



Water Master Plan Update

Prepared for:

City of Weatherford



Adopted by Municipal Utility Board on January 24, 2013

Prepared by:

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WEA11138



Innovative approaches
Practical results
Outstanding service

Water Master Plan Update

Prepared for:

City of Weatherford

Jessica L. Brown



1/10/2013

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- Appendix B – Field Testing Data
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1.0 INTRODUCTION

The City of Weatherford is located west of the Dallas-Fort Worth Metroplex. The City provides water to a service area of approximately 27 square miles. The population within the water service area is projected to increase 25% over the next 10 years and is projected to be roughly 65% larger than the current population by the buildout planning period. Accommodating this growth in an efficient and cost effective manner, while maintaining a safe and reliable water supply for the citizens of Weatherford, was the focus of the 2011 Water Distribution System Master Plan.

1.1 SCOPE OF WORK

Freese and Nichols, Inc. was retained in 2011 by the City of Weatherford to conduct a Water Distribution System Master Plan Update. The goals of this project were to evaluate the existing water distribution system and to recommend a phased Capital Improvements Plan through the buildout planning period. The recommended improvements will serve as a basis for the design, construction and financing of facilities required to meet Weatherford's water service area needs as a result of projected population growth. The major elements of the scope of this project included:

- Water Model Development
- Field Testing and Model Calibration
- Population and Water Demand Projections for 5-year, 10-year and buildout planning periods
- Distribution System Hydraulic Capacity Analysis
- Water System Capital Improvements Plan
- Water Distribution System Master Plan Report

1.2 LIST OF ABBREVIATIONS

Abbreviation	Actual
AD	Average Day Demand
CCN	Certificate of Convenience and Necessity
CIP	Capital Improvements Plan
EST	Elevated Storage Tank
ETJ	Extraterritorial Jurisdiction
FNI	Freese and Nichols, Inc.
GIS	Geographic Information System
gpad	gallons per acre per day
gpcd	gallons per capita per day
gpm	gallons per minute
GST	Ground Storage Tank
MD	Maximum Day Demand
MG	Million Gallons
mgd	million gallons per day
NCTCOG	North Central Texas Council of Governments
PH	Peak Hour Demand
PRV	Pressure Reducing Valve
PS	Pump Station
psi	pounds per square inch
SCADA	Supervisory Control and Data Acquisition
TCEQ	Texas Commission on Environmental Quality
TSZ	Traffic Survey Zone
WL	Water Line

2.0 POPULATION AND LAND USE

Population and land use are important elements in the analysis of water distribution systems. Water demands depend on the residential population and commercial development served by the distribution system. A thorough analysis of historical and projected populations, along with land use data, provides the basis for future water demands.

2.1 SERVICE AREA

FNI worked with the City to define the five, ten and buildout water service areas. Weatherford's and surrounding retail water suppliers' Certificates of Convenience and Necessity (CCN) were one consideration when delineating the service areas. A CCN is a state regulated agreement in which the CCN holder is required to provide continuous and adequate utility service to all of its retail customers and, in turn, is protected from encroachment by other retail service providers. The current boundary of Weatherford's water CCN encompasses the entire city limits and also includes portions of the extra-territorial jurisdiction (ETJ). The CCN boundary is expected to expand further into the ETJ for the future planning periods. **Figure 2-1** shows the Weatherford and surrounding retail water supplier CCN boundaries. **Figure 2-2** identifies the projected five, ten and buildout service areas used for this study.

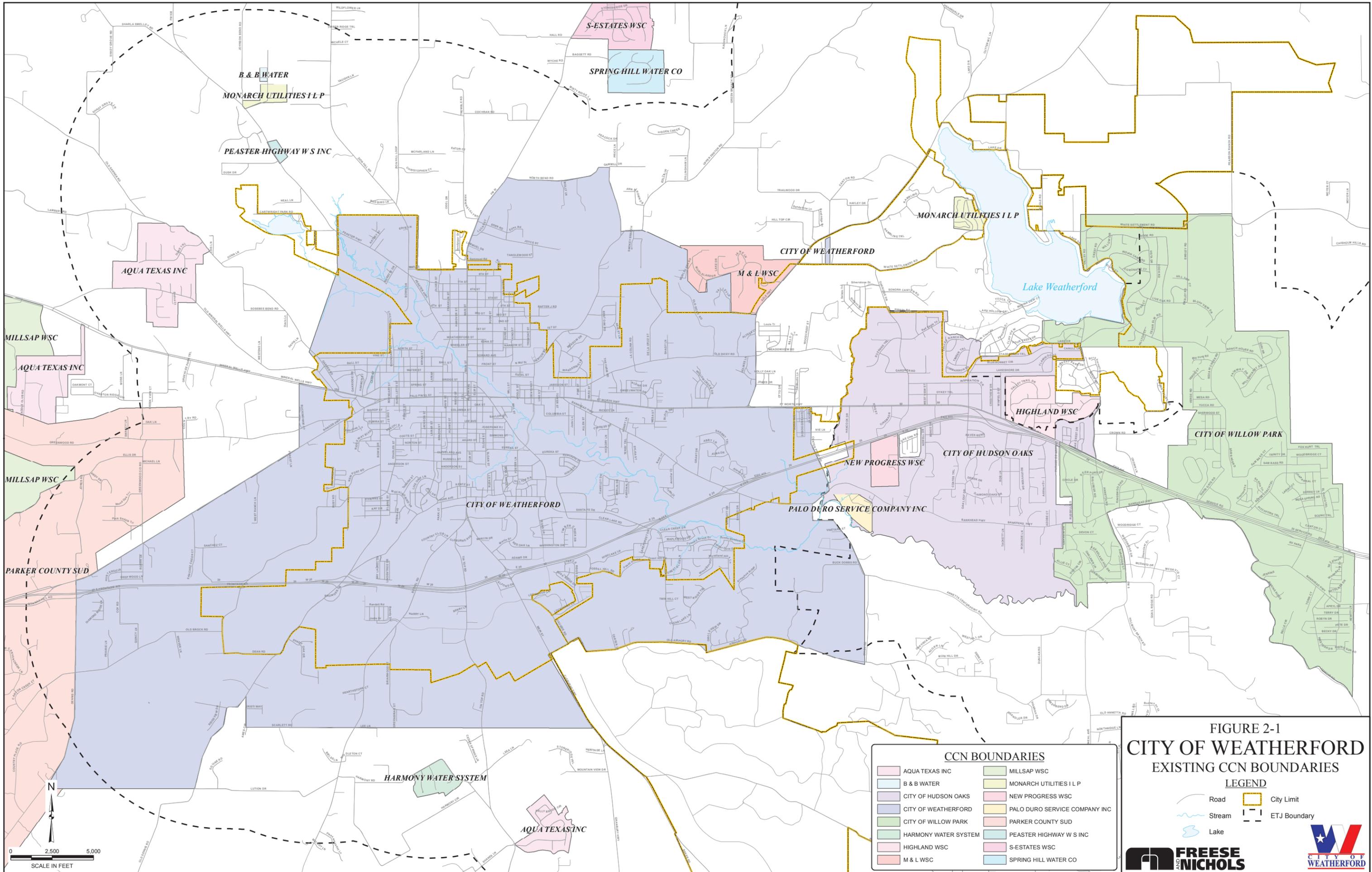


FIGURE 2-1
CITY OF WEATHERFORD
EXISTING CCN BOUNDARIES

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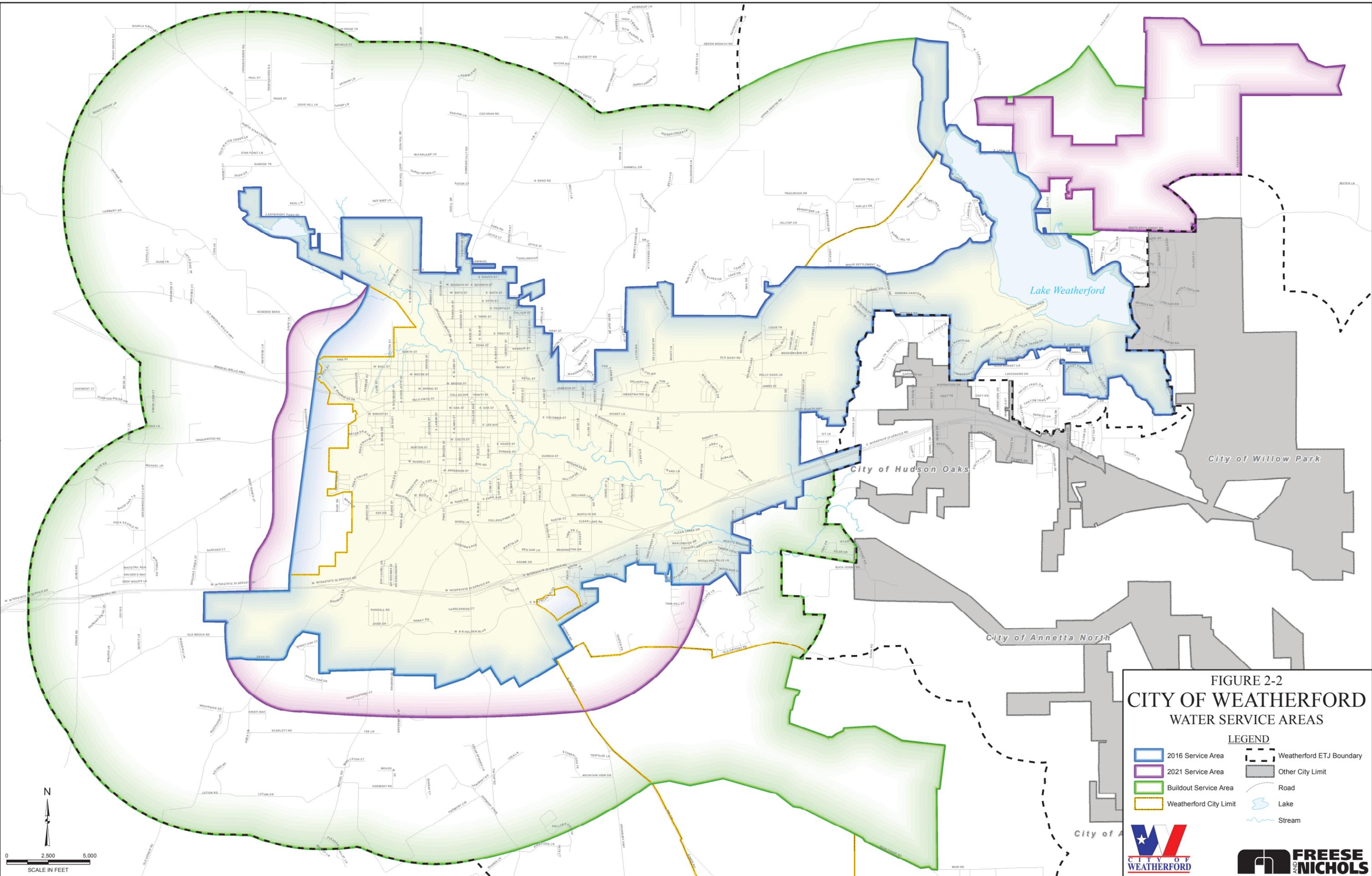


FIGURE 2-2
CITY OF WEATHERFORD
WATER SERVICE AREAS

LEGEND

 2016 Service Area	 Weatherford ETJ Boundary
 2021 Service Area	 Other City Limit
 Buildout Service Area	 Road
 Weatherford City Limit	 Lake
	 Stream

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2.2 HISTORICAL POPULATION

The City of Weatherford provided yearly population data from 2001 through 2010. These populations were adjusted to reflect the populations reported during the 2000 and 2010 Census since the official 2010 Census population differed from the original 2010 population estimate. The annual growth rate calculated from the historical population data provided by City of Weatherford was maintained when adjusting the intermittent year populations between the 2000 and 2010 Census records. The average annual growth rate over the last 10 years was 2.89%. **Table 2-1** presents the historical population for the City of Weatherford.

Table 2-1 Historical Population

Year	Population	Growth Rate
2000	19,000	-
2001	19,296	1.56%
2002	19,699	2.09%
2003	20,203	2.56%
2004	21,252	5.19%
2005	22,144	4.20%
2006	22,882	3.33%
2007	23,658	3.39%
2008	24,396	3.12%
2009	24,939	2.23%
2010	25,250	1.25%
Average		2.89%

2.3 POPULATION AND NON-RESIDENTIAL GROWTH PROJECTIONS

FNI and the City held a meeting to discuss future water service area boundaries and population projections. The North Central Texas Council of Governments (NCTCOG) 2011 population estimate for the City of Weatherford was 25,300. Through a review of historical growth and discussions with city staff, it was determined that an annual growth rate of 2.0% would be used for the 2016 planning period, and a 2.5% annual increase through the 2021 planning period. The projected population for each planning year is presented in **Table 2-2**.

The buildout population was estimated by determining the future land use acreage within the buildout service area that would be residential. It was determined that the area in and around the middle of the

City would develop at a density of 3 units per acre and 2.5 people per unit, resulting in 7.5 people per acre. Areas outside the core of the City that stretch into the ETJ in the future are projected to have a density of 2 units per acre and 2 people per unit, resulting in 4 people per acre. The resulting projected buildout population is 160,720.

Table 2-2 Projected Population

Year	Population
2011	25,300
2016	27,933
2021	31,604
Buildout	160,720

The population for each planning year was then distributed throughout the City using two sources of data: modified Traffic Survey Zones (TSZs) and the geocoded water billing meter data. Geocoding is a process in which a field or group of fields of a table collectively signifies an address that can be assigned a spatial location using corresponding streets or small area polygons, such as parcels, that are descriptive of an area. The geocoded billing data provided FNI the basis for distributing the existing population throughout the City.

NCTCOG develops population projections using smaller planning areas called Traffic Survey Zones (TSZs). A TSZ is a type of data collection zone that was established by NCTCOG for all counties within the North Texas region. The TSZs in the City of Weatherford were too large to provide enough detail for the distribution of the population; therefore, FNI split the existing TSZs, making them smaller to better facilitate the population and water demand distribution.

The existing population was then distributed and assigned to a TSZ using the geocoded billing meter data. The 2011 population was 25,300, and there were 11,292 existing residential meters within the City. This results in a density of 2.24 people per meter. The density was applied to each water meter and then intersected with the TSZs to determine the population within each TSZ.

The intermediate year population distribution was determined using information obtained through discussions with City staff. Most of the growth in the 5-year and 10-year planning periods is projected to occur within the proposed loop around the City. **Figure 2-3** shows the population by TSZ for each planning period. **Figure 2-4** shows non-residential acreage by TSZ for each planning period.

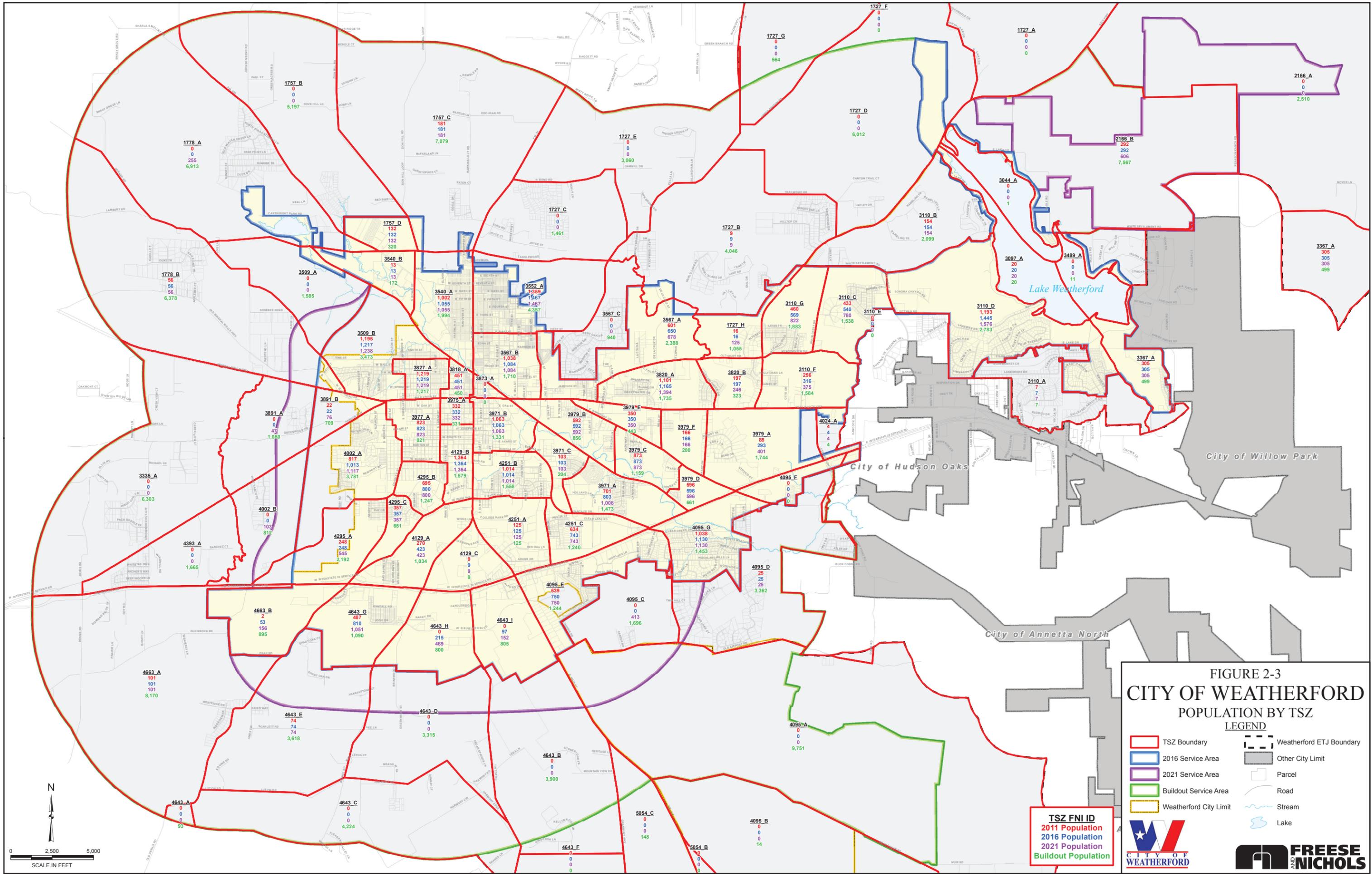


FIGURE 2-3
CITY OF WEATHERFORD
POPULATION BY TSZ
LEGEND

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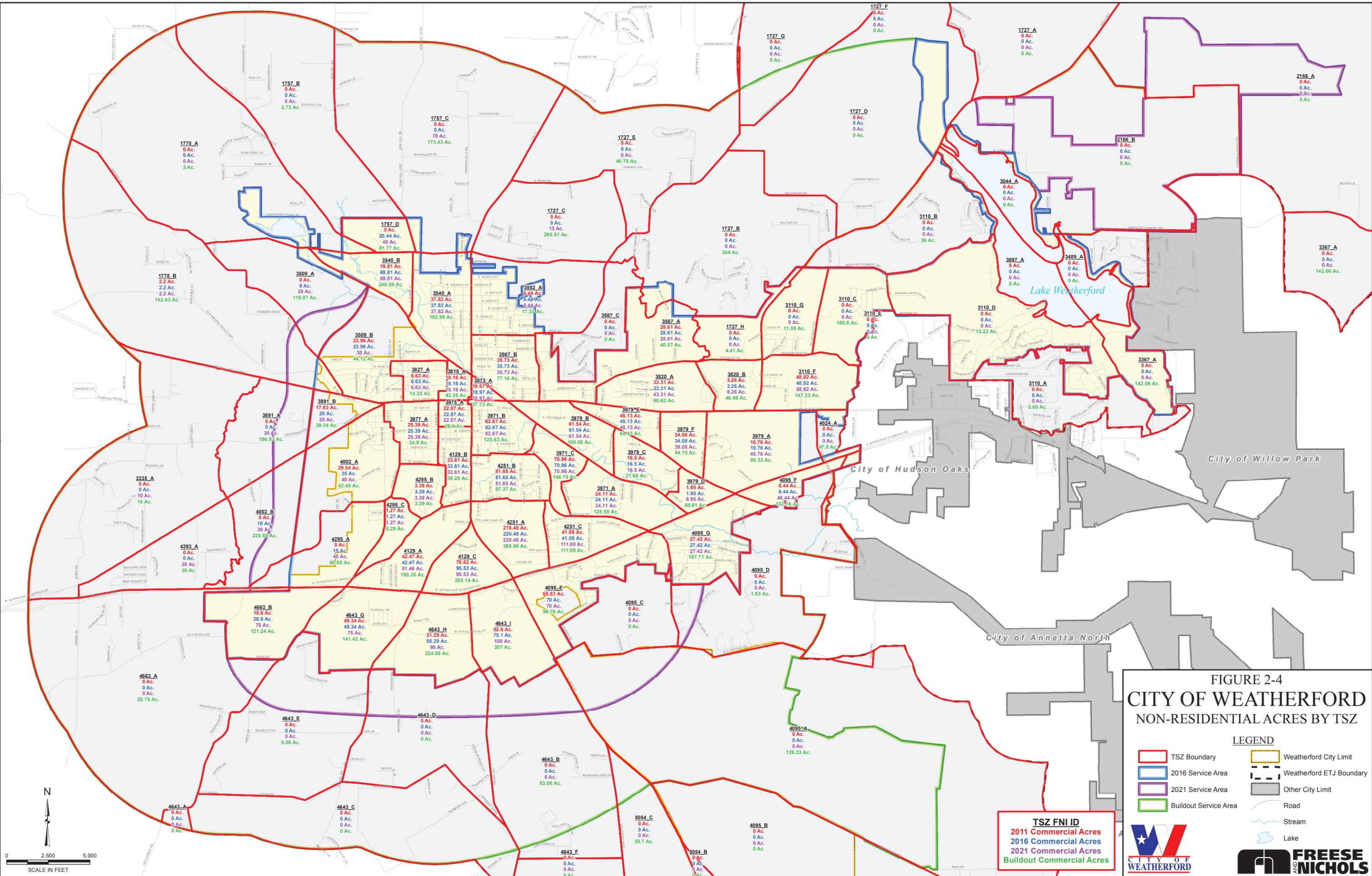
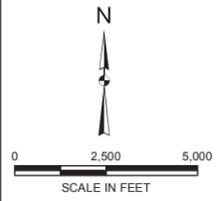


FIGURE 2-4
CITY OF WEATHERFORD
 NON-RESIDENTIAL ACRES BY TSZ

- LEGEND**
- TSZ Boundary
 - 2016 Service Area
 - 2021 Service Area
 - Buildout Service Area
 - Weatherford City Limit
 - Weatherford ETJ Boundary
 - Other City Limit
 - Road
 - Stream
 - Lake

TSZ FNI ID
 2011 Commercial Acres
 2016 Commercial Acres
 2021 Commercial Acres
 Buildout Commercial Acres



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2.4 LAND USE

The City provided zoning shapefiles that include the current zoning for the City of Weatherford. The zoning data only covered the area within the city limits. The 2010 zoning data along with the geocoded billing meter data was used to determine the existing and future total non-residential acreage. To determine the existing non-residential acreage, the geocoded billing data was intersected with the Weatherford parcel data. Every parcel that contained a non-residential water meter was considered a non-residential parcel. The sum of the areas of the existing non-residential parcels is 1,463 acres.

To determine the buildout non-residential acreage, FNI and the City determined locations of future commercial and industrial centers. It was assumed that the area near the future Weatherford Loop around the City would be primarily commercial. Other locations, such as the Weatherford College property in the south and the industrial area in the northwest, were also taken into account. The projected buildout non-residential acreage is 6,435 acres.

For the intermediate planning years, an annual growth trend similar to the population growth rate was assumed with additional acreage applied to the 2016 and 2021 projections to account for growth along the proposed Weatherford Loop. **Table 2-3** and **Figure 2-4** present the non-residential acreage by planning year for the water service area.

Table 2-3 Projected Non-residential Acreage

Year	Acres
2011	1,463
2016	1,616
2021	1,976
Buildout	6,519

3.0 WATER DEMANDS

A water utility must be able to supply water at rates that fluctuate over a wide range. Yearly, monthly, daily, and hourly variations in water use occur, with higher use 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. 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). Average day use is the total annual water use divided by the number of days in the year. The average day 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. Treatment facilities are typically designed based on the maximum day rate. 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

Historical water usage records were analyzed for the years 2005 through 2010. The City provided recent water usage data consisting of monthly production and maximum day consumption. The City also provided data on the unaccounted for water from internal water audits. Historical annual average day demand, maximum day to average day peaking factors, and per-capita consumptions are summarized in

Table 3-1.

Table 3-1 Historical Water Usage

Year	Population	Average Day (MGD)	Maximum Day (MGD)	Max. Day to Avg. Day Peaking Factor	Average Day Per-capita Consumption (gpcd)
2005	22,144	4.86	6.95	1.43	219
2006	22,882	4.58	8.29	1.81	200
2007	23,658	3.39	7.26	2.14	143
2008	24,396	3.90	7.91	2.03	160
2009	24,939	3.79	7.93	2.09	152
2010	25,250	4.08	7.74	1.90	162
Average				1.90	173

The utility billing data was also utilized in the analysis of historical water usage. Metered water usage from the last six years was reviewed and evaluated based on usage type. The residential sales accounted for approximately 60% of the total sales from 2005 through 2010. Residential per-capita water usage was calculated for each year and is presented in **Table 3-2**. An average non-residential per-acre usage was calculated using the observed 2010 non-residential demand of 1.59 MGD and the 1,465 non-residential acres in the City. The 2010 non-residential per acre demand was 1,085 gpad.

The City of Hudson Oaks is the only wholesale water customer of the City of Weatherford. Hudson Oaks is currently contracted to purchase 0.09 MGD from the City of Weatherford with no penalty for a maximum take; however, a new contract is nearly complete that will increase the daily take rate.

Table 3-2 Metered Water Usage by Customer Class

Year	Average Annual Residential Sales (mgd)	Residential Per-capita (gpcd)	Average Annual Non-residential Sales (mgd)	Wholesale Water Demands (MGD)
2005	2.90	131	1.96	0.12
2006	2.59	113	1.99	0.11
2007	1.91	81	1.48	0.01
2008	2.33	96	1.56	0.05
2009	2.24	90	1.55	0.08
2010	2.49	99	1.59	0.07
Average		101		0.07

3.2 PROJECTED WATER DEMANDS

Water demands were projected for 2011, 2016, 2021 and buildout conditions. The evaluation of historical data provided a basis for determining the design criteria used to project water demands. For future planning periods, a per capita residential demand of 120 gpcd was used. For non-residential areas, it was assumed that the same types of industries will continue to develop into the future so the non-residential gallons per acre per day (gpad) was held constant at 1,100 gpad for each planning year. This assumption is in-line with other similar sized cities in the Metroplex.

Historical water usage data indicated the maximum day to average day peaking factor ranged from 1.43 to 2.09 over the last six years with an average factor of 1.91; therefore, a peaking factor of 2.0 was selected for future year demands. An overall maximum day to peak hour peaking factor of 1.5 was



utilized based on previous Master Plans and prior modeling experience. The projected water demands are shown in **Table 3-3**.

The City of Hudson Oaks provided projected demands and their average day water demands are projected to be 0.55 MGD by 2016, 0.67 MGD by 2021 and 1.29 MGD by the buildout planning period. **Table 3-4** lists the system-wide water demands. **Table 3-5** shows the projected water demands by pressure plane.

Table 3-3 Water Demand Projections

Year	Population	Commercial Acreage (acre)	Per Capita Residential Water Demand (gpcd)	Per Acre Commercial Water Demand (gpad)	Residential Water Demand (MGD)	Commercial Water Demand (MGD)	Wholesale Average Day Water Demand (MGD)	Total Average Day Water Demand (MGD)
2011	25,300	1,462	120	1,100	3.04	1.61	0.43	5.09
2016	27,933	1,616	120	1,100	3.35	1.78	0.55	5.70
2021	31,604	1,976	120	1,100	3.79	2.01	0.67	6.65
Buildout	160,720	6,519	120	1,100	19.29	7.08	1.29	27.74

Table 3-4 Total System Water Demand Projections

Year	Average Day Demand (mgd)	Maximum Day Demand (mgd)	Peak Hour Demand (mgd)
2011	5.09	10.60	15.58
2016	5.70	11.88	17.42
2021	6.65	13.85	20.30
Buildout	27.74	56.12	83.38

Any utility service provider that possesses a CCN is obligated to ensure adequate system capacity to service qualified applicants within its CCN area. If the system demand has reached 85% or more of design capacity when compared to the most restrictive criteria (well capacity, pumping, etc.) of the TCEQ’s minimum capacity requirements in the Chapter 290 Rules and Regulations for Public Water Systems, the utility service provide must submit a planning report to the Commission in accordance with § 291.93(3) of the TCEQ’s Rules explaining how the service provider plans to expand capacity to meet demands in the foreseeable future.

Table 3-5
Population and Water Demand Projections by Pressure Plane

Pressure Plane	2011					2016					2021					Buildout				
	Pop.	Commercial Acreage	Avg. Day Demand (mgd)	Max. Day Demand (mgd)	Peak Hour Demand (mgd)	Pop.	Commercial Acreage	Avg. Day Demand (mgd)	Max. Day Demand (mgd)	Peak Hour Demand (mgd)	Pop.	Commercial Acreage	Avg. Day Demand (mgd)	Max. Day Demand (mgd)	Peak Hour Demand (mgd)	Pop.	Commercial Acreage	Avg. Day Demand (mgd)	Max. Day Demand (mgd)	Peak Hour Demand (mgd)
Central	10,655	646	2.44	5.31	7.64	-		-	-											
<i>East</i>	-	-	-	-		5,209	165	1.37	3.22	4.43	5,878	272	1.69	3.91	5.40	19,490	1,261	5.05	10.76	15.33
<i>Central (New)</i>	-	-	-	-		6,125	483	1.28	2.56	3.84	6,357	542	1.37	2.74	4.12	9,457	1,001	2.25	4.51	6.76
Franklin	2,780	74	0.36	0.72	1.08	2,871	148	0.45	0.90	1.35	2,920	203	0.52	1.03	1.55	15,900	944	2.63	5.26	7.89
Dubellette	7,004	663	1.57	3.14	4.71	8,037	732	1.77	3.54	5.31	9,595	847	2.08	4.17	6.25	61,605	2,544	10.19	20.38	30.57
Miller	2,848	78	0.48	0.97	1.45	3,103	84	0.53	1.05	1.58	3,271	90	0.56	1.11	1.67	14,957	368	2.50	5.00	7.50
Oak Ridge	1252	1	0.15	0.30	0.45	1,520	1	0.18	0.37	0.55	1,974	1	0.24	0.48	0.71	12,237	352	1.86	3.71	5.57
West Lake	761	0	0.08	0.16	0.24	857	0	0.09	0.18	0.27	1,059	0	0.11	0.22	0.33	9,245	24	1.00	1.99	2.99
Northwest	-	-	-	-		65	3	0.01	0.02	0.03	255	21	0.05	0.11	0.16	11,624	25	1.48	2.96	4.44
Northeast	-	-	-	-		146	0	0.02	0.04	0.05	295	0	0.04	0.07	0.11	6,205	0	0.78	1.55	2.33
Total	25,300	1,462	5.09	10.60	15.58	27,933	1,616	5.70	11.88	17.42	31,604	1,976	6.65	13.85	20.30	160,720	6,519	27.74	56.12	83.38

*The City of Hudson Oaks wholesale average, maximum, and peak hour demand was provided to the City of Weatherford by the City of Hudson Oaks. This demand is applied to the Central East Pressure Plane for future planning periods.

4.0 EXISTING WATER DISTRIBUTION SYSTEM

The City of Weatherford's water distribution system consists of a network of water lines, a water treatment plant with associated high service pump station and clearwell, five elevated storage tanks, one standpipe, three ground storage tanks, and four pump stations. **Figure 4-1** shows the existing water distribution system for the City of Weatherford.

4.1 PRESSURE PLANES

The distribution system is separated into six major pressure planes: Central, Dubellette, Franklin, Miller, Oak Ridge and West Lake. A schematic of the existing water distribution system is presented on **Figure 4-2**.

4.1.1 Central Pressure Plane

The Central Pressure Plane is the largest plane spanning from Lake Weatherford on the eastern portion of the city limits to Main Street in the middle of the City. The Central Pressure Plane accounts for 44% of the City's total water usage. It is supplied directly from the Water Treatment Plant through the 12.0 MGD high service pump station. The Central Pressure Plane operates at a static hydraulic grade of 1185 feet. The hydraulic grade is established by the overflow elevation of the Harberger Hill, Dubellette and College Hill ground storage tanks (GSTs) that act as elevated storage for the Central Pressure Plane. Ground elevations throughout the pressure plane range from 920 feet to 1120 feet. A small area in the eastern portion of the Central Pressure Plane, north of Hudson Oaks is regulated by pressure reducing valves (PRVs) that maintain an operating pressure of 45 psi.

4.1.2 Franklin Pressure Plane

The Franklin Pressure Plane includes areas in the northwestern portion of the City with ground elevations ranging from 1020 feet to 1160 feet. The Franklin Pressure Plane is supplied by the Harberger Hill Pump Station (P.S.) located at the intersection of King St. and Common St. The pump station consists of two 730 gpm pumps that pump water from the 2 million gallon (MG) Harberger Hill GST. A static hydraulic gradient of 1257 feet is established by the Franklin elevated storage tank (EST) along Franklin St. in the northern portion of the pressure plane.

4.1.3 Miller Pressure plane

The Miller Pressure Plane is on the west side of the City. The Miller Pressure Plane encompasses the highest ground elevations throughout the City with elevations ranging from 1040 feet to 1260 feet. The static hydraulic gradient of the Miller Pressure Plane is established at 1320 feet by the Miller EST on the western border of the existing city limits. The pressure plane is supplied by the Dubellette GST and PS located near the intersection of Love St. and Oak St. The pump station contains two 1,400 gpm pumps that draw water from the 1 MG Dubellette GST.

4.1.4 Dubellette Pressure Plane

The Dubellette Pressure Plane is the second largest pressure plane. It encompasses the downtown portion of Weatherford and extends south of I-20. The ground elevations range from 880 feet to 1160 feet, and the static hydraulic gradient of 1257 feet is established by the West Park and Dubellette ESTs. Water is supplied by the 2 MG College Hill PS and GST located on the campus of Weatherford College.

4.1.5 Oak Ridge Pressure Plane

The Oak Ridge Pressure Plane is located west of Lake Weatherford. The Oak Ridge Pressure Plane is supplied by the West Lake Pump Station. The hydraulic grade is established by the 0.25 MG Oak Ridge EST located along Saddle Ridge Trail. The overflow elevation of the Oak Ridge ST is 1235 ft. Under existing average day conditions, the Oak Ridge Pressure Plane experiences low water demands and struggles to turn over water in the Oak Ridge EST.

4.1.6 Westlake Pressure Plane

The Westlake Pressure Plane is a small pressure plane around Lake Weatherford. The hydraulic grade is established at 1050 feet by the 0.1 MG Westlake Standpipe. Water is supplied to the Westlake Pressure Plane by the Water Treatment Plant through a PRV along West Lake Dr. The PRV maintains a pressure of 75-80 psi.

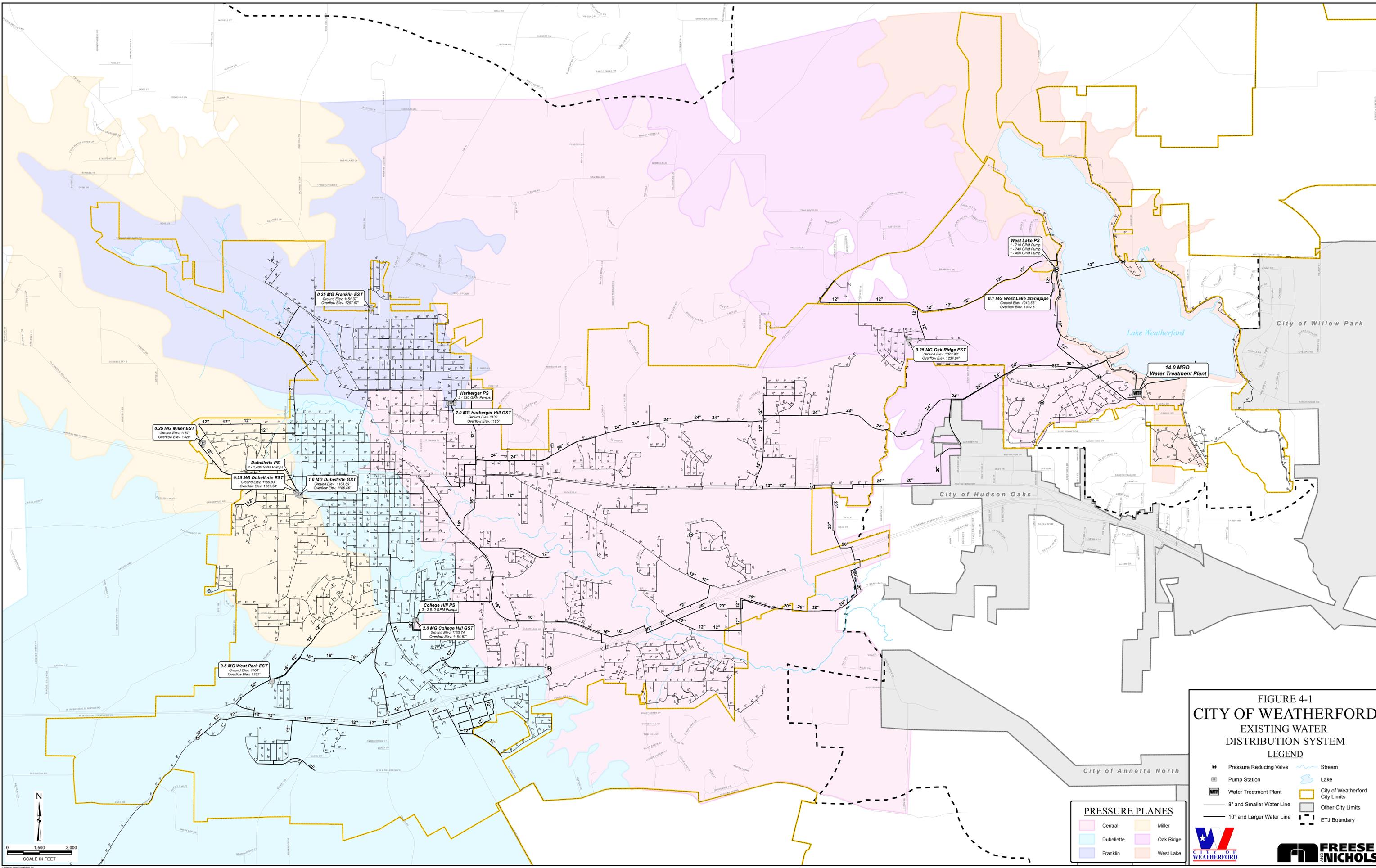


FIGURE 4-1
CITY OF WEATHERFORD
 EXISTING WATER
 DISTRIBUTION SYSTEM
LEGEND

- Pressure Reducing Valve
- Pump Station
- Water Treatment Plant
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Stream
- Lake
- City of Weatherford City Limits
- Other City Limits
- ETJ Boundary

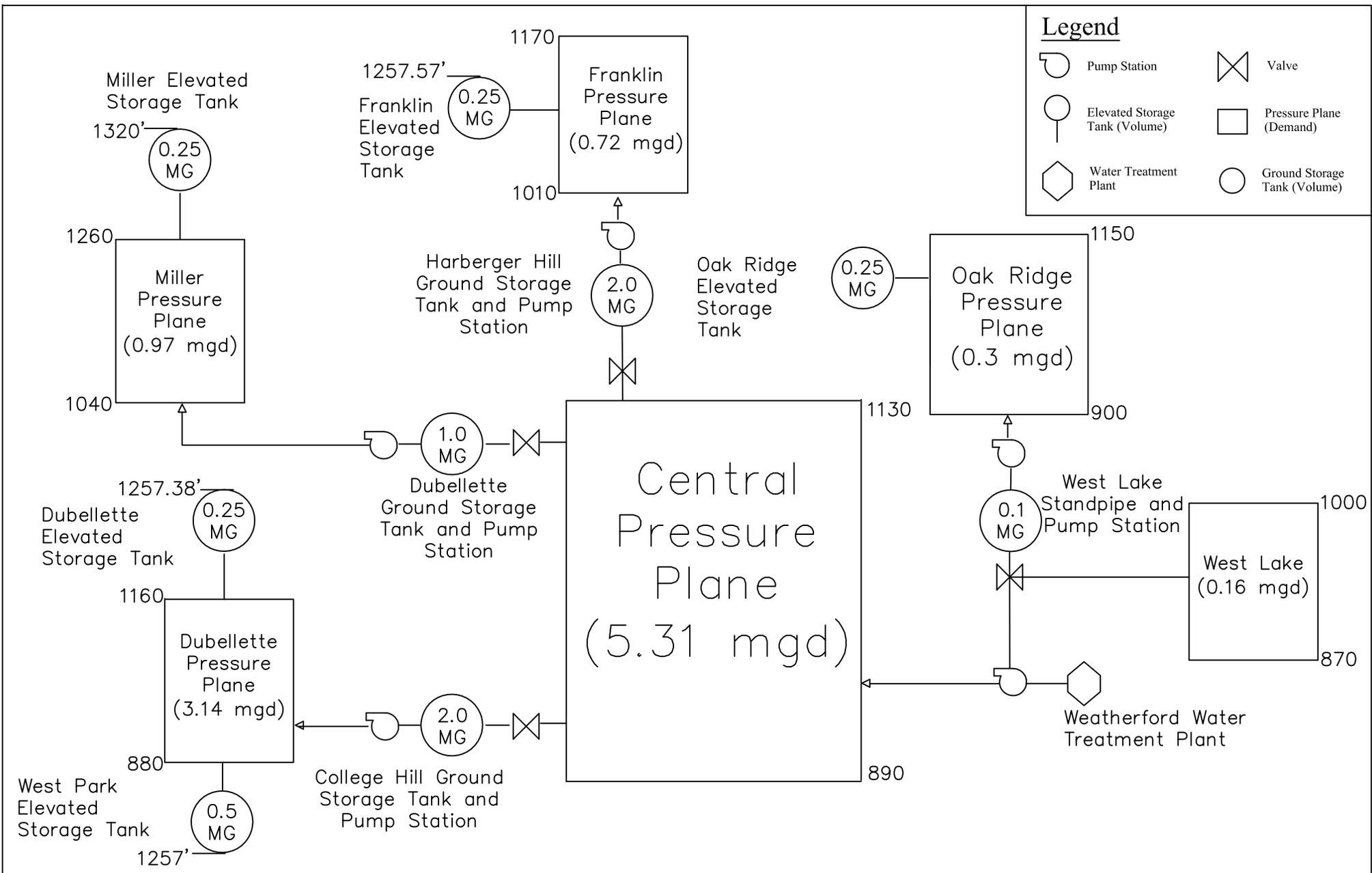
PRESSURE PLANES

	Central		Miller
	Dubellette		Oak Ridge
	Franklin		West Lake



0 1,500 3,000
 SCALE IN FEET

DATE: 10/15/2019
 PROJECT: WEATHERFORD WATER DISTRIBUTION SYSTEM
 SHEET: 4-1
 DRAWN: J. HARRIS
 CHECKED: M. HARRIS
 APPROVED: M. HARRIS



4055 International Plaza, Suite 200
 Fort Worth, Texas 76109-4895
 Phone - (817) 735-7300
 Fax - (817) 735-7491

Figure 4-2
 City of Weatherford
 Existing System Maximum Day Demand Diagram
 (10.60 MGD)

4.2 WATER TREATMENT PLANT

The City currently operates a water treatment plant near Lake Weatherford. The current treatment capacity is 14 MGD, and the existing site is built out. The treatment plant has one clearwell with a total storage capacity of 1.0 MG. The high service pump station, which has a firm capacity of 12.1 MGD, supplies water directly to the Central Pressure Plane through 27-inch and 42-inch water lines. There are four pumps at the pump station. Two of the pumps have variable frequency drives (VFD) that allow the operator to choke down the flow rate into the system.

