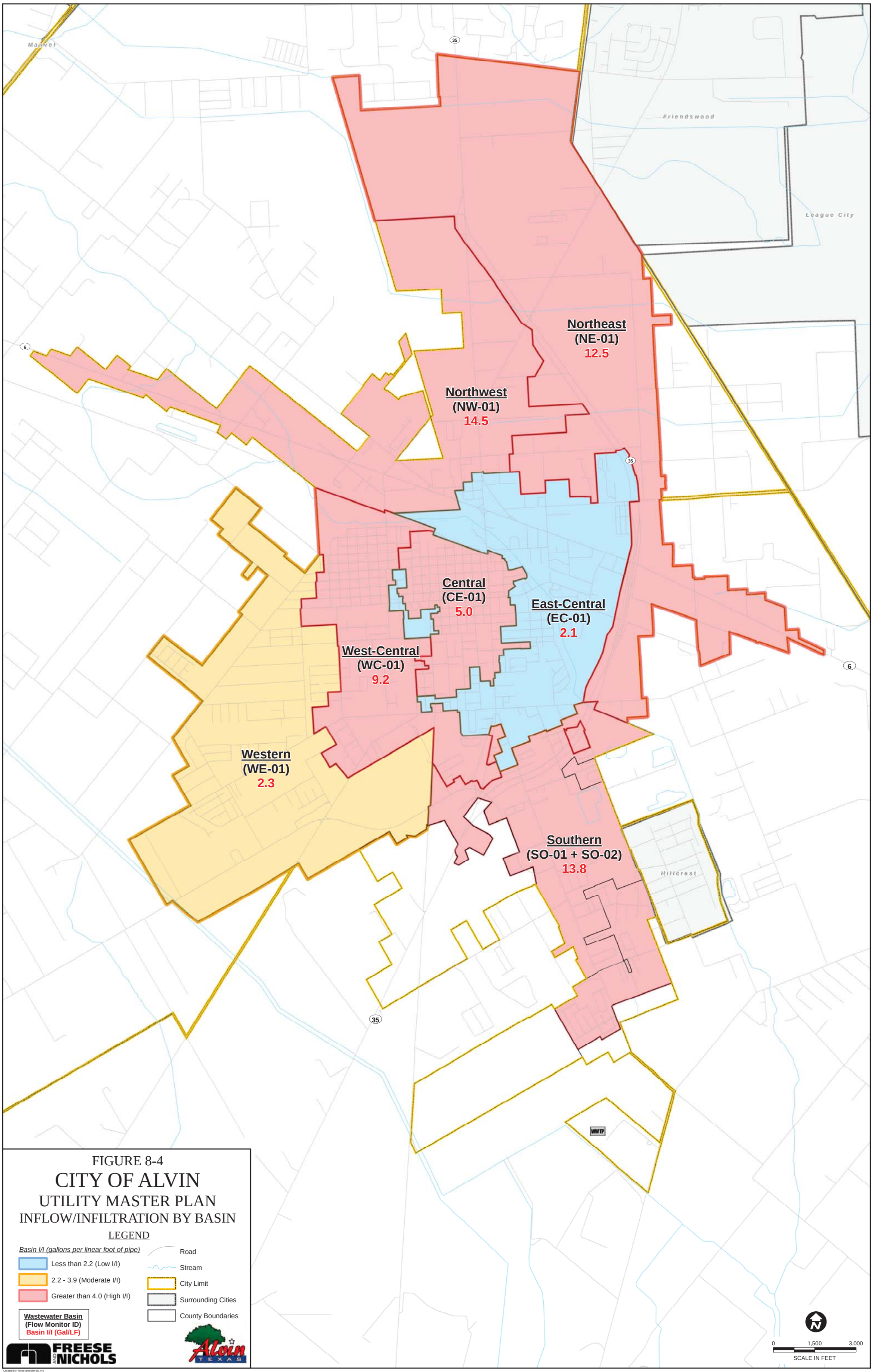
Calculating the discrete I/I per flow monitor basin can help identify which basins should be prioritized for future condition assessment work. The seven wastewater basins identified in this wastewater system evaluation are shown on **Figure 8-4**. The amount of inflow and infiltration within each basin has been categorized as high, moderate, or low. These categories, as well as basin priority rankings for condition assessment work, are presented in **Table 8-6**.

Table 8-6: Summary of Basin Inflow and Infiltration

Basin	Flow Monitor ID	Basin Priority Ranking	Basin I/I (Gal/LF)
Northwest	NW-01	1	**14.5**
Southern	SO-01 & SO-02	2	**13.8**
Northeast	NE-01	3	**12.5**
West Central	WC-01	4	**9.2**
Central	CE-01	5	**5.0**
Western	WE-01	6	**2.3**
East Central	EC-01	7	**2.1**

Categories of Inflow and Infiltration

(Gal/LF)	Description
I/I Greater than 4.0	*High* amount of I/I
I/I Between 2.2 - 3.9	*Moderate* amount of I/I
I/I Less than 2.2	*Low* amount of I/I



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9.0 WASTEWATER FLOW PROJECTIONS

9.1 HISTORICAL WASTEWATER FLOWS

Wastewater flows in a municipal collection system vary by time of day, wastewater discharge source, and weather conditions. Average daily flow is defined as the total wastewater flow over a one year period divided by the number of days in that year. Wastewater treatment plants are typically sized in terms of average daily flow. The collection system must be able to convey the peak flows that result from a design level storm event.

FNI analyzed flow data provided by the City from 2010 through 2014 to determine the historical trends in system-wide average day wastewater flow and per-capita flow. The citywide per-capita flow rate ranged from 94 gpcd in 2014 to 122 gpcd in 2010. The average flow rate to the plant over the past five years was 2.69 MGD, which equates to an average per capita of 107 gpcd. **Table 9-1** is a summary of the historical wastewater flows.

Table 9-1: Historical Wastewater Flows

Year	Population	Average WWTP Flow (MGD)	Per Capita Flow (gpcd)	Average Peak 2-Hour Flow (MGD) (1)	Annual Rainfall (inches)
2010	24,236	2.96	122	-	29.5
2011	24,721	2.48	100	-	26.1
2012	25,215	2.86	113	-	47.1
2013	25,719	2.67	104	5.07	34.3
2014	26,234	2.46	94	4.72	-
Average	**-**	**2.69**	**107**	**4.90**	**34.3**

(1) The City did not provide data for 2010 – 2012.

9.2 POPULATION AND PROJECTED WASTEWATER FLOWS

Projected wastewater flows for the 2015, 2020, 2025, and 2035 planning periods were developed by analyzing the historical wastewater flow rates, 2014 flow monitoring data, and projected residential and commercial developments in the City. The wastewater flows were based on the populations developed in **Section 2.0**. FNI developed projected wastewater flows for each of the seven wastewater basins and assigned the future flows to the model subcatchments.

9.2.1 Existing Population and Wastewater Flows

The 2015 population of 26,759 was distributed to the wastewater basins based on the geocoded meter billing data. FNI utilized the flow monitoring data from May 15 – July 8, 2014 to distribute the existing average day wastewater flows to the basins.

9.2.2 Projected Population and Wastewater Flows

As discussed in **Section 3.0**, FNI used 130 gpcd for future water demands, with a density of 4 LUEs (1,206 gpcd) per acre to predict commercial water demand. Based on historical water production and wastewater flow data, FNI selected a 90% return rate for all future wastewater flows. The resulting gpcd for future residential flows was 117, and the resulting gallons per acre day (gpad) is 1,100 for future commercial flows. These wastewater flow projections were added to the existing wastewater flows in each basin to determine the projected future average day flows.

9.2.3 Projected Peak Wastewater Flows

The wastewater flow monitoring data was used to develop peaking factors to correlate the average day flow in each wastewater basin to a peak wet weather flow. Peaking factors greater than 4 are considered high. Five of the seven wastewater basins were observed to have peaking factors greater than 4. The high peaking factors are contributing to capacity issues in the existing system. FNI is recommending that the Northwest, Northeast and West Central Basins be prioritized for sanitary sewer evaluation survey (SSES). Recommendations for SSES work are discussed in **Section11.0**. FNI assumed that a reduction in I/I would be achieved, and utilized reduced peaking factors to compute future peak flows in these three basins. **Table 9-2** through **9-5** provide a breakdown of the projected populations and the average day and peak wastewater flows by basin for each planning period.

Table 9-2: 2015 Wastewater Flows by Basin

Basin	Served Population	Average Day Flow (MGD) (1)	Peak Wet Weather Flow (MGD)	Instantaneous Wet Weather Peaking Factor
Northwest	1,231	0.21	2.79	13.3
Northeast	2,204	0.50	3.38	6.8
West-Central	3,711	0.38	4.09	10.9
Central	2,792	0.30	1.82	6.1
East-Central	5,449	0.13	0.78	5.9
Western	5,269	0.75	3.68	4.9
Southern	6,102	0.20	0.93	4.7
Total	**26,759**	**2.46**	**-**	**-**

(1) 2015 Average Day Flow (ADF) based on May 15 - July 8, 2014 flow monitoring and 2014 WWTP historical flow data.

Table 9-3: 2020 Wastewater Flows by Basin

Basin	Served Population	Average Day Flow (MGD)	Peak Wet Weather Flow (MGD)	Resulting Wet Weather Peaking Factor(1)
Northwest	1,413	0.29	1.99	6.9
Northeast	3,380	0.67	3.42	5.1
West-Central	3,907	0.38	3.49	9.3
Central	2,939	0.30	1.82	6.1
East-Central	5,769	0.14	0.80	5.8
Western	5,711	0.77	3.75	4.9
Southern	6,424	0.22	1.01	4.6
Total	**29,544**	**2.75**	**-**	**-**

(1) Reduction in peaking factors due to anticipated rehabilitation and impact of new infrastructure for future growth.

Table 9-4: 2025 Wastewater Flows by Basin

Basin	Served Population	Average Day Flow (MGD)	Peak Wet Weather Flow (MGD)	Resulting Wet Weather Peaking Factor(1)
Northwest	2,293	0.44	2.60	5.9
Northeast	5,176	0.81	4.00	4.9
West-Central	3,922	0.38	3.49	9.3
Central	2,950	0.30	1.82	6.1
East-Central	5,942	0.15	0.85	5.7
Western	5,888	0.77	3.75	4.9
Southern	6,448	0.23	1.08	4.6
Total	**32,618**	**3.08**	**-**	**-**

(1) Reduction in peaking factors due to anticipated rehabilitation and impact of new infrastructure for future growth.

Table 9-5: 2035 Wastewater Flows by Basin

Basin	Served Population	Average Day Flow (MGD)	Peak Wet Weather Flow (MGD)	Resulting Wet Weather Peaking Factor(1)
Northwest	4,476	0.74	3.81	5.1
Northeast	8,253	1.10	5.16	4.7
West-Central	3,990	0.39	3.53	9.1
Central	2,981	0.31	1.84	6.0
East-Central	6,510	0.21	1.09	5.2
Western	6,691	0.87	4.17	4.8
Southern	6,862	0.33	1.45	4.4
Total	**39,762**	**3.95**	**-**	**-**

(1) Reduction in peaking factors due to anticipated rehabilitation and impact of new infrastructure for future growth.

10.0 WASTEWATER SYSTEM ANALYSES AND HYDRAULIC MODELING

10.1 WASTEWATER MODEL DEVELOPMENT

10.1.1 Modeled Network

FNI selected InfoWorks® ICM (ICM) hydraulic modeling software by *Innovyze* to build and calibrate the hydraulic model of the Alvin wastewater system. The wastewater model consists of gravity pipes 8 inches and larger, all lift stations and associated force mains, and the WWTP head works and influent lift station. The model consists of approximately 1,996 links and 2,012 nodes, including 1 outfall, 42 lift stations, and 90 pumps.

10.1.2 Network Development

The City's GIS was imported into ICM to serve as the basis for the hydraulic model. FNI reviewed the conduit (pipe) and node (manhole) data in the model for proper connectivity. Pipes were reviewed to check for missing invert levels and diameters, and manholes were reviewed to check for missing ground levels (manhole rim elevations). Missing pipe invert and diameter fields were populated using data from the City's *1999 Carter & Burgess WWMP Report*, manhole measure downs provided by the City, incoming inverts at each lift station wet well obtained by ADS, as-built drawings, interpolation, engineering judgment, or by assigning minimum slopes from the Texas Commission on Environmental Quality (TCEQ). **Table 10-1** shows TCEQ minimum slope requirements. Missing ground level fields were populated using survey information provided by the City, 2-ft contours, information from as-built drawings, and the City's *1999 Carter & Burgess WWMP Report*.

10.1.3 Wastewater System Field Data Collection

Field data collection was performed by ADS to collect information on each lift station. This information was utilized to populate missing GIS attribute data at the lift stations, allowing them to be incorporated into the hydraulic model. Data obtained at each lift station included incoming pipe inverts, pump On/Off levels, and wet well geometry.

The City of Alvin surveyed rim elevations at 149 manholes and measure down information at 79 manholes throughout the City. This information was used to populate missing invert information and determine network connectivity for the hydraulic model. This information is included in **Appendix G**.

Table 10-1: TCEQ Minimum Slope Requirements

Pipe Size (1) (in)	Minimum Slope (ft/ft)	Maximum Slope (ft/ft)
6	0.005	12.35
8	0.0033	8.4
10	0.0025	6.23
12	0.002	4.88
15	0.0015	3.62
18	0.0011	2.83
21	0.0009	2.3
24	0.0008	1.93
27	0.0006	1.65
30	0.00055	1.43
33	0.00045	1.26

(1) Minimum slope for diameters larger than 33 inches are determined by a minimum velocity of 2 ft/s.

10.1.4 Flow Allocation

FNI allocated demands to the model using water customer billing accounts. The residential component of the wastewater flow was then generated by applying a per capita flow rate to the population stored in the model subcatchments. The commercial component of the wastewater flows was developed by using the November demands for each commercial water meter. Using data from November helps excludes water demand due to irrigation, which does not contribute to wastewater flows. These commercial loads were then added into the model subcatchments.

10.2 MODEL CALIBRATION

FNI calibrated the hydraulic model of the Alvin wastewater system to reflect flow monitor data during both dry and wet weather. Model calibration is the process of adjusting parameters within the hydraulic model until flows are generated and conveyed that closely match the wastewater flows observed during the field data collection period. A properly calibrated model serves as the foundation for any future modeling scenarios and CIP development.

10.2.1 Dry Weather Calibration

FNI calibrated the wastewater model to the week of May 19, 2014, which represented a week of dry weather flow data. The diurnal patters were applied to the residential and commercial loads within each flow monitor basin in the model. Within each flow monitor basin, the per capita flow rates were adjusted to match observed flow volumes. Iterations were performed until the model results closely reflected the observed dry weather flow data at each flow meter site. ICM model results provide the total wastewater flow volume over the dry weather calibration period, which FNI matched to the flow metering results within a tolerance of +/- 5% at most sites. This tolerance is standard for a planning level model dry weather calibration.

10.2.2 Wet Weather Calibration

The calibrated dry weather flow was utilized during wet weather calibration to represent the dry weather component of the observed flow hydrographs. Applying the calibrated dry weather flow allows the modeler to graphically identify the magnitude of I/I during wet weather calibration. The largest rain storm during the field data collection period occurred on May 28. A total of 2.47 inches of rain fell during this storm event. The day before, May 27, 0.85 inches of rain fell on the system. Wet weather calibration was performed for the combined storm events of May 27 and 28, totaling 3.32 inches of rainfall over two days. FNI utilized the RTK hydrologic routing method to calibrate to the wet weather events. The RTK method utilized three hydrographs that each contain three parameters modified to achieve calibration: flow of water represented as runoff into the system (R), the time to the peak flow (T), and the ratio of time until normalization of flow to time to peak (K). FNI calibrated the model so that generated peak wastewater flows were within the standard, wet weather planning level tolerance of +/- 10% of the observed peak flows at most sites. **Figure 10-1** and **Figure 10-2** graphically illustrate the individual RTK parameters as well as the component RTK hydrographs used during the calibration process.

Figure 10-1: RTK Parameters

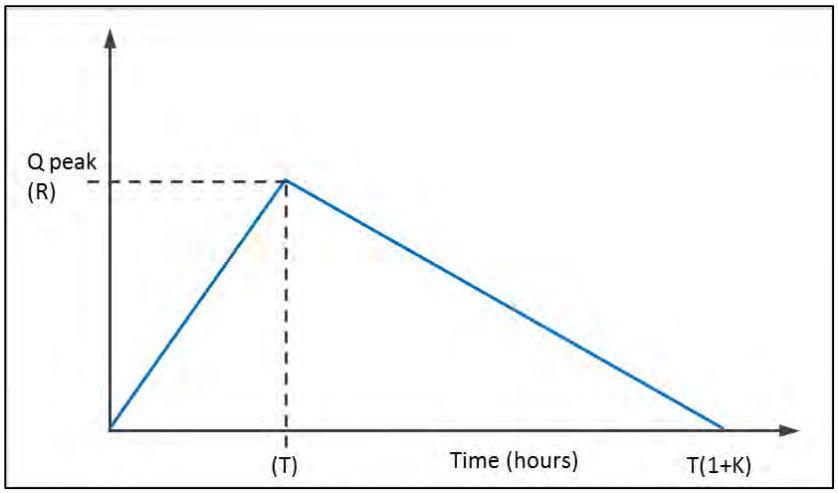
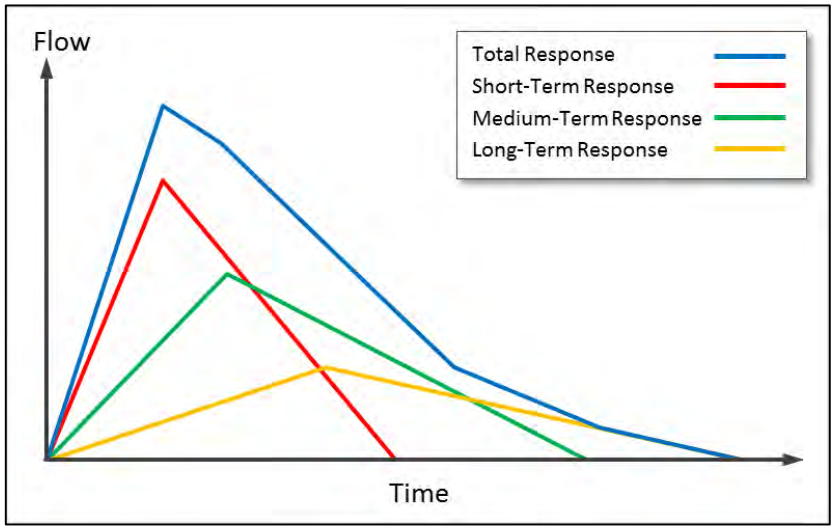


Figure 10-2: RTK Component Hydrographs



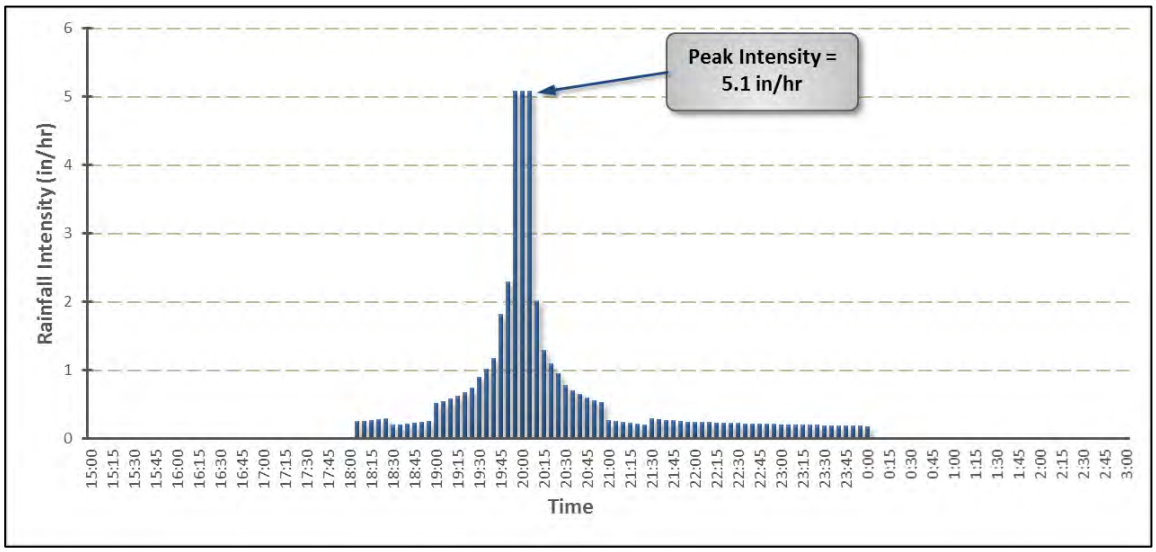
A close correlation was achieved for both the dry and wet weather calibrations, and therefore FNI is confident that the model closely matches real-world conditions and is suitable to use for hydraulic analyses and CIP development. Results of the dry and wet weather calibrations are available in **Appendix H.** The calibrated sewer model was used to identify currently needed projects as well as future upgrades and expansions to the City's sanitary sewer system.

10.3 DESIGN STORM

The existing collection system was evaluated to assess the ability of the system to adequately convey wastewater to the WWTP without excessively surcharging or overflowing. A 2-year, 6-hour design storm

was utilized for the existing and future wastewater system analysis. This size design storm is used by the City of Houston for hydraulic modeling and sizing of sewer infrastructure. The size of the design storm was determined using the historical storm event data for the region of Alvin, Texas. This historical data was analyzed and summarized in the United States Geological Survey (USGS) *Atlas of Depth-Duration Frequency of Precipitation Annual Maxima for Texas*. The 2-year, 6-hour storm event for the City of Alvin is a 3.4 inch rainfall event. The shape of the design storm hyetograph (rainfall vs. time) was developed using HEC-HMS software from the U.S. Army Corps of Engineers. The 2-year, 6-hour design storm hyetograph that was applied to the Alvin wastewater model is shown in **Figure 10-3**.

Figure 10-3: 2 year, 6 hour Design Storm Hyetograph



10.4 EXISTING WASTEWATER SYSTEM ANALYSES

The critical flow condition for analyzing a wastewater collection system is peak wet weather. Flow, depth, and velocity are important factors when analyzing the peak wet weather flow simulations. Design criteria vary, but for this wastewater system study, it was determined that the hydraulic grade line (HGL) should not exceed a depth of 1 foot from the manhole rim. When the design storm is applied to the calibrated model, the resulting effects of I/I in the system can be seen. As the storm intensifies (shown through time in **Figure 10-3**) additional flow enters the system. The model determines the point in time at which the water from the design storm event reaches a peak within the system. This peak represents the most taxing load the system experiences under the design storm event. **Figure 10-4** displays a color-coded map that illustrates the surcharge state of modeled lines and manholes under the peak conditions of a 2-year, 6-hour design storm event on the existing wastewater system. The red wastewater lines indicate

surcharging due to a lack of capacity while the blue wastewater lines indicate surcharging due to a downstream restriction. The locations of predicted sanitary sewer overflows as a result of the modeled 2-year, 6-hour design storm event are shown as red circles on the map. Locations where the predicted peak HGL rises to within 1 foot of the manhole rim are shows as yellow circles on the map. The model shows that the wastewater system experiences a large amount of surcharging during peak flow conditions. The following areas of concern were identified in the existing system scenario:

- The model results show the parallel 27 inch and 33 inch interceptors to the WWTP are surcharging due to inadequate capacity in the interceptors to convey the 2 year 6 hour peak wastewater flows.
- Flow in the Western Basin is exceeding the firm capacity of Lift Station 31. This is causing the HGL to rise upstream of the lift station, resulting in surcharging.
- Flow in the West Central Basin is exceeding the firm capacity of Lift Station 8. This is causing the HGL to rise upstream of the lift station, resulting in surcharging.
- Flow to Lift Station 16 is exceeding the station's firm capacity. Additionally, the model results show that the gravity lines upstream of Lift Station 16 are surcharging excessively, resulting in the HGL rising to within one foot of the manhole rims. The lines do not have enough capacity to convey the 2-year 6-hour design storm flow.
- Flow to Lift Station 1 is exceeding the station's firm capacity. This is causing the HGL to rise upstream of the lift station, resulting in surcharging and predicted sanitary sewer overflows under the 2-year 6-hour design storm conditions. The model is also showing that the gravity lines upstream of Lift Station 1 do not have enough capacity to convey the 2-year 6-hour design storm flow, resulting in the HGL rising further and contributing to the surcharging and predicted sewer overflows.
- Flow to Lift Station 15 is exceeding the station's firm capacity. This is causing the HGL to rise upstream of the lift station, resulting in surcharging to within one foot of the manhole rim under the 2 year 6 hour design storm conditions. The model is also showing that the gravity lines upstream of Lift Station 15 do not have enough capacity to convey the 2-year 6-hour design storm flow, resulting in the HGL rising further and contributing to the surcharging.

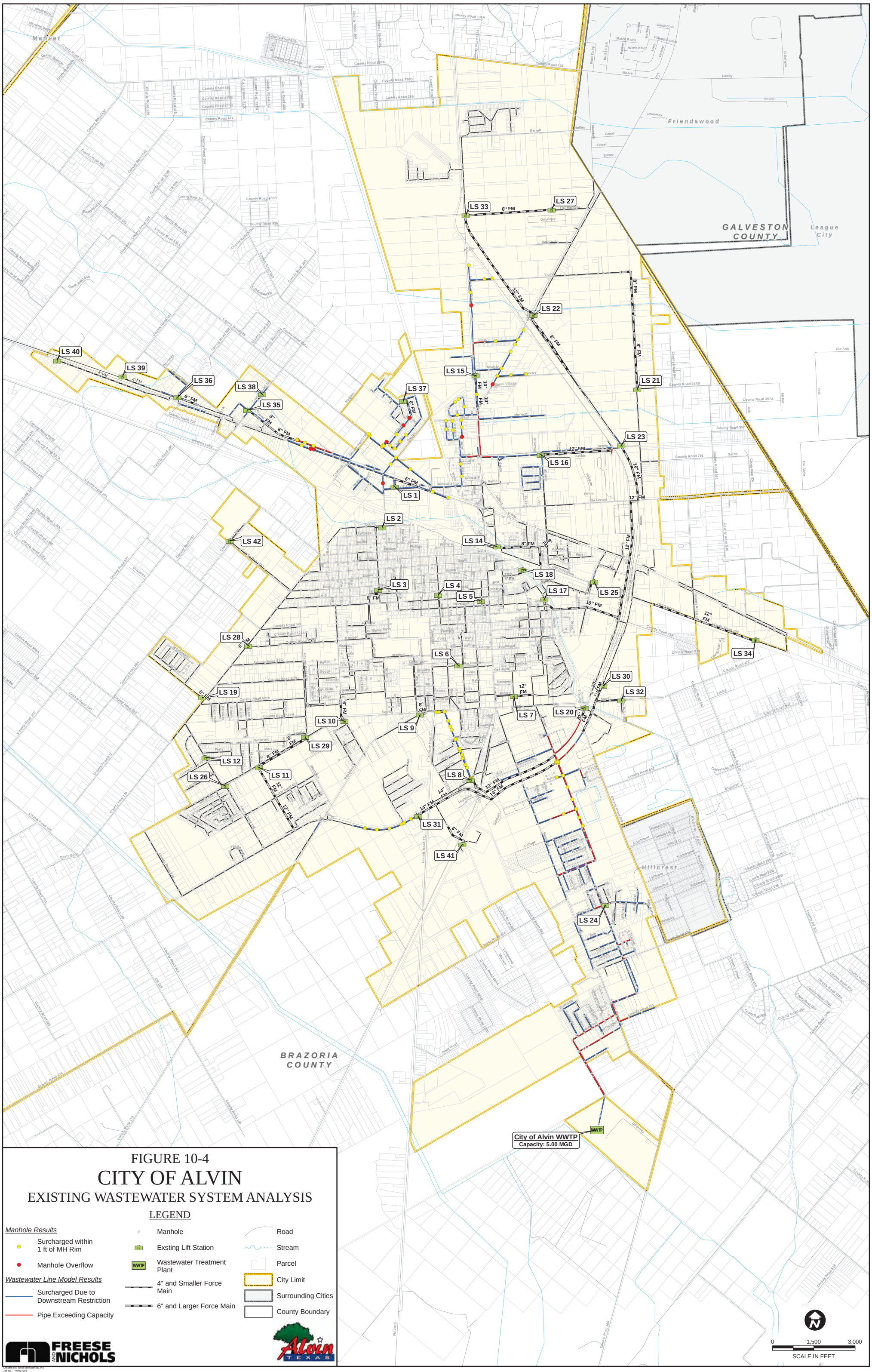


FIGURE 10-4

CITY OF ALVIN

EXISTING WASTEWATER SYSTEM ANALYSIS

LEGEND

Manhole Results

- Surcharged within 1 ft of MH Rim
- Manhole Overflow

Wastewater Line Model Results

- Surcharged Due to Downstream Restriction
- Pipe Exceeding Capacity

- Manhole
- Exsting Lift Station
- Wastewater Treatment Plant
- 4" and Smaller Force Main
- 6" and Larger Force Main
- Road
- Stream
- Parcel
- City Limit
- Surrounding Cities
- County Boundary

FREESE AND NICHOLS

Alvin TEXAS

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Updated: February 04, 2016

10.4.1 Lift Station Condition Assessment

FNI performed a condition assessment on twelve of the City's key lift stations as part of the existing system analysis. The condition assessment included a visual inspection of each lift station, performed by FNI engineering personnel on July 20, 2015. The twelve lift stations were selected based on their system criticality, pumping capacity, anticipated condition, and suspected level of I/I based on flow monitoring results. FNI developed a list of electrical, structural, mechanical, and site components to be inspected at each lift station site. A condition weighting factor was assigned to each component group based on its relative importance to the overall function of the lift station. **Table 10-2** illustrates the condition component groups and weightings used for the lift station condition assessments.

Table 10-2: Condition Assessment Component Groups & Weightings

Component Group	Weight Factor
Electrical – MCC, Back-up Power, Cables	25%
Pumps and Motors	25%
Structure - Hatches, Corrosion, Cracks, Leaking, Ventilation, Odor Control	25%
Piping and Valves	15%
Site - Drainage, Access Drive, Security, Fencing	10%
Total Weighting	**100%**

Numerical scores ranging from 1 through 5 were assigned to each component based on the physical condition as seen during the inspection. **Table 10-3** shows the guidelines used during the assignments of numerical scores for condition component groups.

Table 10-3: Scoring Guidelines for Lift Station Condition Components

Condition Rating	Description
1	**Very good** condition; no improvements recommended to maintain function
2	**Good** condition; minor improvements recommended to maintain function
3	**Fair** condition; improvements recommended to improve performance or efficiency
4	**Poor** condition; improvements recommended to maintain reliability
5	**Very poor** condition; rehabilitation or replacement required

Individual component ratings for each lift station, as well as photos and additional comments from the field visits are compiled in **Appendix I**. The twelve lift stations were grouped into three condition ratings

based on their final condition scores: **Moderate**, **Poor**, and **Very Poor**. None of the lift stations visited by FNI were considered to be in good condition. **Table 10-4** summarizes the lift station condition scores.

Table 10-4: Lift Station Condition Score Summary

Lift Station No.	Condition Score	Condition Rating
23	3.65	Very Poor
14	3.55	Very Poor
2	3.50	Very Poor
17	3.40	Very Poor
31	3.25	Poor
16	3.10	Poor
8	3.05	Poor
30	3.05	Poor
34	3.00	Poor
11	2.90	Poor
1	2.85	Moderate
3	2.25	Moderate

The results of the lift station condition assessment were used to developed rehabilitation projects that were included in the wastewater capital improvement plan. These are discussed further in **Section 11.0**.

10.5 FUTURE WASTEWATER SYSTEM ANALYSES

Wastewater system improvements were developed to accommodate the anticipated residential and non-residential growth over the next 20 years. To serve the future growth, the City of Alvin must rehabilitate, replace or upsize existing infrastructure and provide additional service to areas of growth where little or no infrastructure currently exists.

Hydraulic analyses were conducted to establish a capital improvements plan to improve the existing system and accommodate projected peak wastewater flows through 2035. FNI modeled a 2-year 6-hour design storm on the existing wastewater system with projected 2035 flows to identify the timing and size of recommended improvements. **Figure 10-5** displays a color-coded map that illustrates the surcharge state of modeled lines and manholes under the peak conditions of a 2-year, 6-hour design storm event with 2035 flows on the existing system. The red wastewater lines indicate surcharging due to a lack of capacity while the blue wastewater lines indicate surcharging due to a downstream restriction. The locations of predicted sanitary sewer overflows as a result of the modeled 2-year, 6-hour design storm

event are shown as red circles on the map. Locations where the predicted peak HGL rises to within 1 foot of the manhole rim are shows as yellow circles on the map. Lift stations with red labels have projected 2035 peak wastewater flows that exceed the firm pumping capacities of the lift stations. The model shows that the wastewater system continues to experience a large amount of surcharging during peak flow conditions. The following areas of concern were identified in the 2035 scenario:

- The parallel 27 inch 33 inch interceptors to the WWTP are experiencing significant surcharging due to inadequate capacity in the interceptors to convey the projected 2035 flows under a 2-year 6-hour design storm.
- Flow in the Western Basin is exceeding the firm capacity of Lift Station 31. This is causing the HGL to rise upstream of the lift station, resulting in additional surcharging.
- Flow in the West Central Basin is exceeding the firm capacity of Lift Station 8. This is causing the HGL to rise upstream of the lift station, resulting in surcharging.
- Flow in the Northeast Basin is exceeding the firm capacity of Lift Station 30. This is causing the HGL to rise upstream of the lift station, resulting in additional surcharging.
- Flow to Lift Station 23 is exceeding the station's firm capacity. This is causing the HGL to rise upstream of the lift station, resulting in significant surcharging to within one foot of the manhole rim.
- Flow to Lift Station 22 is exceeding the station's firm capacity. This is causing the HGL to rise upstream of the lift station, resulting in surcharging.
- Flow to Lift Station 33 is exceeding the station's firm capacity. This is causing the HGL to rise upstream of the lift station, resulting in surcharging.
- Flow to Lift Station 16 is exceeding the station's firm capacity. Additionally, the model results show that the gravity lines upstream of Lift Station 16 are surcharging excessively, resulting in multiple predicted sanitary sewer overflows. The lines do not have enough capacity to convey the 2-year 6-hour design storm flow.
- Flow to Lift Station 1 is exceeding the station's firm capacity. Peak flow from the Martha's Vineyard development is contributing to this flow. This is resulting in additional surcharging in

the gravity lines upstream of Lift Station 1, and contributing to predicted sanitary sewer overflows.

- Flow to Lift Station 15 is exceeding the station's firm capacity. This is causing the HGL to rise upstream of the lift station, resulting in surcharging to within one foot of the manhole rim under the 2-year 6-hour design storm conditions. The Kendall Lakes Light Industrial Park is contributing to this flow. The model is also showing that the gravity lines upstream of Lift Station 15 do not have enough capacity to convey the 2-year 6-hour design storm flow, resulting in the HGL rising further and contributing to the surcharging.
- The increased flow to Lift Station 35 from Martha's Vineyard will require a lift station expansion to 0.82 MGD. This will alleviate the observed surcharging upstream of the lift station.
- The increased flow to Lift Station 36 from Martha's Vineyard will require a lift station expansion to 0.55 MGD. This will alleviate the observed surcharging upstream of the lift station.

Various combinations of improvements and modifications were investigated to determine the most appropriate approach for conveying projected flows. Parameters used in developing the wastewater capital improvements plan included increasing system reliability, simplifying system operations, conveying peak wet weather flows, maintaining proper velocities, and reducing surcharging and sanitary sewer overflows. Key observations and recommendations resulting from the modeling and evaluation of the collection system are discussed in the following sections.

10.5.1 Future Wastewater Loads

As discussed in **Section 2.0**, City staff provided FNI with the locations of anticipated residential and commercial developments. The majority of these developments are concentrated in the Northeast and Northwest wastewater basins. A major focus of the hydraulic analysis concentrated on how to convey these projected peak flows efficiently to the WWTP on the southern end of the collection system. The anticipated developments, coupled with the high observed peak flow in the Northwest Basin resulted in several recommended expansions to lift station pumping capacities.

10.5.2 Wastewater Basin SSES Projects

The City of Alvin's wastewater system consists of seven wastewater basins, as identified in **Section 8.0**. Five of these basins had inflow and infiltration rates that are considered to be high (higher than 4 gal/LF

of I/I). It is recommended that the City conduct Sanitary Sewer Evaluation Surveys (SSES) throughout the Northwest, Northeast, West Central, Central, and Southern Basins to identify sources of I/I. Typical SSES studies consist of smoke testing, television inspection (CCTV), and manhole and sewer pipe inspections to determine the physical condition of wastewater assets and identify sources of I/I. Reducing I/I in the collection system will reduce peak wastewater flows and reduce the potential for sanitary sewer overflows. Additionally, the City will save money by reducing the volume of wastewater that must be treated and extending the life of the existing wastewater infrastructure. The five wastewater basin SSES projects are discussed further in **Section 11.0**.

10.5.3 TCEQ Design Criteria

When determining the size of proposed wastewater lines, TCEQ design criteria (§217.53 (l) (1)) dictate that gravity sewer lines shall be sized to maintain a minimum velocity of 2 feet/second. Maintaining these velocities discourages settling of solids. TCEQ design criteria (§217.67 (a)) also state 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 the smallest pump operating at a lift station with three or more pumps. When sizing lines for future wastewater loading, it is specifically stated in TCEQ Chapter 217 §217.53 (j) (3) that "An owner must ensure that the collection system has capacity to prevent a surcharge." Therefore, all proposed lines are sized to convey peak flows without surcharging conditions.

Lift station capacity was also analyzed under peak wet weather flow conditions. FNI recommends new lift station sizing or lift station expansion sizing to meet TCEQ requirements. TCEQ Chapter 217 §217.61 (c) states that "the firm pumping capacity of a lift station must handle the expected peak flow." Firm pumping capacity is defined as total station, maximum pumping capacity with the largest pumping unit out of service. FNI sized all new or expanded lift stations to convey the predicted peak wet weather flows.

10.5.4 Lift Station Evaluation

The Alvin wastewater system is highly dependent on lift stations to convey wastewater flows throughout the City to the WWTP on the southern end of the system. FNI completed a detailed capacity evaluation of key lift stations as part of the overall wastewater system analyses. The projected 2035 peak wastewater flows to each lift station were compared to the existing firm capacities to determine if an expansion was needed. If the existing firm capacity was adequate to serve anticipated peak flows, FNI recommended lift station rehabilitation projects based on the field condition assessments. **Table 10-5** summarizes the lift

station capacity and condition evaluation. Projected lift station peak flows shown **in red** exceed the existing lift station firm pumping capacity. The individual lift station expansion and rehabilitation projects are discussed further in **Section 11.0**.

Table 10-5: Lift Station Evaluation Summary

Lift Station	Existing Firm Pumping Capacity (MGD)	Projected Lift Station Peak Flow (MGD)	Lift Station Condition Rating	Wastewater CIP Recommendation
1	0.30	2.00	Moderate	Expansion
2	0.58	0.25	**Very Poor**	Rehabilitation
3	0.65	1.39	Moderate	Rehabilitation
8	3.17	3.55	Poor	Expansion
11	2.02	0.84	Poor	Rehabilitation
14	1.58	0.26	**Very Poor**	Rehabilitation
15	0.66	1.35	*Not Evaluated*	Expansion
16	1.64	5.00	Poor	Expansion
17	3.34	3.19	**Very Poor**	Rehabilitation
22	0.63	1.10	*Not Evaluated*	Expansion
23	2.02	7.50	**Very Poor**	Expansion
30	4.61	9.00	Poor	Expansion
31	3.60	4.20	Poor	Expansion
33	1.26	2.02	*Not Evaluated*	Expansion
34	1.01	0.20	Poor	Rehabilitation
35	0.68	0.81	*Not Evaluated*	Expansion
36	0.38	0.55	*Not Evaluated*	Expansion

10.5.5 WWTP Capacity

Based on the population and flow projections, the City will need to begin planning additional treatment capacity by 2035. The existing WWTP permitted capacity is 5 MGD. The projected 2035 AADF is 3.95 MGD. **Figure 10-6** shows the projected average day flows per wastewater basin, the current permitted AADF, and the 75% and 90% of permitted AADF capacity values. These lines reflect the TCEQ "75/90 rule". This rule states that when a plant exceeds 75% of its permitted annual average flow (75% of 5 MGD is 3.5 MGD) for three consecutive months, the facility must begin planning for its next expansion. In addition,

the rule states that when a treatment facility exceeds 90% of its permitted annual average flow (90% of 5 MGD is 4.5 MGD), the facility must be in construction of its next expansion.

By the year 2035, the average annual flow to the treatment plant is expected to exceed 75% of its treatment capacity. The City will need to begin planning for a treatment plant expansion when the AADF reached 75% of the permitted flow. However, since the AADF is not projected to reach 90% of the permitted treatment capacity by 2035, FNI is not including a treatment plant expansion as a project in the wastewater system capital improvements plan.

10.5.6 Peak Flow Basin

The permitted peak flow discharge rate for the City's WWTP is 15 MGD. The projected 2035 peak flows to the WWTP greater than 20 MGD. To maintain the peak flow discharge below 15 MGD, and to prevent surcharging in the gravity interceptor upstream of the plant, peak flow management would be required. Storage of excess peak wastewater flow can be accomplished with a storage basin on or near treatment sites. The peak flow basin's primary use is to attenuate peak wet weather events at the WWTP. Additionally, peak flow basins can be used as storage during emergency events in which the plant may need to be taken offline for periods of time.

FNI is recommending a peak flow storage basin be constructed on City owned land near the existing treatment plant site. Design considerations for peak flow basins include satellite screening facilities, site hydraulics (the water must typically be either pumped into or out of the basin), and odor control.

Preliminary sizing of the recommended peak flow basin was based on the peak flow WWTP influent hydrograph from the 2035 model scenario. This hydrograph is for all flow from the collection system to the WWTP under a 2-year 6-hour design storm peak flow condition. The peak flow hydrograph is shown on **Figure 10-7**. Flows above the treatment plant's peak flow capacity would need to be stored until the peak flow receded. The required storage volume of the peak flow basin is found from the area beneath the hydrograph curve and above the peak permitted flow, as shown. Based on flow projections and the hydraulic model results, the required volume for the peak flow storage basin is 1 MG.

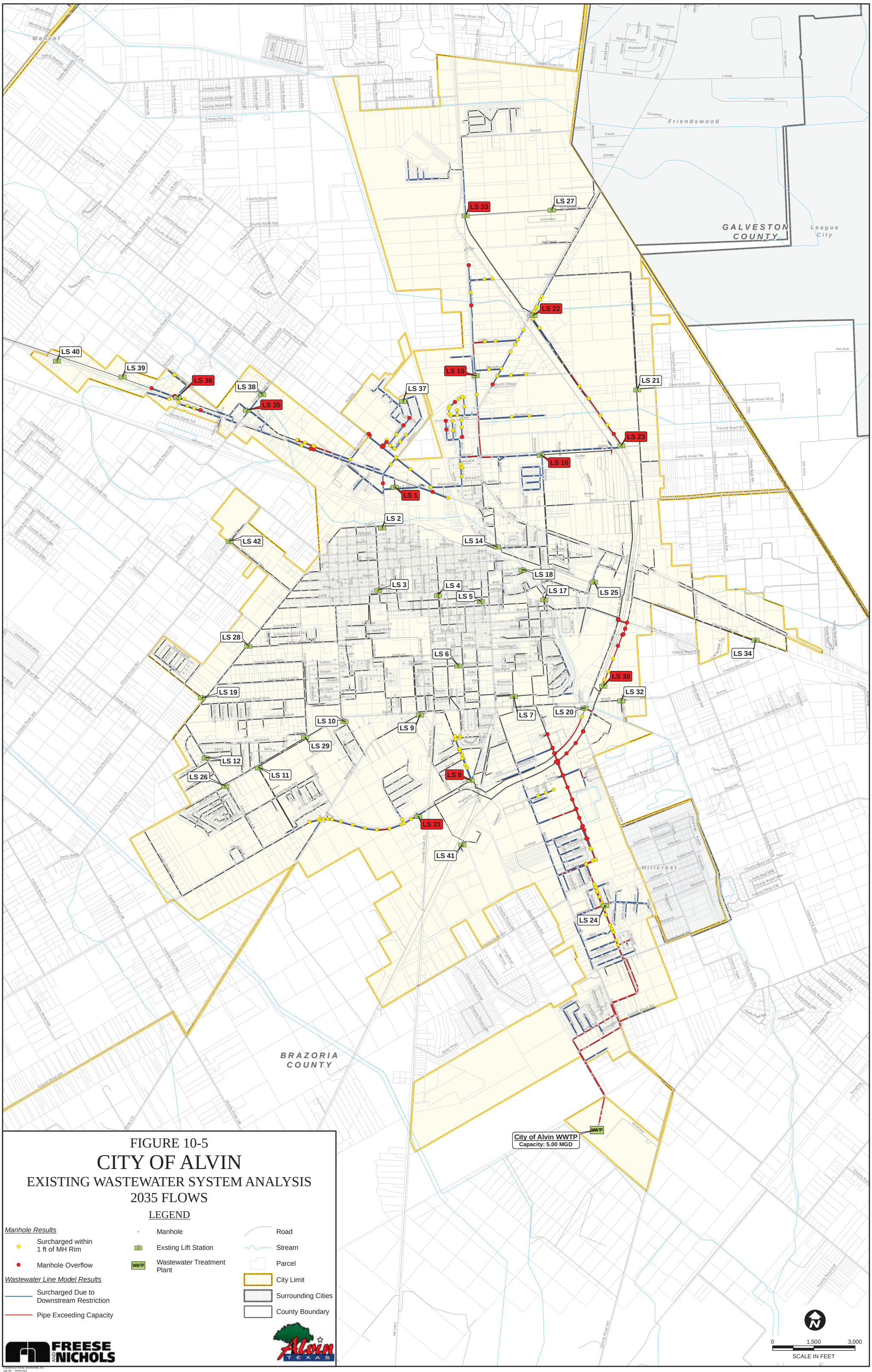

FIGURE 10-5

CITY OF ALVIN

EXISTING WASTEWATER SYSTEM ANALYSIS
2035 FLOWS

LEGEND

Manhole Results

- Surcharged within 1 ft of MH Rim
- Manhole Overflow

Wastewater Line Model Results

- Surcharged Due to Downstream Restriction
- Pipe Exceeding Capacity

- Manhole
- Exsting Lift Station
- Wastewater Treatment Plant

- Road
- Stream
- Parcel
- City Limit
- Surrounding Cities
- County Boundary

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Alvin TEXAS

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Job No.: AVN14181
Location: H:\W_WW_PLANNING\Final_Report\(Figure_10-5)_Existing_WW_System_Analysis_2035_Flows.mxd
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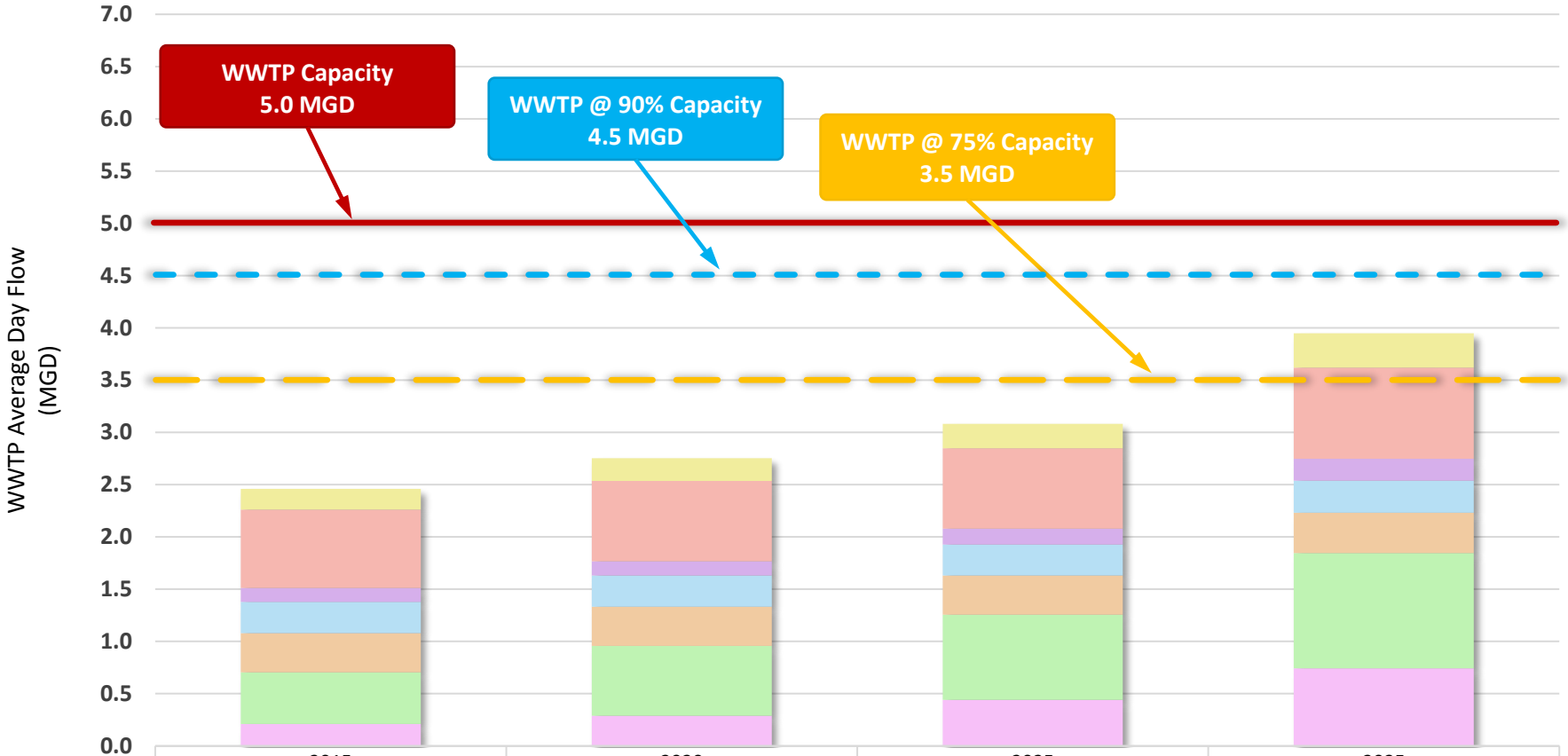
Figure 10-6

WWTP Annual Average Day Flow Projections by Wastewater Basin

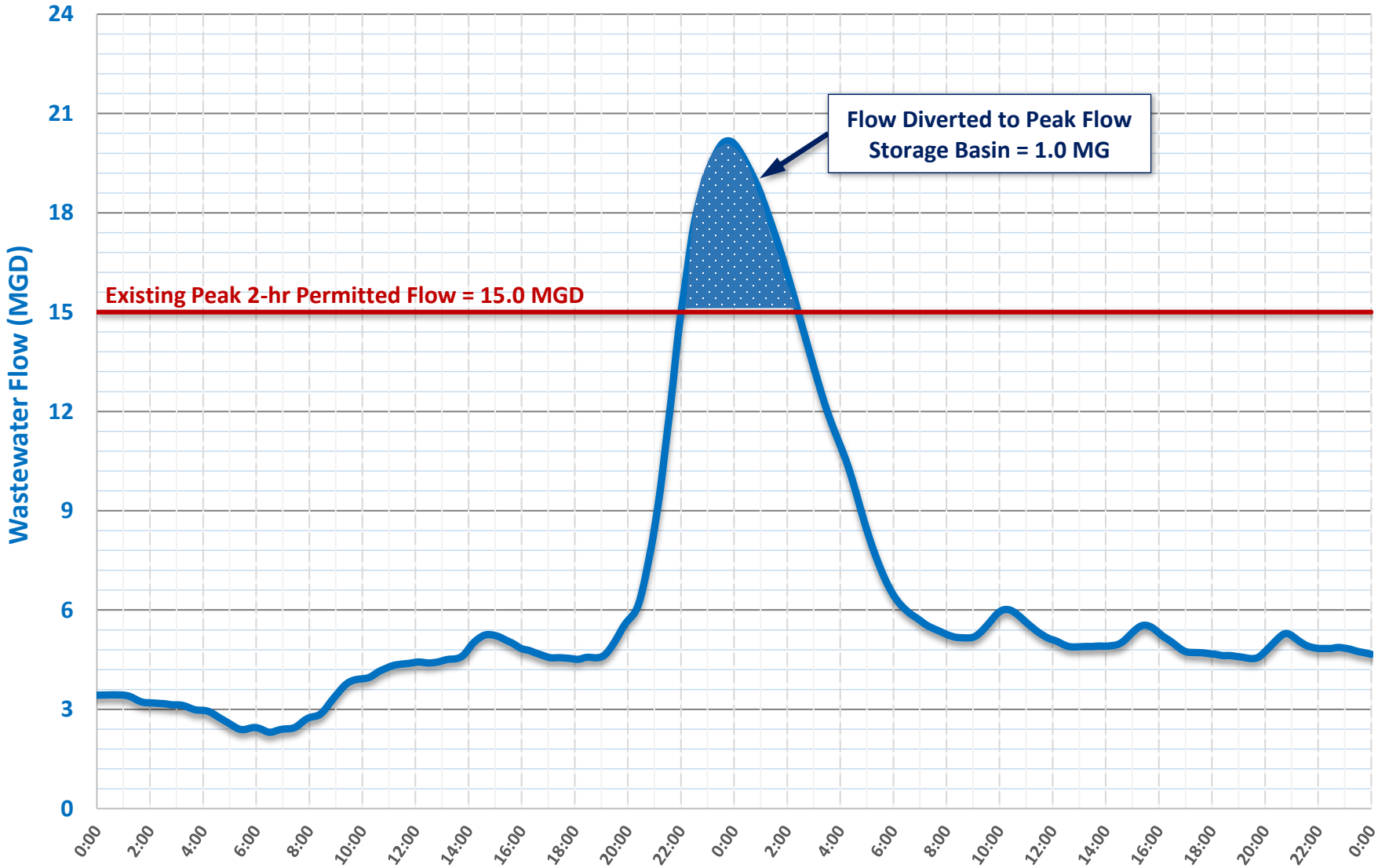


	2015	2020	2025	2035
Southern	0.20	0.22	0.23	0.33
Western	0.75	0.77	0.77	0.87
East-Central	0.13	0.14	0.15	0.21
Central	0.30	0.30	0.30	0.31
West-Central	0.38	0.38	0.38	0.39
Northeast	0.50	0.67	0.81	1.10
Northwest	0.21	0.29	0.44	0.74

FIGURE 10-7

City of Alvin

Peak Flow Storage Basin Analysis



11.0 WASTEWATER SYSTEM CAPITAL IMPROVEMENTS PLAN

A wastewater capital improvements plan was developed for the City of Alvin to improve the wastewater collection system's ability to convey flow to the wastewater treatment plant. The recommended improvements provide the capacity and reliability to meet projected wastewater flows through year 2035. The recommended projects for the collection system are presented on **Figure 11-1**. Locations shown for new mains and other recommended improvements were generalized for hydraulic analyses. Specific alignments and sites will be determined as part of the design process. It is recommended that these projects be constructed generally in the order listed. However, development or renewal patterns may make it necessary to construct some projects sooner than anticipated. Capital costs were calculated for the recommended improvements. The costs are in 2015 dollars and include an allowance for engineering, surveying, and contingencies. Detailed cost estimates are included in **Appendix B**.

11.1 WASTEWATER PROJECTS FROM 2016-2020

Projects recommended within the first phase are the most critical to the system. These projects resolve existing deficiencies or accommodate impending growth. A detailed description of each project is provided below.

Project 1: Replacement 54" Eastside Interceptor

This project includes the construction of a 54 inch wastewater line from the 35 Bypass to the WWTP. The model showed the existing 27 inch and 33 inch wastewater lines do not have enough capacity to convey existing peak flows to the plant. The 54 inch line is sized to convey projected wastewater system peak flows through 2035. Constructing a single line in place of the two undersized lines will allow for easier system operations and less maintenance.

Project 2: Lift Station 30 Expansion and Highway 35 Bypass Gravity Mains

This project includes the expansion of Lift Station 30 from a firm capacity of 4.61 MGD to a firm pumping capacity of 9.0 MGD. The model shows that the gravity lines upstream of this lift station experience surcharging under 2035 wastewater loads, indicating that the existing pumping capacity is not adequate to convey peak wastewater flows. This project includes a new 24 inch force main, and the upsizing of the gravity lines to 36 inches immediately upstream and downstream of Lift Station 30. The existing 30 inch gravity lines do not have enough capacity to convey projected 2035 peak wastewater flows. The 9.0 MGD

lift station expansion and proposed gravity lines are sized to convey projected 2035 peak wastewater flows from the Northeast and Northwest basins.

Project 3: Peak Flow Storage Basin at WWTP

This project includes the construction of a 1 MG peak flow basin near the wastewater treatment plant. The permitted peak flow discharge rate for the City's WWTP is 15 MGD. Projected 2035 peak flows to the WWTP are in excess of 20 MGD. To maintain the peak flow discharge below 15 MGD, and to prevent surcharging in the gravity interceptor upstream of the plant, peak flow management would be required. FNI is recommending a peak flow storage basin be constructed on City owned land near the existing treatment plant site. Design considerations for peak flow basins include satellite screening facilities, site hydraulics (the water must typically be either pumped into or out of the basin), and odor control.

Rehabilitation Project 1: Northwest Basin Sanitary Sewer Evaluation Survey (SSES)

This project includes a sanitary sewer evaluation survey (SSES) of the Northwest Basin. The wastewater flow monitoring performed in this study showed that the wet weather to average dry flow peaking factor was greater than 13. Peaking factors greater than 4 are considered to be high. This means that a large volume of inflow is entering the sewer system during wet weather events. The flow monitoring results calculated this volume at 14.5 gallons per linear foot. Volumes greater than 4 gallons per linear foot are considered to be high. FNI recommends that an SSES be conducted throughout the Northwest Basin to identify sources of I/I. Once sources of I/I are found, the City should address them as required to reduce excess water entering the wastewater system.

Rehabilitation Project 2: Northeast Basin Sanitary Sewer Evaluation Survey SSES

This project includes a sanitary sewer evaluation survey (SSES) of the Northeast Basin. The wastewater flow monitoring performed in this study showed that the wet weather to average dry flow peaking factor was greater than 5. Peaking factors greater than 4 are considered to be high. This means that a large volume of inflow is entering the sewer system during wet weather events. The flow monitoring results calculated this volume at 12.5 gallons per linear foot. Volumes greater than 4 gallons per linear foot are considered to be high. FNI recommends that an SSES be conducted throughout the Northeast Basin to identify sources of I/I. Once sources of I/I are found, the City should address them as required to reduce excess water entering the wastewater system.

Rehabilitation Project 3: Lift Station 17 Rehabilitation

This project includes the rehabilitation of Lift Station 17. The condition assessment results showed this lift station to be in very poor condition. FNI recommends rehabilitating the wet well, piping, and valves and replacing the electrical equipment. As part of the lift station rehabilitation project, FNI recommends decommissioning the 10" force main that allows flow to be pumped east to the Northeast Basin. This will simplify system operations and reduces the future peak flows to Lift Station 30, thereby reducing the cost of the Lift Station 30 expansion. There is a second force main at Lift Station 17 that pumps to the south, into the East Central Basin. This force main should be utilized for future flows.

Rehabilitation Project 4: Lift Station 14 Rehabilitation

This project includes the rehabilitation of Lift Station 14. The condition assessment results showed this lift station to be in very poor condition. FNI recommends rehabilitation or replacement of the wet well, the piping and valves, and the electrical system. Additionally, FNI recommends abandoning the old wet well pit.

11.2 WASTEWATER PROJECTS FROM 2021-2025

Projects recommended within the second phase resolve additional system deficiencies and accommodate growth. A detailed description of each project is provided below.

Project 4: Lift Station 23 Expansion

This project includes the expansion of Lift Station 23 from a firm capacity of 2.02 MGD to a firm pumping capacity of 7.5 MGD. This will include a new 18 inch force main. The model shows that the gravity lines upstream of this lift station experience surcharging under 2035 wastewater loads, indicating that the existing pumping capacity is not adequate to convey peak wastewater flows. The 7.5 MGD expansion is sized to convey projected 2035 peak wastewater flows from the Northeast and Northwest basins.

Project 5: Wastewater SCADA System

This project includes the installation of a wastewater supervisory control and data acquisition (SCADA) system. A wastewater SCADA system would allow City staff to optimize the operation of the wastewater system. Operations staff would have access to real time data, leading to less down time when operational issues arise. System data available in various SCADA packages include wet well levels, pump on/off status

and run times, and wet well flow rates. SCADA systems also help to prevent sanitary sewer overflows in wet weather events by alerting operations staff to rising wet well levels or pump issues. FNI recommends that the wastewater SCADA system be connected to the operation of the peak flow basin.

Project 6: Lift Station 16 Expansion and Replacement Gravity Mains

This project includes the expansion of Lift Station 16 from a firm capacity of 1.64 MGD to a firm pumping capacity of 5.0 MGD. This will include a new 16 inch force main. The model shows that the gravity lines upstream of this lift station experience surcharging under existing wastewater loads, indicating that the pumping capacity is not adequate to convey peak wastewater flows. This project also includes upsizing of the gravity lines upstream of Lift Station 16 to Lift Station 1 and Lift Station 15. These gravity lines do not have enough capacity to convey peak wastewater flows. The proposed lift station expansion and gravity lines are sized to convey projected 2035 peak wastewater flows from the Northwest basin.