4.3 PUMP STATIONS

In addition to the high service pump station at the WTP, the City operates four booster pump stations that supply water to the Franklin, Dubellette, Miller and Oak Ridge Pressure Planes. The West Lake PS takes suction from the West Lake standpipe and discharges into the Oak Ridge Pressure Plane. The College Hill PS supplies water to the Dubellette Pressure Plane. The Harberger Hill PS and the Dubellette PS supply water to the Franklin and Miller Pressure Planes, respectively. **Table 4-1** presents a summary of the pumping facilities in the City of Weatherford's distribution system.

Table 4-1 Summary of Pumping Facilities

Pump Station Name	Pump No.	Rated Capacity		Rated Head (feet)	Pressure Plane
		(gpm)	(mgd)		
WTP High Service Pump Station	1	2,800	4.03	131	Central
	2*	2,800	4.03	131	Central
	3*	2,800	4.03	131	Central
	4	2,800	4.03	131	Central
	Total	11,200	16.13		
	Firm	8,400	12.10		
West Lake	1	710	1.02	240	Oak Ridge
	2	740	1.07	355	Oak Ridge
	3	400	0.58	350	Oak Ridge
	Total	1,850	2.66		
	Firm	1,110	1.60		
Harberger Hill	1	730	1.05	205	Franklin
	2	730	1.05	205	Franklin
	Total	1,460	2.10		
	Firm	730	1.05		
College Hill	1	2,610	3.76	90	Dubellette
	2	2,610	3.76	90	Dubellette
	3	2,610	3.76	90	Dubellette
	Total	7,830	11.28		
	Firm	5,220	7.52		
Dubellette	1	1,400	2.02	200	Miller
	2	1,400	2.02	200	Miller
	Total	2,800	4.03		
	Firm	1,400	2.02		

* Pumps #2 and #3 at the Water Treatment Plant are variable speed pumps.

4.4 STORAGE FACILITIES

Five tanks provide elevated storage within the City of Weatherford's distribution system. The Westlake standpipe serves the Westlake Pressure Plane. The Franklin EST provides storage for the Franklin Pressure Plane. The Oak Ridge EST provides elevated storage for the Oak Ridge Pressure Plane. The Miller EST provides storage for the Miller Pressure Plane, and the Dubellette and West Park ESTs provide storage for the Dubellette Pressure Plane. The College Hill, Harberger Hill, and Dubellette GSTs are also utilized to provide elevated storage for the Central Pressure Plane. The Harberger Hill, College Hill, and Dubellette GSTs were constructed at elevations that allow them to provide ground storage for the booster pump stations, as well as, provide elevated storage for the Central Pressure Plane. **Table 4-2** summarizes the storage facilities in the City of Weatherford's distribution system.

Table 4-2 Summary of Storage Facilities

Facility Name	Type	Pressure Plane	Volume (MG)	Overflow Elevation (feet)
College Hill GST	Ground	Dubellette	2.00	1185
Dubellette GST	Ground	Miller	1.00	1186
Harberger Hill GST	Ground	Franklin	2.00	1185
GST Subtotal			5.00	
West Lake Standpipe	Elevated	West Lake	0.01	1050
Oak Ridge EST	Elevated	Oak Ridge	0.25	1235
West Park EST	Elevated	Dubellette	0.5	1257
Dubellette EST	Elevated	Dubellette	0.25	1257
Miller EST	Elevated	Miller	0.25	1320
Franklin EST	Elevated	Franklin	0.25	1257
EST Subtotal			1.5	
Total System			6.5	

4.5 VALVES

The City of Weatherford maintains four pressure reducing valve (PRV) stations to regulate pressures in areas with lower ground elevations in the Central Pressure Plane. This area is located north of the City of Hudson Oaks and maintains an operating pressure of 45 psi at the PRV. Additionally, the City operates three modulating valves on the intake side of the Harberger, College Hill, and Dubellete GST. The valves are modulated to maximize flow to the Dubellette GST. Under maximum day demand conditions, it is difficult to fill the Dubellette GST. As a result, the Harberger Hill valve stays closed for the majority of the

day due to low demand in the Franklin Pressure Plane. The Harberger Hill GST fills faster than the other two GSTs due to the close proximity to the 24-inch distribution line from the WTP. The valve seat on the College Hill valve is broken and cannot be closed more than 33%. However, the valve can be opened to 100% and is operated as such when water is needed at the College Hill GST. There is also an 8-inch gate valve at the intersection of Baylor and Lamar that remains cracked open (3 to 4 turns) at all times to bleed water through the valve from the Dubellette EST into the Dubellette GST.

4.6 WATER LINES

The water distribution network consists of pipes ranging in size from 0.75-inches to 36-inches. **Table 4-3** presents length of pipe by diameter in Weatherford's distribution system.

Table 4-3 Length of Pipe by Diameter

Diameter	Length (feet)	Percent of Total Length
2-inch	66,522	5.2%
3-inch	5,396	0.4%
4-inch	46,088	3.6%
6-inch	396,106	30.9%
8-inch	485,627	37.9%
10-inch	391	0.0%
12-inch	162,456	12.7%
16-inch	34,837	2.7%
20-inch	27,745	2.2%
24-inch	40,028	3.1%
30-inch	5,749	0.4%
36-inch	10,060	0.8%
Total	1,281,005	100.0%

5.0 MODEL DEVELOPMENT

A hydraulic model was developed to be used as a tool in the evaluation of the City of Weatherford's water distribution system. The modeling software uses engineering equations and mathematical algorithms to determine the flows and pressures that would occur in a distribution system under a specified set of conditions. In general, the flow and gradient patterns depend upon the magnitude and location of system supplies and demands and on the characteristics of the water mains and other facilities in the distribution network. The head loss through each main is a function of the flow rate and the pipe diameter, length, and interior roughness. Sound model construction and calibration provide an accurate representation of the distribution system that can be used to evaluate existing and future system operations.

5.1 GIS MODIFICATIONS

Freese and Nichols, Inc. (FNI) was tasked with evaluating the connectivity of the water lines in the Geographic Information System (GIS) shapefiles to develop recommendations for modifications to facilitate building a water system model that will maintain a one-to-one relationship with the GIS database. The GIS database allows users to spatially locate known assets in a given area while also containing asset specific data on each segment. FNI evaluated the City of Weatherford's water line shapefiles for connectivity issues. Connectivity issues included locations where line segments are tied together or not at intersections and areas where the end points of lines are not snapped together. FNI utilized tools in the Bentley WaterGEMS V8i software to determine critical areas for City staff to investigate. FNI provided the City with shapefiles of points where line segments should be broken, points where endpoints were not snapped to lines in close proximity, and locations where fire hydrants were not connected to water lines. The City reviewed the shapefiles and made the corrections as necessary.

Following the joining and splitting of lines, FNI met with the City to discuss the significance of a unique identifier for every asset in the GIS. The purpose of a unique identifier is to provide the City a simple and sustainable method to locate and identify valves, pipes and fire hydrants. The City chose to utilize an alpha-numeric naming convention where the first letters (WLM-Water Line Main, WV-Water Valve, FH-Fire Hydrant) determine the type of asset and the 4 digit number that follows is specific to each asset. The City assigned a unique ID to every valve, fire hydrant and water line in the GIS.

5.2 MODEL DEVELOPMENT PROCESS

The water model was developed using WaterGEMS V8i software by Bentley and contains all pipes in the distribution system. The pipes were imported into the model from the City's geographic information system (GIS). Junctions were created at each endpoint of a pipe using the water modeling software. Hazen-Williams roughness coefficients for pipes were assigned based on the installation year and pipeline diameter and are listed in **Table 5-1**. All pumping, storage and valve facilities were manually added to the model based on as-built drawings, where available, and information provided by the City.

Table 5-1 Initial C-Value Assignment

Installation Year	C-Value	
	Diameter < 12 inches	Diameter > 12 inches
2000 – present	130	130
1980 – 1999	110	120
1960 – 1979	100	110
Before 1960	90	100

FNI then distributed the existing water demands throughout the City. FNI received the water meter billing data from the City of Weatherford. This billing data included the address of each meter, the monthly water usage at each location, and other information used by Weatherford's billing department. Using the associated address from the billing data in conjunction with the Parker County streets, FNI was able to geocode the location of each meter. Geocoding is a process within the GIS software that allows the user to spatially reference given data under user-defined specifications. When geocoding the meter locations, a confidence rating is assigned to every meter to specify how well the meter address matches the parcel address. A confidence rating of 75 or higher is considered a good match. A rating less than 75 qualifies as an unmatched meter location meaning that GIS was not able to determine a location for the given meter. The active water meters in July 2010 were geocoded, and the associated consumption was assigned to the nearest model node.

5.3 FIELD TESTING

Field pressure testing was conducted June 24 through July 11, 2011. Nine pressure recorders were installed throughout the Central, Oak Ridge and West Lake Pressure Planes from June 24th through July 1st, and then moved to locations throughout the Franklin, Miller and Dubellette Pressure Planes from July 1st through 11th. Locations of the pressure recorders are illustrated on **Figure 5-1**. Using the pressure recorder data from the field testing, FNI was able to replicate system pressures during the

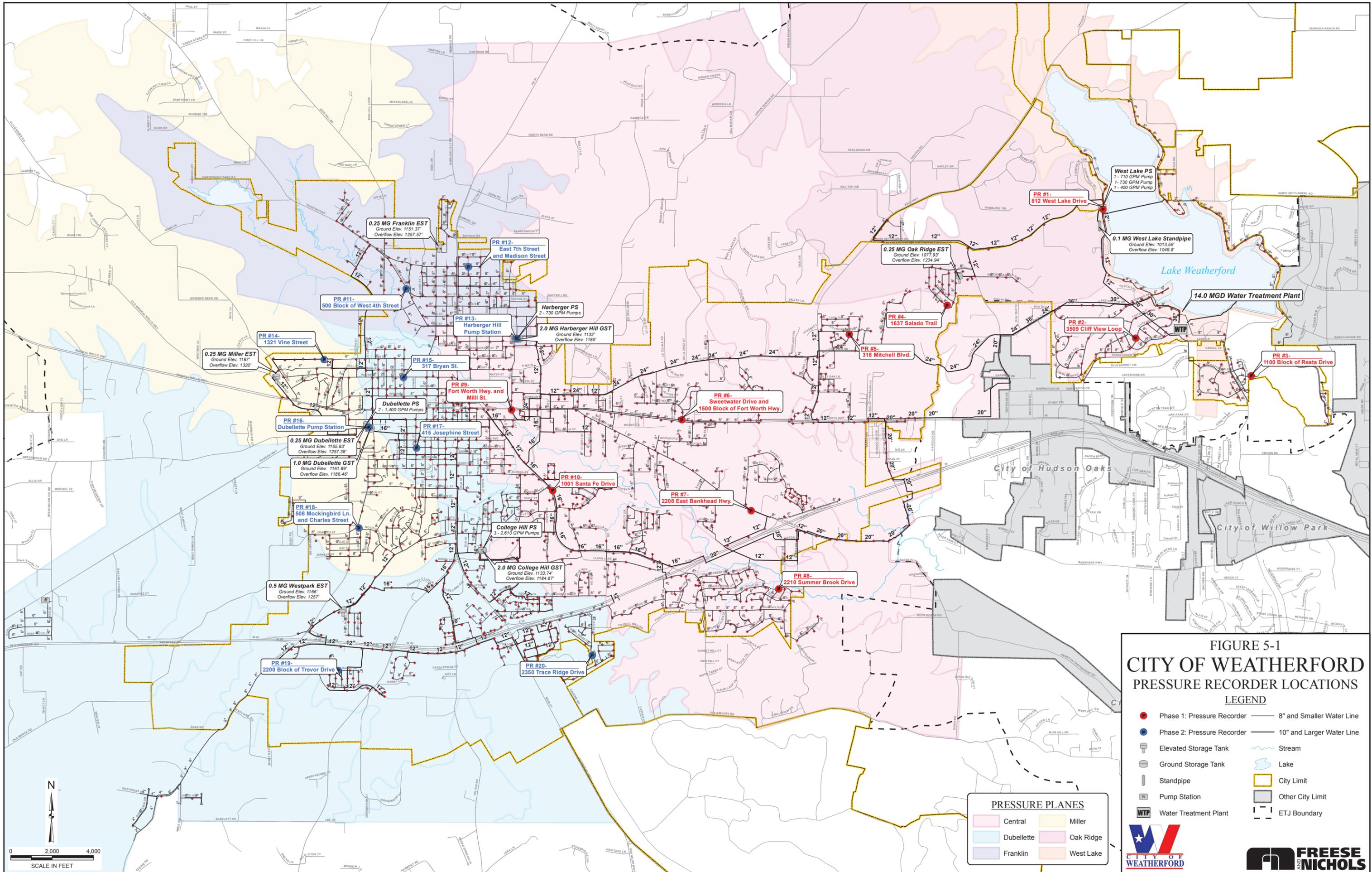
model calibration. **Appendix B** contains the pressure recorder data from the field testing period. The City provided SCADA data during the pressure testing period. Tank levels were recorded every 15 minutes, and flow was available for the WTP High Service Pump Station (HSPS) and College Hill PS. Additionally, the City provided pump on/off status for the West Lake, Dubellette, College Hill and Harberger Hill Pump Stations.

5.4 EPS CALIBRATION

In order to verify that the hydraulic model accurately represented the actual distribution system operation, model calibration analysis was performed. The calibration process involves adjusting system operations, C-values, demand allocation and peaking factors to match a known condition. Two separate 24-hour periods, occurring on June 29th and July 10th, were selected for calibration. Two separate days were used for calibration because testing was not performed citywide at the same time.

5.4.1 Diurnal Curves

Flow, pump status and tank level data was utilized to calculate a diurnal curve by examining water going into (supply) and out of (demand) the distribution system. Because flow rates were not available for the Harberger, Dubellette and West Lake Pump Stations, these flows were estimated using pump status and rated capacities of pumps. Diurnal curves were developed for the Central, Dubellette, Franklin and Miller Pressure Planes and input to the model in one hour increments. The diurnal curve for the West Lake and Oakridge Pressure Planes were estimated. **Figure 5-2** presents the diurnal curve for the Central Pressure Plane for June 29th. The demand factors range from 0.81 to 1.13. The data showed that a peak hour demand of 9.12 MGD occurred at 7:45 AM. **Figures 5-3, 5-4** and **5-5** present the diurnal curves for the Dubellette, Franklin and Miller Pressure Planes for July 10th.



**FIGURE 5-1
CITY OF WEATHERFORD
PRESSURE RECORDER LOCATIONS
LEGEND**

- Phase 1: Pressure Recorder
- Phase 2: Pressure Recorder
- Elevated Storage Tank
- Ground Storage Tank
- Standpipe
- Pump Station
- Water Treatment Plant
- 8" and Smaller Water Line
- 10" and Larger Water Line
- ~ Stream
- ~ Lake
- ▭ City Limit
- ▭ Other City Limit
- - - ETJ Boundary

PRESSURE PLANES

	Central		Miller
	Dubellette		Oak Ridge
	Franklin		West Lake

0 2,000 4,000
SCALE IN FEET

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Figure 5-2 Diurnal Curve for Central Pressure Plane: June 29, 2011

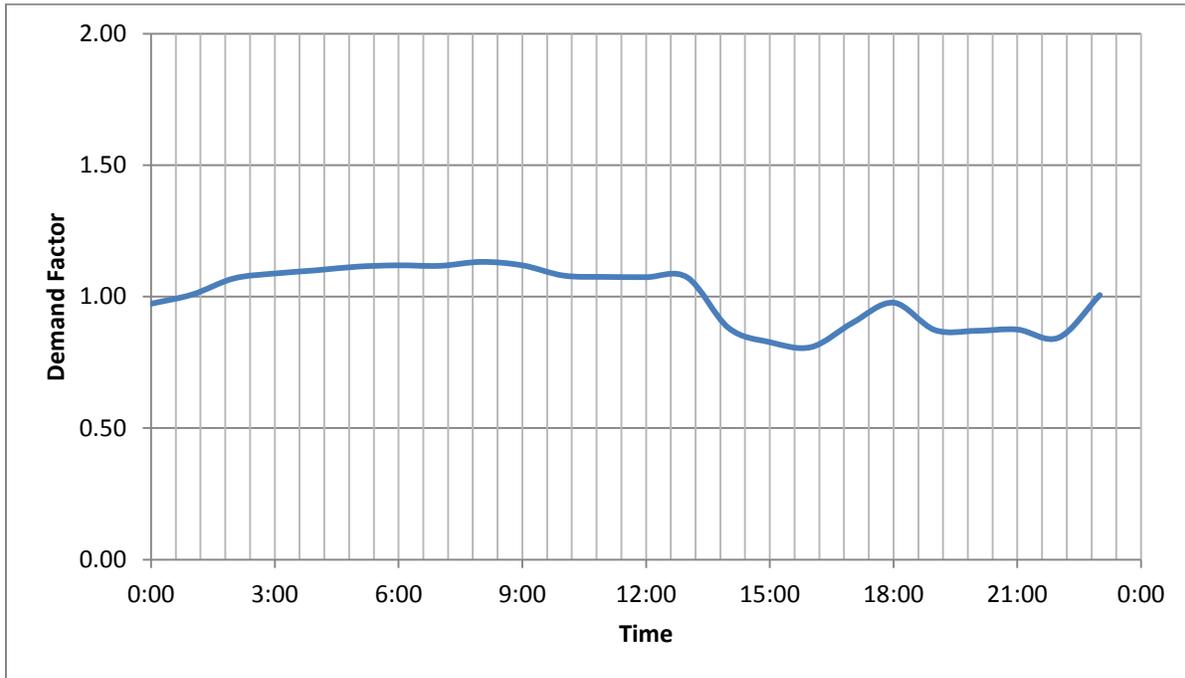


Figure 5-3 Diurnal Curve for Dubellette Pressure Plane: July 10, 2011

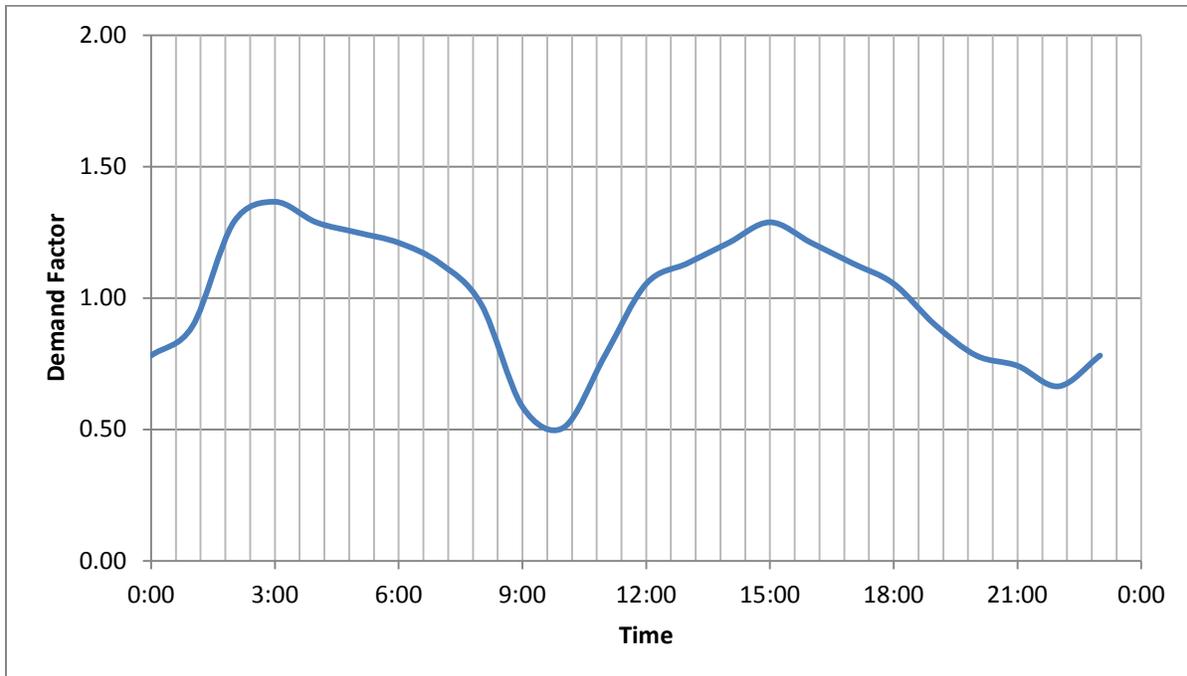


Figure 5-4 Diurnal Curve for Harberger Pressure Plane: July 10, 2011

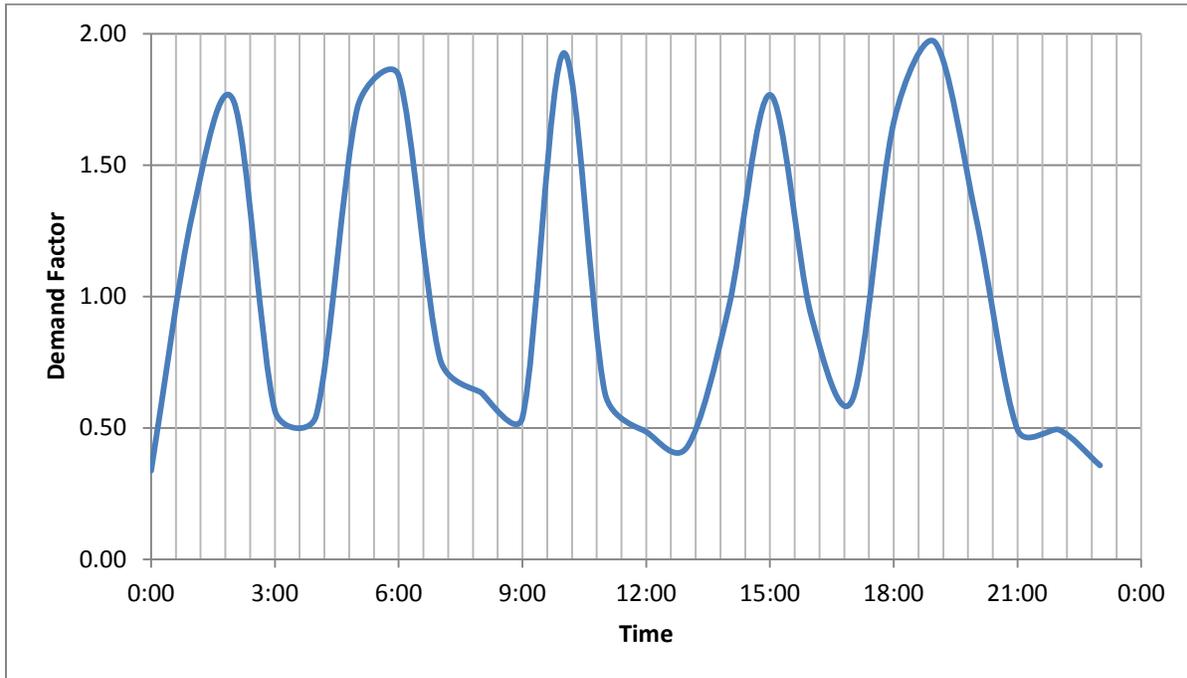
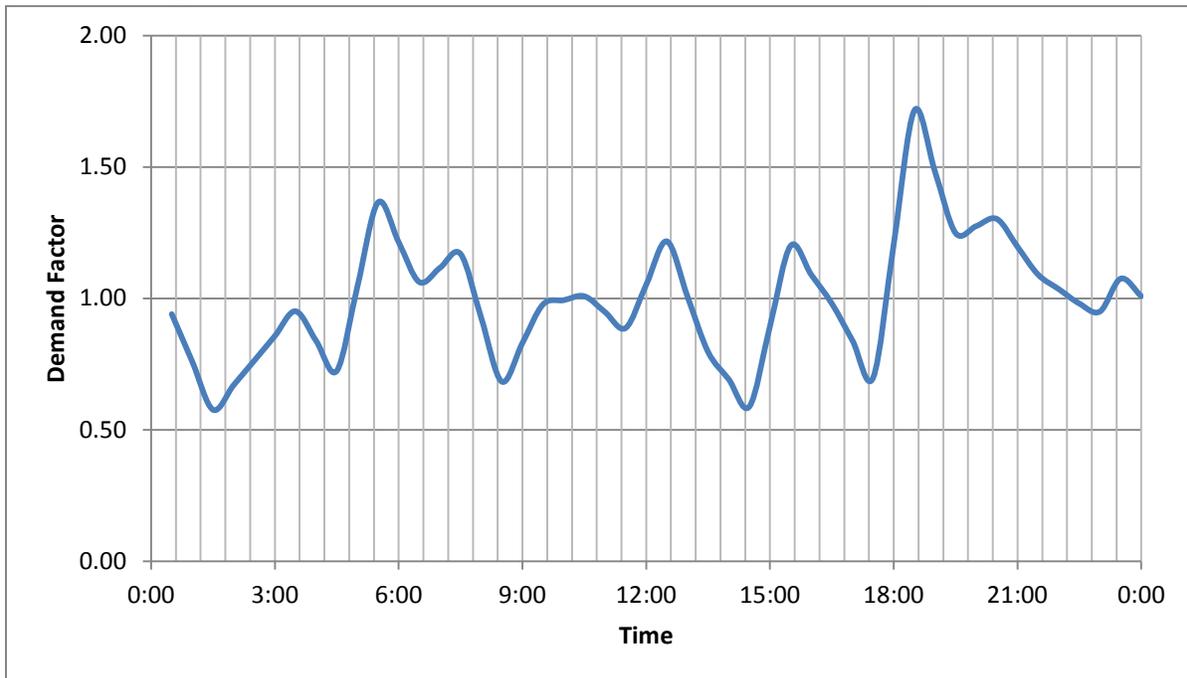


Figure 5-5 Diurnal Curve for Miller Pressure Plane: July 10, 2011



5.5 CALIBRATION ADJUSTMENTS

During the EPS calibration, adjustments were made to the model in order to match the known conditions of June 29th and July 11th. The SCADA values are an instantaneous reading of the flow at a given time and do not account for changes in the flow between time steps. Therefore, the diurnal curves were modified slightly to account for the changes in the system.

Pump controls at the Harberger Hill, College Hill, and Dubellette Pump Stations were determined and adjusted to match the pump run times monitored during the calibration period. The minimum and maximum levels at the Miller, Franklin, Dubellette and West Park ESTs that correspond with when the pumps kick on were determined using SCADA and applied to the model. Initial water surface elevations were also adjusted to match the SCADA data at the ground and elevated storage tanks. Valve open/close status was toggled where the GIS valve shapefile specified.

At the Dubellette Pump Station, SCADA shows that the two pumps were operated alternately throughout the day based on the water surface elevation in the Miller EST. FNI utilized one pump in the model to represent the pump station operation to avoid inputting complex controls, since the pumps are the same capacity.

Since the pressure recorders were moved, and the calibration dates are split between June 29th and July 11th, two model scenarios were set up to capture the system operations. The demands for the July 11th period were greater than that of June 29th. This affects the pump station flows and therefore alters the system pressures observed. By running two separate scenarios, pump on/off levels, tanks levels and pressures can be calibrated separately before being combined into a single scenario to capture system wide operations.

5.6 MODEL CALIBRATION RESULTS

The results of the EPS calibration are summarized on the graphs included in **Appendix C**. The graphs show modeled flows, pressures and tank levels versus recorded data at pump stations, tanks and pressure recorder locations. The calibration results suggest a good correlation between recorded and modeled values and provide confidence in the accuracy of the model.

At certain locations where the modeled graphs deviate from the actual graphs, a significant amount of time was spent trying to more closely match the actual patterns. The modeling results are within the accuracy range recommended.

At the Dubellette PS, the modeled pump run times slightly differed from the actual pump run times. The modeled tank levels at the Miller EST and the pressures at pressure recorders #203435 and #203018 matched the actual recorded data. However, the modeled pressures at pressure recorder #1670 were off slightly due to the difference in the Dubellette pump run times.

6.0 EXISTING SYSTEM HYDRAULIC ANALYSIS

In order to plan for the future, it is important to know how the system performs under existing conditions. The primary methods for analyzing the existing system with an extended period simulation hydraulic model are: pumping and storage facility capacity analysis, fire flow analysis and peak hour pressure analysis. Each analysis gives important insight as to how the system is functioning, where deficiencies may exist and where there is a need for expansions of pumping and storage facilities.

6.1 TCEQ REQUIREMENTS

As a public water utility, the City of Weatherford 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 is required to meet the TCEQ elevated storage capacity requirement of 100 gallons per connection (or a pressure tank capacity of 20 gallons per connection for systems up to 2,500 connections) and total storage capacity requirement of 200 gallons per connection.

A comparison of the City's existing storage capacity by pressure plane to TCEQ requirements is shown in **Table 6-1**. In addition to storage requirements, the City is also required to meet the pumping capacity requirements for each pressure plane presented in **Table 6-2**. Existing pumping capacity was evaluated and is summarized in **Table 6-3**.

Table 6-1 TCEQ Requirements for Existing Storage

Pressure Plane	Existing Population	Existing Connections	Total Storage (MG)		Elevated Storage (MG)	
			Existing	Required	Existing	Required
Central	10,634	4,756	2.5	0.95	2.5	0.48
Franklin	2,775	1,241	0.75	0.25	0.25	0.12
Dubellette	6,990	3,126	2.25	0.63	0.75	0.31
Miller	2,842	1,271	0.75	0.25	0.25	0.13
Oak Ridge	1,250	559	0.25	0.11	0.25	0.06
West Lake	759	340	0.10	0.07	0.1	0.03
Total	25,250	11,292	6.60	2.26	4.10	1.13

Table 6-2 TCEQ Service Pumping Requirements

Elevated Storage Capacity	Service Pumping Capacity Requirement ⁽¹⁾
≥ 200 gallons per connection	(1) Two service pumps with a minimum combined capacity of 0.6 gpm per connection at each pressure plane.
< 200 gallons per connection	(2) 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
⁽¹⁾ According to 30 TAC §290.45(b)(2)(F)	

Table 6-3 TCEQ Requirements for Existing Pumping Capacity

Pressure Plane	Existing Connections	Elevated Storage (MG)	Elevated Storage Gallons per Connection	Firm Pumping Capacity (MGD)	
				Existing	Required
Central	4,756	2.5	526	12.1	4.1
Franklin	1,241	0.25	201	1.1	1.1
Dubellette	3,126	0.75	240	7.5	2.7
Miller	1,271	0.25	197	2.0	1.4
Oak Ridge	559	0.25	447	1.6	0.5
West Lake	340	0.1	294	-	0.3
Total	11,292	4.10		24.3	10.1

Tables 6-1 and 6-3 indicate that the City’s current distribution system meets all TCEQ pumping and storage requirements. The TCEQ requirements for the Franklin Pressure Plane are greater than what is needed for existing demands.

6.2 FIRE FLOW ANALYSIS

The fire flow analysis is another critical method for evaluating a water system. Having both available fire flow and sufficient water pressure is important because it enables firefighters to respond to an

emergency in one area without negatively impacting other areas of the system. The recommended minimum conditions for fire flow in the City of Weatherford are 1,000 gpm of available flow at each hydrant, while maintaining a pressure of 20 psi at the fire hydrant. FNI performed a fire flow analysis on the existing system with the results shown in **Figure 6-1**.

Available fire flow is typically controlled by the static pressure and line size, with line size typically being the limiting factor. The areas shown in red and orange have an available fire flow less than 1000 psi while maintaining a residual pressure of 20 psi. In a majority of the cases, the areas are served by 6" and smaller lines with minimal or no looping.

6.3 PEAK HOUR ANALYSIS

The final analysis of the existing system is the peak hour analysis. The peak hour is defined as the greatest amount of water used in one hour during the year. Typically this is seen during the warmer summer months, but the peak hour is not limited to a warm weather event. During peak hour events, the distribution system experiences the highest demands, and as a result, the pressure drops. The purpose of the peak hour analysis is to highlight areas where the pressures are too low and where headlosses are too high. **Figure 6-2** shows the pressures within Weatherford's distribution system during the peak hour period. Plumbing code states that areas where the pressure exceeds 80 psi require a pressure reducing valve on the service line. Areas where pressures fall below 45 psi are not desirable from a customer standpoint. **Figure 6-3** shows the areas within Weatherford's distribution system where the headlosses through the distribution system are larger than desired.

Customers in the Central Pressure Plane have long experienced high pressures. The area south of I-20, near the river, typically experiences the highest pressures due to the low ground elevation and the high discharge pressures at the WTP. Pressures in this area regularly climb above 120 psi and were witnessed during the pressure testing period.

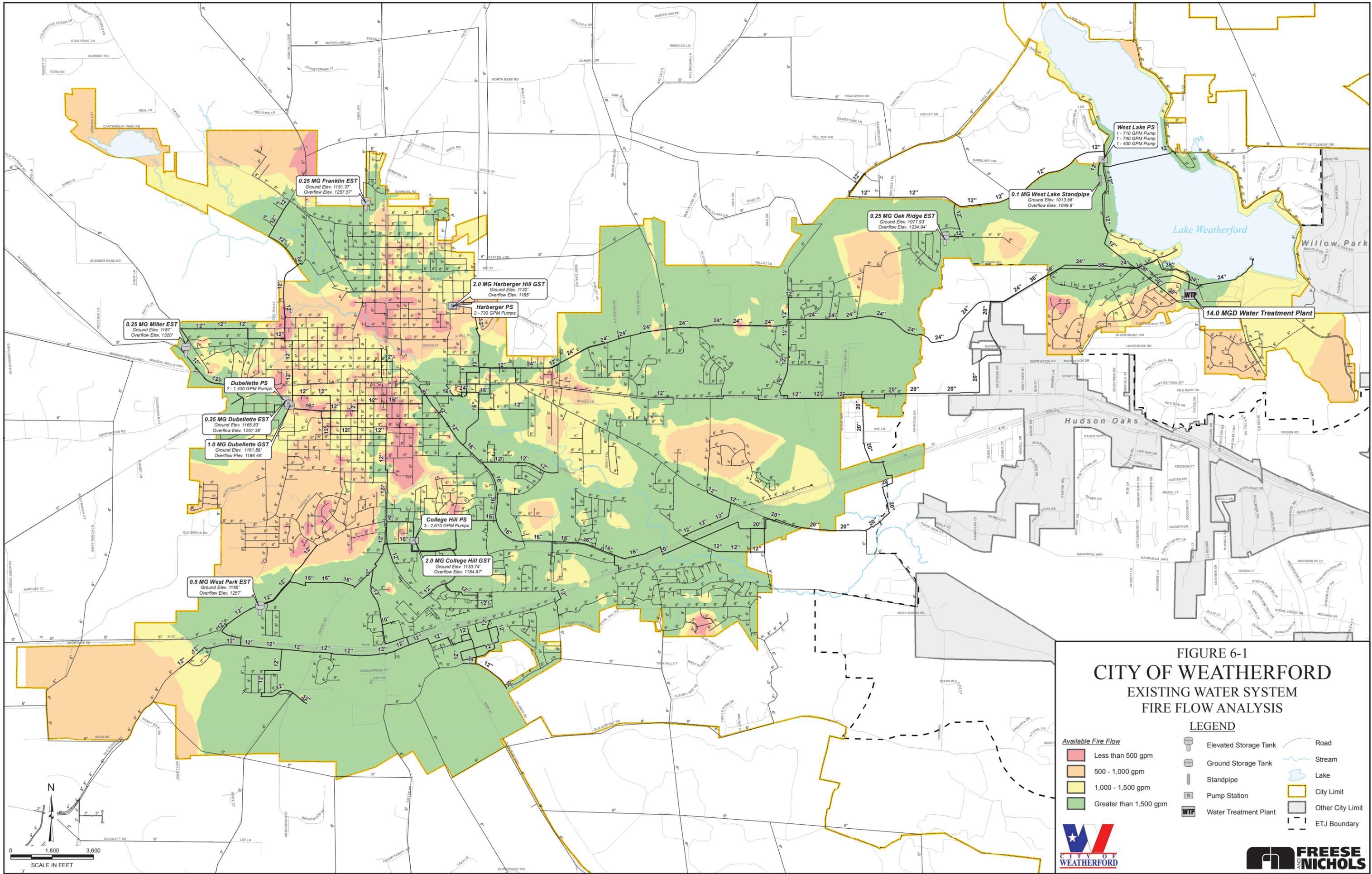
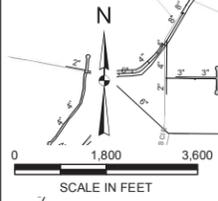


FIGURE 6-1
CITY OF WEATHERFORD
 EXISTING WATER SYSTEM
 FIRE FLOW ANALYSIS

- LEGEND**
- Available Fire Flow: Less than 500 gpm
 - Available Fire Flow: 500 - 1,000 gpm
 - Available Fire Flow: 1,000 - 1,500 gpm
 - Available Fire Flow: Greater than 1,500 gpm
 - Elevated Storage Tank
 - Ground Storage Tank
 - Standpipe
 - Pump Station
 - Water Treatment Plant
 - Road
 - Stream
 - Lake
 - City Limit
 - Other City Limit
 - ETJ Boundary



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 Updated: Thursday, January 05, 2017 10:18:48 AM

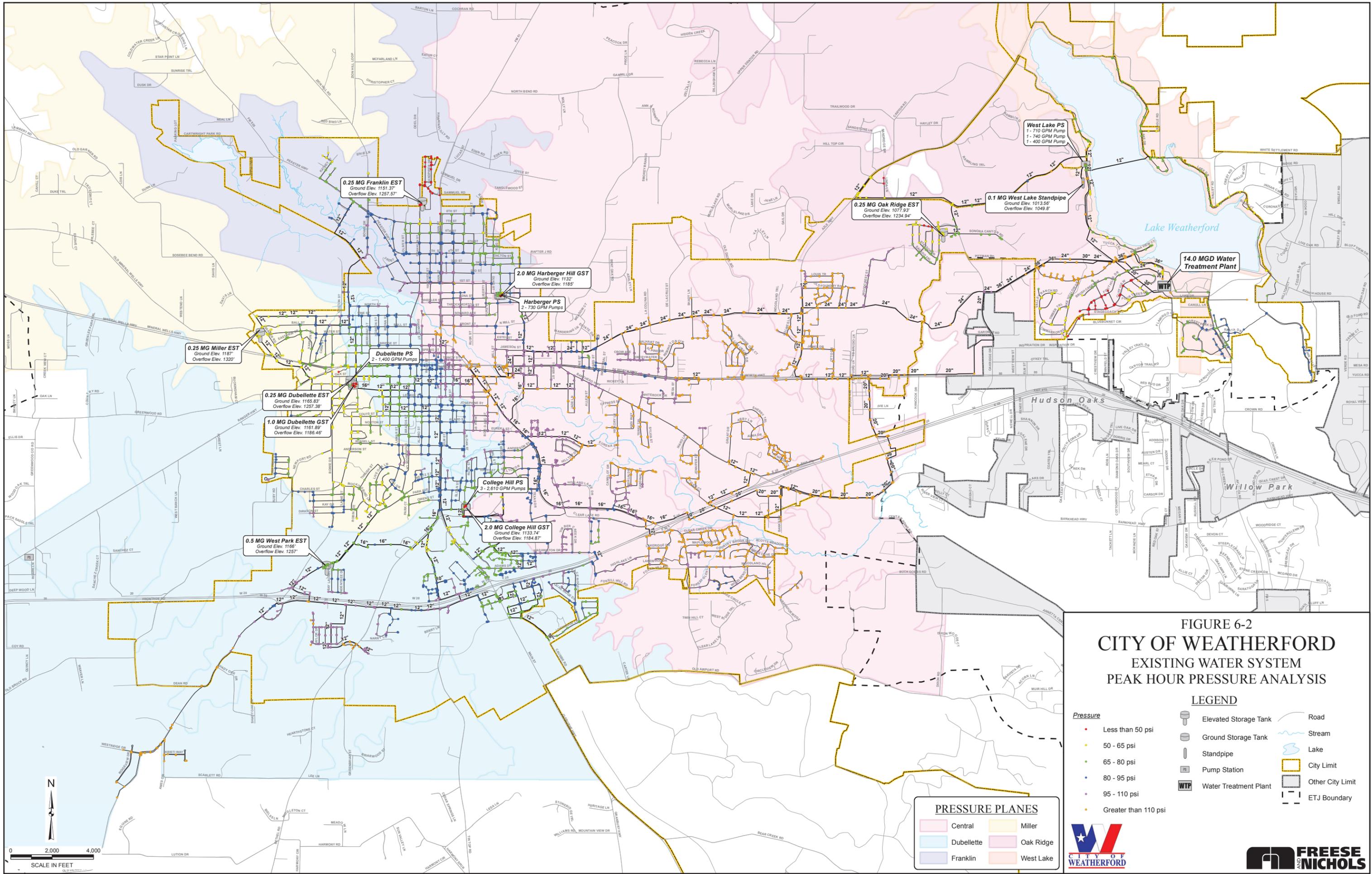


FIGURE 6-2
CITY OF WEATHERFORD
 EXISTING WATER SYSTEM
 PEAK HOUR PRESSURE ANALYSIS

LEGEND

Less than 50 psi	Elevated Storage Tank	Road
50 - 65 psi	Ground Storage Tank	Stream
65 - 80 psi	Standpipe	Lake
80 - 95 psi	Pump Station	City Limit
95 - 110 psi	Water Treatment Plant	Other City Limit
Greater than 110 psi	ETJ Boundary	

PRESSURE PLANES

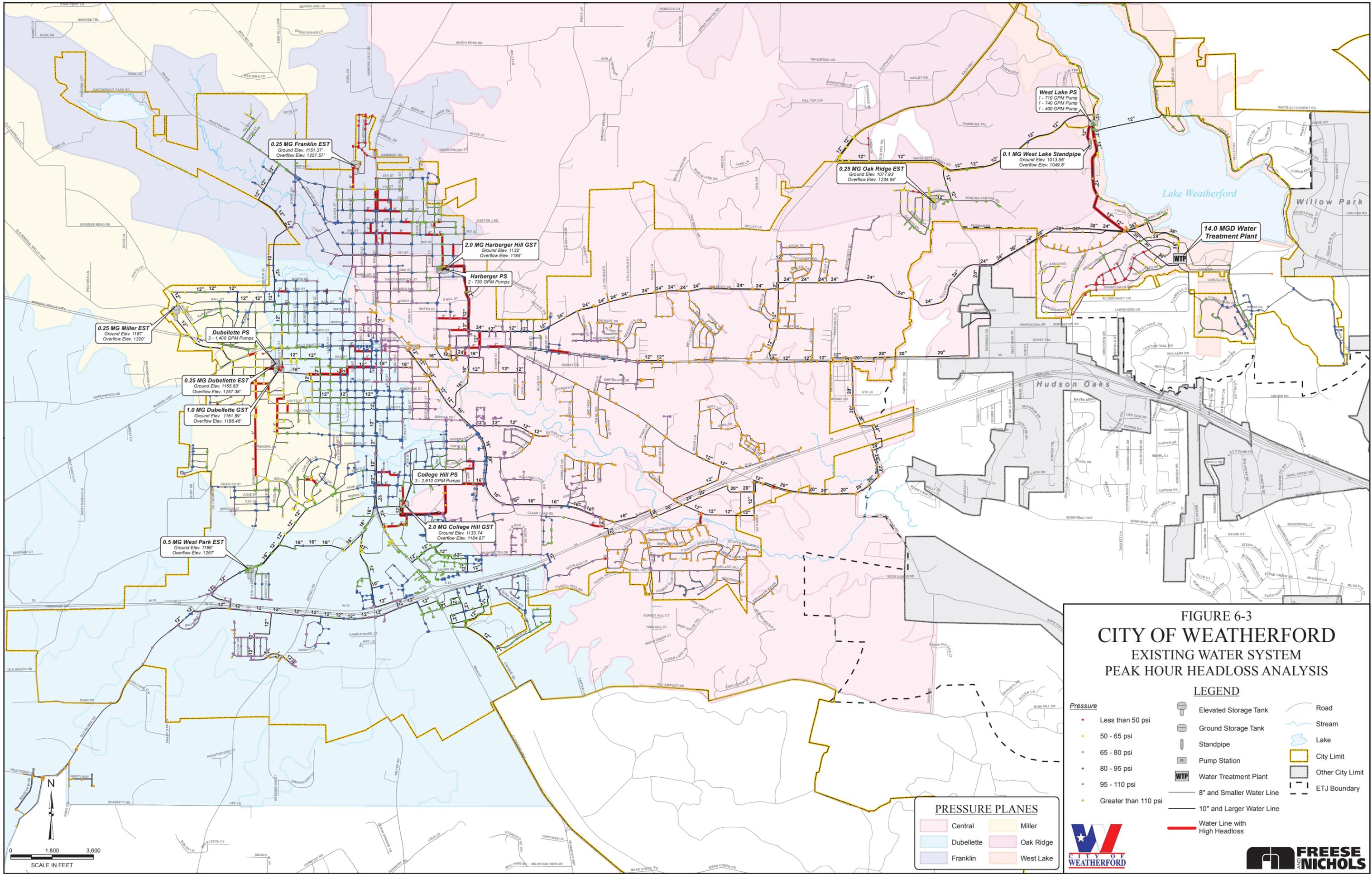
Central	Miller
Dubellette	Oak Ridge
Franklin	West Lake

SCALE IN FEET

0 2,000 4,000



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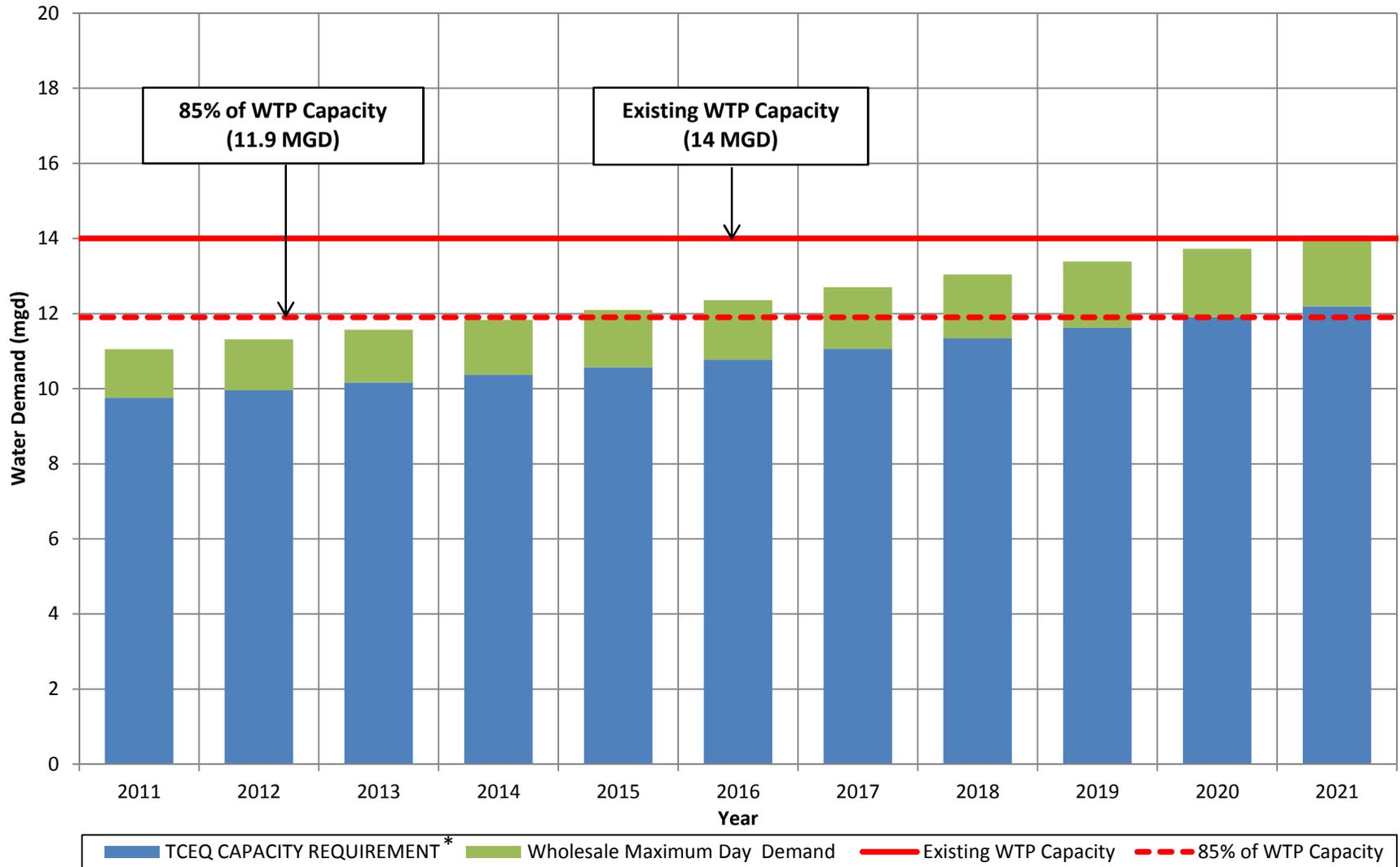
7.0 FUTURE WATER SYSTEM ANALYSIS

Hydraulic analyses were conducted to identify deficiencies in the City of Weatherford's water distribution system and to establish a capital improvements plan to reinforce the existing system and meet projected water demands through the buildout planning period. Various combinations of improvements and 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, simplifying system operations, meeting required fire flows, and maintaining residual pressures of at least 35 psi under peak hour demand conditions.

7.1 WATER TREATMENT PLANT CAPACITY

As the City of Weatherford continues growing towards buildout, the water treatment plant capacity will require expansion to meet future maximum day water demands. For this master plan, FNI assumed that all water would be supplied from Lake Weatherford and the Tarrant Regional Water District through the buildout planning period. **Figure 7-1** illustrates the required treatment plant capacity through the buildout planning period. The projected capacity is based on the TCEQ requirement of having 0.6 gpm per connection. The buildout required capacity of the water treatment plant is projected to be 65 MGD. The red line on the chart shows the existing plant capacity and the corresponding proposed expansions in 2021 and through buildout to meet buildout.

Figure 7-1
Weatherford Water Treatment Plant
TCEQ WTP Capacity Requirement vs. Existing Treatment Capacity



*0.6 gpm per connection plus wholesale maximum day demand.

7.2 FUTURE PRESSURE PLANE DELINEATION

Currently the City operates six pressure planes: the Central, Franklin, Miller, Dubellette, Oak Ridge, and West Lake Pressure Planes. Each pressure plane is designed to maintain an adequate range of pressure throughout its service area by using elevated tanks and pumps to maintain a consistent flow of water. The Franklin, Miller, Oak Ridge, and West Lake Pressure Planes will remain mostly unchanged in the future planning periods, except for small expansions to incorporate new growth around the city limits.

The Dubellette Pressure Plane will expand southward to the outer boundaries of the buildout service area in **Figure 2-2**. Locations where the ground elevation is lower than 1025 feet will be served through several regional PRVs to mitigate high pressures.

As discussed in Section 6, the range of elevations served by the existing Central Pressure Plane results in high pressures, greater than 120 psi. To mitigate the higher pressures, the Central Pressure Plane will be split into two pressure planes with the construction of a new GST and PS on Ward St. just north of Hwy. 180. The new ground storage tank will have a lower overflow elevation of 1130 feet and will lower the pressure in the proposed “East” Pressure Plane where high pressures are experienced in the existing system. The hydraulic grade for the “Central” Pressure Plane will still be established by the Harberger Hill, College Hill, and Dubellette GSTs.

As the City continues to grow to the far northwest and far northeast of the buildout service area, two new pressure planes are needed to serve future customers in those portions of the city. The new “Northwest” and “Northeast” Pressure Planes will be served by proposed ground storage tanks and pump stations and will include an elevated storage tank. The Northwest and Northeast Pressure Planes will maintain static hydraulic grades of 1374 feet and 1244 feet, respectively. The proposed delineation of the future pressure planes is shown on **Figure 7-2**.

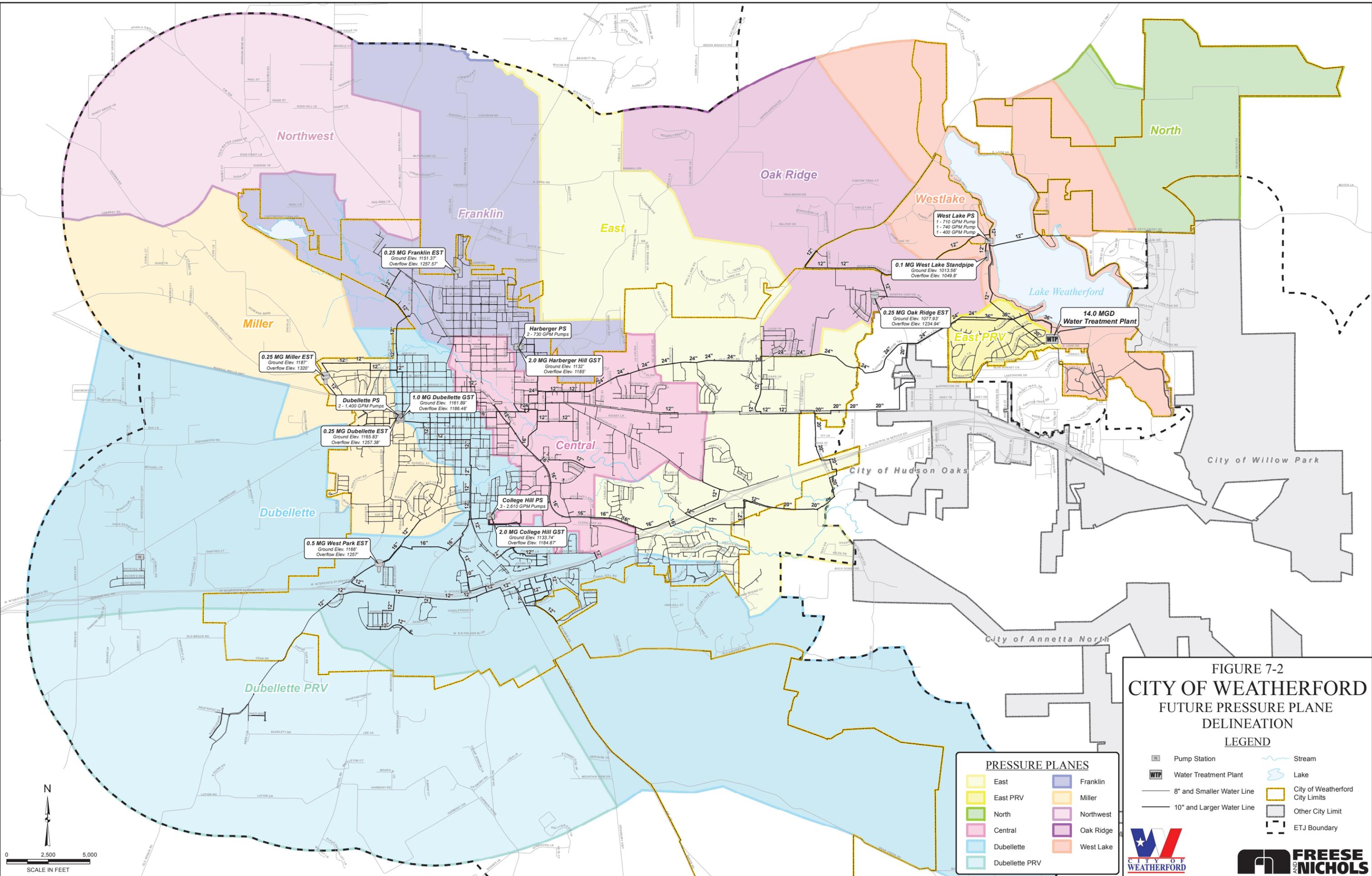
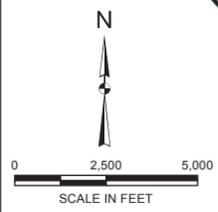


FIGURE 7-2
CITY OF WEATHERFORD
 FUTURE PRESSURE PLANE
 DELINEATION
 LEGEND

PRESSURE PLANES		LEGEND	
 East	 Franklin	 Pump Station	 Stream
 East PRV	 Miller	 Water Treatment Plant	 Lake
 North	 Northwest	 8" and Smaller Water Line	 City of Weatherford City Limits
 Central	 Oak Ridge	 10" and Larger Water Line	 Other City Limit
 Dubellette	 West Lake	 ETJ Boundary	
 Dubellette PRV			



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7.3 FUTURE RECOMMENDED STORAGE AND PUMPING EVALUATION

In order to properly plan and provide water service for the future planning periods, it is necessary to know how much water is needed for storage and distribution. FNI created graphs for each pressure plane showing required vs. proposed ground storage, elevated storage and pumping capacity. The vertical bars represent the water demand for the planning period, and the horizontal red line which runs the duration of the chart is the capacity in the system at the given time. The capacity changes over time with the expansion or decommissioning of facilities in order to meet the demands. These criteria are typically more stringent than TCEQ requirements and take into consideration many additional factors including operational flexibility, fire suppression and energy efficiency.

The design criteria used to determine the required elevated storage tank capacity is to maintain enough capacity to provide adequate storage for peak hour demands plus emergency storage for fire protection. For elevated storage tanks, the capacity is based on meeting the greater of either (a) 40% of the peak hour demand for 3 hours or (b) fire flow storage. The required capacity for emergency fire protection storage is calculated as the volume of water needed to meet a 1,500 GPM fire for a 3-hour time period. For performing fire flow analysis, the Texas Commission on Environmental Quality (TCEQ) states that a minimum pressure of 20 psi must be maintained at the location of the fire flow demand, and a pressure of 35 psi maintained in the throughout the rest of the system. In addition to these criteria, the City must also meet the TCEQ elevated storage capacity of 100 gallons per connection.

The design criteria used to determine required ground storage tank capacity is providing adequate storage for maximum day demands. For ground storage tanks, the capacity is based on meeting the maximum day demand for 3 hours. In addition to these criteria, the City must also meet the TCEQ total storage capacity of 200 gallons per connection.

All of the capacities shown in the following graphs indicate the capacity available for each pressure plane and not the actual capacity of the facility that is being called out. Only the red callouts indicate a proposed expansion of a given facility.

7.3.1 Central Pressure Plane Future System Capacities

The new Central Pressure Plane will be created following the construction of the Ward St. GST along Ward St. Water will be supplied through a new pump station at the ground storage tank. The Ward St. GST and PS must be large enough to supply water to the Central Pressure Plane, as well as the Franklin,

Miller, Dubellette and Northwest Pressure Planes. **Figures 7-3** through **7-5** show the Central Pressure Plane future system capacities. **Table 7-1** provides a breakdown of the amount of connections per water tank that trigger building a new or expanding an existing facility.

Figure 7-3 Central Pressure Plane Ground Storage Requirement

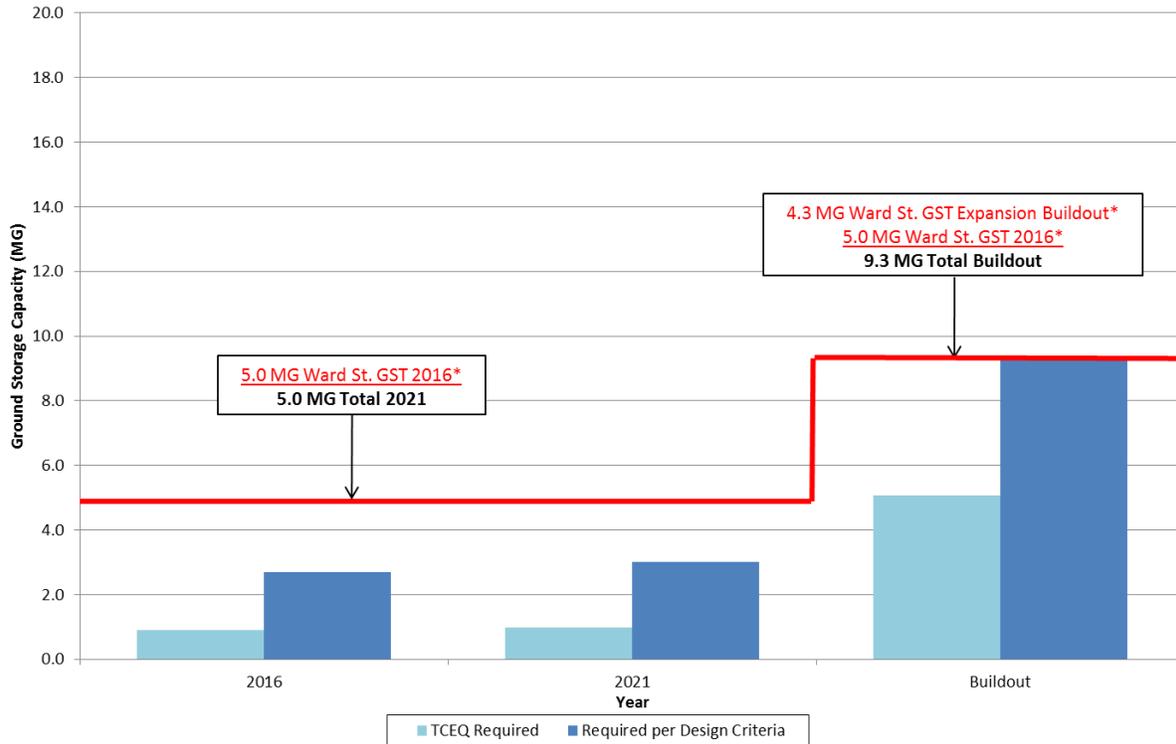


Figure 7-4 Central Pressure Plane Elevated Storage Requirement

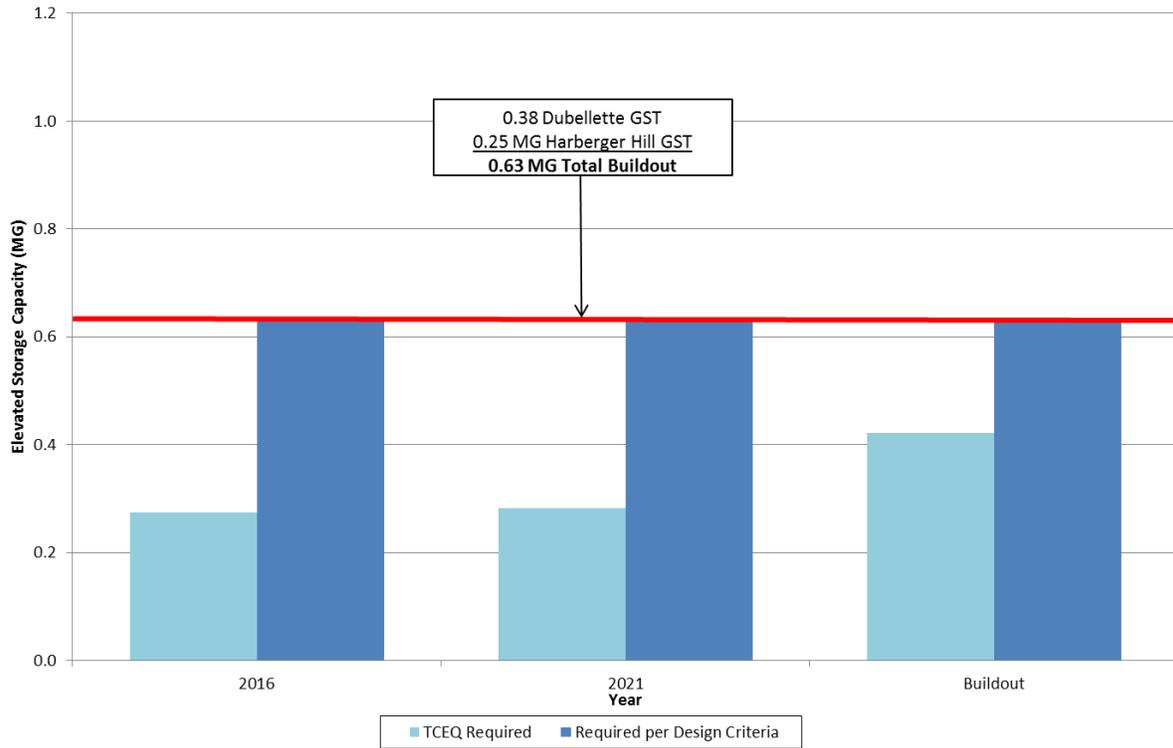


Figure 7-5 Central Pressure Plane Pumping Capacity Requirement

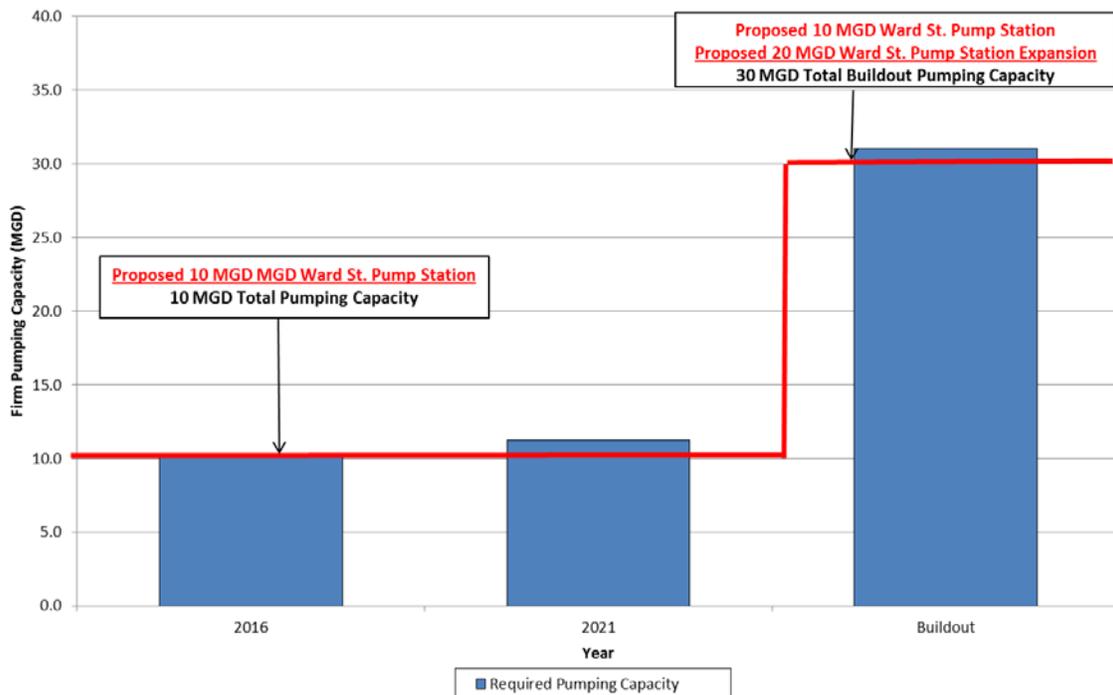


Table 7-1 Central Connections per Facility

Facility	Capacity	Current Connections Served	Max. # of Connections Served
Ground Storage			
Ward St. GST(2016)	5.0	-	14,309
Pump Station			
Ward St. PS	10.0	-	7,631

7.3.2 East Pressure Plane Future System Capacities

The East Pressure Plane will be created following the construction of the Ward St. GST along Ward St. Water will be supplied from the WTP and high service pump station. **Figures 7-6 through 7-8** show the Central Pressure Plane future system capacities.

Figure 7-6 East Pressure Plane Ground Storage Requirement

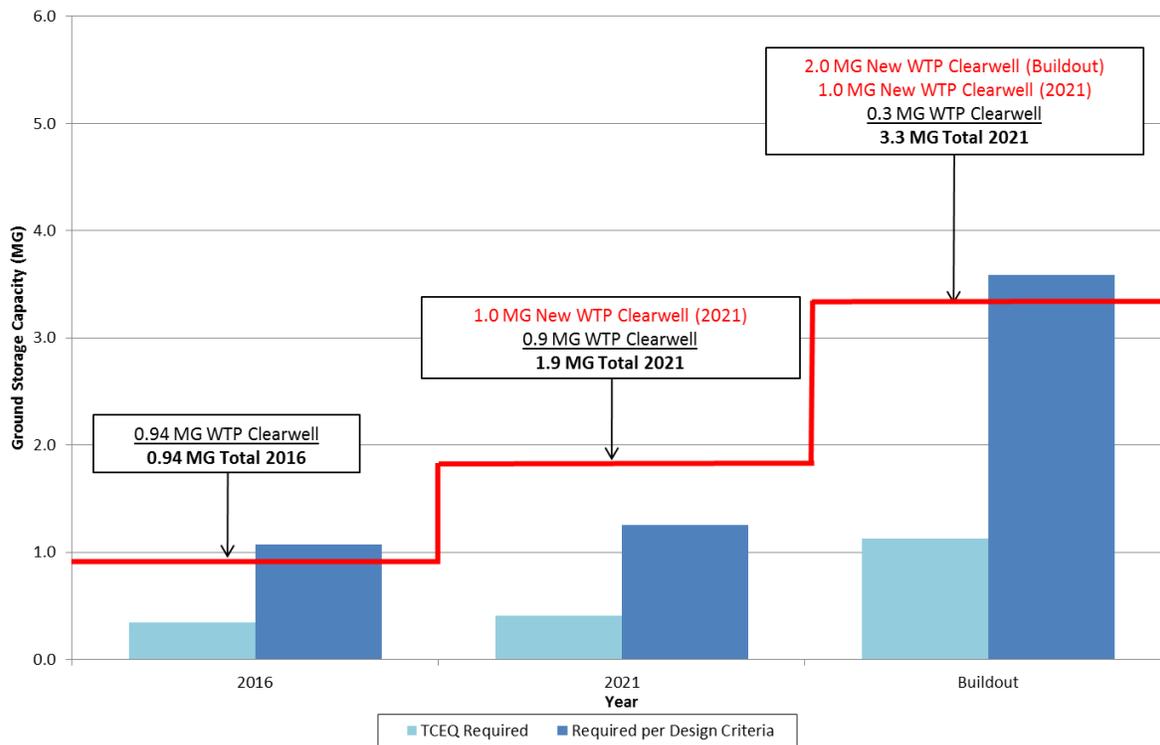


Figure 7-7 East Pressure Plane Elevated Storage Requirement

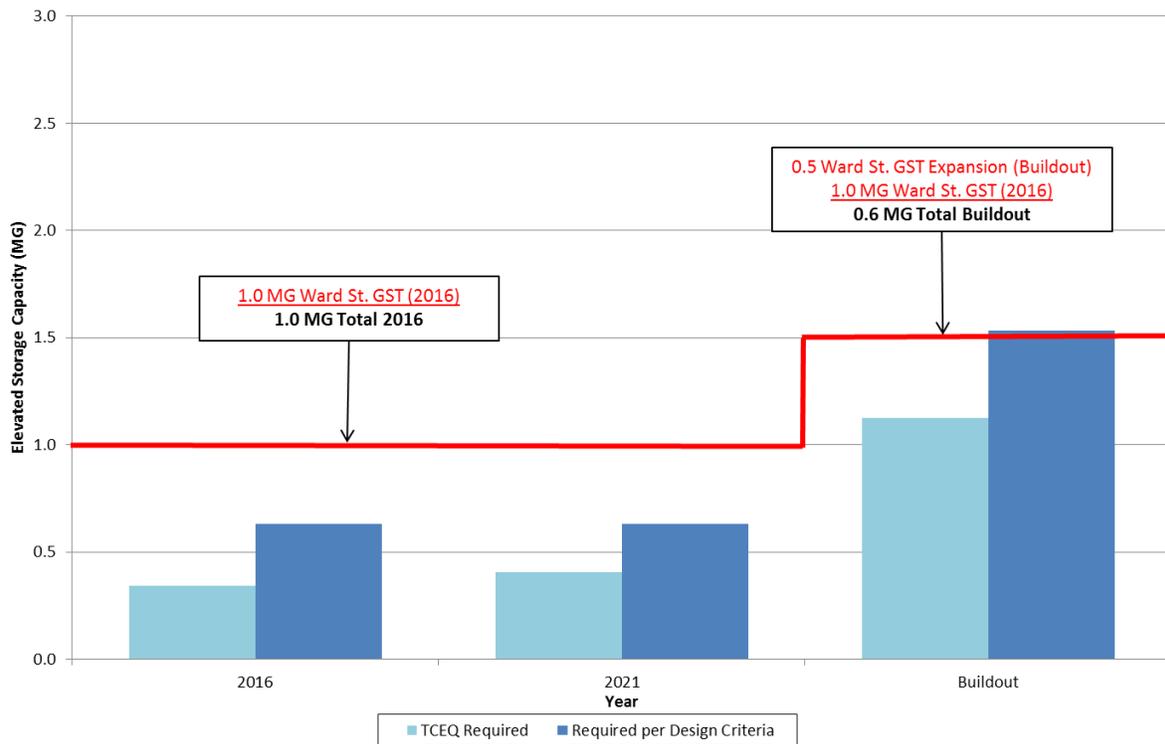
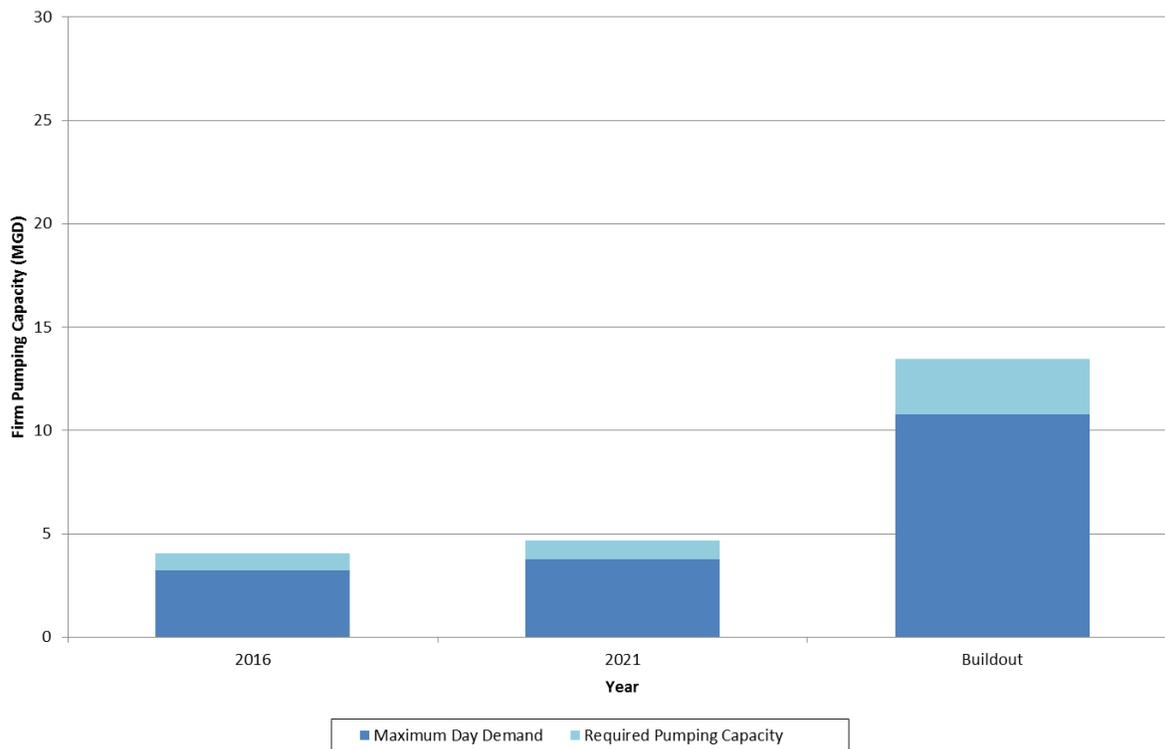


Figure 7-8 East Pressure Plane Pumping Capacity Requirement



7.3.3 Franklin Pressure Plane Future System Capacities

Based on the existing system analysis, the Franklin Pressure Plane has enough ground storage, elevated storage and pumping capacity to meet maximum day and peak hour requirements through the 2021 planning period. However, there is not enough pumping and elevated storage capacity to meet buildout demand conditions. FNI recommends building a new 0.5 MG EST in the northern portion of the pressure plane. FNI also recommends expanding the Harberger Hill PS to 7.0 MGD to meet buildout pumping capacity requirements. **Figures 7-9** through **7-11** show the Franklin Pressure Plane future system capacities. **Table 7-2** provides a breakdown of the amount of connections per water tank that trigger building a new or expanding an existing facility.

Figure 7-9 Franklin Pressure Plane Ground Storage Requirement

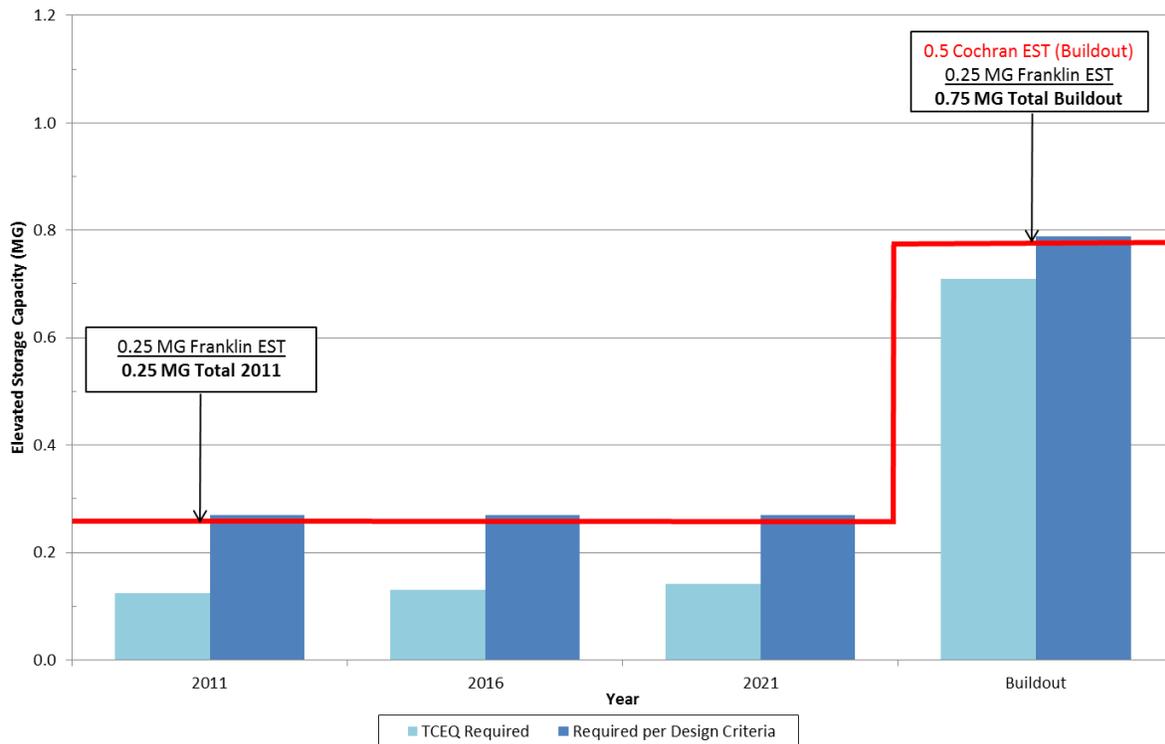


Figure 7-10 Franklin Pressure Plane Elevated Storage Requirement

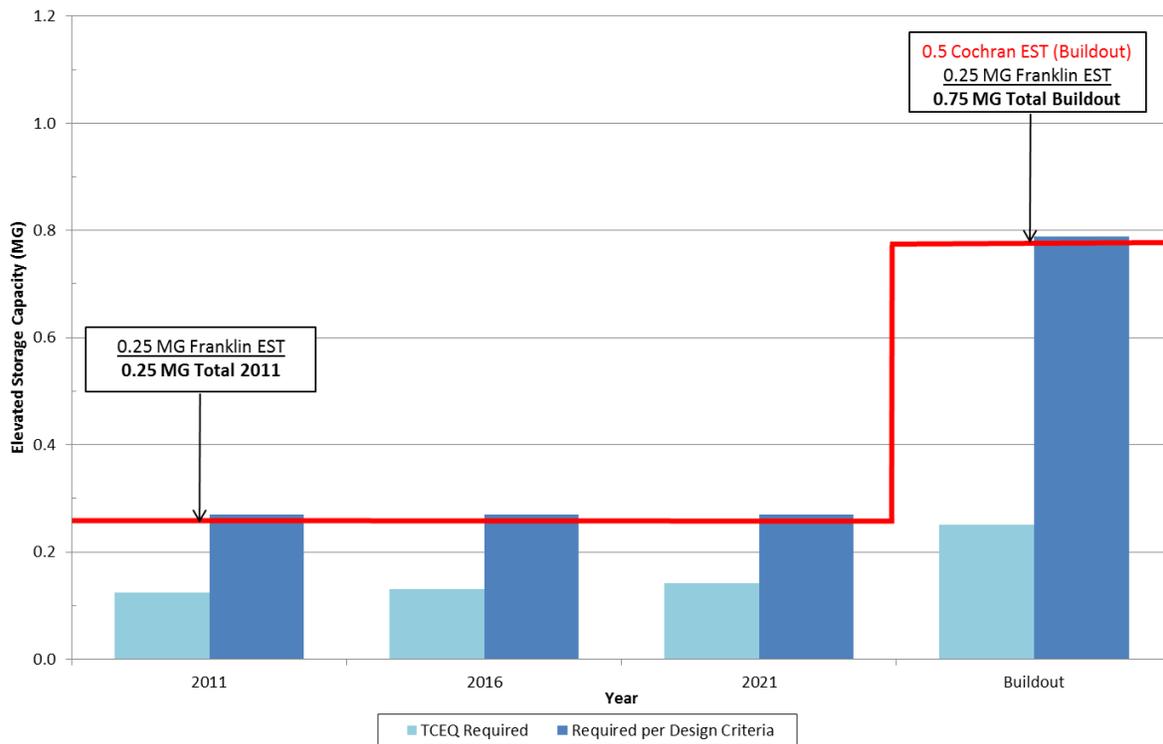


Figure 7-11 Franklin Pressure Plane Pumping Capacity Requirement

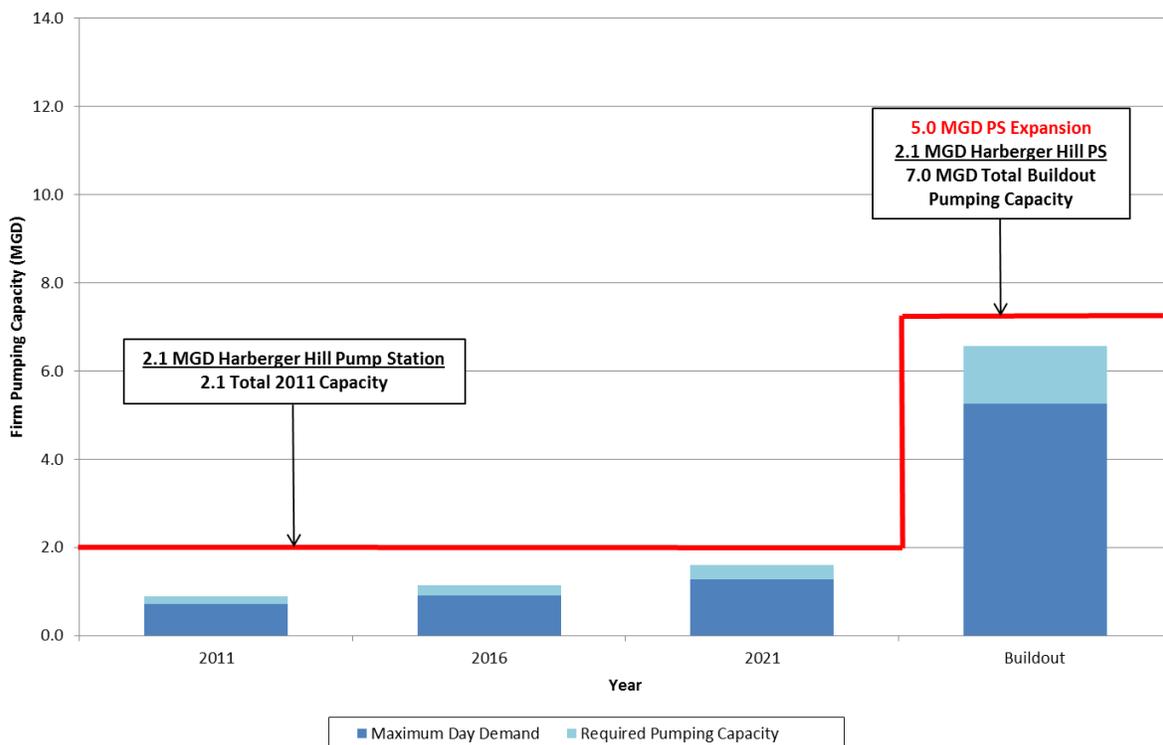


Table 7-2 Franklin Connections per Facility

Facility	Capacity	Current Connections Served	Max. # of Connections Served
Ground Storage			
<i>Existing Harberger Hill GST</i>	0.45	1,241	1,499
Elevated Storage			
<i>Existing Franklin EST</i>	0.25	1,241	1,851
Pump Station			
<i>Existing Harberger Hill PS</i>	2.00	1,241	1,777

7.3.4 Miller Pressure Plane Future System Capacities

The Miller Pressure Plane has enough ground storage, elevated storage, and pumping capacity to meet maximum day requirements through the 2021 planning period. To meet buildout demands, FNI recommends adding a 0.75 MG GST and a 5 MGD pump station expansion at the Dubellette PS. It is also recommended that a new 0.5 MG EST be constructed to meet maximum day elevated storage capacity requirements. **Figures 7-12** through **7-15** show the Miller Pressure Plane future system capacities. **Table 7-3** provides a breakdown of the amount of connections per water tank that trigger building a new or expanding an existing facility.