Project 7: Lift Station 1 Expansion and Highway 6 Replacement Gravity Mains

This project includes the expansion of Lift Station 1 from a firm capacity of 0.30 MGD to a firm pumping capacity of 2.0 MGD. This will include a new 12 inch force main. The model shows that the gravity lines upstream of this lift station experience surcharging under existing wastewater loads, indicating that the pumping capacity is not adequate to convey peak wastewater flows. This project also includes upsizing of the gravity lines upstream of Lift Station 1 along Highway 6. These gravity lines do not have enough capacity to convey peak wastewater flows. The proposed lift station expansion and gravity lines are sized to convey projected 2035 peak wastewater flows from the Northwest basin, including the Martha's Vineyard development.

Project 8: Lift Station 22 and 33 Expansion

This project includes the expansion of Lift Station 22 from a firm capacity of 0.63 MGD to a firm pumping capacity of 1.1 MGD, and the expansion of Lift Station 33 from a firm capacity of 1.26 MGD to a firm pumping capacity of 2.4 MGD. The proposed lift station expansions are sized to convey projected 2035 peak wastewater flows from anticipated developments in the Northeast basin.

Project 9: Lift Station 15 Expansion and Replacement Gravity Mains

This project includes the expansion of Lift Station 15 from a firm capacity of 0.66 MGD to a firm pumping capacity of 1.35 MGD. This will include a new 12 inch force main. This project also includes upsizing of

the gravity lines upstream of Lift Station 15 along State Highway 35. The proposed lift station expansion and gravity lines are sized to convey projected 2035 peak wastewater flows from the Kendall Lakes Light Industrial Park development.

Project 10: Lift Station 35 Expansion

This project includes the expansion of Lift Station 35 from a firm capacity of 0.68 MGD to a firm pumping capacity of 0.82 MGD. This expansion is sized to convey the additional peak flow from the Martha's Vineyard development.

Project 11: Lift Station 36 Expansion

This project includes the expansion of Lift Station 36 from a firm capacity of 0.38 MGD to a firm pumping capacity of 0.55 MGD. This expansion is sized to convey the additional peak flow from the Martha's Vineyard development.

Project 12: New Martha's Vineyard Lift Station and Force Main

This project includes the construction of a new 0.275 MGD Lift Station and 4 inch force main. This lift station will serve the Martha's Vineyard development.

Rehabilitation Project 5: West Central Basin Sanitary Sewer Evaluation Survey (SSES)

This project includes a sanitary sewer evaluation survey (SSES) of the West Central Basin. The wastewater flow monitoring performed in this study showed that the wet weather to average dry flow peaking factor was greater than 10. Peaking factors greater than 4 are considered to be high. This means that a large volume of inflow is entering the sewer system during wet weather events. The flow monitoring results calculated this volume at 9.2 gallons per linear foot. Volumes greater than 4 gallons per linear foot are considered to be high. FNI recommends that an SSES be conducted throughout the West Central Basin to identify sources of I/I. Once sources of I/I are found, the City should address them as required to reduce excess water entering the wastewater system.

Rehabilitation Project 6: Southern Basin Sanitary Sewer Evaluation Survey (SSES)

This project includes a sanitary sewer evaluation survey (SSES) of the Southern Basin. The wastewater flow monitoring performed in this study showed that a large volume of inflow is entering the sewer system during wet weather events. The flow monitoring results calculated this volume at 13.8 gallons per linear

foot. Volumes greater than 4 gallons per linear foot are considered to be high. FNI recommends that an SSES be conducted throughout the Southern Basin to identify sources of I/I. Once sources of I/I are found, the City should address them as required to reduce excess water entering the wastewater system.

Rehabilitation Project 7: Lift Station 2 Rehabilitation

This project includes the rehabilitation of Lift Station 2. The condition assessment results showed this lift station to be in very poor condition. FNI recommends rehabilitating the electrical equipment and performing structural repair on the slab.

11.3 WASTEWATER PROJECTS FROM 2026-2035

Projects recommended within the third phase resolve additional system deficiencies and accommodate growth. A detailed description of each project is provided below.

Project 13: Lift Station 31 Expansion

This project includes the expansion of Lift Station 31 from a firm capacity of 3.6 MGD to a firm pumping capacity of 4.2 MGD. The gravity lines upstream of this lift station are currently experiencing surcharging, indicating that the existing pumping capacity is not adequate to convey peak wastewater flows. The 4.2 MGD expansion is sized to convey projected 2035 peak wastewater flows from the West Central basin.

Project 14: Lift Station 8 Expansion

This project includes the expansion of Lift Station 8 from a firm capacity of 3.17 MGD to a firm pumping capacity of 3.55 MGD. The gravity lines upstream of this lift station are currently experiencing surcharging, indicating that the existing pumping capacity is not adequate to convey peak wastewater flows. The 3.55 MGD expansion is sized to accommodate projected growth and convey projected 2035 peak wastewater flows from the West Central basin.

Rehabilitation Project 8: Central Basin Sanitary Sewer Evaluation Survey (SSES)

This project includes a sanitary sewer evaluation survey (SSES) of the Central Basin. The wastewater flow monitoring performed in this study showed that the wet weather to average dry flow peaking factor was greater than 5. Peaking factors greater than 4 are considered to be high. This means that a large volume of inflow is entering the sewer system during wet weather events. The flow monitoring results calculated this volume at 5.0 gallons per linear foot. Volumes greater than 4 gallons per linear foot are considered

to be high. FNI recommends that an SSES be conducted throughout the Central Basin to identify sources of I/I. Once sources of I/I are found, the City should address them as required to reduce excess water entering the wastewater system.

Rehabilitation Project 9: Lift Station 34 Rehabilitation

This project includes the rehabilitation of Lift Station 34. The condition assessment results showed this lift station to be in poor condition. FNI recommends rehabilitating the electrical equipment and performing structural repair on the slab.

Rehabilitation Project 10: Lift Station 11 Rehabilitation

This project includes the rehabilitation of Lift Station 11. The condition assessment results showed this lift station to be in poor condition. FNI recommends rehabilitating the electrical equipment and replacing the pumps and motors.

Rehabilitation Project 11: Lift Station 3 Rehabilitation

This project includes the rehabilitation of Lift Station 3. The condition assessment results showed this lift station to be in moderate condition. FNI recommends rehabilitating the wet well, piping, and vales, and placing the electrical equipment.

Table 11-1: Wastewater Capital Improvements Plan Summary

Phase	Project	Wastewater Collection System Capital Improvements Plan	Cost
2020	1	Replacement 54" Eastside Interceptor	$ 12,991,700
	2	Lift Station 30 Expansion and Highway 35 Bypass Gravity Mains	$ 8,975,200
	3	Peak Flow Storage Basin at WWTP	$ 1,287,000
		Capital Improvements Total	$ 23,253,900
	R1	Northwest Basin Sanitary Sewer Evaluation Survey (SSES)	$ 47,100
	R2	Northeast Basin Sanitary Sewer Evaluation Survey (SSES)	$ 48,200
	R3	Lift Station 17 Rehabilitation	$ 780,000
	R4	Lift Station 14 Rehabilitation	$ 780,000
		Rehabilitation and SSES Totals	$ 1,655,300
Total 2015 - 2020			**$ 24,909,200**
2025	4	Lift Station 23 Expansion	$ 7,176,500
	5	Wastewater SCADA System	$ 2,373,600
	6	Lift Station 16 Expansion and Replacement Gravity Mains	$ 7,253,400
	7	Lift Station 1 Expansion and Highway 6 Replacement Gravity Mains	$ 3,150,000
	8	Lift Stations 22 and 33 Expansion	$ 1,232,400
	9	Lift Station 15 Expansion and Replacement Gravity Mains	$ 1,889,900
	10	Lift Station 35 Expansion	$ 645,900
	11	Lift Station 36 Expansion	$ 435,300
	12	New Martha's Vineyard Lift Station and Force Main	$ 879,200
		Capital Improvements Total	$ 25,036,200
	R5	West Central Basin Sanitary Sewer Evaluation Survey (SSES)	$ 64,700
	R6	Southern Basin Sanitary Sewer Evaluation Survey (SSES)	$ 56,600
	R7	Lift Station 2 Rehabilitation	$ 390,000
		Rehabilitation and SSES Totals	$ 511,300
Total 2020 - 2025			**$ 25,547,500**
2035	13	Lift Station 31 Expansion	$ 3,223,500
	14	Lift Station 8 Expansion	$ 1,519,200
		Capital Improvements Total	$ 4,742,700
	R8	Central Basin Sanitary Sewer Evaluation Survey (SSES)	$ 44,900
	R9	Lift Station 34 Rehabilitation	$ 546,000
	R10	Lift Station 11 Rehabilitation	$ 624,000
	R11	Lift Station 3 Rehabilitation	$ 561,600
		Rehabilitation and SSES Totals	$ 1,776,500
Total 2025 - 2035			**$ 6,519,200**
		Total	**$ 56,975,900**

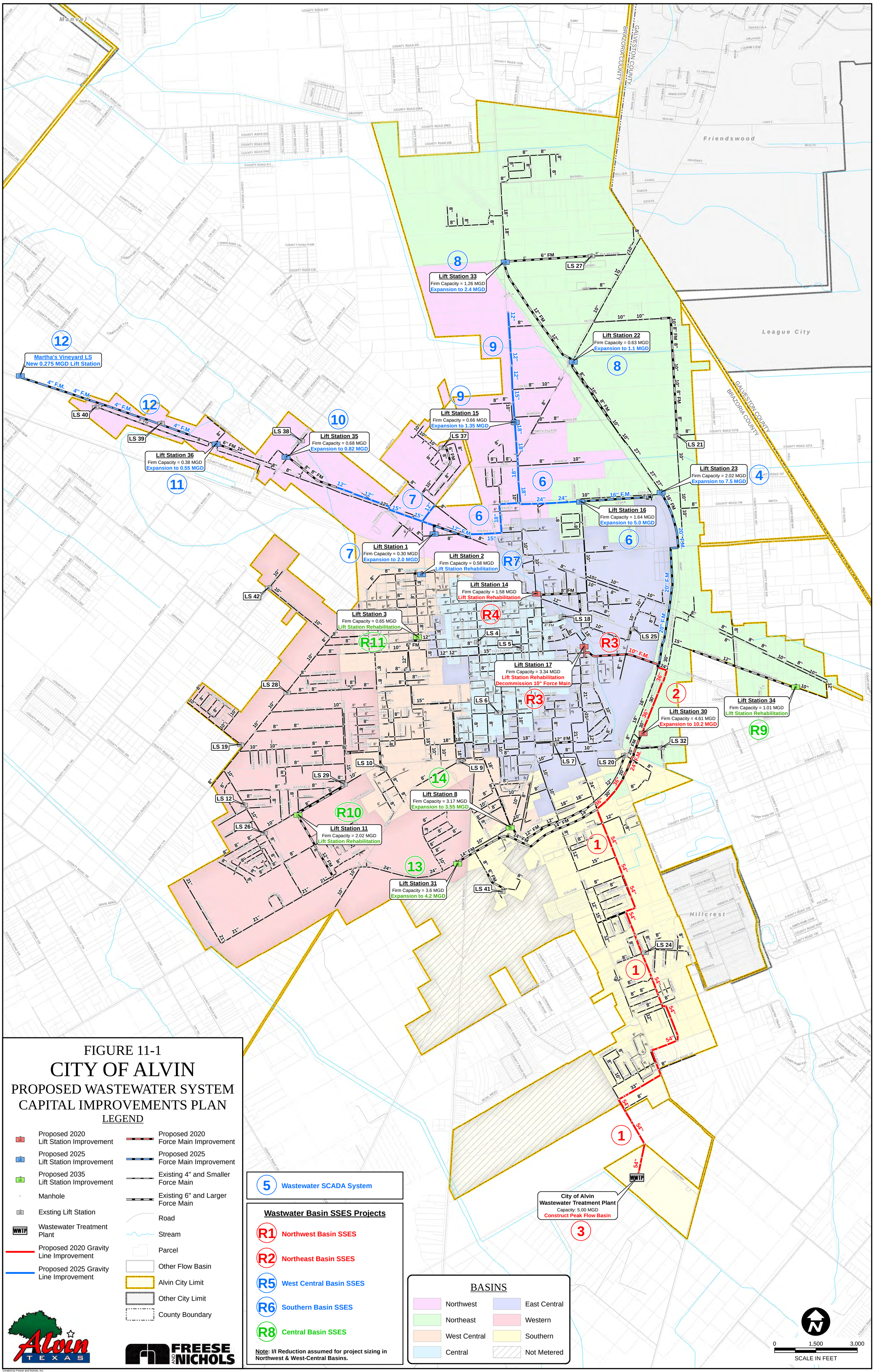


FIGURE 11-1

CITY OF ALVIN

PROPOSED WASTEWATER SYSTEM CAPITAL IMPROVEMENTS PLAN

LEGEND

- Proposed 2020 Lift Station Improvement
- Proposed 2025 Lift Station Improvement
- Proposed 2035 Lift Station Improvement
- Manhole
- Exsting Lift Station
- Wastewater Treatment Plant
- Proposed 2020 Gravity Line Improvement
- Proposed 2025 Gravity Line Improvement
- Proposed 2020 Force Main Improvement
- Proposed 2025 Force Main Improvement
- Existing 4" and Smaller Force Main
- Existing 6" and Larger Force Main
- Road
- Stream
- Parcel
- Other Flow Basin
- Alvin City Limit
- Other City Limit
- County Boundary

Alvin TEXAS

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Updated: February 03, 2016
User: 02216

APPENDIX A:
Water System Capital Improvements Plan Project Costs

City of Alvin

Water Capacity CIP Projects - 2020

OPINION OF PROBABLE COST

February 4, 2016

Construction Project Number 1

Project Description

Fairway Drive and South Street Water Line Improvements

Detailed Description

New 12-inch water lines along South Street and Fairway Drive to parallel existing 8-inch water lines. New 10-inch water line along FM 1462 and new 6-inch water line along Koster Road to replace existing 2.25-inch water lines.

Purpose

Connect existing 10-inch and 6-inch water lines and reduce excessive headloss between the new Dyche Lane and Verhalen elevated storage tanks.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" Water Line & Appurt.	16,000	LF	$96	$1,536,000
2	10" Water Line & Appurt.	400	LF	$80	$32,000
3	6" Water Line & Appurt.	100	LF	$48	$4,800
4	18" Boring and Casing	600	LF	$351	$210,600
5	Pavement Repair	15,900	LF	$50	$795,000
		SUBTOTAL:			$2,578,400
		CONTINGENCY		30%	$773,600
		SUBTOTAL:			$3,352,000
		ENG/SURVEY		20%	$670,400
		SUBTOTAL:			$4,022,400

PROJECT TOTAL **$4,022,400**

City of Alvin

Water Capacity CIP Projects - 2020

OPINION OF PROBABLE COST

February 4, 2016

Construction Project Number 2

Project Description

Water Plant No. 6 Ground Storage Tank Replacement

Detailed Description

Decommission three existing 0.43 MG ground storage tanks and add new 1.5 MG ground storage tank at Water Plant No. 6.

Purpose

Replace degrading ground storage tanks and increase storage capacity.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	1.5 MG Ground Storage Tank	1	EA	$2,025,000	$2,025,000
		SUBTOTAL:			$2,025,000
		CONTINGENCY		30%	$607,500
		SUBTOTAL:			$2,632,500
		ENG/SURVEY		20%	$526,500
		SUBTOTAL:			$3,159,000
PROJECT TOTAL					**$3,159,000**

City of Alvin

Water Capacity CIP Projects - 2020

OPINION OF PROBABLE COST

February 4, 2016

Construction Project Number 3

Project Description

Water Plant No. 4 Ground Storage Tank Replacement

Detailed Description

Decommission existing 0.21 MG and 0.43 MG ground storage tanks and add new 1 MG ground storage tank at Water Plant No. 4.

Purpose

Replace degrading ground storage tanks and increase storage capacity.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	1 MG Ground Storage Tank	1	EA	$1,350,000	$1,350,000
		SUBTOTAL:			$1,350,000
		CONTINGENCY		30%	$405,000
		SUBTOTAL:			$1,755,000
		ENG/SURVEY		20%	$351,000
		SUBTOTAL:			$2,106,000

PROJECT TOTAL **$2,106,000**

City of Alvin

Water Capacity CIP Projects - 2025

OPINION OF PROBABLE COST

February 4, 2016

Construction Project Number 4

Project Description

Water Plant No. 3 Ground Storage Tank Replacement

Detailed Description

Decommission existing 1 MG ground storage tank and add new 1 MG ground storage tank at Water Plant No. 3.

Purpose

Replace degrading ground storage tanks and increase storage capacity.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	1 MG Ground Storage Tank	1	EA	$1,350,000	$1,350,000
		SUBTOTAL:			$1,350,000
		CONTINGENCY		30%	$405,000
		SUBTOTAL:			$1,755,000
		ENG/SURVEY		20%	$351,000
		SUBTOTAL:			$2,106,000

PROJECT TOTAL **$2,106,000**

City of Alvin

Water Capacity CIP Projects - 2025

OPINION OF PROBABLE COST

February 4, 2016

Construction Project Number 5

Project Description

East Water Plant

Detailed Description

New 1,000 gpm groundwater well, two new 500 gpm service pumps and new 1 MG ground storage tank to create the new East Water Plant. Dependent on Alternative Capacity Requirement from TCEQ.

Purpose

Increase water supply and service pumping capacity to meet TCEQ minimum requirements.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	1,000 gpm Water Supply Well	1	EA	$1,200,000	$1,200,000
2	1,000 gpm Pump Station	1	EA	$850,000	$850,000
3	1 MG Ground Storage Tank	1	EA	$1,350,000	$1,350,000
		SUBTOTAL:			$3,400,000
		CONTINGENCY		30%	$1,020,000
		SUBTOTAL:			$4,420,000
		ENG/SURVEY		20%	$884,000
		SUBTOTAL:			$5,304,000

PROJECT TOTAL **$5,304,000**

City of Alvin

Water Capacity CIP Projects - 2035 & Beyond

OPINION OF PROBABLE COST — **February 4, 2016**

Construction Project Number 6

Project Description

East Water Plant Pump Expansion

Detailed Description

New 500 gpm pump at the new East Water Plant (Project 6).

Purpose

Increase service pumping capacity to meet TCEQ minimum requirements.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	500 gpm Service Pumping Expansion	1	EA	$50,000	$50,000
		SUBTOTAL:			$50,000
		CONTINGENCY		30%	$15,000
		SUBTOTAL:			$65,000
		ENG/SURVEY		20%	$13,000
		SUBTOTAL:			$78,000

PROJECT TOTAL **$78,000**

City of Alvin

Water Capacity CIP Projects - 2035 & Beyond

OPINION OF PROBABLE COST — **February 4, 2016**

Construction Project Number 7

Project Description

WWTP Water Line Improvements

Detailed Description

New 8-inch water lines to connect existing 6-inch and 8-inch dead end water lines and replace existing 6-inch water lines near the City's Wastewater Treatment Plant.

Purpose

Increase available fire flow capacity by connecting small dead end water lines.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	8" Water Line & Appurt.	8,800	LF	$64	$563,200
2	Pavement Repair	8,800	LF	$50	$440,000
		SUBTOTAL:			$1,003,200
		CONTINGENCY		30%	$301,000
		SUBTOTAL:			$1,304,200
		ENG/SURVEY		20%	$260,900
		SUBTOTAL:			$1,565,100

PROJECT TOTAL **$1,565,100**

City of Alvin

Water Rehabilitation CIP Projects

OPINION OF PROBABLE COST

February 4, 2016

Construction Project Number A

Project Description

Water Line Improvements Phase 1

Detailed Description

New 10-inch, 8-inch, and 6-inch water lines to connect and replace existing small water lines in the area bounded by Adoue Street, Gordon Street, South Park Drive, and Johnson Street.

Purpose

Increase available fire flow capacity and replace existing small water lines.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	10" Water Line & Appurt.	300	LF	$80	$24,000
2	8" Water Line & Appurt.	900	LF	$64	$57,600
3	6" Water Line & Appurt.	18,600	LF	$48	$892,800
4	Pavement Repair	19,800	LF	$50	$990,000
		SUBTOTAL:			$1,964,400
		CONTINGENCY		30%	$589,400
		SUBTOTAL:			$2,553,800
		ENG/SURVEY		20%	$510,800
		SUBTOTAL:			$3,064,600
PROJECT TOTAL					**$3,064,600**

City of Alvin

Water Rehabilitation CIP Projects

OPINION OF PROBABLE COST

February 4, 2016

Construction Project Number B

Project Description

Water Line Improvements Phase 2

Detailed Description

New 10-inch, 8-inch and 6-inch water lines to connect and replace existing small water lines in the area bounded by State Highway 6, State Highway 35 Bypass, Sealy Street, and Second Street.

Purpose

Increase available fire flow capacity and replace existing small water lines.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	10" Water Line & Appurt.	1,000	LF	$80	$80,000
2	8" Water Line & Appurt.	9,400	LF	$64	$601,600
3	6" Water Line & Appurt.	4,300	LF	$48	$206,400
4	Pavement Repair	14,700	LF	$50	$735,000
		SUBTOTAL:			$1,623,000
		CONTINGENCY		30%	$486,900
		SUBTOTAL:			$2,109,900
		ENG/SURVEY		20%	$422,000
		SUBTOTAL:			$2,531,900
PROJECT TOTAL					**$2,531,900**

City of Alvin

Water Rehabilitation CIP Projects

OPINION OF PROBABLE COST

February 4, 2016

Construction Project Number C

Project Description

Water Line Improvements Phase 3

Detailed Description

New 8-inch and 6-inch water lines to connect and replace existing small water lines in the area bounded by House Street, Bayou Drive, South Street, and Gordon Street.

Purpose

Increase available fire flow capacity and replace existing small water lines.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	8" Water Line & Appurt.	7,600	LF	$64	$486,400
2	6" Water Line & Appurt.	11,200	LF	$48	$537,600
3	Pavement Repair	18,800	LF	$50	$940,000
		SUBTOTAL:			$1,964,000
		CONTINGENCY		30%	$589,200
		SUBTOTAL:			$2,553,200
		ENG/SURVEY		20%	$510,700
		SUBTOTAL:			$3,063,900

PROJECT TOTAL **$3,063,900**

City of Alvin

Water Rehabilitation CIP Projects

OPINION OF PROBABLE COST

February 4, 2016

Construction Project Number D

Project Description

Water Line Improvements Phase 4

Detailed Description

New 12-inch, 10-inch, 8-inch and 6-inch water lines to connect and replace existing small water lines in the area bounded by Blum Street, Johnson Street, South Street, and Callaway Drive.

Purpose

Increase available fire flow capacity and replace existing small water lines.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" Water Line & Appurt.	200	LF	$96	$19,200
2	10" Water Line & Appurt.	700	LF	$80	$56,000
3	8" Water Line & Appurt.	2,800	LF	$64	$179,200
4	6" Water Line & Appurt.	13,800	LF	$48	$662,400
5	Pavement Repair	17,500	LF	$50	$875,000
		SUBTOTAL:			$1,791,800
		CONTINGENCY		30%	$537,600
		SUBTOTAL:			$2,329,400
		ENG/SURVEY		20%	$465,900
		SUBTOTAL:			$2,795,300

PROJECT TOTAL **$2,795,300**

City of Alvin

Water Rehabilitation CIP Projects

OPINION OF PROBABLE COST

February 4, 2016

Construction Project Number E

Project Description

Water Line Improvements Phase 5

Detailed Description

New 8-inch and 6-inch water lines to connect and replace existing small water lines in the area bounded by Stevenwood Lane, Kost Road, Rosharon Road, and the City of Alvin Limits.

Purpose

Increase available fire flow capacity and replace existing small water lines.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	8" Water Line & Appurt.	4,200	LF	$64	$268,800
2	6" Water Line & Appurt.	11,100	LF	$48	$532,800
3	Pavement Repair	15,300	LF	$50	$765,000
		SUBTOTAL:			$1,566,600
		CONTINGENCY		30%	$470,000
		SUBTOTAL:			$2,036,600
		ENG/SURVEY		20%	$407,400
		SUBTOTAL:			$2,444,000
PROJECT TOTAL					**$2,444,000**

City of Alvin

Water Rehabilitation CIP Projects

OPINION OF PROBABLE COST

February 4, 2016

Construction Project Number F

Project Description

Water Line Improvements Phase 6

Detailed Description

New 6-inch water lines to connect and replace existing small water lines in the area bounded by Windsor Square, Fairway Drive, County Road 161, and Mustang Road.

Purpose

Increase available fire flow capacity and replace existing small water lines.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	8" Water Line & Appurt.	7,100	LF	$64	$454,400
2	6" Water Line & Appurt.	8,700	LF	$48	$417,600
3	Pavement Repair	15,800	LF	$50	$790,000
		SUBTOTAL:			$1,662,000
		CONTINGENCY		30%	$498,600
		SUBTOTAL:			$2,160,600
		ENG/SURVEY		20%	$432,200
		SUBTOTAL:			$2,592,800
PROJECT TOTAL					**$2,592,800**

City of Alvin

Water Rehabilitation CIP Projects

OPINION OF PROBABLE COST

February 4, 2016

Construction Project Number G

Project Description

Water Line Improvements Phase 7

Detailed Description

New 8-inch water lines to connect and replace existing small water lines in the area bounded by Wheeler Drive, State Highway 35 Bypass, Dickinson Road, and North Gordon Street.

Purpose

Increase available fire flow capacity and replace existing small water lines.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	8" Water Line & Appurt.	12,700	LF	$64	$812,800
2	6" Water Line & Appurt.	5,600	LF	$48	$268,800
3	Pavement Repair	18,300	LF	$50	$915,000
		SUBTOTAL:			$1,996,600
		CONTINGENCY		30%	$599,000
		SUBTOTAL:			$2,595,600
		ENG/SURVEY		20%	$519,200
		SUBTOTAL:			$3,114,800

PROJECT TOTAL **$3,114,800**

City of Alvin

Water Rehabilitation CIP Projects

OPINION OF PROBABLE COST

February 4, 2016

Construction Project Number H

Project Description

Fire Hydrant Connection Retrofitting

Detailed Description

Replace existing hydrant connectors with new, standardized 5-inch Hydrant Storz connectors and rehabilitate hydrant.

Purpose

Standardize fire protection equipment and maintain hydrant performance.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	5-inch Hydrant Storz Connector	1,020	EA	$300	$306,000
		SUBTOTAL:			$306,000
		CONTINGENCY		30%	$91,800
		SUBTOTAL:			$397,800
		ENG/SURVEY		0%	$0
		SUBTOTAL:			$397,800
PROJECT TOTAL					**$397,800**

APPENDIX B:
Wastewater System Capital Improvements Plan Project Costs

City of Alvin

Wastewater CIP Projects - 2020

OPINION OF PROBABLE COST

October 29, 2015

Construction Project Number 1

Project Description

Replacement 54" Eastside Interceptor

Detailed Description

This project includes the construction of a 54 inch wastewater line from the 35 Bypass to the WWTP. The model showed the existing 27 inch and 33 inch wastewater lines do not have enough capacity to convey existing peak flows to the plant.

Purpose

The 54 inch line is sized to convey projected wastewater system peak flows through 2035.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	54" Pipe	17,000	LF	$405	$6,885,000
2	60" Diameter Manhole	18	EA	$6,000	$108,000
3	60" Boring and Casing	1,200	LF	$1,050	$1,260,000
4	Pavement Repair	1,500	LF	$50	$75,000
		SUBTOTAL:			$8,328,000
		CONTINGENCY		30%	$2,498,400
		SUBTOTAL:			$10,826,400
		ENG/SURVEY		20%	$2,165,300
		SUBTOTAL:			$12,991,700
PROJECT TOTAL					**$12,991,700**

City of Alvin

Wastewater CIP Projects - 2020

OPINION OF PROBABLE COST

October 29, 2015

Construction Project Number 2

Project Description

Lift Station 30 Expansion and HWY 35 Bypass Gravity Mains

Detailed Description

This project includes the expansion of Lift Station 30 from a firm capacity of 4.61 MGD to a firm pumping capacity of 9.0 MGD. This project includes a new 24 inch force main, and the upsizing of the gravity lines to 36 inches immediately upstream and downstream of Lift Station 30.

Purpose

The 9.0 MGD lift station expansion and proposed gravity lines are sized to convey projected 2035 peak wastewater flows from the Northeast and Northwest basins.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Lift Station 30 Expansion (10.2 MGD)	1	LS	$3,526,000	$3,526,000
2	24" D.I. W.L. & Appurt.	1,900	LF	$192	$364,800
3	36" Pipe	4,300	LF	$270	$1,161,000
4	38" Boring and Casing	500	LF	$665	$332,500
5	60" Diameter Manhole	14	EA	$6,000	$84,000
6	Pavement Repair	5,700	LF	$50	$285,000
		SUBTOTAL:			$5,753,300
		CONTINGENCY		30%	$1,726,000
		SUBTOTAL:			$7,479,300
		ENG/SURVEY		20%	$1,495,900
		SUBTOTAL:			$8,975,200

PROJECT TOTAL **$8,975,200**

City of Alvin

Wastewater CIP Projects - 2020

OPINION OF PROBABLE COST

October 29, 2015

Construction Project Number 3

Project Description

Construct Peak Flow Storage Basin at WWTP

Detailed Description

This project includes the construction of a 1.0 million gallon (MG) peak flow basin near the wastewater treatment plant. FNI is recommending a peak flow storage basin be constructed on City owned land near the existing treatment plant site.

Purpose

To maintain the peak flow discharge below 15 MGD, and to prevent surcharging in the gravity interceptor upstream of the plant, peak flow management would be required.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Peak Flow Basin	1	LS	$825,000	$825,000
		SUBTOTAL:			$825,000
		CONTINGENCY		30%	$247,500
		SUBTOTAL:			$1,072,500
		ENG/SURVEY		20%	$214,500
		SUBTOTAL:			$1,287,000

PROJECT TOTAL **$1,287,000**

City of Alvin

Wastewater CIP Projects - 2020

OPINION OF PROBABLE COST — October 29, 2015

Construction Project Number — R1

Project Description

Northwest Basin Sanitary Sewer Evaluation Survey (SSES)

Detailed Description

FNI recommends that an SSES be conducted throughout the Northwest Basin to identify sources of I/I. Once sources of I/I are found, the City should address them as required to reduce excess water entering the wastewater system.

Purpose

This project is a sanitary sewer evaluation survey (SSES) of the Northwest Basin.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	SSES Flow Monitoring	1	LS	$5,000	$5,000
2	SSES Smoke Testing	22,100	LF	$0.62	$13,702
3	SSES Manhole Inspection	80	EA	$210	$16,800
		SUBTOTAL:			$35,600
		CONTINGENCY		10%	$3,600
		SUBTOTAL:			$39,200
		ENG/SURVEY		20%	$7,900
		SUBTOTAL:			$47,100

PROJECT TOTAL **$47,100**

City of Alvin

Wastewater CIP Projects - 2020

OPINION OF PROBABLE COST — October 29, 2015

Construction Project Number — R2

Project Description

Northeast Basin Sanitary Sewer Evaluation Survey (SSES)

Detailed Description

FNI recommends that an SSES be conducted throughout the Northeast Basin to identify sources of I/I. Once sources of I/I are found, the City should address them as required to reduce excess water entering the wastewater system.

Purpose

This project is a sanitary sewer evaluation survey (SSES) of the Northeast Basin.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	SSES Flow Monitoring	1	LS	$5,000	$5,000
2	SSES Smoke Testing	24,900	LF	$0.62	$15,438
3	SSES Manhole Inspection	76	EA	$210	$15,960
		SUBTOTAL:			$36,400
		CONTINGENCY		10%	$3,700
		SUBTOTAL:			$40,100
		ENG/SURVEY		20%	$8,100
		SUBTOTAL:			$48,200

PROJECT TOTAL **$48,200**

City of Alvin

Wastewater CIP Projects - 2020

OPINION OF PROBABLE COST

October 29, 2015

Construction Project Number R3

Project Description

Lift Station 17 Rehabilitation

Detailed Description

This project includes the rehabilitation of Lift Station 17. The condition assessment results showed this lift station to be in very poor condition.

Purpose

This rehabilitation project will increase the service life and reliability of this lift station.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Lift Station 17 Rehabilitation	1	LS	$500,000	$500,000
		SUBTOTAL:			$500,000
		CONTINGENCY		30%	$150,000
		SUBTOTAL:			$650,000
		ENG/SURVEY		20%	$130,000
		SUBTOTAL:			$780,000
PROJECT TOTAL					**$780,000**

City of Alvin

Wastewater CIP Projects - 2020

OPINION OF PROBABLE COST

October 29, 2015

Construction Project Number R4

Project Description

Lift Station 14 Rehabilitation

Detailed Description

This project includes the rehabilitation of Lift Station 14. The condition assessment results showed this lift station to be in very poor condition.

Purpose

This rehabilitation project will increase the service life and reliability of this lift station.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Lift Station 14 Rehabilitation	1	LS	$500,000	$500,000
		SUBTOTAL:			$500,000
		CONTINGENCY		30%	$150,000
		SUBTOTAL:			$650,000
		ENG/SURVEY		20%	$130,000
		SUBTOTAL:			$780,000
PROJECT TOTAL					**$780,000**

City of Alvin

Wastewater CIP Projects - 2025

OPINION OF PROBABLE COST

October 29, 2015

Construction Project Number 4

Project Description

Lift Station 23 Expansion

Detailed Description

This project includes the expansion of Lift Station 23 from a firm capacity of 2.02 MGD to a firm pumping capacity of 7.5 MGD. This will include a new 18 inch force main.

Purpose

The 7.5 MGD expansion is sized to convey projected 2035 peak wastewater flows from the Northeast and Northwest basins.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Lift Station 23 Expansion (8.5 MGD)	1	LS	$2,982,300	$2,982,300
2	20" D.I. W.L. & Appurt.	7,000	LF	$160	$1,120,000
3	24" Boring and Casing	400	LF	$420	$168,000
4	Pavement Repair	6,600	LF	$50	$330,000
		SUBTOTAL:			$4,600,300
		CONTINGENCY		30%	$1,380,100
		SUBTOTAL:			$5,980,400
		ENG/SURVEY		20%	$1,196,100
		SUBTOTAL:			$7,176,500
PROJECT TOTAL					**$7,176,500**

City of Alvin

Wastewater CIP Projects - 2025

OPINION OF PROBABLE COST

October 29, 2015

Construction Project Number 5

Project Description

Wastewater SCADA System

Detailed Description

This project includes the installation of a wastewater supervisory control and data acquisition (SCADA) system. FNI recommends that the wastewater SCADA system be connected to the operation of the peak flow basin.

Purpose

A wastewater SCADA system would allow City staff to optimize the operation of the wastewater system.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Lift Station SCADA System	43	EA	$33,075	$1,422,225
2	WWTP SCADA System	1	EA	$99,225	$99,225
		SUBTOTAL:			$1,521,500
		CONTINGENCY		30%	$456,500
		SUBTOTAL:			$1,978,000
		ENG/SURVEY		20%	$395,600
		SUBTOTAL:			$2,373,600

PROJECT TOTAL **$2,373,600**

City of Alvin

Wastewater CIP Projects - 2025

OPINION OF PROBABLE COST — October 29, 2015

Construction Project Number 6

Project Description

Lift Station 16 Expansion and Replacement Gravity Mains

Detailed Description

This project includes the expansion of Lift Station 16 from a firm capacity of 1.64 MGD to a firm pumping capacity of 5.0 MGD. This will include a new 16 inch force main. This project also includes upsizing of the gravity lines upstream of Lift Station 16 to Lift Station 1 and Lift Station 15.

Purpose

The proposed lift station expansion and gravity lines are sized to convey projected 2035 peak wastewater flows from the Northwest basin.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Lift Station 16 Expansion (5 MGD)	1	LS	$2,389,000	$2,389,000
2	24" Pipe	2,300	LF	$180	$414,000
3	18" Pipe	4,800	LF	$135	$648,000
4	15" Pipe	1,200	LF	$113	$135,000
5	16" D.I. W.L. & Appurt.	2,700	LF	$128	$345,600
6	60" Diameter Manhole	28	EA	$6,000	$168,000
7	Pavement Repair	11,000	LF	$50	$550,000
		SUBTOTAL:			$4,649,600
		CONTINGENCY		30%	$1,394,900
		SUBTOTAL:			$6,044,500
		ENG/SURVEY		20%	$1,208,900
		SUBTOTAL:			$7,253,400
PROJECT TOTAL					**$7,253,400**

City of Alvin

Wastewater CIP Projects - 2025

OPINION OF PROBABLE COST — October 29, 2015

Construction Project Number 7

Project Description

Lift Station 1 Expansion and Highway 6 Replacement Gravity Mains

Detailed Description

This project includes the expansion of Lift Station 1 from a firm capacity of 0.30 MGD to a firm pumping capacity of 2.0 MGD. This will include a new 12 inch force main. This project also includes upsizing of the gravity lines upstream of Lift Station 1 along Highway 6.

Purpose

The proposed lift station expansion and gravity lines are sized to convey projected 2035 peak wastewater flows from the Northwest basin, including the Martha's Vineyard development.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Lift Station 1 Expansion (2 MGD)	1	LS	$804,000	$804,000
2	12" C900 W.L. & Appurt.	1,800	LF	$96	$172,800
3	18" Pipe	800	LF	$135	$108,000
4	15" Pipe	1,600	LF	$113	$180,000
5	12" Pipe	2,900	LF	$90	$261,000
6	60" Diameter Manhole	18	EA	$6,000	$108,000
7	18" Boring and Casing	400	LF	$351	$140,400
8	Pavement Repair	4,900	LF	$50	$245,000
		SUBTOTAL:			$2,019,200
		CONTINGENCY		30%	$605,800
		SUBTOTAL:			$2,625,000
		ENG/SURVEY		20%	$525,000
		SUBTOTAL:			$3,150,000
PROJECT TOTAL					**$3,150,000**

City of Alvin

Wastewater CIP Projects - 2025

OPINION OF PROBABLE COST

October 29, 2015

Construction Project Number 8

Project Description

Lift Stations 22 and 33 Expansion

Detailed Description

This project includes the expansion of Lift Station 22 from a firm capacity of 0.63 MGD to a firm pumping capacity of 1.1 MGD, and the expansion of Lift Station 33 from a firm capacity of 1.26 MGD to a firm pumping capacity of 2.4 MGD.

Purpose

The proposed lift station expansions are sized to convey projected 2035 peak wastewater flows from anticipated developments in the Northeast basin.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Lift Station 33 Expansion (2.4 MGD)	1	LS	$350,000	$350,000
2	Lift Station 22 Expansion (1.1 MGD)	1	LS	$440,000	$440,000
		SUBTOTAL:			$790,000
		CONTINGENCY		30%	$237,000
		SUBTOTAL:			$1,027,000
		ENG/SURVEY		20%	$205,400
		SUBTOTAL:			$1,232,400

PROJECT TOTAL **$1,232,400**

City of Alvin

Wastewater CIP Projects - 2025

OPINION OF PROBABLE COST — October 29, 2015

Construction Project Number 9

Project Description

Lift Station 15 Expansion and Replacement Gravity Mains

Detailed Description

This project includes the expansion of Lift Station 15 from a firm capacity of 0.66 MGD to a firm pumping capacity of 1.35 MGD. This will include a new 12 inch force main. This project also includes upsizing of the gravity lines upstream of Lift Station 15 along State Highway 35.

Purpose

The proposed lift station expansion and gravity lines are sized to convey projected 2035 peak wastewater flows from the Kendall Lakes Light Industrial Park development.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Lift Station 15 Expansion (1.35 MGD)	1	LS	$544,000	$544,000
2	16" D.I. W.L. & Appurt.	50	LF	$128	$6,400
3	15" Pipe	1,200	LF	$113	$135,000
4	12" Pipe	2,900	EA	$90	$261,000
5	60" Diameter Manhole	10	EA	$6,000	$60,000
6	Pavement Repair	4,100	LF	$50	$205,000
		SUBTOTAL:			$1,211,400
		CONTINGENCY		30%	$363,500
		SUBTOTAL:			$1,574,900
		ENG/SURVEY		20%	$315,000
		SUBTOTAL:			$1,889,900
PROJECT TOTAL					**$1,889,900**

City of Alvin

Wastewater CIP Projects - 2025

OPINION OF PROBABLE COST

October 29, 2015

Construction Project Number 10

Project Description

Lift Station 35 Expansion

Detailed Description

This project includes the expansion of Lift Station 35 from a firm capacity of 0.68 MGD to a firm pumping capacity of 0.82 MGD.

Purpose

This expansion is sized to convey the additional peak flow from the Martha's Vineyard development.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Lift Station 35 Expansion (0.82 MGD)	1	LS	$414,000	$414,000
		SUBTOTAL:			$414,000
		CONTINGENCY		30%	$124,200
		SUBTOTAL:			$538,200
		ENG/SURVEY		20%	$107,700
		SUBTOTAL:			$645,900

PROJECT TOTAL **$645,900**

City of Alvin

Wastewater CIP Projects - 2025

OPINION OF PROBABLE COST

October 29, 2015

Construction Project Number 11

Project Description

Lift Station 36 Expansion

Detailed Description

This project includes the expansion of Lift Station 36 from a firm capacity of 0.38 MGD to a firm pumping capacity of 0.55 MGD.

Purpose

This expansion is sized to convey the additional peak flow from the Martha's Vineyard development.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Lift Station 36 Expansion (0.55 MGD)	1	LS	$279,000	$279,000
		SUBTOTAL:			$279,000
		CONTINGENCY		30%	$83,700
		SUBTOTAL:			$362,700
		ENG/SURVEY		20%	$72,600
		SUBTOTAL:			$435,300

PROJECT TOTAL **$435,300**

City of Alvin

Wastewater CIP Projects - 2025

OPINION OF PROBABLE COST

October 29, 2015

Construction Project Number 12

Project Description

New Martha's Vineyard Lift Station and Force Main

Detailed Description

This project includes the construction of a new 0.275 MGD Lift Station and 4 inch force main.

Purpose

This lift station will serve the Martha's Vineyard development.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	New 0.275 MGD Lift Station	1	EA	$141,500	$141,500
2	6" C900 W.L. & Appurt.	6,500	LF	$48	$312,000
3	Pavement Repair	2,200	LF	$50	$110,000
		SUBTOTAL:			$563,500
		CONTINGENCY		30%	$169,100
		SUBTOTAL:			$732,600
		ENG/SURVEY		20%	$146,600
		SUBTOTAL:			$879,200
PROJECT TOTAL					**$879,200**

City of Alvin

Wastewater CIP Projects - 2025

OPINION OF PROBABLE COST

October 29, 2015

Construction Project Number R5

Project Description

West Central Basin Sanitary Sewer Evaluation Survey (SSES)

Detailed Description

FNI recommends that an SSES be conducted throughout the West Central Basin to identify sources of I/I. Once sources of I/I are found, the City should address them as required to reduce excess water entering the wastewater system.

Purpose

This project is a sanitary sewer evaluation survey (SSES) of the West Central Basin.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	SSES Flow Monitoring	1	LS	$5,000	$5,000
2	SSES Smoke Testing	32,200	LF	$0.62	$19,964
3	SSES Manhole Inspection	114	EA	$210	$23,940
		SUBTOTAL:			$49,000
		CONTINGENCY		10%	$4,900
		SUBTOTAL:			$53,900
		ENG/SURVEY		20%	$10,800
		SUBTOTAL:			$64,700

PROJECT TOTAL **$64,700**

City of Alvin

Wastewater CIP Projects - 2025

OPINION OF PROBABLE COST

October 29, 2015

Construction Project Number R6

Project Description

Southern Basin Sanitary Sewer Evaluation Survey (SSES)

Detailed Description

FNI recommends that an SSES be conducted throughout the Southern Basin to identify sources of I/I. Once sources of I/I are found, the City should address them as required to reduce excess water entering the wastewater system.

Purpose

This project is a sanitary sewer evaluation survey (SSES) of the Southern Basin.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	SSES Flow Monitoring	1	LS	$5,000	$5,000
2	SSES Smoke Testing	28,700	LF	$0.62	$17,794
3	SSES Manhole Inspection	95	EA	$210	$19,950
		SUBTOTAL:			$42,800
		CONTINGENCY		10%	$4,300
		SUBTOTAL:			$47,100
		ENG/SURVEY		20%	$9,500
		SUBTOTAL:			$56,600

PROJECT TOTAL **$56,600**

City of Alvin

Wastewater CIP Projects - 2025

OPINION OF PROBABLE COST

October 29, 2015

Construction Project Number | R7

Project Description

Lift Station 2 Rehabilitation

Detailed Description

This project includes the rehabilitation of Lift Station 2. The condition assessment results showed this lift station to be in very poor condition.

Purpose

This rehabilitation project will increase the service life and reliability of this lift station.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Lift Station 2 Rehabilitation	1	LS	$250,000	$250,000
		SUBTOTAL:			$250,000
		CONTINGENCY		30%	$75,000
		SUBTOTAL:			$325,000
		ENG/SURVEY		20%	$65,000
		SUBTOTAL:			$390,000
PROJECT TOTAL					**$390,000**

City of Alvin

Wastewater CIP Projects - 2035 & Beyond

OPINION OF PROBABLE COST — **October 29, 2015**

Construction Project Number 13

Project Description

Lift Station 31 Expansion

Detailed Description

This project includes the expansion of Lift Station 31 from a firm capacity of 3.6 MGD to a firm pumping capacity of 4.2 MGD.

Purpose

The 4.2 MGD expansion is sized to convey projected 2035 peak wastewater flows from the West Central basin.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Lift Station 31 Expansion (4.2 MGD)	1	LS	$2,066,300	$2,066,300
		SUBTOTAL:			$2,066,300
		CONTINGENCY		30%	$619,900
		SUBTOTAL:			$2,686,200
		ENG/SURVEY		20%	$537,300
		SUBTOTAL:			$3,223,500
PROJECT TOTAL					**$3,223,500**

City of Alvin

Wastewater CIP Projects - 2035 & Beyond

OPINION OF PROBABLE COST — **October 29, 2015**

Construction Project Number 14

Project Description

Lift Station 8 Expansion

Detailed Description

This project includes the expansion of Lift Station 8 from a firm capacity of 3.17 MGD to a firm pumping capacity of 3.55 MGD.

Purpose

The 3.55 MGD expansion is sized to accommodate projected growth and convey projected 2035 peak wastewater flows from the West Central basin.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Lift Station 8 Rehabilitation and Expansion (3.55	1	LS	$973,800	$973,800
		SUBTOTAL:			$973,800
		CONTINGENCY		30%	$292,200
		SUBTOTAL:			$1,266,000
		ENG/SURVEY		20%	$253,200
		SUBTOTAL:			$1,519,200
PROJECT TOTAL					**$1,519,200**

City of Alvin

Wastewater CIP Projects - 2035 & Beyond

OPINION OF PROBABLE COST — **October 29, 2015**

Construction Project Number — R8

Project Description

Central Basin Sanitary Sewer Evaluation Survey (SSES)

Detailed Description

FNI recommends that an SSES be conducted throughout the Central Basin to identify sources of I/I. Once sources of I/I are found, the City should address them as required to reduce excess water entering the wastewater system.

Purpose

This project is a sanitary sewer evaluation survey (SSES) of the Central Basin.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	SSES Flow Monitoring	1	LS	$5,000	$5,000
2	SSES Smoke Testing	21,600	LF	$0.62	$13,392
3	SSES Manhole Inspection	74	EA	$210.00	15,540
		SUBTOTAL:			$34,000
		CONTINGENCY		10%	$3,400
		SUBTOTAL:			$37,400
		ENG/SURVEY		20%	$7,500
		SUBTOTAL:			$44,900

PROJECT TOTAL **$44,900**

City of Alvin

Wastewater CIP Projects - 2035 & Beyond

OPINION OF PROBABLE COST — **October 29, 2015**

Construction Project Number — R9

Project Description

Lift Station 34 Rehabilitation

Detailed Description

This project includes the rehabilitation of Lift Station 34. The condition assessment results showed this lift station to be in poor condition.

Purpose

This rehabilitation project will increase the service life and reliability of this lift station.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Lift Station 34 Rehabilitation	1	LS	$350,000	$350,000
		SUBTOTAL:			$350,000
		CONTINGENCY		30%	$105,000
		SUBTOTAL:			$455,000
		ENG/SURVEY		20%	$91,000
		SUBTOTAL:			$546,000
PROJECT TOTAL					**$546,000**

City of Alvin

Wastewater CIP Projects - 2035 & Beyond

OPINION OF PROBABLE COST — **October 29, 2015**

Construction Project Number — R10

Project Description

Lift Station 11 Rehabilitation

Detailed Description

This project includes the rehabilitation of Lift Station 11. The condition assessment results showed this lift station to be in poor condition.

Purpose

This rehabilitation project will increase the service life and reliability of this lift station.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Lift Station 11 Rehabilitation	1	LS	$400,000	$400,000
		SUBTOTAL:			$400,000
		CONTINGENCY		30%	$120,000
		SUBTOTAL:			$520,000
		ENG/SURVEY		20%	$104,000
		SUBTOTAL:			$624,000

PROJECT TOTAL **$624,000**

City of Alvin

Wastewater CIP Projects - 2035 & Beyond

OPINION OF PROBABLE COST — **October 29, 2015**

Construction Project Number — R11

Project Description

Lift Station 3 Rehabilitation

Detailed Description

This project includes the rehabilitation of Lift Station 3. The condition assessment results showed this lift station to be in moderate condition.

Purpose

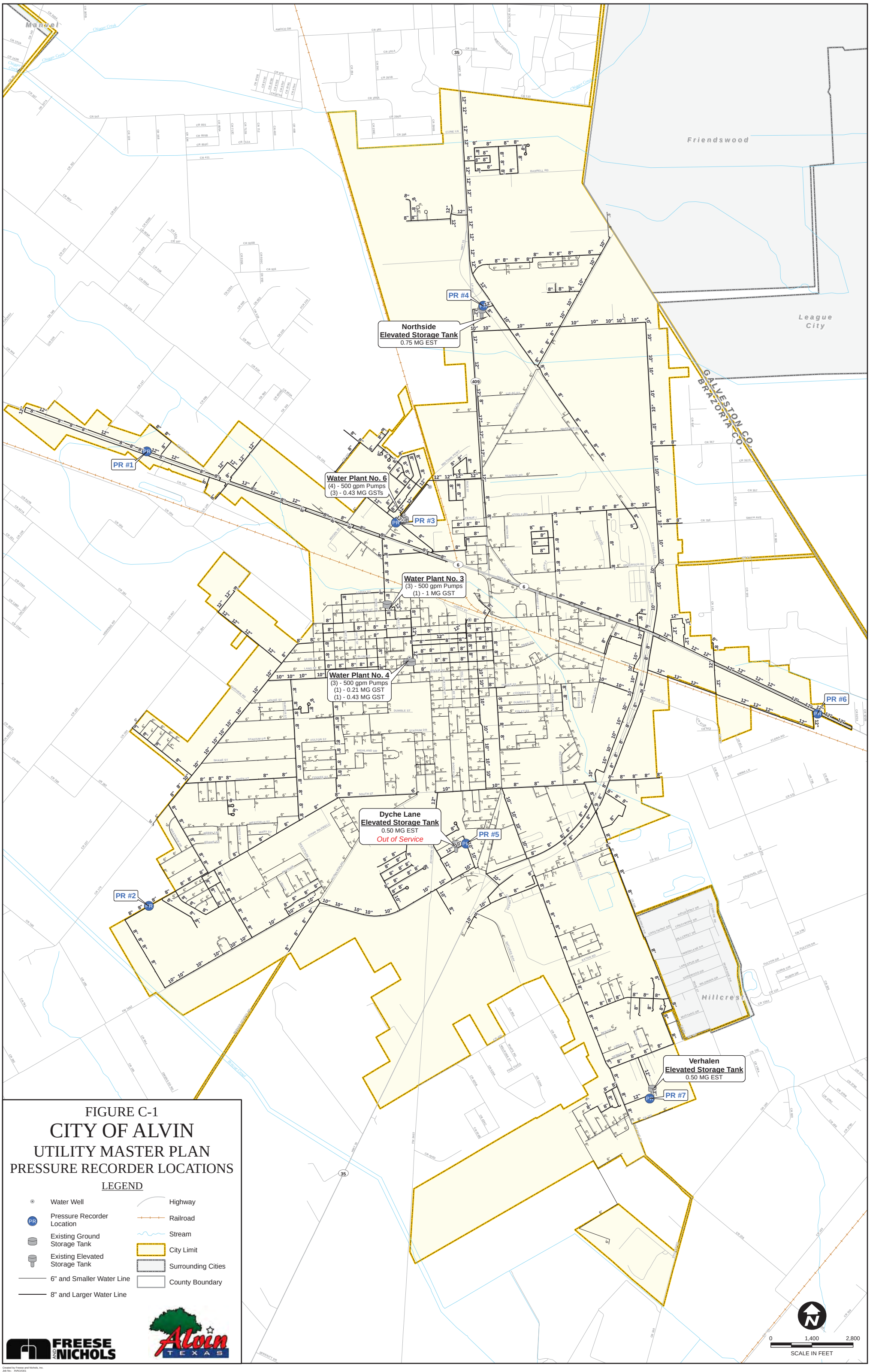
This rehabilitation project will increase the service life and reliability of this lift station.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Lift Station 3 Rehabilitation	1	LS	$360,000	$360,000
2	0	-	0	$0	$0
3	0	-	0	$0	$0

SUBTOTAL:		$360,000
CONTINGENCY	30%	$108,000
SUBTOTAL:		$468,000
ENG/SURVEY	20%	$93,600
SUBTOTAL:		$561,600

PROJECT TOTAL **$561,600**

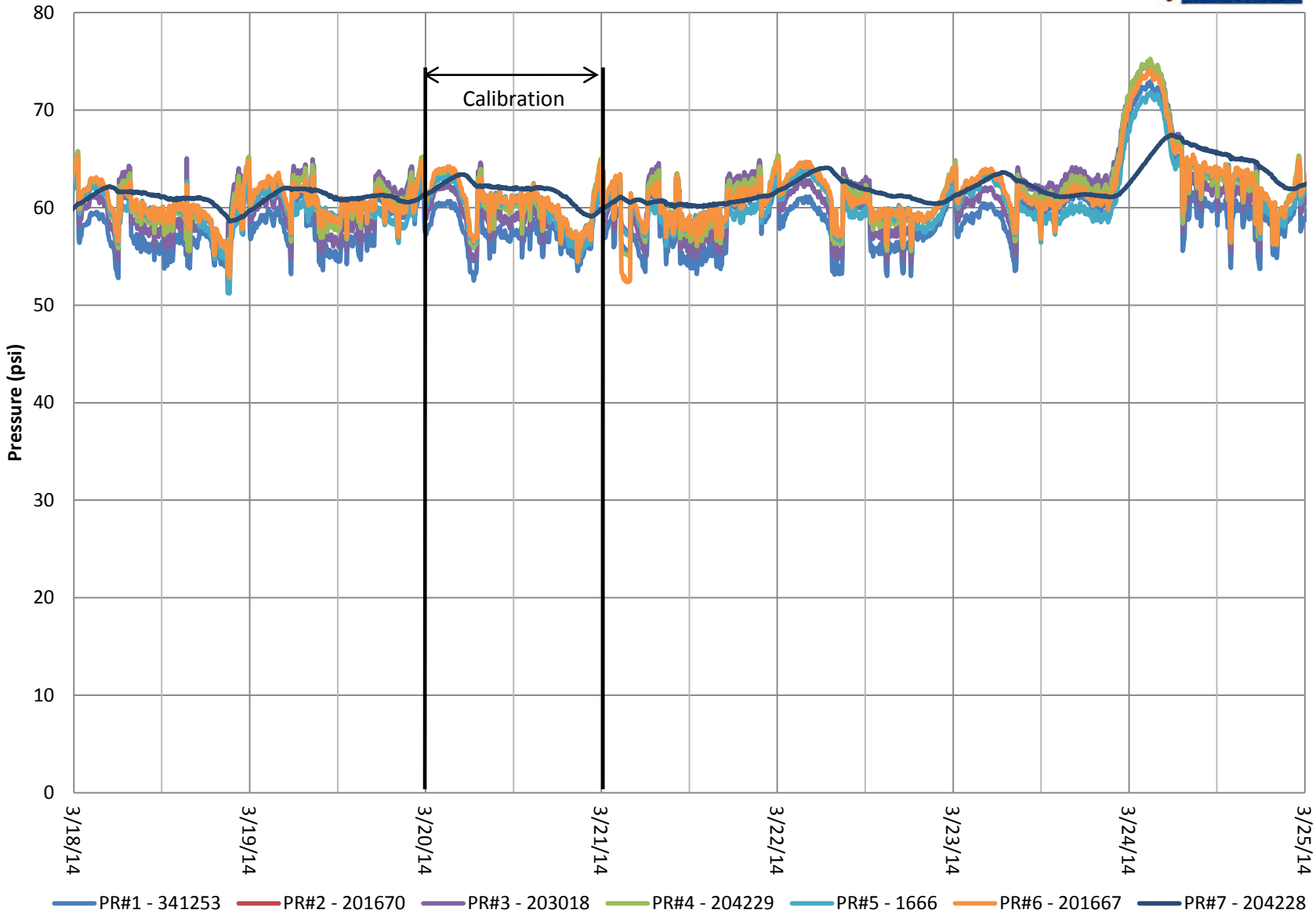
APPENDIX C:
Pressure Recorder Data

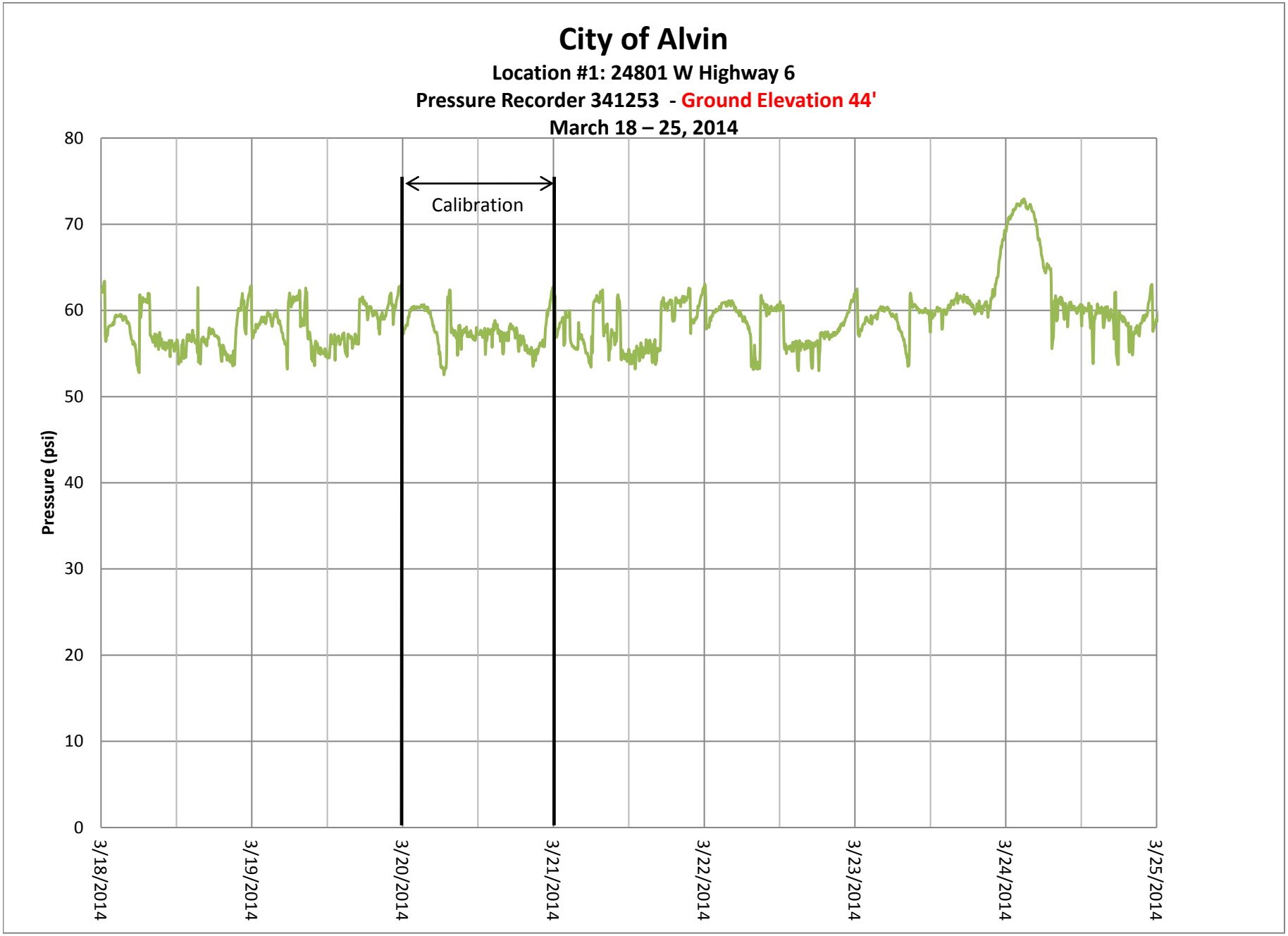


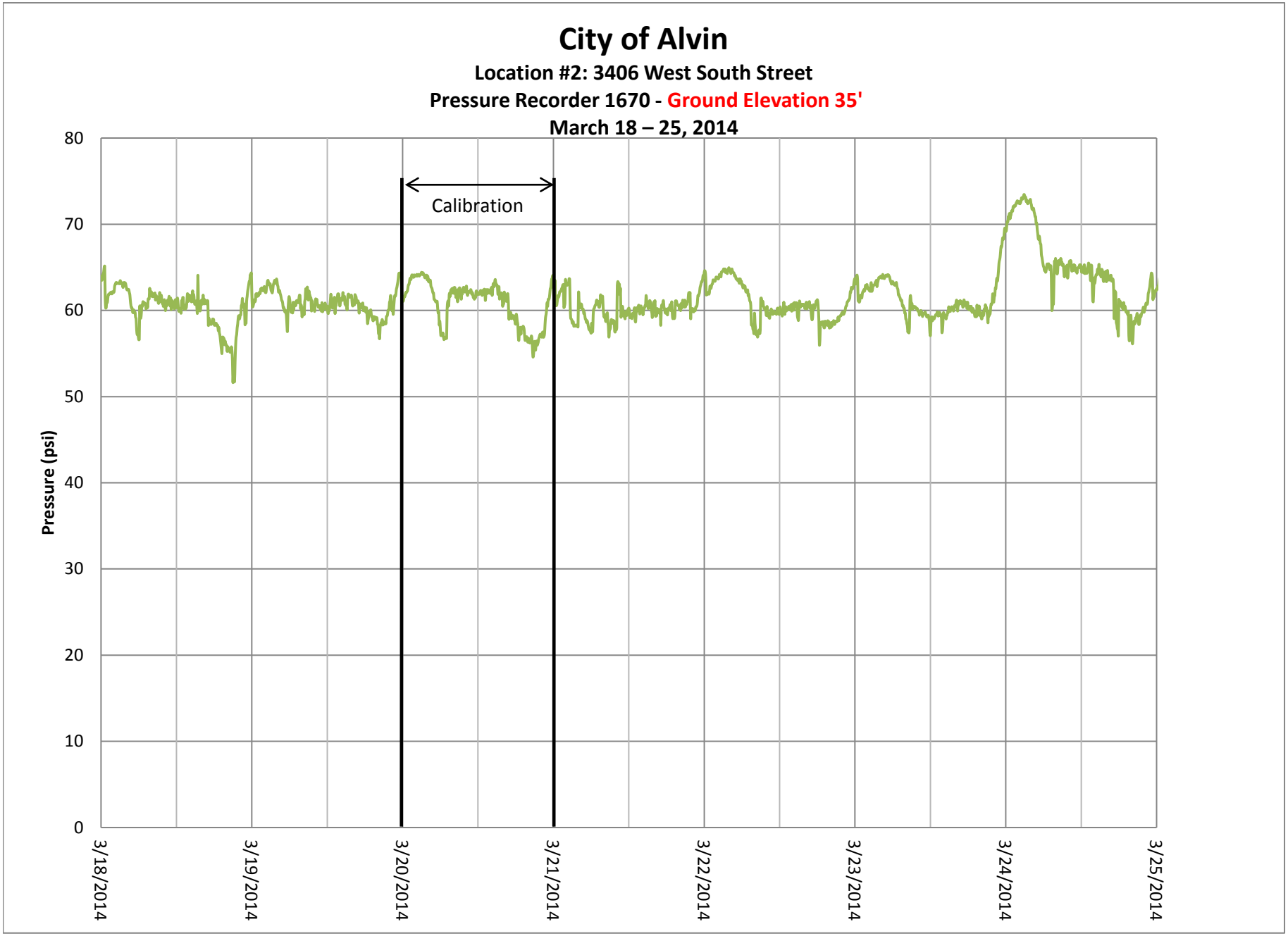
Created by Freese and Nichols, Inc.
Job No.: AVN14181
Location: H:\W_WW_PLANNING\Final_Report\Figure_C-1)_Pressure_Recorder_Locations.mxd
Updated: Thursday, February 04, 2016