Figure 7-12 Miller Pressure Plane Ground Storage Requirement

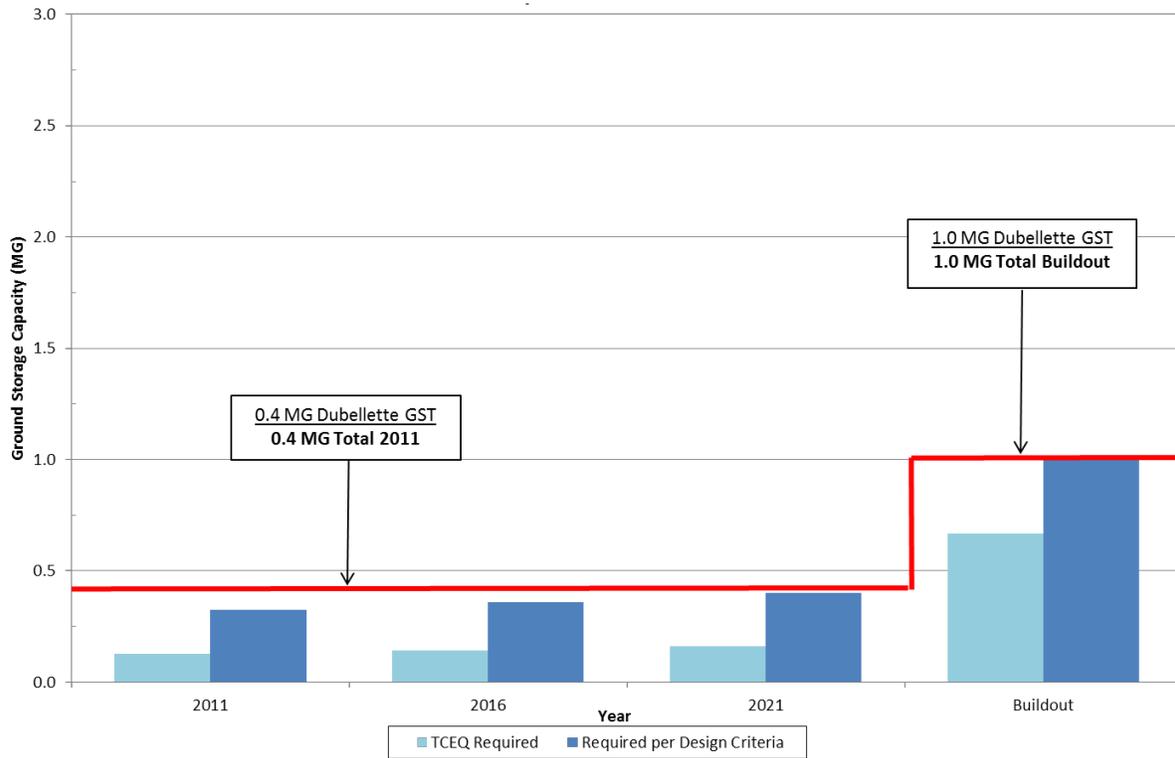


Figure 7-13 Miller Pressure Plane Elevated Storage Requirement

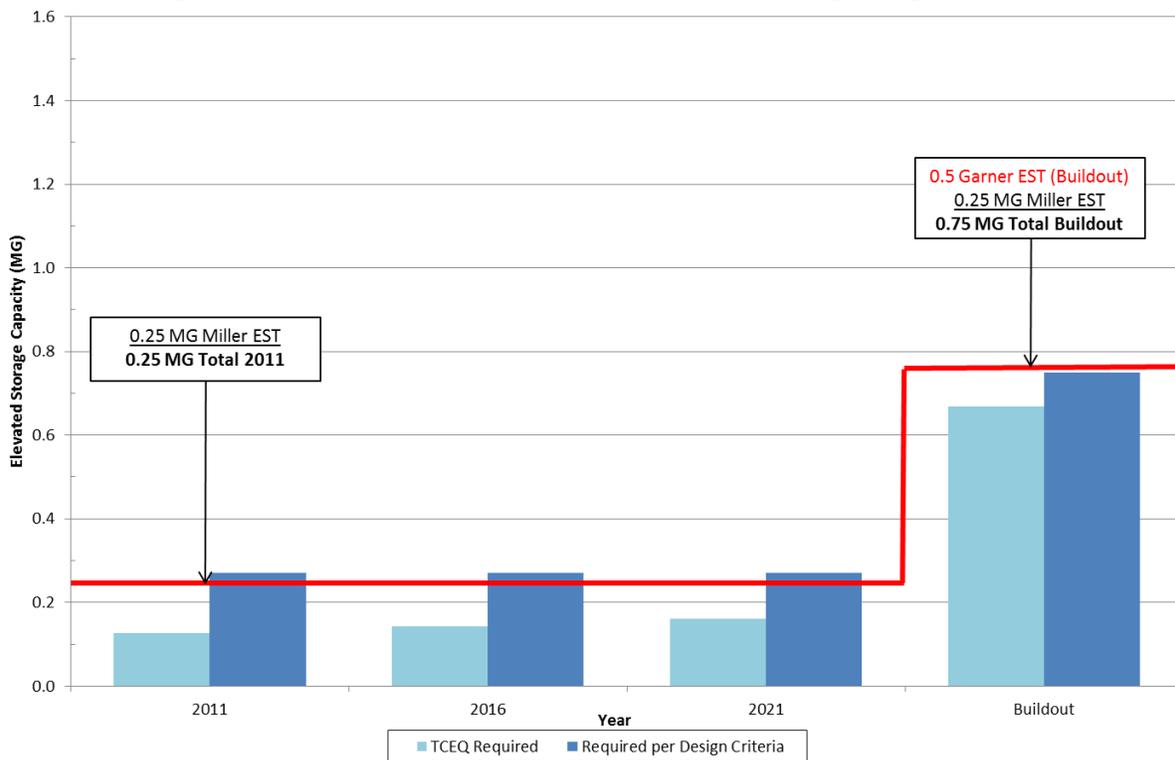


Figure 7-14 Miller Pressure Plane Pumping Capacity Requirement

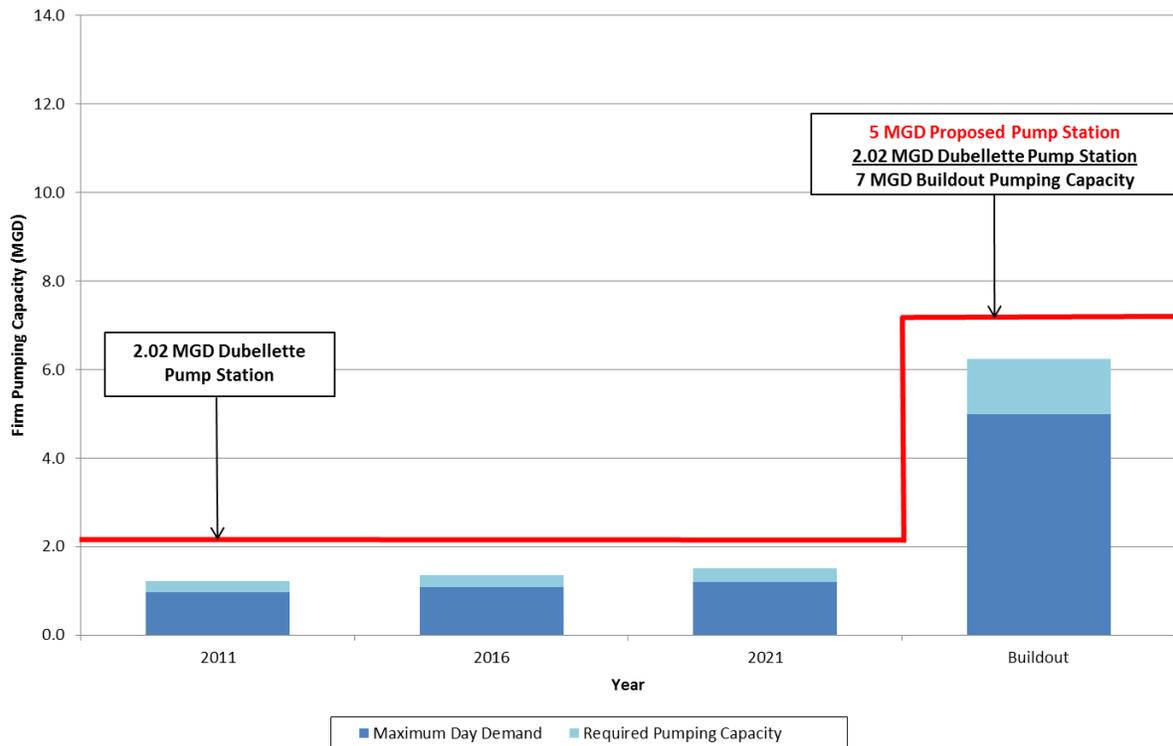


Table 7-3 Miller Connections per Facility

Facility	Capacity	Current Connections Served	Max. # of Connections Served
Ground Storage			
<i>Existing Dubellette GST</i>	0.40	1,271	1,576
Elevated Storage			
<i>Existing Miller EST</i>	0.25	1,271	2,188
Pump Station			
<i>Existing Dubellette PS</i>	2.00	1,271	2,101

7.3.5 Dubellette Pressure Plane Future System Capacities

The Dubellette Pressure Plane is projected to be the largest pressure plane by the buildout planning period. To meet buildout maximum day and peak hour demand conditions, FNI recommends constructing a new Ward St. GST and PS along with an additional 2.0 MG GST and 7 MGD PS at the existing Dubellette GST and EST site. **Figures 7-15 through 7-17** show the Dubellette Pressure Plane

future system capacities. **Table 7-4** provides a breakdown of the amount of connections per water tank that trigger building a new or expanding an existing facility.

Figure 7-15 Dubellette Pressure Plane Ground Storage Requirement

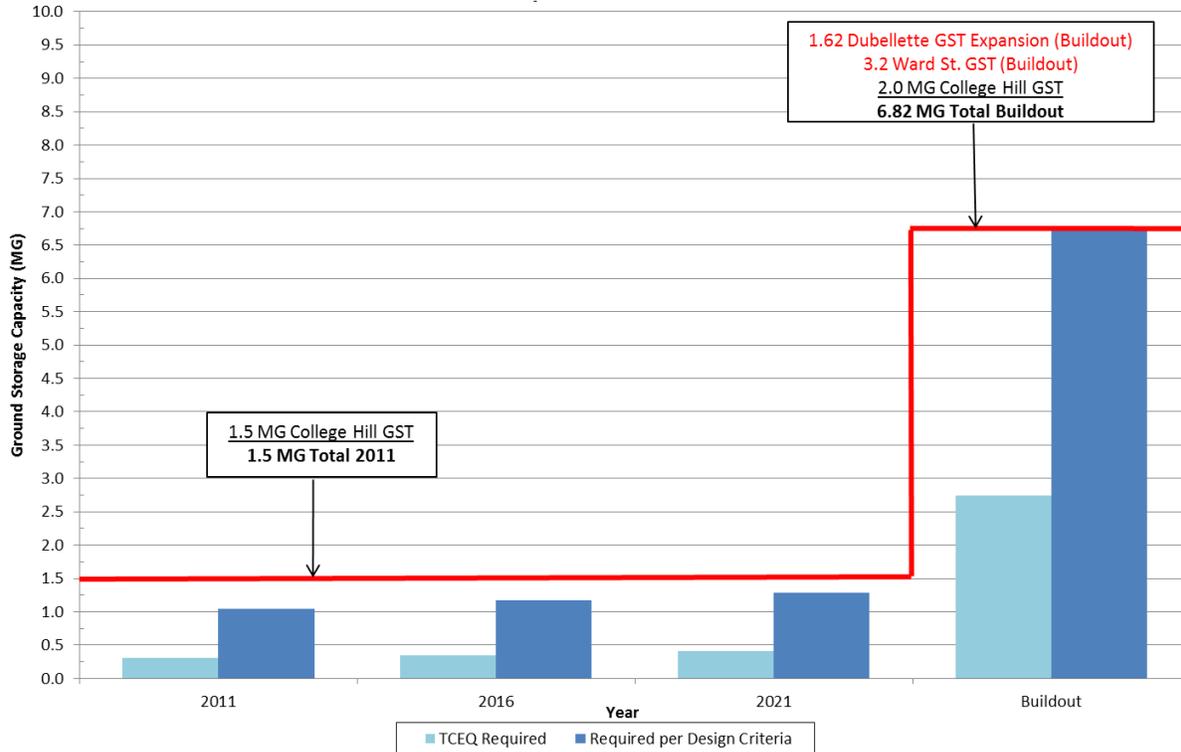


Figure 7-16 Dubellette Pressure Plane Elevated Storage Requirement

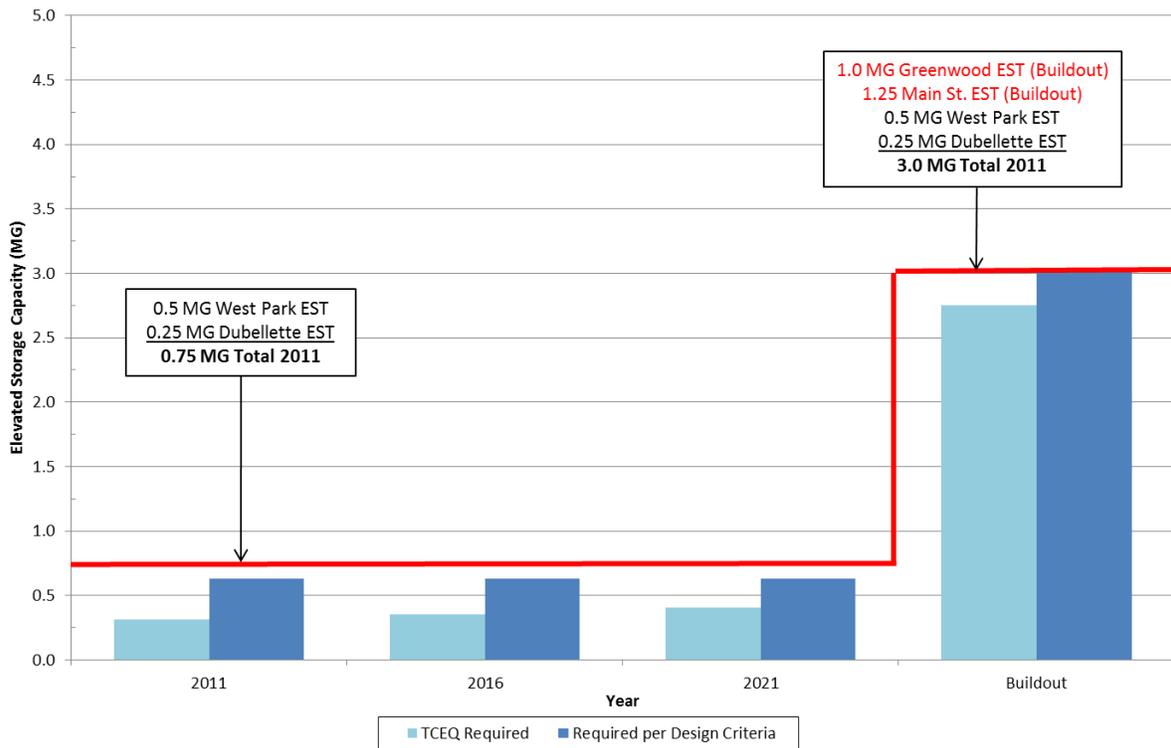


Figure 7-17 Dubellette Pressure Plane Pumping Capacity Requirement

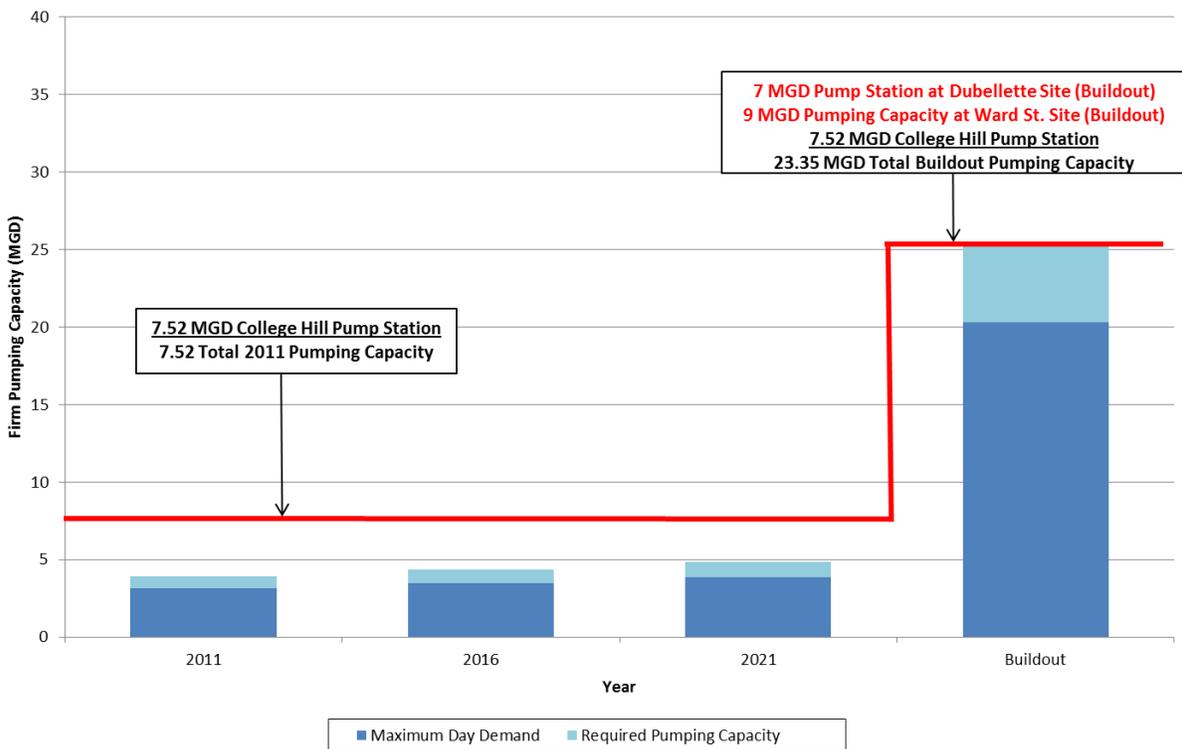


Table 7-4 Dubellette Connections per Facility

Facility	Capacity	Current Connections Served	Max. # of Connections Served
Ground Storage			
<i>Existing College Hill GST</i>	1.50	3,127	4,716
Elevated Storage			
<i>Existing Dubellette EST</i>	0.25	1,747	1,747
<i>Existing West Park EST</i>	0.50	1,380	3,493
Pump Station			
<i>Existing College Hill PS</i>	7.52	1,747	6,304

7.3.6 Oak Ridge Pressure Plane Future System Capacities

The Oak Ridge Pressure Plane water system has adequate capacity to meet all existing demand requirements through the 2021 planning period. However, improvements are necessary to meet buildout demand condition requirements. FNI proposes a new 1.25 MG Oak Ridge GST and 3.0 MGD Pump Station to supply water to the pressure plane. In addition to the GST and pump station, FNI recommends a new 0.25 MG EST to meet maximum day demand capacity requirements. **Figures 7-18** through **7-20** show the Oak Ridge Pressure Plane future system capacities. **Table 7-5** provides a breakdown of the amount of connections per water tank that trigger building a new or expanding an existing facility.

Figure 7-18 Oak Ridge Pressure Plane Ground Storage Requirement

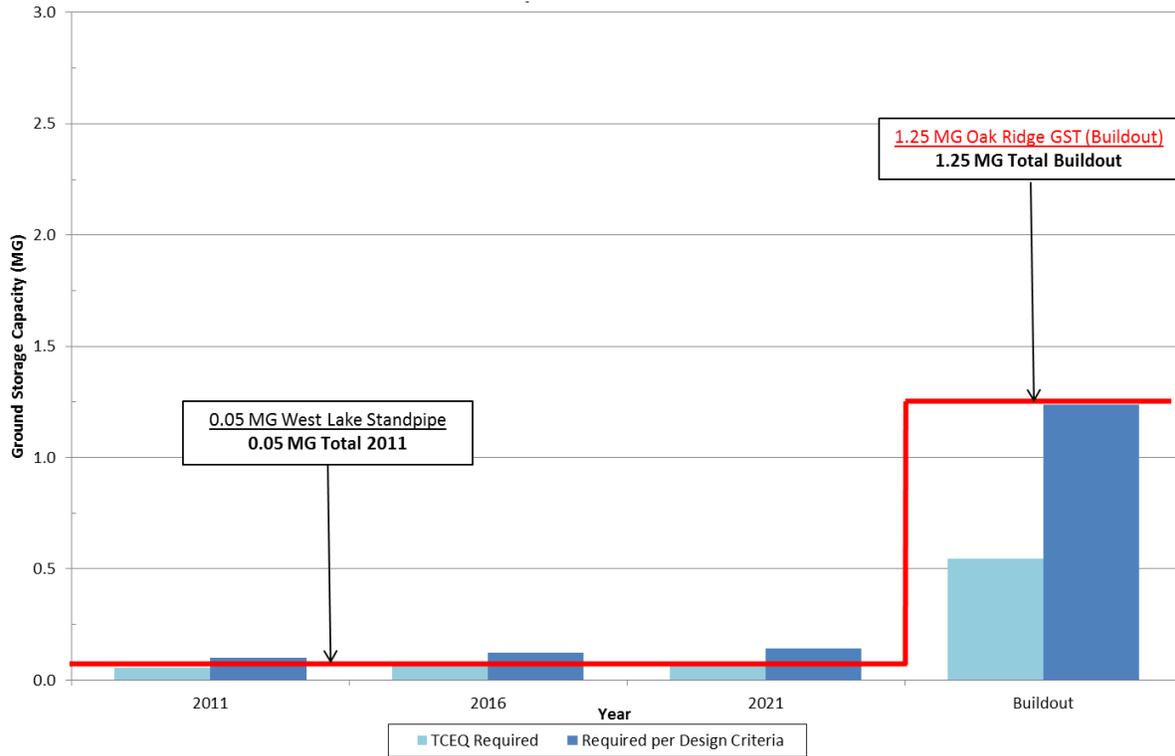


Figure 7-19 Oak Ridge Pressure Plane Elevated Storage Requirement

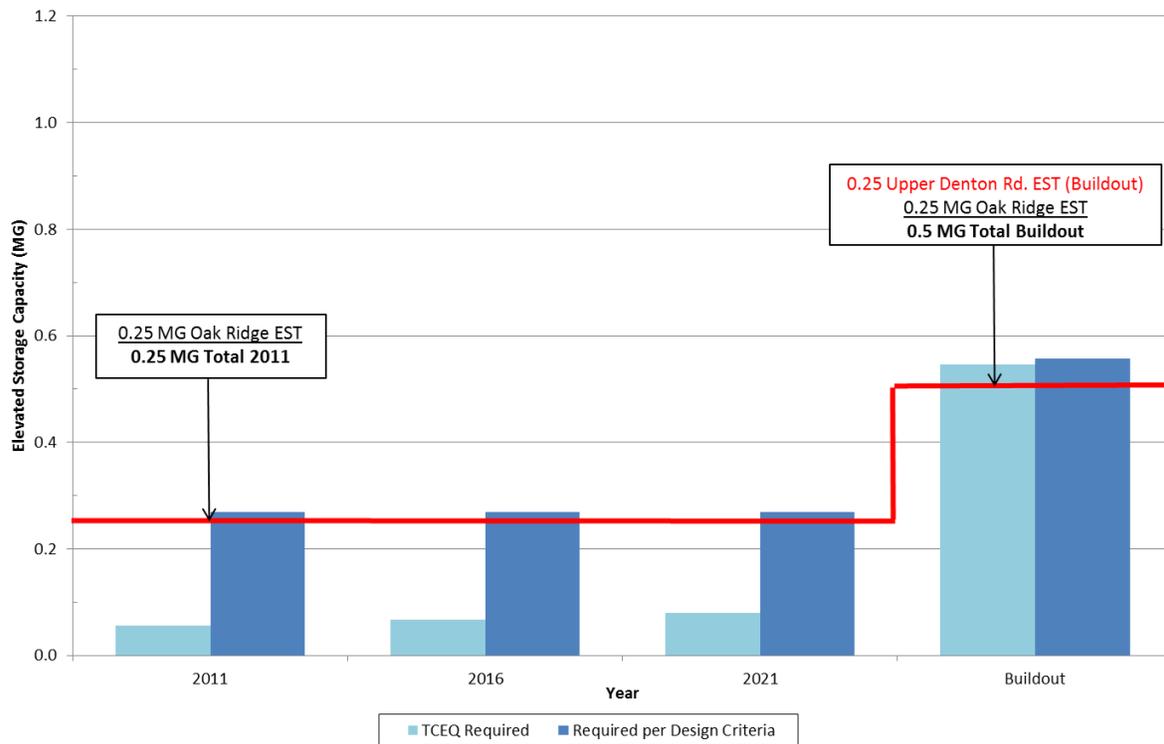


Figure 7-20 Oak Ridge Pressure Plane Pumping Capacity Requirement

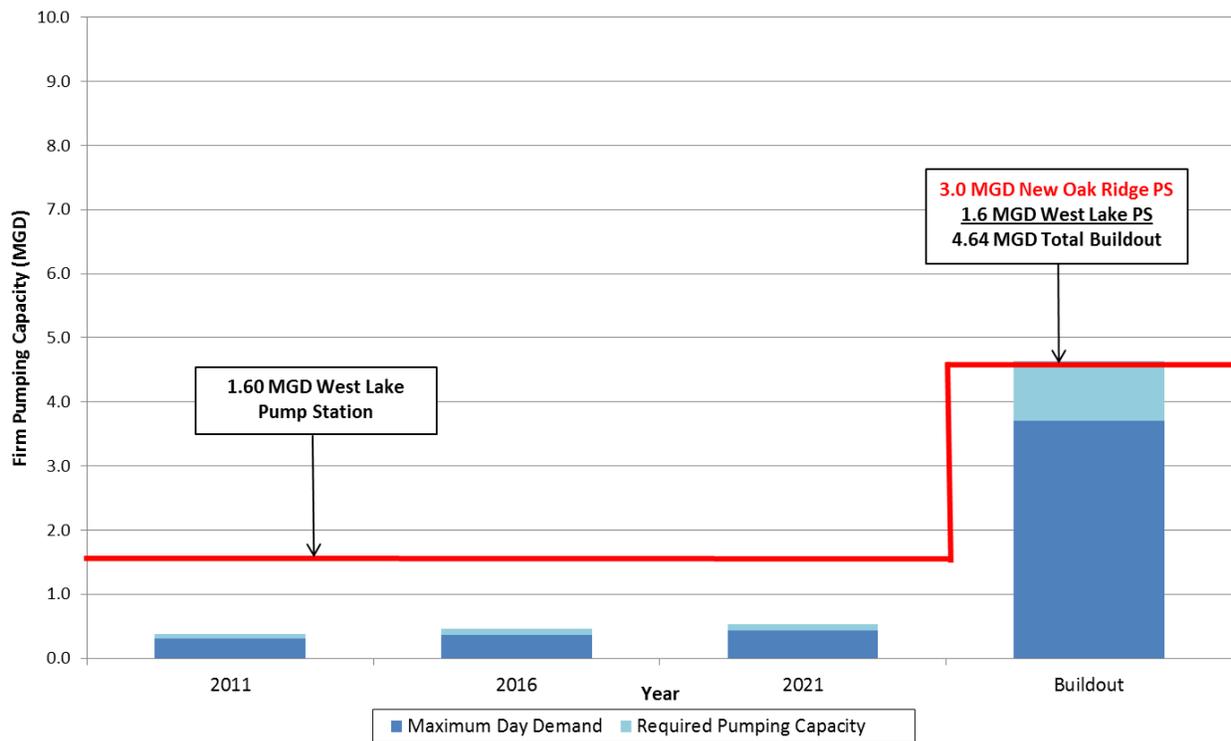


Table 7-5 Oak Ridge Connections per Facility

Facility	Capacity	Current Connections Served	Max. # of Connections Served
Elevated Storage			
<i>Existing Oak Ridge EST</i>	0.25	559	2,657
Pump Station			
<i>Existing West Lake PS</i>	1.60	559	2,041

7.3.7 West Lake Pressure Plane Future System Capacities

The West Lake Pressure Plane is a small pressure plane that encompasses the area around Lake Weatherford. The pressure plane is supplied through a PRV by the Water Treatment Plant. FNI recommends. **Figures 7-21** through **7-22** show the Oak Ridge Pressure Plane future system capacities. **Figure 7-22** regarding the elevated storage tank capacity indicates that the design criteria exceeds the existing capacity. This criteria is based on serving the fire flow demand for 3 hours. Based on the number of connections served by this pressure plane, the full design capacity is not necessary until the buildout planning period. **Table 7-6** provides a breakdown of the amount of connections per water tank that trigger building a new or expanding an existing facility.

Figure 7-21 West Lake Pressure Plane Ground Storage Requirement

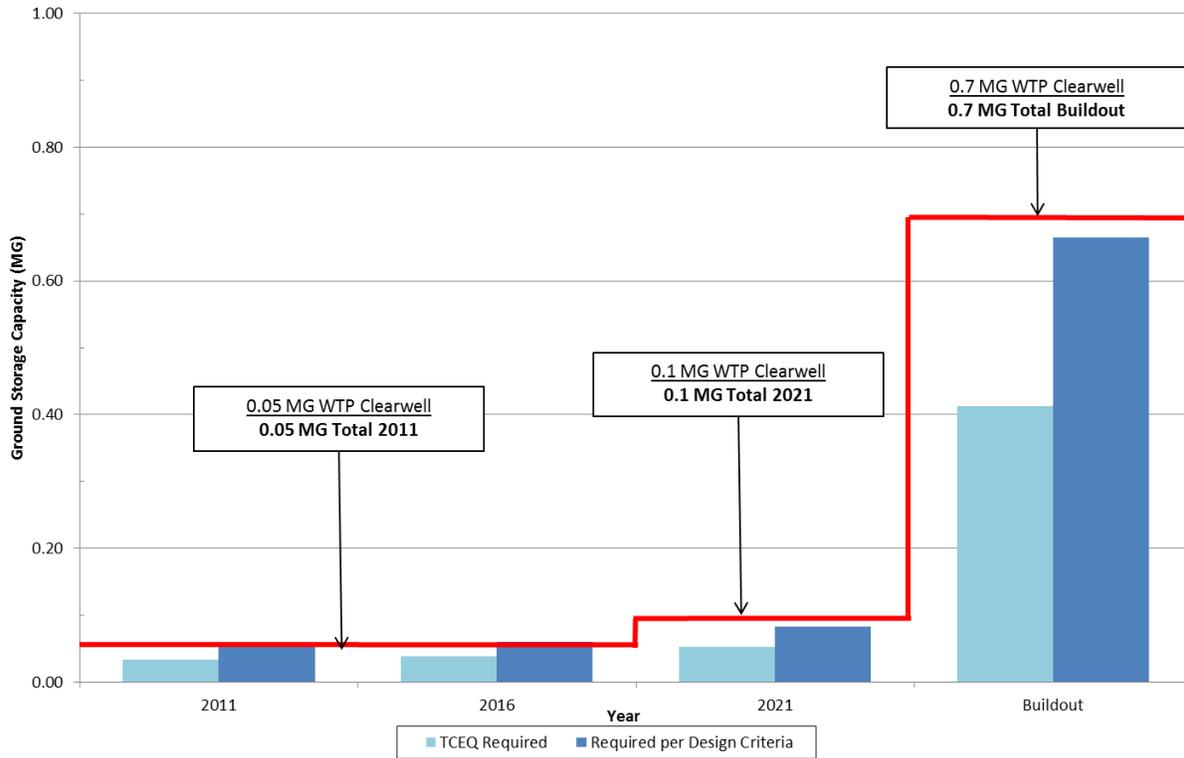


Figure 7-22 West Lake Pressure Plane Elevated Storage Requirement

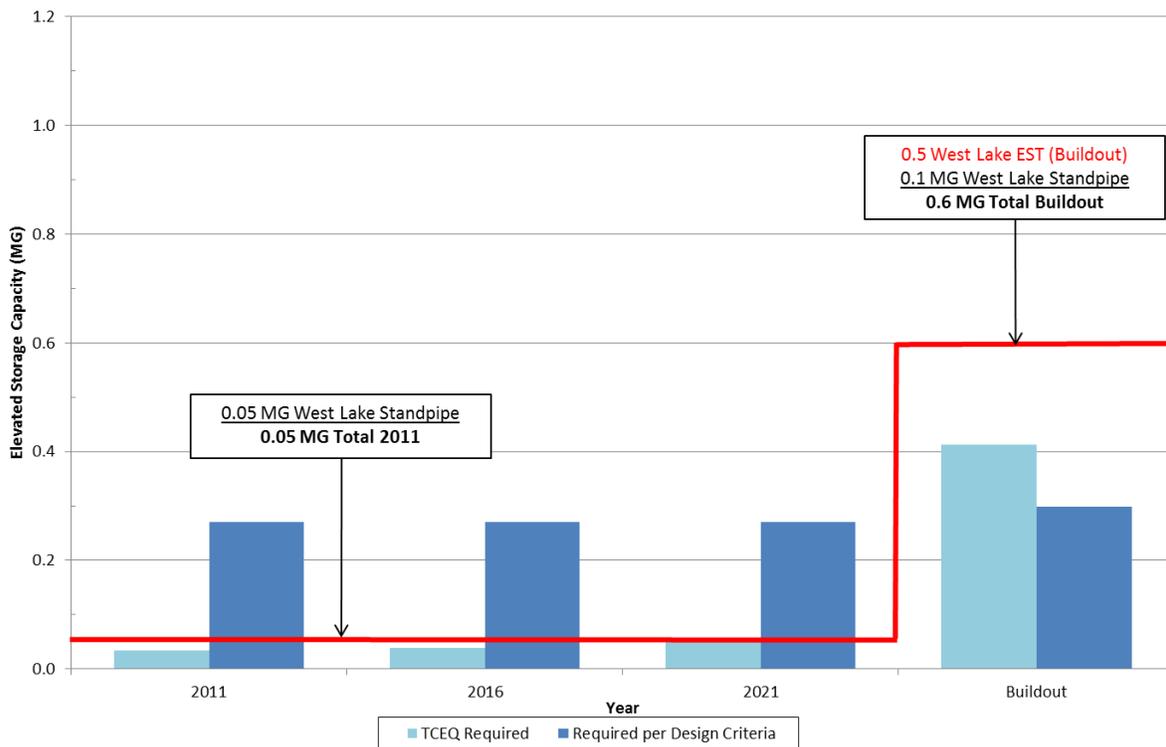


Figure 7-23 West Lake Pressure Plane Pumping Capacity Requirement

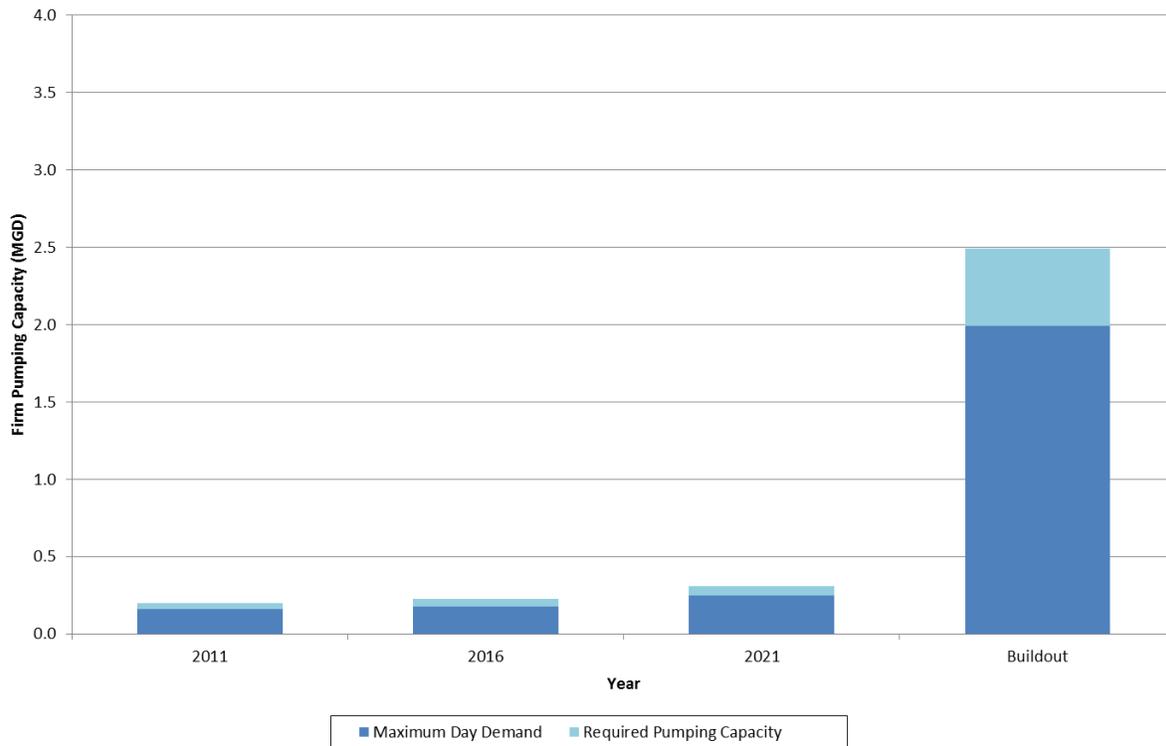


Table 7-6 West Lake Connections per Facility

Facility	Capacity	Current Connections Served	Max. # of Connections Served
Elevated Storage			
<i>West Lake GST</i>	0.05	340	709

7.3.8 Northwest Pressure Plane Future System Capacities

The Northwest Pressure Plane is located in the most northwestern portion of the City. The City of Weatherford does not currently serve this area, but service will be extended with the construction of the new Weatherford Loop around the City and the further expansion into the buildout service area. To supply this new Northwest Pressure Plane, FNI recommends building a new 1.0 MG GST and 3.5 MGD Pump Station to meet maximum day capacity requirements. FNI also recommends a new 0.5 MG Elevated Storage Tank. **Figures 7-24** through **7-26** show the Northwest Pressure Plane future system capacities.

Figure 7-24 Northwest Pressure Plane Ground Storage Requirement

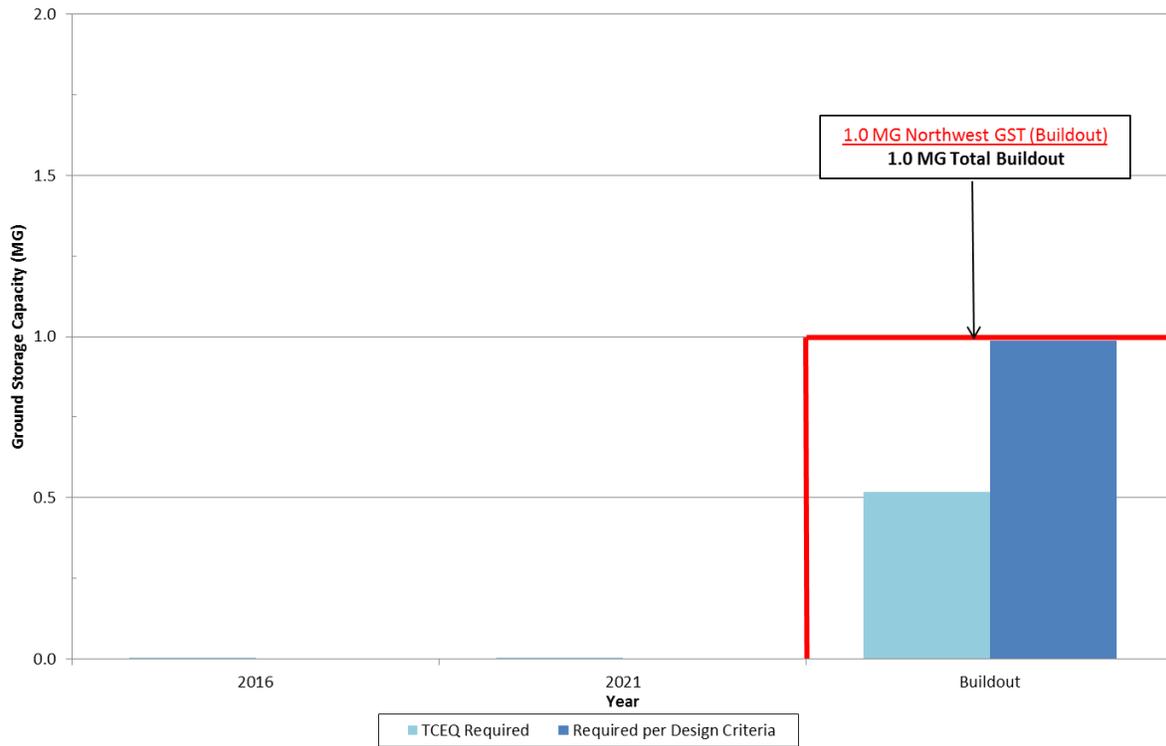


Figure 7-25 Northwest Pressure Plane Elevated Storage Requirement

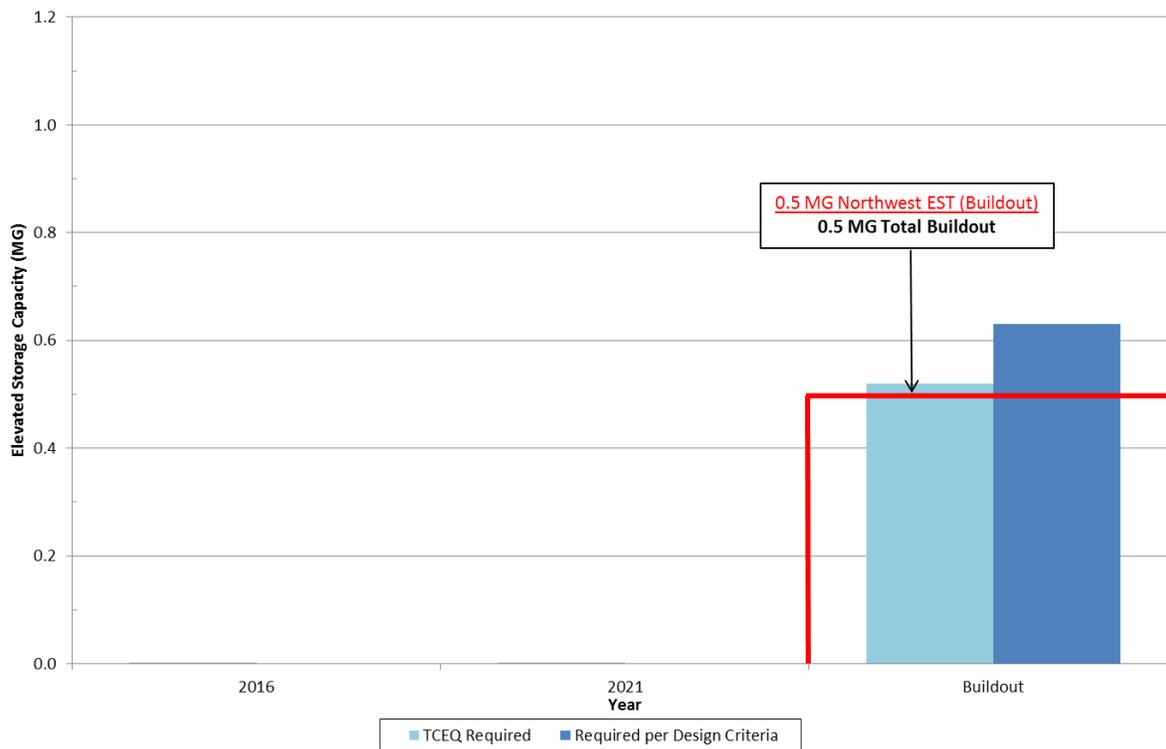
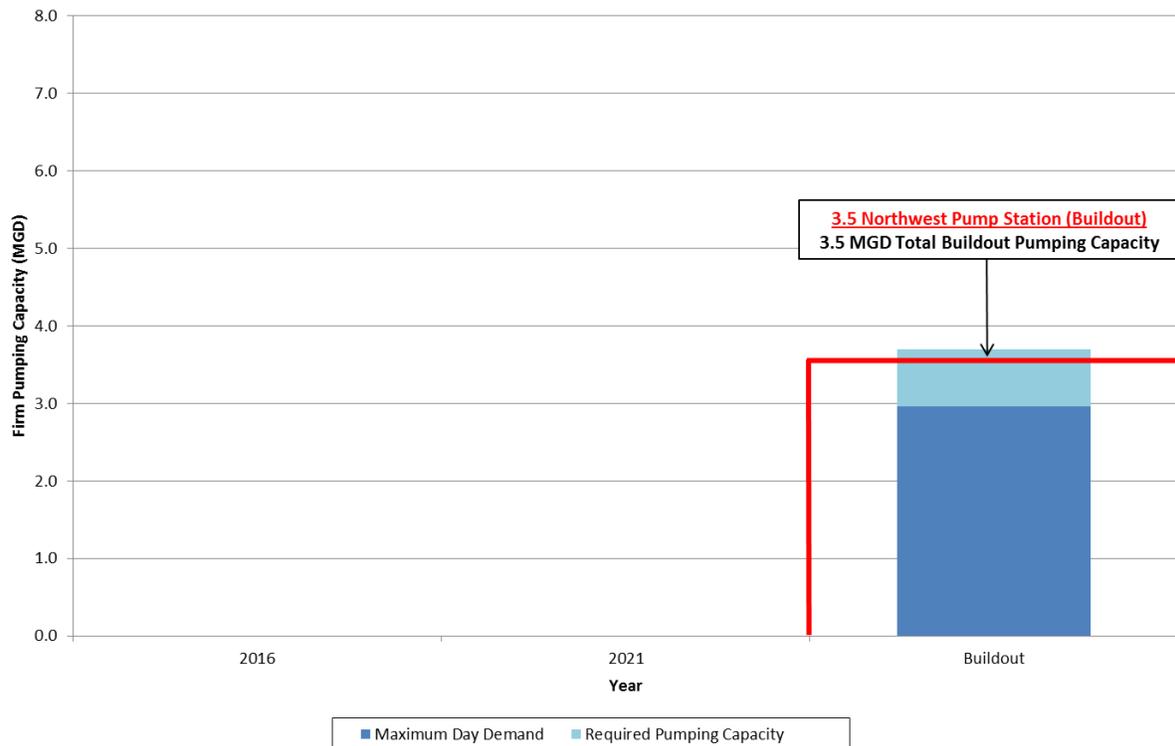


Figure 7-26 Northwest Pressure Plane Pumping Capacity Requirement



7.3.9 Northeast Pressure Plane Future System Capacities

The Northeast Pressure Plane is located in the most northeastern portion of the City. The City of Weatherford does not currently serve this area, but service will be extended to the northeast with the further expansion into the buildout service area. To supply this new Northwest Pressure Plane, FNI recommends building a new 0.5 MG GST and 2.0 MGD Pump Station to meet maximum day capacity requirements. FNI also recommends a new 0.25 MG EST. **Figures 7-26 through 7-28** show the Northwest Pressure Plane future system capacities.

Figure 7-27 Northeast Pressure Plane Ground Storage Requirement

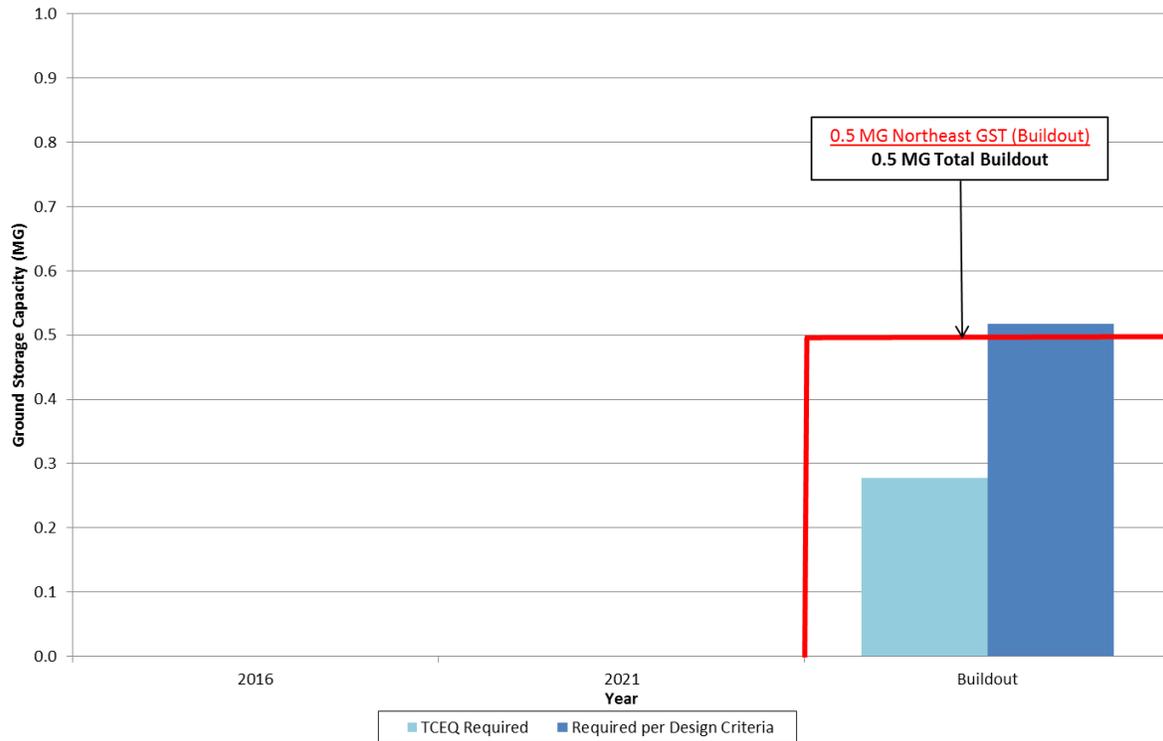


Figure 7-28 Northeast Pressure Plane Elevated Storage Requirement

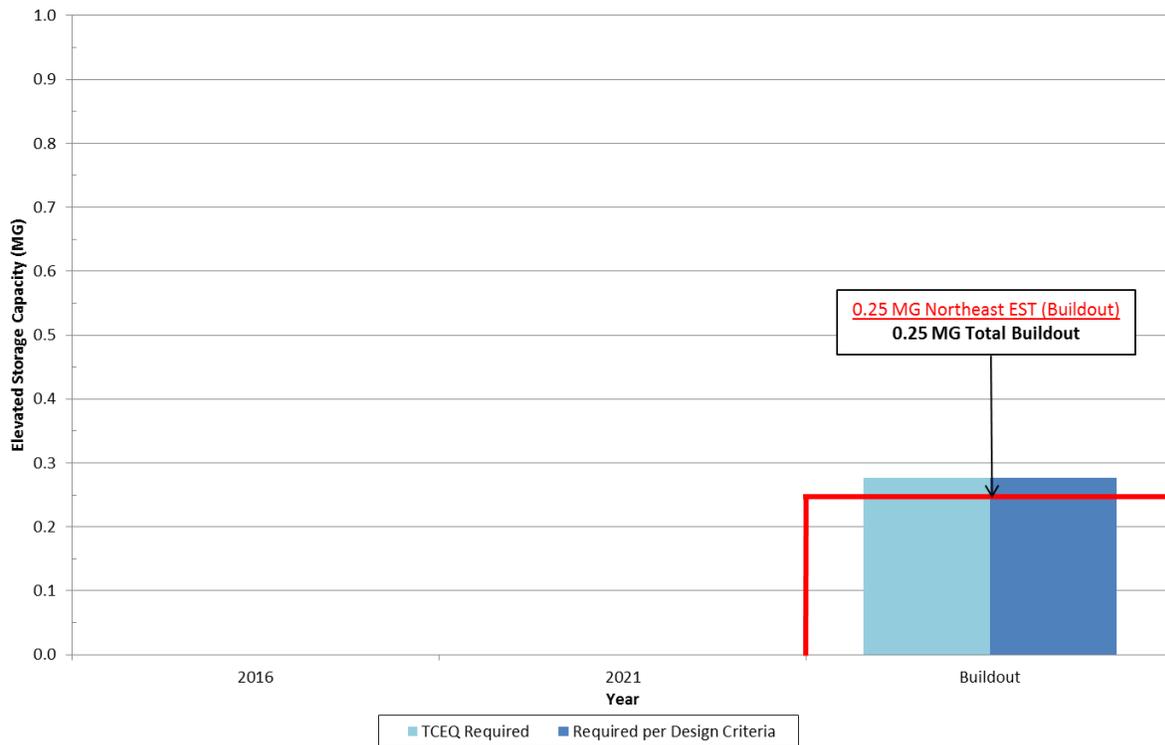
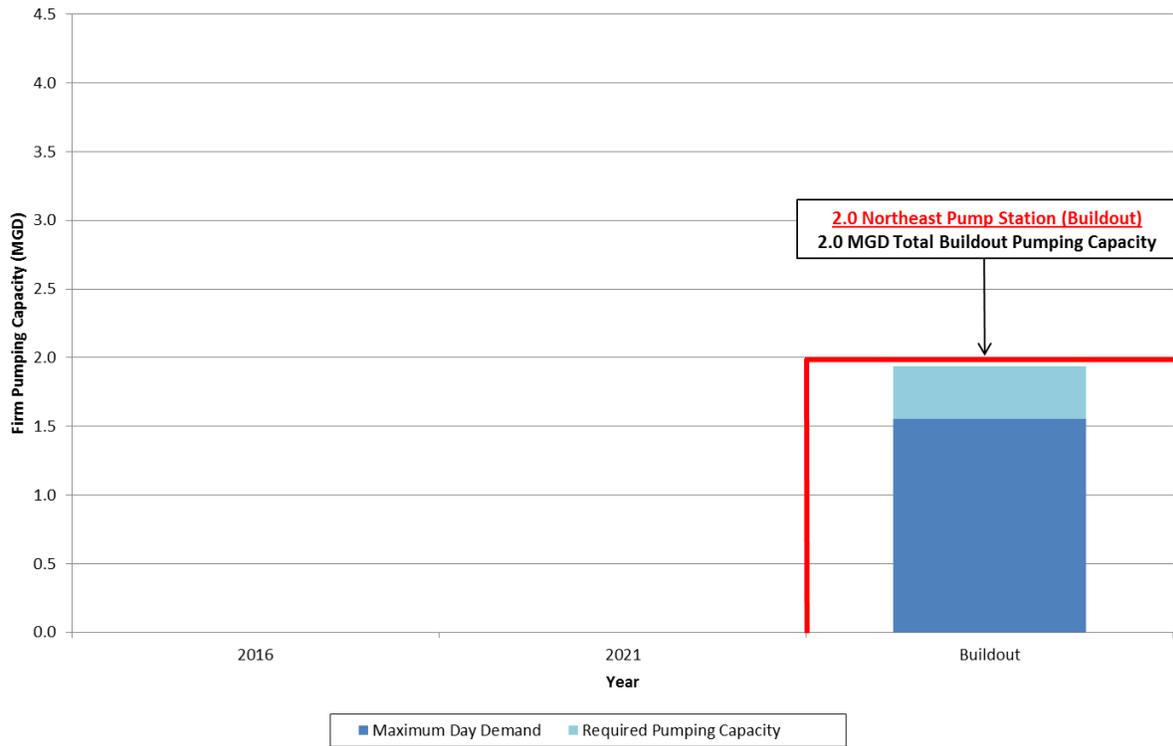


Figure 7-29 Northeast Pressure Plane Pumping Capacity Requirement



8.0 WATER SYSTEM CAPITAL IMPROVEMENT PLAN

Figure 8-1 illustrates the proposed capital improvement projects. **Table 8-1** provides a cost summary for each project and corresponds with the numbered projects in **Figure 8-1**. All project costs shown in this report are based on construction costs representing 2011 conditions and should be adjusted in the future to reflect current construction environment. In addition to capital improvement projects, a yearly allowance was included in the five year CIP for renewing 2% of the system each year. **Appendix A** contains a detailed cost description of each individual project.

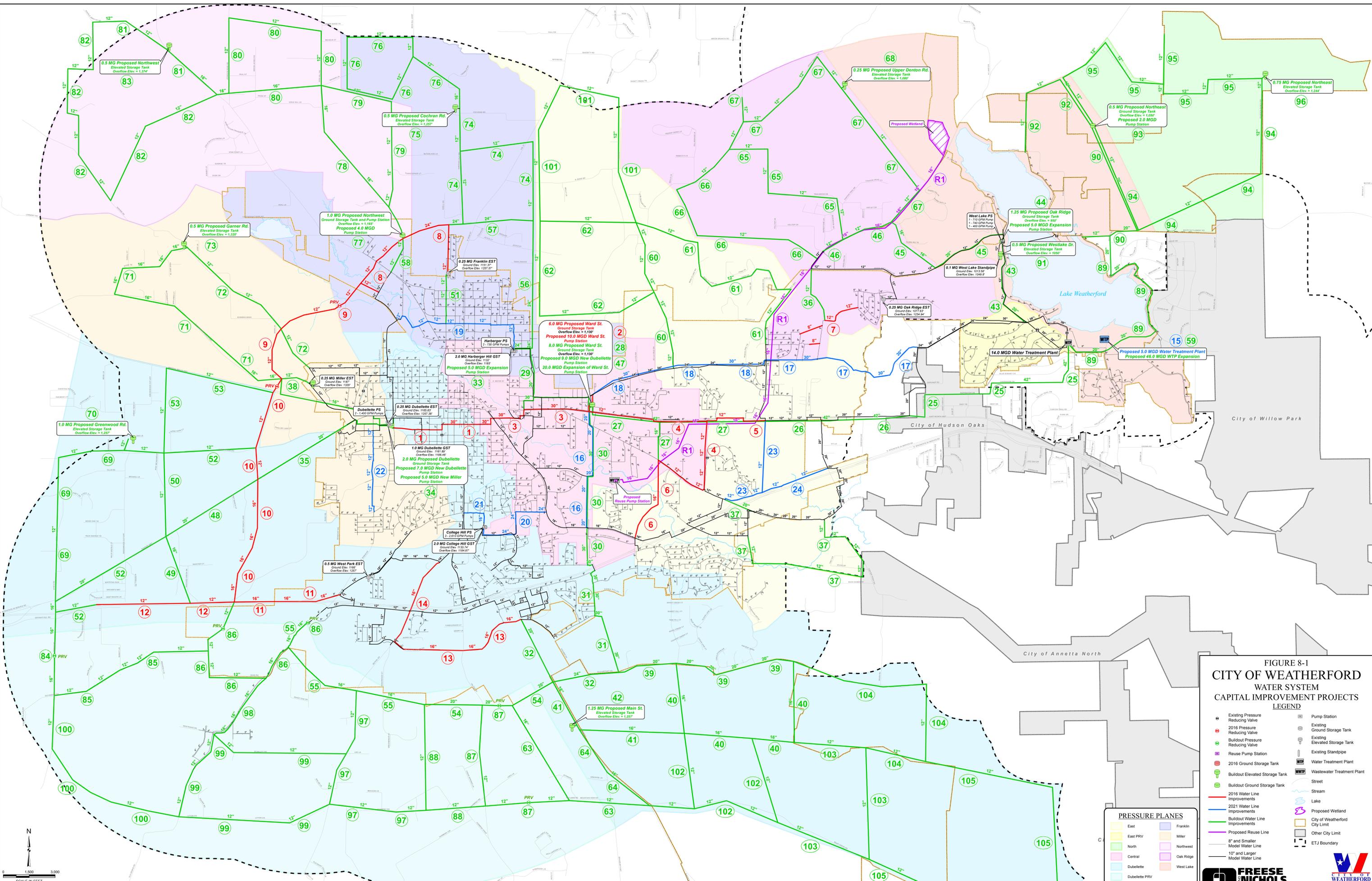


FIGURE 8-1
CITY OF WEATHERFORD
 WATER SYSTEM
 CAPITAL IMPROVEMENT PROJECTS
 LEGEND

- Existing Pressure Reducing Valve
- 2016 Pressure Reducing Valve
- Buildout Pressure Reducing Valve
- Reuse Pump Station
- 2016 Ground Storage Tank
- Buildout Elevated Storage Tank
- Buildout Ground Storage Tank
- 2016 Water Line Improvements
- 2021 Water Line Improvements
- Buildout Water Line Improvements
- 8" and Smaller Model Water Line
- 10" and Larger Model Water Line
- Pump Station
- Existing Ground Storage Tank
- Existing Elevated Storage Tank
- Existing Standpipe
- Water Treatment Plant
- Wastewater Treatment Plant
- Stream
- Lake
- Proposed Wetland
- City of Weatherford City Limit
- Other City Limit
- ETJ Boundary

PRESSURE PLANES

East	Franklin
East PRV	Miller
North	Northwest
Central	Oak Ridge
Dubellette	West Lake
Dubellette PRV	

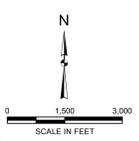


Table 8-1			
	Proj. No.	Water System Capital Improvement Plan	Cost
2016	R1	Reuse Water project	\$ 10,968,430
	1	30-inch Supply Line to the Dubellette GST in the Dubellette Pressure Plane	\$ 1,733,760
	2	New 10 MGD Ward St Pump Station and 6 MG GST in the Central PP	\$ 6,070,850
	3	30-inch Supply Line from the New Ward St Pump Station to the 30-inch Project 1	\$ 2,493,120
	4	12-inch Supply Line from the New Ward St Pump Station in the Central PP	\$ 1,437,550
	5	12-inch Water Line in the East Pressure Plane	\$ 552,120
	6	16-inch and 12-inch Water Line in the East Pressure Plane	\$ 1,249,920
	7	12-inch and 8-inch Water Lines in the Oak Ridge Pressure Plane	\$ 477,930
	8	24-inch and 12-inch Water Line along the Weatherford Loop in the Franklin PP	\$ 1,669,250
	9	12-inch Water Line and PRV in the Miller Pressure Plane	\$ 927,900
	10	16-inch and 12-inch Water Line and PRV in the Dubellette Pressure Plane	\$ 1,810,100
	11	16-inch Water Line along I-20 in the Dubellette Pressure Plane	\$ 864,470
	12	12-inch Water Line along I-20 in the Dubellette Pressure Plane	\$ 855,330
	13	16-inch Water Line along BB Fielder Blvd in the Dubellette Pressure Plane	\$ 1,751,510
14	16-inch Water Line along Bethel Rd. in the Dubellette Pressure Plane	\$ 1,315,980	
Total 2016			\$ 34,178,220
2021	15	New 5.0 MGD Water Treatment Plant	\$ 16,020,480
	16	20-inch Supply Line from the New Pump Station in Project 2	\$ 1,368,870
	17	30-inch Transmission Line Replacement along Meadowview Dr. and Suzanne Tr.	\$ 3,093,890
	18	30-inch Parallel Transmission Main along Old Dicey Rd.	\$ 3,642,240
	19	12-inch Water Line Replacement in the Franklin Pressure Plane	\$ 1,349,380
	20	24-inch Water Line from Santa Fe Drive to College Hill GST	\$ 1,330,830
	21	16-inch Water Line from the College Hill Pump Station	\$ 351,860
	22	12-inch Water Line in along Bowie Dr. in the Miller Pressure Plane	\$ 755,600
	23	12-inch Water Line in the East Pressure Plane	\$ 687,060
24	12-inch Water Line in the East Pressure Plane along I-20	\$ 684,100	
Total 2021			\$ 29,284,310

Table 8-1

	25	42-inch Transmission Main from the WTP to 20-inch Water Line on the Border of Hudson Oaks	\$ 5,670,340
	26	42-inch Transmission Main from the end of Project 25 to Azle Highway	\$ 3,474,780
	27	42-inch Transmission Main and 16-inch Water Line from the end of Project 26 to the Ward St GST	\$ 5,218,080
	28	New 9.0 MGD Central Pump Station and 8.0 MG GST in the Central Pressure Plane	\$ 7,092,290
	29	30-inch and 20-inch Transmission Main from Ward St Pump Station to Harberger Hill GST	\$ 2,525,380
	30	30-inch Transmission Main from the New Pump Station on Ward St.	\$ 2,967,560
	31	30-inch Transmission Main from I-20 to Old Airport Road	\$ 1,878,920
	32	24-inch and 20-inch Water Line in Dubellette Pressure Plane along Main St. and Old Airport Rd.	\$ 1,892,090
	33	5.0 MGD Harberger Hill Pump Station Expansion	\$ 3,557,570
	34	New 2 MG Dubellette Ground Storage Tank and Pump Station	\$ 4,141,940
	35	20-inch Transmission Main from the New Dubellette Pump Station	\$ 2,198,790
	36	12-inch Water Line in the Oak Ridge Pressure Plane	\$ 358,050
	37	20-inch and 12-inch Water Line in the East Pressure Plane	\$ 2,332,520
	38	16-inch Transmission Main in the Miller Pressure Plane along Mineral Wells Hwy.	\$ 1,285,810
	39	20-inch Water Line along Old Airport Road in the Dubellette Pressure Plane	\$ 2,553,600
	40	16-inch Water Line in the Dubellette Pressure Plane	\$ 2,128,900
	41	16-inch Water Line in the Dubellette Pressure Plane	\$ 1,518,190
	42	New 1.25 MG Main St. Elevated Storage Tank in the Dubellette Pressure Plane	\$ 3,360,000
	43	20-inch Transmission Main along West Lake Drive	\$ 951,560
	44	New 1.25 MG Oak Ridge Ground Storage Tank and 5.0 MGD Pump Station	\$ 3,181,250
	45	20-inch and 16-inch Transmission Main from the New Oak Ridge Pump Station	\$ 1,708,500
	46	12-inch Water Line along White Settlement Rd. in the Oak Ridge Pressure Plane	\$ 680,340
	47	20.0 MGD Expansion of the Ward St Pump Station	\$ 4,072,320
	48	20-inch Water Line in the Dubellette Pressure Plane	\$ 1,132,660
	49	16-inch Water Line along Sanchez Creek Dr. in the Dubellette Pressure Plane	\$ 593,520
	50	12-inch Water Line along High Meadows Dr. in the Dubellette Pressure Plane	\$ 512,880
	51	12-inch Water Line along Franklin St. in the Franklin Pressure Plane	\$ 488,150
	52	12-inch Water Line along Greenwood Rd. in the Dubellette Pressure Plane	\$ 762,860
	53	12-inch Water Line along Mineral Wells Hwy. in the Dubellette Pressure Plane	\$ 1,190,250
	54	20-inch Water Line along the Weatherford Loop in Dubellette Pressure Plane	\$ 1,406,840
	55	16-inch Water Line in the Dubellette Pressure Plane	\$ 1,584,980
	56	24-inch Transmission Main in the Franklin Pressure Plane	\$ 1,801,500
	57	24-inch and 12-inch Water Line in the Franklin Pressure Plane	\$ 1,385,400
	58	12-inch Supply Line in the Franklin Pressure Plane	\$ 295,680
	59	46 MGD Expansion of the Water Treatment Plant	\$ 90,720,000
	60	12-inch Water Line in the East Pressure Plane	\$ 1,194,820
	61	12-inch Water Line in the East Pressure Plane	\$ 2,376,730
	62	12-inch Water Line in the East Pressure Plane	\$ 1,966,810
	63	16-inch and 12-inch Water Line in the Dubellette Pressure Plane	\$ 1,528,670
	64	16-inch Water Line in the Dubellette Pressure Plane along FM 171	\$ 1,254,760
	65	12-inch Water Line in the Oak Ridge Pressure Plane	\$ 1,919,770
	66	12-inch Water Line in the Oak Ridge Pressure Plane	\$ 1,701,510
	67	12-inch Water Line in the Oak Ridge Pressure Plane	\$ 2,872,940
	68	New 0.25 MG Upper Denton Rd. EST in the Oak Ridge Pressure Plane	\$ 672,000
	69	12-inch Water Line in the Dubellette Pressure Plane	\$ 2,335,340
	70	New 1.0 MG Greenwood EST in the Dubellette Pressure Plane	\$ 2,688,000
	71	16-inch Water Line in the Miller Pressure Plane	\$ 3,973,410
	72	12-inch Water Line in the Miller Pressure Plane	\$ 1,755,810
	73	New 0.5 MG Garner Rd. EST in the Miller Pressure Plane	\$ 1,344,000
	74	12-inch Water Line in the Franklin Pressure Plane	\$ 2,088,580
	75	New 0.5 MG Cochran EST in the Franklin Pressure Plane	\$ 1,344,000
	76	12-inch Water Line in the Franklin Pressure Plane	\$ 2,031,060
	77	New 1.0 MG Northwest GST and 4.0 MGD Pump Station	\$ 2,845,250
	78	16-inch Water Line in the Northwest Pressure Plane	\$ 1,667,910
	79	12-inch Water Line in the Northwest Pressure Plane	\$ 1,406,640
	80	16-inch and 12-inch Water Line in the Northwest Pressure Plane	\$ 2,455,760
	81	16-inch and 12-inch Water Line in the Northwest Pressure Plane	\$ 1,642,640
	82	12-inch Water Line in the Northwest Pressure Plane	\$ 3,031,530
	83	New 0.5 MG Northwest EST in the Northwest Pressure Plane	\$ 1,344,000
	84	16-inch Water Line and PRV in the Dubellette Pressure Plane PRV Area	\$ 1,201,270
	85	12-inch Water Line in the Dubellette Pressure Plane PRV Area	\$ 1,574,100
	86	16-inch and 12-inch Water Line and PRVs in the Dubellette Pressure Plane PRV Area	\$ 2,496,750
	87	20-inch and 12-inch Water Line and PRVs in the Dubellette Pressure Plane PRV Area	\$ 2,141,800
	88	12-inch Water Line in the Dubellette Pressure Plane PRV Area	\$ 962,580
	89	20-inch and 12-inch Water Lines in the West Lake Pressure Plane	\$ 3,617,650
	90	20-inch Water Line in the West Lake Pressure Plane	\$ 1,452,870
	91	New 0.5 MG Westlake Drive EST	\$ 1,344,000
	92	12-inch Water Line in the West Lake Pressure Plane	\$ 1,221,160
	93	New 0.5 MG Northeast GST and 2.0 MGD Pump Station	\$ 2,173,250
	94	12-inch Water Line in the Northeast Pressure Plane	\$ 2,302,010
	95	12-inch Water Lines in the Northeast Pressure Plane	\$ 3,069,970
	96	New 0.75 MG Northeast Pressure Plane EST	\$ 2,016,000
	97	12-inch Water Line in the Dubellette Pressure Plane PRV Area	\$ 1,774,080
	98	16-inch Water Line in the Dubellette Pressure Plane PRV Area	\$ 956,400
	99	12-inch Water Line Loop in the Dubellette Pressure Plane PRV Area	\$ 3,565,370
	100	12-inch Water Line in the Dubellette Pressure Plane PRV Area	\$ 1,356,910
	101	12-inch Water Line in the East Pressure Plane	\$ 2,046,920
	102	12-inch Water Line in the Dubellette Pressure Plane	\$ 1,829,460
	103	12-inch Water Line in the Dubellette Pressure Plane	\$ 1,960,360
	104	12-inch Water Line in the Dubellette Pressure Plane	\$ 1,730,810
	105	Proposed Reuse Water Project	\$ 3,168,890
		Total Buildout	\$ 258,028,050
		Grand Total	\$ 321,490,580
Rehab		Yearly rehabilitation of 2% of all water distribution lines.	\$ 1,446,200

8.1 WATER SYSTEM IMPROVEMENTS 2011 TO 2016

These projects provide an initial basis for the 2016 planning period CIP. These projects were assigned to the appropriate planning period based on need of the project and not on actual timing of construction.

The overall cost for the 2016 CIP is **\$34,178,220**.

R1. Reuse Water Project

This project is a proposed reuse water project at the Weatherford Wastewater Treatment Plant. This project will allow the City to transfer treated effluent from the existing wastewater treatment plant to a proposed wetland site next to Lake Weatherford.

1. 30-inch Supply Line to the Dubellete GST in the Dubellette Pressure Plane (Project 1)

This project replaces the existing 12-inch line constructed in 1956 that runs along Columbia Ave, from Walnut Street to Davis St. It then runs down Davis to Baylor St. and then on to the Dubellette GST. This project will increase the supply of water to the Dubellette GST from the Central Pressure Plane. This increased supply will help the City meet maximum day and peak hour storage requirements at the Dubellette GST without the help of the Dubellette EST.

2. New 10 MGD Central West Pump Station and 6 MG GST in the Central Pressure Plane (Project 2)

The proposed GST and pump station will be located on Ward St. between Fort Worth Highway and Old Dicey Rd. This project will create a new "Central East" Pressure Plane with an overflow elevation of 1,130 ft. to mitigate high pressure issues that currently exist in low lying areas.

3. 30-inch Supply Line from the New Ward St. Pump Station to the 30-inch Project 1 (Project 3)

This proposed 30-inch line will run from the new Central West Pump Station along the Fort Worth Highway to South Weiland St. The line will then travel down South Weiland

to Oak St. over to Rusk St. and down to Columbia Ave. The line will then tie-in to Project 1. This project will connect the new pump station to the new 30-inch line connecting to the Dubellette GST in Project 1. The additional capacity will help to fill the Dubellette GST during maximum day and peak hour demand conditions.

4. 12-inch Supply Line from the New Ward St. Pump Station in the Central Pressure Plane (Project 4)

This project is a 12-inch water line along Fort Worth Highway from Ward St. to FM 730 and is a 12-inch water line along Grant Rd. between Fort Worth Highway and East Bankhead Highway. This water line will provide additional flow and looping in the new "Central" Pressure Plane. The proposed line will tie-in to the existing 8-inch line along Bankhead Highway that will be a dead-end line with the creation of the new pressure planes. The redundancy will increase fire flow protection and increase supply to customers along Bankhead Highway in the Central Pressure Plane.

5. 12-inch Water Line in the East Pressure Plane (Project 5)

This 12-inch line will run along the Fort Worth Highway in the new East Pressure Plane. It will replace the existing 8-inch line between Willow Creek Dr. and Azle Highway. The new 12-inch line will provide greater redundancy in the newly formed East Pressure Plane. It will increase the supply of water customers along Willow Creek Dr. and along Azle Highway to meet maximum day and peak hour demand conditions.

6. 16-inch and 12-inch Water Line in the East Pressure Plane (Project 6)

This project is a 12-inch and 16-inch water line in the East Pressure Plane. The 12-inch line will tie-in to the existing 12-inch line at the intersection of Grant Dr. and East Bankhead Dr. The 12-inch line will NOT tie-in to the existing 8-inch line along Bankhead, but will run parallel before turning south to the west of Ikard Ln. The line will then continue south as a 16-inch water line and tie-in to the 16-inch water line along Santa Fe Dr. near the intersection with I-20. This project will provide greater redundancy in the East Pressure Plane. When splitting the Central Pressure Plane into two pressure planes, some of the lines will temporarily be dead end lines until future projects are

constructed. This project will provide additional supply and redundancy in the East Pressure Plane to increase the supply of water and fire flow protection to customers along Santa Fe Dr.

7. 12-inch and 8-inch Water Lines in the Oak Ridge Pressure Plane (Project 7)

This project is located in the neighborhood between Azle Highway and Meadowview Rd. It is centered on Woodcrest St. located southwest of the Oak Ridge EST. This project will transfer the neighborhood along Meadowview Rd. and Azle Highway into the Oak Ridge Pressure Plane. This area experiences high pressures due to the pump head at the Water Treatment Plant. Moving this neighborhood into the Oak Ridge Pressure Plane will mitigate the high pressures and help to turn over the water in the Oak Ridge EST during average and below average day demand conditions.

8. 24-inch and 12-inch Water Line along the Weatherford Loop in the Franklin Pressure Plane (Project 8)

This project will consist of a 24-inch and a 12-inch water line in the Franklin Pressure Plane along the new Weatherford Loop from Hawkins Lilly Rd. to the pressure plane division between the Franklin and Miller Pressure Plane. This project will provide water service to customers along the proposed Weatherford Loop around the City. The new water line will allow the City to meet maximum day and peak hour pressure water demands along the new loop as well as providing fire flow protection to new commercial customers.

9. 12-inch Water Line and PRV in the Miller Pressure Plane (Project 9)

This project will continue adding service to customers along the proposed Weatherford Loop in the Miller Pressure Plane. The 12-inch water line will tie-into project 8 at the pressure plane divide and continue south to Mineral Wells Highway. This project will provide water service to customers along the proposed Weatherford Loop around the City. The new water line will allow the City to meet maximum day and peak hour pressure water demands along the new loop as well as providing fire flow protection to

commercial customers. The PRV will remain closed, but provides the option to open it in the event more water is needed in either pressure plane.

10. 16-inch and 12-inch Water Line and PRV in the Dubellette Pressure Plane (Project 10)

This project will continue adding service to customers along the proposed Weatherford Loop in the Dubellette Pressure Plane. The 12-inch water line will tie-into project 9 at Mineral Wells Highway and continue south to I-20. This project will provide water service to customers along the proposed Weatherford Loop around the City. The new water line will allow the City to meet maximum day and peak hour pressure water demands along the new loop as well as providing fire flow protection to commercial customers. The PRV will remain closed, but provides the option to open it in the event more water is needed in either pressure plane.

11. 16-inch Water Line along I-20 in the Dubellette Pressure Plane (Project 11)

This project is a 16-inch water line along I-20 from Bowie Dr. to the proposed intersection of the new Weatherford Loop. This project will tie-in to the existing 12-inch line at the intersection of Bowie Dr. and I-20. It will connect to project 10 and together will provide service to customers along the new Weatherford Loop.

12. 12-inch Water Line along I-20 in the Dubellette Pressure Plane (Project 12)

This project is a 12-inch water line that ties into the 16-inch water line (Project 10 and 11) at the intersection of I-20 and the Weatherford Loop. This project will provide water service to customers in the Deerfield Estates subdivision in west Weatherford. The subdivision is currently supplied by well water. This project will also provide service to future customers along I-20.

13. 16-inch Water Line along BB Fielder Blvd in the Dubellette Pressure Plane (Project 13)

This project is a 16-inch water line along BB Fielder Blvd. It will tie-in to the existing 12-inch water line at the intersection of BB Fielder and Main St. It will replace the existing 6-inch water line to Fielder Dr. A new 16-inch line will then tie-in to the existing 12-inch line near the intersection of BB Fielder and Bethel Rd. This project will provide

additional redundancy in the southern portion of the Dubellette Pressure Plane. This will increase the supply of water to future commercial and retail customers along BB Fielder Blvd. as well as provide additional fire flow protection to meet TCEQ requirements.

14. 16-inch Water Line along Bethel Rd. in the Dubellette Pressure Plane (Project 14)

This project consists of a new 16-inch water line along Bethel Rd. between BB Fielder Blvd. and south of Tin Top Rd. It will tie-into the existing 16-inch water line along Bethel and the new 16-inch line along BB Fielder (Project 13). This project extends the 16-inch water line along Bethel Rd. to Project 13 in order to provide additional flow further south to meet maximum day and peak hour pressure demands in the Dubellette Pressure Plane.

8.2 WATER SYSTEM IMPROVEMENTS 2017 TO 2021

These projects provide an initial basis for the 2021 planning period CIP. These projects were assigned to the appropriate planning period based on need of the project and not on actual timing of construction. The overall cost for the 2021 CIP is **\$29,284,310**.

15. New 5.0 MGD Water Treatment Plant (Project 15)

This project is a new 5.0 Water Treatment Plant along Lake Dr. south of Lake Weatherford. TCEQ recommends a capacity of 0.6 gpm per connection at the Water Treatment Plant. The water demand for the 2021 planning period is projected to exceed the existing plant capacity.

16. 20-inch Supply Line from the New Pump Station in Project 2 (Project 16)

The 20-inch water line runs south from the Central West Pump Station (Project 2) from Fort Worth Highway to Santa Fe Dr. This project will tie-in to the 12-inch water line on Eureka St. The addition of the proposed Central West GST and Pump Station will require additional system transmission capacity to properly supply the Central West Pressure Plane as well as the Dubellette, Miller, and Franklin Pressure Planes. The 20-inch transmission line will supply water to the southern and central section of the Central

West Pressure Plane and provide additional supply to the Dubellette GST and Pump Station.

17. 30-inch Transmission Line Replacement along Meadowview Dr. and Suzanne Tr. (Project 17)

This project is a 30-inch transmission main replacement of the 24-inch transmission line along Meadowview Dr. and Suzanne Tr. It will tie-in to the existing 36-inch line at the intersection of Oak Ridge Dr. and Suzanne Tr. and end at the intersection of Meadowview Dr. and Azle Hwy. This project will replace the existing 24-inch line built in 1955. Model results indicate that due to age and material of the existing 24-inch line, high headlosses in the pipe contribute to high pressures in the East Pressure Plane. Replacing this line with a newer 30-inch line along with project 18 and the new Ward St. GST (Project 2) will mitigate high pressures throughout the East Pressure Plane.