City of Alvin Pressure Testing Results

March 18 – 25, 2014




City of Alvin
Location #1: 24801 W Highway 6
Pressure Recorder 341253 - Ground Elevation 44'
March 18 – 25, 2014
Calibration
Pressure (psi)
80
70
60
50
40
30
20
10
0
3/18/2014
3/19/2014
3/20/2014
3/21/2014
3/22/2014
3/23/2014
3/24/2014
3/25/2014

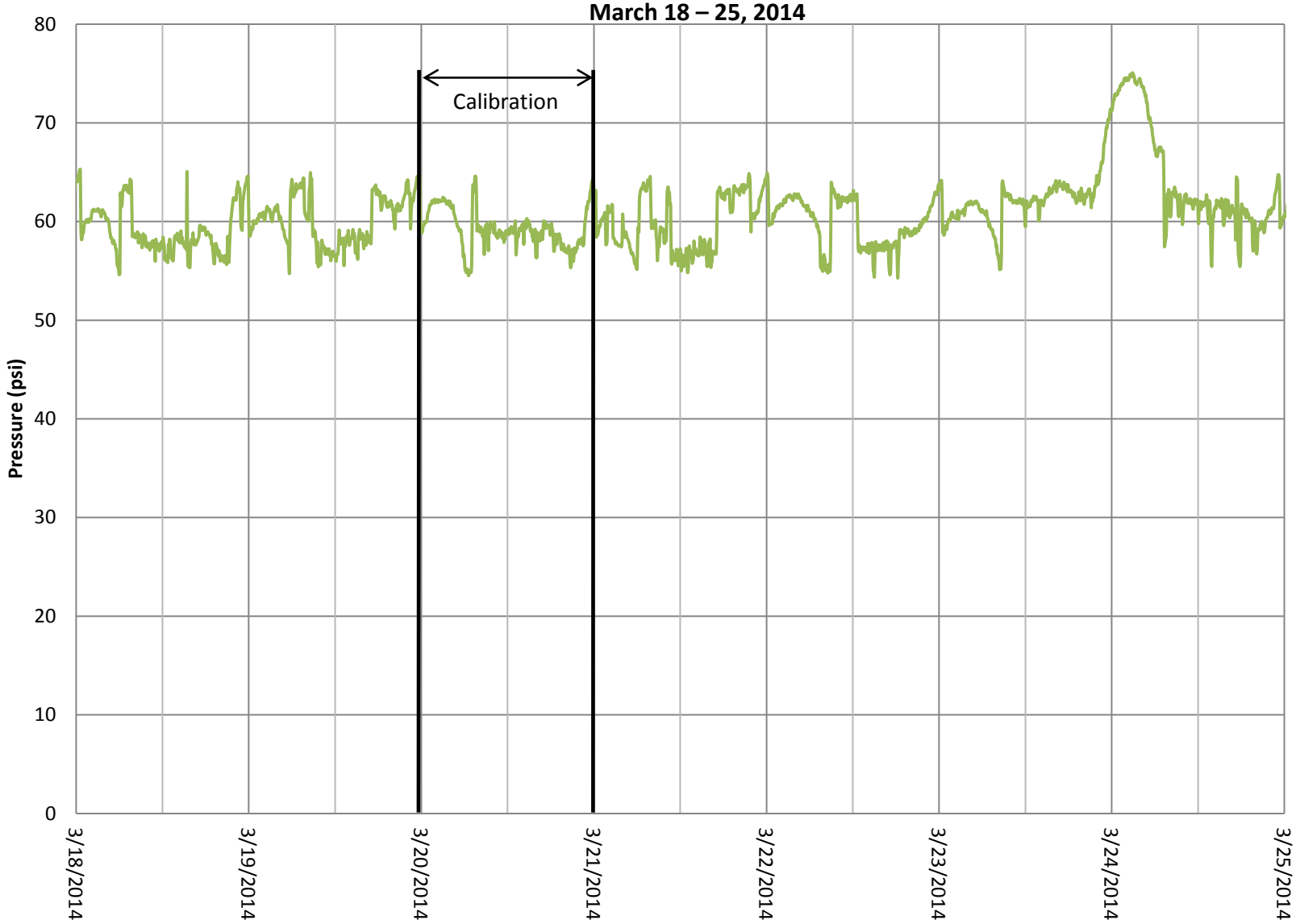

City of Alvin
Location #2: 3406 West South Street
Pressure Recorder 1670 - Ground Elevation 35'
March 18 – 25, 2014
Calibration
Pressure (psi)
80
70
60
50
40
30
20
10
0
3/18/2014
3/19/2014
3/20/2014
3/21/2014
3/22/2014
3/23/2014
3/24/2014
3/25/2014

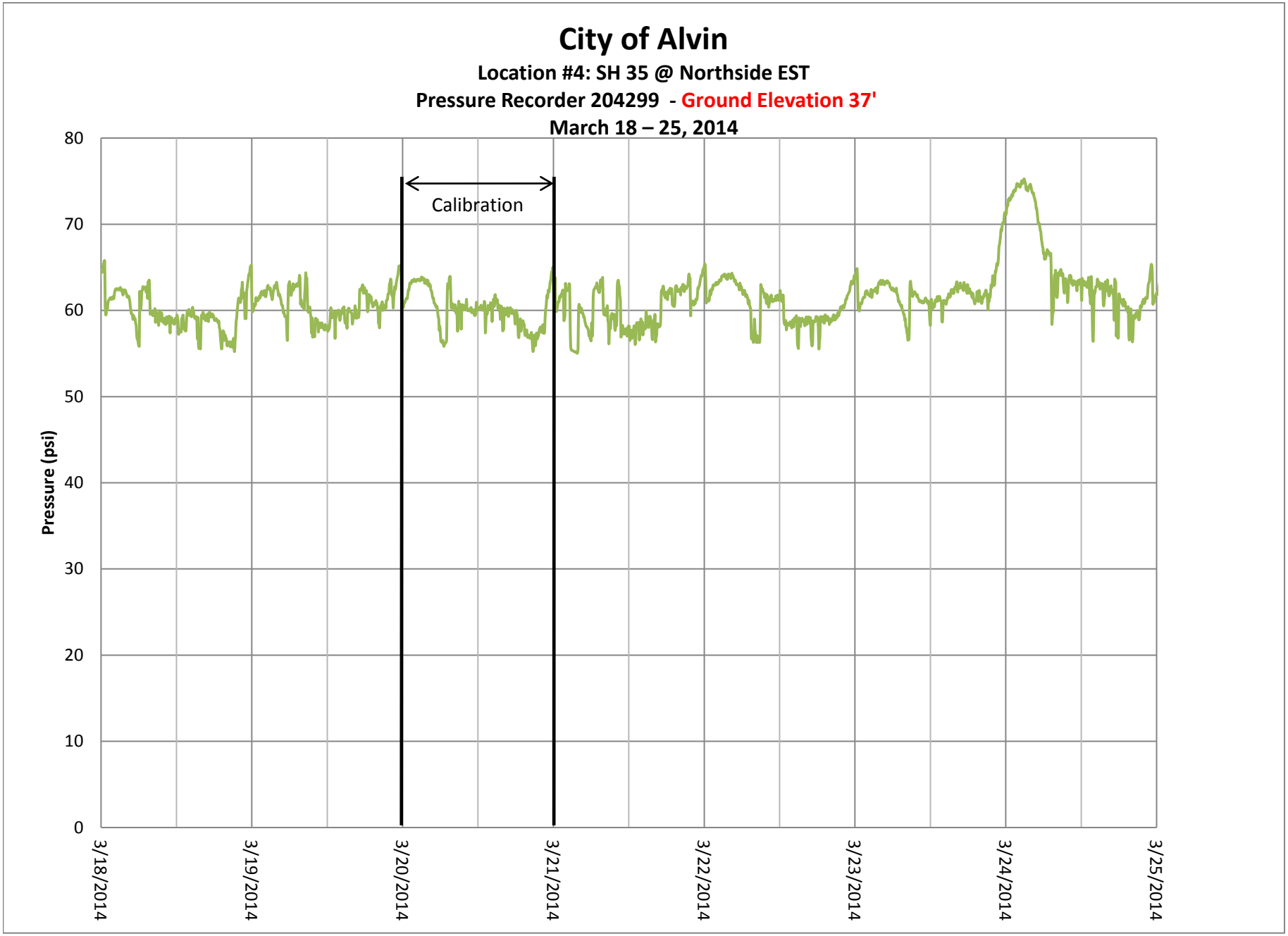
City of Alvin

Location #3: Brazos Street @ Heights Road

Pressure Recorder 203018 - Ground Elevation 40'

March 18 – 25, 2014



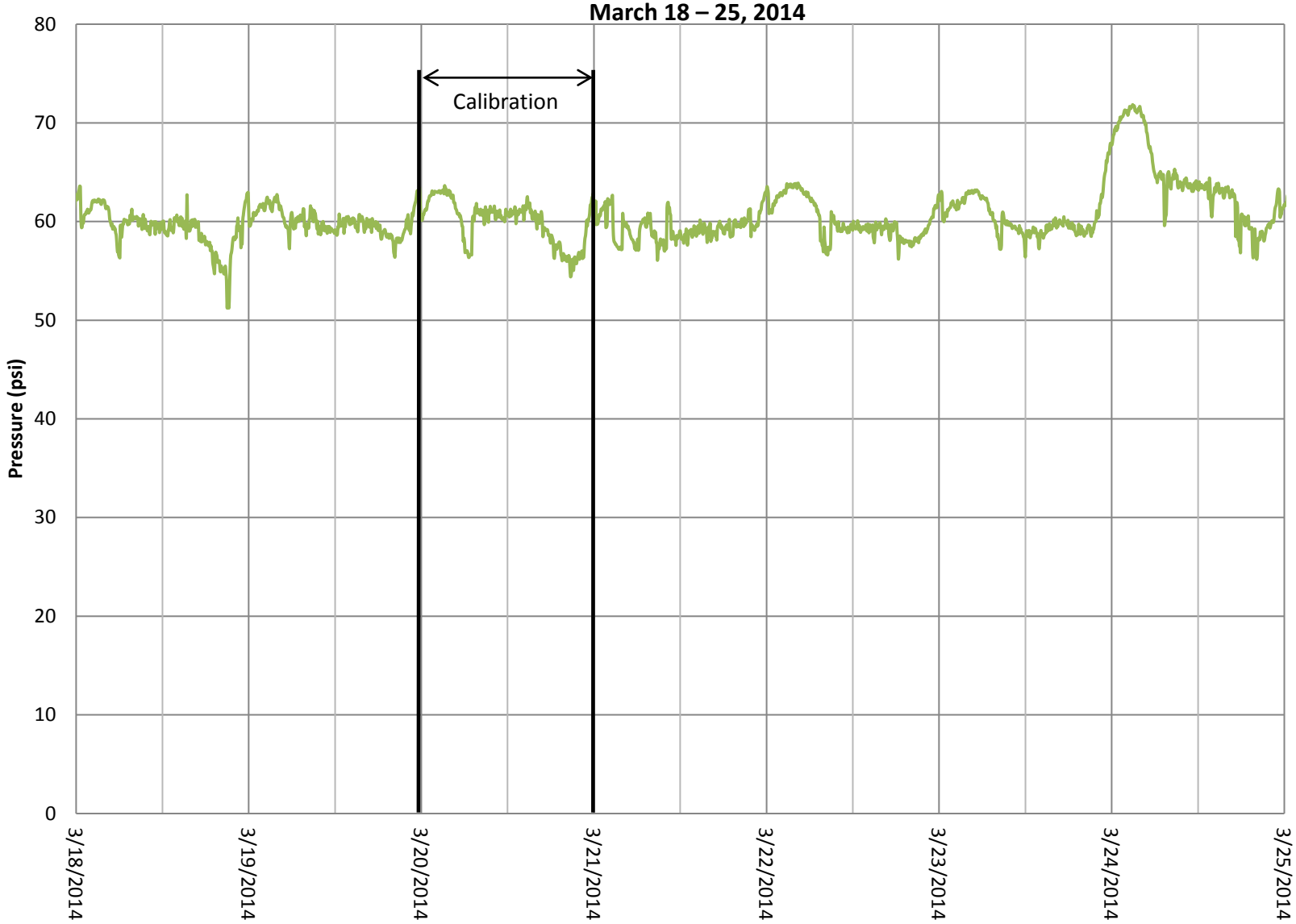

City of Alvin
Location #4: SH 35 @ Northside EST
Pressure Recorder 204299 - Ground Elevation 37'
March 18 – 25, 2014
Calibration
Pressure (psi)
80
70
60
50
40
30
20
10
0
3/18/2014
3/19/2014
3/20/2014
3/21/2014
3/22/2014
3/23/2014
3/24/2014
3/25/2014

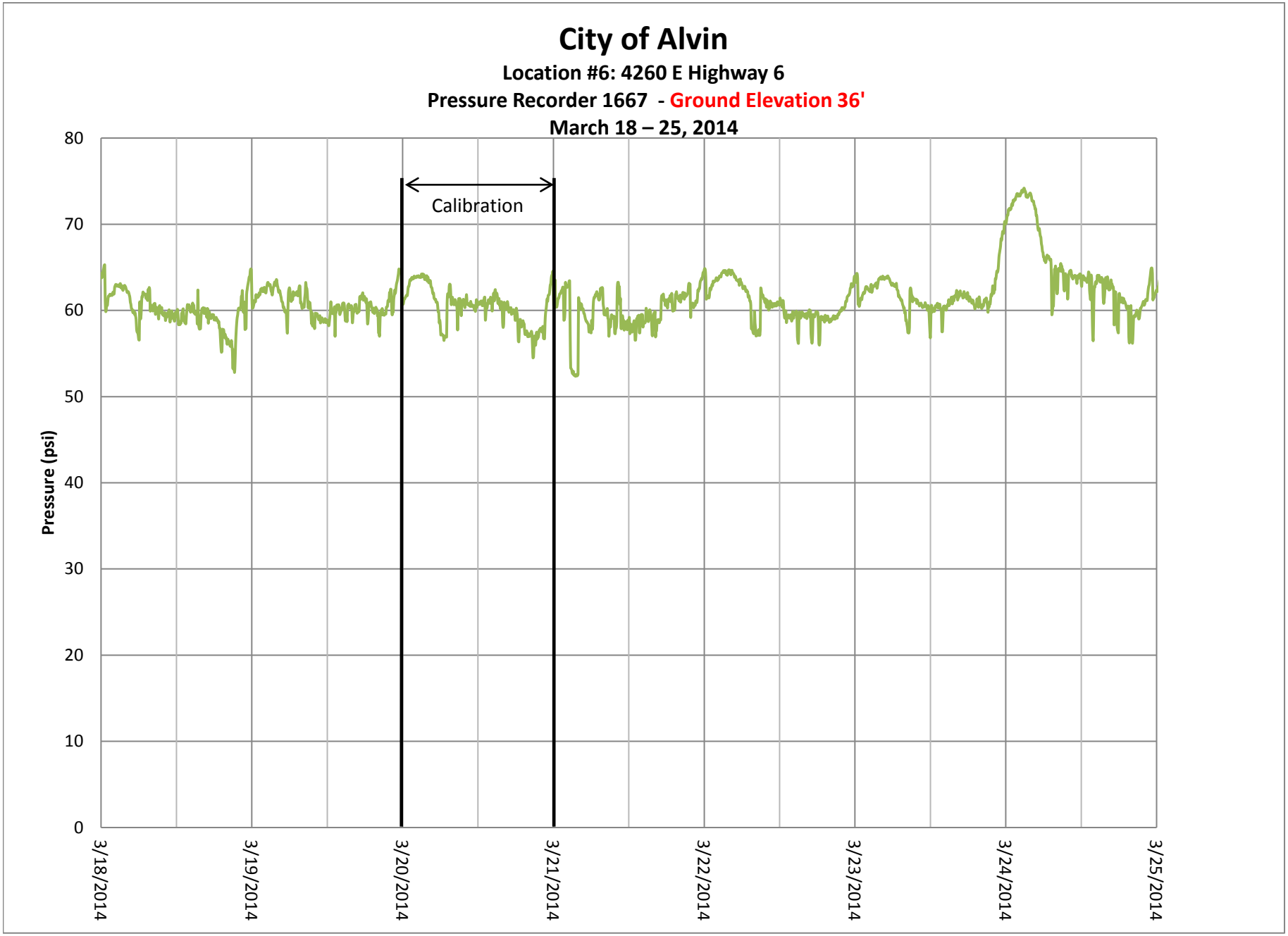
City of Alvin

Location #5: Dyche Lane @ Cramer Road

Pressure Recorder 1666 - Ground Elevation 36'

March 18 – 25, 2014



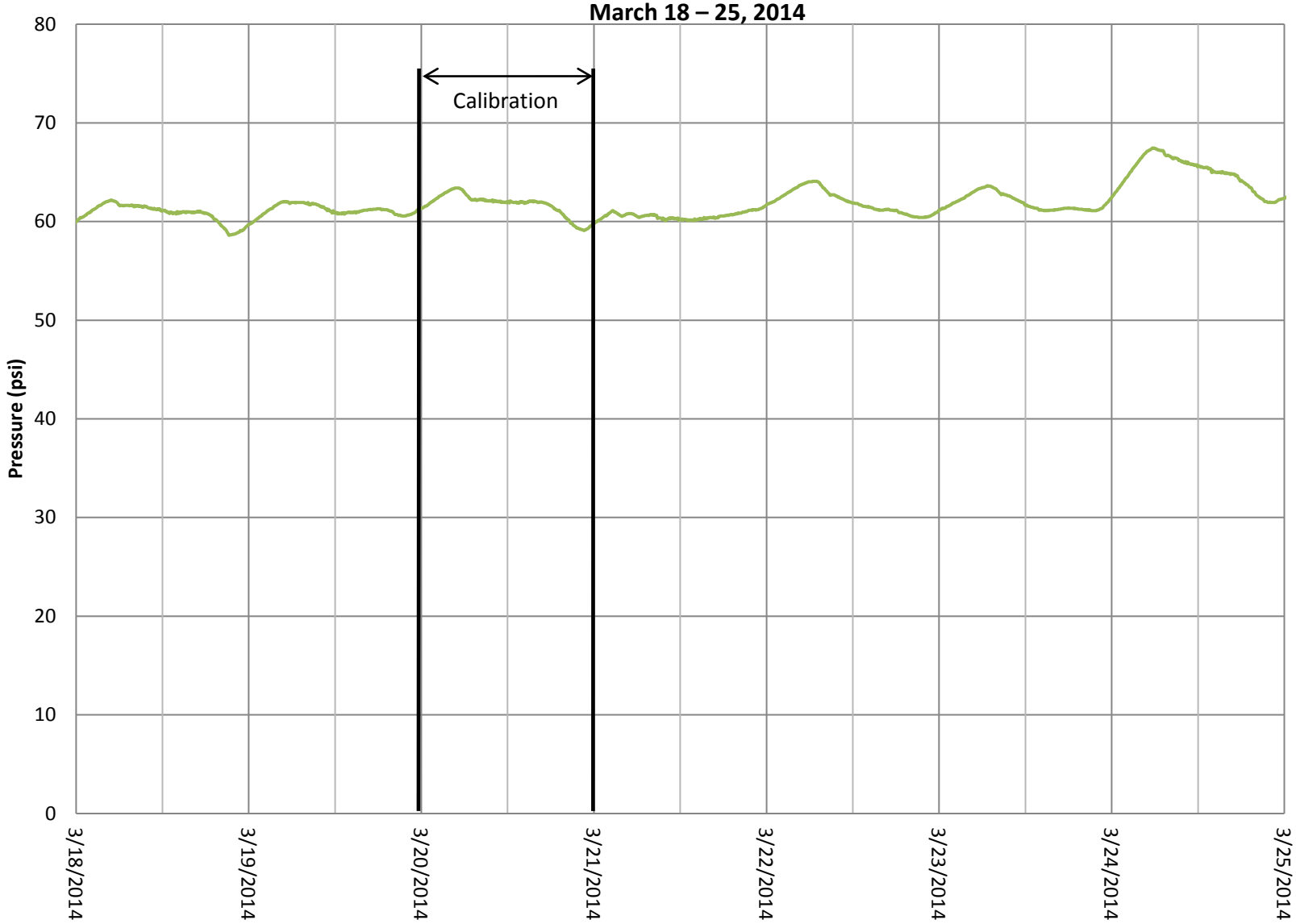

City of Alvin
Location #6: 4260 E Highway 6
Pressure Recorder 1667 - Ground Elevation 36'
March 18 – 25, 2014
Calibration
Pressure (psi)
80
70
60
50
40
30
20
10
0
3/18/2014
3/19/2014
3/20/2014
3/21/2014
3/22/2014
3/23/2014
3/24/2014
3/25/2014

City of Alvin

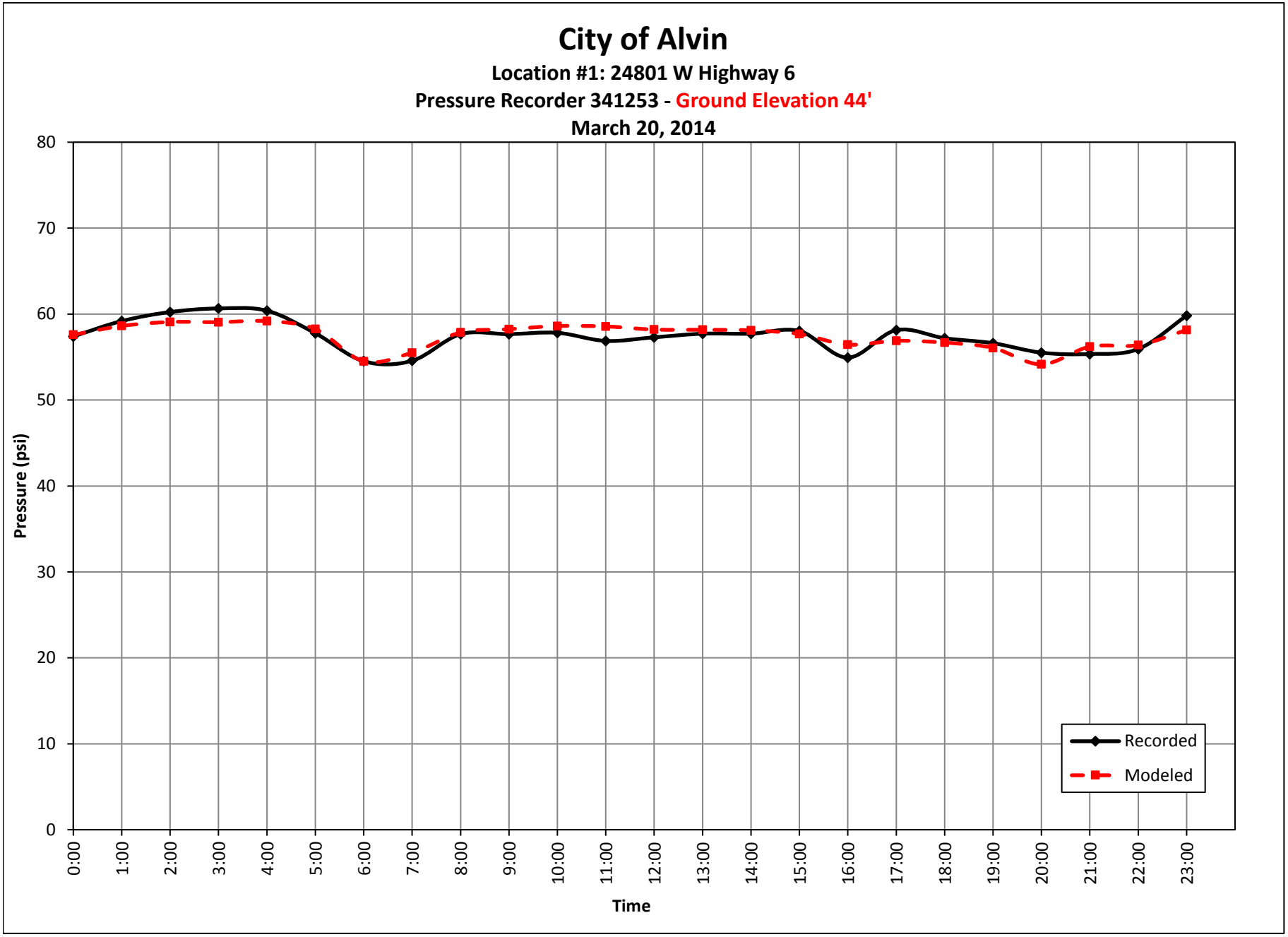
Location #7: Verhalen EST Behind Stevenson Primary School

Pressure Recorder 204228 - Ground Elevation 30'

March 18 – 25, 2014



APPENDIX D:
Water Model Calibration Results


City of Alvin
Location #1: 24801 W Highway 6
Pressure Recorder 341253 - Ground Elevation 44'
March 20, 2014
Pressure (psi)
80
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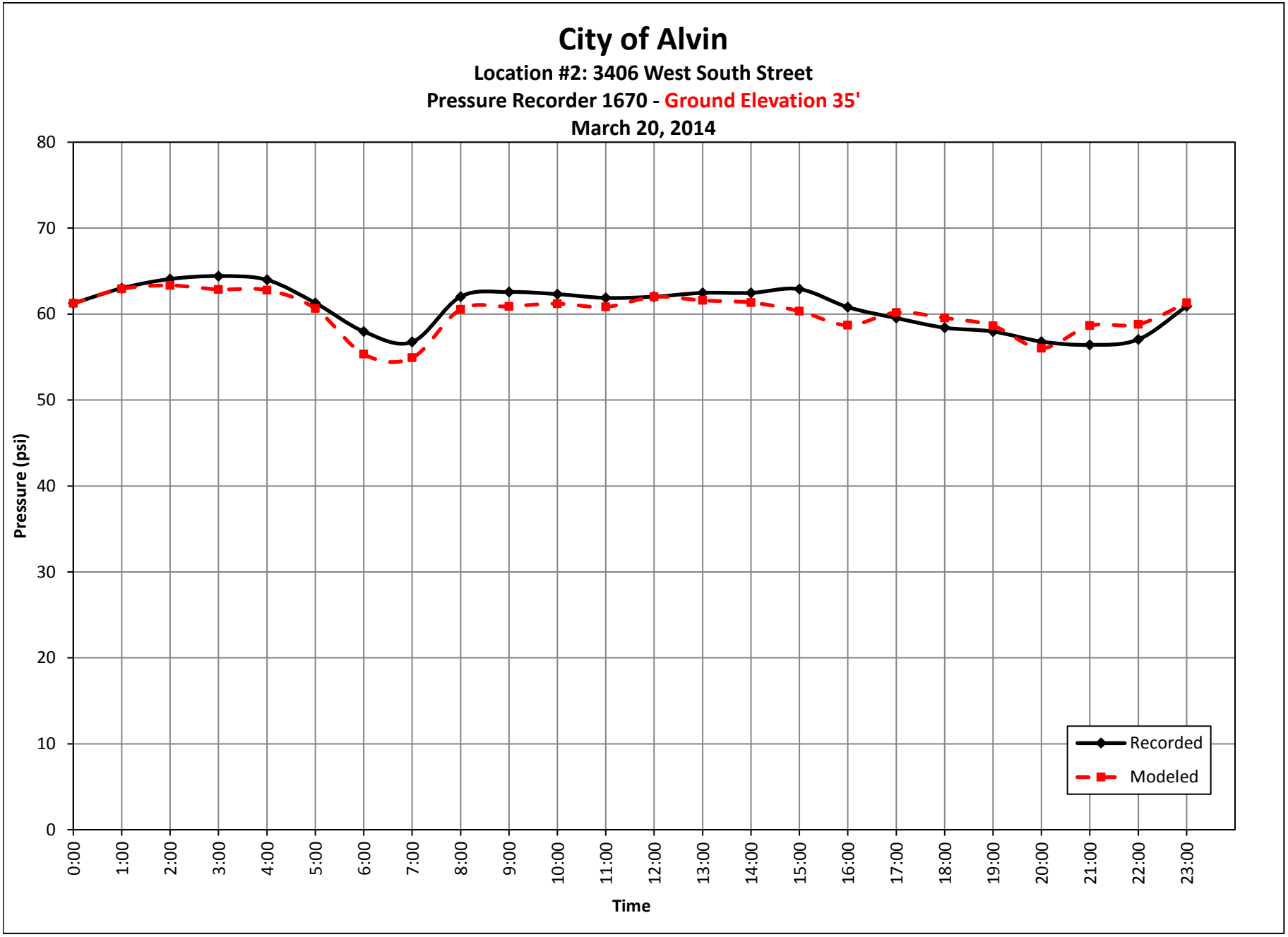
23:00
Time
Recorded
Modeled


City of Alvin
Location #2: 3406 West South Street
Pressure Recorder 1670 - Ground Elevation 35'
March 20, 2014
Pressure (psi)
80
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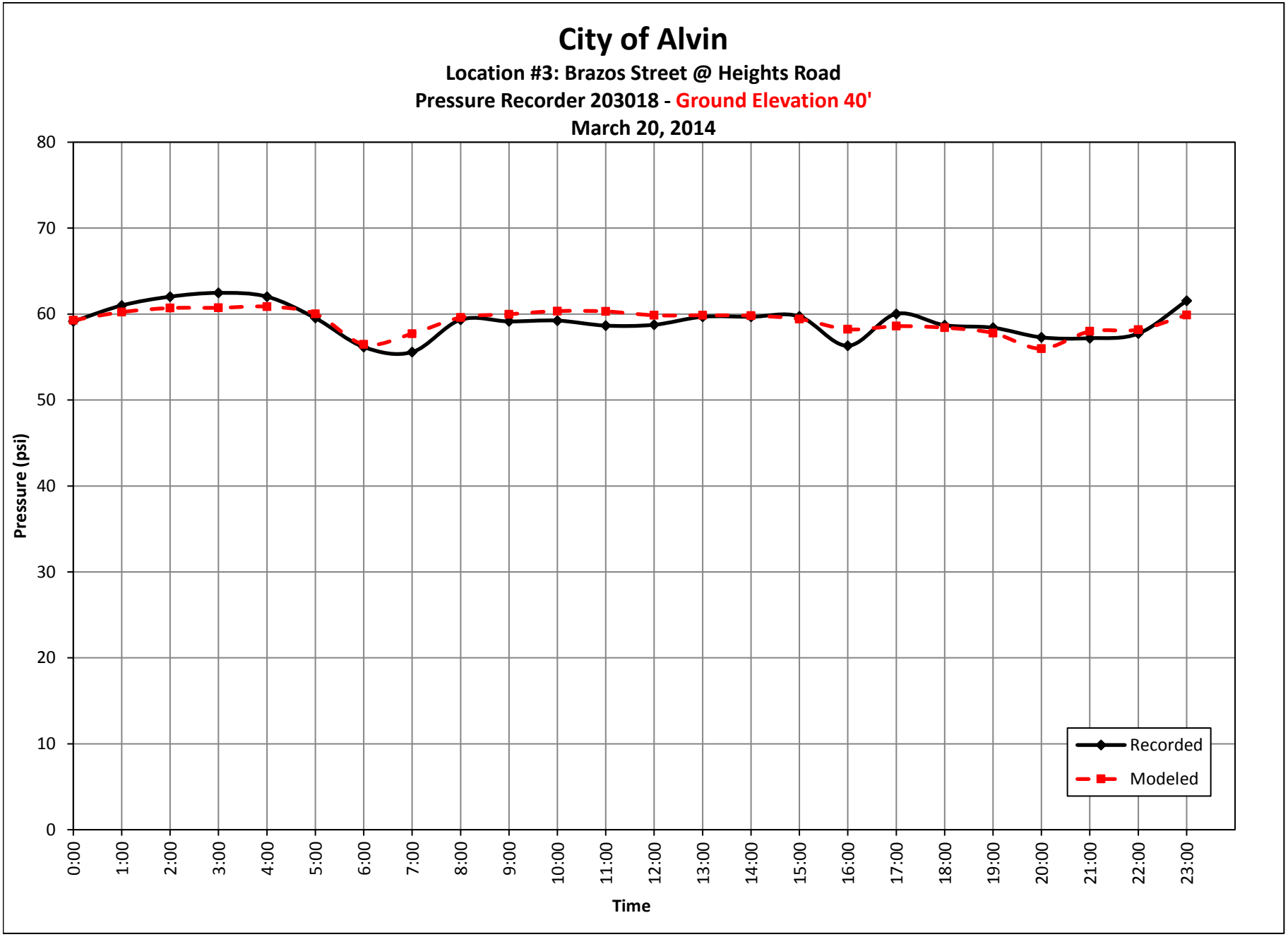
22:00
23:00
Time
Recorded
Modeled


City of Alvin
Location #3: Brazos Street @ Heights Road
Pressure Recorder 203018 - Ground Elevation 40'
March 20, 2014
Pressure (psi)
80
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40
30
20
10
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0:00
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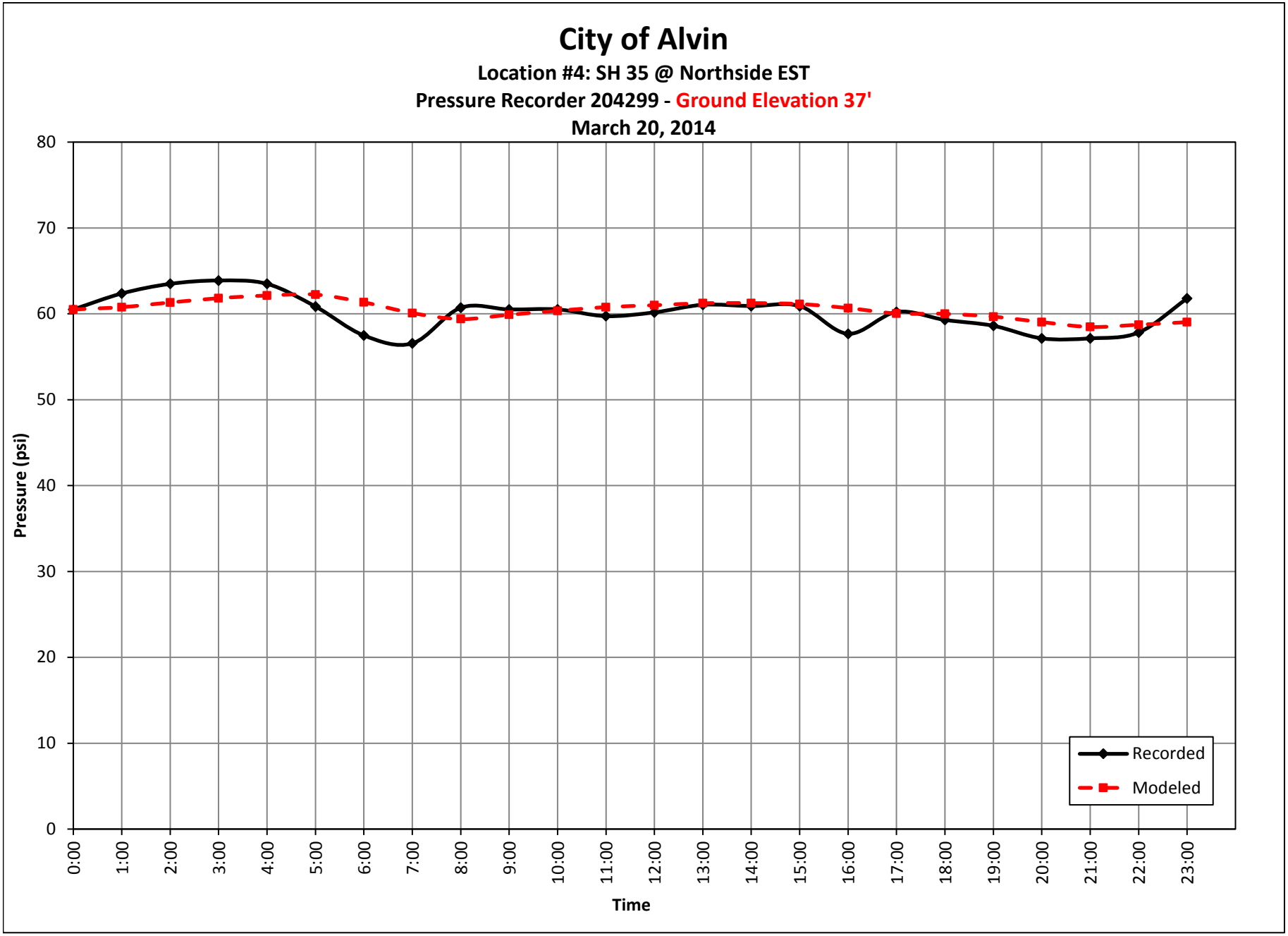
19:00
20:00
21:00
22:00
23:00
Time
Recorded
Modeled


City of Alvin
Location #4: SH 35 @ Northside EST
Pressure Recorder 204299 - Ground Elevation 37'
March 20, 2014
Pressure (psi)
80
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40
30
20
10
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0:00
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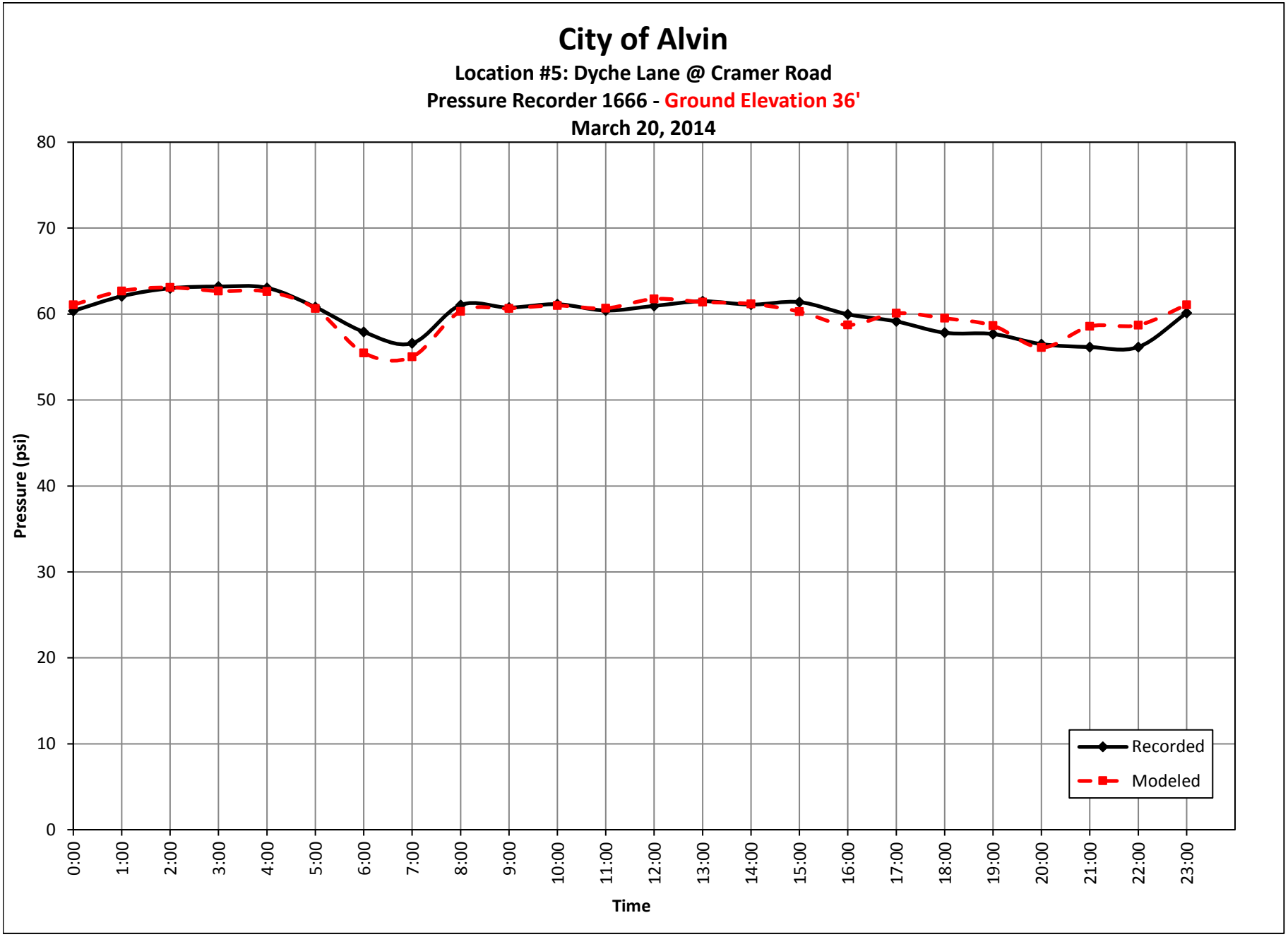
21:00
22:00
23:00
Time
Recorded
Modeled


City of Alvin
Location #5: Dyche Lane @ Cramer Road
Pressure Recorder 1666 - Ground Elevation 36'
March 20, 2014
Pressure (psi)
80
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40
30
20
10
0
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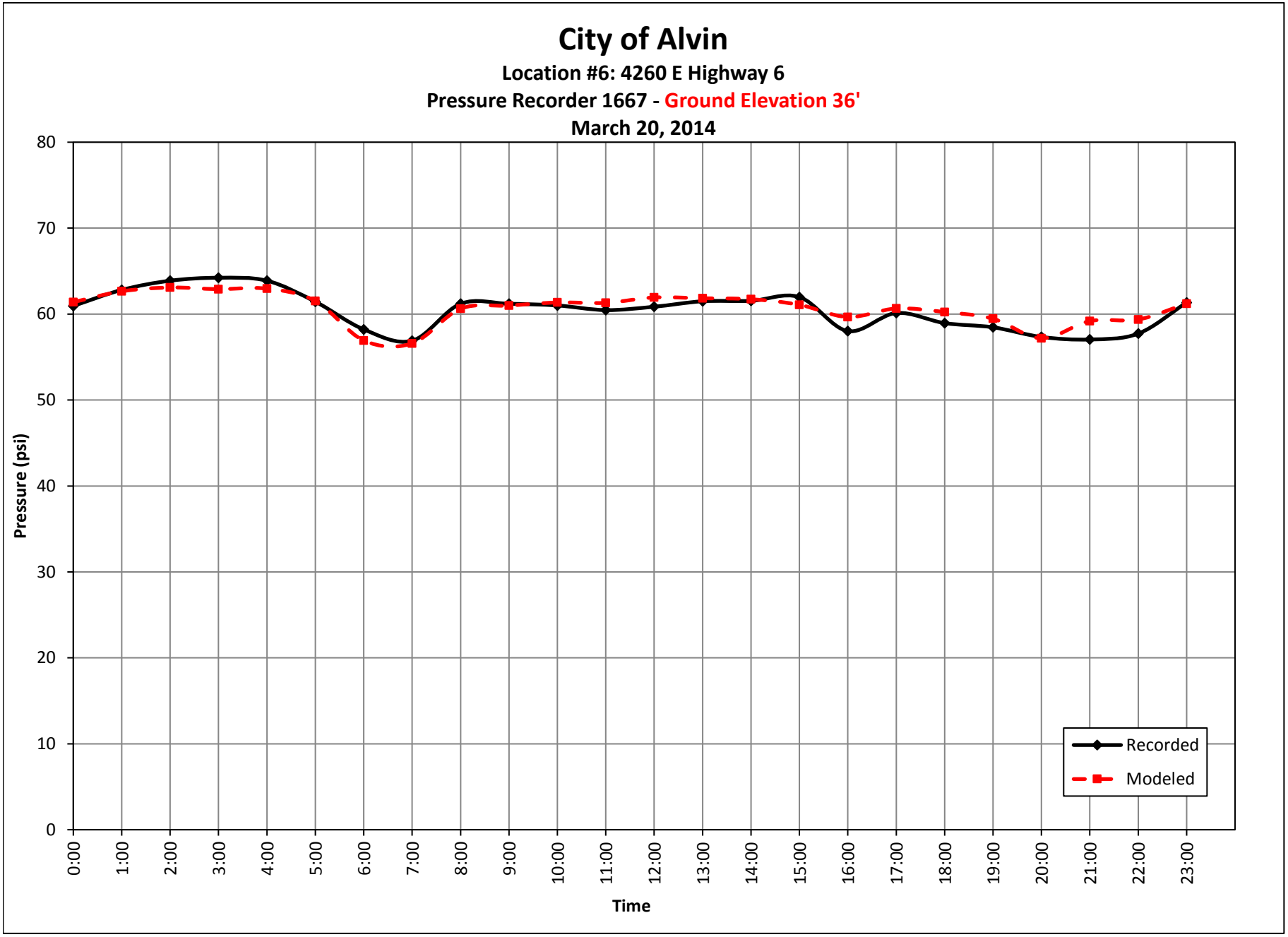
Time
Recorded
Modeled


City of Alvin
Location #6: 4260 E Highway 6
Pressure Recorder 1667 - Ground Elevation 36'
March 20, 2014
Pressure (psi)
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60
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30
20
10
0
0:00
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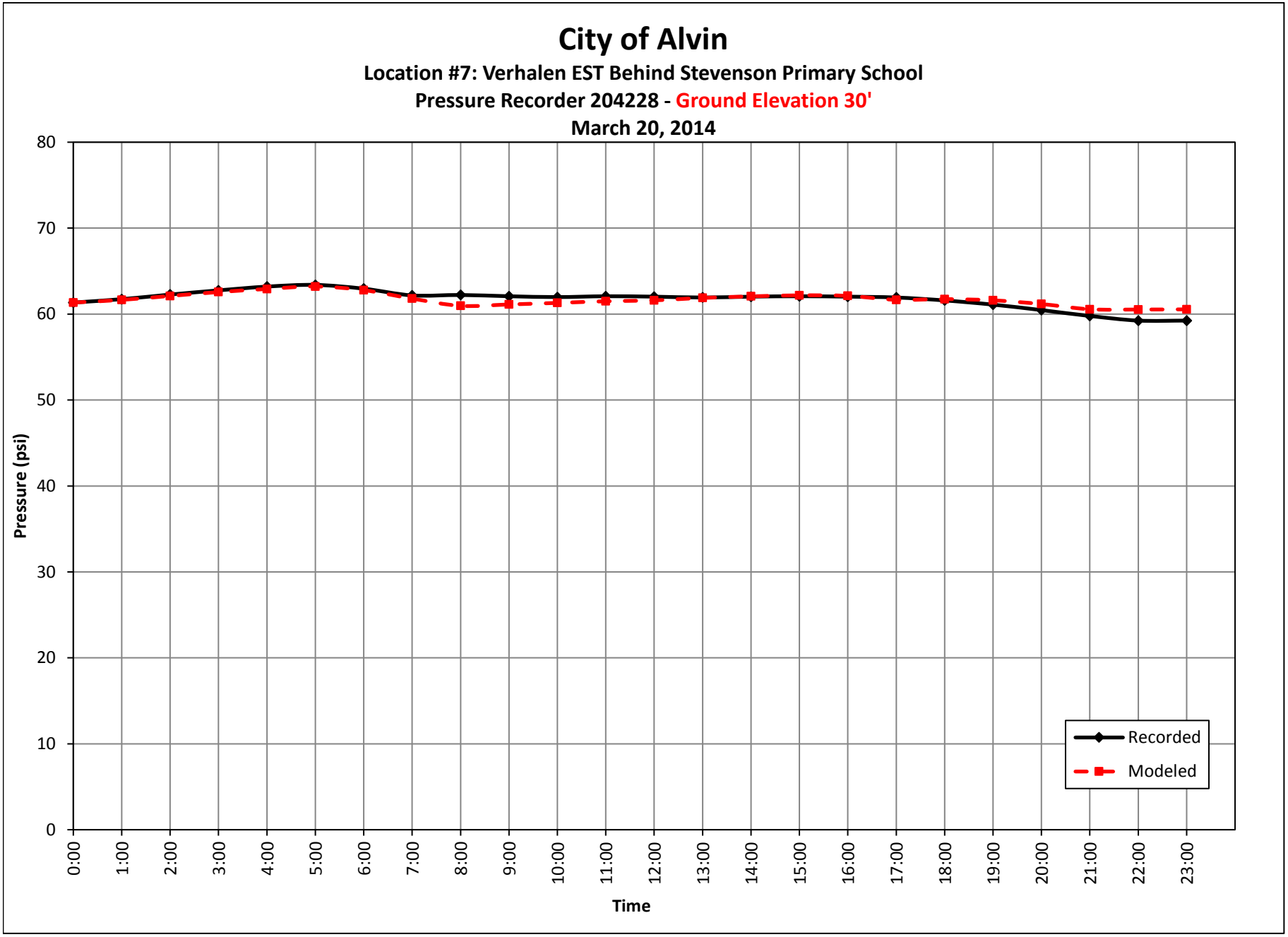
23:00
Time
Recorded
Modeled


City of Alvin
Location #7: Verhalen EST Behind Stevenson Primary School
Pressure Recorder 204228 - Ground Elevation 30'
March 20, 2014
Pressure (psi)
80
70
60
50
40
30
20
10
0
0:00
1:00
2:00
3:00
4:00
5:00
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23:00
Time
Recorded
Modeled

APPENDIX E:
Flow Monitor and Rain Gauge Site Sheets

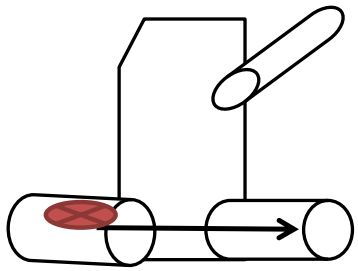
ADS Site Report

Quality Form

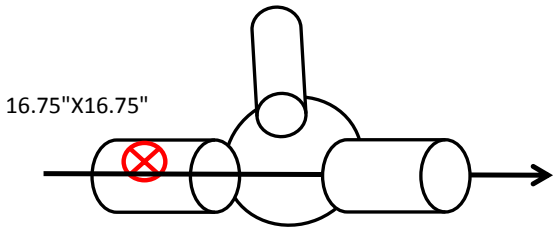
Project Name:	Alvin	City/State:	Alvin, TX	FM Initials:	DM
Site Name:	CE-01	Monitor Series:	Monitor S/N#:		
Address / Location:	604 Sunset St.		Manhole #:	3-E-54-A	
			Map Page #:		
Access: Drive	Type of System:	Sanitary X / Storm / Combined	Pipe Height:	16.75"	
			Pipe Width:	16.75"	
			Phone Number:		

Date/Time of Investigation:	4/22/2014 14:20:00 PM		Manhole Depth:	8	Feet	
Site Hydraulics:	Good Hydraulics		Manhole Material / Condition:	Concrete		
Upstream Input: (L/S, P/S)	DNI		Pipe Material / Condition:	PVC		Good
Upstream Manhole:	DNI		Mini System Character:	Residential X	Commercial X	Industrial / Other
Downstream Manhole:	Wet well					
			Telephone Information:	N/A		
Depth of Flow (Wet Dof):	5.75	+/- 0.25	Access Pole #:	N/A		
Range (Air Dof):		+/-	Distance From Manhole:	N/A	Feet	
Peak Velocity:	0.92	fps	Road Cut Length:	N/A	Feet	
Silt:	0.5	Inches	Trenche Length:	N/A	Feet	

Other Information:



Cross Section



Planar N

Installation Information	
Installation Type:	Ring / Crank
Sensors / Devices:	UVP
Surcharge Height:	Feet
Rain Gauge Zone:	

Backup	Yes	No		Distance
Trunk		X		
Lift/Pump Station		X		
WWTP		X		
Other		X		

Additional Site Information / Comments:

N29°25.1721 W095°14.4756

ADS Site Report

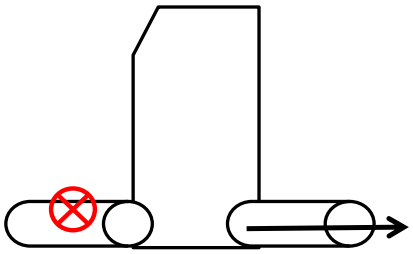
Quality Form

Project Name:	Alvin	City/State:	Alvin, TX	FM Initials:	DM
Site Name:	EC-01	Monitor Series:	Monitor S/N#:		
Address / Location:	2085 Jephson Ln		Manhole #:	1-J-4	
			Map Page #:		
Access: Drive	Type of System:	Sanitary X / Storm / Combined	Pipe Height:	23	
			Pipe Width:	23	
			Phone Number:		

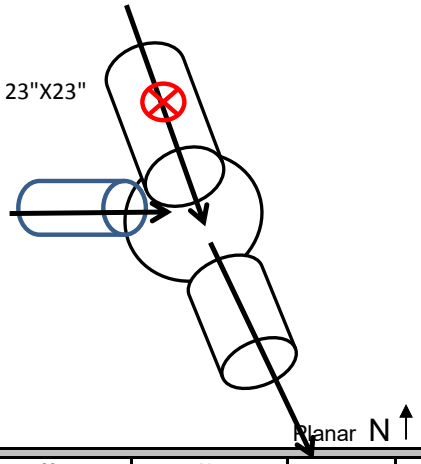
Manhole Information:

Date/Time of Investigation:	5/15/14 12:30 PM	Manhole Depth:	12 Feet		
Site Hydraulics:	Good Hydraulics	Manhole Material / Condition:	Concrete		
Upstream Input: (L/S, P/S)	DNI	Pipe Material / Condition:	Liner		Good
Upstream Manhole:	DNI	Mini System Character:	Residential	Commercial	Industrial	Other
Downstream Manhole:	DNI		X	X		
		Telephone Information: N/A			
Depth of Flow (Wet Dof):	5 +/- 0.25	Access Pole #:	N/A		
Range (Air Dof):	+/-	Distance From Manhole:	N/A Feet		
Peak Velocity:	1.2 fps	Road Cut Length:	N/A Feet		
Silt:	0 Inches	Trenche Length:	N/A Feet		

Other Information:



Cross Section



Installation Information		Backup	Yes	No		Distance
Installation Type:	Ring / Crank	Trunk	X			DS- 500ft'
Sensors / Devices:	UVP	Lift/Pump Station		X		
Surcharge Height:	Feet	WWTP		X		
Rain Gauge Zone:		Other		X		

Additional Site Information / Comments:

N29°24.227' W095°14.162'

ADS Site Report

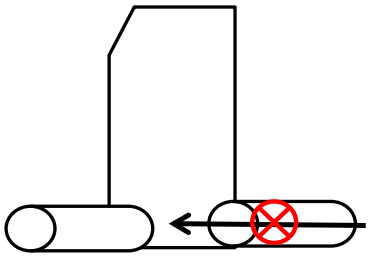
Quality Form

Project Name:	Alvin	City/State:	Alvin, TX	FM Initials:	DM
Site Name:	NE-01	Monitor Series:	Monitor S/N#:		
Address / Location:	2309 S. HWY 35 Bypass		Manhole #:	1-I-12	
			Map Page #:		
Access: Drive	Type of System:	Sanitary X / Storm / Combined	Pipe Height:	28.75	
			Pipe Width:	29	
			Phone Number:		

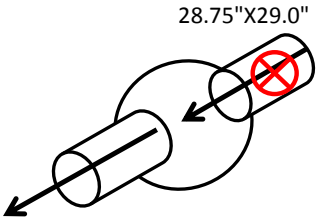
Manhole Information:

Date/Time of Investigation:	4/22/2014 16:00:00 PM	Manhole Depth:	12 Feet		
Site Hydraulics:	Good Hydraulics, does appear to have upstream PS influence	Manhole Material / Condition:	Concrete		
Upstream Input: (L/S, P/S)	DNI	Pipe Material / Condition:	Liner		Good
Upstream Manhole:	DNI	Mini System Character:	Residential	Commercial	Industrial	Other
Downstream Manhole:			X	X		
		Telephone Information:	N/A		
Depth of Flow (Wet Dof):	10 +/- 0.25	Access Pole #:	N/A		
Range (Air Dof):	+/-	Distance From Manhole:	N/A Feet		
Peak Velocity:	1.5 fps	Road Cut Length:	N/A Feet		
Silt:	0 Inches	Trenche Length:	N/A Feet		

Other Information:



Cross Section



Planar N

Installation Information		Backup	Yes	No		Distance
Installation Type:	Ring / Crank	Trunk		X		
Sensors / Devices:	UVP	Lift/Pump Station	X			US
Surcharge Height:	Feet	WWTP		X		
Rain Gauge Zone:		Other		X		

Additional Site Information / Comments:

N29°24.2630 W095°14.1427

ADS Site Report

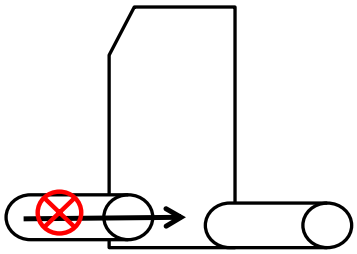
Quality Form

Project Name:	Alvin	City/State:	Alvin, TX	FM Initials:	DM
Site Name:	NW-01	Monitor Series:	Monitor S/N#:		
Address / Location:	102 Steel Road		Manhole #:	5-E-17	
			Map Page #:		
Access: Drive	Type of System:	Sanitary X / Storm / Combined	Pipe Height:	16.75"	
			Pipe Width:	18.5"	
			Phone Number:		

Manhole Information:

Date/Time of Investigation:	4/22/2014 13:45:00 PM	Manhole Depth:	14 Feet			
Site Hydraulics:	Good Hydraulics, can be effected by the downstream PS wetwell level	Manhole Material / Condition:	Concrete			
Upstream Input: (L/S, P/S)	DNI	Pipe Material / Condition:	PVC			Good
Upstream Manhole:	DNI	Mini System Character:	Residential	Commercial	Industrial	Other
Downstream Manhole:	Wet well		X	X		
		Telephone Information: N/A				
Depth of Flow (Wet Dof):	5 +/- 0.25	Access Pole #:	N/A			
Range (Air Dof):	+/-	Distance From Manhole:	N/A Feet			
Peak Velocity:	1.32 fps	Road Cut Length:	N/A Feet			
Silt:	1.5 Inches	Trenche Length:	N/A Feet			

Other Information:



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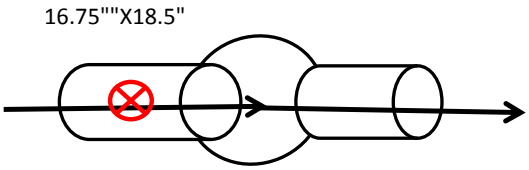


Planar N

Installation Information		Backup	Yes	No		Distance
Installation Type:	Ring / Crank	Trunk		X		
Sensors / Devices:	UVP	Lift/Pump Station	X			DS- 500ft'
Surcharge Height:	Feet	WWTP		X		
Rain Gauge Zone:		Other		X		

Additional Site Information / Comments:

N29°26.0587 W095°14.4106

ADS Site Report

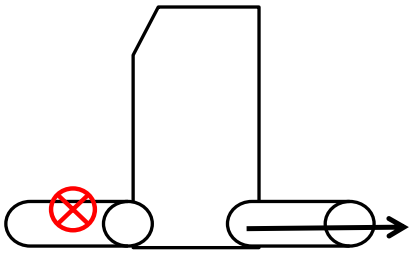
Quality Form

Project Name:	Alvin	City/State:	Alvin, TX	FM Initials:	DM
Site Name:	SO-01	Monitor Series:	Monitor S/N#:		
Address / Location:	699 Verhallen Rd, Trailer Park		Manhole #:	1-B-17	
			Map Page #:		
Access: Drive	Type of System:	Sanitary X / Storm / Combined	Pipe Height:	32	
			Pipe Width:	32	
			Phone Number:		

Manhole Information:

Date/Time of Investigation:	5/15/14 9:30 AM	Manhole Depth:	11.8 Feet			
Site Hydraulics:	Good Hydraulics	Manhole Material / Condition:	Concrete			
Upstream Input: (L/S, P/S)	DNI	Pipe Material / Condition:	Liner			Good
Upstream Manhole:	DNI	Mini System Character:	Residential	Commercial	Industrial	Other
Downstream Manhole:	DNI		X	X		
		Telephone Information: N/A				
Depth of Flow (Wet Dof):	11.25 +/- 0.25	Access Pole #:	N/A			
Range (Air Dof):	+/-	Distance From Manhole:	N/A Feet			
Peak Velocity:	1.25 fps	Road Cut Length:	N/A Feet			
Silt:	0 Inches	Trenche Length:	N/A Feet			

Other Information:



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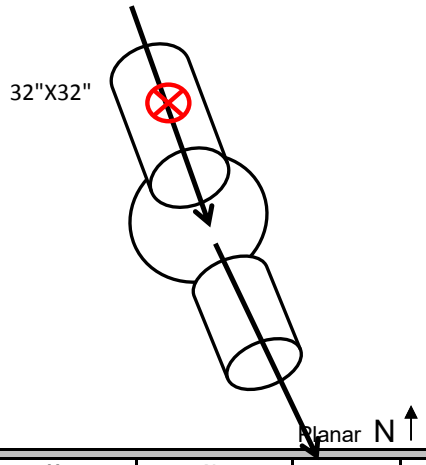


Installation Information		Backup	Yes	No		Distance
Installation Type:	Ring / Crank	Trunk		X		
Sensors / Devices:	UVP	Lift/Pump Station		X		
Surcharge Height:	Feet	WWTP		X		
Rain Gauge Zone:		Other		X		

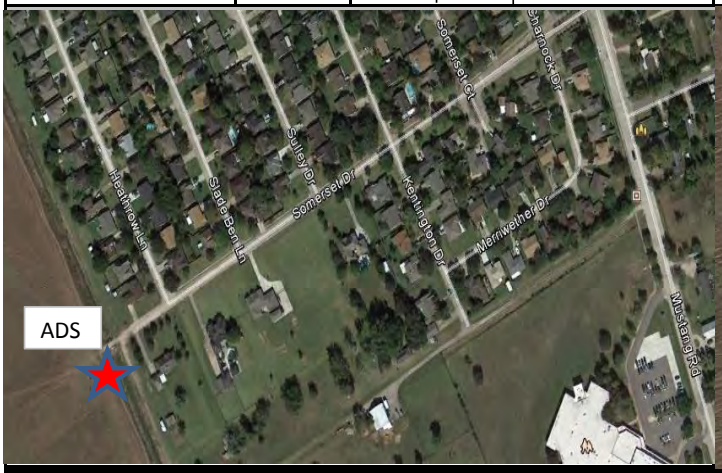
Additional Site Information / Comments:

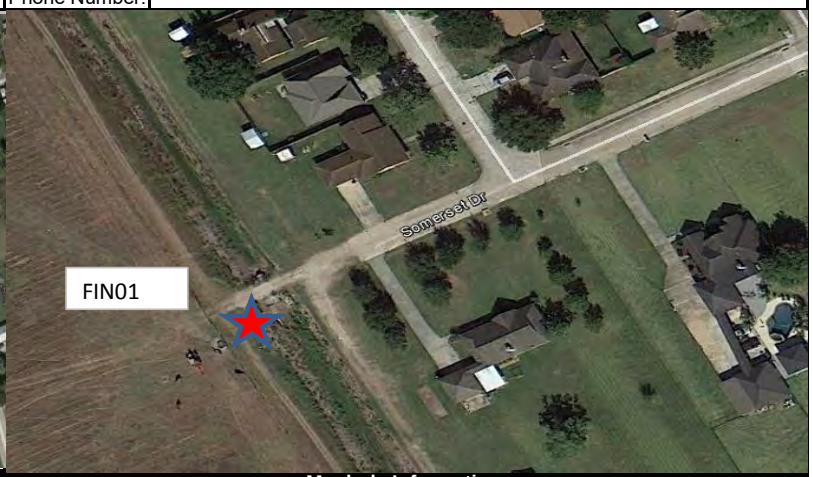
N29°22.565 W095°13.473

ADS Site Report

Quality Form

Project Name:	Alvin	City/State:	Alvin, TX	FM Initials:	DM
Site Name:	SO-02	Monitor Series:	Monitor S/N#:		
Address / Location:	Dead end of Somerset Drive		Manhole #:	FIN01	
			Map Page #:		
Access: Drive	Type of System:	Sanitary X / Storm / Combined	Pipe Height:	26"	
			Pipe Width:	27"	
			Phone Number:		

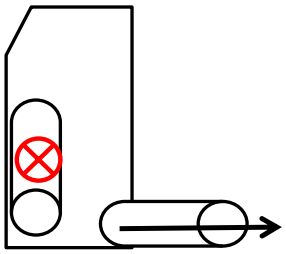




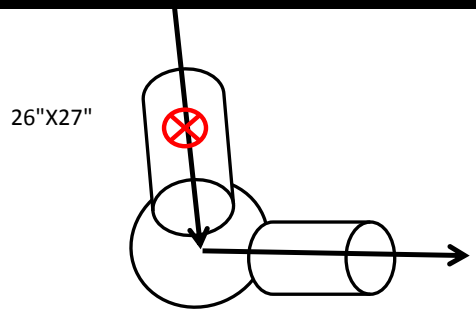
Manhole Information:

Date/Time of Investigation:	5/15/14 10:30 AM	Manhole Depth:	10.8 Feet			
Site Hydraulics:	Good Hydraulics, can be effected by the downstream manhole debris	Manhole Material / Condition:	Concrete			
Upstream Input: (L/S, P/S)	DNI	Pipe Material / Condition:	PVC			Good
Upstream Manhole:	DNI	Mini System Character:	Residential	Commercial	Industrial	Other
Downstream Manhole:	JCT MH, HVY Debris, Surcharged		X	X		
		Telephone Information:	N/A			
Depth of Flow (Wet Dof):	3.25 +/- 0.25	Access Pole #:	N/A			
Range (Air Dof):	+/-	Distance From Manhole:	N/A Feet			
Peak Velocity:	0.6 fps	Road Cut Length:	N/A Feet			
Silt:	0 Inches	Trenche Length:	N/A Feet			

Other Information:



Cross Section



Planar N

Installation Information		Backup	Yes	No		Distance
Installation Type:	Ring / Crank	Trunk	X			DS- 500ft'
Sensors / Devices:	UVP	Lift/Pump Station		X		
Surcharge Height:	Feet	WWTP		X		
Rain Gauge Zone:		Other		X		

Additional Site Information / Comments:

N29°22.327 W095°14.098

ADS Site Report

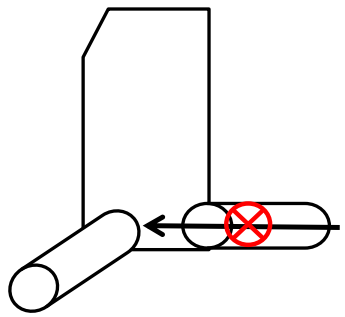
Quality Form

Project Name:	Alvin	City/State:	Alvin, TX	FM Initials:	DM
Site Name:	WC-01	Monitor Series:	Monitor S/N#:		
Address / Location:	2580 Koster Road		Manhole #:	2-A-3	
			Map Page #:		
Access: Drive	Type of System:	Sanitary X / Storm / Combined	Pipe Height:	23"	
			Pipe Width:	23.75"	
			Phone Number:		

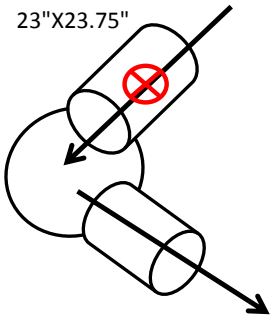
Manhole Information:

Date/Time of Investigation:	4/23/14 8:20 AM	Manhole Depth:	13 Feet		
Site Hydraulics:	Good Hydraulics, can be effected by the downstream PS wetwell level	Manhole Material / Condition:	Concrete		
Upstream Input: (L/S, P/S)	DNI	Pipe Material / Condition:	PVC		Good
Upstream Manhole:	DNI	Mini System Character:	Residential	Commercial	Industrial	Other
Downstream Manhole:	Wet well		X	X		
		Telephone Information: N/A			
Depth of Flow (Wet Dof):	5 +/- 0.25	Access Pole #:	N/A		
Range (Air Dof):	+/-	Distance From Manhole:	N/A Feet		
Peak Velocity:	1.1 fps	Road Cut Length:	N/A Feet		
Silt:	0 Inches	Trenche Length:	N/A Feet		

Other Information:



Cross Section



Planar N

Installation Information		Backup	Yes	No		Distance
Installation Type:	Ring / Crank	Trunk		X		
Sensors / Devices:	UVP	Lift/Pump Station	X			US
Surcharge Height:	Feet	WWTP		X		
Rain Gauge Zone:		Other		X		

Additional Site Information / Comments:

N29°24.1268 W095°14.8063

ADS Site Report

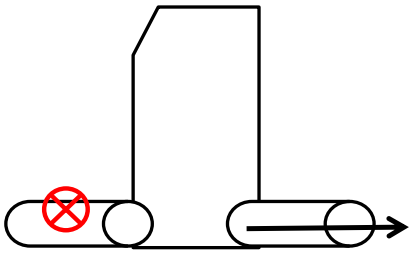
Quality Form

Project Name:	Alvin	City/State:	Alvin, TX	FM Initials:	DM
Site Name:	WE-01	Monitor Series:	Monitor S/N#:		
Address / Location:	1407 FM 1462		Manhole #:	4-A-5	
			Map Page #:		
Access: Drive	Type of System:	Sanitary X / Storm / Combined	Pipe Height:	23	
			Pipe Width:	23	
			Phone Number:		

Manhole Information:

Date/Time of Investigation:	5/15/14 11:30 PM	Manhole Depth:	17.5 Feet		
Site Hydraulics:	Good Hydraulics	Manhole Material / Condition:	Concrete		
Upstream Input: (L/S, P/S)	DNI	Pipe Material / Condition:	Liner		Good
Upstream Manhole:	DNI	Mini System Character:	Residential	Commercial	Industrial	Other
Downstream Manhole:	DNI		X	X		
		Telephone Information: N/A			
Depth of Flow (Wet Dof):	7.5 +/- 0.25	Access Pole #:	N/A		
Range (Air Dof):	+/-	Distance From Manhole:	N/A Feet		
Peak Velocity:	1.25 fps	Road Cut Length:	N/A Feet		
Silt:	0 Inches	Trenche Length:	N/A Feet		

Other Information:



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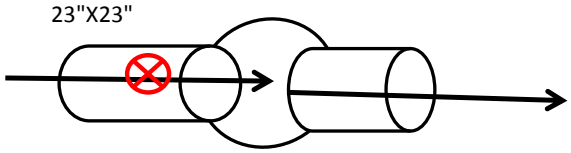


Planar N

Installation Information		Backup	Yes	No		Distance
Installation Type:	Ring / Crank	Trunk		X		
Sensors / Devices:	UVP	Lift/Pump Station	X			DS- 500ft'
Surcharge Height:	Feet	WWTP		X		
Rain Gauge Zone:		Other		X		

Additional Site Information / Comments:

N29°23.541' W095°15.128'

ADS Site Report

Quality Form

Project Name:	Alvin	City/State:	Alvin, TX	FM Initials:	DM
Site Name:	AT-RG01	Monitor Series:		Monitor S/N#:	
Address / Location:	2580 Koster Road			Manhole #:	
				Map Page #:	
Access: Drive	Type of System:	Sanitary X	Storm	Combined	
				Pipe Height:	
				Pipe Width:	
				Phone Number:	

Manhole Information:

Date/Time of Investigation:	4/23/14 8:20 AM	Manhole Depth:	Feet		
Site Hydraulics:		Manhole Material / Condition:	Concrete		
Upstream Input: (L/S, P/S)		Pipe Material / Condition:	Good		
Upstream Manhole:		Mini System Character:	Residential X	Commercial X	Industrial	Other
Downstream Manhole:					
		Telephone Information: N/A			
Depth of Flow (Wet Dof):		Access Pole #:	N/A		
Range (Air Dof):		Distance From Manhole:	N/A	Feet	
Peak Velocity:		Road Cut Length:	N/A	Feet	
Silt:		Trenche Length:	N/A	Feet	

Other Information:

RG

Cross Section

RG

Planar N

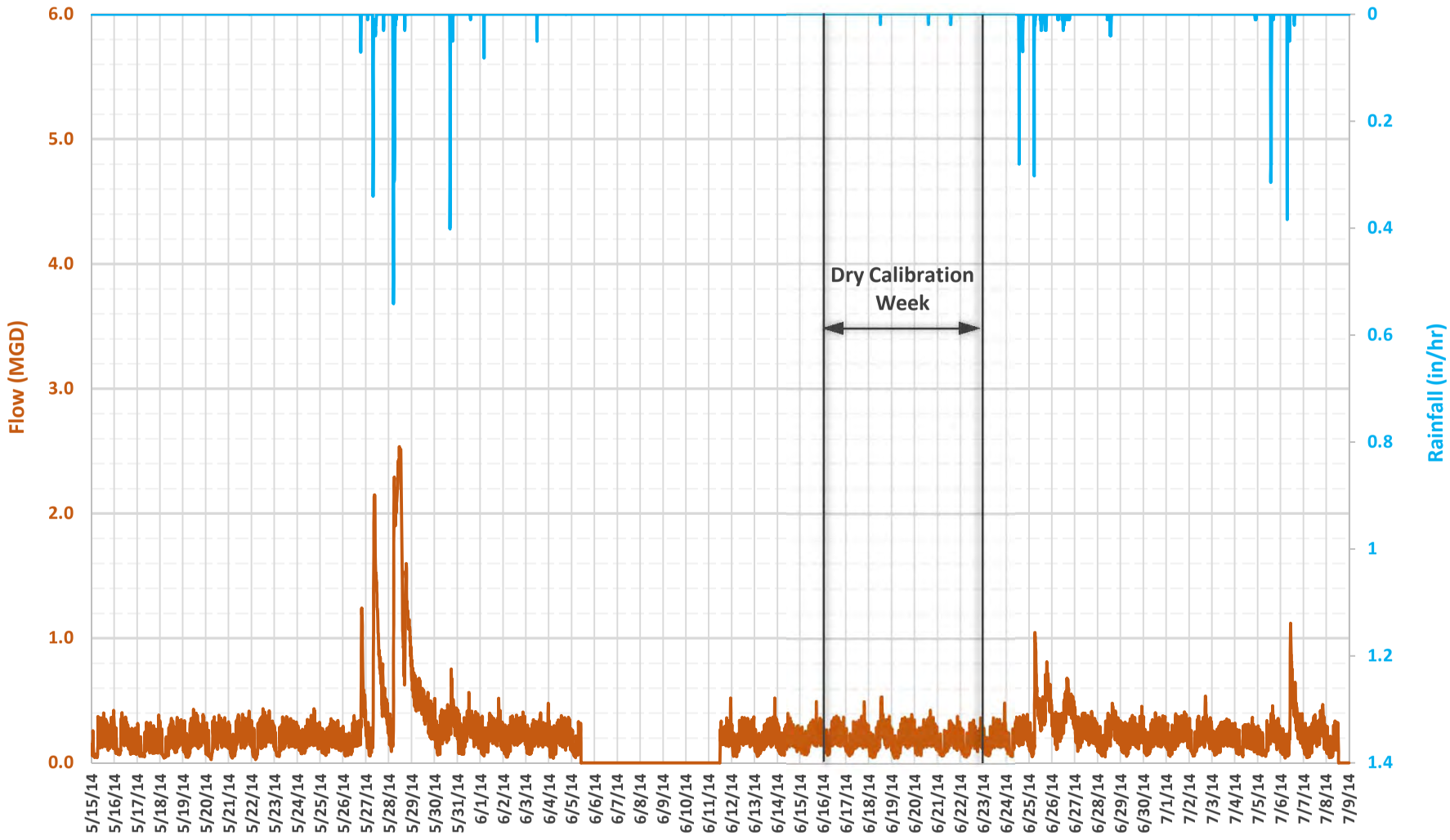
Installation Information		Backup	Yes	No		Distance
Installation Type:	Rain Gauge/tipping bucket	Trunk				
Sensors / Devices:		Lift/Pump Station				US
Surcharge Height:	Feet	WWTP				
Rain Gauge Zone:		Other				

Additional Site Information / Comments:

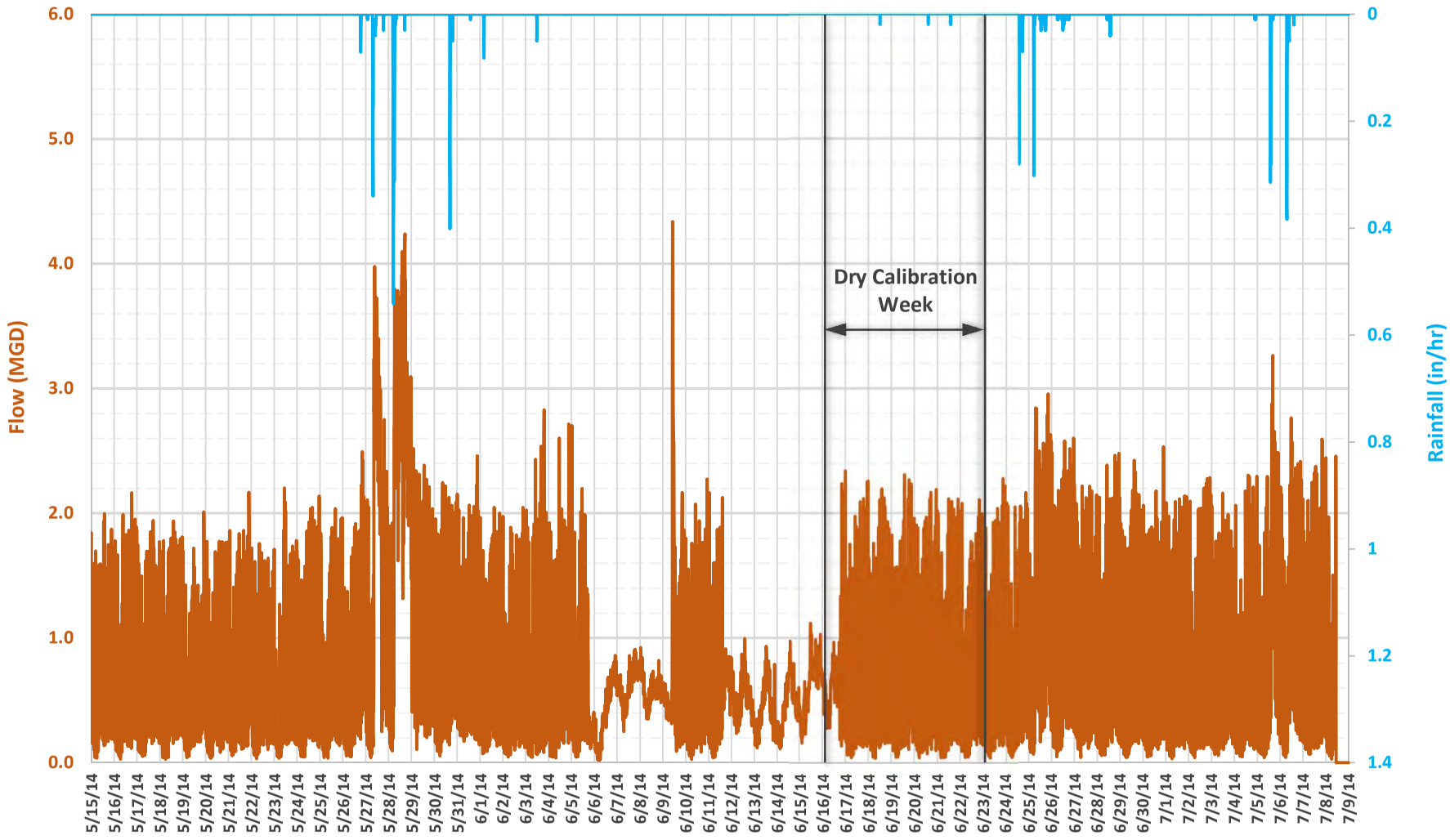
N29°24.1268 W095°14.8063

APPENDIX F:
Flow Monitoring Hydrographs and Diurnal Patterns

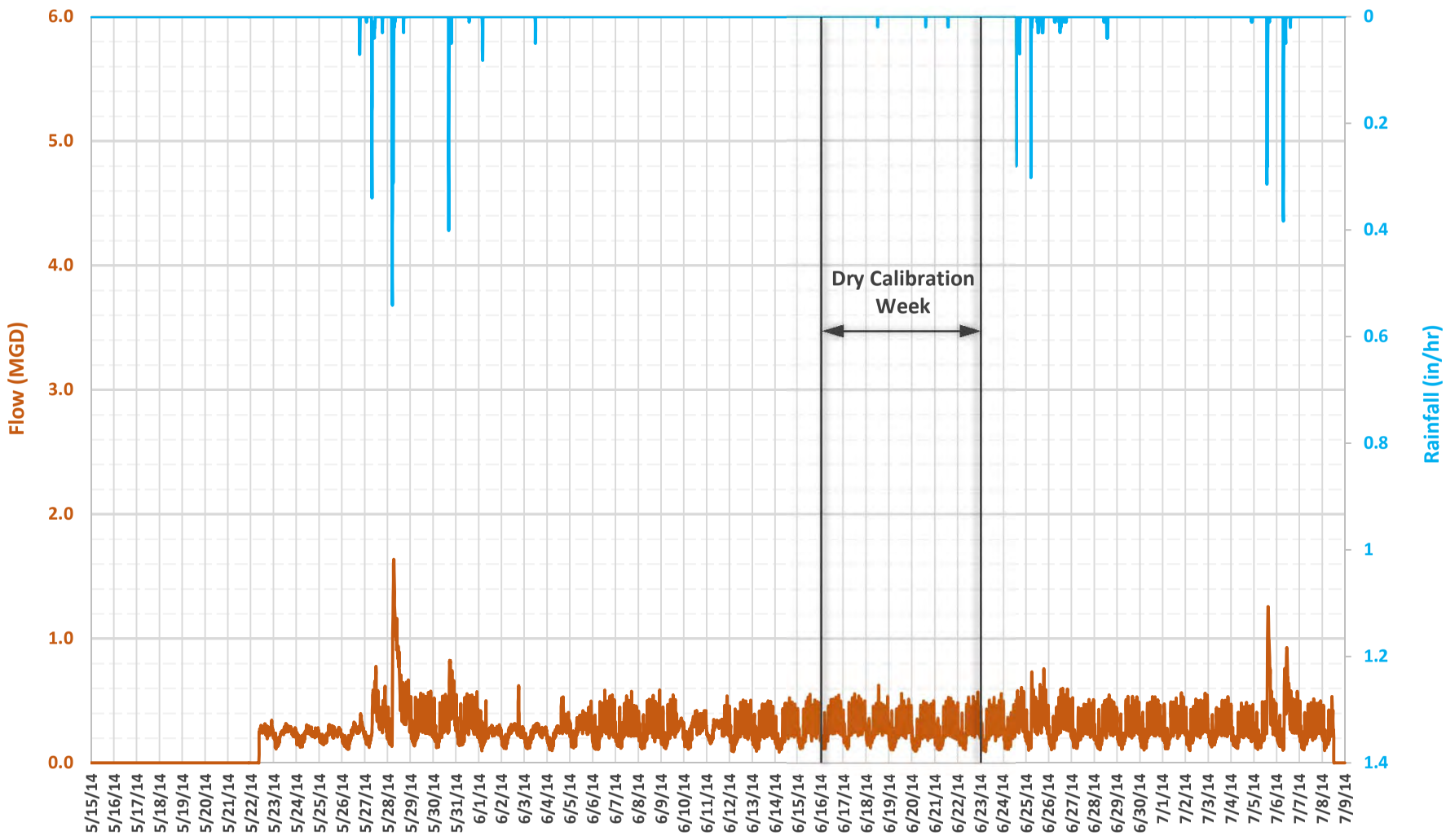
City of Alvin
Wastewater System Field Testing
Flow Monitor Data
Northwest Basin
Flow Monitor ID: NW-01



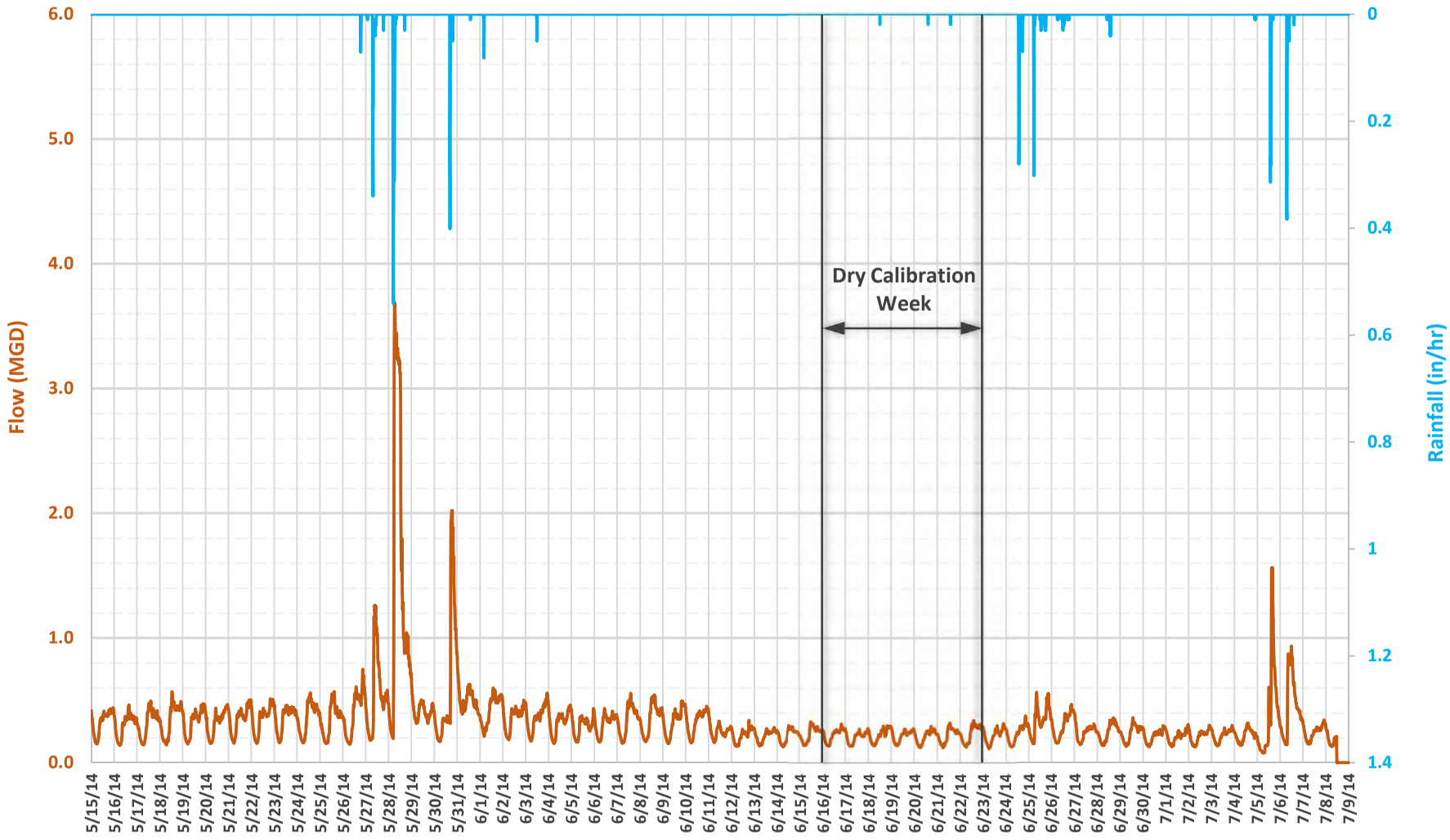
City of Alvin
Wastewater System Field Testing
Flow Monitor Data
Northeast Basin
Flow Monitor ID: NE-01



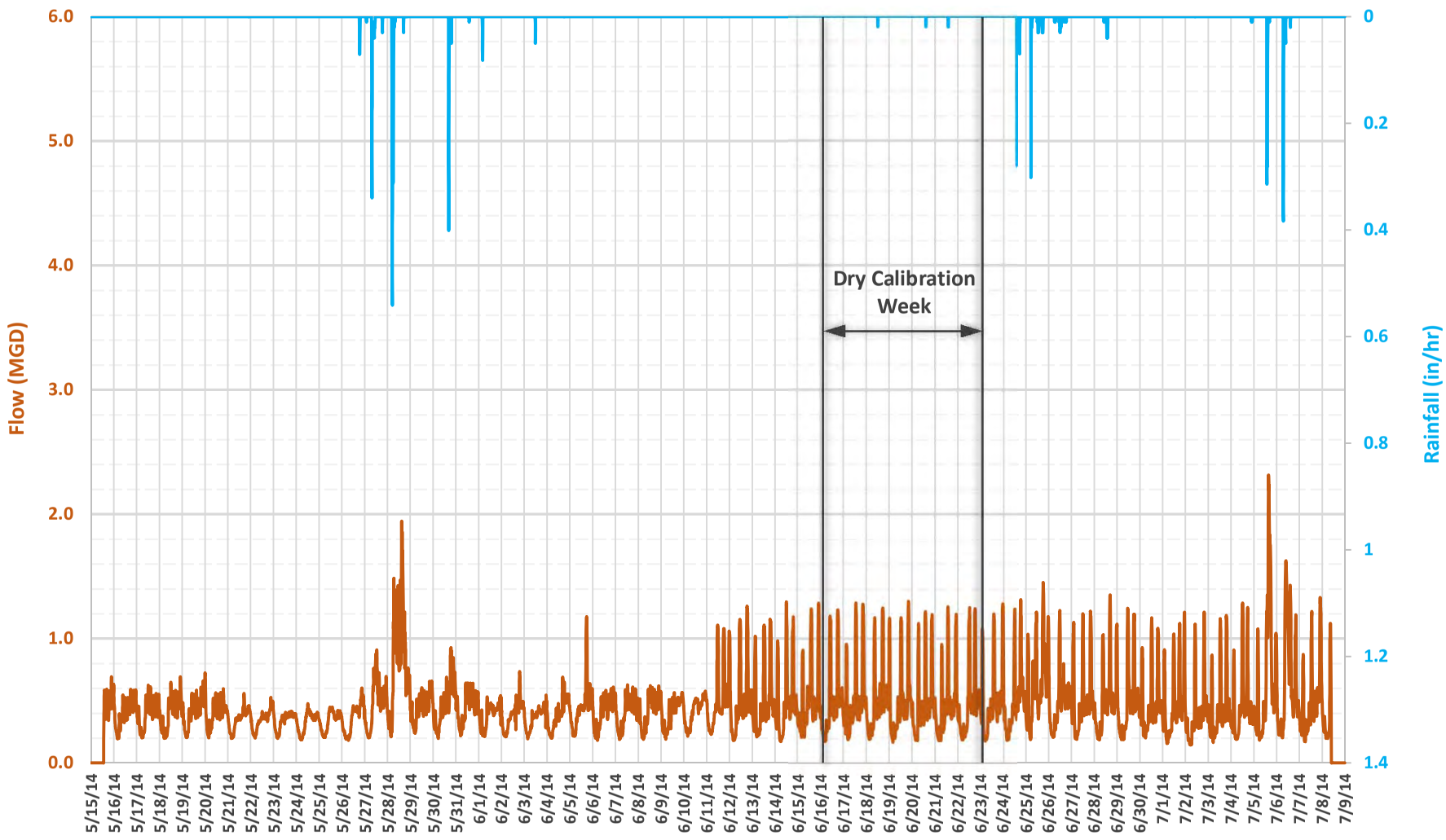
City of Alvin
Wastewater System Field Testing
Flow Monitor Data
Central Basin
Flow Monitor ID: CE-01



City of Alvin
Wastewater System Field Testing
Flow Monitor Data
West-Central Basin
Flow Monitor ID: WC-01

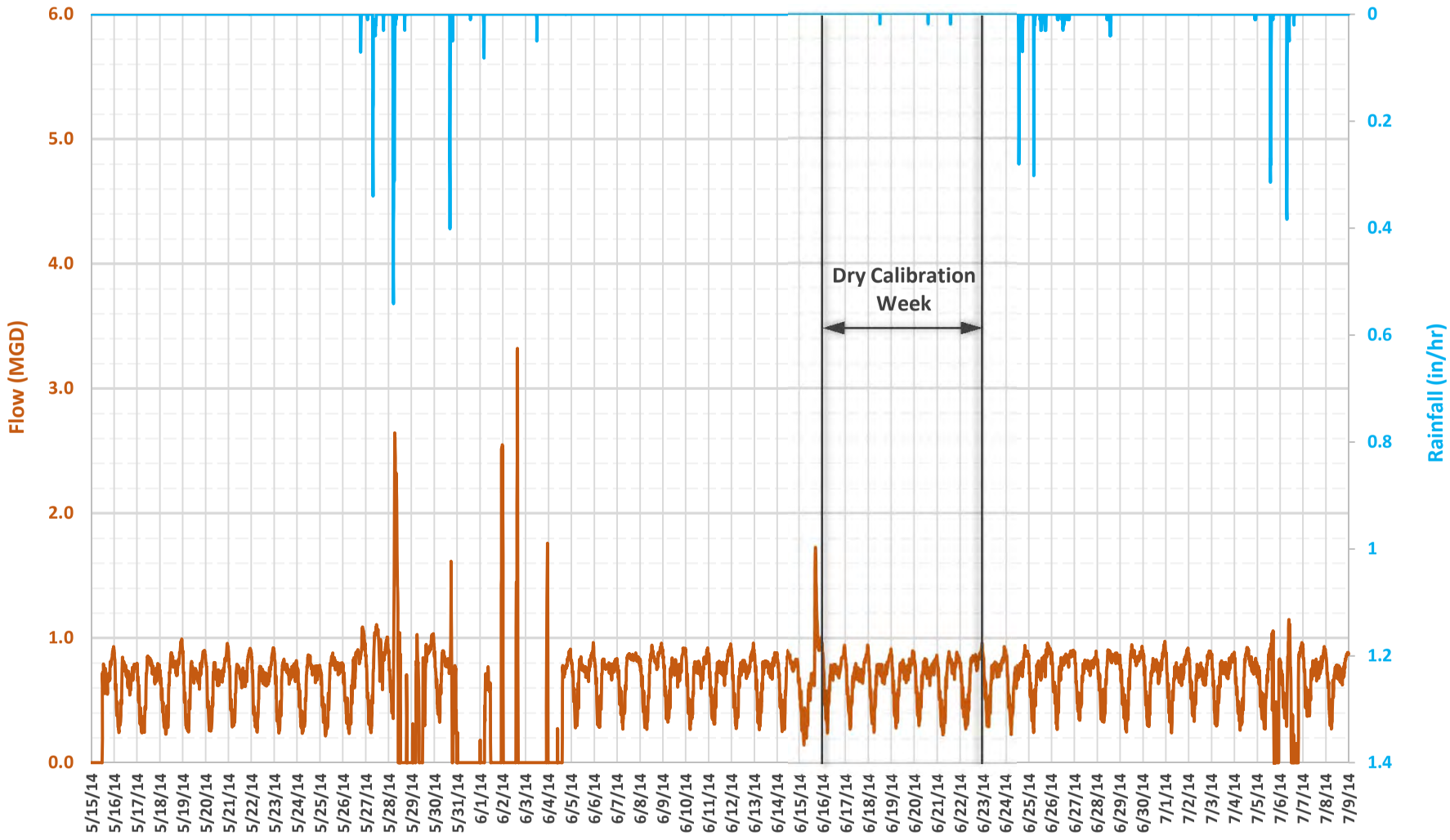


City of Alvin
Wastewater System Field Testing
Flow Monitor Data
East-Central Basin
Flow Monitor ID: EC-01

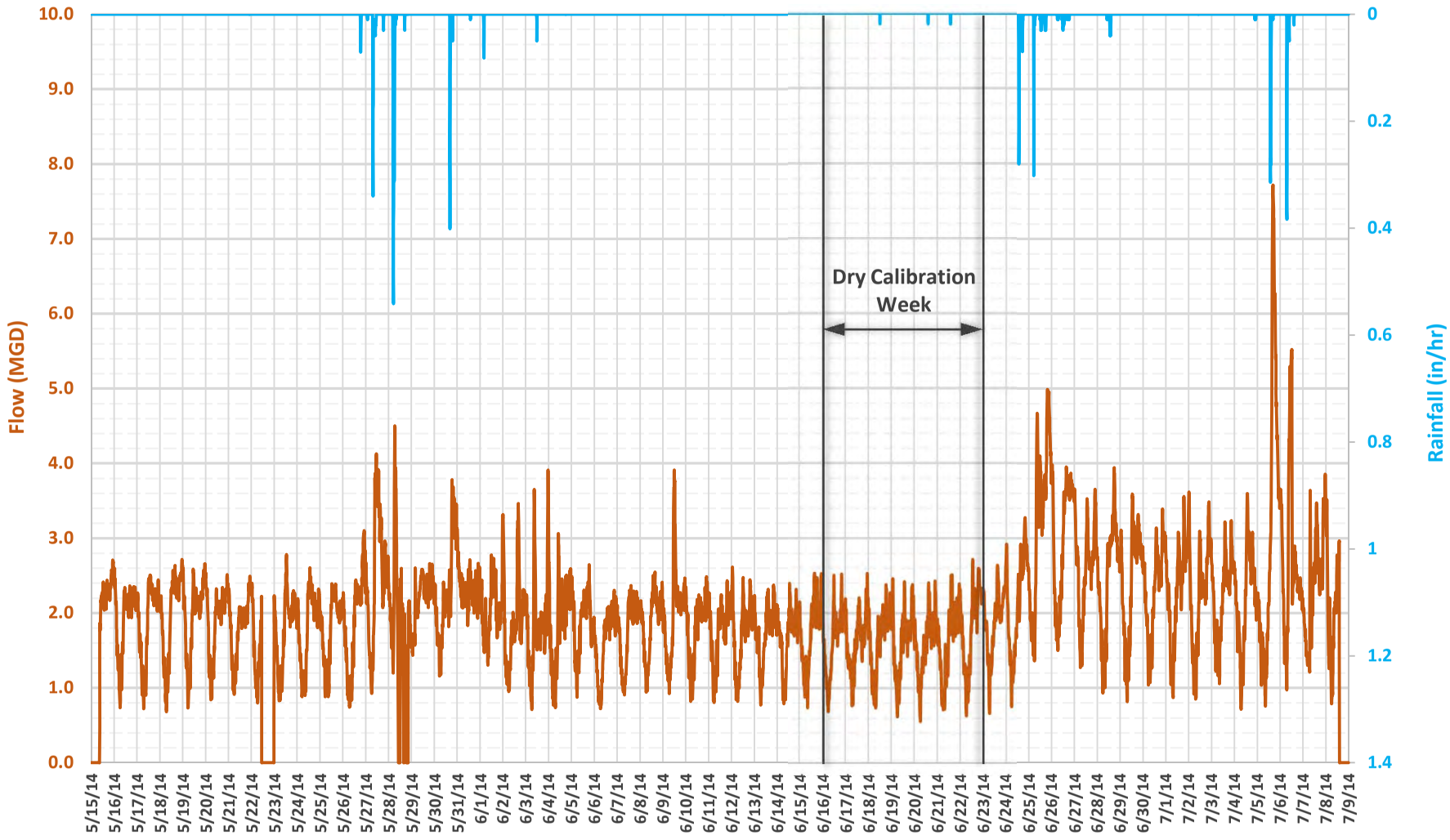


City of Alvin
Wastewater System Field Testing
Flow Monitor Data
Western Basin
Flow Monitor ID: WE-01

Recorded
Flow Rate

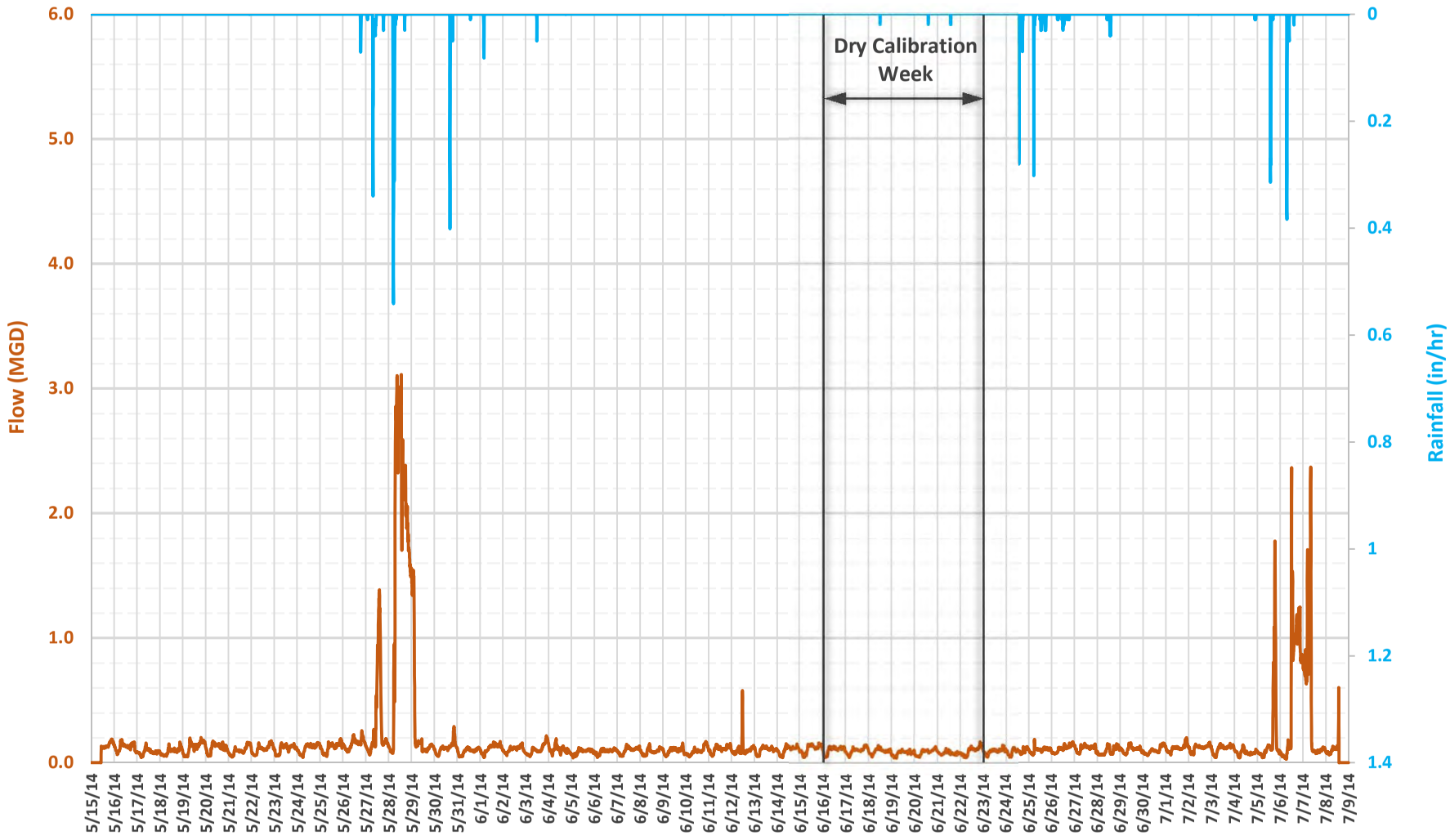


City of Alvin
Wastewater System Field Testing
Flow Monitor Data
Southern Basin
Flow Monitor ID: SO-01

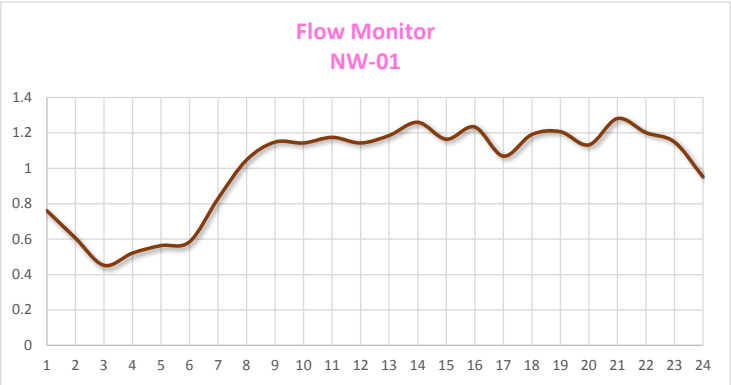


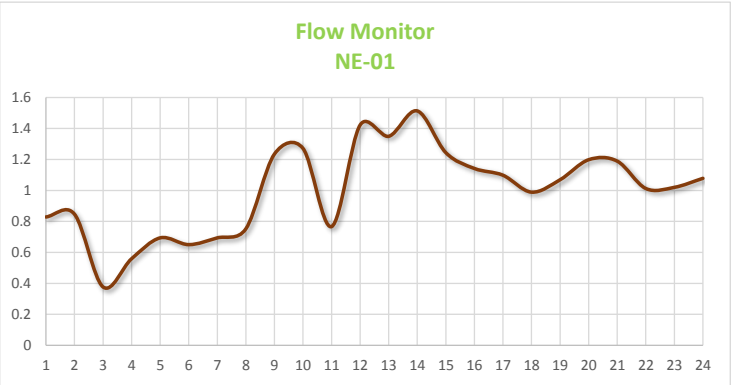
City of Alvin
Wastewater System Field Testing
Flow Monitor Data
Southern Basin
Flow Monitor ID: SO-02

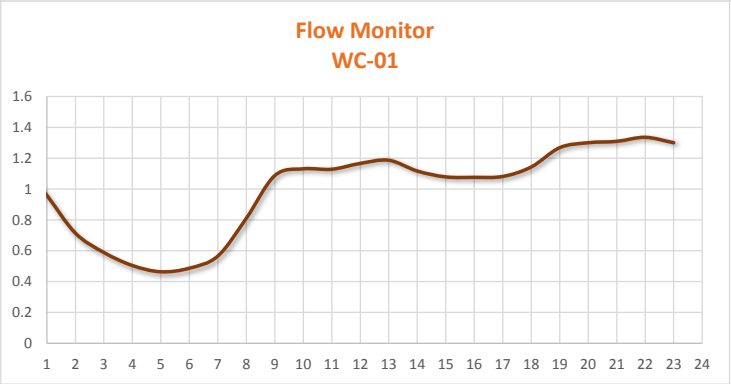
Recorded
Flow Rate

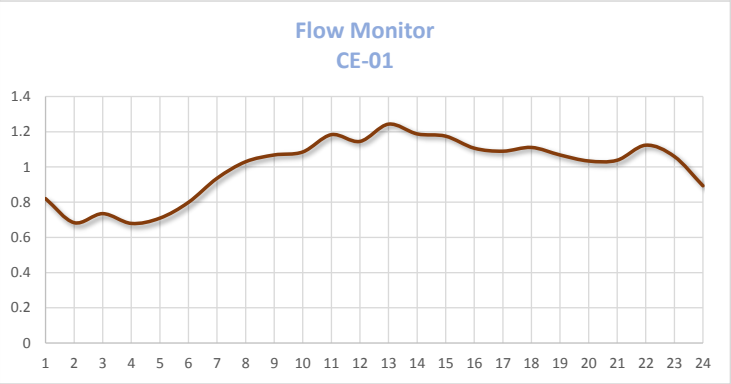


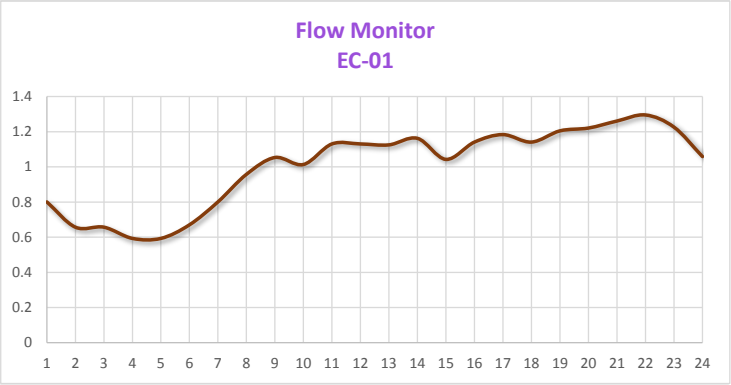
City of Alvin
Wastewater System Field Testing
Diurnal Patterns

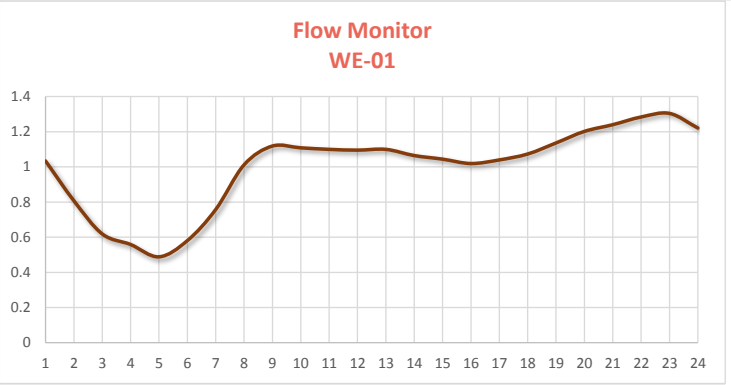


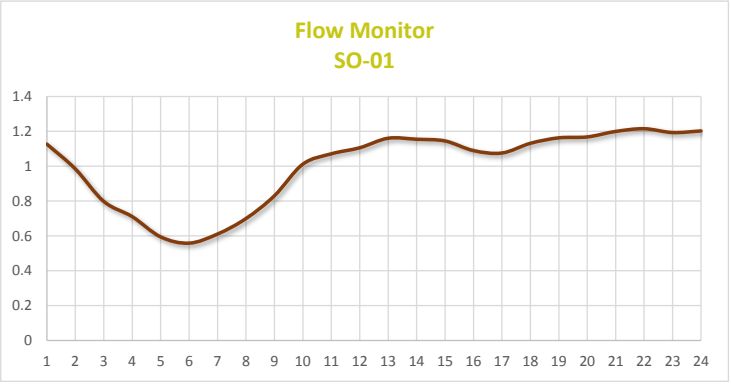


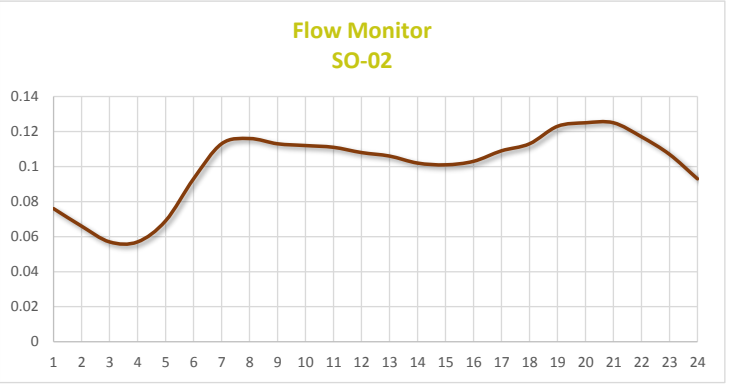












APPENDIX G:
Manhole Measure Down and Survey Data

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

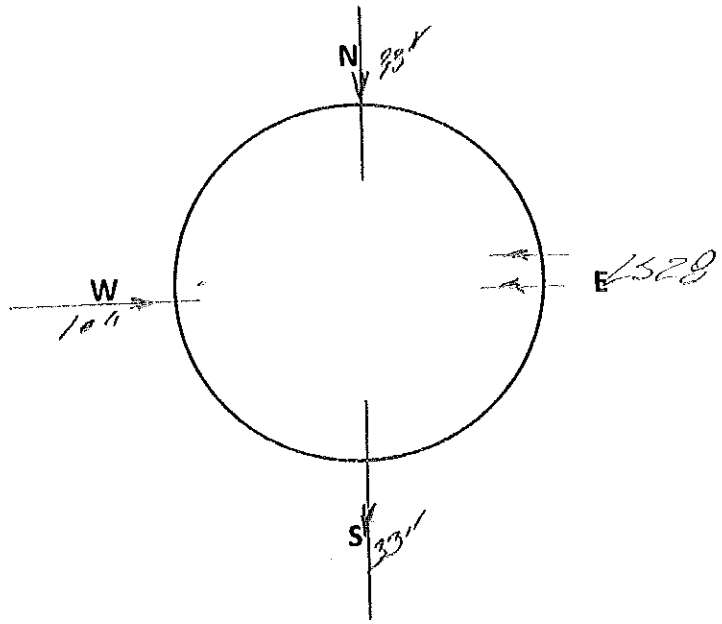
MANHOLE ID: 1-E-38

CREW LEADER:

DATE OF COLLECTION: 10/29/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☒ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	11.38	Forced main
	IN		
	IN		
	OUT		
	OUT		

P 32

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

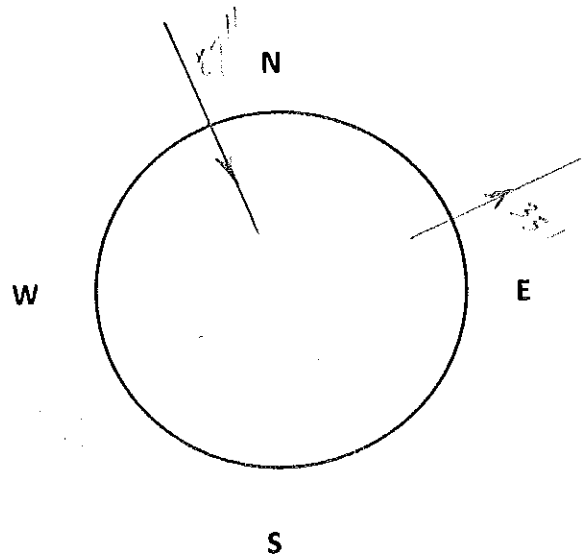
MANHOLE ID: 1-C-10A

CREW LEADER:

DATE OF COLLECTION: 11/4/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	12.61'	
	IN		
	IN		
	OUT		
	OUT		

PTB

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

MANHOLE ID: 1-E-2

CREW LEADER:

DATE OF COLLECTION: 11/4/14

TIME OF COLLECTION:

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

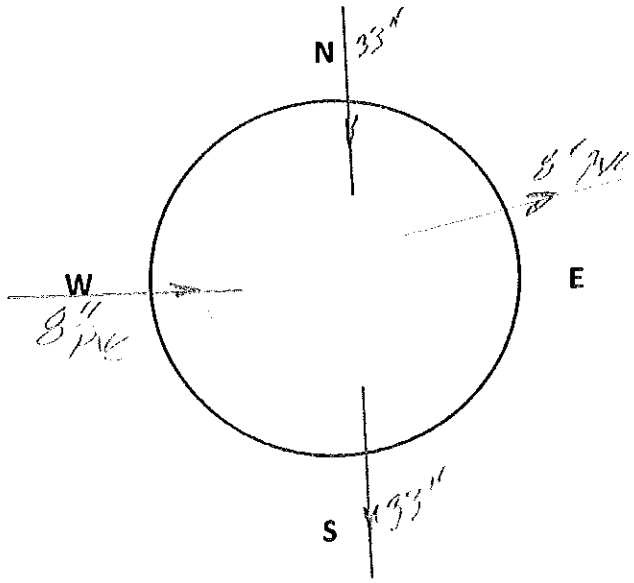
☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	11.60	
	IN		
	IN		
	OUT		
	OUT		

P TB

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

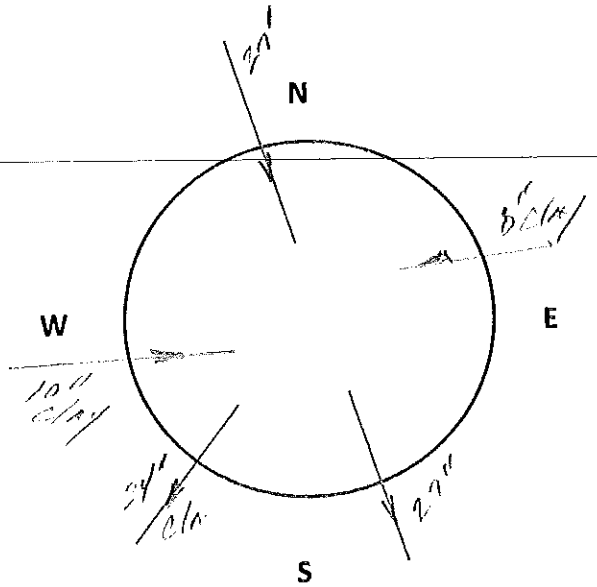
MANHOLE ID: 1-E-32

CREW LEADER:

DATE OF COLLECTION: 11/4/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	10.25'	
	IN		
	IN		
	OUT		
	OUT		

P TB

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

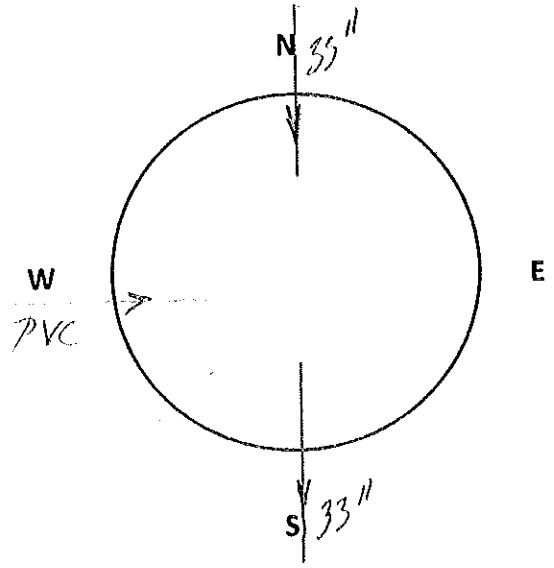
MANHOLE ID: 1-8-20

CREW LEADER:

DATE OF COLLECTION: 10/29/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	10.61	
	IN		
	IN		
	OUT		
	OUT		

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MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

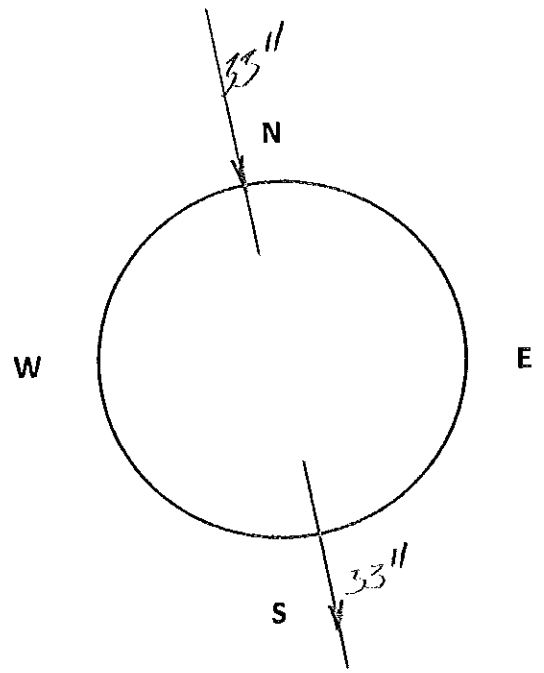
MANHOLE ID: 1-H-2

CREW LEADER:

DATE OF COLLECTION: 10/29/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER:_____

RIM ELEVATION:_____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	12.19	
	IN		
	IN		
	OUT		
	OUT		