18. 30-inch Parallel Transmission Main along Old Dickey Rd. (Project 18)

This project is a 30-inch parallel transmission main along Old Dickey Rd. from Azle Hwy. to the new Ward St. GST on Ward St. This project will not tie-in to the existing 24-inch water line along Old Dickey Rd. This project, combined with project 17, will complete the new 30-inch transmission main from Oak Ridge Rd. to the Ward St. GST on Ward St. The new transmission main along with the Ward St. GST will reduce pressures in the East Pressure Plane, as well as increase the supply of water to the new Ward St. GST.

19. 12-inch Water Line Replacement in the Franklin Pressure Plane (Project 19)

This project replaces the existing 6-inch water line along King St. from Common St. to Third St. It then replaces the existing 6-inch water line along Third St. from King St. to where it dead ends west of Franklin St. The 12-inch line then extends to tie-in to the existing 12-inch water line along Bowie St., replacing portions of 8-inch line along the way. This project will increase the supply of water through the middle of the Franklin Pressure Plane by replacing some of the smaller, older lines. This will increase the supply of water to the new 12-inch water line (Project 8) along the proposed Weatherford

Loop. It will also increase the fire flow protection to commercial and industrial customers.

20. 24-inch Water Line from Santa Fe Drive to College Hill GST (Project 20)

This project is a 24-inch water line replacement of the existing 16-inch water line along Park Ave and College Park Dr. from Santa Fe Dr. to the College Hill GST. This project will increase the supply of water to the College Hill GST and Pump Station along with the construction of the new Ward St. GST and Pump Station.

21. 16-inch Water Line from the College Hill Pump Station (Project 21)

This project is a 16-inch water line from the College Hill Pump Station to the 12-inch water line along Main St. The proposed line will follow Park St and will replace the existing 6-inch water line. This transmission line from the College Hill Pump Station is intended to increase the flow into the Dubellette Pressure Plane especially the Dubellette Elevated Storage tank. The new transmission line will also increase the water supply and fire flow protection in the northern portion of the Dubellette Pressure Plane.

22. 12-inch Water Line in along Bowie Dr. in the Miller Pressure Plane (Project 22)

This project is a 12-inch water line replacement of the existing 6-inch water line along Bowie Dr. from Cherokee St. to Charles St. The purpose of this project is to increase fire flow protection in the middle and southern portion of the Miller Pressure Plane. The 12-inch line replacement will also increase the water supply to the south to meet maximum day and peak hour pressure demand conditions.

23. 12-inch Water Line in the East Pressure Plane (Project 23)

This project is a 12-inch water line in the new Central East Pressure Plane between Fort Worth Highway and I-20 that begins east of Azle Highway. This water line will provide additional flow and looping in the new "Central East" Pressure Plane. The redundancy will increase fire flow protection in the East Pressure Plane.

24. 12-inch Water Line in the East Pressure Plane along I-20 (Project 24)

This project is a 12-inch water line in the new Central East Pressure Plane along I-20 from the intersection of Bankhead Highway to Center Point Rd. This water line will provide additional flow and looping in the new "Central East" Pressure Plane. The redundancy will increase fire flow protection in the East Pressure Plane.

8.3 WATER SYSTEM IMPROVEMENTS 2022 TO BUILDOUT

These projects provide an initial basis for the Buildout planning period CIP. These projects were assigned to the appropriate planning period based on need of the project and not on actual timing of construction. The overall cost for the Buildout CIP is **\$258,028,050**.

25. 42-inch Transmission Main from the WTP to 20-inch Water Line on the Border of Hudson Oaks (Project 25)

This project is a 42-inch transmission main from the WTP to the eastern border of the City of Hudson Oaks' city limits. The proposed line will follow Lakeshore Dr. down to Inspiration Dr. through the City of Hudson Oaks before going south on Oak Ridge Dr. The purpose of this project is to increase the water supply from the WTP to the Ward St. GST at the Ward St. site. Pumping at the Ward St. site will continue to increase through buildout. Therefore, it is necessary to have a transmission main with enough capacity to meet future demands.

26. 42-inch Transmission Main from the end of Project 25 to Azle Highway (Project 26)

This project is a continuation of project 25 along Fort Worth Highway from Oak Ridge Dr. to Azle Highway. The purpose of this project is to increase the water supply from the WTP to the Ward St. GST at the Ward St. site. Pumping at the Ward St. site will continue to increase through buildout. Therefore, it is necessary to have a transmission main with enough capacity to meet future demands.

27. 42-inch Transmission Main and 16-inch Water Line from the end of Project 26 to the Ward St. GST (Project 27)

This project is a continuation of project 26 along Fort Worth Highway from Azle Highway to the Ward St. GST along Ward St. This project also consists of a 16-inch water that connects to the proposed north south 16-inch line in project 6. The purpose of this project is to increase the water supply from the WTP to the Ward St. GST at the Ward St. site. Pumping at the Ward St. site will continue to increase through buildout. Therefore, it is necessary to have a transmission main with enough capacity to meet future demands. The 16-inch portion of this project will provide additional redundancy and increase the supply of water in the East Pressure Plane.

28. New 9.0 MGD Central Pump Station and 6.0 MG GST in the Central Pressure Plane (Project 28)

The proposed GST and pump station will be located on Ward St. between Fort Worth Highway and Old Dickey Rd. adjacent to the GST and pump station proposed in project 2. This project will provide addition ground storage capacity for the Dubellette Pressure Plane. The pump station will supply water to the Dubellette pressure plane south of I-20.

29. 30-inch and 20-inch Transmission Main from Ward St. Pump Station to Harberger Hill GST (Project 29)

This project is a 30-inch and 20-inch transmission main from the new Ward St. PS to the Harberger Hill GST. The purpose of this project is to increase the supply of water to the Harberger Hill GST. The new water line will help meet the future maximum day and peak hour demands at the Harberger Hill GST and PS.

30. 30-inch Transmission Main from the New Pump Station on Ward St. (Project 30)

The 30-inch water line runs south from the Ward St. Pump Station (Project 2) from Fort Worth Highway to I-20. The addition of the proposed Ward St. GST and Pump Station will require additional system transmission capacity to properly supply the expansion of

the Dubellette Pressure Plane to the south. The 30-inch transmission line will supply water to the southern portion of the Dubellette Pressure Plane.

31. 30-inch Transmission Main from I-20 to Old Airport Road (Project 31)

This project is a continuation of Project 30 to extend service further south into the Dubellette Pressure Plane. The new line will begin at I-20 and run south down Carter Rd. to Old Airport Rd. The addition of the proposed Ward St. GST and Pump Station will require additional system transmission capacity to properly supply the expansion of the Dubellette Pressure Plane to the south. The 30-inch transmission line will supply water to the southern portion of the Dubellette Pressure Plane.

32. 24-inch and 20-inch Water Line in Dubellette Pressure Plane along Main St. and Old Airport Rd. (Project 32)

This project consists of a new 24-inch water line along Old Airport Rd. from Carter Rd. to Main St. There will also be a 20-inch along Main St. from Old Airport Rd. to BB Fielder Blvd. where it will tie-into the proposed 16-inch line from Project 13. The purpose of this line is to expand water service in the Dubellette Pressure Plane.

33. 5.0 MGD Harberger Hill Pump Station Expansion (Project 33)

This project consists of a 5 MGD expansion of the Harberger Hills PS. Population projections indicate that the existing Harberger Hill PS will not have enough capacity to meet future demands in the buildout planning period. The additional 5 MGD pumping capacity will meet TCEQ requirements.

34. New 2 MG Dubellette West Ground Storage Tank and Pump Station (Project 34)

This project consists of a new 2.0 MG GST adjacent to the existing Dubellette GST and EST along with the expansion of the existing Dubellette PS. The purpose of this project is to increase the ground storage and pumping capacity in the Dubellette and Miller Pressure Plane. As each pressure plane expands, more capacity is necessary to meet maximum day and peak hour pressure requirements at buildout.

35. 20-inch Transmission Main from the New Dubellette Pump Station (Project 35)

This project is a new 20-inch transmission main from the proposed Dubellette pump station that pumps into the Dubellette Pressure Plane. This project is located along Ranger Hwy. from the PS to West Ranch Ln. The purpose of this project is to extend service further west in the Dubellette Pressure Plane. It will also expand the GST and pumping capacity in the Miller Pressure Plane to meet future demands.

36. 12-inch Water Line in the Oak Ridge Pressure Plane (Project 36)

This project is a 12-inch water line in the Oak Ridge Pressure Plane from Azle Hwy to Woodcrest St. The purpose of this project is to add redundancy and increase fire flow and capacity in the Oak Ridge Pressure Plane.

37. 20-inch and 12-inch Water Line in the East Pressure Plane (Project 37)

This project consists of a 20-inch water line crossing of I-20 along Bankhead Hwy. along with a 12-inch water line along the buildout service area boundary in the East Pressure Plane. The purpose of this project is to expand service in the East Pressure Plane.

38. 16-inch Transmission Main in the Miller Pressure Plane along Mineral Wells Hwy. (Project 38)

This project is a 16-inch transmission main for the Dubellette Pump Station to along Mineral Wells Hwy. to Old Mineral Wells Hwy. in the Miller Pressure Plane. The purpose of this project is to extend service and increase capacity further west in the Miller Pressure Plane.

39. 20-inch Water Line along Old Airport Road in the Dubellette Pressure Plane (Project 39)

This project consists of a 20-inch water line along Old Airport Rd. from Carter Rd. to the buildout service area in the Dubellette Pressure Plane. The purpose of this project is to expand water service further south in the Dubellette Pressure Plane.

40. 16-inch Water Line in the Dubellette Pressure Plane (Project 40)

This project is a 16-inch in the southeast portion of the Dubellette Pressure Plane. The purpose of this project is to expand water service further south in the Dubellette Pressure Plane.

41. 16-inch Water Line in the Dubellette Pressure Plane (Project 41)

This project is a 16-inch in the southeast portion of the Dubellette Pressure Plane along Main St. This project will extend water service further south in the Dubellette Pressure Plane.

42. New 1.25 MG Main St. Elevated Storage Tank in the Dubellette Pressure Plane (Project 42)

This project is a proposed new 1.25 MG EST along Main St. in the Dubellette Pressure Plane. The purpose of this project is to help meet TCEQ requirements in the Dubellette Pressure Plane for buildout maximum day and peak hour demand conditions.

43. 20-inch Transmission Main along West Lake Drive (Project 43)

This project is a 20-inch parallel transmission main along Lakeshore Dr. from the WTP to the West Lake Stand Pipe. The purpose of this project is to increase the supply of water to the Oak Ridge and West Lake Pressure Planes.

44. New 1.25 MG Oak Ridge Ground Storage Tank and Pump Station (Project 44)

This project is a new Oak Ridge Ground Storage Tank and Pump Station along Lake Shore Dr. The purpose of this project is to increase the storage and pumping capacity in the Oak Ridge Pressure Plane to meet TCEQ requirements for the buildout planning period.

45. 20-inch and 16-inch Transmission Main from the New Oak Ridge Pump Station (Project 45)

This project consists of a 20-inch and a 16-inch transmission main from the proposed Oak Ridge GST and PS. in the Oak Ridge Pressure Plane. The purpose of this project is to increase the supply of water in the Oak Ridge Pressure Plane. The increased capacity will help meet maximum day and peak hour demand conditions.

46. 12-inch Water Line along White Settlement Rd. in the Oak Ridge Pressure Plane (Project 46)

This project consists of a 12-inch water line along Azle Hwy. in the Oak Ridge Pressure Plane. The project will start at the end of project 45 and run southwest to the existing 12-inch water line at the intersection of Azle Hwy. and Hilltop Dr. The 12-inch line will increase redundancy in the Oak Ridge Pressure Plane. It will extend water service to future customers along Azle Hwy. and will increase fire flow protection and capacity to meet buildout maximum day and peak hour demand conditions.

47. 20.0 MGD Expansion of the Ward St. Pump Station along Ward St. (Project 47)

This project consists of a 20 MGD expansion of the new Ward St. Pump Station along Ward St. The purpose of this project is to increase the pumping capacity of the new pump station to meet buildout demand conditions in the Central, Franklin, Northwest, Dubellette, and Miller Pressure Planes.

48. 20-inch Water Line in the Dubellette Pressure Plane (Project 48)

This project consists of a 20-inch water line in the Dubellette Pressure Plane along Ranger Hwy. from the new Weatherford Loop to Sanchez Creek Ct. The new 20-inch water line will extend water service into the buildout service area in the Dubellette Pressure Plane. The 20-inch line will have capacity to meet buildout maximum day and peak hour demand conditions.

49. 16-inch Water Line along Sanchez Creek Dr. in the Dubellette Pressure Plane (Project 49)

This project is a proposed 16-inch water line along Sanchez Creek Dr. between Ranger Hwy. and I-20. The purpose of this project is to increase redundancy and extend water service further west in the Dubellette Pressure Plane.

50. 12-inch Water Line along High Meadows Dr. in the Dubellette Pressure Plane (Project 50)

This project consists of a 12-inch water line along High Meadows Dr. in the Dubellette Pressure Plane between Greenwood Rd. and Ranger Hwy. The purpose of this project is to increase redundancy and extend water service further west in the Dubellette Pressure Plane.

51. 12-inch Water Line along Franklin St. in the Franklin Pressure Plane (Project 51)

This project consists of a 12-inch water line along Franklin St. in the Franklin Pressure Plane. The water line will run from Third St. where it will tie-into the proposed 12-inch water line (project 19) up to the Franklin EST. The purpose of this project is to increase water supply in the Franklin Pressure Plane. It will also increase the flow of water to the Franklin EST. The additional capacity will increase the fire flow protection to customers in the Franklin Pressure Plane and will help meet buildout maximum day and peak hour demand conditions.

52. 12-inch Water Line along Greenwood Rd. in the Dubellette Pressure Plane (Project 52)

This project consists of a 12-inch water line along Greenwood Rd. from the Weatherford Loop to High Meadows Dr. The purpose of this project is to increase redundancy and extend water service further west in the Dubellette Pressure Plane.

53. 12-inch Water Line along Mineral Wells Hwy. in the Dubellette Pressure Plane (Project 53)

This project consists of a 12-inch water line along Mineral Wells Hwy. from the Weatherford Loop to the Greenwood Cut-Off. The 12-inch line will then extend south to tie-in to the 12-inch proposed line (project 52) along Greenwood Rd. The purpose of this project is to increase redundancy and extend water service further west in the Dubellette Pressure Plane.

54. 20-inch Water Line along the Weatherford Loop in Dubellette Pressure Plane (Project 54)

This project consists of a new 20-inch water line along the Weatherford Loop in the Dubellette Pressure Plane between Main St. and Briarwood St. The purpose of this project is to extend water service to new customers along the Weatherford Loop in the southern portion of the Dubellette Pressure Plane.

55. 16-inch Water Line in the Dubellette Pressure Plane (Project 55)

This project consists of a new 16-inch water line along the Weatherford Loop from Briarwood St. to Old Dennis Rd. The purpose of this project is to extend water service to new customers along the Weatherford Loop in the southern portion of the Dubellette Pressure Plane.

56. 24-inch Transmission Main in the Franklin Pressure Plane (Project 56)

This project consists of a 24-inch transmission main from the Harberger Hill Pump Station to the Weatherford Loop in the Franklin Pressure Plane. The purpose of this project is to extend water service to new customers along the Weatherford Loop in the Franklin Pressure Plane.

57. 24-inch and 12-inch Water Line In the Franklin Pressure Plane (Project 57)

This project consists of a 24-inch water line along the Weatherford Loop from project 56 to west of Hawkins Lilly Rd. The purpose of this project is to extend water service to new customers along the Weatherford Loop in the Franklin Pressure Plane.

58. 12-inch Supply Line in the Franklin Pressure Plane (Project 58)

This project consists of a 24-inch water line along the Weatherford Loop from project 56 to west of Hawkins Lilly Rd. The purpose of this project is to extend water service to new customers along the Weatherford Loop in the Franklin Pressure Plane.

59. 46 MGD Expansion of the Water Treatment Plant (Project 59)

This project proposes the buildout water treatment plant capacity to serve buildout demands. The purpose of this project is to meet TCEQ water treatment plant capacity requirements. TCEQ requirements state that the WTP should have 0.6 gpm per connection. The buildout population is projected to be 160,720. The average persons per connection was calculated to be 2.24. Therefore, with this expansion, the WTP capacity will be 65 MGD and will meet TCEQ requirements.

60. 12-inch Water Line in the East Pressure Plane (Project 60)

This project is a proposed 12-inch water line along De La Cruz Dr. in the East Pressure Plane. It will tie-into the existing 24-inch line along Old Dicey Rd. and run north to Upper Denton Rd. The purpose of this project is to extend water service to the north in the East Pressure Plane.

61. 12-inch Water Line in the East Pressure Plane (Project 61)

This project will tie-into the project 60 at the intersection of De La Cruz Dr. and Upper Denton Rd. The project will run east and follow Murl's Lake Dr. to Gail Dr. over to and down Azle Hwy. and tie-into the existing 12-inch line at the intersection of Azle Hwy. and Alyssa Ct. The purpose of this project is to extend water service in the East Pressure Plane. It will also create redundancy and increase the fire flow protection to new customers.

62. 12-inch Water Line in the East Pressure Plane (Project 62)

This project will tie-into the project 60 at the intersection of De La Cruz Dr. and Upper Denton Rd. This project will create a loop in the northern portion of the East Pressure Plane. The purpose of this project is to extend water service in the East Pressure Plane. It will also create redundancy and increase the fire flow protection to new customers.

63. 16-inch and 12-inch Water Line in the Dubellette Pressure Plane (Project 63)

This project will tie into project 54 along the Weatherford Loop. It will run south to the boundary of the buildout service area and will run east along Mountain View Dr. The purpose of this project is to extend water service in the Dubellette Pressure Plane. It will also create redundancy and increase the fire flow protection to new customers.

64. 16-inch Water Line in the Dubellette Pressure Plane along FM 171 (Project 64)

This project will tie into project 63 and project 41. It will run south along Main St. to Bear Creek Rd. The purpose of this project is to extend water service in the Dubellette Pressure Plane. It will also create redundancy and increase the fire flow protection to new customers.

65. 12-inch Water Line in the Oak Ridge Pressure Plane (Project 65)

This project is a 12-inch water line that will begin at the intersection of Azle Hwy. and Trailwood Dr. It will continue along Trailwood Dr. to the intersection with Upper Denton Rd. The purpose of this project is to extend water service in the Oak Ridge Pressure Plane. It will also create redundancy and increase the fire flow protection to new customers.

66. 12-inch Water Line in the Oak Ridge Pressure Plane (Project 66)

This project consists of a 12-inch water line in the Oak Ridge Pressure Plane that will tie into project 65 at the intersection of Upper Denton Rd. and Trailwood Dr. It will then follow the pressure plane boundary and tie back into the existing 12-inch line along Azle Hwy. The purpose of this project is to extend water service in the Oak Ridge Pressure Plane. It will also create redundancy and increase the fire flow protection to new customers.

67. 12-inch Water Line in the Oak Ridge Pressure Plane (Project 67)

This project consists of a 12-inch water line that begins at the intersection of Upper Denton Rd. and Trailwood Dr. and runs northeast to the buildout service area boundary.

It will then run southeast to Azle Hwy. where it will tie-into project 45 and 46. The purpose of this project is to extend water service in the Oak Ridge Pressure Plane. It will also create redundancy and increase the fire flow protection to new customers.

68. New 0.25 MG Upper Denton Rd. EST in the Oak Ridge Pressure Plane (Project 68)

This is a proposed 0.25 MG EST in the Oak Ridge Pressure Plane near Upper Denton Rd. The purpose of this project is to expand the elevated storage capacity in the Oak Ridge Pressure Plane to meet buildout planning period capacity requirements.

69. 12-inch Water Line in the Dubellette Pressure Plane (Project 69)

This project consists of a 12-inch water line along Greenwood Rd. and Jones Rd. in the Dubellette Pressure Plane. The purpose of this project is to increase redundancy and extend water service further west in the Dubellette Pressure Plane.

70. New 1.0 MG Greenwood EST in the Dubellette Pressure Plane (Project 70)

This project is a proposed 1.0 MG EST along Greenwood Rd. in the Dubellette Pressure Plane. The purpose of this project is to expand the elevated storage capacity in the Dubellette Pressure Plane to meet buildout planning period capacity requirements.

71. 16-inch Water Line in the Miller Pressure Plane (Project 71)

This project consists of a 16-inch water line in the Miller Pressure Plane along Old Mineral Wells Hwy. and Duke Tr. from the Miller EST to the proposed Garner Rd. EST (Project 73). The purpose of this project is to increase redundancy and extend water service in the Miller Pressure Plane.

72. 12-inch Water Line in the Miller Pressure Plane (Project 72)

This project consists of a 12-inch water line in the Miller Pressure Plane along Garner Rd. from the Miller EST to the proposed Garner Rd. EST (Project 73). The purpose of this project is to increase redundancy and extend water service in the Miller Pressure Plane.

73. New 0.5 MG Garner Rd. EST in the Miller Pressure Plane (Project 73)

This project is a proposed 0.5 MG EST in the Miller Pressure Plane along Garner Rd. The purpose of this project is to expand the elevated storage capacity in the Miller Pressure Plane to meet buildout planning period capacity requirements.

74. 12-inch Water Line in the Franklin Pressure Plane (Project 74)

This project consists of a 12-inch water line in the Franklin Pressure Plane along Hawkins Lilly Rd. The 12-inch line will create a loop along the eastern boundary of the pressure plane. The 12-inch line will also supply the proposed Cochran EST (Project 75). The purpose of this project is to increase redundancy and extend water service to future customers in the Franklin Pressure Plane.

75. New 0.5 MG Cochran EST in the Franklin Pressure Plane (Project 75)

This project is a proposed 0.5 MG EST in the Franklin Pressure Plane along Cochran Rd. The purpose of this project is to expand the elevated storage capacity in the Franklin Pressure Plane to meet buildout planning period capacity requirements.

76. 12-inch Water Line in the Franklin Pressure Plane (Project 76)

This project consists of a 12-inch water line in the most northern portion of the Franklin Pressure Plane to the buildout service area boundary. The purpose of this project is to increase redundancy and extend water service to future customers in the Franklin Pressure Plane.

77. New 1.0 MG Northwest GST and 4.0 MGD Pump Station (Project 77)

This project consists of a new 1.0 MG GST and 4.0 MGD PS near the intersection of Zion Hill Rd. and the Weatherford Loop. The purpose of this project is to create a new Northwest Pressure Plane to serve future water customers in the northwestern portion of the City. Due to higher ground elevations, customers in this area cannot currently be served by the existing pressure plane delineation. The new pump station will meet

future maximum day and peak hour demand conditions as well as meeting buildout storage and pumping capacity requirements.

78. 16-inch Water Line in the Northwest Pressure Plane (Project 78)

This project is the construction of a 16-inch water line in the Northwest Pressure Plane along Zion Hill Road from the proposed Northwest PS and GST to Vaughn Lane. The purpose of this project is to serve future water customers in the northwestern portion of the City.

79. 12-inch Water Line in the Northwest Pressure Plane (Project 79)

This project consists of a 12-inch water line in the Northwest Pressure Plane along the Zion Hill Loop from Red Bird Lane to the intersection of Zion Hill Road and Vaughn Lane. The purpose of this project is to increase system looping and redundancy and extend water service to future customers in the Northwest Pressure Plane.

80. 16-inch and 12-inch Water Line in the Northwest Pressure Plane (Project 80)

This project consists of a 12-inch and 16-inch loop in the Northwest Pressure Plane. The project begins at the intersection of Vaughn Lane and Zion Hill Road and runs west to Johnson Bend Road continuing north close to the ETJ boundary then looping back to the start of the project. The purpose of this project is to increase system looping and redundancy and extend water service to future customers in the Northwest Pressure Plane.

81. 16-inch and 12-inch Water Line in the Northwest Pressure Plane (Project 81)

This project is the construction of a new 16-inch and 12-inch water line in the Northwest Pressure Plane along FM 920 and Sharla Smelly Road from Johnson Bend Road to Shady Grove Road. The purpose of this project is to extend water service to potential future customers in the far northwest corner of the City's ETJ boundary.

82. 12-inch Water Line in the Northwest Pressure Plane (Project 82)

This project consists of a new 12-inch Water Line from Sharla Smelley Road to FM 920. The 12-inch line completes a loop in the northwestern portion of the Northwest Pressure Plane. The purpose of this project is to extend water service to potential future customers in the far northwest corner of the City's ETJ boundary.

83. New 0.5 MG Northwest EST in the Northwest Pressure Plane (Project 83)

This project is the addition of a new 0.5 MG EST in the Northwest Pressure Plane along FM 920. The purpose of this project is to expand the elevated storage capacity in the Northwest Pressure Plane to meet buildout planning period capacity requirements.

84. 16-inch Water Line and PRV in the Dubellette Pressure Plane PRV Area (Project 84)

This project consists of a 16-inch line in the Dubellette Pressure Plane PRV area along Dennis Road from Interstate 20 to Old Brock Road. This project also includes the addition of a pressure reducing valve. The purpose of this project is to extend service to future water customers in the area. The PRV is used because of the changing elevations in the area which can create pressure issues.

85. 12-inch Water Line in the Dubellette Pressure Plane PRV Area (Project 85)

This project consists of a 12-inch water line along Old Brock Road from Dennis Road to Dean Road in the Dubellette Pressure Plane PRV area. The purpose of this project is to increase redundancy and extend water service to future customers in the Dubellette Pressure Plane PRV area.

86. 16-inch and 12-inch Water Line and PRVs in the Dubellette Pressure Plane PRV Area (Project 86)

This project consists of a 16-inch water line along Old Dennis Road, a 12-inch water line along Dean Road/Old Brock Road, and two PRVs between the Dubellette Pressure Plane and the Dubellette Pressure Plane PRV area. The purpose of this project is to extend

service to future water customers in the area and promote system looping. The PRV is used because of the changing elevations in the area which can create pressure issues.

87. 20-inch and 12-inch Water Line and PRVs in the Dubellette Pressure Plane PRV Area (Project 87)

This project consists of a 20-inch water line that crosses Tin Top Road, a 12-inch water line along Tin Top Road, and two PRVs between the Dubellette Pressure Plane and the Dubellette Pressure Plane PRV area. The purpose of this project is to extend service to future water customers in the area and promote system looping. The PRV is used because of the changing elevations in the area which can create pressure issues.

88. 12-inch Water Line in the Dubellette Pressure Plane PRV Area (Project 88)

This project consists of a 12-inch water line that connects to a proposed 20-inch water line and a proposed 12-inch line along Tin Top Road to create a system loop in the Dubellette Pressure Plane PRV area. The purpose of this project is to extend service to future water customers in the area and promote system looping.

89. 20-inch and 12-inch Water Lines in the West Lake Pressure Plane (Project 89)

This project consists of a new 20-inch water line from the City's Water Treatment Plant to White Settlement Road, and a 12-inch water line along White Settlement Road from the proposed 20-inch line to an existing 8-inch line near Lake Weatherford. This project promotes redundancy and system looping in the West Lake Pressure Plane.

90. 20-inch Water Line in the West Lake Pressure Plane (Project 90)

This project is the construction of a new 20-inch water line in the West Lake Pressure Plane from White Settlement Road to a future GST and PS location in northeast Weatherford. This project is the second phase of a water line necessary to create a future Northeast Pressure Plane in the City's ETJ.

91. New 0.5 MG Westlake Drive EST (Project 91)

This project is the construction of a new 0.5 MG EST in the West Lake Pressure Plane. The purpose of this project is to expand the elevated storage capacity in the West Lake Pressure Plane to meet buildout planning period capacity requirements.

92. 12-inch Water Line in the West Lake Pressure Plane (Project 92)

This project consists of a 12-inch water line from the future Northeast GST and PS site, along FM 730 and Ragle Road, and connecting to an existing 8-inch line at East Lake Drive. This project creates a loop in the West Lake Pressure Plane to serve future water customers.

93. New 0.5 MG Northeast GST and Pump Station (Project 93)

This project is the construction of a new 0.5 MG GST and 2.0 MGD pump station. The construction of this facility allows for the formation of a new Northeast pressure plane in the City's ETJ.

94. 12-inch Water Line in the Northeast Pressure Plane (Project 94)

This project consists of a new 12-inch water line from the Northeast Pressure Plane PS/GST to Pearson Ranch Road. The purpose of this project is to extend service to future water customers in the area.

95. 12-inch Water Lines in the Northeast Pressure Plane (Project 95)

This project consists of 12-inch water line in the Northeast Pressure Plane. The first line runs along Pearson Ranch Road and FM 730 to the PS/GST site. The second 12-inch line branches off Pearson Road and dead ends due north in the Northeast Pressure Plane. The purpose of this project is to extend service to future water customers in the area and provide system redundancy and looping.

96. New 0.75 MG Northeast Pressure Plane EST (Project 96)

This project is the construction of a new 0.75 MG elevated storage tank in the Northeast Pressure Plane. The purpose of this project is to expand the elevated storage capacity in the Northeast Pressure Plane to meet buildout planning period capacity requirements.

97. 12-inch Water Line in the Dubellette Pressure Plane PRV Area (Project 97)

This project consists of a new 12-inch water line crossing Harmony Road and then running along Bethel Road to connect to a proposed 16-inch line in the Dubellette Pressure Plane PRV area. The purpose of this project is to extend service to future water customers in the area and provide system redundancy and looping.

98. 16-inch Water Line in the Dubellette Pressure Plane PRV Area (Project 98)

This project consists of a 16-inch water line along Old Dennis Road from Dean Road to Westridge Drive in the Dubellette Pressure Plane PRV area. The purpose of this project is to extend water service in the Dubellette Pressure Plane PRV area.

99. 12-inch Water Line Loop in the Dubellette Pressure Plane PRV Area (Project 99)

This project consists of a 12-inch water line along Scarlett Road, Old Dennis Road, and Lution Road completing a 12-inch loop in the area. This project creates a loop in the Dubellette Pressure Plane PRV area to serve future water customers and promote redundancy.

100. 12-inch Water Line in the Dubellette Pressure Plane PRV Area (Project 100)

This project consists of a 12-inch water line from the intersection of Dennis Road and Old Brock Road to the intersection of Old Dennis Road and Lution Road in the Dubellette Pressure Plane PRV area. This project creates a loop in the Dubellette Pressure Plane PRV area to serve future water customers and promote redundancy.

101. 12-inch Water Line in the East Pressure Plane (Project 101)

This project consists of a 12-inch water line creating an additional loop in the East Pressure Plane. This project creates a loop in the East Pressure Plane to serve future water customers and promote redundancy.

102. 12-inch Water Line in the Dubellette Pressure Plane (Project 102)

This project consists of a 12-inch water line creating a loop and connecting to a proposed 16-inch line in the southern portion of the Dubellette Pressure Plane. This project creates a loop in the Dubellette Pressure Plane to serve future water customers and promote redundancy.

103. 12-inch Water Line in the Dubellette Pressure Plane (Project 103)

This project consists of a 12-inch water line creating a loop and connecting to proposed 16-inch and 12-inch lines in the southern portion of the Dubellette Pressure Plane. This project creates a loop in the Dubellette Pressure Plane to serve future water customers and promote redundancy.

104. 12-inch Water Line in the Dubellette Pressure Plane (Project 104)

This project consists of a 12-inch water line creating a loop and connecting to proposed 20-inch and 12-inch lines in the southern portion of the Dubellette Pressure Plane. This project creates a loop in the Dubellette Pressure Plane to serve future water customers and promote redundancy.

105. 12-inch Water Line in the Dubellette Pressure Plane (Project 105)

This project consists of a 12-inch water line creating a loop and connecting to proposed 12-inch lines in the southeastern portion of the Dubellette Pressure Plane. This project creates a loop in the Dubellette Pressure Plane to serve future water customers and promote redundancy.



**APPENDIX A
WATER CIP COST TABLES**

City of Weatherford
2016 Capital Improvements Plan



OPINION OF PROBABLE COST

January 2013

Construction Project Number						R1
Project Description						
Reuse Water Project						
Detailed Description						
Reuse Water Project at the Weatherford Wastewater Treatment Plant						
Purpose						
This project will allow the City to transfer treated effluent from the existing wastewater treatment plant to a proposed wetland site next to Lake Weatherford.						
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	
From Transfer Station at WWTP						
1	Transfer Pumps (2), Stand Pipe, Fill Station	1	EA	-	\$	2,500,000
Pipelines						
2	Transfer Pipeline (16-inch)	35,000	LF	\$80.00	\$	2,800,000
Wetland						
3	Wetland	50	Acres	\$28,000.00	\$	1,400,000
4	Lake Outfall	1	LS	\$75,000.00	\$	75,000
SUBTOTAL:						\$6,775,000
CONTINGENCY 30%						\$2,032,500
SUBTOTAL:						\$8,807,500
ENG/SURVEY 15%						\$1,321,130
Environmental Permitting						\$107,800
OWNER'S COST						
(Wetland Purchase and Pipeline Easement)						\$732,000
SUBTOTAL:						\$10,968,430
PROJECT TOTAL						\$10,968,430

Construction Project Number						1
Project Description						
30-inch Supply Line to the Dubellette GST in the Dubellette Pressure Plane						
Detailed Description						
This project replaces the existing 12-inch line constructed in 1956 that runs along Columbia Ave, from Walnut Street to Davis St. It then runs down Davis to Baylor St. and then on to the Dubellette GST.						
Purpose						
This project will increase the supply of water to the Dubellette GST from the Central Pressure Plane. This increased supply will help the City meet maximum day and peak hour storage requirements at the Dubellette GST without the help of the Dubellette EST.						
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	
1	30" Water Line and Appurtenances	6,000	LF	\$180.00	\$	1,080,000
2	Pavement Repair	4,200	LF	\$50.00	\$	210,000
SUBTOTAL:						\$1,290,000
CONTINGENCY 20%						\$258,000
SUBTOTAL:						\$1,548,000
ENG/SURVEY 12%						\$185,760
SUBTOTAL:						\$1,733,760
PROJECT TOTAL						\$1,733,760

City of Weatherford
2016 Capital Improvements Plan



OPINION OF PROBABLE COST

January 2013

Construction Project Number						4
Project Description						
12-inch Supply Line from the New Ward St Pump Station in the Central PP						
Detailed Description						
This project is a 12-inch water line along Fort Worth Highway from Ward St. to FM 730 and is a 12-inch water line along Grant Rd. between Fort Worth Highway and East Bankhead Highway.						
Purpose						
This water line will provide additional flow and looping in the new "Central" Pressure Plane. The proposed line will tie-in to the existing 8-inch line along Bankhead Highway that will be a dead-end line with the creation of the new pressure planes. The redundancy will increase fire flow protection and increase supply to customers along Bankhead Highway in the Central Pressure Plane.						
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	
1	12" Water Line and Appurtenances	11,800	LF	\$72.00	\$	849,600
2	Pavement Repair	2,000	LF	\$50.00	\$	100,000
3	20" Boring and Casing	400	LF	\$300.00	\$	120,000
SUBTOTAL:						\$1,069,600
CONTINGENCY 20%						\$213,920
SUBTOTAL:						\$1,283,520
ENG/SURVEY 12%						\$154,030
SUBTOTAL:						\$1,437,550
PROJECT TOTAL						\$1,437,550

Construction Project Number						5
Project Description						
12-inch Water Line in the East Pressure Plane						
Detailed Description						
This 12-inch line will run along the Fort Worth Highway in the new East Pressure Plane. It will replace the existing 8-inch line between Willow Creek Dr. and Azle Highway.						
Purpose						
The new 12-inch line will provide greater redundancy in the newly formed East Pressure Plane. It will increase the supply of water customers along Willow Creek Dr. and along Azle Highway to meet maximum day and peak hour demand conditions.						
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL	
1	12" Water Line and Appurtenances	3,900	LF	\$72.00	\$	280,800
2	Pavement Repair	200	LF	\$50.00	\$	10,000
3	20" Boring and Casing	400	LF	\$300.00	\$	120,000
SUBTOTAL:						\$410,800
CONTINGENCY 20%						\$82,160
SUBTOTAL:						\$492,960
ENG/SURVEY 12%						\$59,160
SUBTOTAL:						\$552,120
PROJECT TOTAL						\$552,120

City of Weatherford
Buildout Capital Improvements Plan



OPINION OF PROBABLE COST

January 2013

Construction Project Number						33
Project Description						
5.0 MGD Harberger Hill Pump Station Expansion						
Detailed Description						
This project consists of a 5 MGD expansion of the Harberger Hills PS.						
Purpose						
Population projections indicate that the existing Harberger Hill PS will not have enough capacity to meet future demands in the buildout planning period. The additional 5 MGD pumping capacity will meet TCEQ requirements.						
ITEM						
DESCRIPTION						
QUANTITY						
UNIT						
UNIT PRICE						
TOTAL						
1	2.5 MGD Pumps	3	LS	\$300,000.00		\$900,000.00
2	On-Site Piping Improvements	1	LS	\$500,000.00		\$500,000.00
3	SCADA System Improvements	1	LS	\$530,000.00		\$530,000.00
4	Pump Station Building (Electrical, HVAC)	1	LS	\$450,000.00		\$450,000.00
5	Pump Station Piping & Appurtenances	1	LS	\$267,000.00		\$267,000.00
SUBTOTAL:						\$2,647,000
CONTINGENCY 20%						\$529,400
SUBTOTAL:						\$3,176,400
ENG/SURVEY 12%						\$381,170
SUBTOTAL:						\$3,557,570
PROJECT TOTAL						\$3,557,570

Construction Project Number						34
Project Description						
New 2 MG Dubellette Ground Storage Tank and Pump Station						
Detailed Description						
This project consists of a new 2.0 MG GST adjacent to the existing Dubellette GST and EST along with the expansion of the existing Dubellette PS.						
Purpose						
The purpose of this project is to increase the ground storage and pumping capacity in the Dubellette and Miller Pressure Plane. As each pressure plane expands, more capacity is necessary to meet maximum day and peak hour pressure requirements at buildout.						
ITEM						
DESCRIPTION						
QUANTITY						
UNIT						
UNIT PRICE						
TOTAL						
1	2.0 MG Ground Storage Tank	1	LS	\$1,000,000.00		\$1,000,000.00
2	5.0 MGD Pumps	2	LS	\$400,000.00		\$800,000.00
3	2.5 MGD Pumps	1	LS	\$300,000.00		\$300,000.00
4	Electrical (Installation, SCADA, MCC)	1	LS	\$200,000.00		\$200,000.00
5	Pump Station Piping & Appurtenances	1	LS	\$267,000.00		\$267,000.00
6	Pump Station Building (Electrical, HVAC)	1	LS	\$450,000.00		\$450,000.00
7	12" Water Line and Appurtenances	900	LF	\$72.00		\$64,800.00
SUBTOTAL:						\$3,081,800
CONTINGENCY 20%						\$616,360
SUBTOTAL:						\$3,698,160
ENG/SURVEY 12%						\$443,780
SUBTOTAL:						\$4,141,940
PROJECT TOTAL						\$4,141,940

City of Weatherford
Buildout Capital Improvements Plan



OPINION OF PROBABLE COST

January 2013

Construction Project Number **77**

Project Description

New 1.0 MG Northwest GST and 4.0 MGD Pump Station

Detailed Description

This project consists of a new 1.0 MG GST and 4.0 MGD PS near the intersection of Zion Hill Rd. and the Weatherford Loop.

Purpose

The purpose of this project is to create a new Northwest Pressure Plane to serve future water customers in the northwestern portion of the City. Due to higher ground elevations, customers in this area cannot currently be served by the existing pressure plane delineation. The new pump station will meet future maximum day and peak hour demand conditions as well as meeting buildout storage and pumping capacity requirements.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	1.0 MG Ground Tank	1	LS	\$600,000.00	\$600,000.00
2	2.0 MGD Pumps	3	LS	\$200,000.00	\$600,000.00
3	Electrical (Installation, SCADA, MCC)	1	LS	\$200,000.00	\$200,000.00
4	Pump Station Piping & Appurtenances	1	LS	\$267,000.00	\$267,000.00
5	Pump Station Building (Electrical, HVAC)	1	LS	\$450,000.00	\$450,000.00
SUBTOTAL:					\$2,117,000
CONTINGENCY 20%					\$423,400
SUBTOTAL:					\$2,540,400
ENG/SURVEY 12%					\$304,850
SUBTOTAL:					\$2,845,250

PROJECT TOTAL **\$2,845,250**

Construction Project Number **78**

Project Description

16-inch Water Line in the Northwest Pressure Plane

Detailed Description

This project is the construction of a 16-inch water line in the Northwest Pressure Plane along Zion Hill Road from the proposed Northwest PS and GST to Vaughn Lane.