P R 7

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

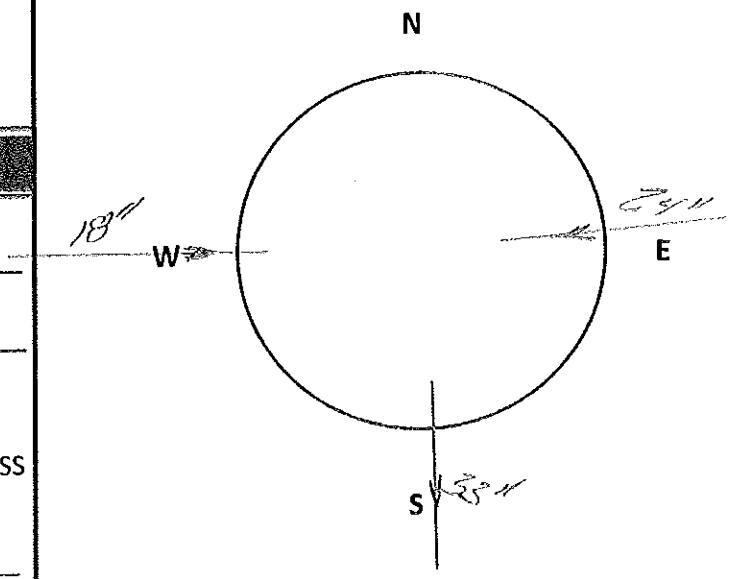
MANHOLE ID: 1-64

CREW LEADER:

DATE OF COLLECTION: 10/29/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☒ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☒ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	11.90	
	IN		
	IN		
	OUT		
	OUT		

P 27

MANHOLE MEASURE DOWN SHEET

FREESE NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

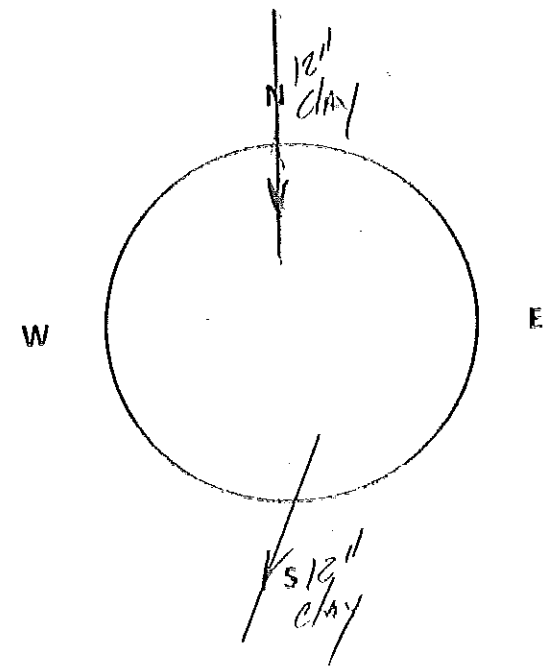
MANHOLE ID: 2-6-13

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	5'6"	
	IN		
	IN		
	OUT		
	OUT		

P-24

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

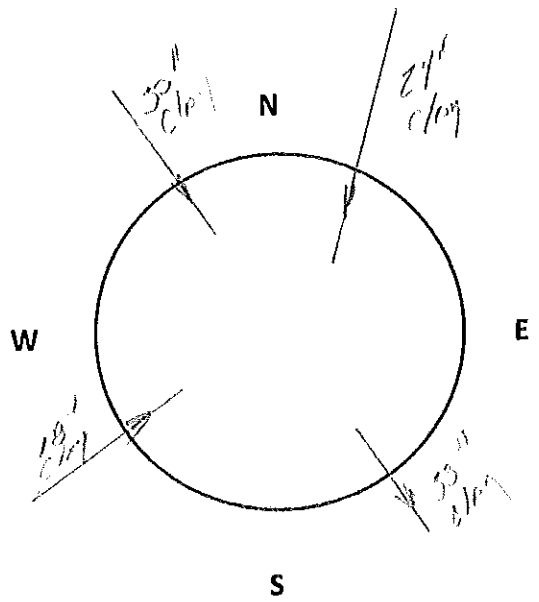
MANHOLE ID: 1 - I - 9

CREW LEADER:

DATE OF COLLECTION: 10/28/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☒ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☒ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	10.73'	
	IN		
	IN		
	OUT		
	OUT		

P-77

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

MANHOLE ID: 1-I-4

CREW LEADER:

DATE OF COLLECTION: 10-28-14

TIME OF COLLECTION:

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

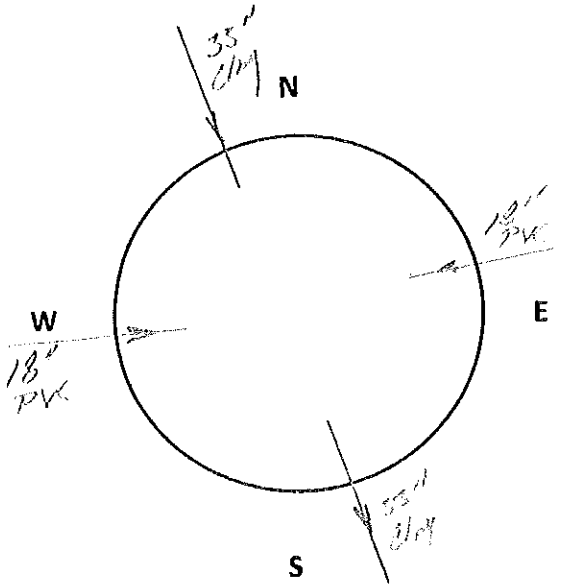
☐ CONCRETE ☒ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☒ GOOD

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	10.50'	
	IN		
	IN		
	OUT		
	OUT		

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MANHOLE MEASURE DOWN SHEET

FREESE NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

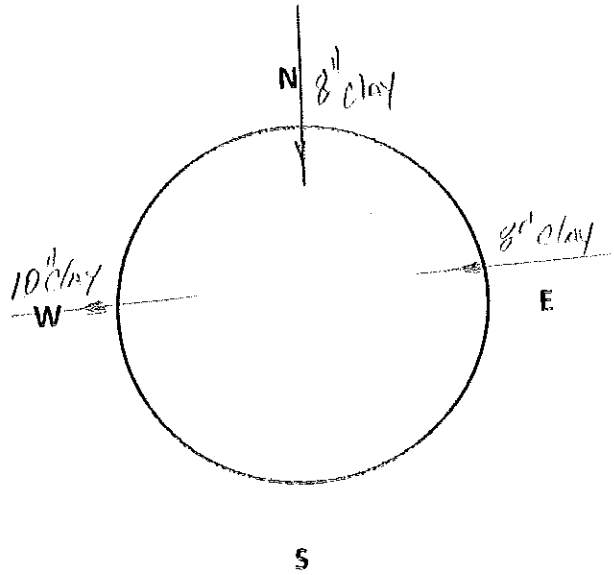
MANHOLE ID: 2N-3

CREW LEADER:

DATE OF COLLECTION: 12/18/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK (☐ FIBERGLASS)

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR (☐ GOOD)

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	8.99'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

MANHOLE ID: E-5-1

CREW LEADER:

DATE OF COLLECTION: 12/18/14

TIME OF COLLECTION:

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

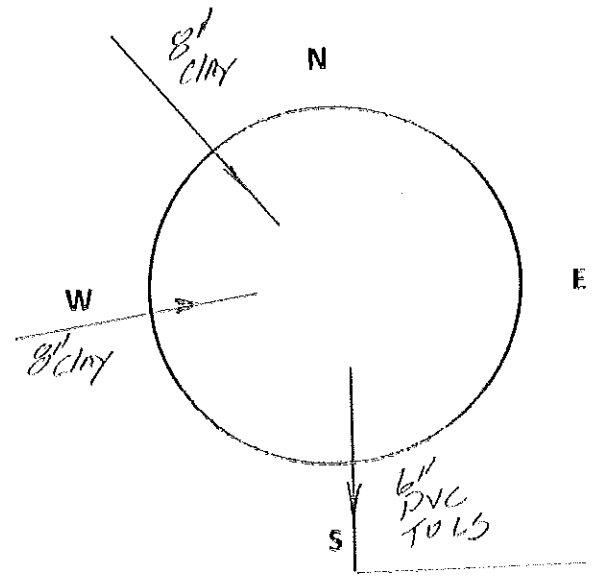
☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	12.00'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

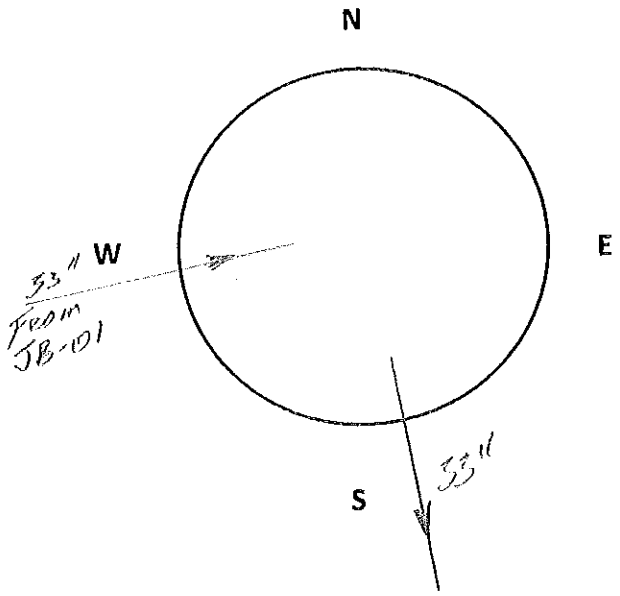
MANHOLE ID: 1-B-18

CREW LEADER:

DATE OF COLLECTION: 11/4/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	12.27	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

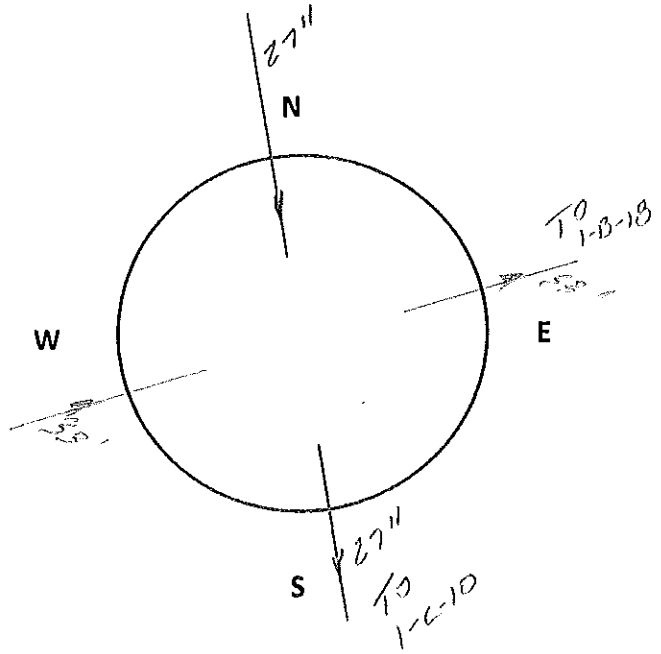
MANHOLE ID: JB-01

CREW LEADER:

DATE OF COLLECTION: 11/4/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER:

RIM ELEVATION:

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER:

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	12.46'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

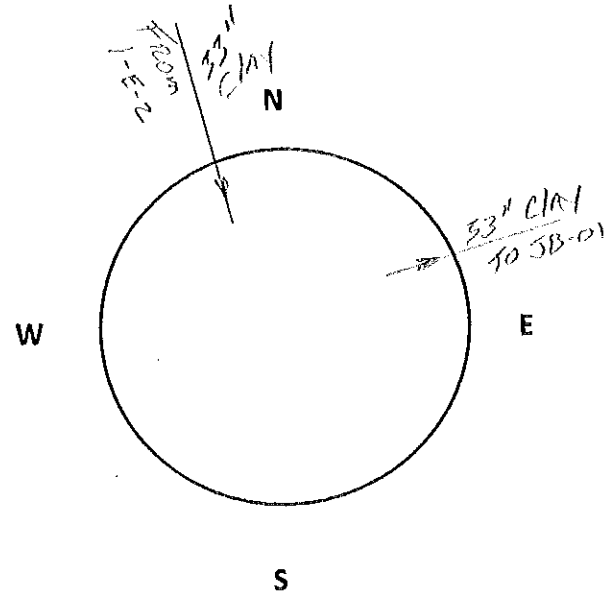
MANHOLE ID: 1-C-10A

CREW LEADER:

DATE OF COLLECTION: 11/4/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	12.61	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

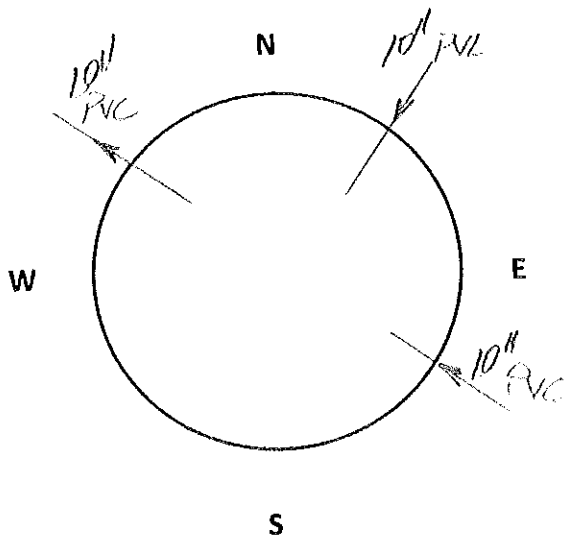
MANHOLE ID: 3-J-42

CREW LEADER:

DATE OF COLLECTION: 12/1/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER:_____

RIM ELEVATION:_____

MANHOLE CONSTRUCTION MATERIAL:

☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	6.93'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

MANHOLE ID: S-E-51

CREW LEADER:

DATE OF COLLECTION: 12/1/11

TIME OF COLLECTION:

MANHOLE DETAILS

MANHOLE DIAMETER:_____

RIM ELEVATION:_____

MANHOLE CONSTRUCTION MATERIAL:

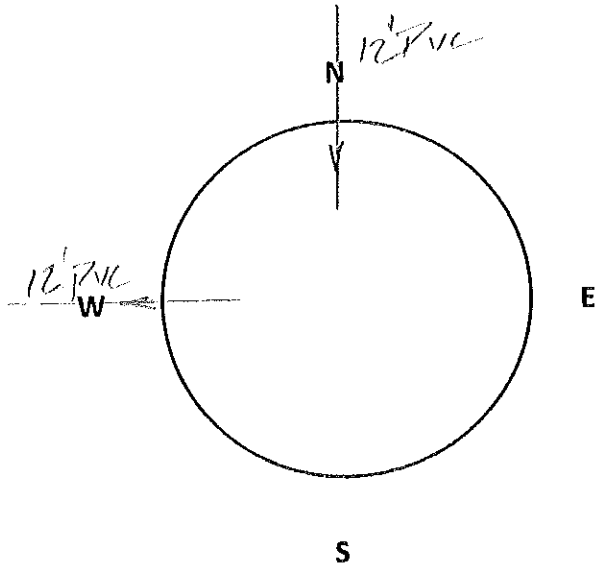
☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	9.96'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

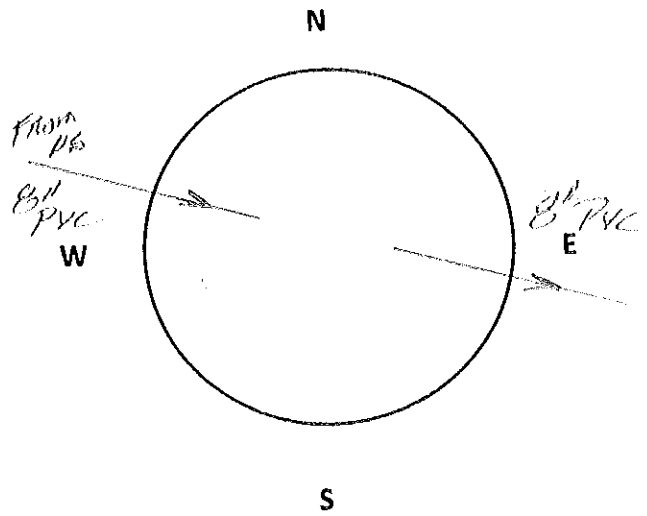
MANHOLE ID: S-5-53

CREW LEADER:

DATE OF COLLECTION: 12/1/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK (☐) FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR (☐) GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	5.19'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

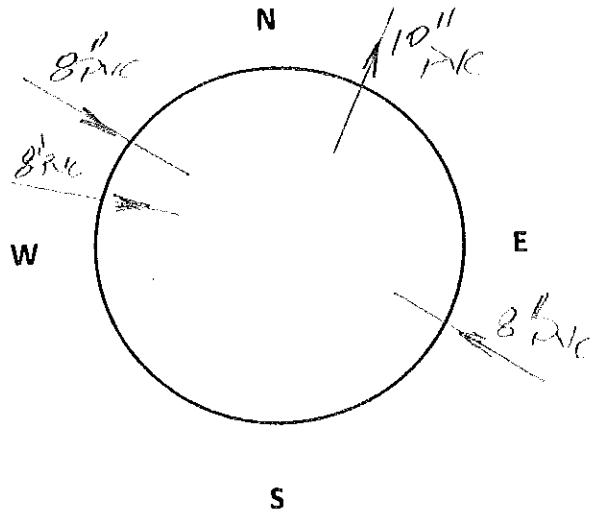
MANHOLE ID: 3-J-66

CREW LEADER:

DATE OF COLLECTION: 12/1/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	9.69'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

MANHOLE ID: 3-V-4

CREW LEADER:

DATE OF COLLECTION: 12/1/14

TIME OF COLLECTION:

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

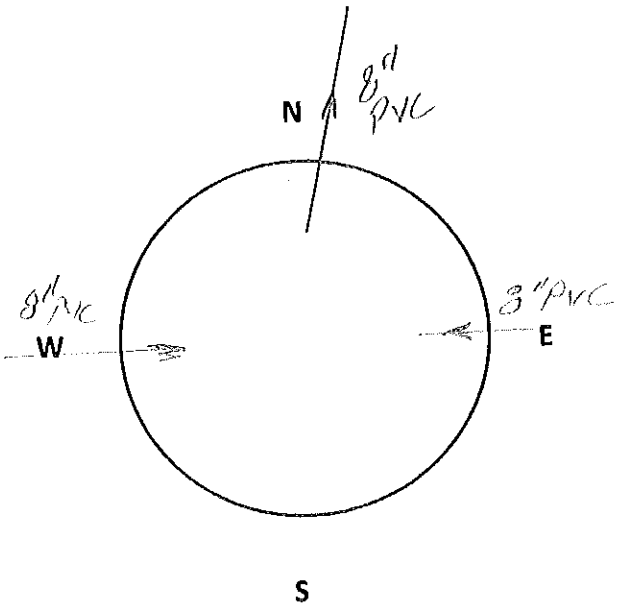
☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	11.05'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

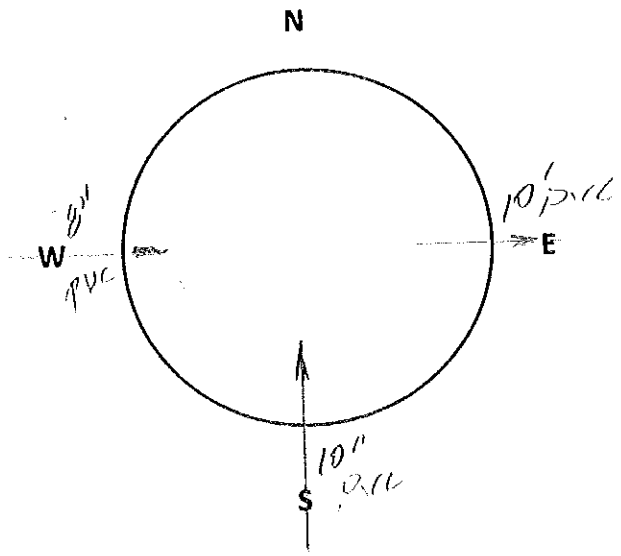
MANHOLE ID: 3-2-15

CREW LEADER:

DATE OF COLLECTION: 12/1/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	11.45'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

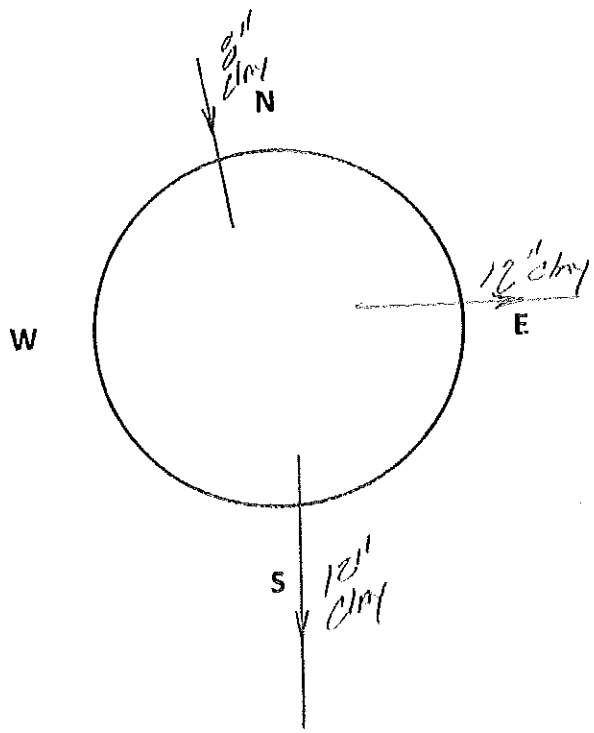
MANHOLE ID: 3-E-10

CREW LEADER:

DATE OF COLLECTION: 12/16/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☑ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	8.29'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

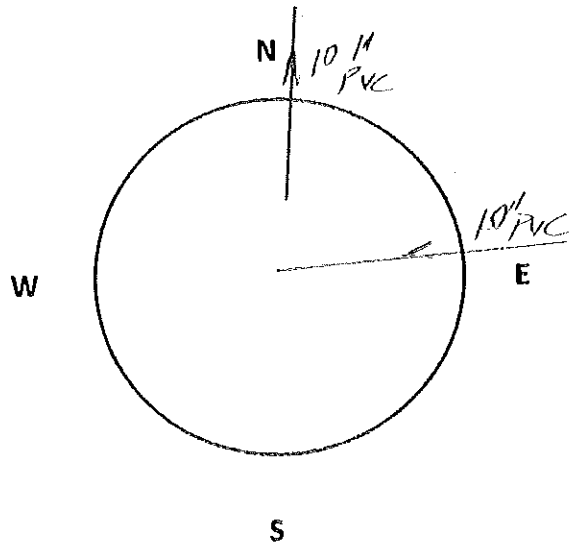
MANHOLE ID: 3-1-2

CREW LEADER:

DATE OF COLLECTION: 12/12/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	17.09'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

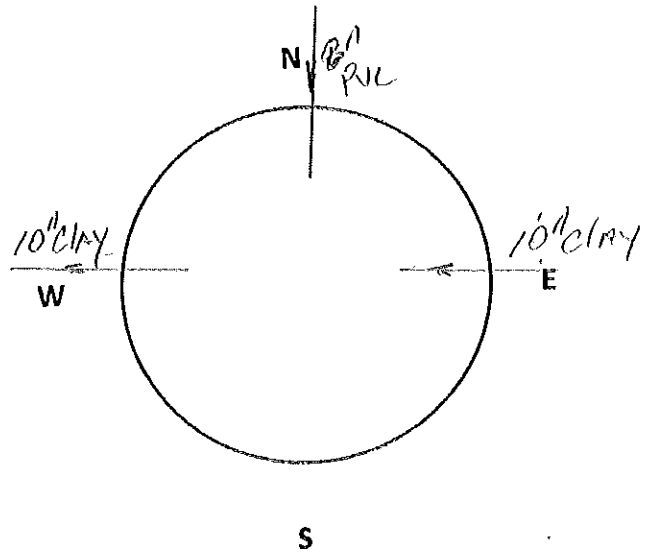
MANHOLE ID: 3-1-10

CREW LEADER:

DATE OF COLLECTION: 12/16/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	11.33'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

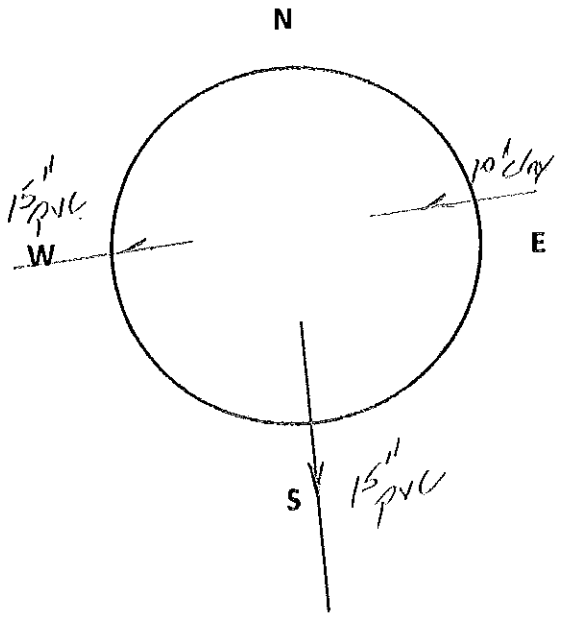
MANHOLE ID: 3-1-16

CREW LEADER:

DATE OF COLLECTION: 10/16/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	11.40	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

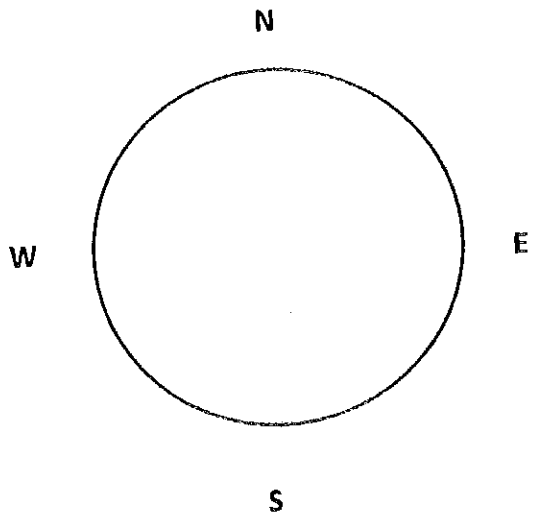
MANHOLE ID: 3-1-42

CREW LEADER:

DATE OF COLLECTION: 12/16/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN		INACCESSABLE
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

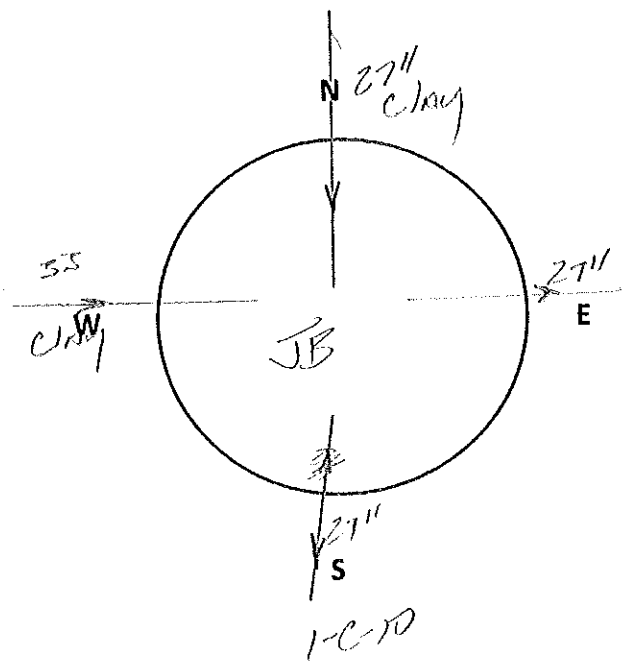
MANHOLE ID: ~~1-B-18~~ J-B-01

CREW LEADER:

DATE OF COLLECTION: 10/4/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	12.27'	
	IN		
	IN		
	OUT		
	OUT		

PTB

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

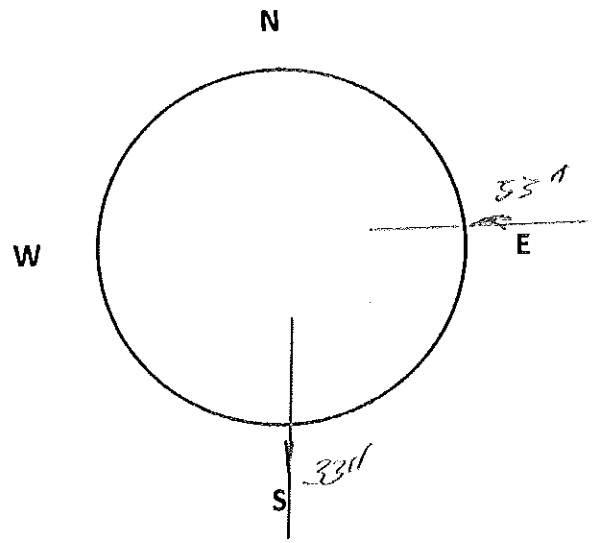
MANHOLE ID: 1-H-3

CREW LEADER:

DATE OF COLLECTION: 10/29/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☒ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☒ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	12.10	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

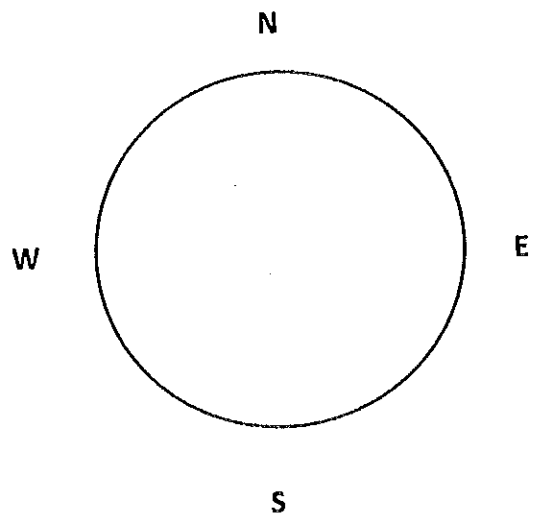
MANHOLE ID: 1-H 2-6

CREW LEADER:

DATE OF COLLECTION: 10/29/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER:_____

RIM ELEVATION:_____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN		MIA
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

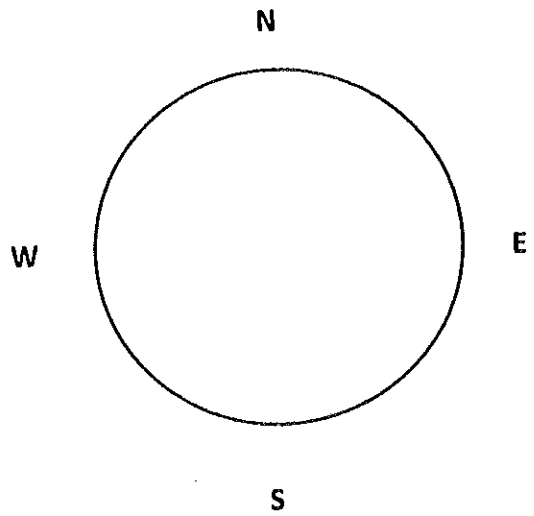
MANHOLE ID: 5-B-2

CREW LEADER:

DATE OF COLLECTION: 10/28/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN		UNABLE TO LOCATE
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

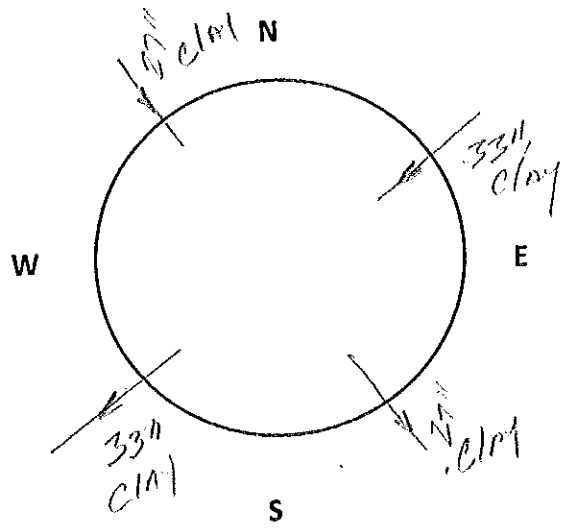
MANHOLE ID: 1-C-8A

CREW LEADER:

DATE OF COLLECTION: 11/4/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	12.22'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

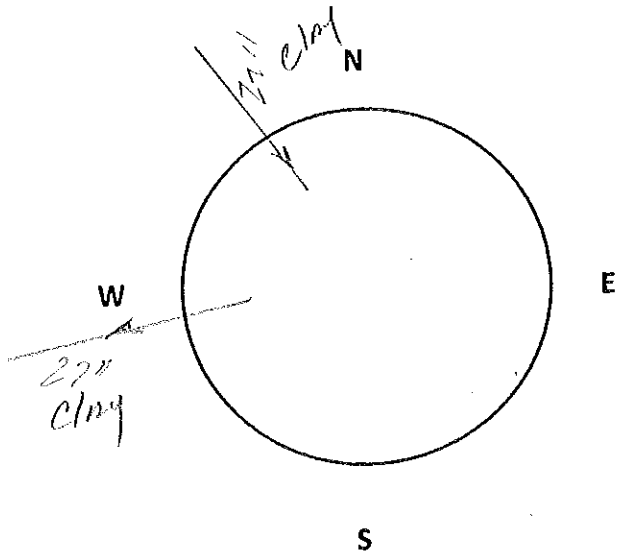
MANHOLE ID: 1-C-9

CREW LEADER:

DATE OF COLLECTION:

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	10.54'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

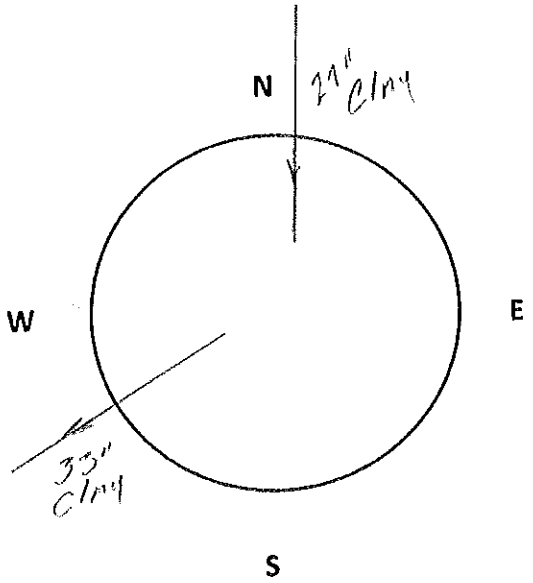
MANHOLE ID: 1-13-14

CREW LEADER:

DATE OF COLLECTION: 11/4/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☒ CONCRETE ☐ BRICK (☒) FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☒ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	11.16'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

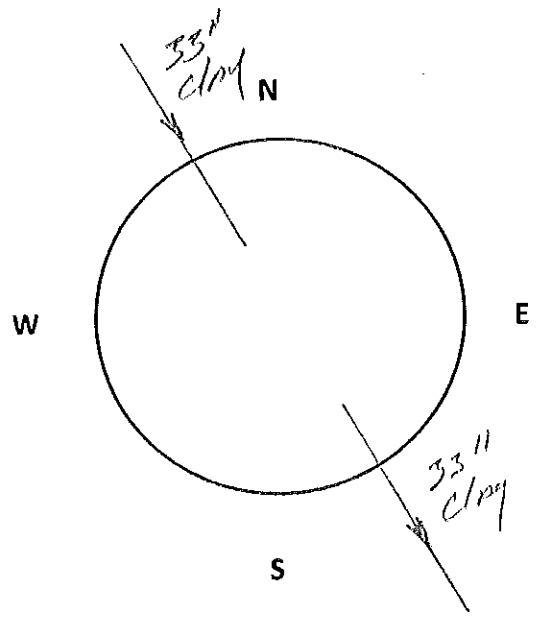
MANHOLE ID: 1-6-12

CREW LEADER:

DATE OF COLLECTION: 11/4/19

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☒ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	11.99'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

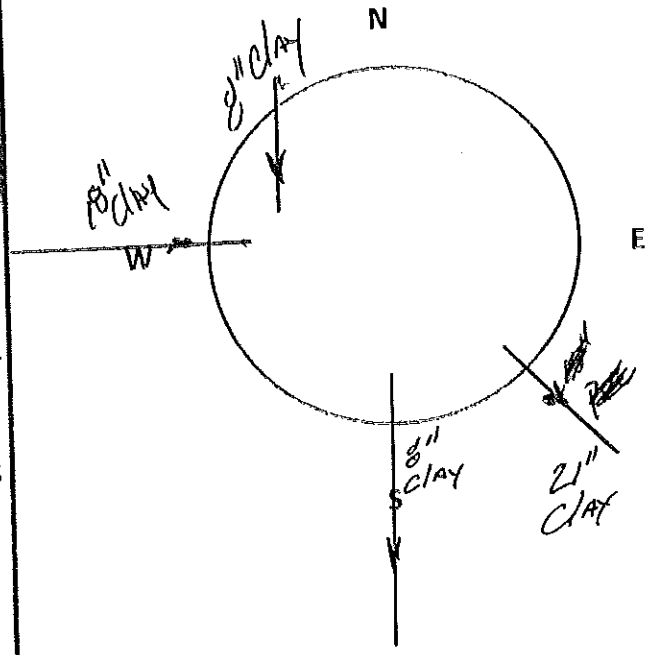
MANHOLE ID: 2-C-6

CREW LEADER:

DATE OF COLLECTION:

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	10.34'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

MANHOLE ID: 2-D-4

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

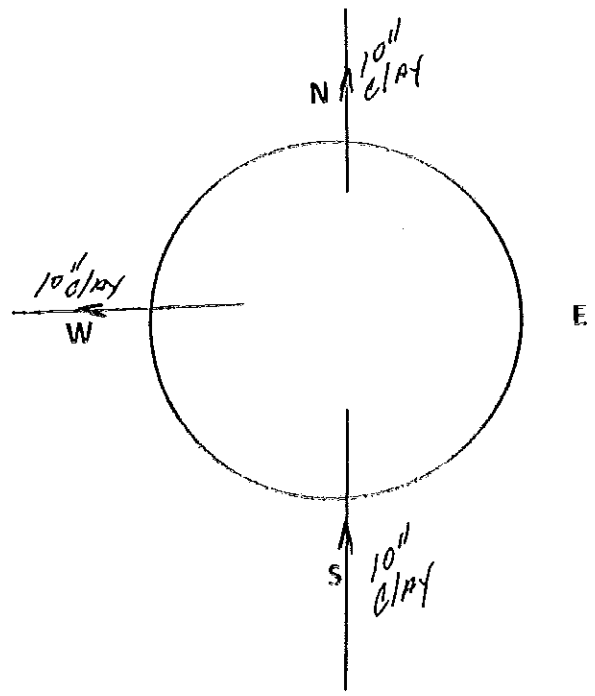
☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	5.27'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

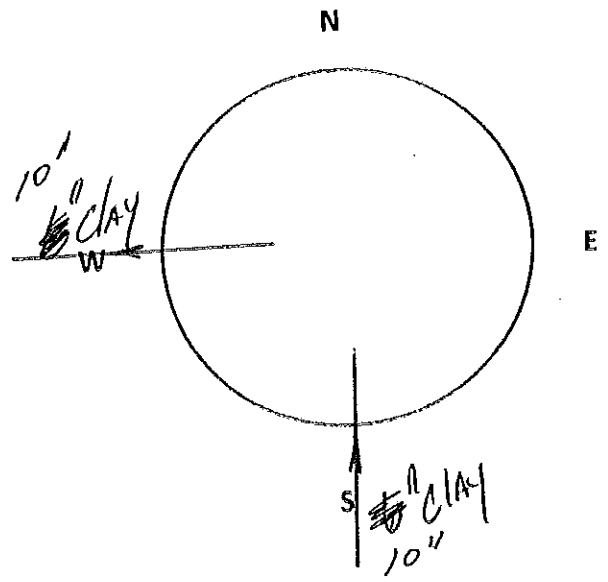
MANHOLE ID: 3-B-3

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	10.41	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

MANHOLE ID: 3-B-6

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE DETAILS

MANHOLE DIAMETER:

RIM ELEVATION:

MANHOLE CONSTRUCTION MATERIAL:

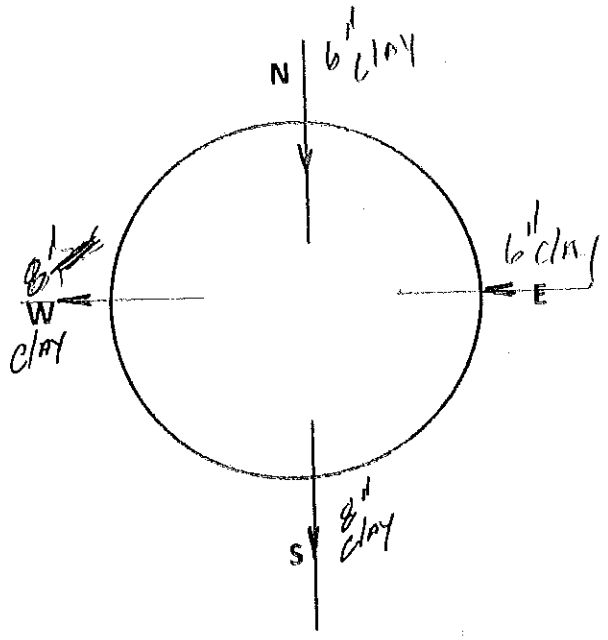
☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER:

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	6.27'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

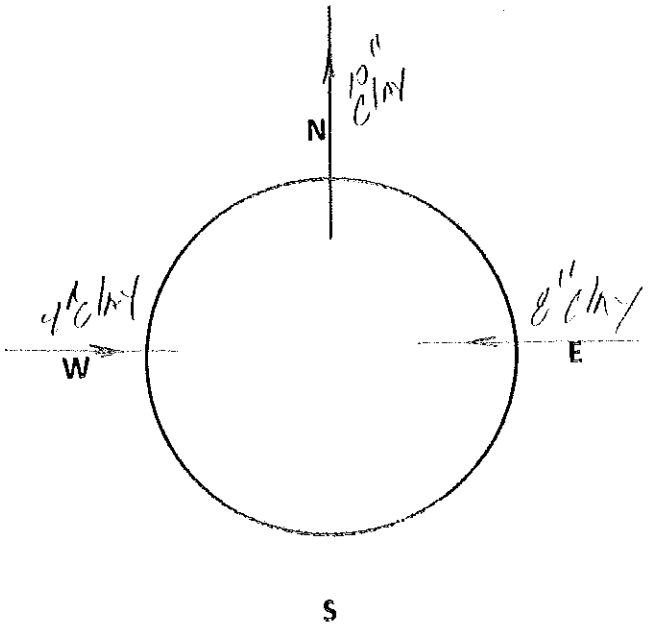
MANHOLE ID: 2-K-17

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☑ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN		Charged (Full water)
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

MANHOLE ID: 2-K-13

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE SKETCH

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PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN		Blocked - full of solids
	IN		unable to determine pipe size
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

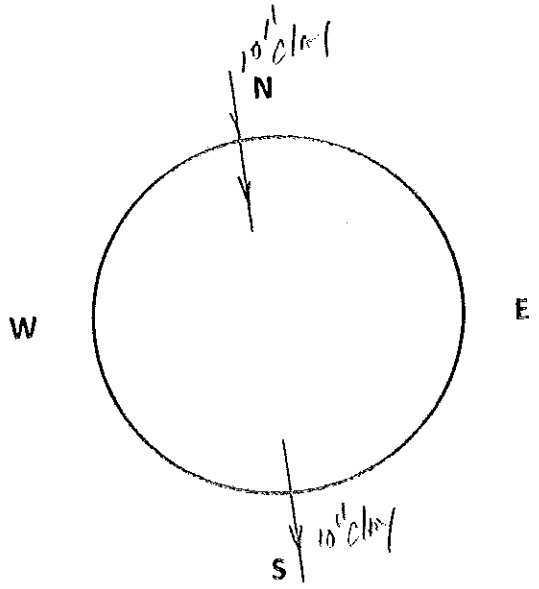
MANHOLE ID: 2-K-10

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

(☐) CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR (☐) GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	7.17'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

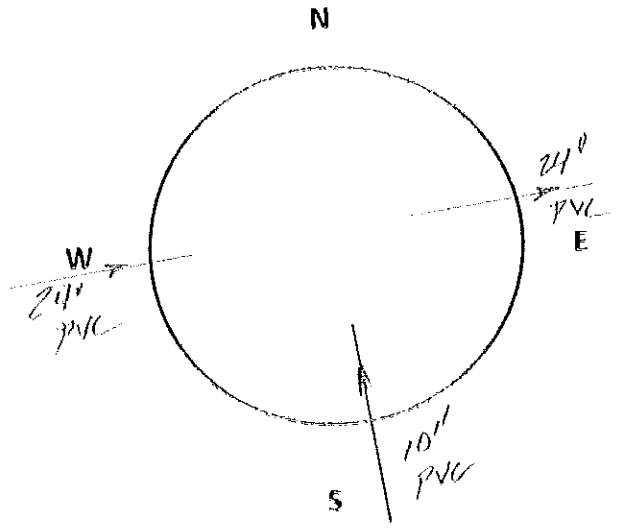
MANHOLE ID: 4-17-16

CREW LEADER:

DATE OF COLLECTION: 1/20/15

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	16.85'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

MANHOLE ID: 3-B-3

CREW LEADER:

DATE OF COLLECTION: 12/22/17

TIME OF COLLECTION:

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

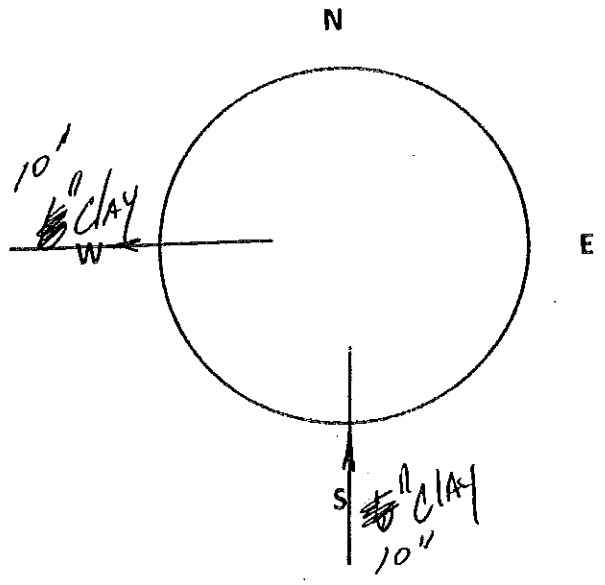
☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	10.41	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

MANHOLE ID: 2-D-4

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

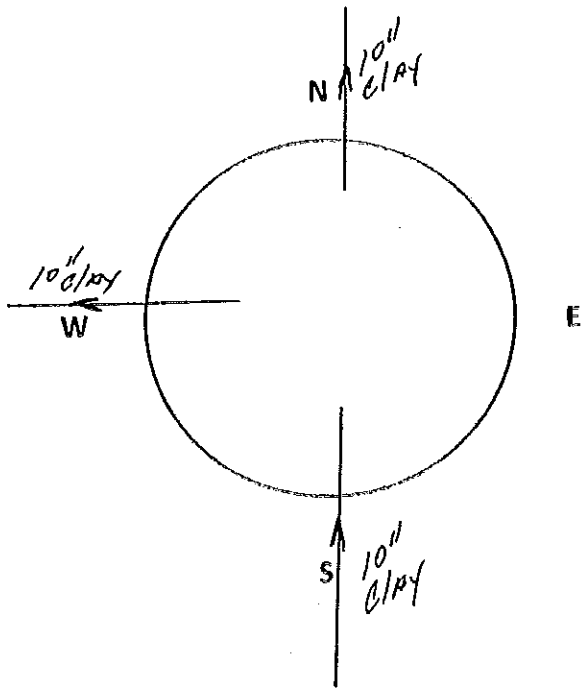
☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	5.27'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

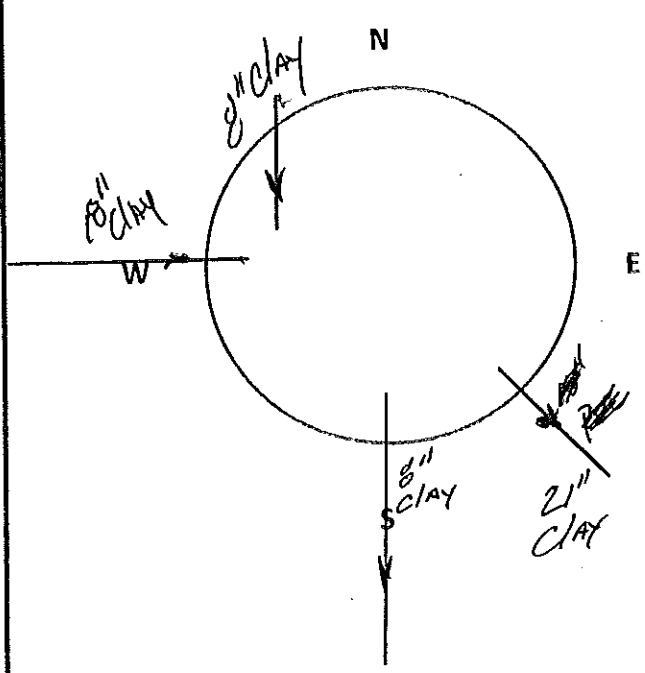
MANHOLE ID: 2-C-6

CREW LEADER:

DATE OF COLLECTION:

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	10.34'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) 2 3

MANHOLE ID: 3-B-6

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

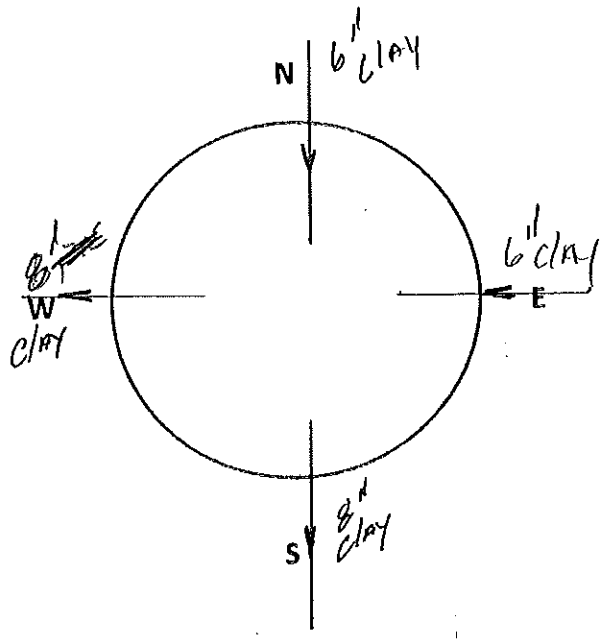
☒ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☒ GOOD

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	6.27'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) FNI 2 3

MANHOLE ID: 5-A-3

CREW LEADER:

DATE OF COLLECTION: 10/28/14

TIME OF COLLECTION:

MANHOLE SKETCH

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UNKNOWN

PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☒ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☒ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	10.15	Problem Area - Bang Workstation
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) FNI 2 3

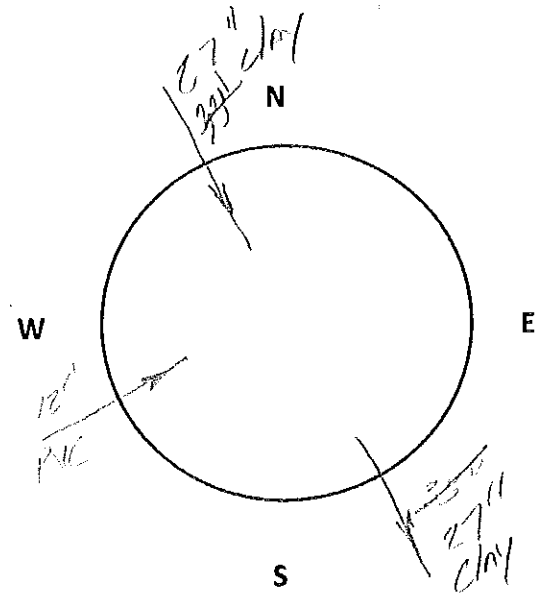
MANHOLE ID: 1-C-10

CREW LEADER:

DATE OF COLLECTION: 11/5/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER:_____

RIM ELEVATION:_____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	10.96'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) FNI 2 3

MANHOLE ID: 3-1-8

CREW LEADER:

DATE OF COLLECTION: 12/14/14

TIME OF COLLECTION:

MANHOLE DETAILS

MANHOLE DIAMETER:_____

RIM ELEVATION:_____

MANHOLE CONSTRUCTION MATERIAL:

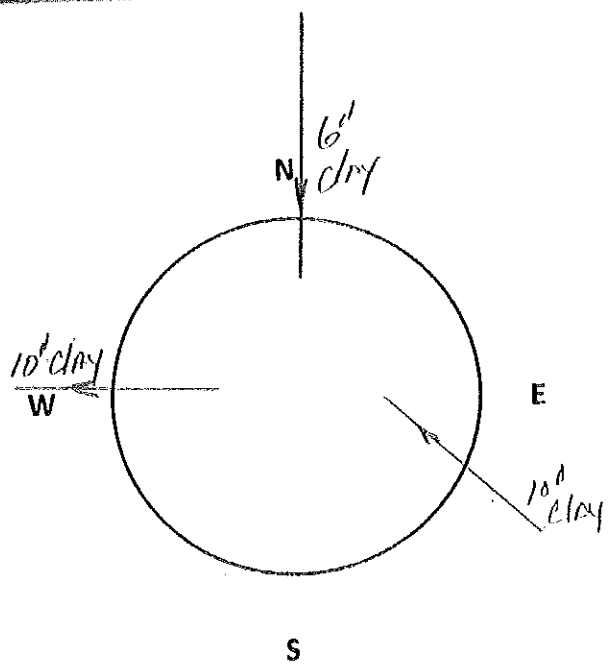
☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	10.92'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) FNI 2 3

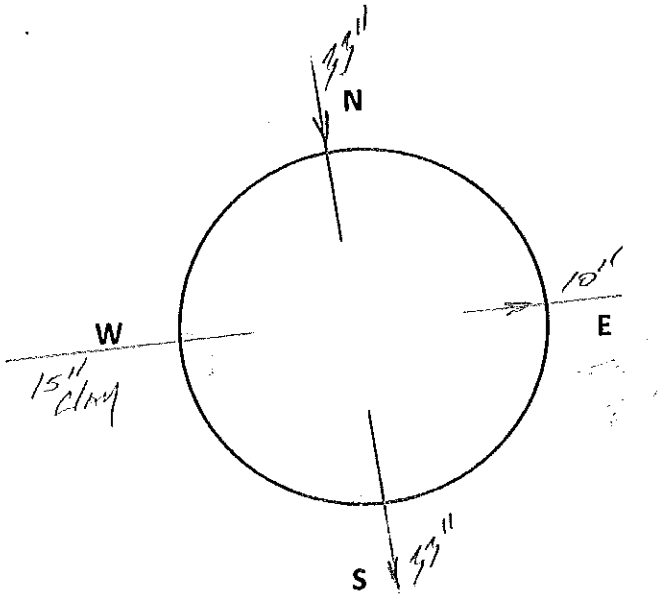
MANHOLE ID: 1-I-1

CREW LEADER:

DATE OF COLLECTION: 10/28/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	11.25'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) FNI 2 3

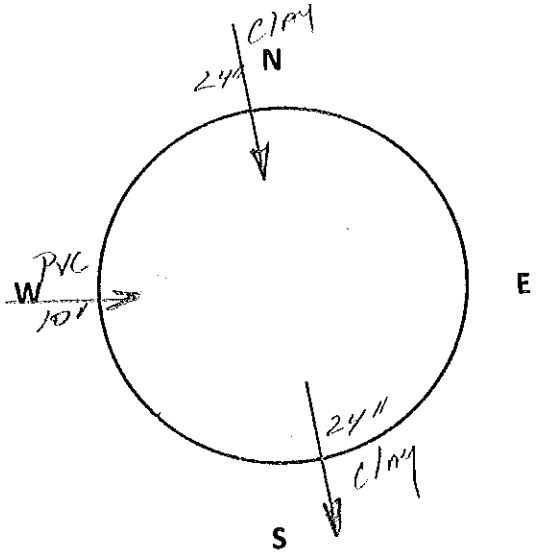
MANHOLE ID: 1-I-8

CREW LEADER:

DATE OF COLLECTION: 10/28/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☒ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☒ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	11.05'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) FNI 2 3

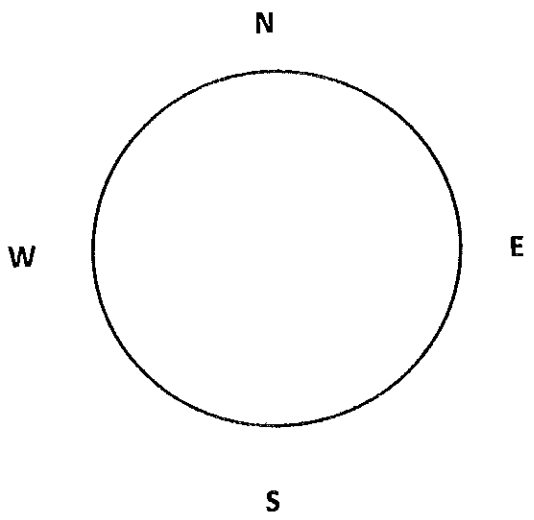
MANHOLE ID: 5-B-21

CREW LEADER:

DATE OF COLLECTION: 10/28/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN		COULD NOT LOCATE
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: (1) FNI 2 3

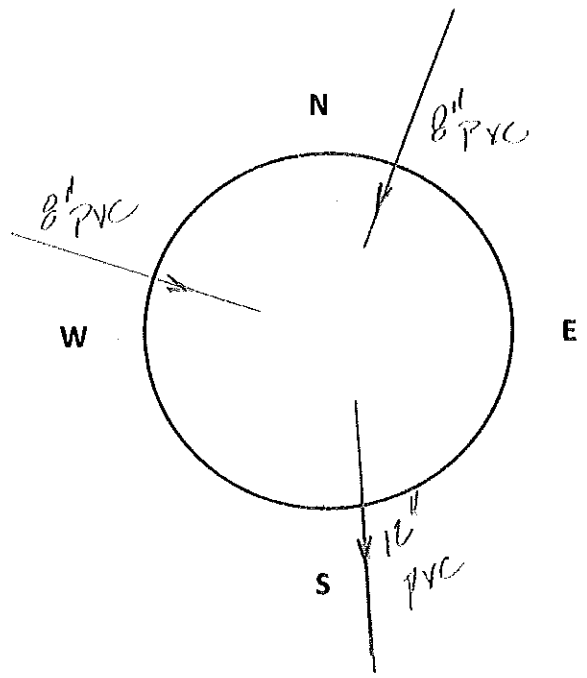
MANHOLE ID: 5-C-7A

CREW LEADER:

DATE OF COLLECTION: 10/28/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☒ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☒ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	12.05'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

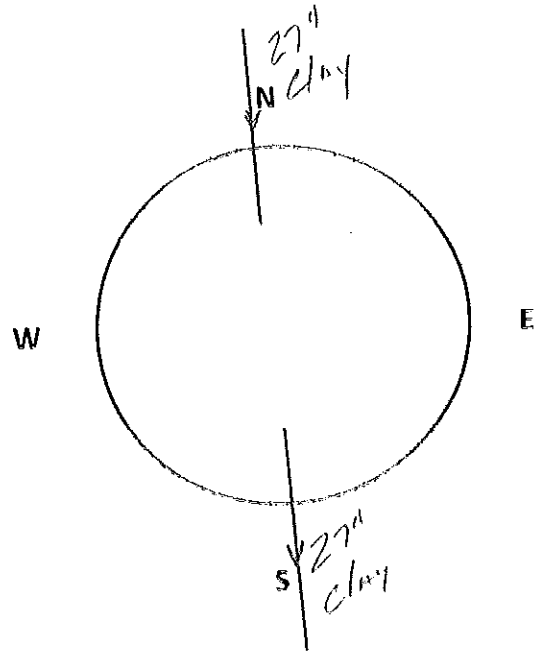
MANHOLE ID: MH-A-2

CREW LEADER:

DATE OF COLLECTION: 1/28/15

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	14.67'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

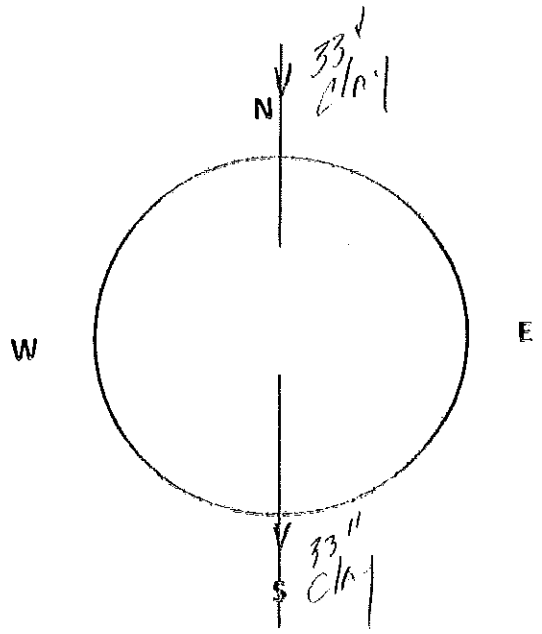
MANHOLE ID: 1-A-2

CREW LEADER:

DATE OF COLLECTION: 1/28/15

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☑ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	16.21'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

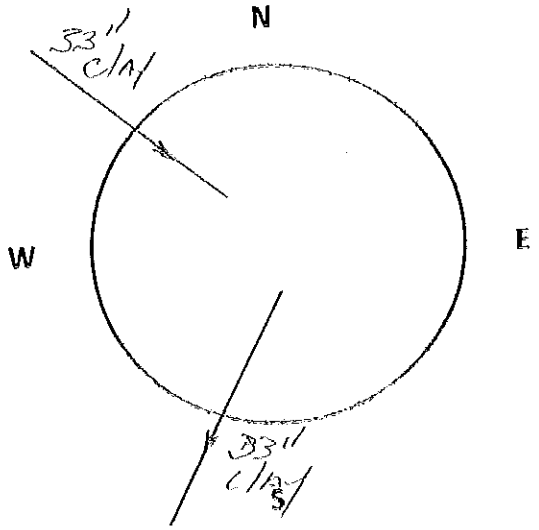
MANHOLE ID: 1-A-5

CREW LEADER:

DATE OF COLLECTION: 1/28/15

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	13.32'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

BRUSH NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 (2) 3

MANHOLE ID: 1-A-6

CREW LEADER:

DATE OF COLLECTION: 1/28/15

TIME OF COLLECTION:

MANHOLE SKETCH

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PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN		Header Closed
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

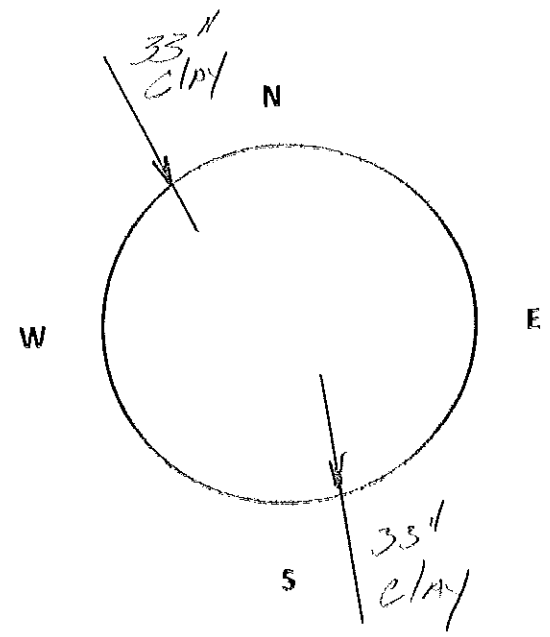
MANHOLE ID: 1-A9

CREW LEADER:

DATE OF COLLECTION: 1/28/15

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	10.59'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 (2) 3

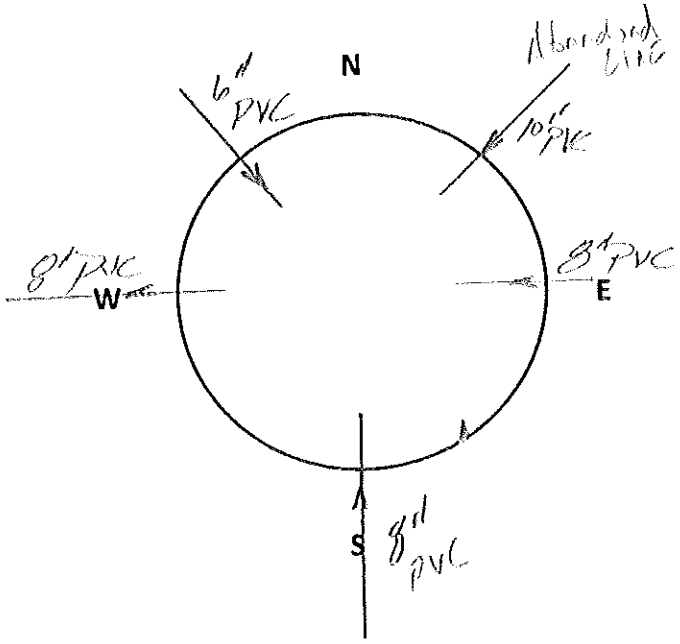
MANHOLE ID: 1-R-5

CREW LEADER:

DATE OF COLLECTION: 10/29/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☒ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	10.86	
	IN		
	IN		
	OUT		
	OUT		

P R2

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 (2) 3

MANHOLE ID: 1-H-11

CREW LEADER:

DATE OF COLLECTION: 10/29/14

TIME OF COLLECTION:

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

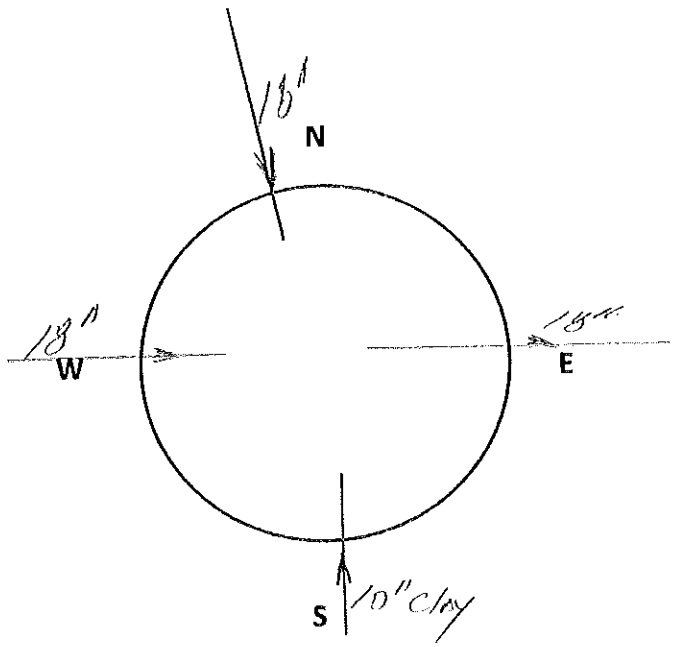
☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	9.50	
	IN		
	IN		
	OUT		
	OUT		

PRT

MANHOLE MEASURE DOWN SHEET

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

MANHOLE ID: 2-P-09

CREW LEADER:

DATE OF COLLECTION: 1/20/15

TIME OF COLLECTION:

MANHOLE DETAILS

MANHOLE DIAMETER:

RIM ELEVATION:

MANHOLE CONSTRUCTION MATERIAL:

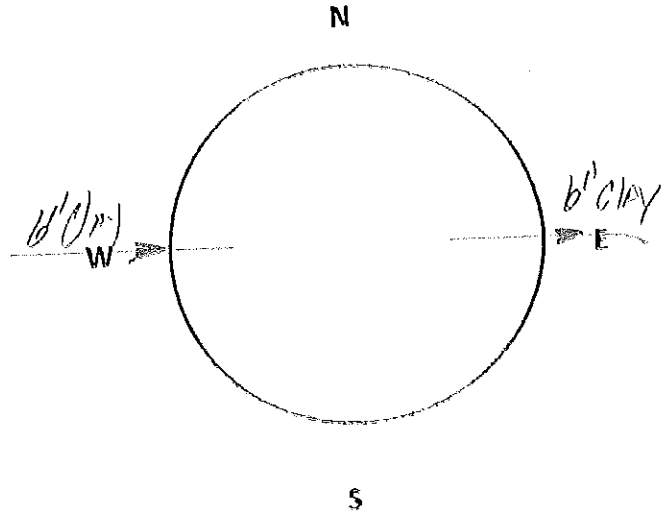
☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER:

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	5.53'	
	IN		
	IN		
	OUT		
	OUT		P-05

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 (2) 3

MANHOLE ID: 3-H-38

CREW LEADER:

DATE OF COLLECTION: 12/20/14

TIME OF COLLECTION:

MANHOLE DETAILS

MANHOLE DIAMETER:

RIM ELEVATION:

MANHOLE CONSTRUCTION MATERIAL:

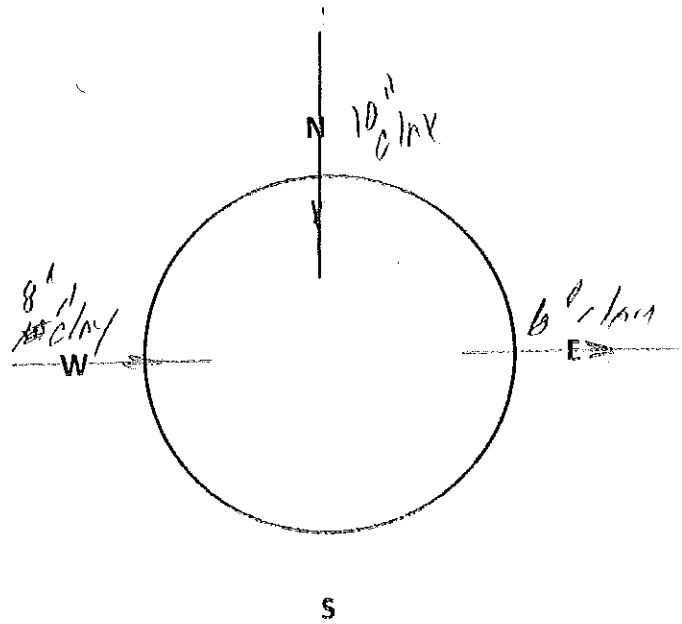
(☐) CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER:

MANHOLE CONDITION:

☐ POOR ☐ FAIR (☐) GOOD

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	10.06'	
	IN		
	IN		
	OUT		
	OUT		

P-15

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 (2) 3

MANHOLE ID: 3-12-4

CREW LEADER:

DATE OF COLLECTION: 12/16/14

TIME OF COLLECTION:

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

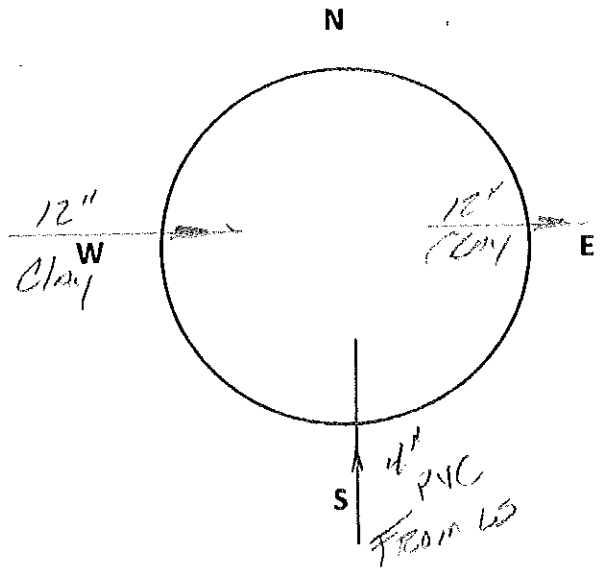
☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	6.51'	
	IN		
	IN		
	OUT		
	OUT		

P-05

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 (2) 3

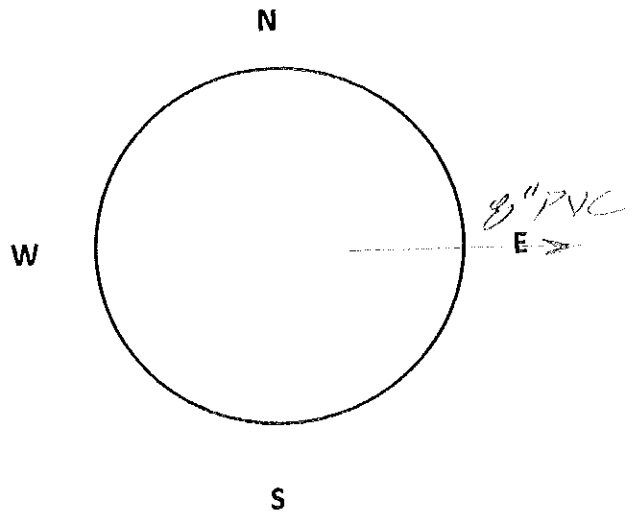
MANHOLE ID: 3-7-44A

CREW LEADER:

DATE OF COLLECTION: 12/1/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	6.25'	
	IN		
	IN		
	OUT		
	OUT		

P-56

MANHOLE MEASURE DOWN SHEET

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 (2) 3

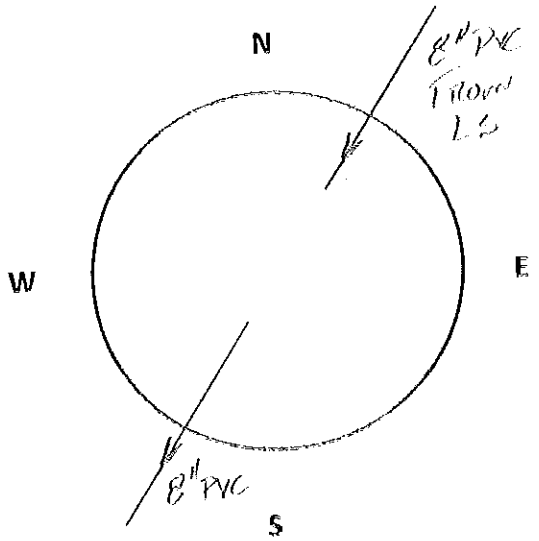
MANHOLE ID:

CREW LEADER:

DATE OF COLLECTION: 12/1/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	4.85	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 (2) 3

MANHOLE ID: 3-J-59

CREW LEADER:

DATE OF COLLECTION: 12/1/14

TIME OF COLLECTION:

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

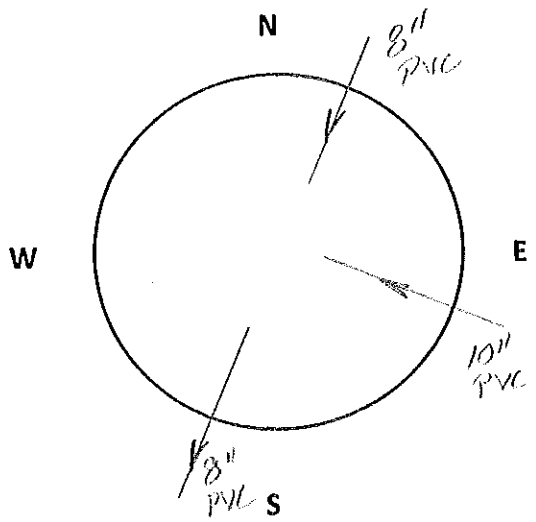
☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☑ POOR ☐ FAIR ☐ GOOD

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN		all Ring & Top Busted up
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

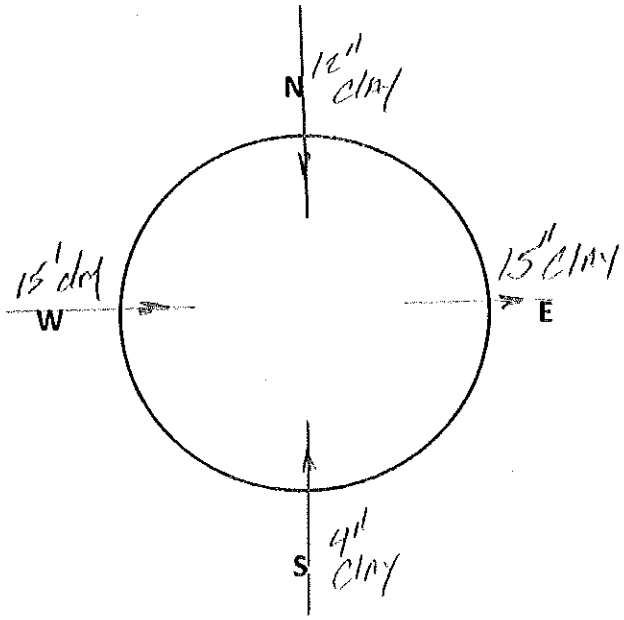
MANHOLE ID: 3-D-2

CREW LEADER:

DATE OF COLLECTION: 12/16/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	7.72'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

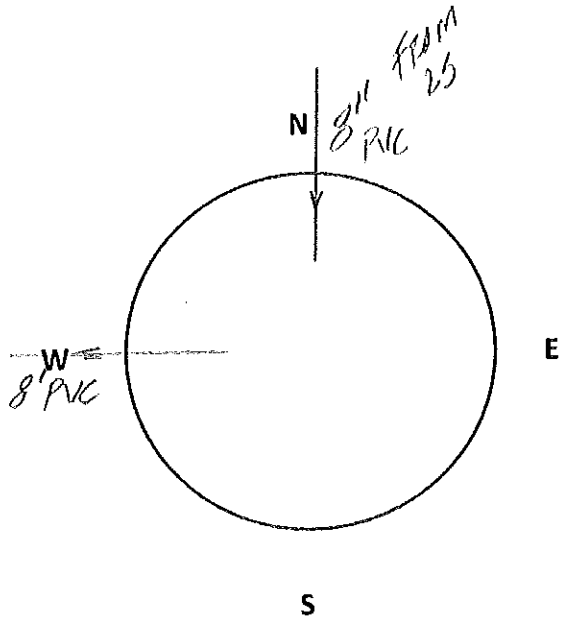
MANHOLE ID: 3-633

CREW LEADER:

DATE OF COLLECTION: 12/4/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	4.25'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 (2) 3

MANHOLE ID: MH-A-1

CREW LEADER:

DATE OF COLLECTION: 12/16/14

TIME OF COLLECTION:

MANHOLE SKETCH

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PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN		unable to locate
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 (2) 3

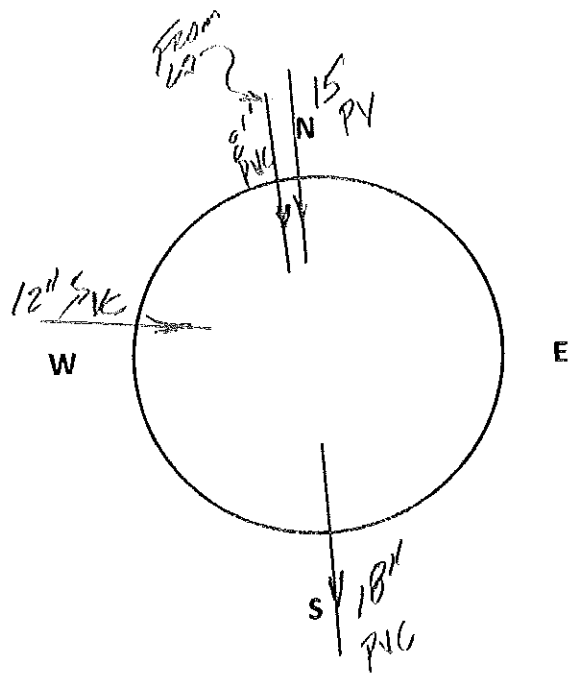
MANHOLE ID: 3-E-8

CREW LEADER:

DATE OF COLLECTION: 12/14/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK (☒) FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR (☒) GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	11.39'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

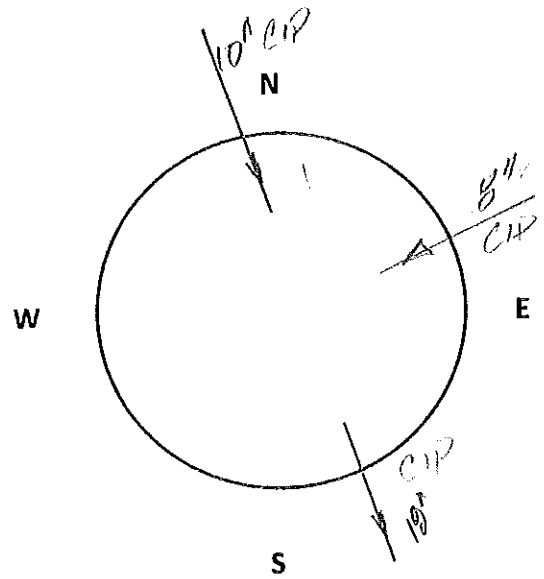
MANHOLE ID: 2-44-19

CREW LEADER:

DATE OF COLLECTION: 10/29/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	9.25	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

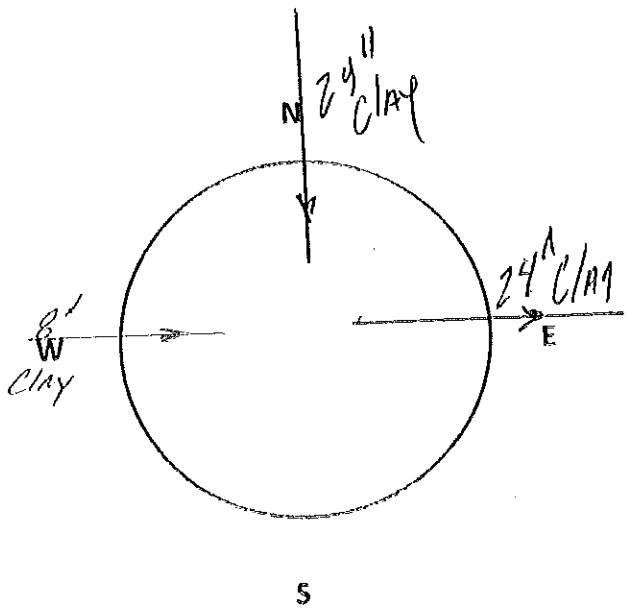
MANHOLE ID: I-J-5A

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	7.55'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 (2) 3

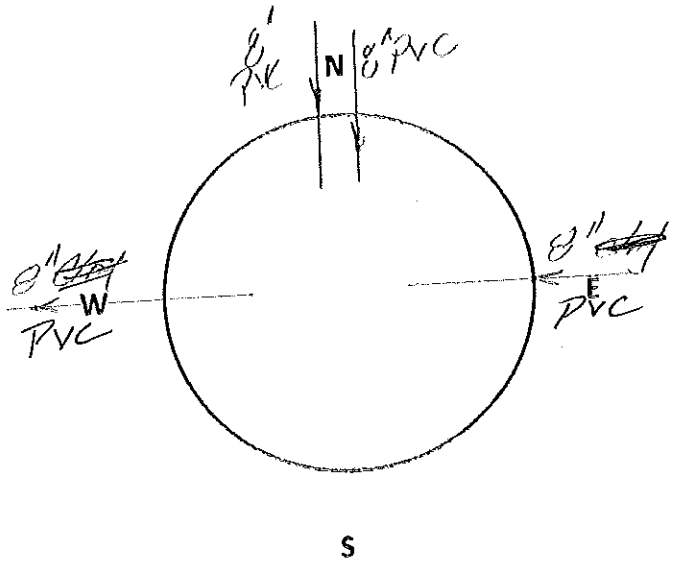
MANHOLE ID: 4-6-4

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	12.92	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 (2) 3

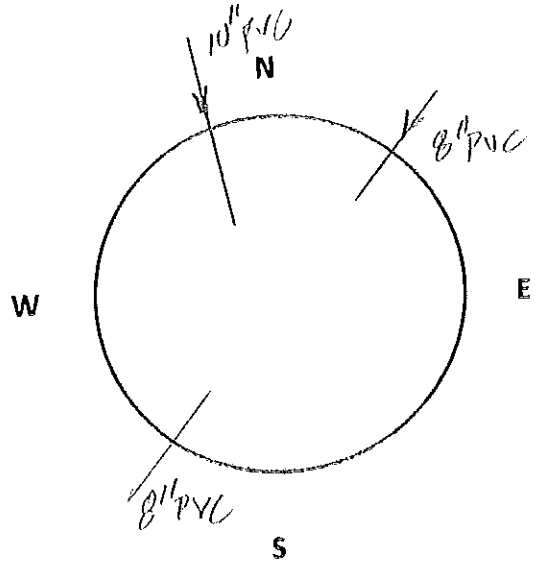
MANHOLE ID: 4-G-29A

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☒ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☒ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	10.6'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 (2) 3

MANHOLE ID: 2-2-15

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

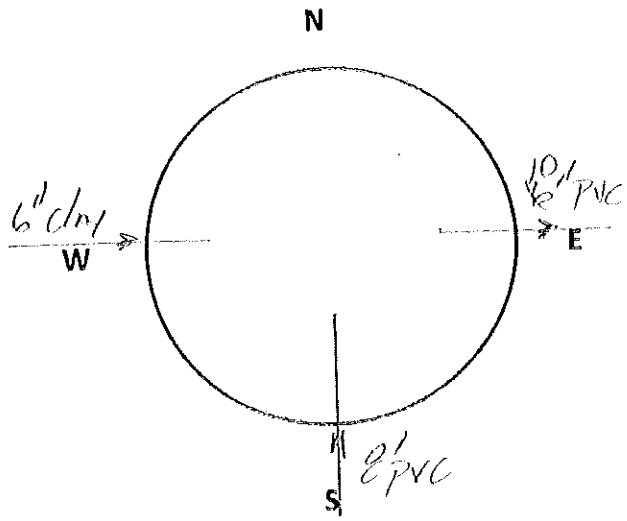
☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	6.41'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 (2) 3

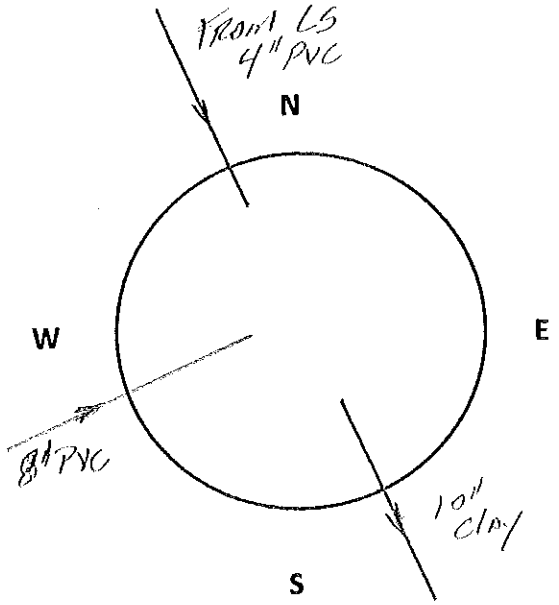
MANHOLE ID: 6-C-29

CREW LEADER:

DATE OF COLLECTION: 1/20/15

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☒ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☒ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	6.65'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 (2) 3

MANHOLE ID: 4-C-42

CREW LEADER:

DATE OF COLLECTION: 1/20/15

TIME OF COLLECTION:

MANHOLE SKETCH

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PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	–	UNABLE TO OPEN - Possible Flood Damage
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 (2) 3

MANHOLE ID: ~~4-5~~ 4-C-39

CREW LEADER:

DATE OF COLLECTION: 1/20/15

TIME OF COLLECTION:

MANHOLE SKETCH

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PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN		Full of Solids - No Ft. Combustible
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 (2) 3

MANHOLE ID: 9-A-48K

CREW LEADER:

DATE OF COLLECTION: 1/20/15

TIME OF COLLECTION:

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

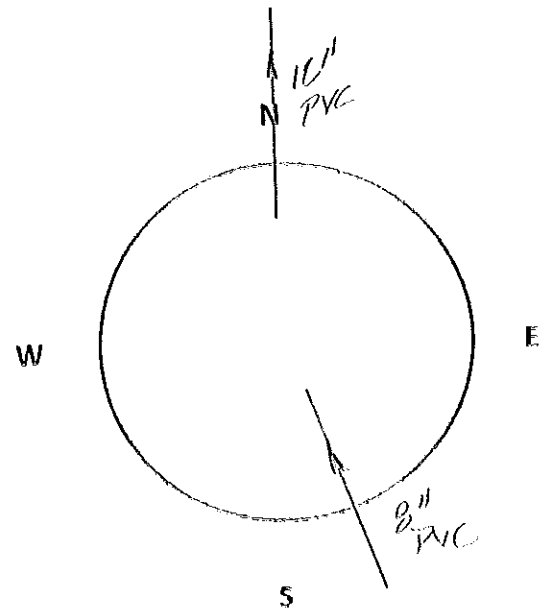
☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	7.85'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 (2) 3

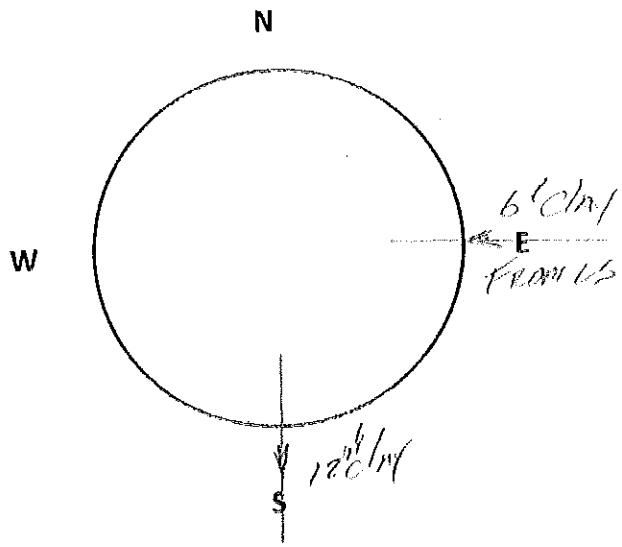
MANHOLE ID: 2-L-23

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

(☑) CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR (☑) GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	5.93'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 (2) 3

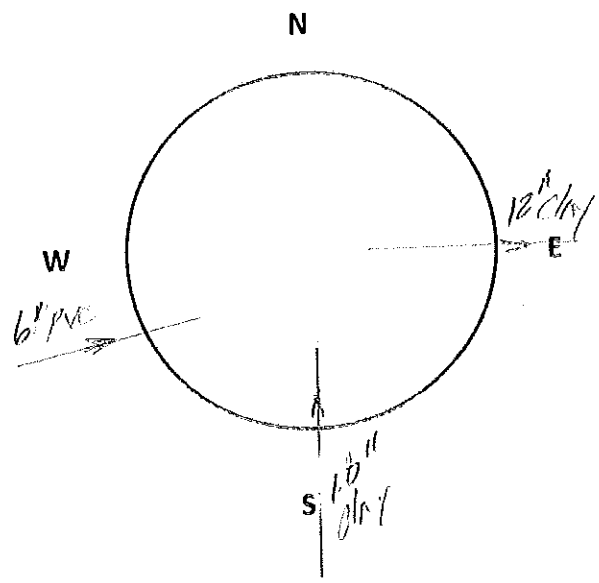
MANHOLE ID: 2-L-12

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE (☑) BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR (☑) GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	1.66	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

MANHOLE ID: 3-4-A

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE SKETCH

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PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☑ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN		Abandoned Sewer main
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

MANHOLE ID: 2-M-2

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE DETAILS

MANHOLE DIAMETER:

RIM ELEVATION:

MANHOLE CONSTRUCTION MATERIAL:

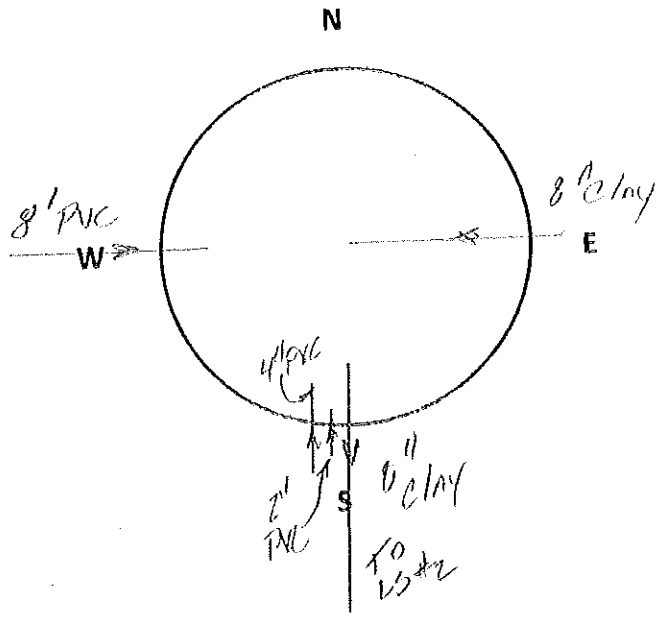
☐ CONCRETE ☒ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER:

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☒ GOOD

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	7.10'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 (2) 3

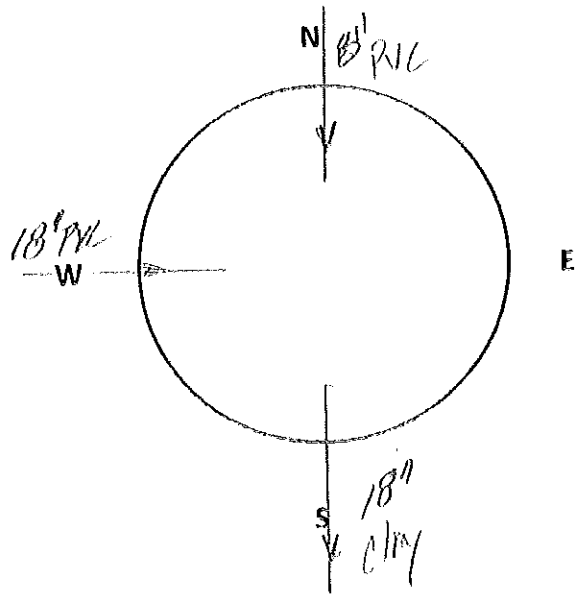
MANHOLE ID: 2-6-8

CREW LEADER:

DATE OF COLLECTION: 12/18/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK (☑) FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR (☑) GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	6.15	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 (2) 3

MANHOLE ID: 2-B-308

CREW LEADER:

DATE OF COLLECTION: 12/18/14

TIME OF COLLECTION:

MANHOLE SKETCH

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S

PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN		PAVED OVER
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 (2) 3

MANHOLE ID: 2-H-1

CREW LEADER:

DATE OF COLLECTION: 12/18/14

TIME OF COLLECTION:

MANHOLE DETAILS

MANHOLE DIAMETER:_____

RIM ELEVATION:_____

MANHOLE CONSTRUCTION MATERIAL:

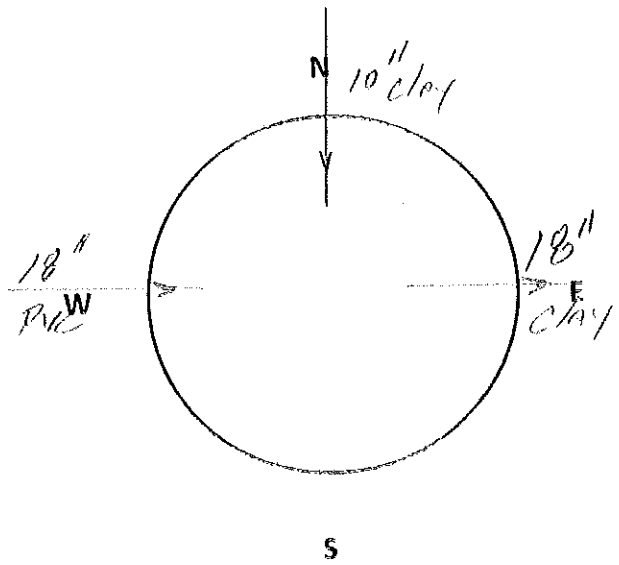
☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	6.70'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 (2) 3

MANHOLE ID: I-J-5A

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

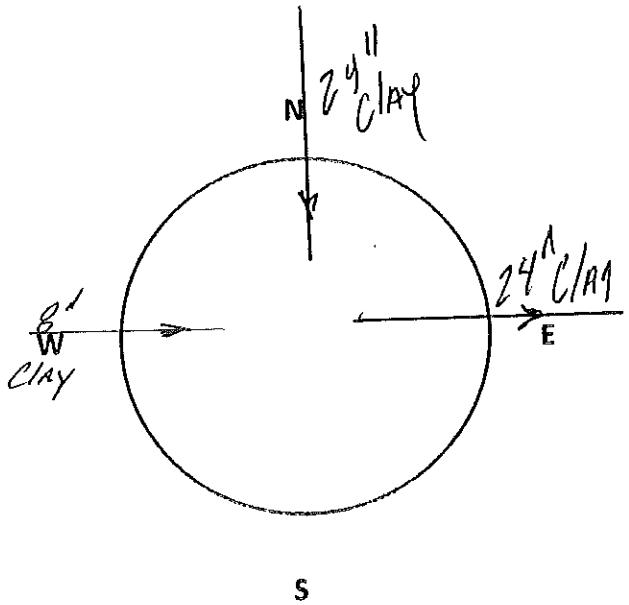
(☑) CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR (☑) GOOD

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	7.55'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 (2) FNL 3

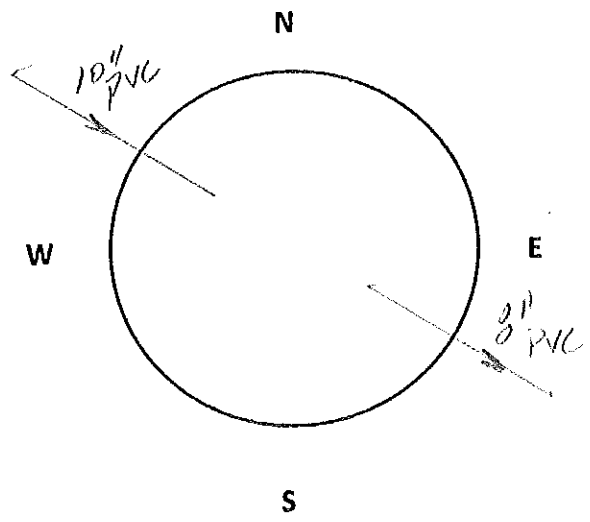
MANHOLE ID: S-C-14A

CREW LEADER:

DATE OF COLLECTION: 10/28/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☒ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☒ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	9.96'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 (3) FNI

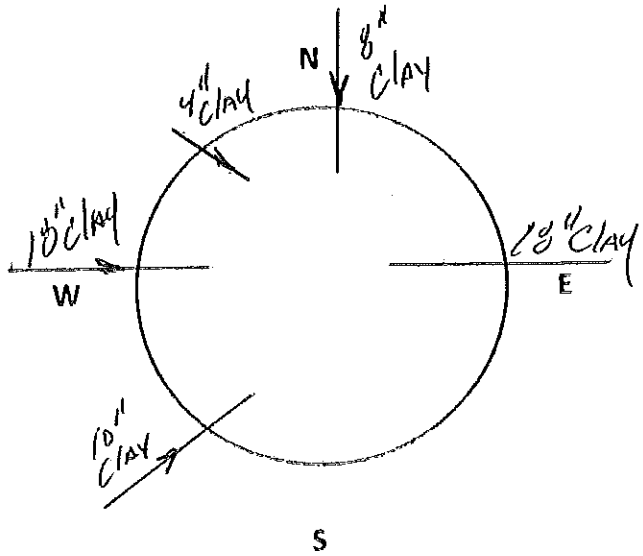
MANHOLE ID: 1-5-15

CREW LEADER:

DATE OF COLLECTION:

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER:

RIM ELEVATION:

MANHOLE CONSTRUCTION MATERIAL:

☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER:

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	9.05'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

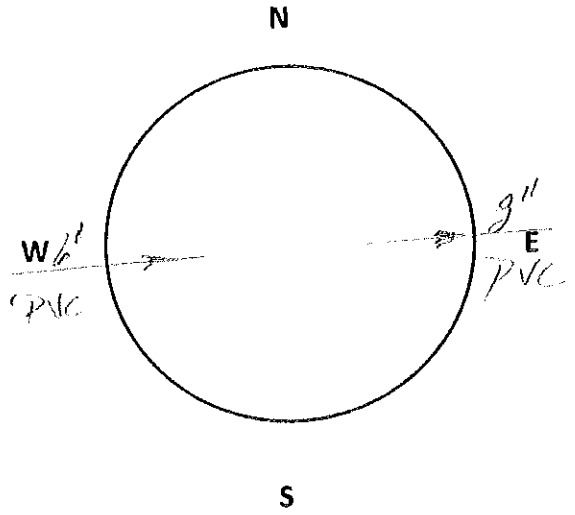
MANHOLE ID: 5-E-51

CREW LEADER:

DATE OF COLLECTION: 12/1/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	7.47'	
	IN		
	IN		
	OUT		
	OUT		

P-75

MANHOLE MEASURE DOWN SHEET

FREESE NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

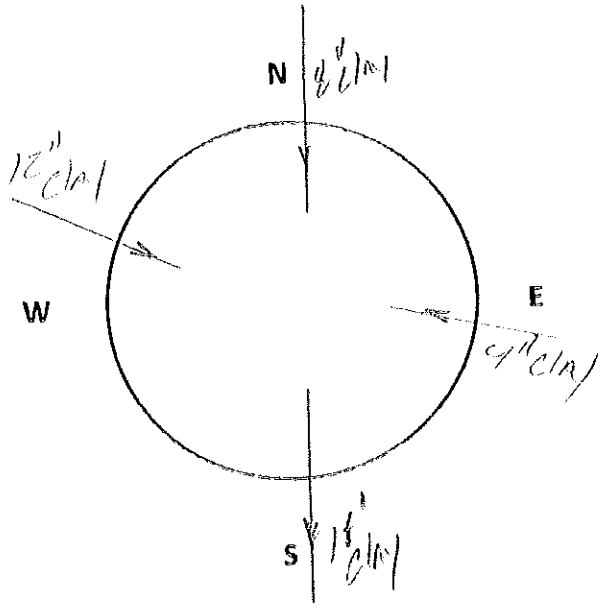
MANHOLE ID: 2-H-6

CREW LEADER:

DATE OF COLLECTION: 12/18/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER:

RIM ELEVATION:

MANHOLE CONSTRUCTION MATERIAL:

☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER:

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	5.85'	
	IN		
	IN		
	OUT		
	OUT		

P-N4

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

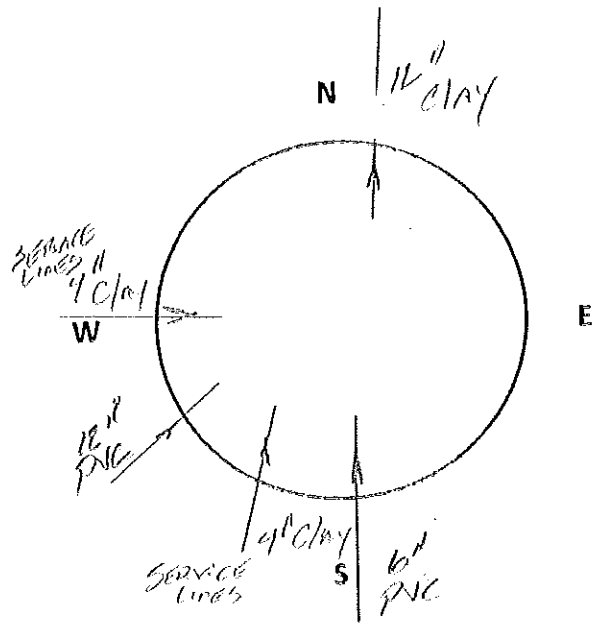
MANHOLE ID: 8-1-6

CREW LEADER:

DATE OF COLLECTION: 12/18/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	4.56'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

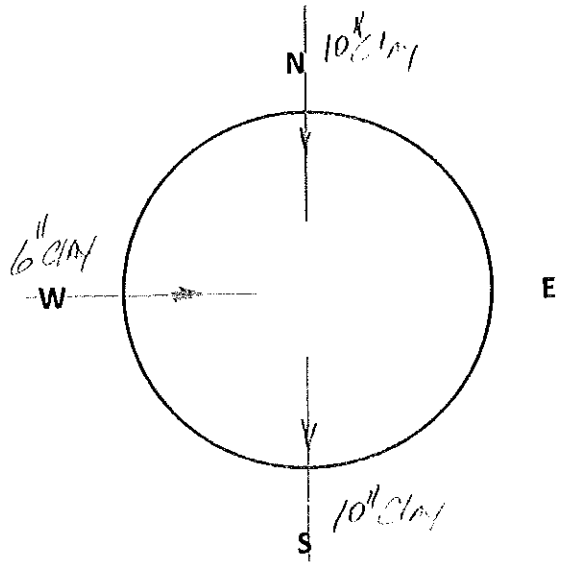
MANHOLE ID: 3-1-45

CREW LEADER:

DATE OF COLLECTION: 12/1/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	3.91'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

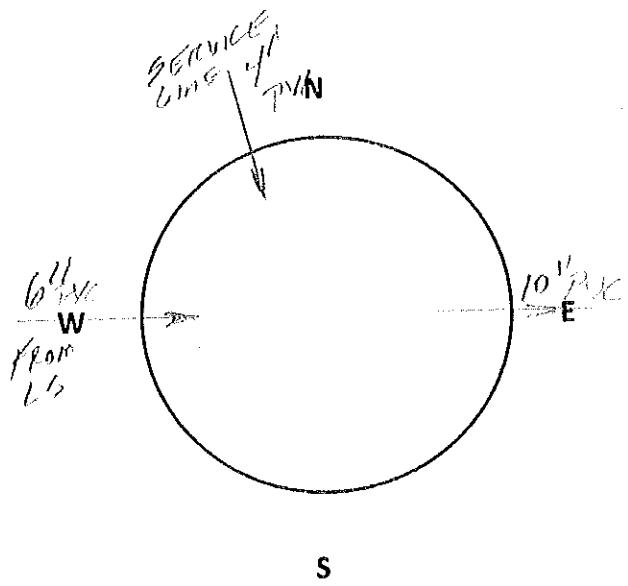
MANHOLE ID: 3-K-9

CREW LEADER:

DATE OF COLLECTION: 12/1/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☑ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	5'8"	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

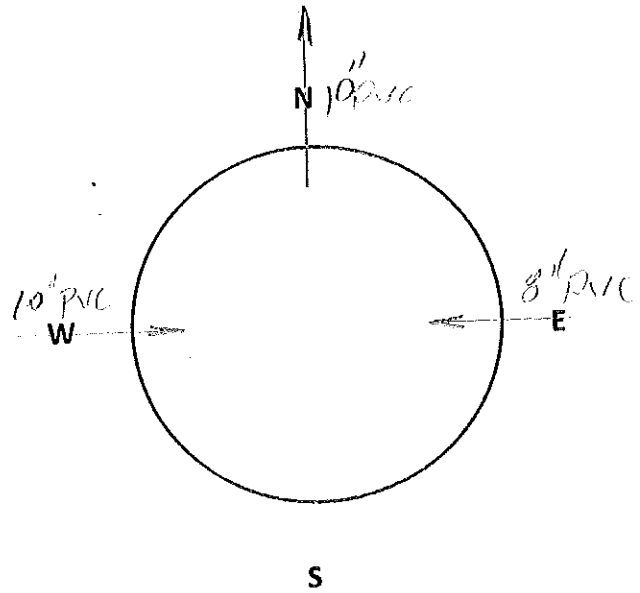
MANHOLE ID: 3-L-1

CREW LEADER:

DATE OF COLLECTION: 12/1/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	11.62'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

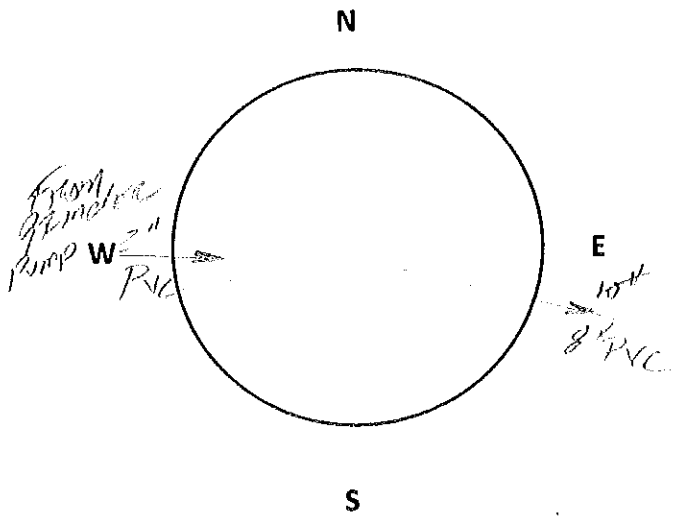
MANHOLE ID: 3-L-18

CREW LEADER:

DATE OF COLLECTION: 12/4/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	6.85'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

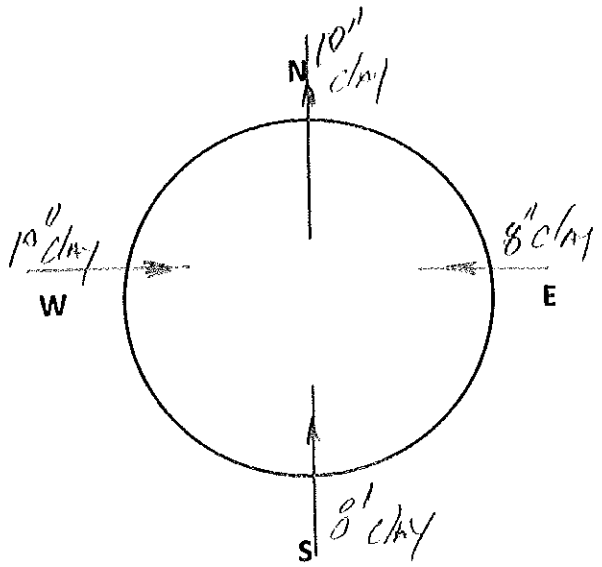
MANHOLE ID: 3-E-69

CREW LEADER:

DATE OF COLLECTION: 12/16/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	6.70'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

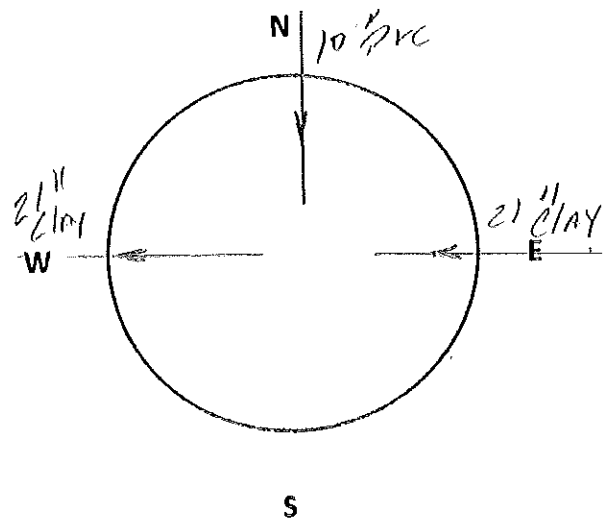
MANHOLE ID: 3-E-37

CREW LEADER:

DATE OF COLLECTION: 12/16/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	8.80'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 (3)

MANHOLE ID: 3-1-37

CREW LEADER:

DATE OF COLLECTION: 12/16/14

TIME OF COLLECTION:

MANHOLE SKETCH

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PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER:_____

RIM ELEVATION:_____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN		unable to locate
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

MANHOLE ID: 3-1-36

CREW LEADER:

DATE OF COLLECTION: 12/16/14

TIME OF COLLECTION:

MANHOLE SKETCH

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PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN		unable to locate
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

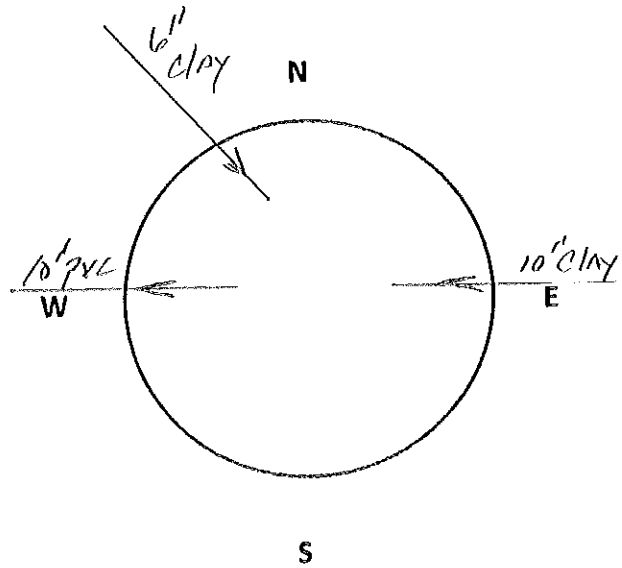
MANHOLE ID: 3-1-4

CREW LEADER:

DATE OF COLLECTION: 12/16/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER:

RIM ELEVATION:

MANHOLE CONSTRUCTION MATERIAL:

☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER:

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	7.36'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

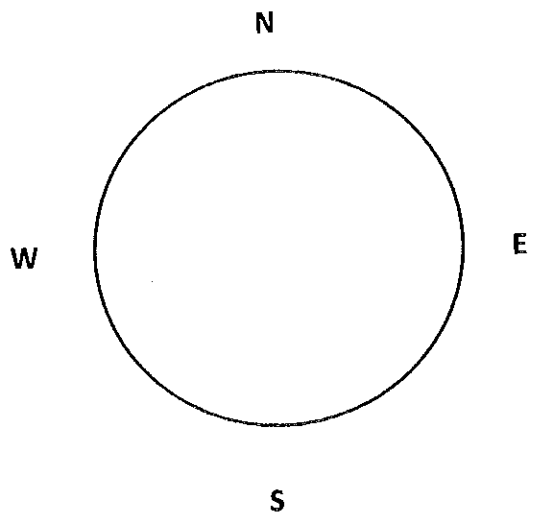
MANHOLE ID: 3-11-17

CREW LEADER:

DATE OF COLLECTION: 12/1/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN		UNABLE TO OPEN MH
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 (3)

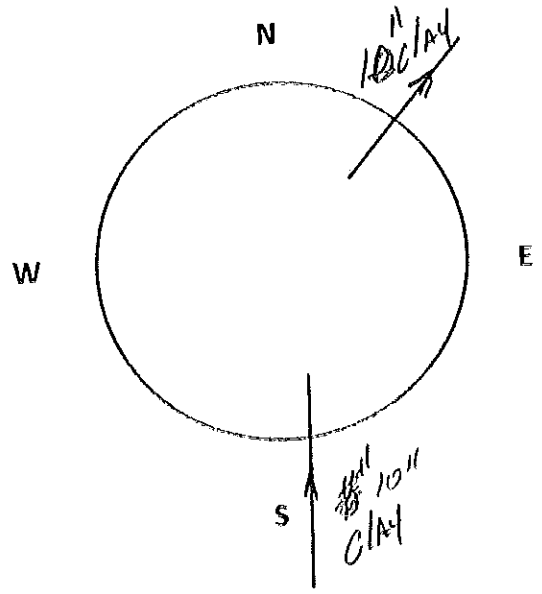
MANHOLE ID: 2-C-22

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	8.12'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

MANHOLE ID: 2-C-5

CREW LEADER:

DATE OF COLLECTION: 10/22/14

TIME OF COLLECTION:

MANHOLE SKETCH

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PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN		Unable to locate
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 (3)

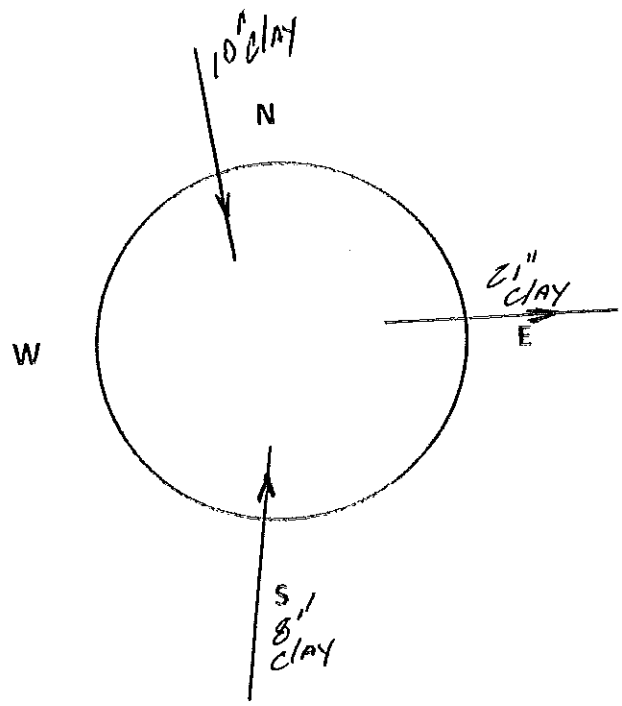
MANHOLE ID: 2-C-3

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE (☐) BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR (☐) GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN		NEEDS PUMPED DOWN
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

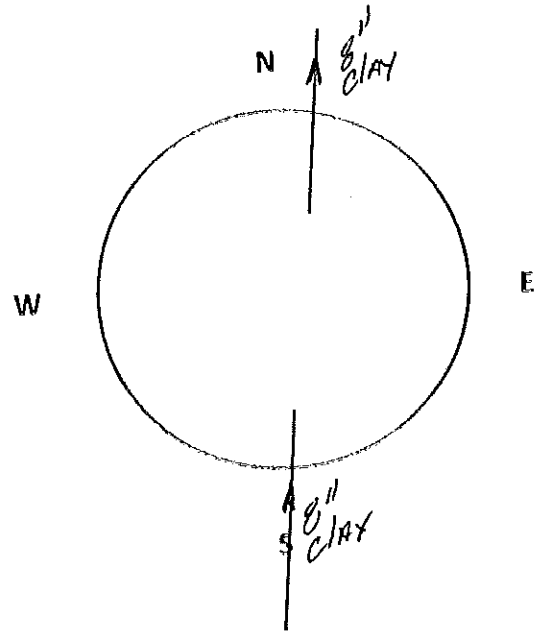
MANHOLE ID: 2-L-9

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☑ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	4.32'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 (3)

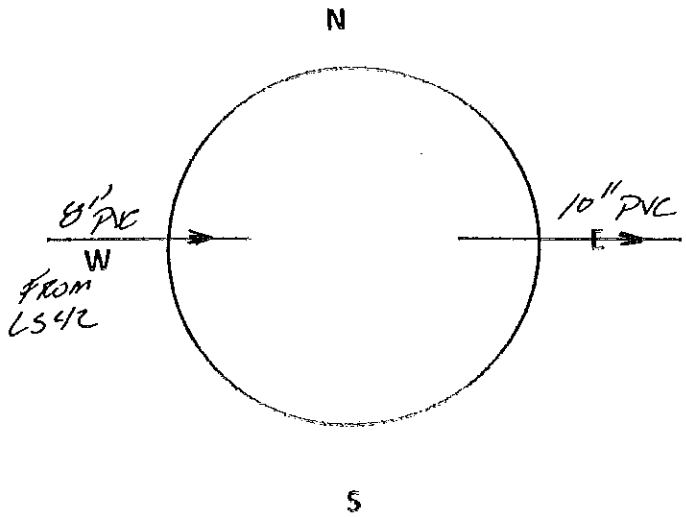
MANHOLE ID: 4-I-8

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	3.99'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

MANHOLE ID: 2-L-28

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE DETAILS

MANHOLE DIAMETER:

RIM ELEVATION:

MANHOLE CONSTRUCTION MATERIAL:

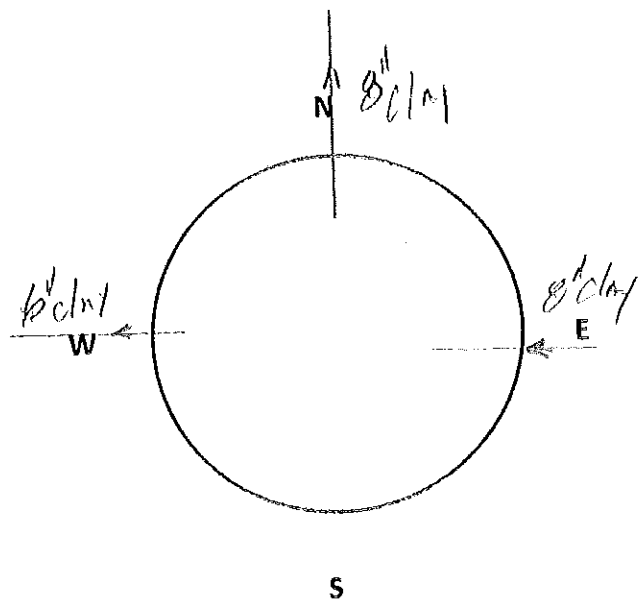
☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER:

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	8.24'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 (3)

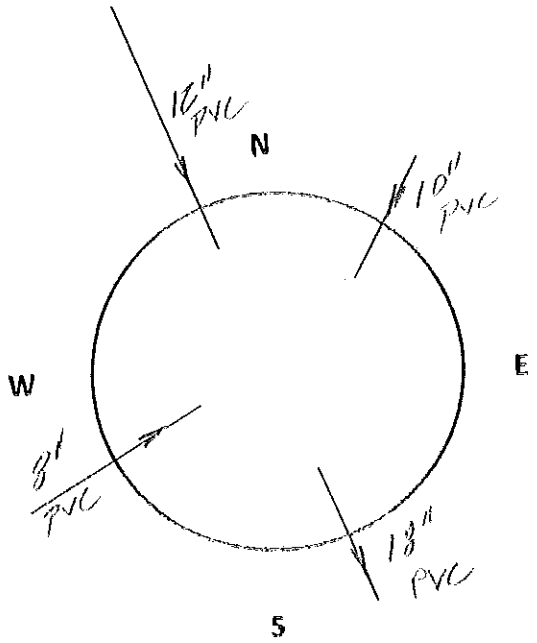
MANHOLE ID: 4-A-25

CREW LEADER:

DATE OF COLLECTION: 1/20/15

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

Busted MH Top

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	8.50	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

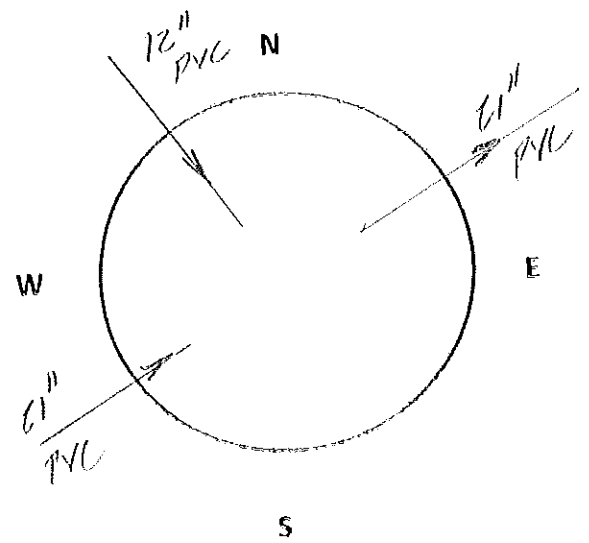
MANHOLE ID: 4-11-48A

CREW LEADER:

DATE OF COLLECTION: 1/20/15

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER:

RIM ELEVATION:

MANHOLE CONSTRUCTION MATERIAL:

☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER:

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	10.77'	
	IN		
	IN		
	OUT		
	OUT		

PG 2

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

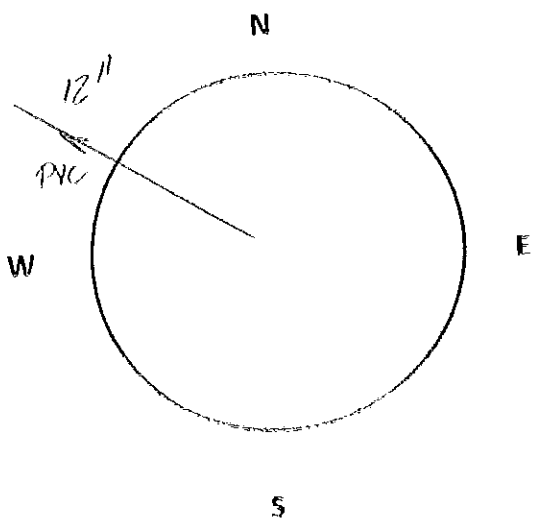
MANHOLE ID: 1-N-4

CREW LEADER:

DATE OF COLLECTION: 1/20/15

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	15.45'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 (3)

MANHOLE ID: 2-L-26

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

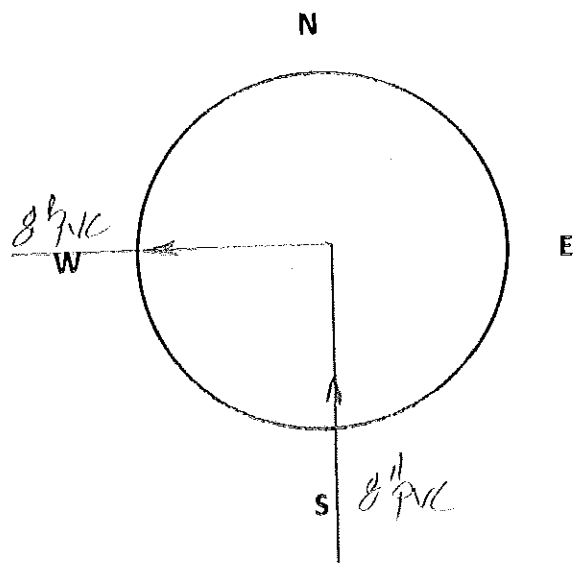
(☑) CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR (☑) GOOD

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	3.24	Abandoned Line
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 (3)

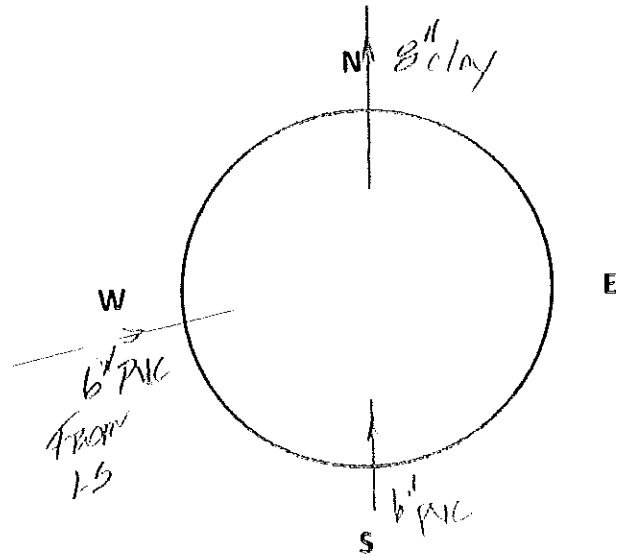
MANHOLE ID: 2-B-24A

CREW LEADER:

DATE OF COLLECTION:

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	6.65'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 (3)

MANHOLE ID: E-K-19

CREW LEADER:

DATE OF COLLECTION: 12/12/14

TIME OF COLLECTION:

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

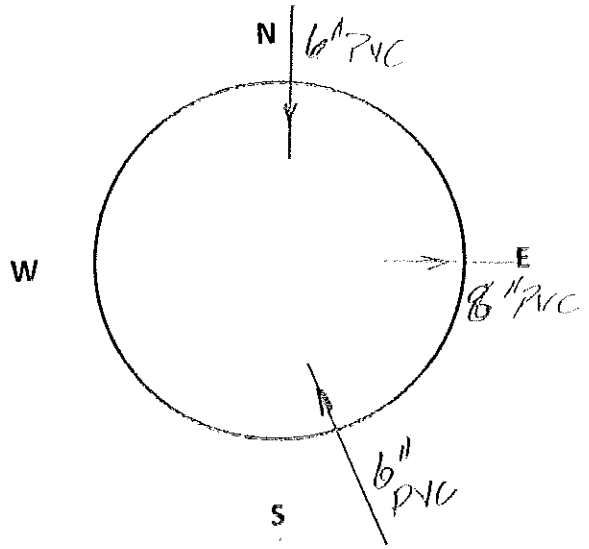
(☐) CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR (☐) GOOD

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	3.25'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

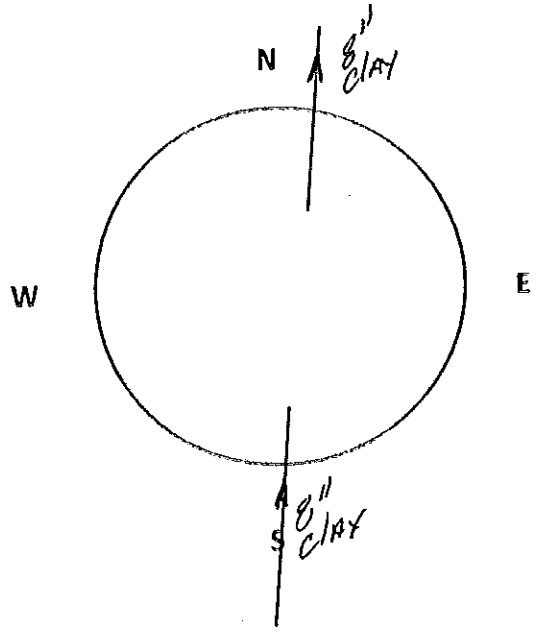
MANHOLE ID: C-L-9

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☑ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	4.32'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 (3)

MANHOLE ID: 4-I-8

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

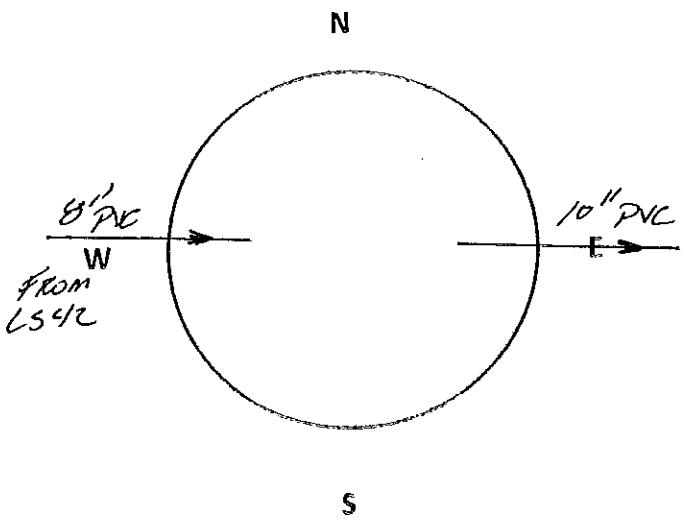
☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	3.99'	
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

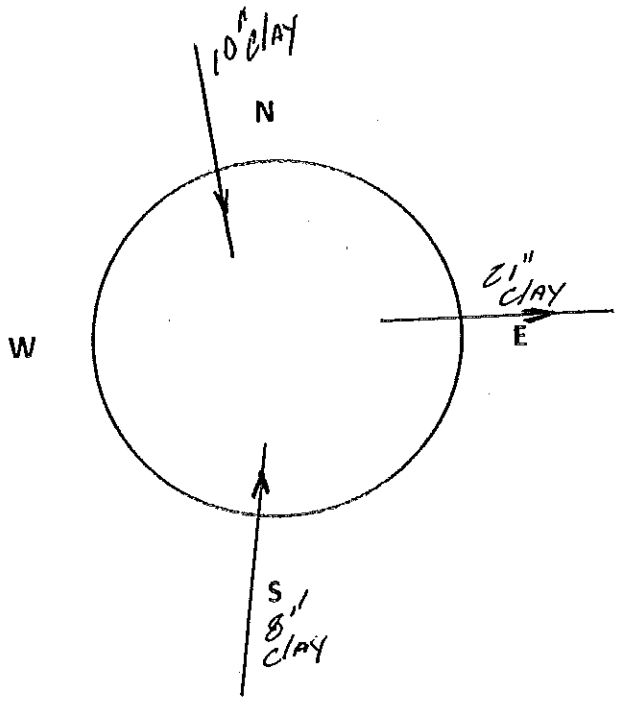
MANHOLE ID: 2-C-3

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☑ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN		Needs Pumped Down
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

MANHOLE ID: 2-C-5

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE SKETCH

N

W E

S

PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☐ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☐ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN		Unable to locate
	IN		
	IN		
	OUT		
	OUT		

MANHOLE MEASURE DOWN SHEET

FREESE AND NICHOLS

MANHOLE MEASURE DOWN COLLECTION FOR THE CITY OF ALVIN, TEXAS

PRIORITY LEVEL: 1 2 3

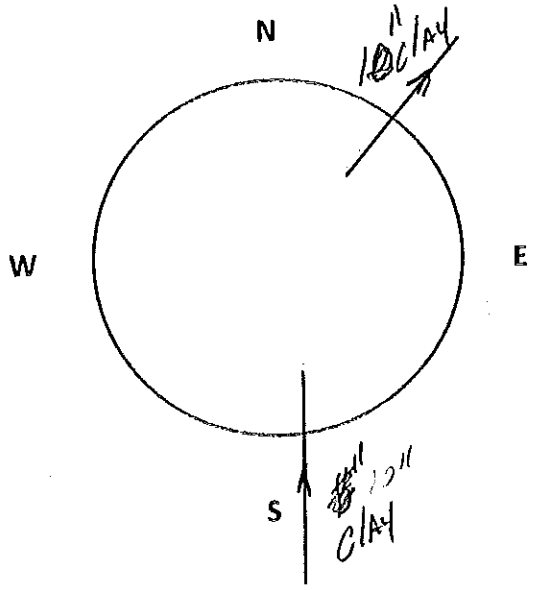
MANHOLE ID: 2-C-22

CREW LEADER:

DATE OF COLLECTION: 12/22/14

TIME OF COLLECTION:

MANHOLE SKETCH



PLEASE SKETCH INCOMING AND OUTGOING LINES

MANHOLE DETAILS

MANHOLE DIAMETER: _____

RIM ELEVATION: _____

MANHOLE CONSTRUCTION MATERIAL:

☑ CONCRETE ☐ BRICK ☐ FIBERGLASS

☐ UNKNOWN OTHER: _____

MANHOLE CONDITION:

☐ POOR ☐ FAIR ☑ GOOD

INCOMING / OUTGOING PIPES

DIAMETER (INCHES)	FLOW DIRECTION	DEPTH FROM RIM (FEET)	COMMENTS
	IN	8.12'	
	IN		
	IN		
	OUT		
	OUT		

UTILITY MASTER
PLAN (MANHOLE TR)
FOR
FREESE & Nichols

Pt*	BS	HI	FS	EL	
BM 410				40.62	
	8.39	49.01			
3-L-1*			5.11	43.90	*
3-L-15*			5.03	43.98	*
TP1			5.68	43.33	
	5.90	49.23			
TP2			3.0	46.23	
	5.0	51.23			
3-L-17*			7.87	43.36	*
3-L-18*			4.39	46.84	*
BM 410				40.62	
	7.92	48.34			
TP1			3.86	44.48	
	4.40	48.88			
3-K-9*			5.72	43.16	
TP2			4.56	44.32	
	5.0	49.32			
TP3			3.06	46.26	
	3.52	49.78			
3-K-4*			3.91	45.87	
TP4			3.10	46.68	
	4.29	50.97			
TBM1			4.25	46.72	

W. Bolt Light Pole SW INT HWY 6 & 149

82 0271
Keuffel & Esser Company

②

PT#	BS	HI	FS	ELEV	
				46.72	
	4.05	50.77			
TP1 3-J-59*			7.43	43.34	
	2.52	45.86			
3-J-65*			4.19	41.67	
BM 402				44.74	
	3.66	48.4			
TP1			3.52	44.88	
	2.20	47.08			
TP2 4-G-29A*			3.29	43.79	(TBM)
	3.65	47.44			
TP2			3.22	44.22	
	3.20	47.42			
TP3			2.71	44.71	
	2.91	47.62			
TP4			3.20	~~44.42~~	
	3.52	~~47.94~~			
TP5			2.66	45.28	
	3.45	48.73			
TP6			3.72	45.01	
	4.02	49.03			
TP7			2.40	46.63	
	2.37	49.00			
4-1-8*			3.69	45.31	

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③

PNT	BS	HI	FS	ELEV
BM 303				42.84
	4.47	47.31		
2-6-15*			4.42	42.89
2-6-16*			4.04	43.27
BM 120				41.84
	4.84	46.68		
TP1			4.76	41.92
	5.39	47.31		
TP2			4.77	42.54
	4.70	47.24		
TP3			5.63	41.61
	4.05	45.66		
TP4			4.13	41.53
	4.57	46.10		
2-6-28*			4.68	41.42
TP5			3.04	43.06
	4.94	48.00		
2-2-13*			4.90	43.10
TP6			4.38	43.62
	5.31	48.93		
TP7			4.99	43.94
	4.44	48.38		
TP8			5.60	42.78

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(4)

PT#	BS	HI	FS	ELEV
		48.38		
2-K-13*			5.49	42.89
2-K-10*			5.63	42.75
	4.26	47.01		
2-K-17*			4.96	42.05
BM400				41.47
	4.43	45.90		
TP1			4.54	41.36
	4.40	45.76		
2-L-26*			3.88	41.88
3-H-49*	TP2		3.84	41.92
	5.50	47.42		
2-L-12*			3.82	43.60
2-L-23*			3.95	43.47
BM404				39.65
	5.79	45.44		
TP1			5.25	40.19
	3.05	43.24		
2-M-2*			4.60	38.64

(5)

Pt	BS	HI	FS	ELEV
BM 404				39.65
	5.17	44.82		
TP1			4.66	40.16
	4.94	45.10		
2-L-9*			3.66	41.44
BM 305				41.94
	4.87	46.81		
TP1			3.75	43.06
	4.07	47.13		
TP2			4.89	42.24
	4.04	46.28		
4-G-4*			3.99	42.29
BM 406				41.23
	5.48	46.71		
TP1			5.03	41.68
	5.75	47.43		
TP2			4.37	43.06
	5.04	48.10		
TP3			4.92	43.18
	4.56	47.74		
5-E-54*			5.07	42.67

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Keuffel & Esser Company

(6)

Pt #	BS	HI	FS	ELEV	
BM 109				39.93	
	5.05	44.98			
TP1			4.92	40.06	
	5.30	45.36			
TP2			5.47	39.89	
	4.94	44.83			
TP3			5.02	39.81	
	4.56	44.37			
5-E26*			4.29	40.08	
BM 109				39.95	
	5.92	45.85			
TP1			4.18	41.67	
	4.09	45.76			AVE F
TBM#1			2.39	43.37	TOP FH
	2.66	46.03			
3-1-44*			4.29	41.74	
3-1-43*			3.99	42.04	
TBM 1				43.37	
	3.10	46.47			
TP1			4.71	41.76	
	5.30	47.06			
5-E-51*			5.04	42.02	
3-1-44A*			4.47	42.59	

82 0271
Keuffel & Esser Company

(2)

Pt#	BS	HI	FS	ELEV	
BM 116				42.81	
	3.64	46.45			
3-1-42*			3.24	43.21	
TP1			4.55	41.90	
	4.13	46.03			
3-1-38*			4.37	41.66	
BM 116				42.81	
	4.39	47.20			
TP1			5.03	42.17	
	2.78	44.95			
TP2			4.86	40.09	
	4.44	44.53			
TP3			3.22	41.31	—
	5.56	46.87			
3-1-2*			4.88	41.99	
TP4			6.26	40.61	No 1-PP
3-E-10*			2.89	43.98	
	4.20	44.81			
TBM	—		4.10	40.71	FH —
	4.46	45.17			
3-1-4*			5.61	39.56	
TP5			2.74	42.43	—
	4.54	46.97			
TBM			1.86	45.11	FHE 02/03/94

(8)

Pt #	BS	HI	FS	ELEV	Ex
TBM				45.41	0 00:58
	0.87	45.98			
3-1-8*			3.75	42.23	
3-1-10*			3.16	42.82	
TP6			2.75	43.23	
	3.52	46.75			
3-1-11*			3.20	43.55	
3-1-12*			3.06	43.69	
TP7			2.17	44.58	
	2.90	47.38			
3-1-16*			3.42	43.96	TBM
3-1-17*	TBM		2.72	44.66	
	3.38	48.04			
TP8			5.14	42.90	
	3.03	45.93			
3-1-5b*			3.78	42.15	
TBM 3-1-16				43.96	
	2.85	46.81			
TP1			3.36	43.45	
	3.49	46.94			
3-E-8*			3.92	43.02	

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(9)

PNT	BS	HI	FS	ELEV	
				44.66	3-1-17
	3.32	48.48			
3-1-23*			5.42	45.06	
3-1-15*			4.84	43.64	
BM110				38.91	
	5.06	43.97			
TP1			4.51	39.46	
	5.60	45.06			
TP2			3.32	41.74	
	5.27	47.01			
3-1-26*			4.40	42.61	
BM111				38.07	
	3.17	41.24			
5-D-24*			3.38	37.86	
5-D-2*			2.43	38.81	
5-D-4*			3.89	37.35	

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(10)

Pt#	BS	HI	FS	ELEV
BM107				37.98
	3.15	41.13		
TP1			4.72	36.41
	3.27	39.68		
TP2			2.48	37.20
	2.66	39.86		
TP3			2.81	37.05
	4.85	41.90		
5-D-11*			3.05	38.85
BM113				34.79
	3.35	38.17		
5-7-18*			3.24	34.93
BM114				38.22
	4.19	42.41		
23-T*			1.76	40.65
BM202				42.20
	5.16	47.86		
3-E-33*			5.41	42.45

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(11)

PN	BS	HI	FS	ELEV	
TBM					36.01
	5.03	42.74			
TP1			4.40	38.34	
	4.77	43.11			
TPM			4.49	38.62	
	3.86	42.48			
TBM			3.15	39.33	
	3.74	43.07			
TP			6.07	37.00	
	5.85	42.85			
TP			5.15	37.70	
	5.0	42.70			
TP			5.53	37.17	
	4.92	42.09			
5-C-2A*			5.54	36.55	
	4.[illegible]				
BM				39.71	Adj.
	4.91	44.62			
5-B-25*			4.97	39.65	
TBM			1.96	42.66	
	2.59	45.05			
5-B-37*			5.35	39.70	

TBM = Moore Transmission (South SET)

SE Cor. Chestnut & Hwy 4 Top FH

NEC Old Galveston Rd & Chestnut (Top FH)

AWD 141 USGS Benchmark - G1208

Cri FH East Hwy 4 on Old Galveston Rd

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All-Weather Writing Paper

(12)

PT#	BS	HI	FS	ELEV	
TBM				39.33	
	3.68	43.01			
TP 1			5.34	37.67	
	4.97	42.64			
TP 2			5.23	37.41	
	5.50	42.91			
TP 3			5.91	37.00	
	5.17	42.17			
S-C-2A*			9.65	36.52	
				(MP 16.20)	
BM206				39.45	
	5.75	45.20			
5-B-14*			5.53	39.67	
5-B-21*					?
5-B-15*					?
BM201				41.14	
	5.15	46.29			
TP1			2.69	43.60	
	3.14	46.74			
TP2			5.48	41.26	
	4.26	45.52			
3-E-37*			4.80	40.72	
3-E-51*			4.19	41.33	TBM
MH-H1*		UNABLE TO LOCATE			

@ NE Pole Chestnut & Old Galveston Rd

(13)

P#	BS	HI	FS	ELEV	
TBM				41.33	3-E-57
	4.01	45.34			
TP1			.42	44.92	
	2.32	47.24			
3-E-69*			4.98	42.26	
BM 200				41.02	
	5.34	46.96			
3-E-54A*			3.76	43.15	
BM 200				41.07	
	4.63	45.70			
3-D-2*			3.12	42.58	TP1
	3.61	46.19			
TP2			4.18	42.01	
	4.65	46.66			
					TP3
3-D-4*			4.71	41.95	TP3
	2.08	44.03			
TP4			4.50	39.53	TP4
	4.66	44.19			
3-H-38*			4.07	40.12	TP5
	3.68	43.80			
TP6			4.09	39.71	
	3.05	42.76			
LS6			3.99	38.77	

(14)

	BS	HI	FS	ELEV	
BM 209				40.14	
	4.48	44.62			
TP			4.75	39.87	TP
	4.44	44.31			
2-C-3*			4.80	39.51	
2-C-6*			4.80	39.51	
BM 209				40.14	
	4.75	44.89			
2-C-15*			6.92	37.97	TP
	5.80	43.77			
			5.15	38.62	TP
	3.98	42.60			
1-J-5A*			5.45	37.15	
			1.92	40.68	TP
	4.59	45.27			
3-A-1*			4.16	41.11	
BM 209					40.14
	3.49	43.63			
			5.30	38.33	TP
	4.71	43.04			
2-D-4*			5.09	37.95	TP
	5.59	43.54			
			4.22	39.32	TP

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(15)

Pt#	BS	HI	FS	ELEV	
				39.32	
	4.40	43.72			
2-D-1*			4.17	39.55	
			4.42	39.30	TP
	5.0	44.30			
			3.64	40.66	TP
	4.64	45.30			
3-B-3*			4.48	40.82	
3-B-6*			5.75	39.55	
BM 312				37.11	
	4.67	41.78			
			4.07	37.71	TP
	4.82	42.53			
2-B-26*			4.50	38.03	
2-B-30*			4.39	38.14	
2-D-30A*			4.65	37.88	
			4.25	38.28	TP
	4.18	42.46			
2-G-8*			5.54	36.92	
BM 209				40.14	
	4.34	44.48			
MH Southwest Corner			4.48	40.00	TP
	2.90	42.90			
2-D-11*			4.31	38.59	

(16)

PT#	BS	HI	FS	ELEV	MK
TBM				40.00	INT WOODWARD & KOSTER
	3.96	43.96			
			6.05	37.91	TP
	3.47	41.38			
Z-13-6T*			3.94	37.44	
TBM				36.09	STORM MH
	5.40	41.49			
			5.80	35.69	TP
	4.78	40.47			
			3.74	36.73	TP
	5.33	42.06			
			3.56	38.50	
	2.59	41.09			
Z-A-16A*			3.70	37.39	
BM 212				36.30	
	4.49	40.99			
			4.03	36.96	TP
	3.92	40.88			
			5.90	34.98	TP
	6.21	41.19			
			3.16	38.03	TP
	2.84	40.87			
			3.53	37.34	TP
*	4.57	41.71			
Z-A-3			4.99	36.72	

NOTE NUMBERS CONE SHT #3 FOR INFO

DAMAGED RING & COVER

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(17)

	BS	HI	FS	ELEV	
FF				47.30	
	2.88	50.18			
#1			9.79	40.39	TOP
			13.48	36.70	FL IN
			13.82	36.36	FL OUT
			13.29	36.89	
TP			3.31	46.87	
	.79	47.66			
			6.88	40.78	TOP
			9.0	38.66	FL
TP			.89	46.77	
	1.34	48.11			
			12.11	36.00	#7
			13.19	34.92	#8
BM 301				41.16	
	3.69	44.85			
Z-K-19*			3.92	40.93	
BM 312				37.11	
	4.20	41.31			
TP			5.82	35.49	
	6.13	41.62			

DOLLAR GENERAL

PIPE IN BACK POND

TOP INLET IN DIRT RD

INFLOW PIPE IN POND IN FRONT (SOUTH PIPE)
" " " (NORTH PIPE)

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(12)

	BS	HI	FS	ELEV	
		41.62			
TP			3.74	37.88	
	6.10	43.88			
TP			4.37	39.51	
	3.0	42.51			
2-H-6*			3.57	38.94	TP
TBM				38.15	
	6.81	44.96			
2-I-6*			4.60	40.36	TP
	4.02	45.28			
TP			4.05	41.23	
	3.23	44.46			
2-J-3*			3.68	40.78	
TP			3.16	41.30	
	4.56	45.86			
2-J-1*			4.26	41.60	
BM216				39.95	
	2.92	42.87			
TP1			4.45	38.42	
	3.69	42.11			
1-1-4*			4.08	38.03	
1-1-9*			3.85	38.26	TP

KOST & SOUTH - NWC - ☐ CUT IN INLET

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All Weather Vellum Paper

(19)

Point #	BS	HI	FS	ELEV	
	3.66	41.92			
TP			3.74	38.18	TP
	5.34	43.52			
1-1-8*			5.74	37.78	
1-1-1*			5.57	37.95	
TBM 1-1-9				38.26	
	5.04	43.30			
1-1-5*			5.49	37.81	
1-1-6*			4.25	39.05	TP
	4.47	43.52			
1-1-7*			7.49	36.03	
1-1-12*			3.28	40.24	
TP			3.89	39.63	
	2.97	42.60			
1-5-1*			4.19	38.41	
1-5-2*			4.19	38.41	
TP			3.27	39.33	
	4.08	43.41			
1-5-4*			4.52	38.89	
2-C-22*			5.94	37.47	
1-5-13*			5.21	38.20	

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(20)

Point #	BS	HI	FS	ELEV	
BM318				36.04	
	6.22	42.61			
4-C-23*			5.25	37.36	
BM318				36.04	
	6.0	42.04			
TP			5.0	37.04	
	4.77	41.21			
4-B-4*				UNABLE TO SHOT	TREES ON TOP
TP			4.89	36.32	TBM
	3.45	39.77			
TP			4.94	34.83	
	4.18	39.01			
4-B-16*			4.52	34.49	
TBM				36.32	
	4.69	41.01			
TP			4.84	36.17	
	4.36	40.53			
TP			4.42	36.4	
	4.43	40.54			
TP			4.70	35.84	
	5.52	39.36			
4-C-42*			4.91	34.45	
4-C-34*			4.54	34.82	
TP			4.05	35.31	

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ALL WEATHER WRITING PAPER

(21)

Point #	BS	HI	FS	ELEV
				35.31
	4.02	39.33		
TP			3.67	35.66
	4.43	40.09		
4-C-53*			4.50	35.59
BM3N3				34.09
	5.24	39.73		
4-N-26*			5.65	34.08
TP			5.05	34.68
	4.49	39.67		
4-A-25*			6.25	33.42
4-A-28*			5.92	33.75
BM326				33.63
	6.23	39.86		
TP			4.55	35.31
	4.52	39.83		
4-R-48A*			5.87	33.96
TP			5.25	34.58
	5.09	39.67		
4-R-48L*			5.05	34.62

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(22)

Point #	BS	HI	FS	ELEV	
BM.318				36.04	
	6.80	42.84			
TP			5.40	37.44	
	5.10	42.54			
TP			4.0	38.54	
	2.40	40.94			
TP			5.0	35.94	
	4.44	40.38			
4-B-28*				unable to locate	
TBM				35.25	TC OF
	3.65	38.90			
1-N-4*			4.01	34.89	
TBM				35.25	
	4.43	39.68			
TP			4.62	35.06	
	5.42	40.48			
2-A-29*			5.04	35.44	
BM217				36.24	
	4.79	41.55			
1-H-19*			5.35	36.20	

L-Rt STA.

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(23)

Point #	BS	HI	FS	ELEV	
BM 8.19				36.76	
	4.72	41.48			
TP			5.62	35.86	
	5.31	41.17			
1-H-11*			5.95	35.22	
TP			4.95	36.22	
	3.74	40.01			
TP			3.26	36.75	
	3.72	40.47			
1-G-1*			3.60	36.87	
1-H-2*			3.72	36.75	
1-H-3*			3.80	36.67	TP
	5.05	41.72			
TP			4.92	36.80	
	2.07	38.87			
1-E-26*			3.0	36.87	
1-E-39*			4.05	34.82	
TP			3.20	35.67	
	3.29	38.96			
1-E-20*			4.97	33.99	
1-E-38*			3.76	35.20	
TP			3.91	35.05	
	4.52	39.57			
1-F-5*			3.56	36.01	

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ALL WEATHER BOND PAPER

(24)

Point #	BS	HI	FS	ELEV	
BM222				34.66	
	5.55	40.21			
TP			5.42	34.79	
	3.47	38.26			
1-B-18 *			3.94	34.32	
1-C-10 *			4.90	33.36	
JB-01 *			3.82	34.44	
1-C-10A *			3.84	34.42	
1-E-32 *			5.27	33.04	
1-E-2 *			4.44	33.82	
BM2A				39.95	
	5.48	45.43			
TP			7.30	38.13	
	3.95	42.08			
1-1-43 *			4.02	37.99	TP
	4.42	42.41			
5-A-3 *			4.53	38.38	
5-A-11 *			4.10	38.31	
TP			3.42	39.99	
	4.33	43.82			
5-B-16C *			4.08	39.74	
TP			2.90	40.92	
	4.28	45.20			
5-B-4 *			4.52	40.68	
5-B-5 *			5.67	39.53	

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(25)

Point *	BS	HI	FS	ELEV	
		45.20			
TP			4.64	40.56	
	4.65	45.21			
5-B-2 *			4.63	40.58	
TBM				35.22	1-B-18
	3.59	38.81			
TP			5.16	33.65	
	4.60	38.25			
1-B-17 *			4.30	33.95	
TP			4.03	34.22	
	4.80	39.02			
1-C-8A *			5.47	33.55	
1-C-9 *			5.95	33.07	
1-B-14 *			6.38	32.64	
TP			6.35	32.67	
	4.85	37.52			
1-B-10 *			4.94	32.58	
1-B-9 *			5.06	32.46	
1-C-7 *			4.93	32.59	
BM 224				28.90	
	4.90	33.80			
1-C-6 *			3.40	30.40	

(26)

Point #	BS	HI	FS	ELEV.	
		33.80			
1-C-1*			3.87	29.93	
1-B-1A*			3.87	29.93	
1-B-1*			4.55	29.25	
BM 226				25.91	
	6.0	31.91			
TP			3.20	28.71	
	4.52	33.23			
TP			4.69	28.54	
	4.69	33.23			
TP			5.43	27.80	
	5.09	32.89			
TBM			5.35	27.54	GREEN
BM 306				39.25	
	5.19	44.44			
4-D-22*			4.0	40.44	
BM 318				36.04	
	6.08	42.12			
TP			4.35	37.77	
	4.64	42.41			
4-C-29*			4.69	37.72	

"X" ON Conc. @ BACK GATE WWTP

(27)

Point #	BS	HI	FS	ELEV	
TBM				27.54	
	5.24	32.78			
TP			5.22	27.56	
	5.07	32.63			
TP			4.90	27.73	
	5.70	33.43			
TP			4.12	29.31	
	4.44	33.75			
1-A-5*			4.05	29.70	
1-A-6*			4.88	28.87	
1-A-7*			5.21	28.54	
TBM				27.54	
	5.81	33.35			
TBM			2.20	31.15	
TBM				36.52	5-C-2A
	3.88	40.4			
TP			3.62	36.74	
	4.40	41.64			
5-C-1A*			7.23	34.41	TP
	7.71	42.12			
5-C-7A*			6.57	35.55	

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R ~~SEWER~~ PLANT

TO EAST COR R WWTP OFFICE TEMPS

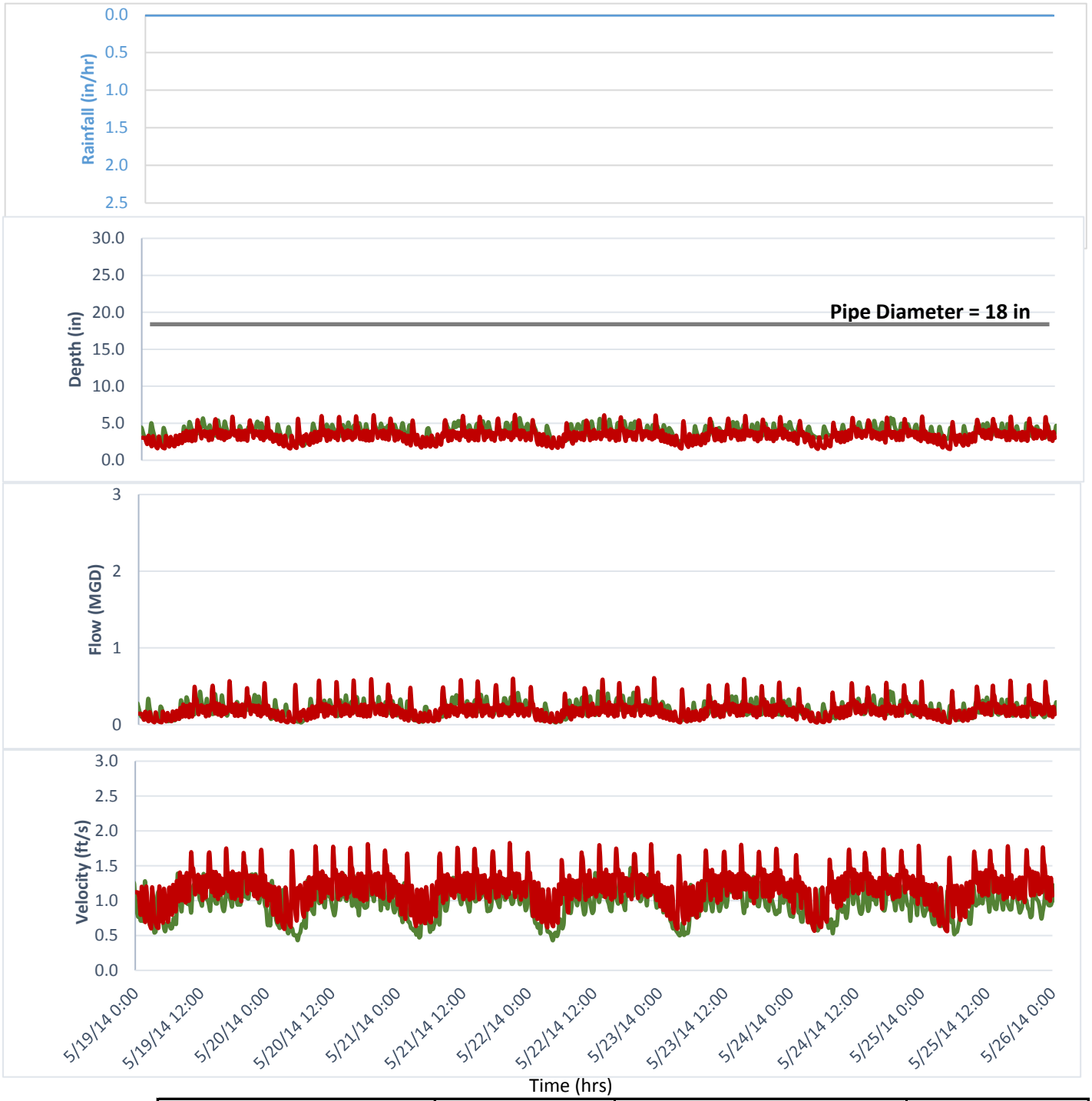
2541

SHIFT POS, INCORRECT ON GIS

APPENDIX H:
Wastewater Model Calibration Results

City of Alvin
Dry Weather Calibration
NW-01

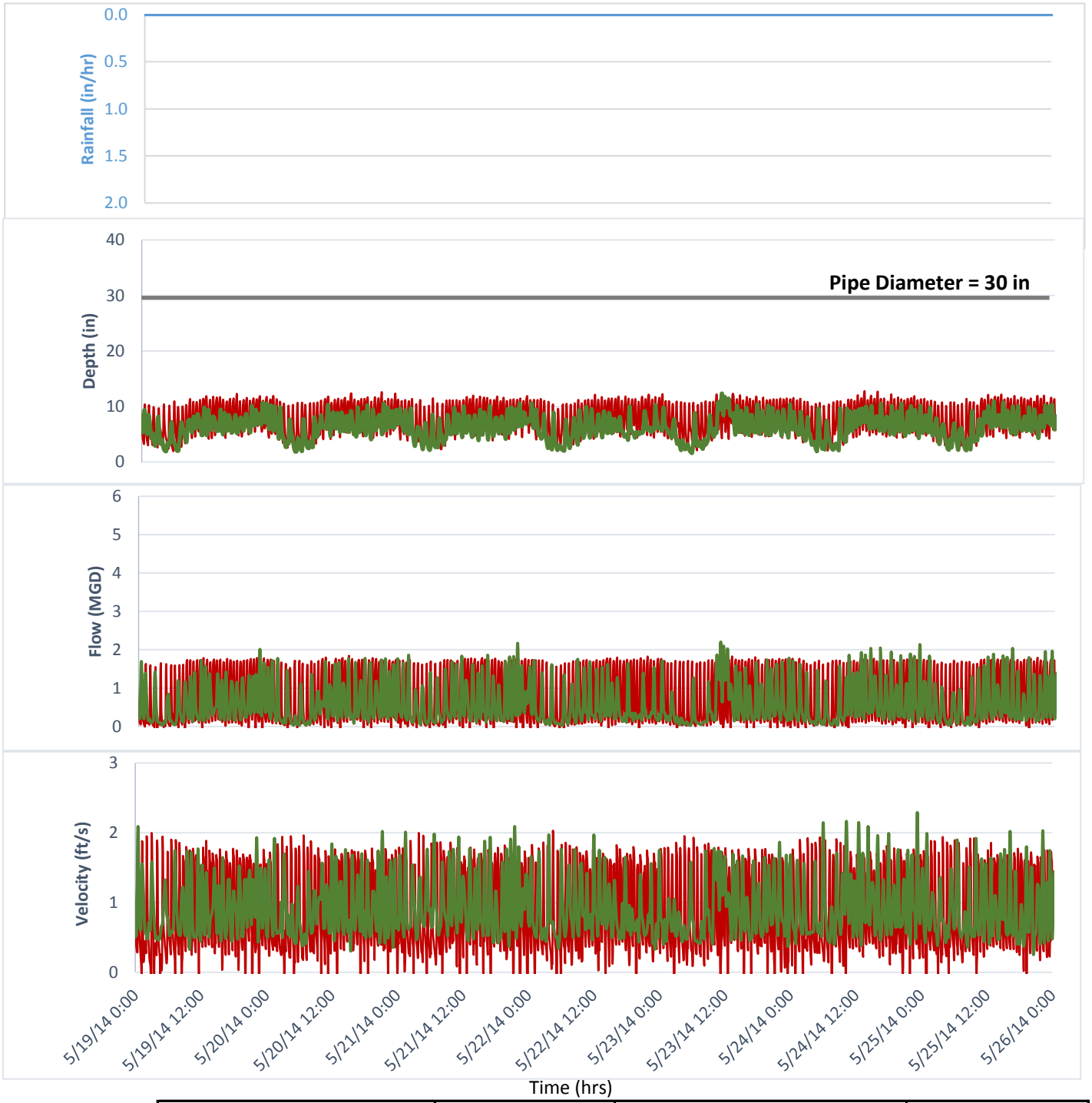
Dry Calibration Week:
5/19/2014 - 5/25/2014



	Rainfall			Depth (in)		Flow (MGD)			Velocity (ft/s)	
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min	Max	Min	Max	Volume (Mgal)	Min	Max
Observed	0.00	0.00	0.00	1.96	5.72	0.03	0.43	1.33	0.43	1.47
Modeled				1.52	6.05	0.03	0.59	1.33	0.56	1.78

City of Alvin
Dry Weather Calibration
NE-01

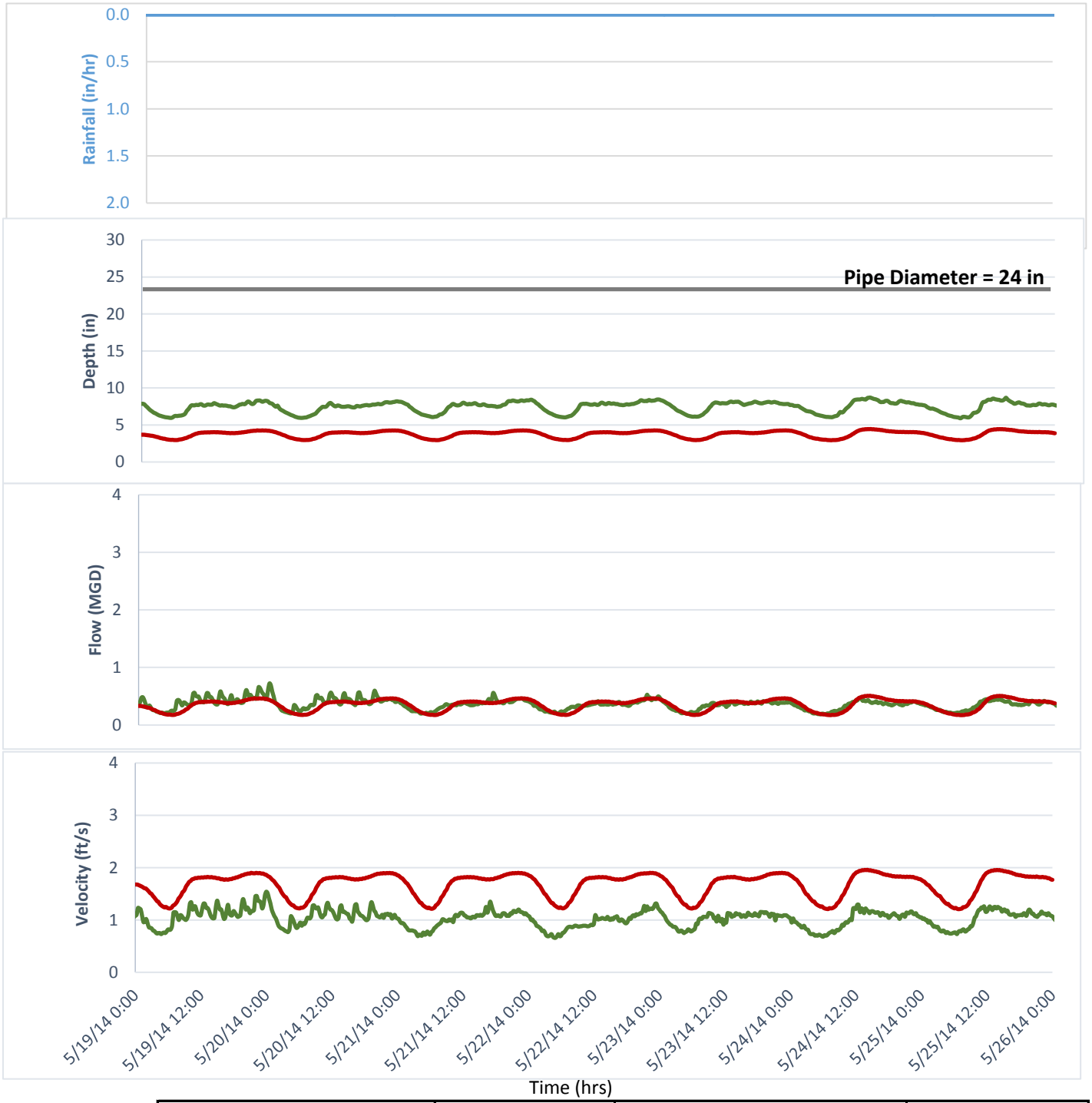
Dry Calibration Week:
5/19/2014 - 5/25/2014



	Rainfall			Depth (in)		Flow (MGD)			Velocity (ft/s)	
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min	Max	Min	Max	Volume (Mgal)	Min	Max
Observed	0.00	0.00	0.00	1.64	12.35	0.03	2.19	4.09	0.28	2.29
Modeled				3.36	13.82	0.00	1.97	5.01	0.00	1.72

City of Alvin
Dry Weather Calibration
WC-01

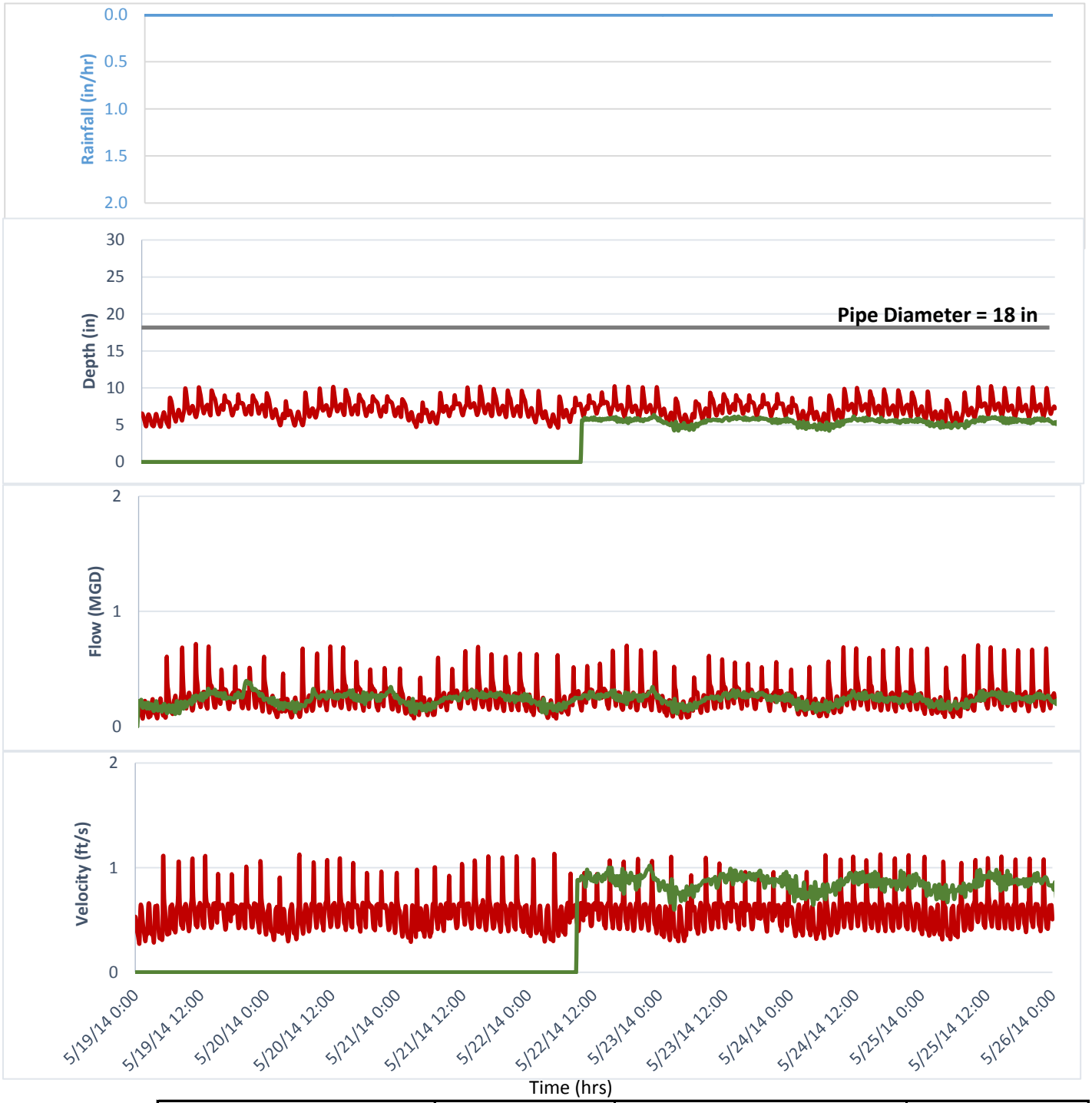
Dry Calibration Week:
5/19/2014 - 5/25/2014



	Rainfall			Depth (in)		Flow (MGD)			Velocity (ft/s)	
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min	Max	Min	Max	Volume (Mgal)	Min	Max
Observed	0.00	0.00	0.00	5.92	8.71	0.15	0.57	2.44	0.38	0.86
Modeled				2.54	3.74	0.17	0.51	2.46	1.49	2.52

City of Alvin
Dry Weather Calibration
CE-01

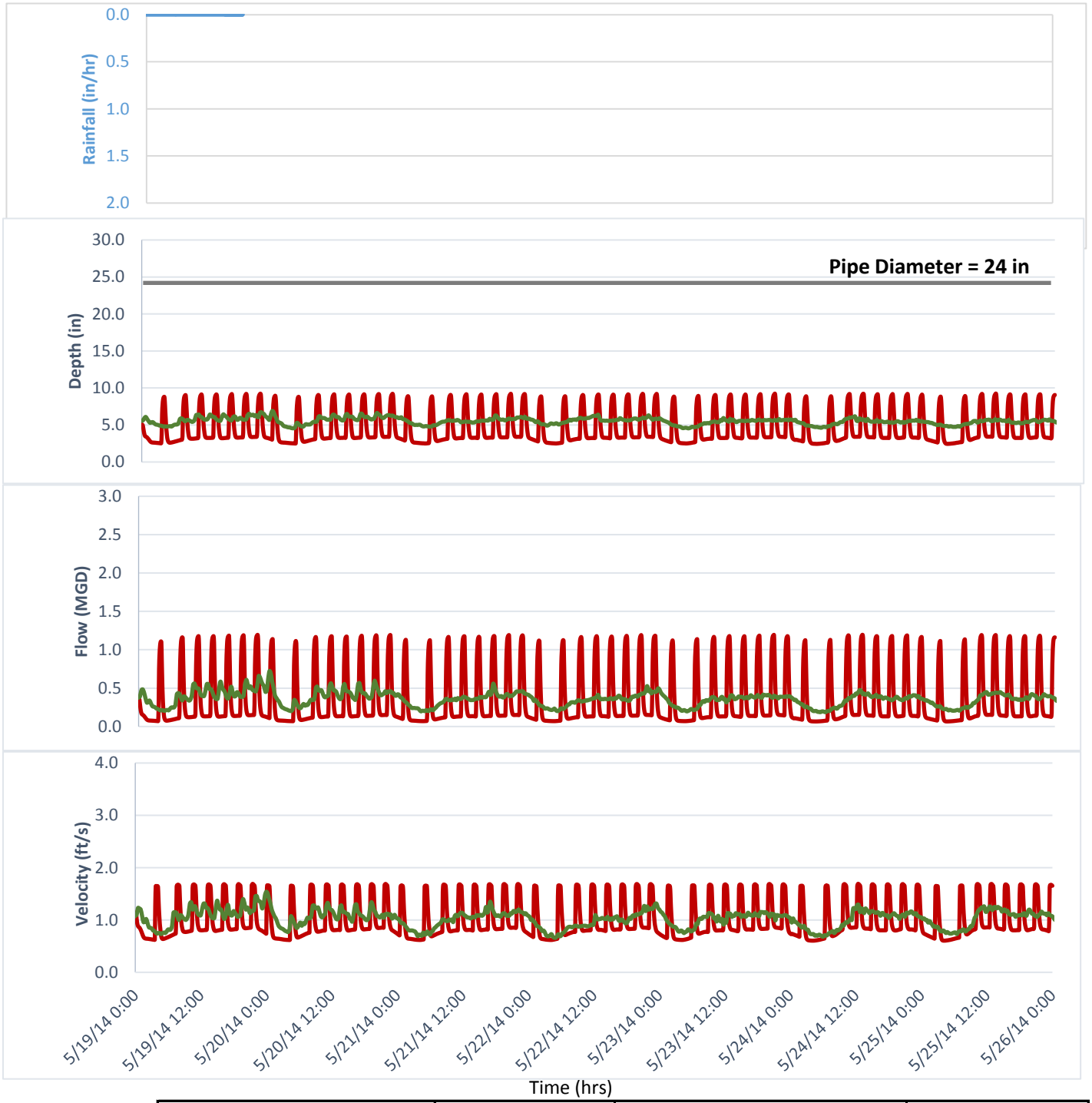
Dry Calibration Week:
5/19/2014 - 5/25/2014



	Rainfall			Depth (in)		Flow (MGD)			Velocity (ft/s)	
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min	Max	Min	Max	Volume (Mgal)	Min	Max
Observed	0.00	0.00	0.00	0.00	6.37	0.00	0.40	1.65	0.00	1.02
Modeled				4.61	10.26	0.06	0.73	1.71	0.25	1.23

City of Alvin
Dry Weather Calibration
EC-01

Dry Calibration Week:
5/19/2014 - 5/25/2014



	Rainfall			Depth (in)		Flow (MGD)			Velocity (ft/s)	
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min	Max	Min	Max	Volume (Mgal)	Min	Max
Observed	0.00	0.00	0.00	4.55	6.89	0.19	0.72	2.54	0.66	1.54
Modeled				2.88	9.66	0.07	1.19	2.50	0.45	1.64

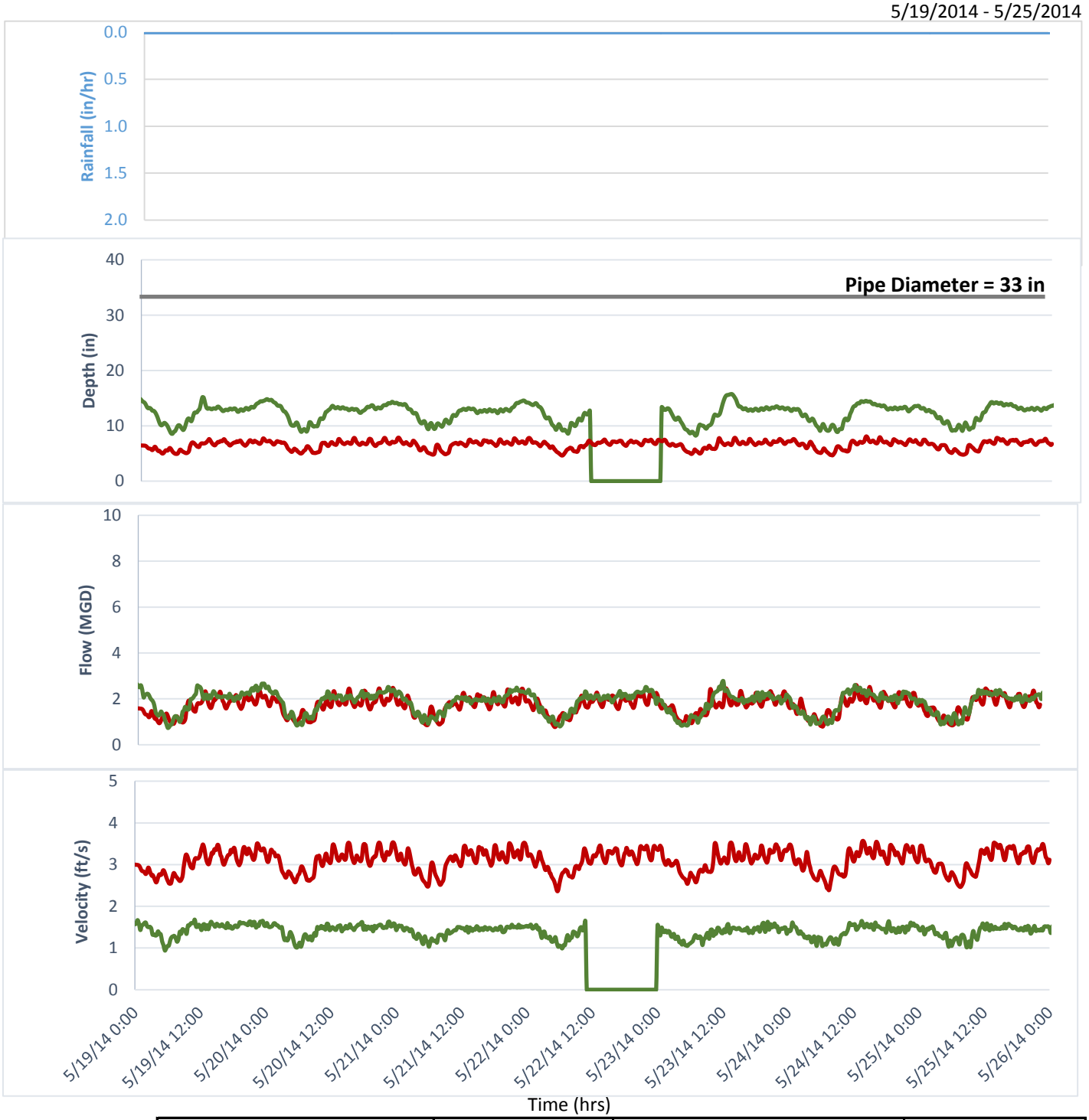
City of Alvin
Dry Weather Calibration
WE-01

Dry Calibration Week:
5/19/2014 - 5/25/2014

	Rainfall			Depth (in)		Flow (MGD)			Velocity (ft/s)	
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min	Max	Min	Max	Volume (Mgal)	Min	Max
Observed	0.00	0.00	0.00	4.06	7.66	0.22	0.96	4.58	0.93	1.81
Modeled				3.28	6.65	0.22	1.00	4.61	1.30	2.19

City of Alvin
Dry Weather Calibration
SO-01

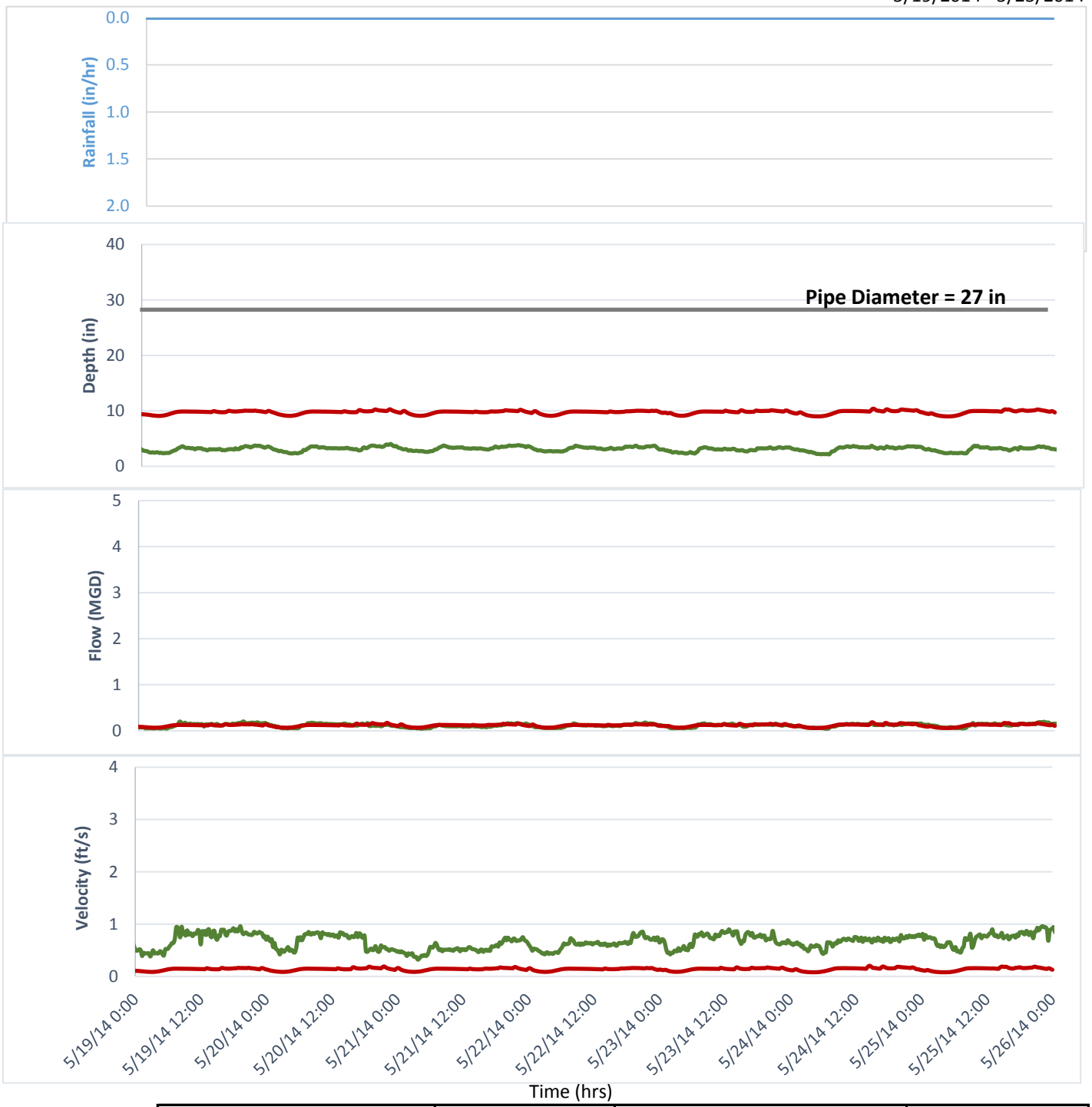
Dry Calibration Week:
5/19/2014 - 5/25/2014