Purpose

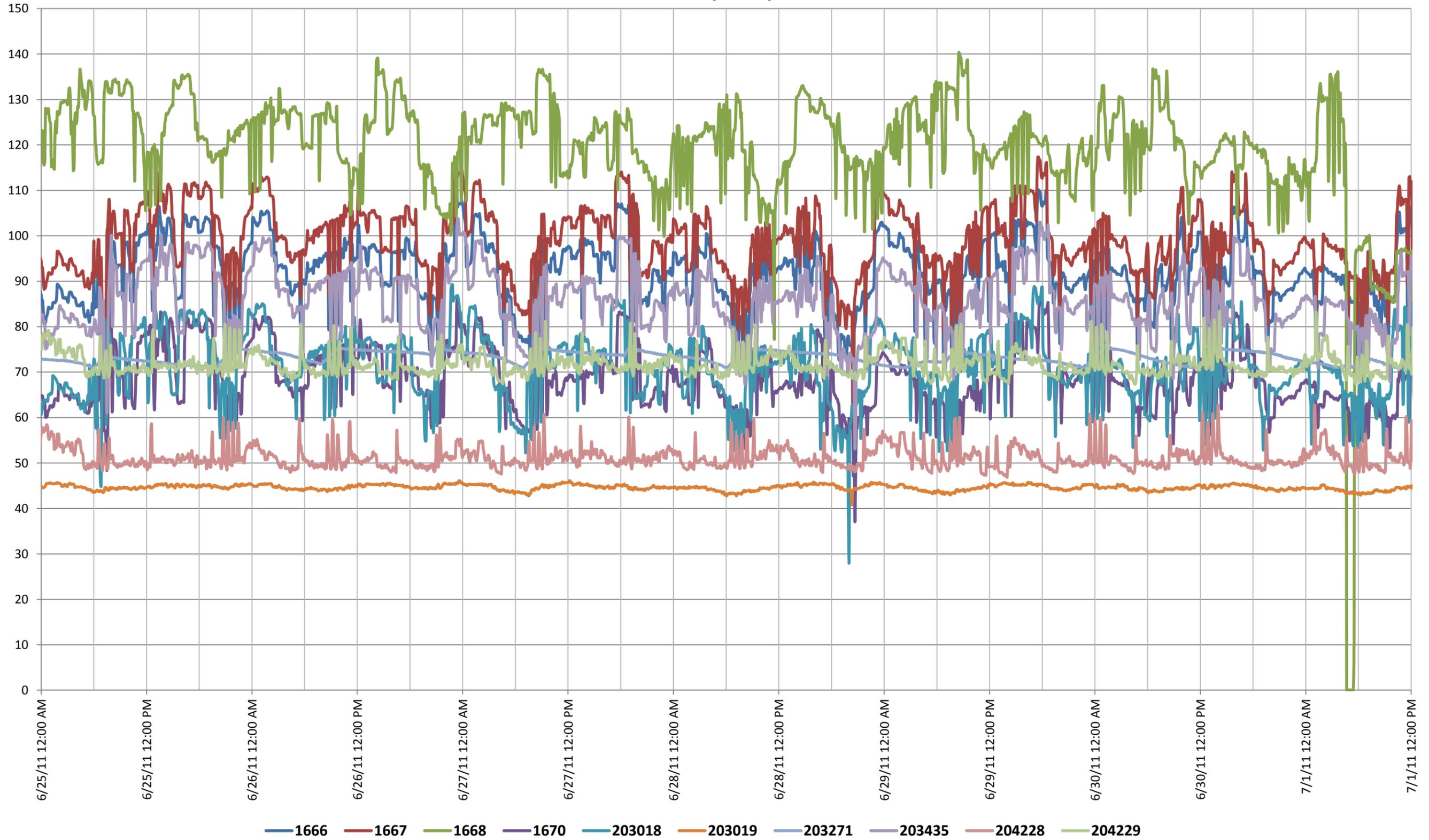
The purpose of this project is to serve future water customers in the northwestern portion of the City.

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	16" Water Line and Appurtenances	8,500	LF	\$96.00	\$816,000.00
2	Pavement Repair	8,500	LF	\$50.00	\$425,000.00
SUBTOTAL:					\$1,241,000
CONTINGENCY 20%					\$248,200
SUBTOTAL:					\$1,489,200
ENG/SURVEY 12%					\$178,710
SUBTOTAL:					\$1,667,910

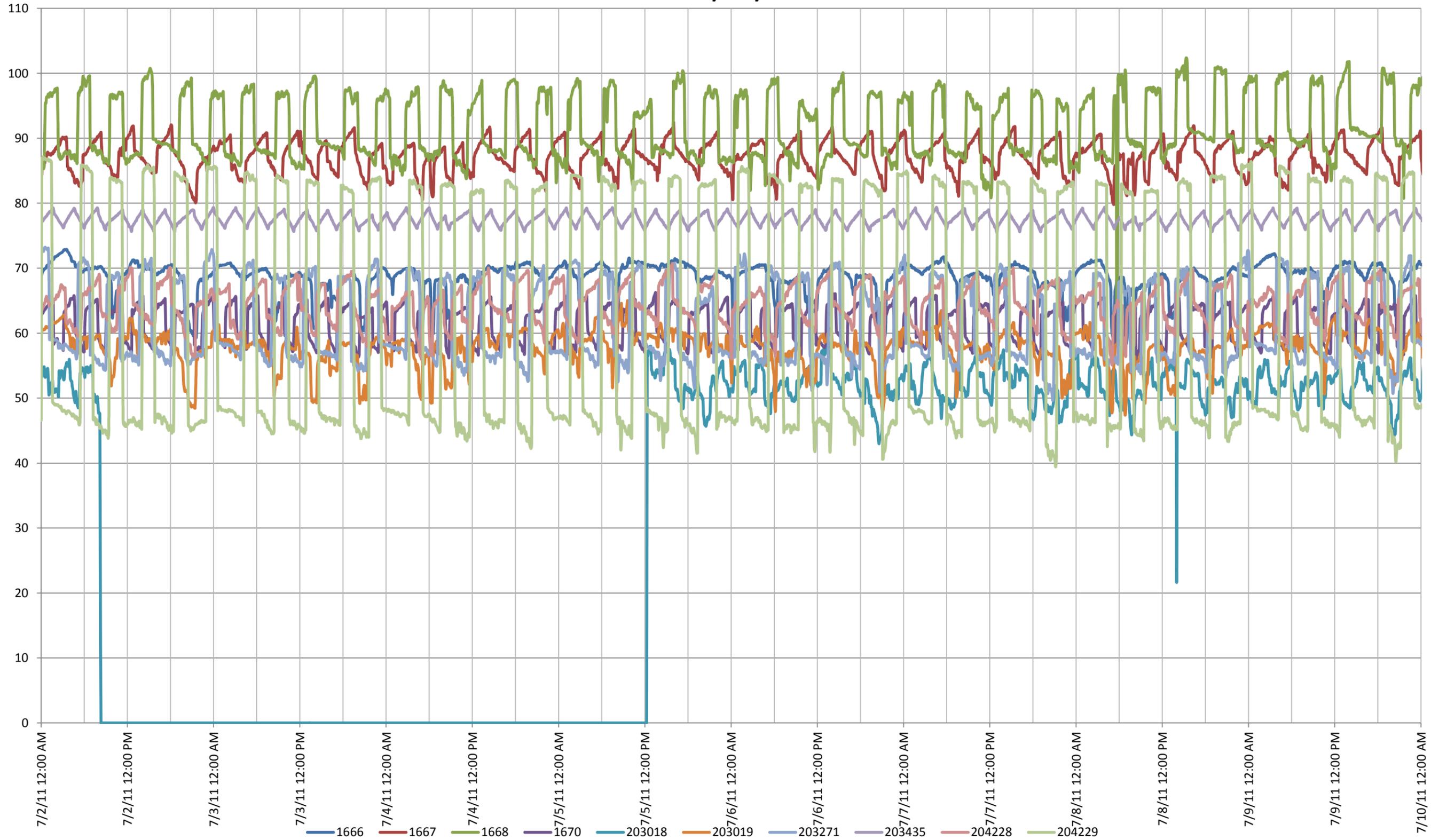
PROJECT TOTAL **\$1,667,910**

**APPENDIX B
FIELD TESTING GRAPHS**

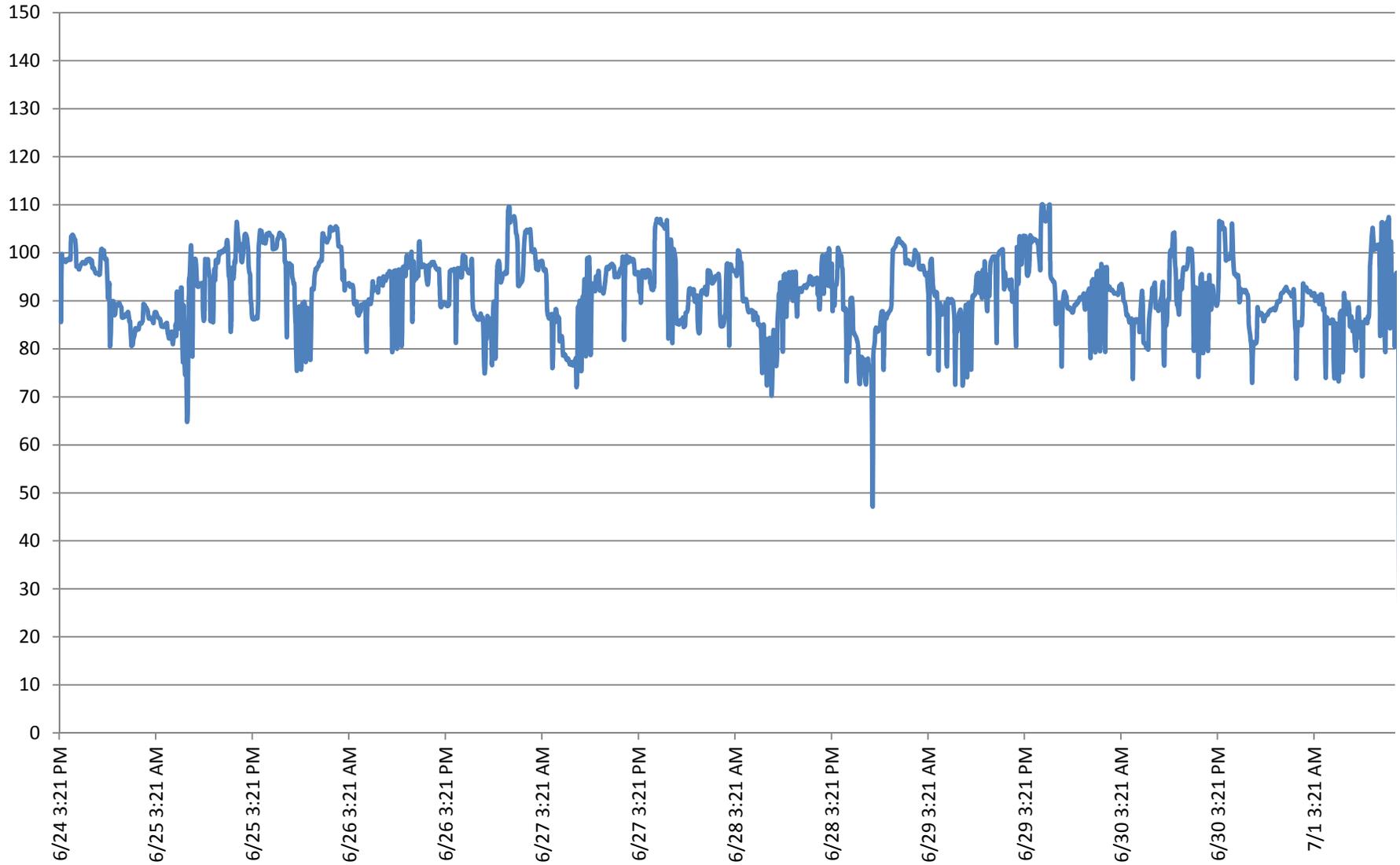
Central, Oak Ridge, and West Lake Pressure Plane Week of 6/24-7/1



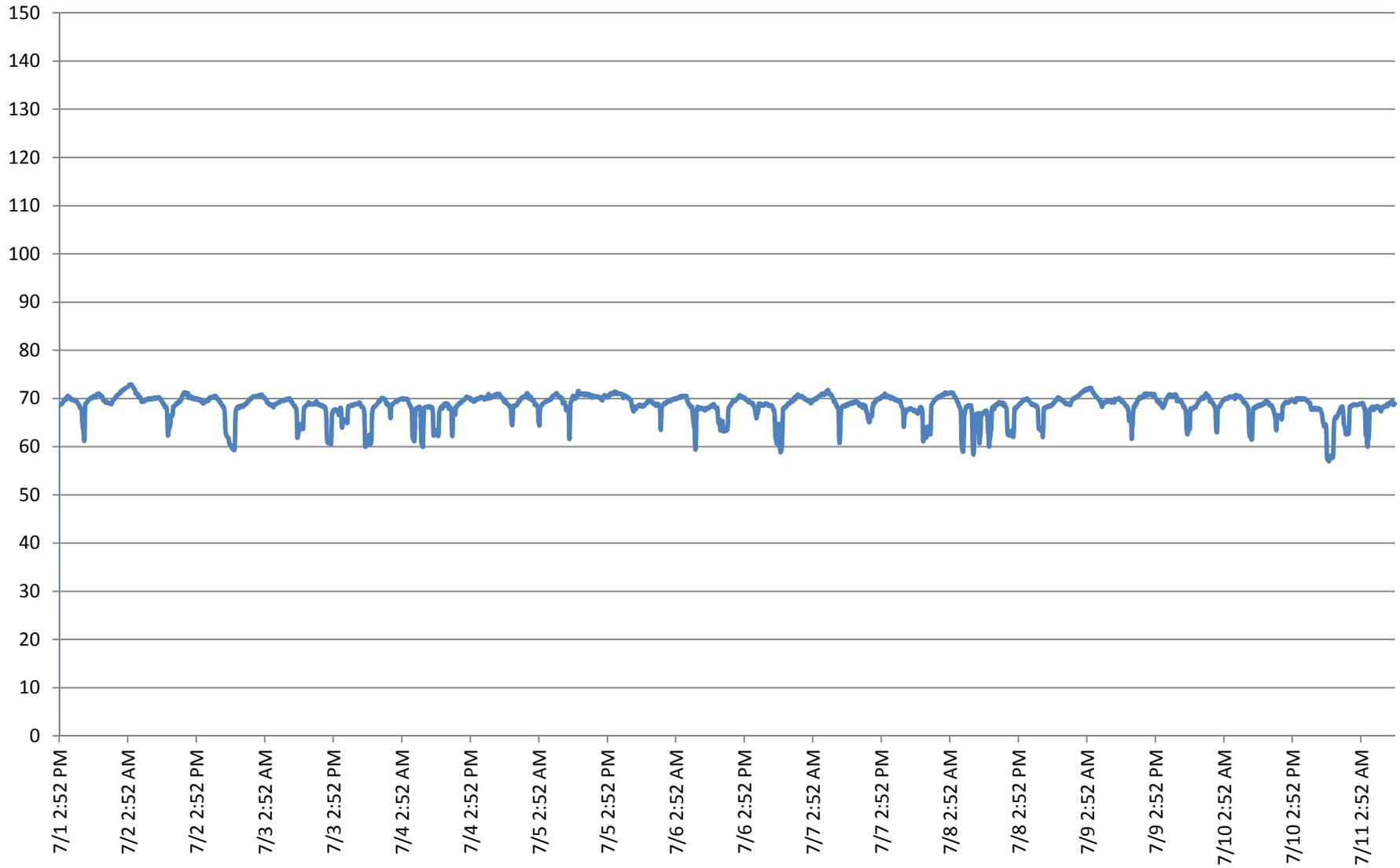
Dubellette, Miller, and Franklin Pressure Plane Week of 7/1-7/11



318 Mitchell Blvd.(#1666)
Central Pressure Plane
(6/24/2011-7/1/2011)



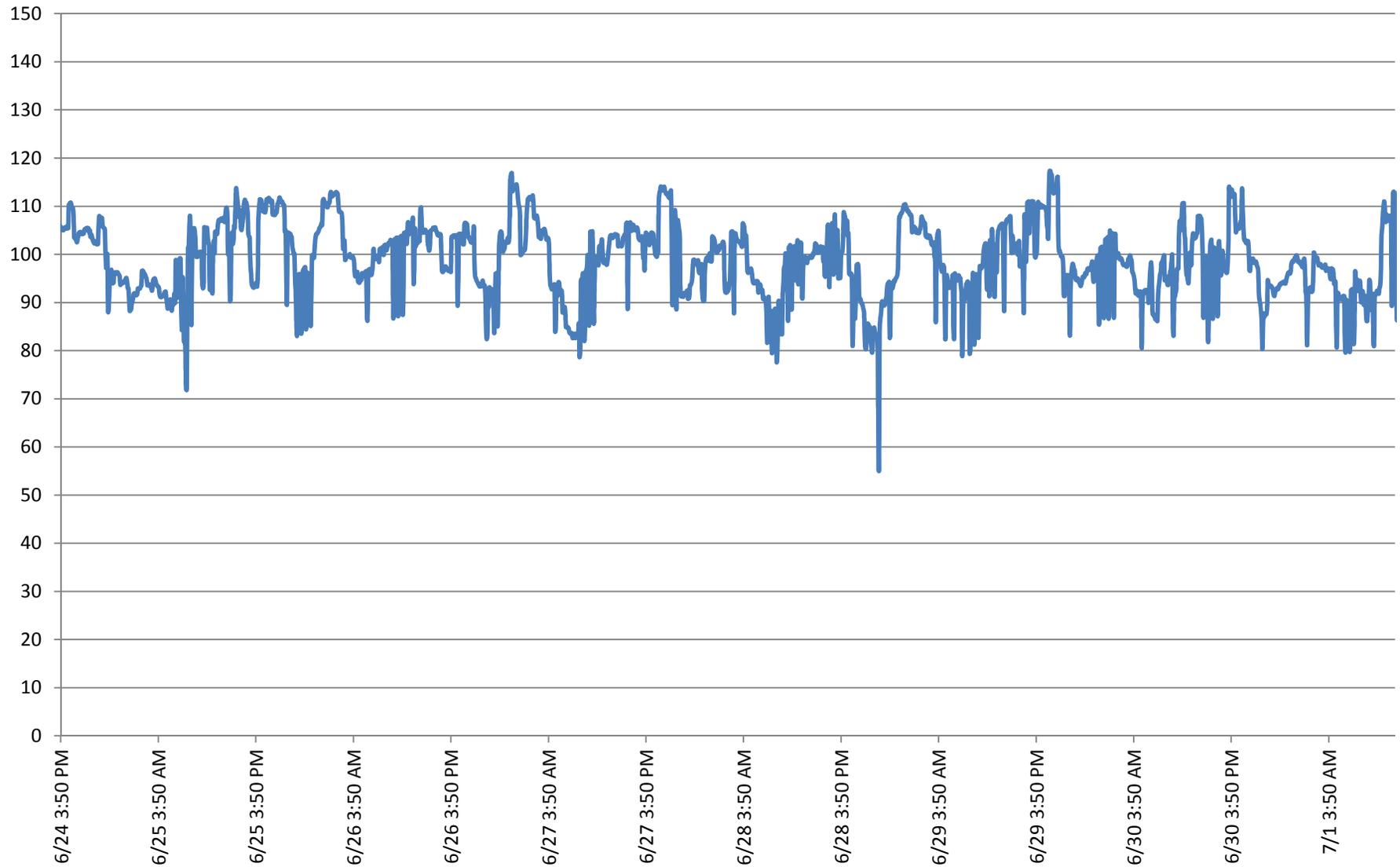
317 Bryan Street (#1666)
Dubellete Pressure Plane
(7/1/2011-7/11/2011)



2208 East Bankhead Hwy. (#1667)

Central Pressure Plane

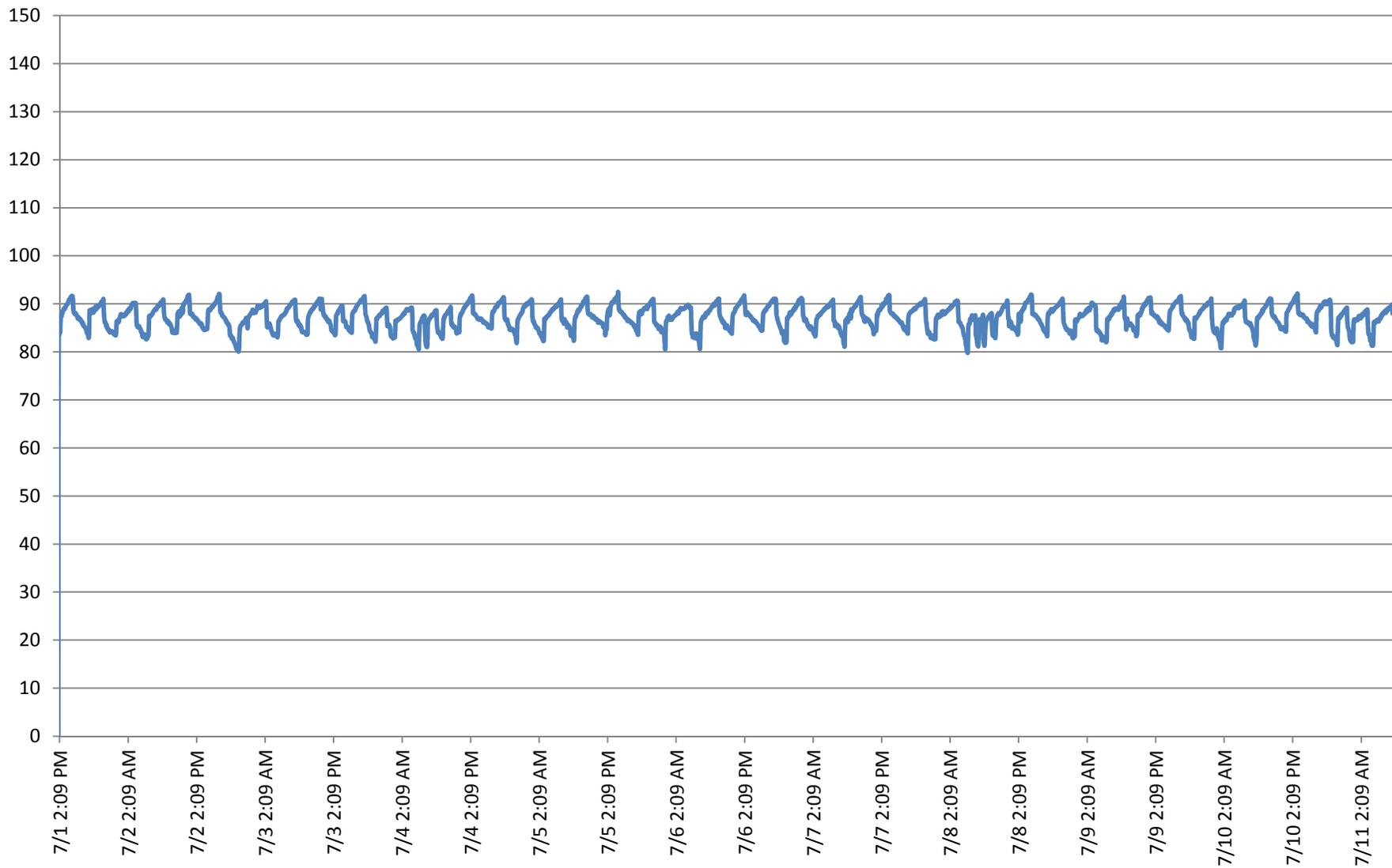
(6/24/2011-7/1/2011)



900 Block of Randall Road (#1667)

Dubellette Pressure Plane

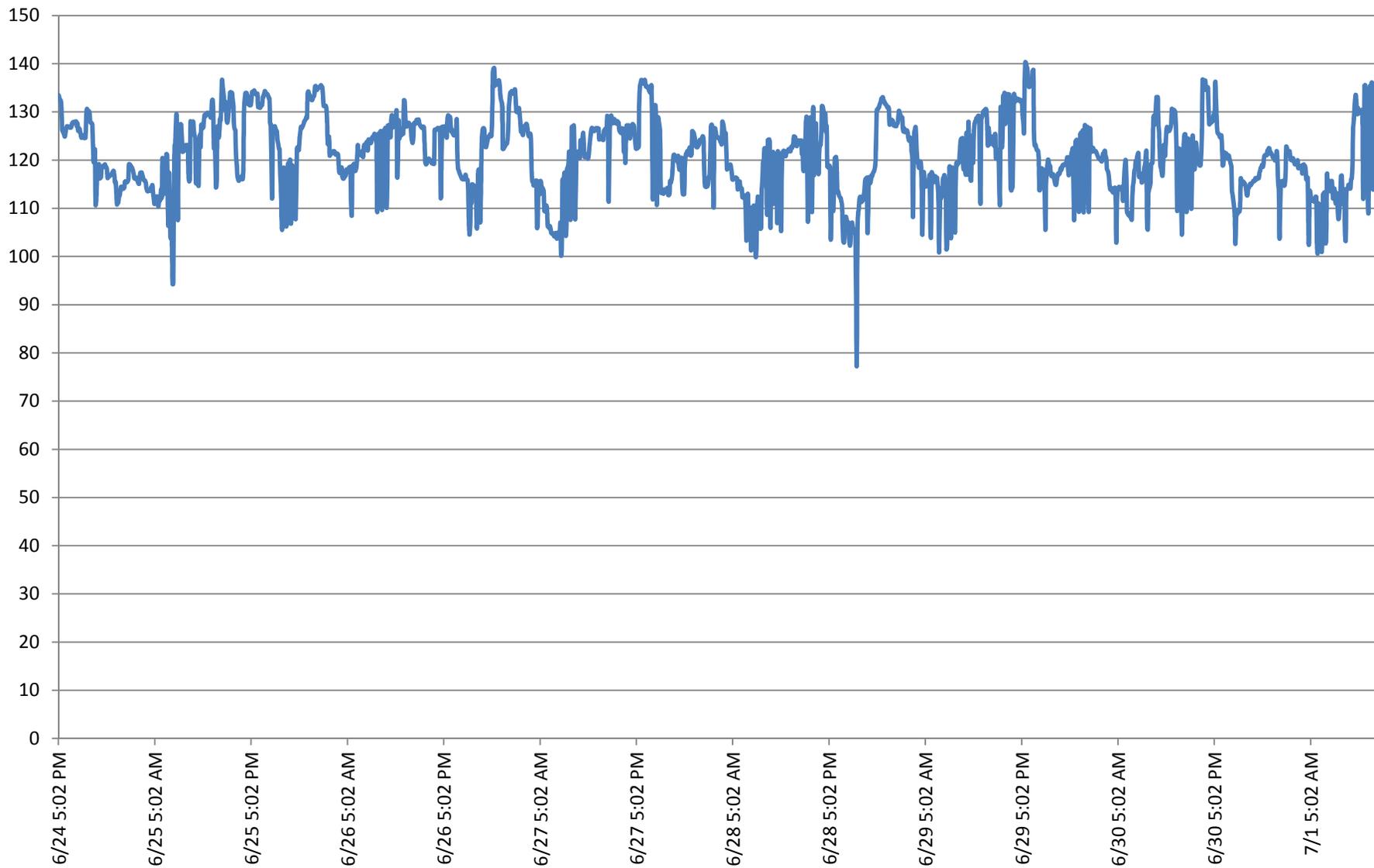
(7/1/2011-7/11/2011)



2210 Summer Brook Drive (#1668)

Central Pressure Plane

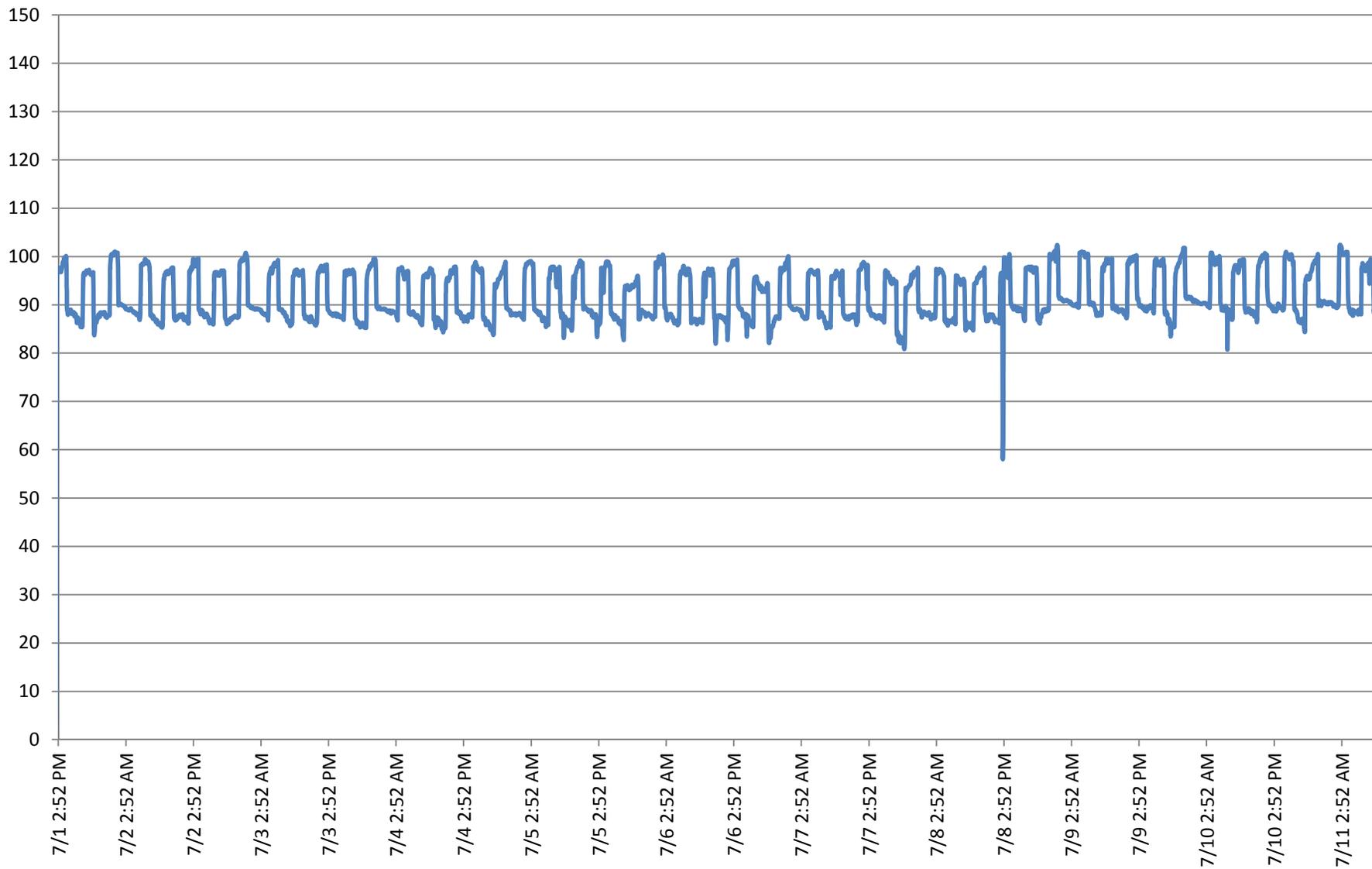
(6/24/2011-7/1/2011)



500 Block of West 4th Street (#1668)

Franklin Pressure Plane

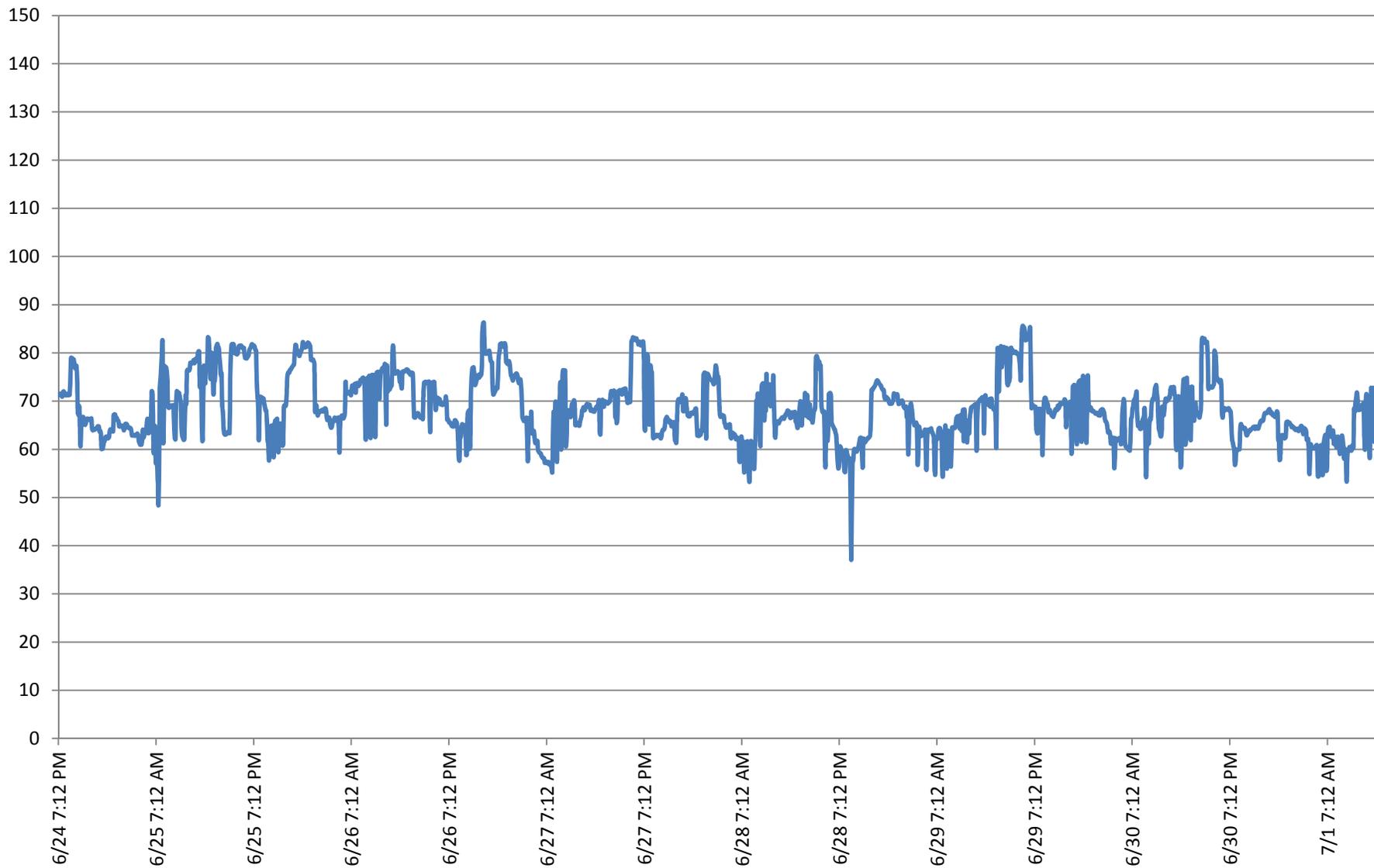
(7/1/2011-7/11/2011)



1001 Santa Fe Drive (#1670)

Central Pressure Plane

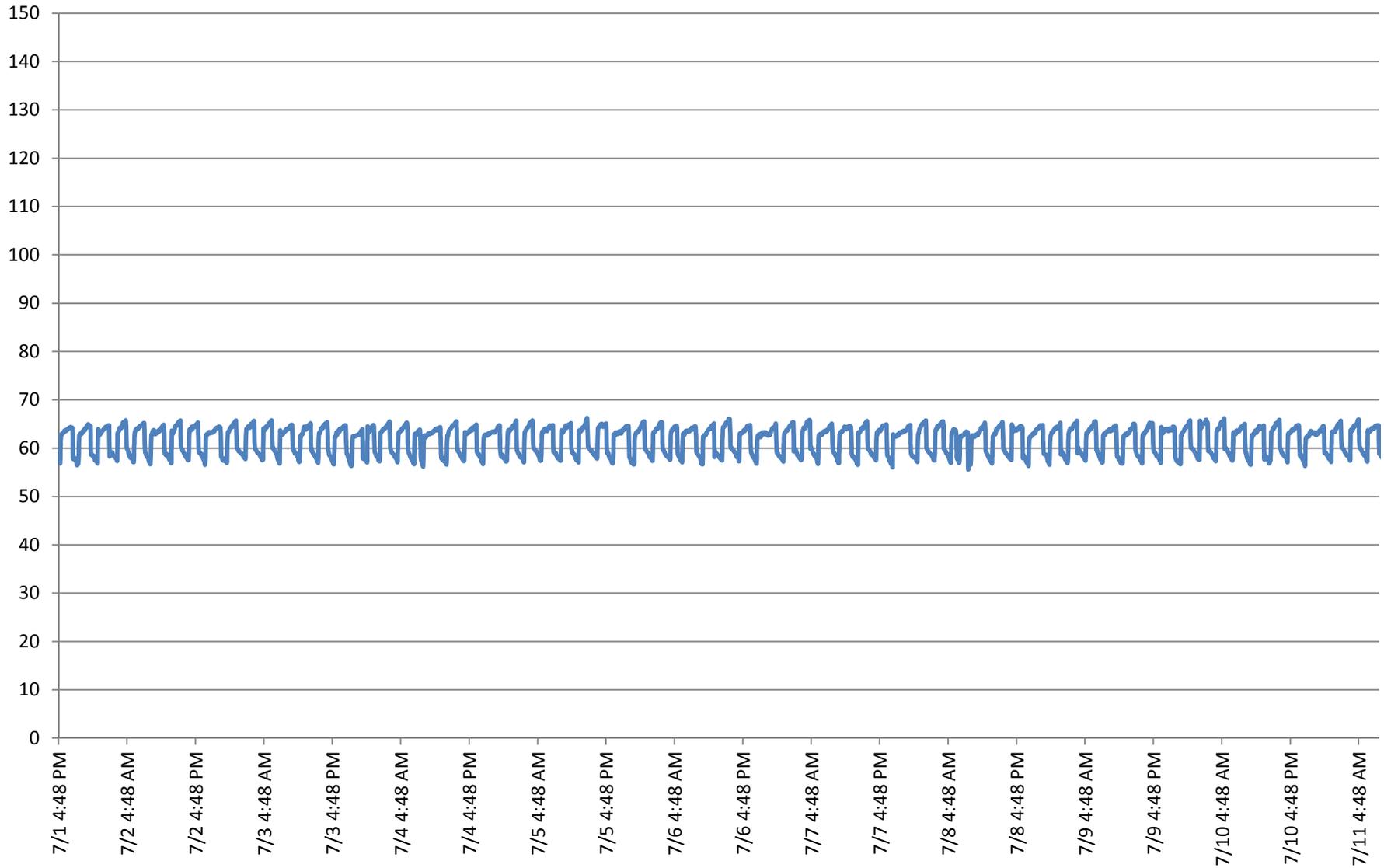
(6/24/2011-7/1/2011)



Dubellette Pump Station (#1670)

Dubellette Pressure Plane

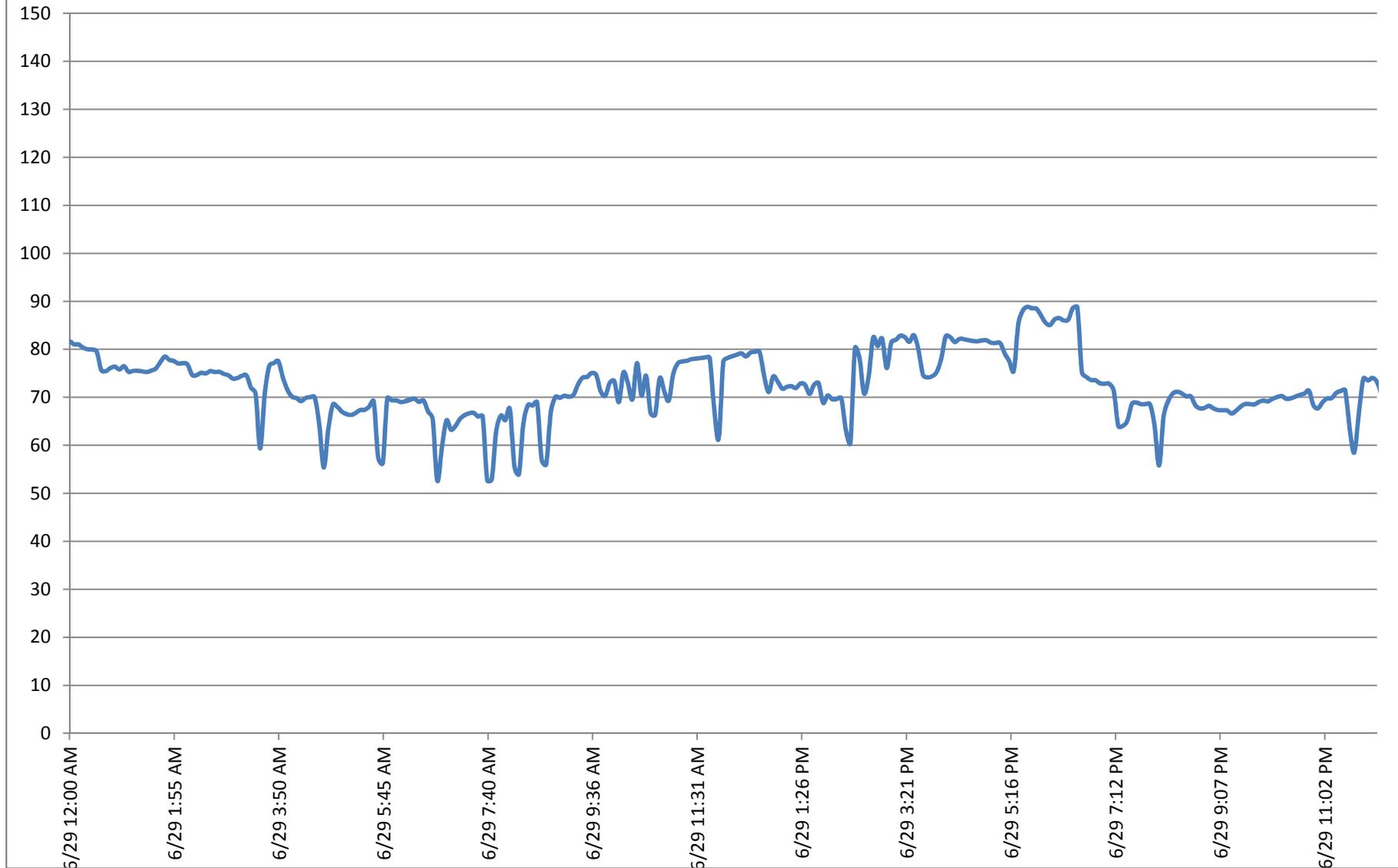
(7/1/2011-7/11/2011)



Sweetwater Drive and 1500 Block of Fort Worth Hwy. (#203018)