	Rainfall			Depth (in)		Flow (MGD)			Velocity (ft/s)	
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min	Max	Min	Max	Volume (Mgal)	Min	Max
Observed	0.00	0.00	0.00	0.00	15.73	0.74	2.77	13.03	0.00	1.68
Modeled				6.37	11.68	0.77	2.60	11.97	1.49	2.15

City of Alvin
Dry Weather Calibration
SO-02

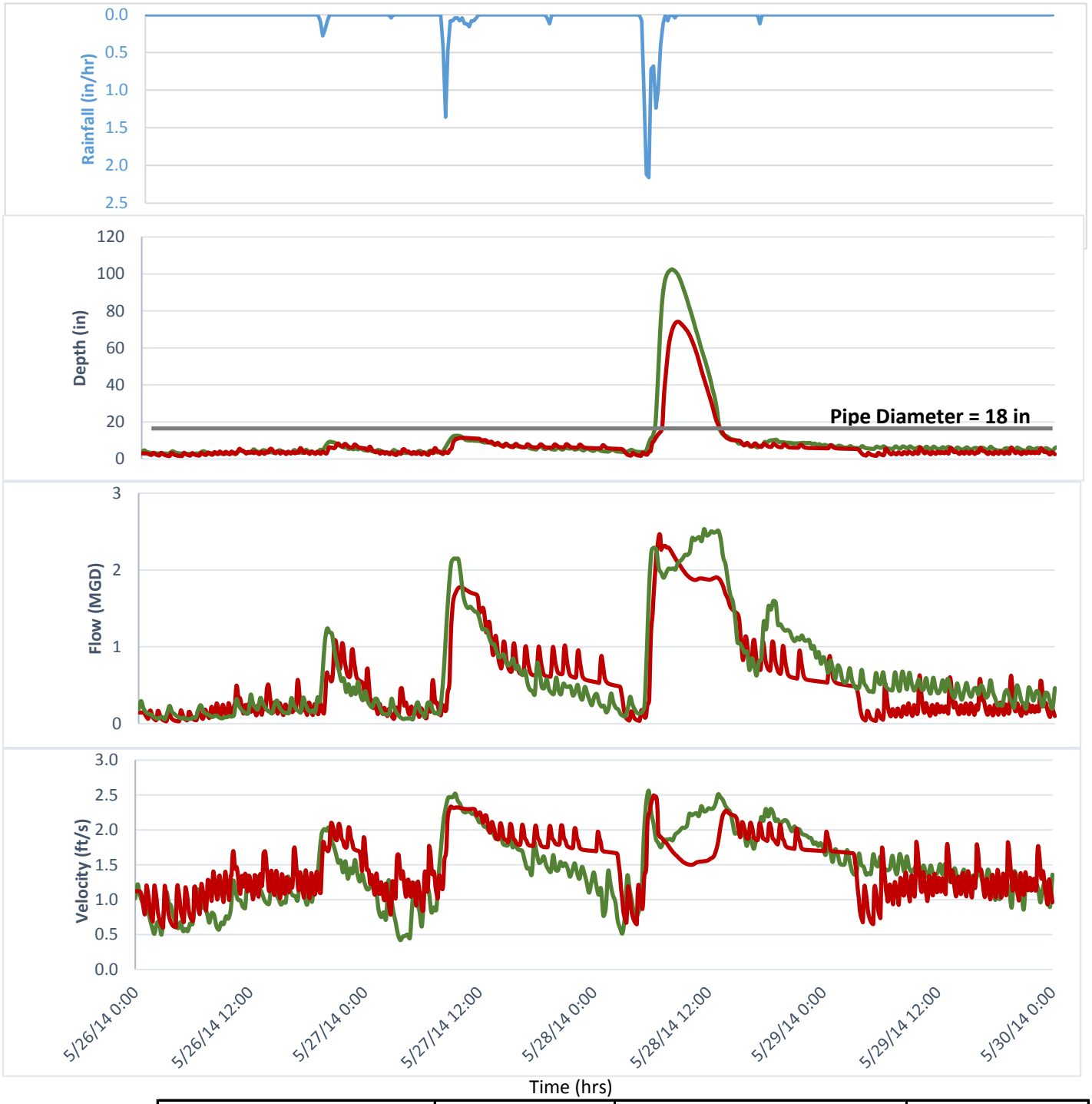
Dry Calibration Week:
5/19/2014 - 5/25/2014



	Rainfall			Depth (in)		Flow (MGD)			Velocity (ft/s)	
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min	Max	Min	Max	Volume (Mgal)	Min	Max
Observed	0.00	0.00	0.00	2.16	4.04	0.04	0.20	0.81	0.32	0.96
Modeled				11.28	12.65	0.06	0.18	0.82	0.06	0.15

City of Alvin
Wet Weather Calibration
NW-01

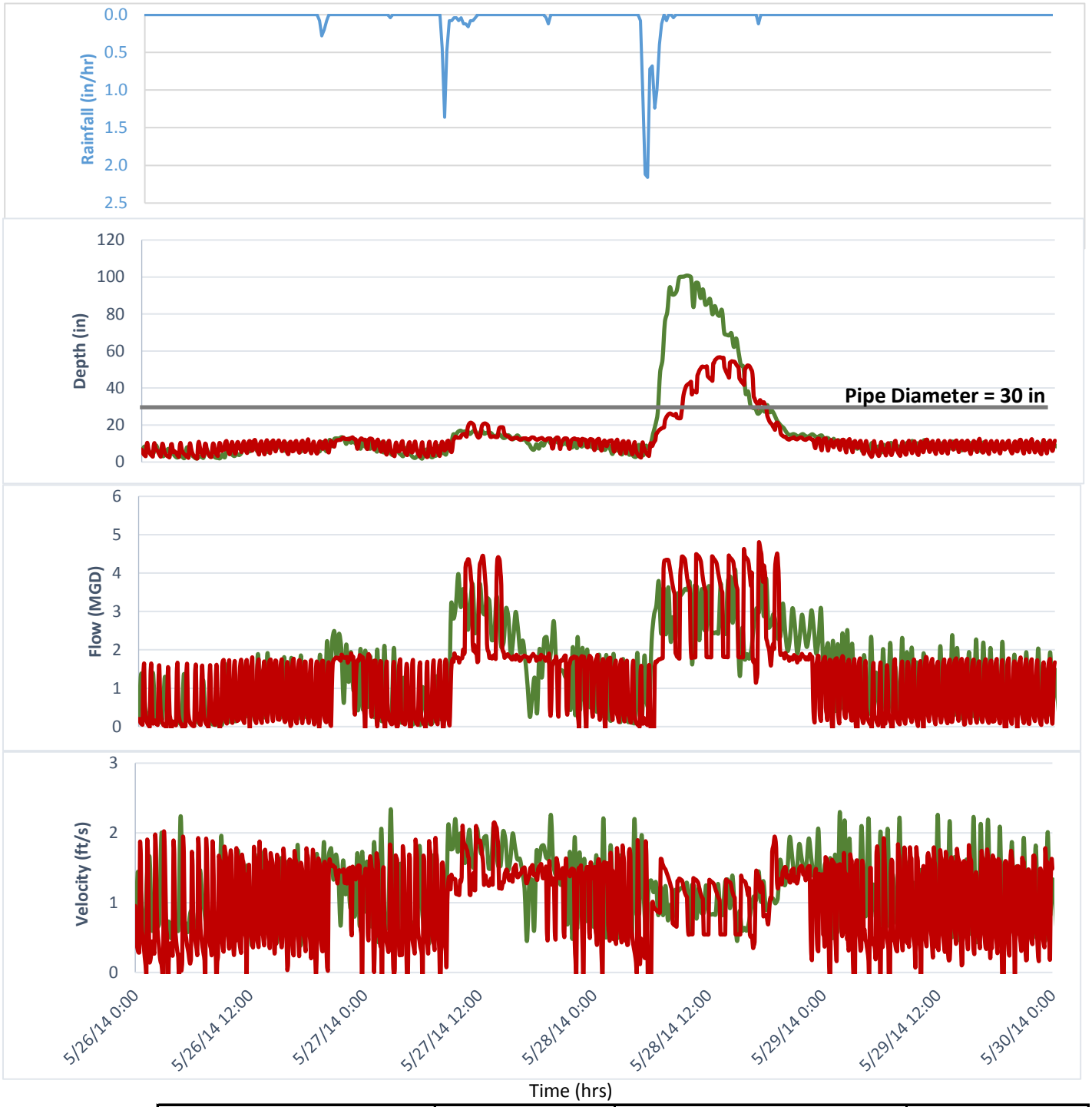
Wet Weather Calibration Days:
5/26/2014-5/29/2014



	Rainfall			Depth (in)		Flow (MGD)			Velocity (ft/s)	
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min	Max	Min	Max	Volume (Mgal)	Min	Max
Observed	3.49	2.16	0.04	2.69	102.44	0.06	2.53	2.69	0.42	2.56
Modeled				1.63	76.22	0.03	2.40	2.33	0.60	2.48

City of Alvin
Wet Weather Calibration
NE-01

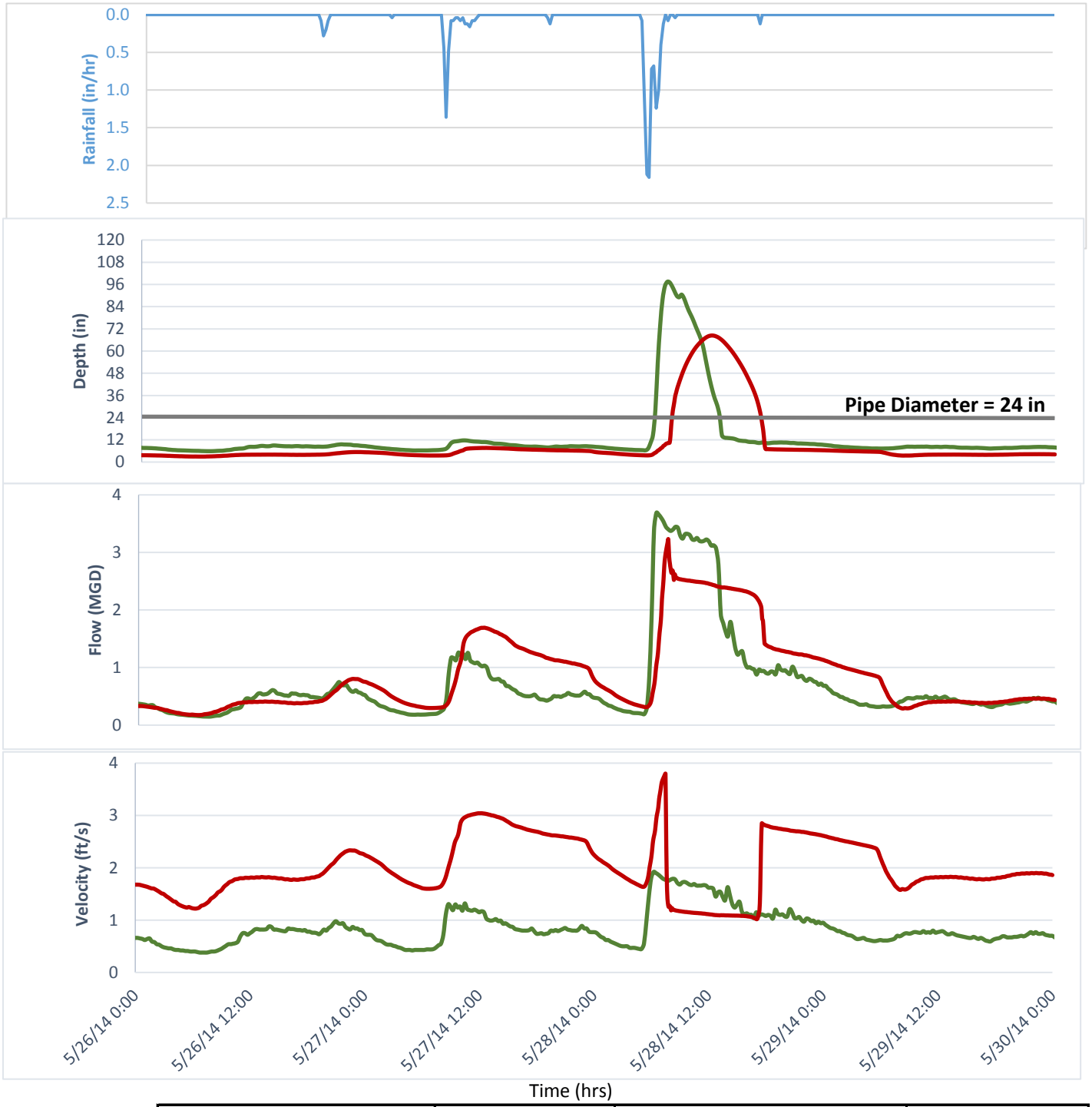
Wet Weather Calibration Days:
5/26/2014-5/29/2014



	Rainfall			Depth (in)		Flow (MGD)			Velocity (ft/s)	
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min	Max	Min	Max	Volume (Mgal)	Min	Max
Observed	3.49	2.16	0.04	1.90	100.75	0.05	4.24	5.69	0.40	2.34
Modeled				3.98	58.15	0.00	4.86	5.38	0.00	2.24

City of Alvin
Wet Weather Calibration
WC-01

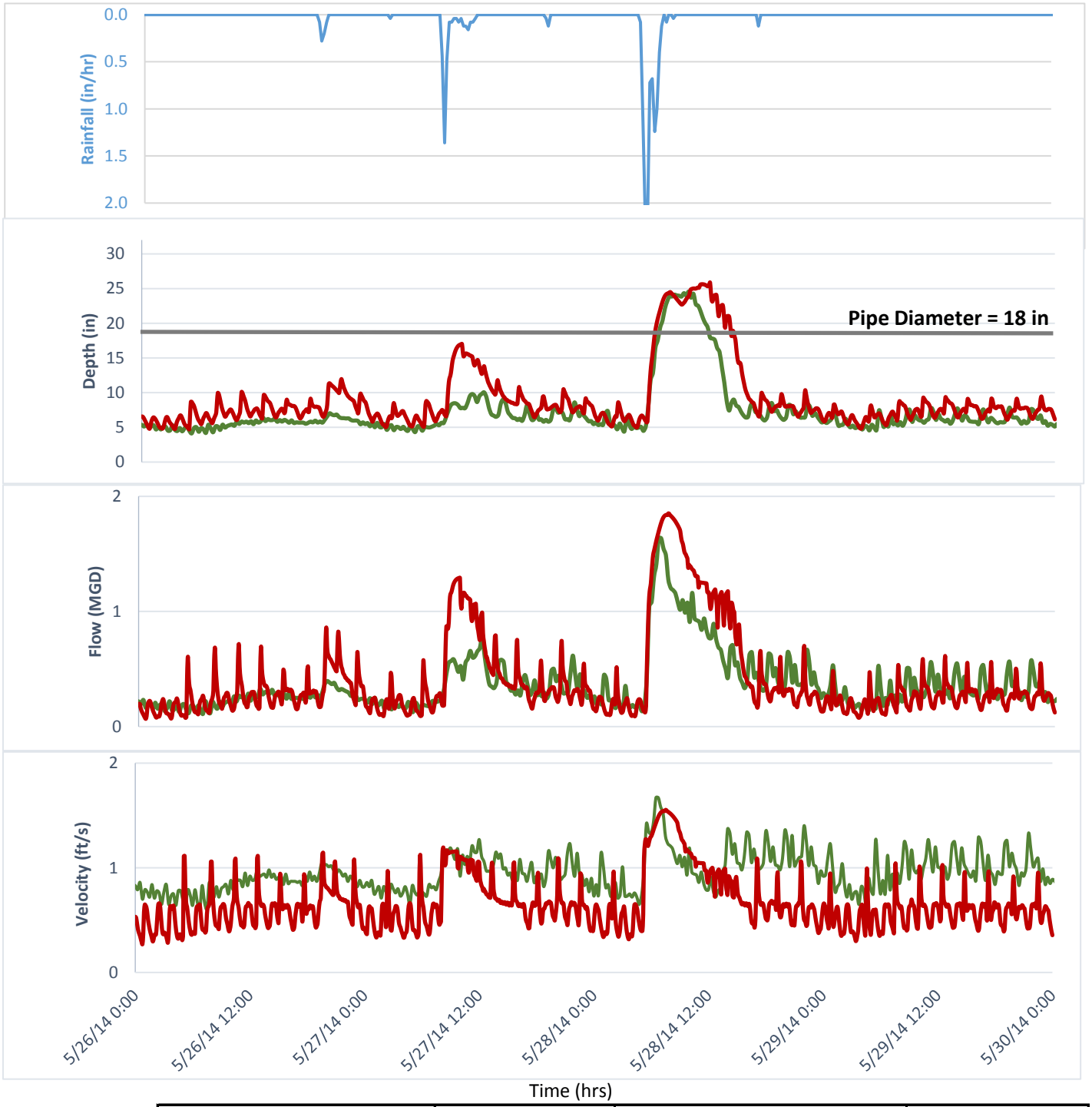
Wet Weather Calibration Days:
5/26/2014-5/29/2014



	Rainfall			Depth (in)		Flow (MGD)			Velocity (ft/s)	
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min	Max	Min	Max	Volume (Mgal)	Min	Max
Observed	3.49	2.16	0.04	5.88	97.42	0.15	3.69	2.92	0.38	1.92
Modeled				2.54	69.06	0.17	3.22	3.49	1.02	4.33

City of Alvin
Wet Weather Calibration
CE-01

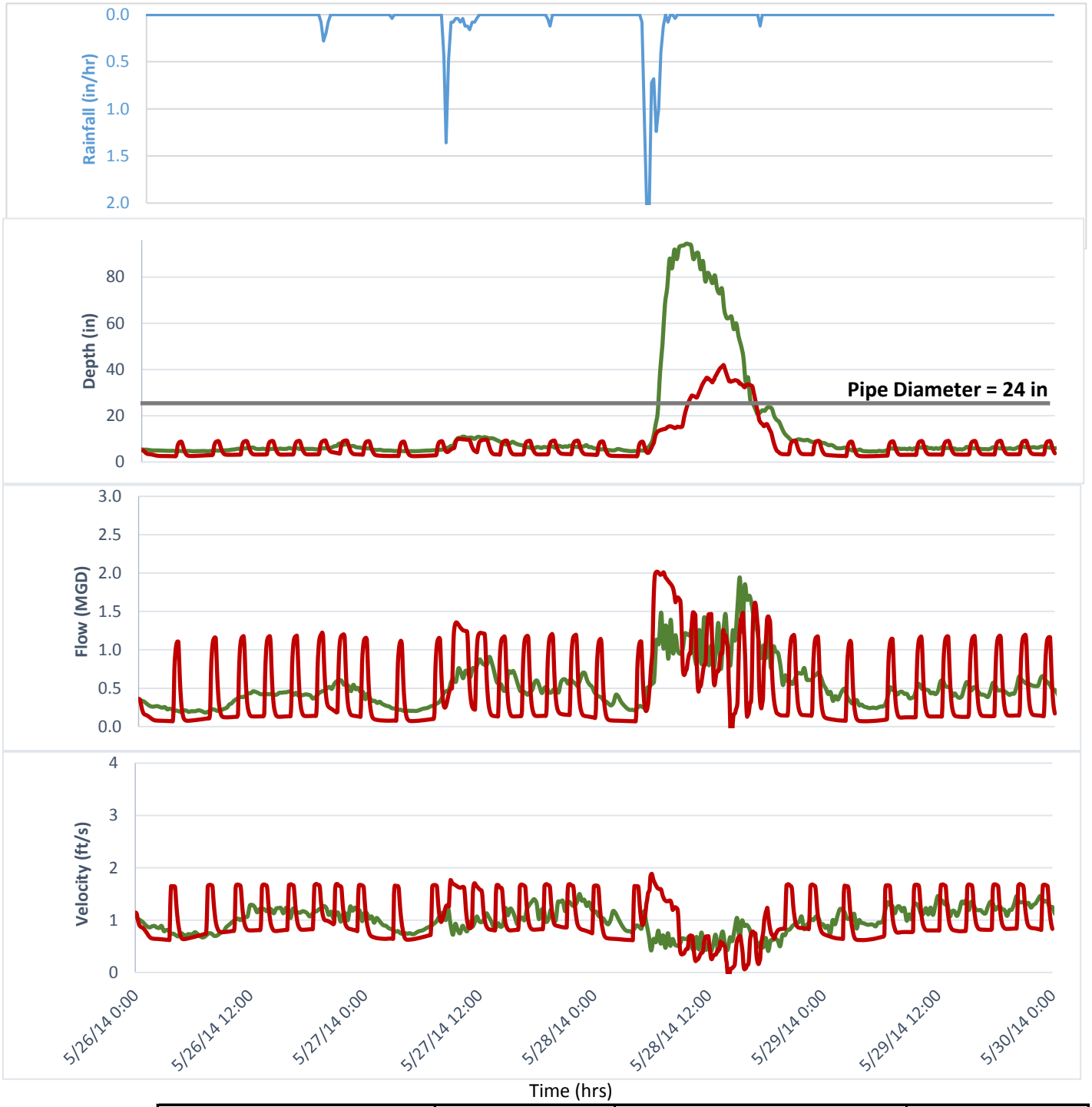
Wet Weather Calibration Days:
5/26/2014-5/29/2014



	Rainfall			Depth (in)		Flow (MGD)			Velocity (ft/s)	
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min	Max	Min	Max	Volume (Mgal)	Min	Max
Observed	3.49	2.16	0.04	4.13	24.56	0.11	1.64	1.51	0.60	1.67
Modeled				4.73	25.76	0.06	1.83	1.65	0.25	1.53

City of Alvin
Wet Weather Calibration
EC-01

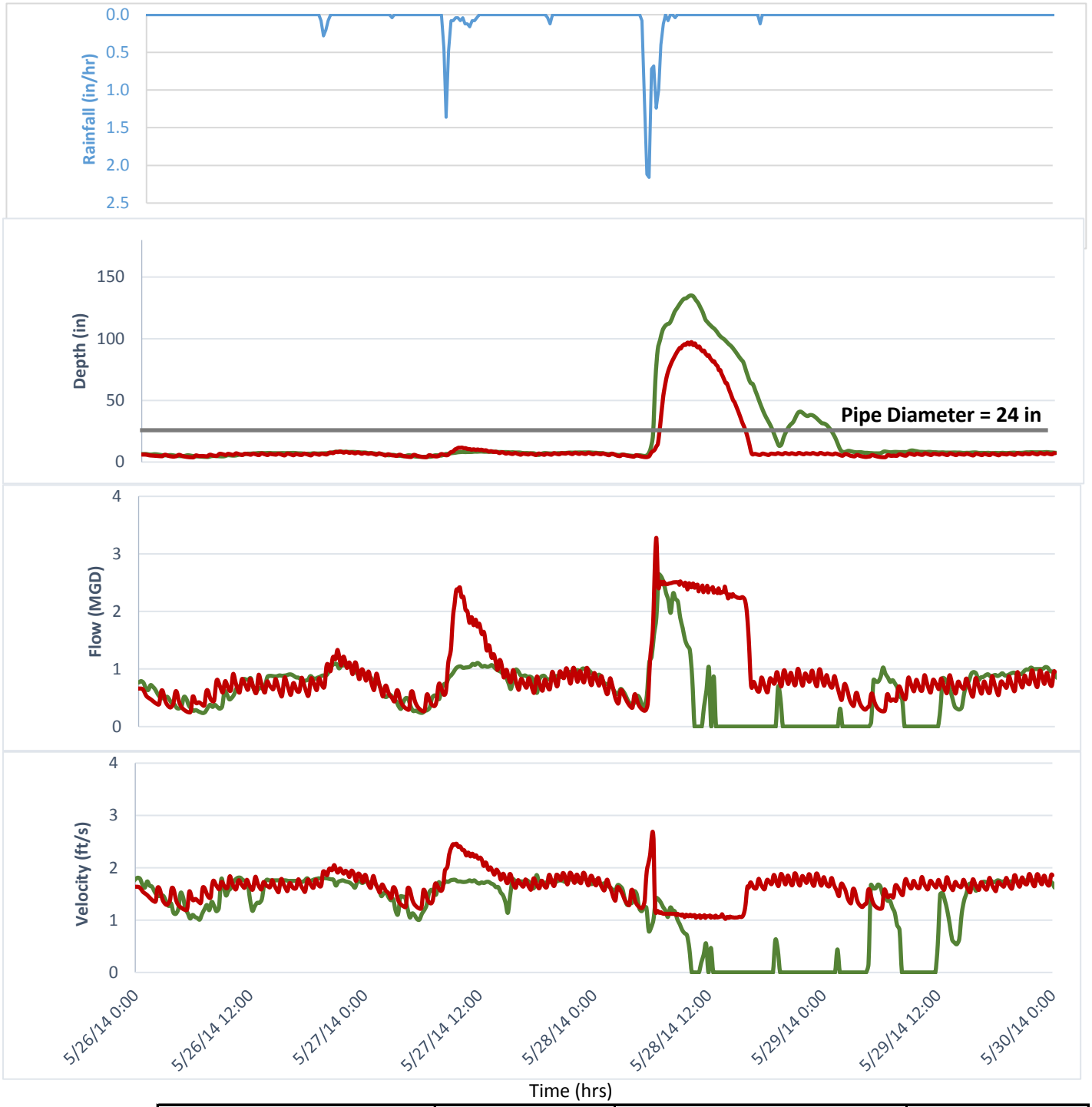
Wet Weather Calibration Days:
5/26/2014-5/29/2014



	Rainfall			Depth (in)		Flow (MGD)			Velocity (ft/s)	
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min	Max	Min	Max	Volume (Mgal)	Min	Max
Observed	3.49	2.16	0.04	4.58	94.42	0.18	1.94	2.15	0.40	1.50
Modeled				2.92	47.38	0.00	2.00	1.96	0.00	1.64

City of Alvin
Wet Weather Calibration
WE-01

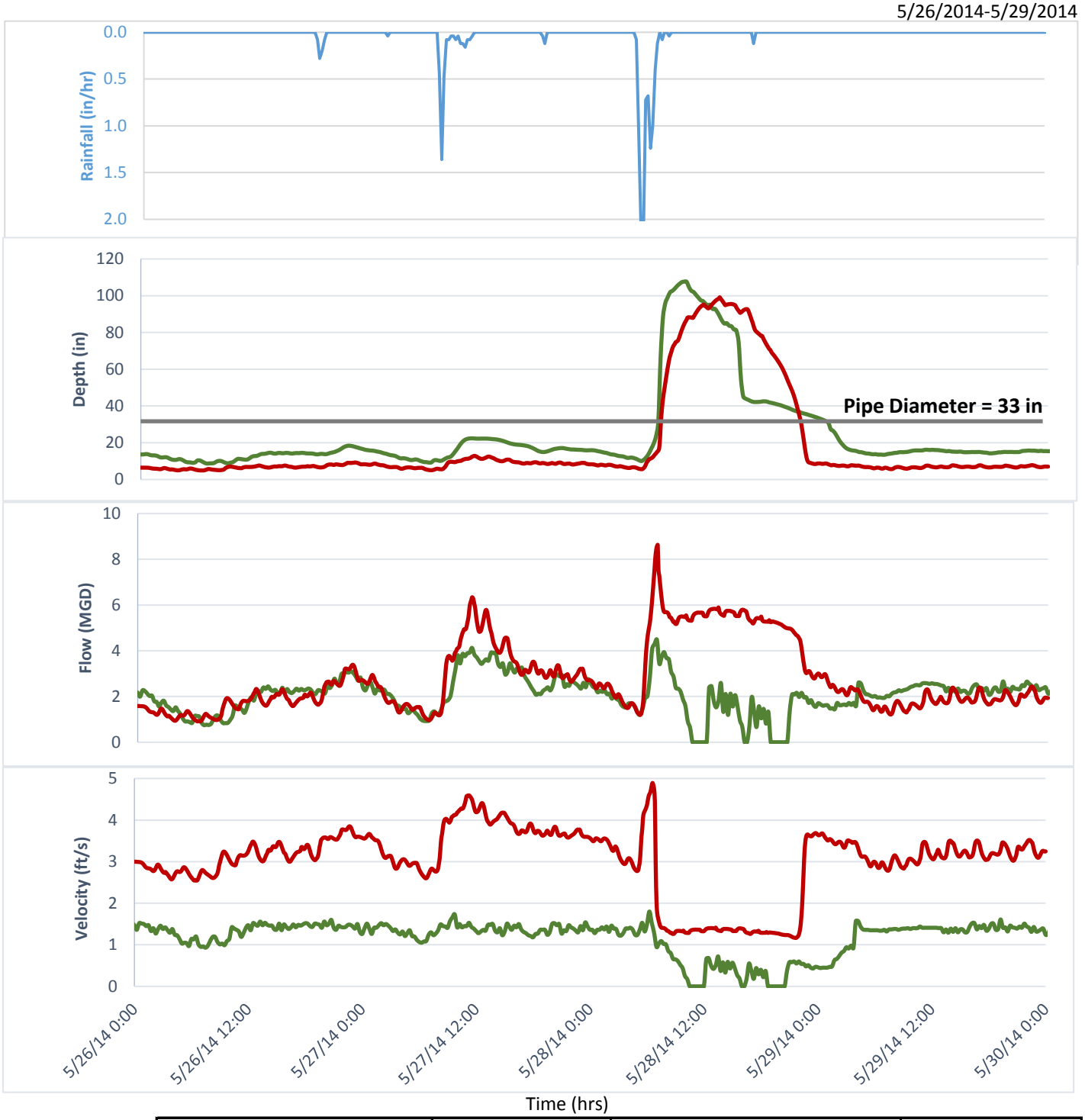
Wet Weather Calibration Days:
5/26/2014-5/29/2014



	Rainfall			Depth (in)		Flow (MGD)			Velocity (ft/s)	
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min	Max	Min	Max	Volume (Mgal)	Min	Max
Observed	3.49	2.16	0.04	4.16	135.10	0.00	2.64	2.57	0.00	1.86
Modeled				3.41	100.04	0.24	3.05	3.69	1.03	3.02

City of Alvin
Wet Weather Calibration
SO-01

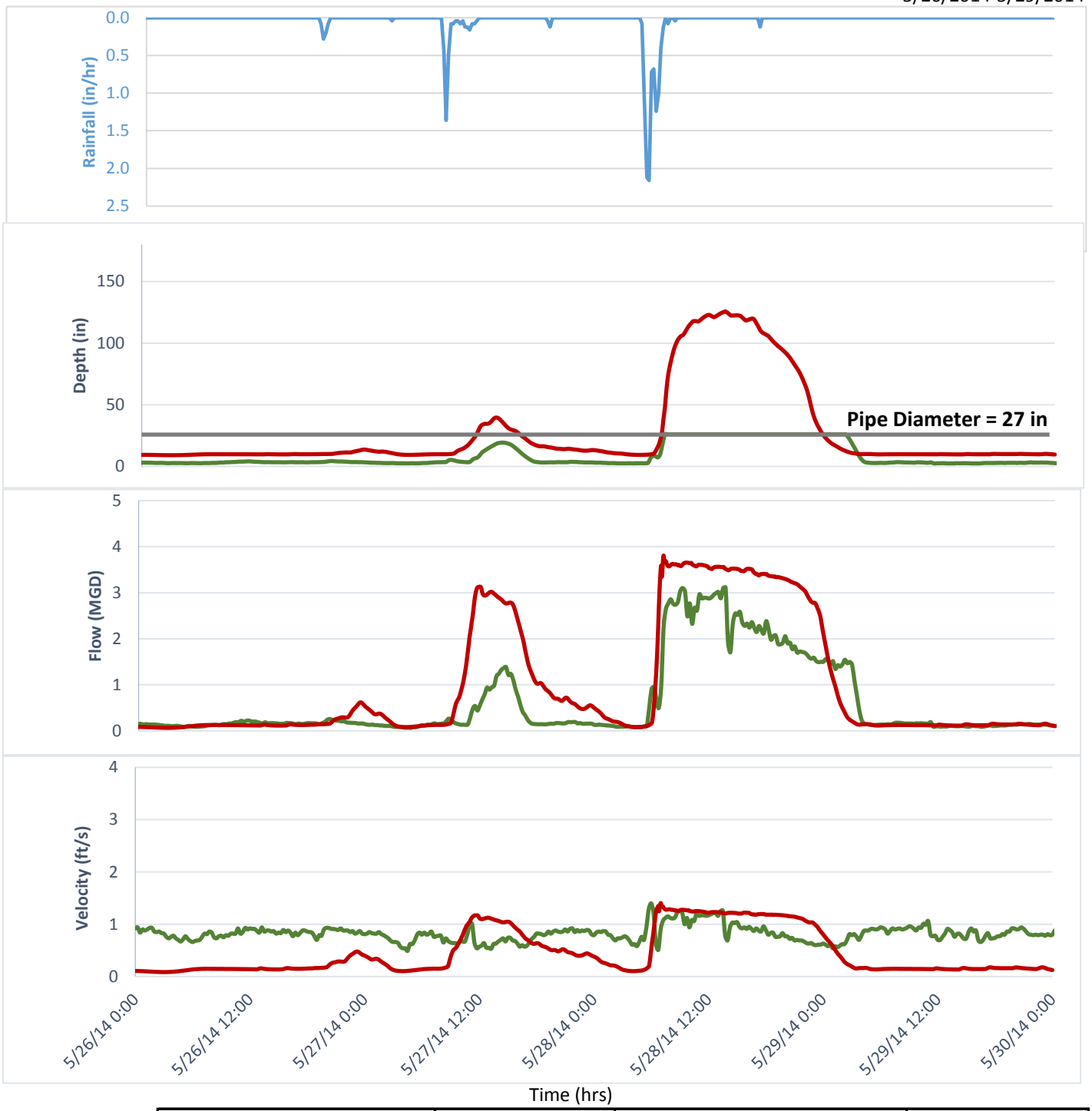
Wet Weather Calibration Days:
5/26/2014-5/29/2014



	Rainfall			Depth (in)		Flow (MGD)			Velocity (ft/s)	
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min	Max	Min	Max	Volume (Mgal)	Min	Max
Observed	3.49	2.16	0.04	8.66	107.66	0.00	4.48	8.28	0.00	1.80
Modeled				6.85	117.60	0.91	8.11	11.27	0.95	2.62

City of Alvin
Wet Weather Calibration
SO-02

Wet Weather Calibration Days:
5/26/2014-5/29/2014



	Rainfall			Depth (in)		Flow (MGD)			Velocity (ft/s)	
	Depth (in)	Peak (in/hr)	Average (in/hr)	Min	Max	Min	Max	Volume (Mgal)	Min	Max
Observed	3.49	2.16	0.04	2.41	26.00	0.06	3.11	2.51	0.49	1.40
Modeled				11.36	126.90	0.07	3.77	3.94	0.06	1.39

APPENDIX I:
Lift Station Condition Assessment

Alvin Lift Station Condition Assessment

1080 Avenue East 1/2

Lift Station No. 1

Inspection Date: 7/20/2015

Facility Information	
Address:	1080 Avenue East 1/2
Year in Service:	
Type of Facility:	Submersible
Number of Pumps:	2
Horsepower:	7.5
Wet Well Diameter (ft):	8
Wet Well Depth (ft):	22
Incoming Pipe Depth (ft):	19

CONDITION ASSESSMENT

Component Group	Component Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Back-up Power, Cables	3	25%	0.75	Portable generator connection.
Pumps and Motors	3	25%	0.75	Age, No issues
Structure - Hatches, Corrosion, Cracks, Leaking, Ventilation, Odor Control	2	25%	0.50	Concrete with liner, Stainless steel hatch, No safety, Stainless steel vent
Piping and Valves	3	15%	0.45	4" DI, Light corrosion, Exterior no issues noted
Site - Drainage, Access Drive, Security, Fencing	4	10%	0.40	No permanent driveway, 5' Chain-link fence without barbed wire
Condition Score	-	-	**2.85**	

OVERALL ASSESSMENT

Relative Ranking (__ / 12)	**11th**
Priority Level	**Moderate Condition**

ADDITIONAL COMMENTS / RECOMMENDATIONS

Notes:
Evidence of high water levels in wet well.

Recommendations:
Should be monitored for additional corrosion.

Alvin Lift Station Condition Assessment

1080 Avenue East 1/2

Lift Station No. 1

Inspection Date: 7/20/2015

5th

Alvin Lift Station Condition Assessment

1200 W. Lobbit St.

Lift Station No. 2

Inspection Date: 7/20/2015

Facility Information	
Address:	1200 W. Lobbit St.
Year in Service:	1986
Type of Facility:	Submersible
Number of Pumps:	2
Horsepower:	3
Wet Well Diameter (ft):	5
Wet Well Depth (ft):	14
Incoming Pipe Depth (ft):	9.2

CONDITION ASSESSMENT

Component Group	Component Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Back-up Power, Cables	5	25%	1.25	Heavy corrosion, Enclosure is located in hazardous location
Pumps and Motors	3	25%	0.75	Likely replaced recently
Structure - Hatches, Corrosion, Cracks, Leaking, Ventilation, Odor Control	3	25%	0.75	Good coating, No air vent, Some cracks around outside concrete, Stainless steel meter
Piping and Valves	3	15%	0.45	Some PVC repair. No GV. CV on 1 pump, only backflow preventer. Some corosion on wet well piping.
Site - Drainage, Access Drive, Security, Fencing	3	10%	0.30	Asphalt driveway in OK condition, 6' wood fence without barbed wire
Condition Score	-	-	**3.50**	

OVERALL ASSESSMENT	
Relative Ranking (__ / 12)	**3rd**
Priority Level	**Very Poor Condition**

ADDITIONAL COMMENTS / RECOMMENDATIONS

Recommendations:

Needs electrical rehab within 5 years, and some structural slab repair.

Alvin Lift Station Condition Assessment

1200 W. Lobbit St.

Lift Station No. 2

Inspection Date: 7/20/2015

5th

Alvin Lift Station Condition Assessment

308 S. Third St.

Lift Station No. 3

Inspection Date: 7/20/2015

Facility Information

Address:	308 S. Third St.
Year in Service:	
Type of Facility:	Submersible
Number of Pumps:	2
Horsepower:	7.5
Wet Well Diameter (ft):	7 x 10 box
Wet Well Depth (ft):	19
Incoming Pipe Depth (ft):	11.5

CONDITION ASSESSMENT

Component Group	Component Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Back-up Power, Cables	3	25%	0.75	Portable generator connection outside fence, Beacon/horn doesn't work, Inside panel good
Pumps and Motors	2	25%	0.50	No issues noted.
Structure - Hatches, Corrosion, Cracks, Leaking, Ventilation, Odor Control	2	25%	0.50	Stainless steel hatch, Galvanized vent without screen, Coated
Piping and Valves	2	15%	0.30	4" DI, Light corrosion
Site - Drainage, Access Drive, Security, Fencing	2	10%	0.20	Shared driveway, 6' Chain-link fence with barbed wire
Condition Score	-	-	**2.25**	

OVERALL ASSESSMENT

Relative Ranking (__ / 12)	**12th**
Priority Level	**Moderate Condition**

ADDITIONAL COMMENTS / RECOMMENDATIONS

Notes:
Potentially high float levels. High volume of flow returning to wet well through pump priming line.

Recommendations:
Should be monitored for additional corrosion.

Alvin Lift Station Condition Assessment

308 S. Third St.

Lift Station No. 3

Inspection Date: 7/20/2015

5th

Alvin Lift Station Condition Assessment

2580 Koster Rd.

Lift Station No. 8

Inspection Date: 7/20/2015

Facility Information	
Address:	2580 Koster Rd.
Year in Service:	
Type of Facility:	
Number of Pumps:	3
Horsepower:	35
Wet Well Diameter (ft):	18 x 19 box
Wet Well Depth (ft):	24
Incoming Pipe Depth (ft):	17

CONDITION ASSESSMENT

Component Group	Component Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Back-up Power, Cables	3	25%	0.75	On-site generator (running), New Panel
Pumps and Motors	4	25%	1.00	Only 1 pump, 2 pumps being rebuilt
Structure - Hatches, Corrosion, Cracks, Leaking, Ventilation, Odor Control	3	25%	0.75	Hoist system in the way, Gooseneck vent rusting, Concrete deterioration, No liner
Piping and Valves	3	15%	0.45	Heavy corrosion in wet well, Check Valve 2 not sealing?
Site - Drainage, Access Drive, Security, Fencing	1	10%	0.10	Asphalt driveway in OK condition, 6' Chain-link fence with barbed wire, No security light
Condition Score	-	-	**3.05**	

OVERALL ASSESSMENT

Relative Ranking (__ / 12)	**7th**
Priority Level	**Poor Condition**

ADDITIONAL COMMENTS / RECOMMENDATIONS

Notes:
Large ovlume of solids built up in wet well. Generator was running for the duration of the site visit; cause for this should be identified.

Recommendations:
Rebah within 5 years. Needs electrical work, wet well coating, new piping inside wet well, and some valve work.

Alvin Lift Station Condition Assessment

2580 Koster Rd.

Lift Station No. 8

Inspection Date: 7/20/2015

5th

Alvin Lift Station Condition Assessment

2285 W. South St.

Lift Station No. 11

Inspection Date: 7/20/2015

Facility Information

Address:	2285 W. South St.
Year in Service:	
Type of Facility:	
Number of Pumps:	2
Horsepower:	10
Wet Well Diameter (ft):	8
Wet Well Depth (ft):	30
Incoming Pipe Depth (ft):	18

CONDITION ASSESSMENT

Component Group	Component Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Back-up Power, Cables	4	25%	1.00	No lock on disconnect, Light corrosion, No portable connection
Pumps and Motors	4	25%	1.00	Pump #2 out of service, Pump rails offset, Pump #1 wired to shut off for Pump #2
Structure - Hatches, Corrosion, Cracks, Leaking, Ventilation, Odor Control	2	25%	0.50	Stainless steel hatch, Stainless Steel vent with screen, Concrete with liner, Good
Piping and Valves	2	15%	0.30	6" DI; CV,PV; Interior piping good
Site - Drainage, Access Drive, Security, Fencing	1	10%	0.10	Asphalt driveway in OK condition, 6' Chain-link fence with barbed wire, Security light
Condition Score	-	-	**2.90**	

OVERALL ASSESSMENT

Relative Ranking (__ / 12)	**10th**
Priority Level	**Poor Condition**

ADDITIONAL COMMENTS / RECOMMENDATIONS

Recommendations:

Needs electrical rehab with new pumps and motors.

Alvin Lift Station Condition Assessment

2285 W. South St.

Lift Station No. 11

Inspection Date: 7/20/2015

5th

Alvin Lift Station Condition Assessment

205 E. Galveston Rd.

Lift Station No. 14

Inspection Date: 7/20/2015

Facility Information

Address:	205 E. Galveston Rd.
Year in Service:	
Type of Facility:	Submersible
Number of Pumps:	2 (1 slot for future)
Horsepower:	20
Wet Well Diameter (ft):	11 x 12 box
Wet Well Depth (ft):	20
Incoming Pipe Depth (ft):	17

CONDITION ASSESSMENT

Component Group	Component Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Back-up Power, Cables	3	25%	0.75	New panel, Portable generator connection, No lock on disconnect
Pumps and Motors	4	25%	1.00	Only 1 pump running, Broken pump rails, No backup pump
Structure - Hatches, Corrosion, Cracks, Leaking, Ventilation, Odor Control	4	25%	1.00	2 vents, Some liner deteroriation, 2 stainless steel hatches
Piping and Valves	4	15%	0.60	Heavy corrosion, Gate Valve Locked Open, CV lever not operational
Site - Drainage, Access Drive, Security, Fencing	2	10%	0.20	Gravel driveway in OK condition, 6' Chain-link fence with barbed wire, No light
Condition Score	-	-	**3.55**	

OVERALL ASSESSMENT

Relative Ranking (__ / 12)	**2nd**
Priority Level	**Very Poor Condition**

ADDITIONAL COMMENTS / RECOMMENDATIONS

Notes:
Old dry pit / wet pit: wet well overflows into old dry pit with no pumping or drains, high corrosion potential.

Recommendations:
Needs rehab of electrical, coating of wet well, new piping and calves, abandonment of old wet well pit.

Alvin Lift Station Condition Assessment

205 E. Galveston Rd.

Lift Station No. 14

Inspection Date: 7/20/2015

5th

Alvin Lift Station Condition Assessment

820 Steele Rd.

Lift Station No. 16

Inspection Date: 7/20/2015

Facility Information

Address:	820 Steele Rd.
Year in Service:	
Type of Facility:	Submersible
Number of Pumps:	3
Horsepower:	20
Wet Well Diameter (ft):	8
Wet Well Depth (ft):	26
Incoming Pipe Depth (ft):	17.1

CONDITION ASSESSMENT

Component Group	Component Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Back-up Power, Cables	5	25%	1.25	Long power drop, No lock on disconnect, Some corrosion
Pumps and Motors	4	25%	1.00	Pump 1 not working, Not meeting firm capacity, Wire twisted with chain
Structure - Hatches, Corrosion, Cracks, Leaking, Ventilation, Odor Control	2	25%	0.50	Stainless steel hatch, Galvanized vent with screen, Liner in good condition
Piping and Valves	1	15%	0.15	8" piping; CV, PV in good condition
Site - Drainage, Access Drive, Security, Fencing	2	10%	0.20	Asphalt driveway in good condition, 6' Chain-link fence with barbed wire, Security light
Condition Score	-	-	**3.10**	

OVERALL ASSESSMENT

Relative Ranking (__ / 12)	**6th**
Priority Level	**Poor Condition**

ADDITIONAL COMMENTS / RECOMMENDATIONS

Notes:

Potentially low float levels. Excessive I/I is a problem at this lift station, and has been observed to overload the pumps. Short driveway is a safety concern.

Recommendations:

May need electrical rehab soon. Should be monitored for additional corrosion.

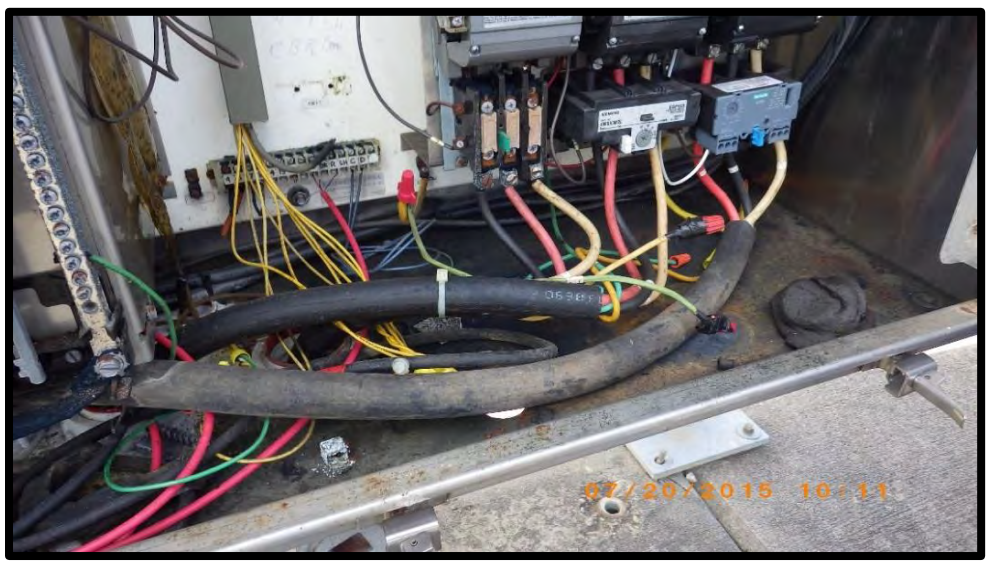
Alvin Lift Station Condition Assessment

820 Steele Rd.

Lift Station No. 16

Inspection Date: 7/20/2015

5th



Alvin Lift Station Condition Assessment

545 E. Hathaway St.

Lift Station No. 17

Inspection Date: 7/20/2015

Facility Information	
Address:	545 E. Hathaway St.
Year in Service:	1984
Type of Facility:	
Number of Pumps:	3
Horsepower:	20
Wet Well Diameter (ft):	12 x 13 box
Wet Well Depth (ft):	21
Incoming Pipe Depth (ft):	10

CONDITION ASSESSMENT

Component Group	Component Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Back-up Power, Cables	4	25%	1.00	Portable generator connection, No lock on disconnect, Unable to access panel age
Pumps and Motors	4	25%	1.00	Only 1 pump installed, Heavy ragging, Pump #2 being worked on
Structure - Hatches, Corrosion, Cracks, Leaking, Ventilation, Odor Control	3	25%	0.75	Heavy concrete deterioration, Liner gone, Stainless steel latch (1 doesn't close)
Piping and Valves	3	15%	0.45	8" DI, Moderate corrosion, Heavy corrosion on int., Some PVC exterior to wet well
Site - Drainage, Access Drive, Security, Fencing	2	10%	0.20	Asphalt driveway in OK condition needs to be extended, 6' Chain-link fence with barbed wire
Condition Score	-	-	**3.40**	

OVERALL ASSESSMENT

Relative Ranking (__ / 12)	**4th**
Priority Level	**Very Poor Condition**

ADDITIONAL COMMENTS / RECOMMENDATIONS

Notes:
Lare amount of trash observed in wet well.

Recommendations:
Needs rehab within 5 years, new electrical, new pumps/motors, new piping and valves, and wet well coating.

Alvin Lift Station Condition Assessment

545 E. Hathaway St.

Lift Station No. 17

Inspection Date: 7/20/2015

Alvin Lift Station Condition Assessment

1823 Steele Rd.

Lift Station No. 23

Inspection Date: 7/20/2015

Facility Information

Address:	1823 Steele Road
Year in Service:	
Type of Facility:	
Number of Pumps:	3 (#3 not installed)
Horsepower:	20
Wet Well Diameter (ft):	9.5 x 11 box
Wet Well Depth (ft):	24
Incoming Pipe Depth (ft):	17

CONDITION ASSESSMENT

Component Group	Component Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Back-up Power, Cables	4	25%	1.00	On-site generator, No lock on disconnect, Some corrosion, Loose wires
Pumps and Motors	4	25%	1.00	Only 2 pumps installed
Structure - Hatches, Corrosion, Cracks, Leaking, Ventilation, Odor Control	4	25%	1.00	Large gooseneck vent, Heavy concrete degradation, No liner, Stainless steel hatches
Piping and Valves	3	15%	0.45	8" DI; CV, PV some corrosion; Heavy corrosion on interior
Site - Drainage, Access Drive, Security, Fencing	2	10%	0.20	Asphalt driveway in good conditio, 6' Chainlink fence with barbed wire, Security light
Condition Score	-	-	**3.65**	

OVERALL ASSESSMENT

Relative Ranking (__ / 12)	**1st**
Priority Level	**Very Poor Condition**

ADDITIONAL COMMENTS / RECOMMENDATIONS

Recommendations:

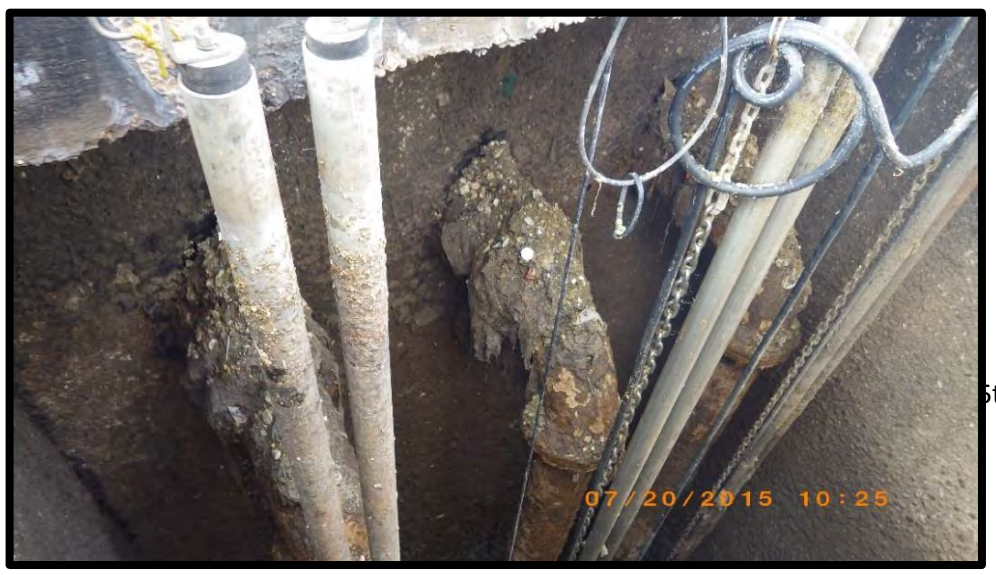
Needs complete rehab within 5 years.

Alvin Lift Station Condition Assessment

1823 Steele Rd.

Lift Station No. 23

Inspection Date: 7/20/2015



Alvin Lift Station Condition Assessment

1587 S. Highway 35 Bypass

Lift Station No. 30

Inspection Date: 7/20/2015

Facility Information

Address:	1587 S. Highway 35 Bypass
Year in Service:	
Type of Facility:	
Number of Pumps:	3
Horsepower:	10, 35
Wet Well Diameter (ft):	13 x 15.5 box
Wet Well Depth (ft):	27
Incoming Pipe Depth (ft):	19

CONDITION ASSESSMENT

Component Group	Component Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Back-up Power, Cables	3	25%	0.75	New on site generator set. Old panel
Pumps and Motors	4	25%	1.00	1 of 3 pumps working, Slow pump
Structure - Hatches, Corrosion, Cracks, Leaking, Ventilation, Odor Control	3	25%	0.75	Concrete with no liner, No cracks, Stainless steel hatches, Gooseneck vent with no screen
Piping and Valves	3	15%	0.45	DI, Moderate corrosion in vault, Moderately corroded interior, CV rebuilt
Site - Drainage, Access Drive, Security, Fencing	1	10%	0.10	Gravel driveway in OK condition, 6' Chainlink fence with barbed wire, Security light
Condition Score	-	-	**3.05**	

OVERALL ASSESSMENT

Relative Ranking (__ / 12)	**8th**
Priority Level	**Poor Condition**

ADDITIONAL COMMENTS / RECOMMENDATIONS

Recommendations:

Needs pump rehab and coating of piping and wet well.

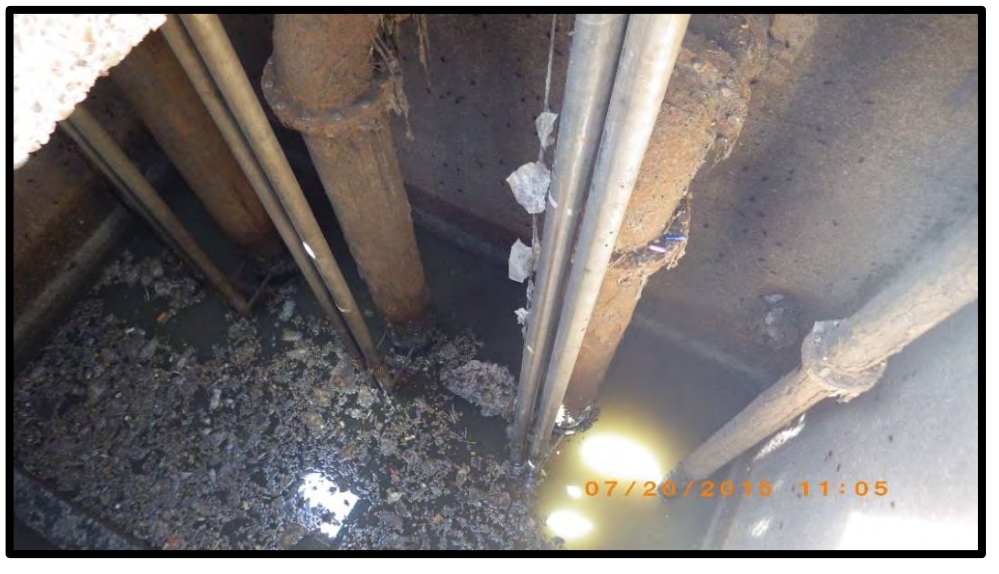
Alvin Lift Station Condition Assessment

1587 S. Highway 35 Bypass

Lift Station No. 30

Inspection Date: 7/20/2015

5th



Alvin Lift Station Condition Assessment

1075 FM 1462

Lift Station No. 31

Inspection Date: 7/20/2015

Facility Information	
Address:	1075 FM 1462
Year in Service:	
Type of Facility:	
Number of Pumps:	3
Horsepower:	35
Wet Well Diameter (ft):	10 x 10 box
Wet Well Depth (ft):	25
Incoming Pipe Depth (ft):	21

CONDITION ASSESSMENT

Component Group	Component Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Back-up Power, Cables	4	25%	1.00	On-site generator set, Evidence of fire
Pumps and Motors	3	25%	0.75	2 pumps installed, Quick cycle time
Structure - Hatches, Corrosion, Cracks, Leaking, Ventilation, Odor Control	3	25%	0.75	Some undermining of slab, Stainless steel hatches, Steel vent (no screen), Concrete with liner, Liner deteroriation
Piping and Valves	3	15%	0.45	CV levers work, Light corrosion, Exterior heavy corrosion
Site - Drainage, Access Drive, Security, Fencing	3	10%	0.30	Gravel/asphalt driveway in poor condition, 6' Chainlink fence with barbed wire, 1 Security light
Condition Score	-	-	**3.25**	

OVERALL ASSESSMENT

Relative Ranking (__ / 12)	**5th**
Priority Level	**Poor Condition**

ADDITIONAL COMMENTS / RECOMMENDATIONS

Recommendations:

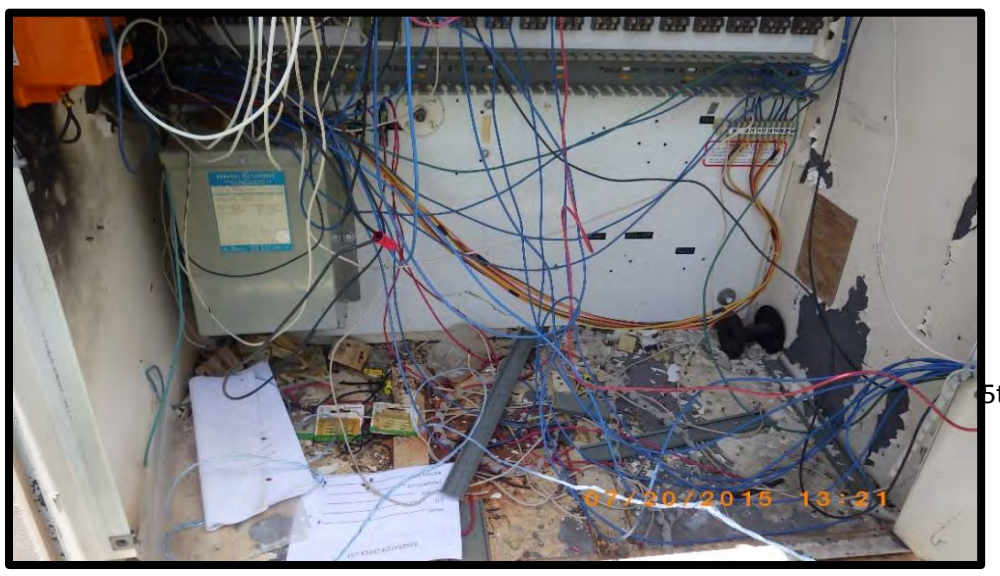
Complete rehab needed within 5 years.

Alvin Lift Station Condition Assessment

1075 FM 1462

Lift Station No. 31

Inspection Date: 7/20/2015



5th

Alvin Lift Station Condition Assessment

3323 Old Galveston Rd.

Lift Station No. 34

Inspection Date: 7/20/2015

Facility Information	
Address:	3323 Old Galveston Rd.
Year in Service:	
Type of Facility:	Submersible
Number of Pumps:	2
Horsepower:	
Wet Well Diameter (ft):	10
Wet Well Depth (ft):	22
Incoming Pipe Depth (ft):	16.5

CONDITION ASSESSMENT

Component Group	Component Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Back-up Power, Cables	3	25%	0.75	Portable generator connection, No lock on disconnect, Ants are a problem
Pumps and Motors	4	25%	1.00	Only 1 pump in wet well
Structure - Hatches, Corrosion, Cracks, Leaking, Ventilation, Odor Control	2	25%	0.50	Concrete with coating in good condition
Piping and Valves	3	15%	0.45	6" DI, Possibly bad CV
Site - Drainage, Access Drive, Security, Fencing	3	10%	0.30	Gravel driveway in poor condition, 6' Chain-link fence with barbed wire
Condition Score	-	-	**3.00**	

OVERALL ASSESSMENT

Relative Ranking (__ / 12)	**9th**
Priority Level	**Poor Condition**

ADDITIONAL COMMENTS / RECOMMENDATIONS

Notes:
Large amounts of I/I is an issue at this lift station. Disconnect turns off power meter.

Recommendations:
Needs a second pump and some valve work. Should be monitored for additional corrosion. Rehab in 10+ years.

Alvin Lift Station Condition Assessment

3323 Old Galveston Rd.

Lift Station No. 34

Inspection Date: 7/20/2015