Central Pressure Plane

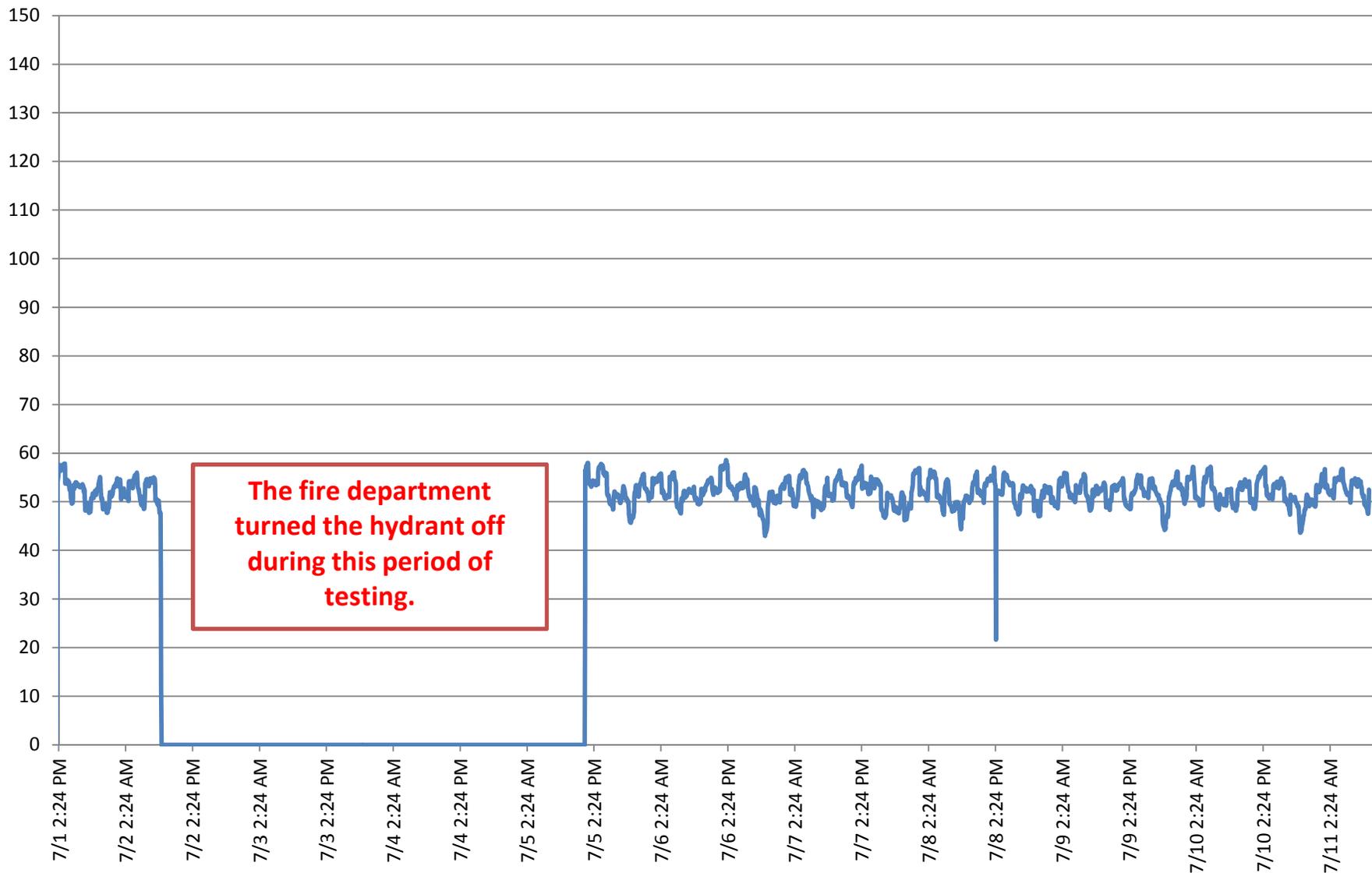
(6/24/2011-7/1/2011)



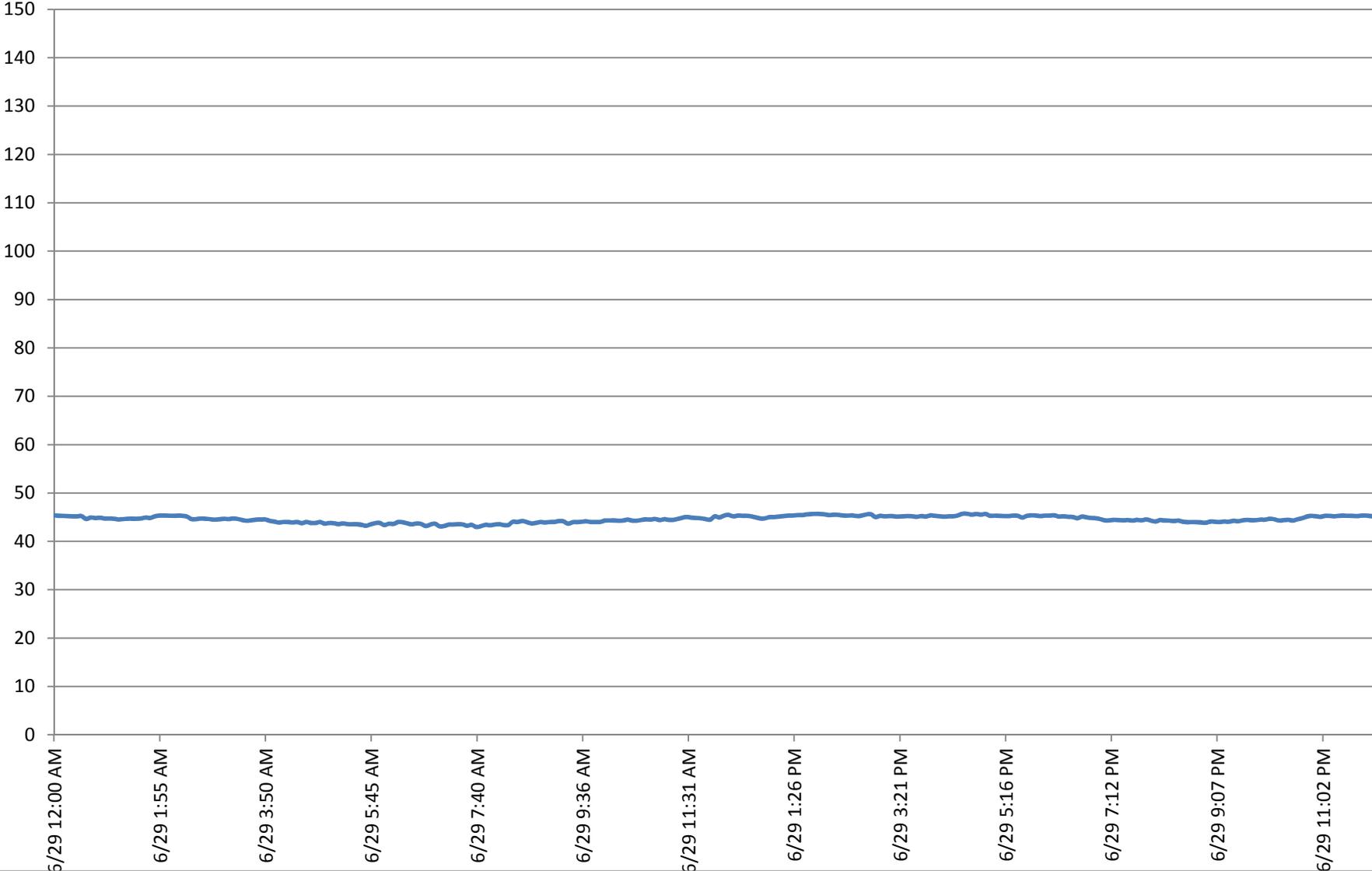
508 Mockingbird Lane and Charles Street (#203018)

Miller Pressure Plane

(7/1/2011-7/11/2011)



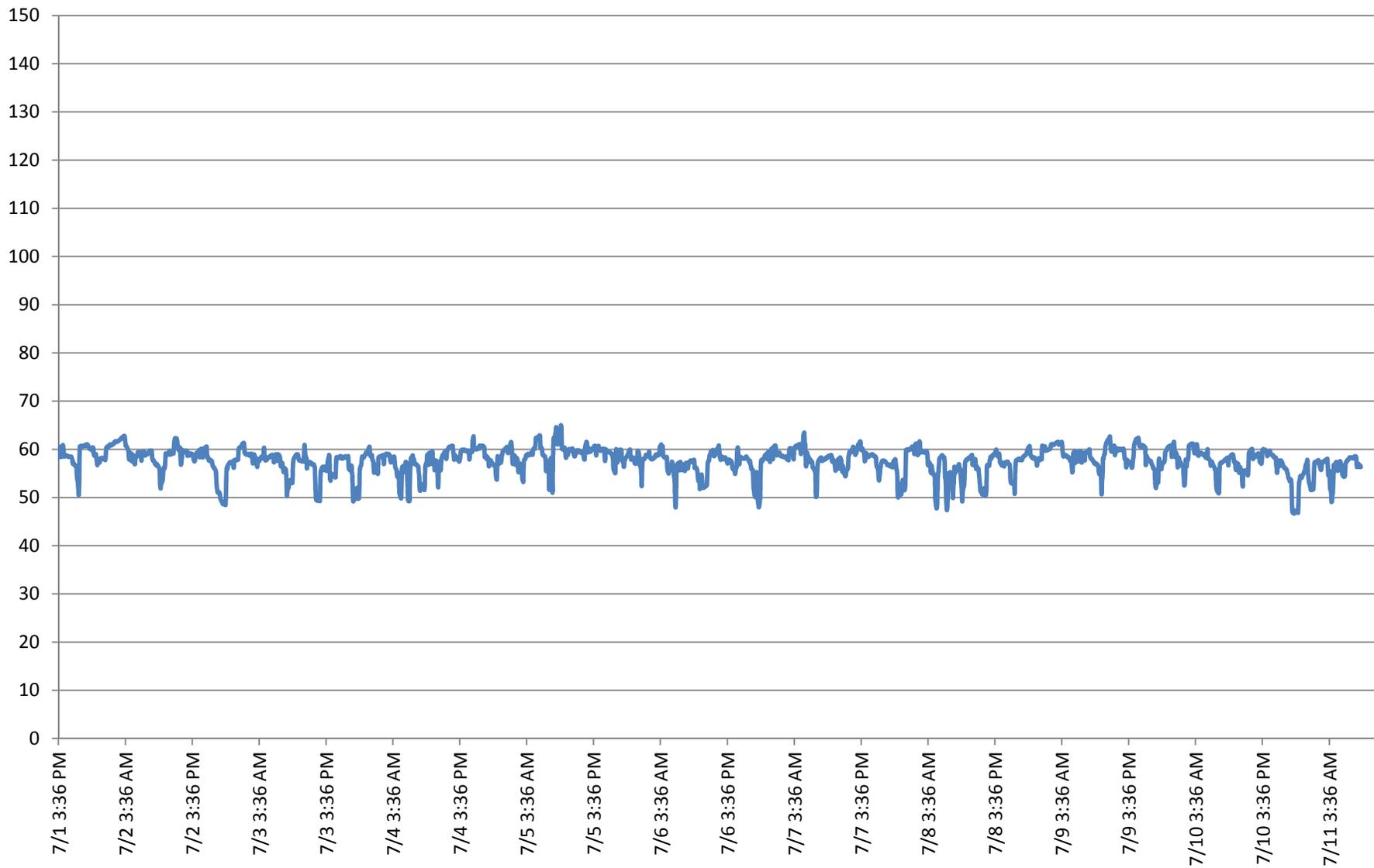
3509 Cliff View Loop (#203019)
Central Pressure Plane
(6/24/2011-7/1/2011)



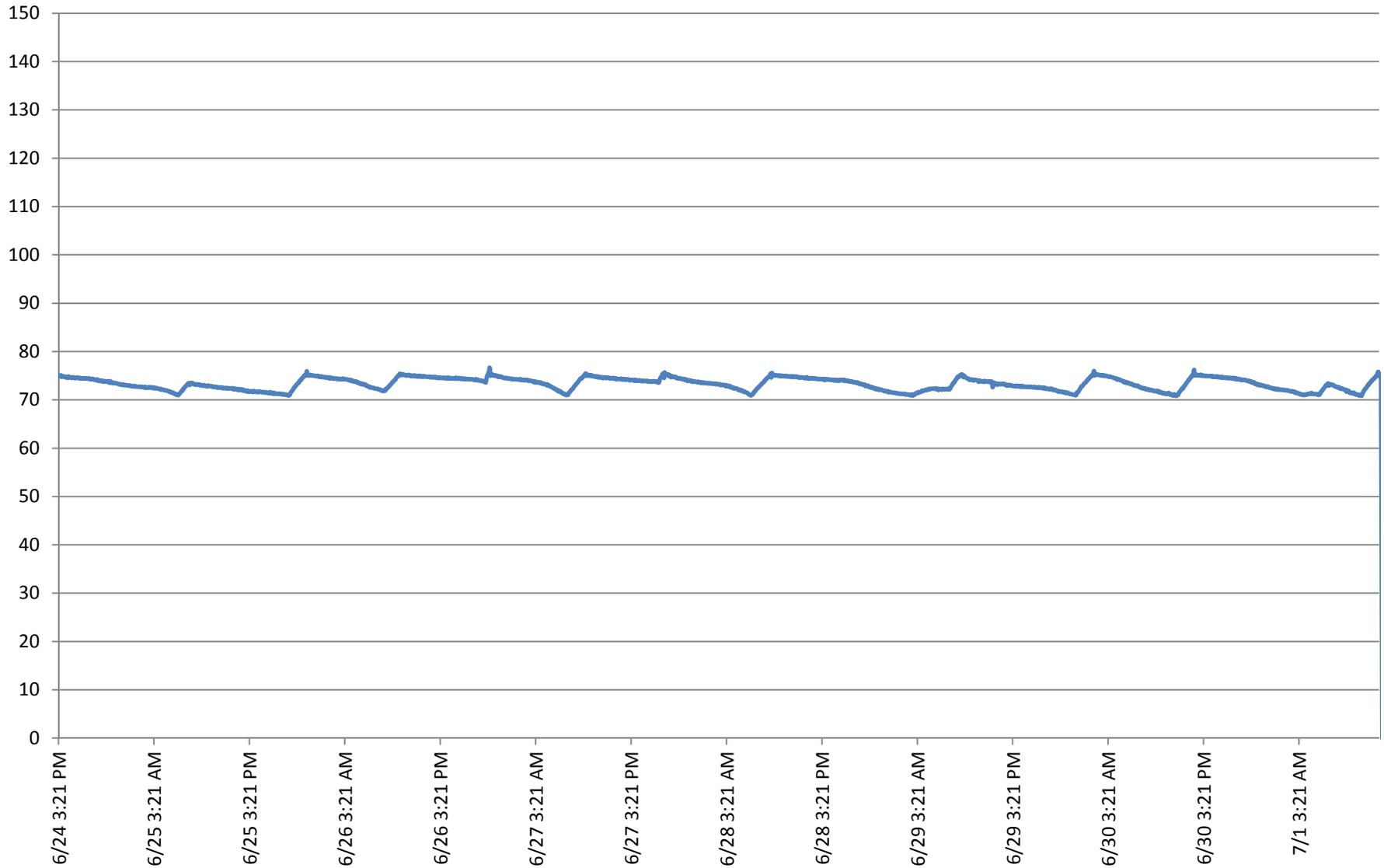
415 Josephine Street (#203019)

Dubellette Pressure Plane

(7/1/2011-7/11/2011)



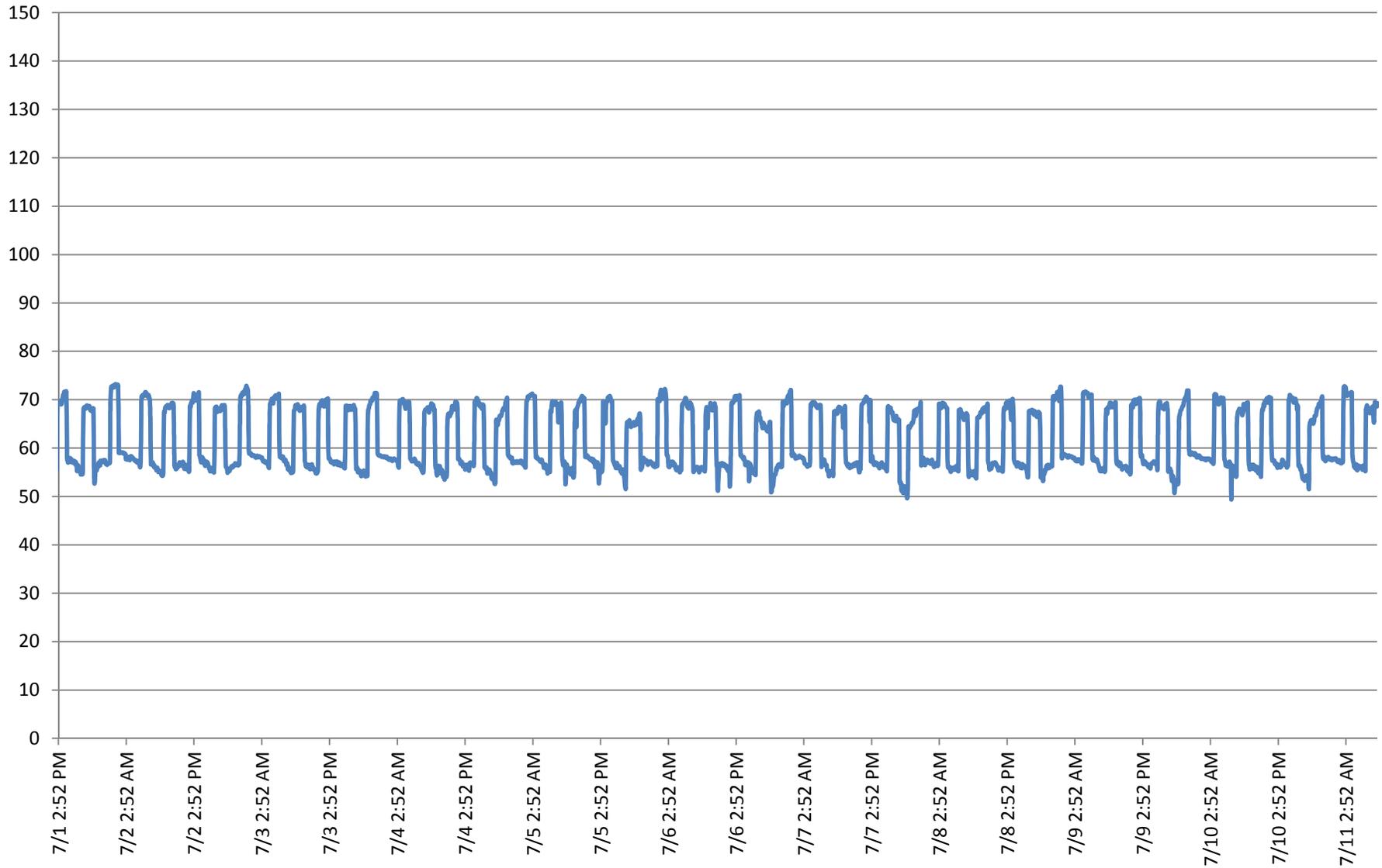
1637 Salado Trail (#203271)
Oakridge Pressure Plane
(6/24/2011-7/1/2011)



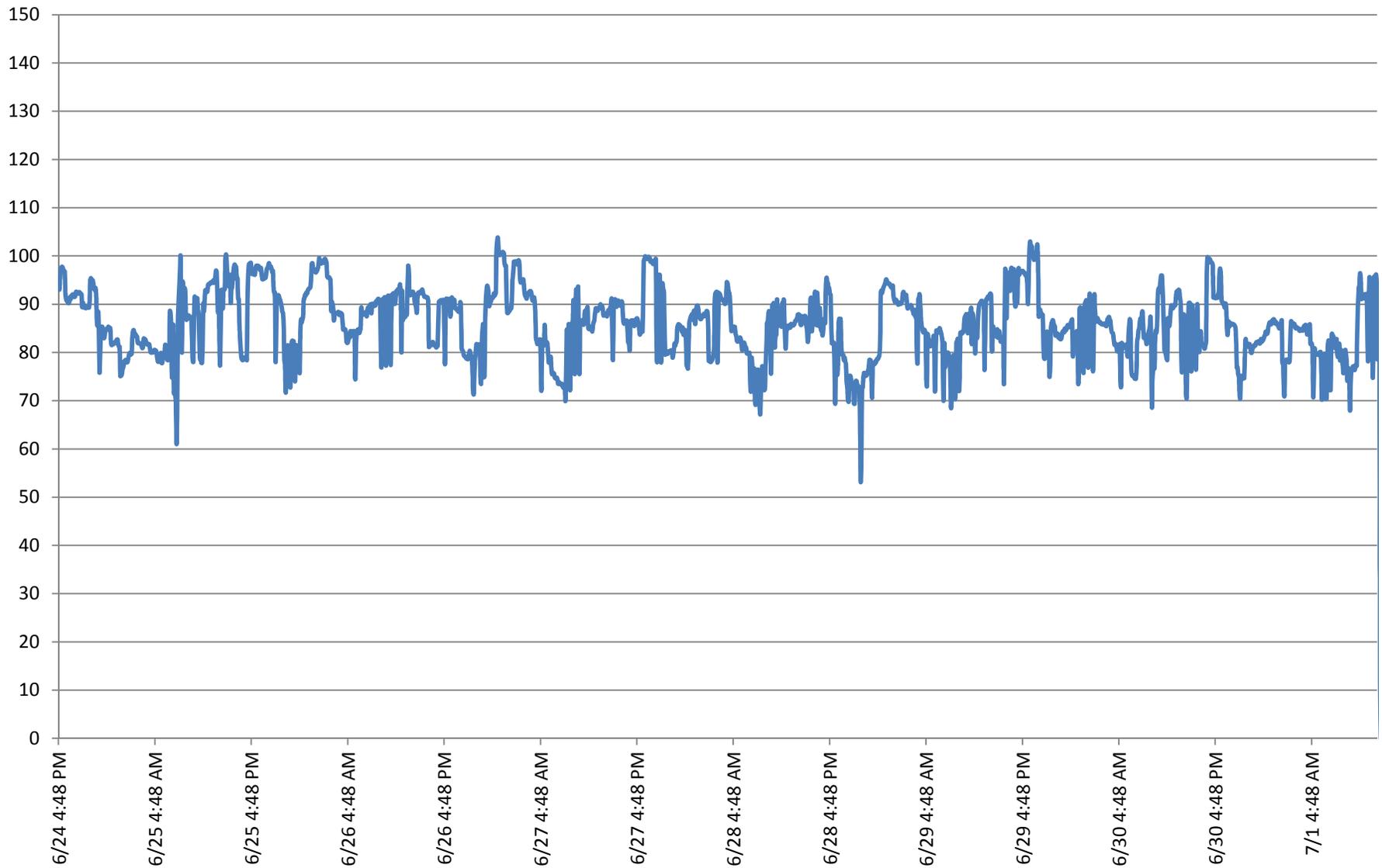
East 7th and North Elm Street (#203271)

Franklin Pressure Plane

(7/1/2011-7/11/2011)



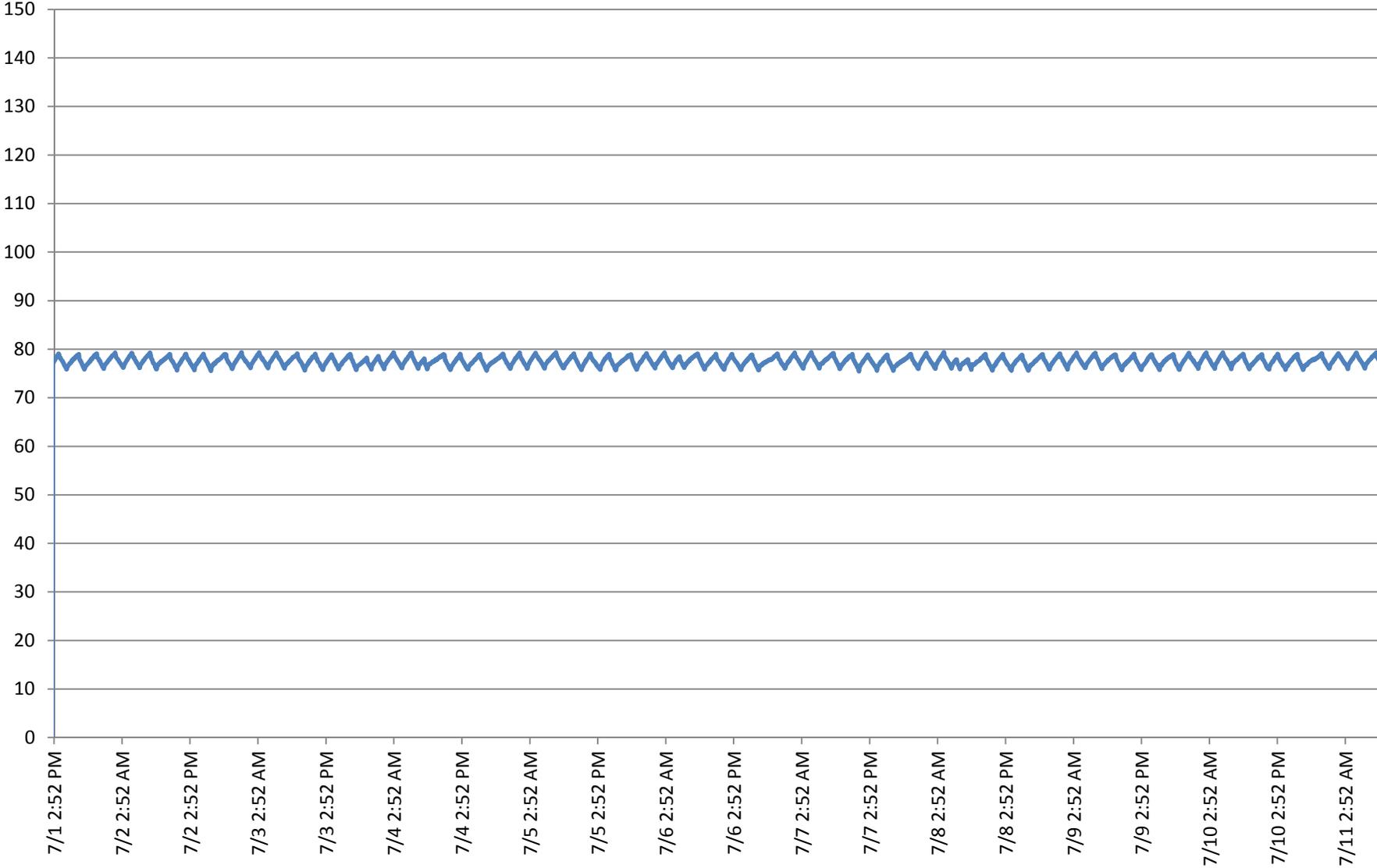
Fort Worth Hwy. and Mill Street (#203435)
Central Pressure Plane
(6/24/2011-7/1/2011)



1321 Vine Street (#203435)

Miller Pressure Plane

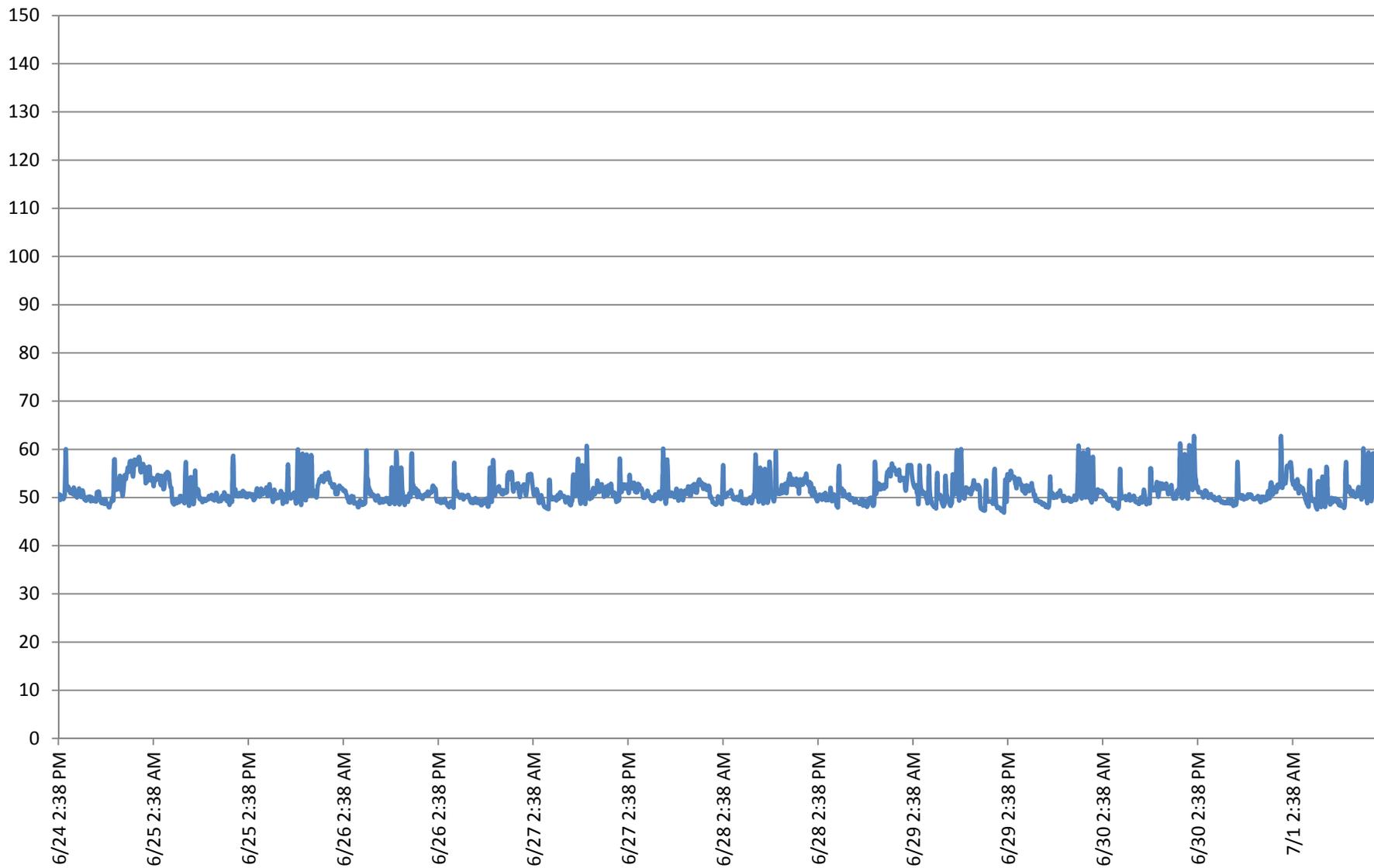
(7/1/2011-7/11/2011)



812 West Lake Drive (#204228)

West Lake Pressure Plane

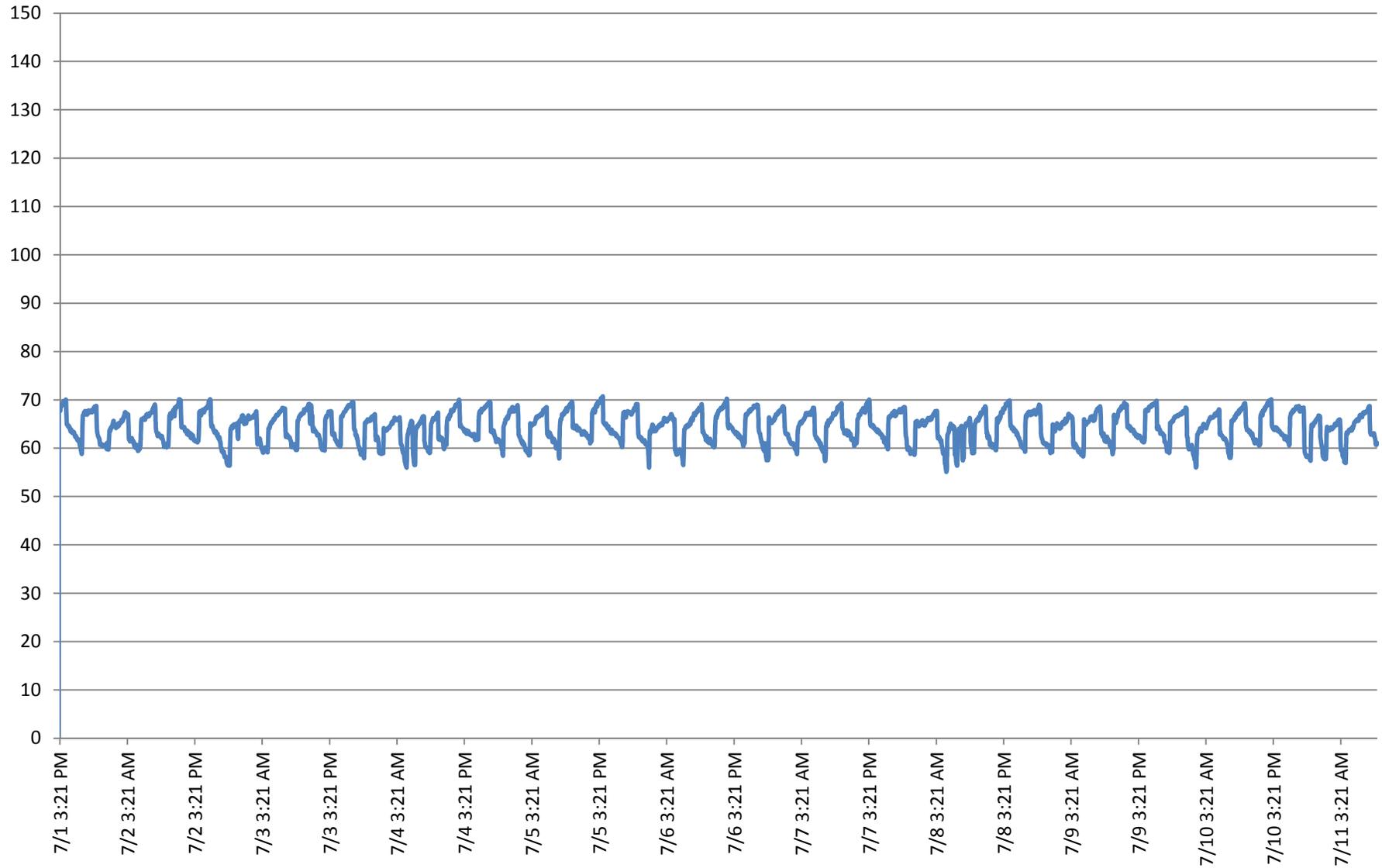
(6/24/2011-7/1/2011)



2350 Trace Ridge Drive (#204228)

Dubellette Pressure Plane

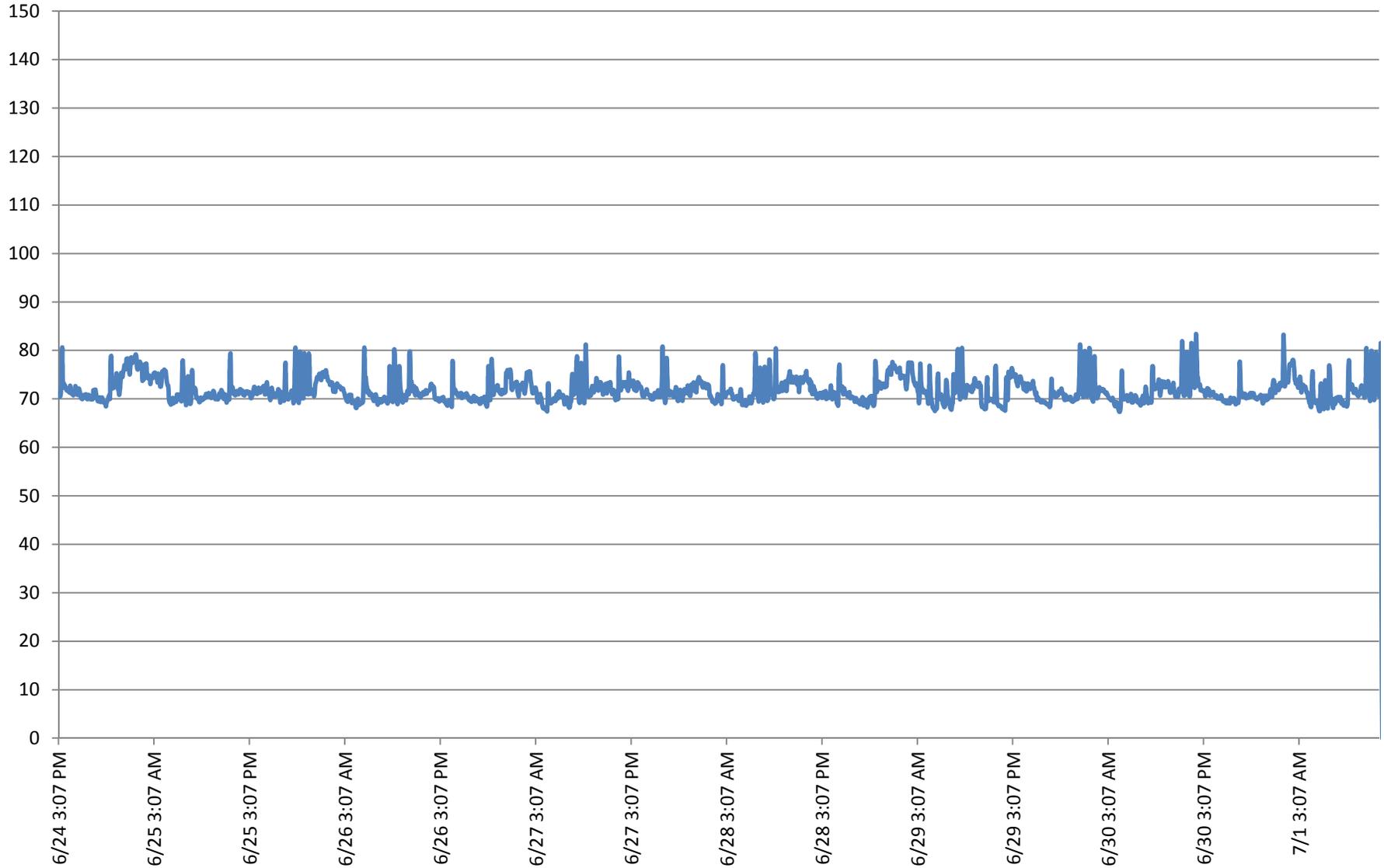
(7/1/2011-7/11/2011)



1100 Block of Reata Drive (#204229)

West Lake Pressure Plane

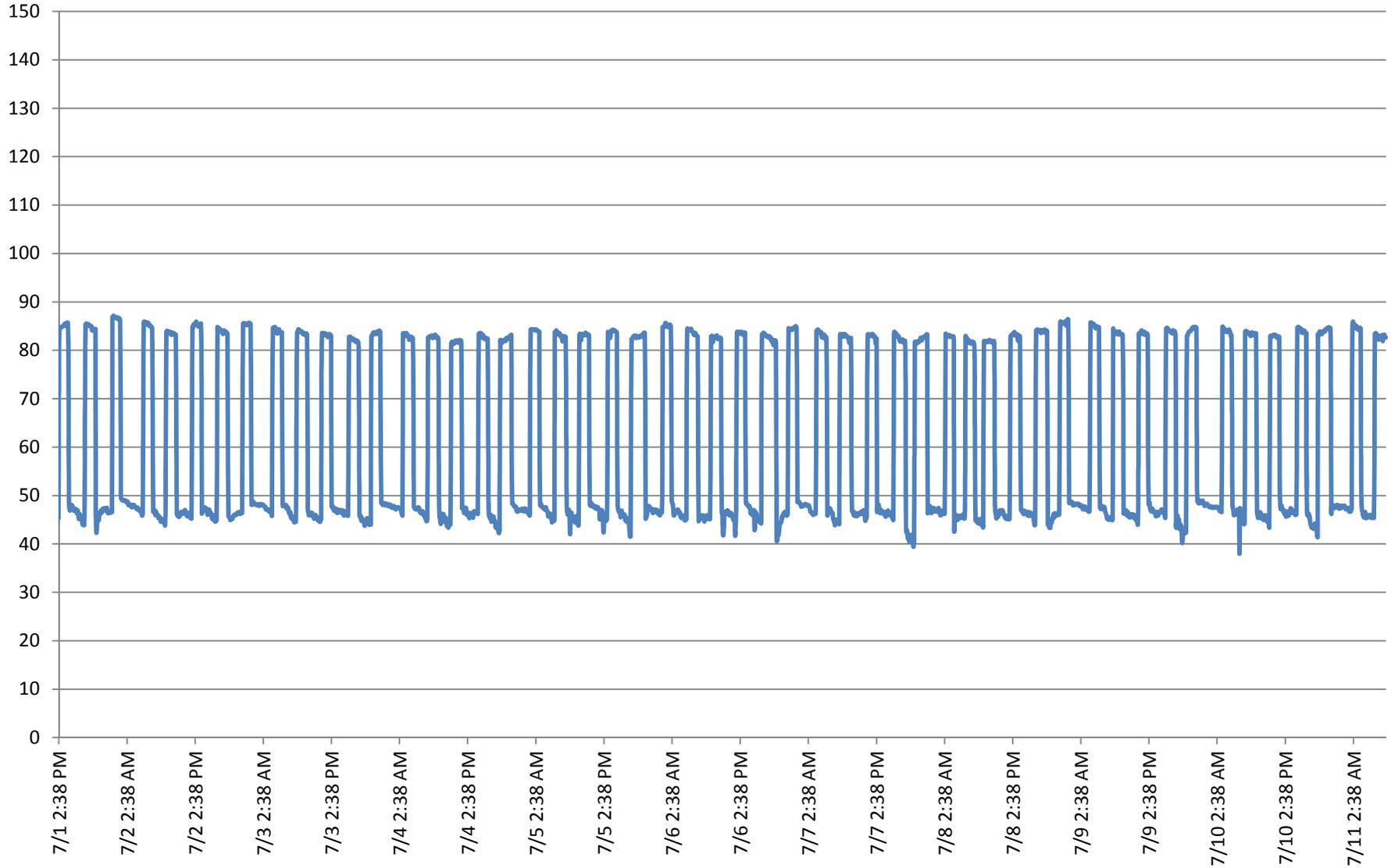
(6/24/2011-7/1/2011)



Harberger Hill Pump Station (#204229)

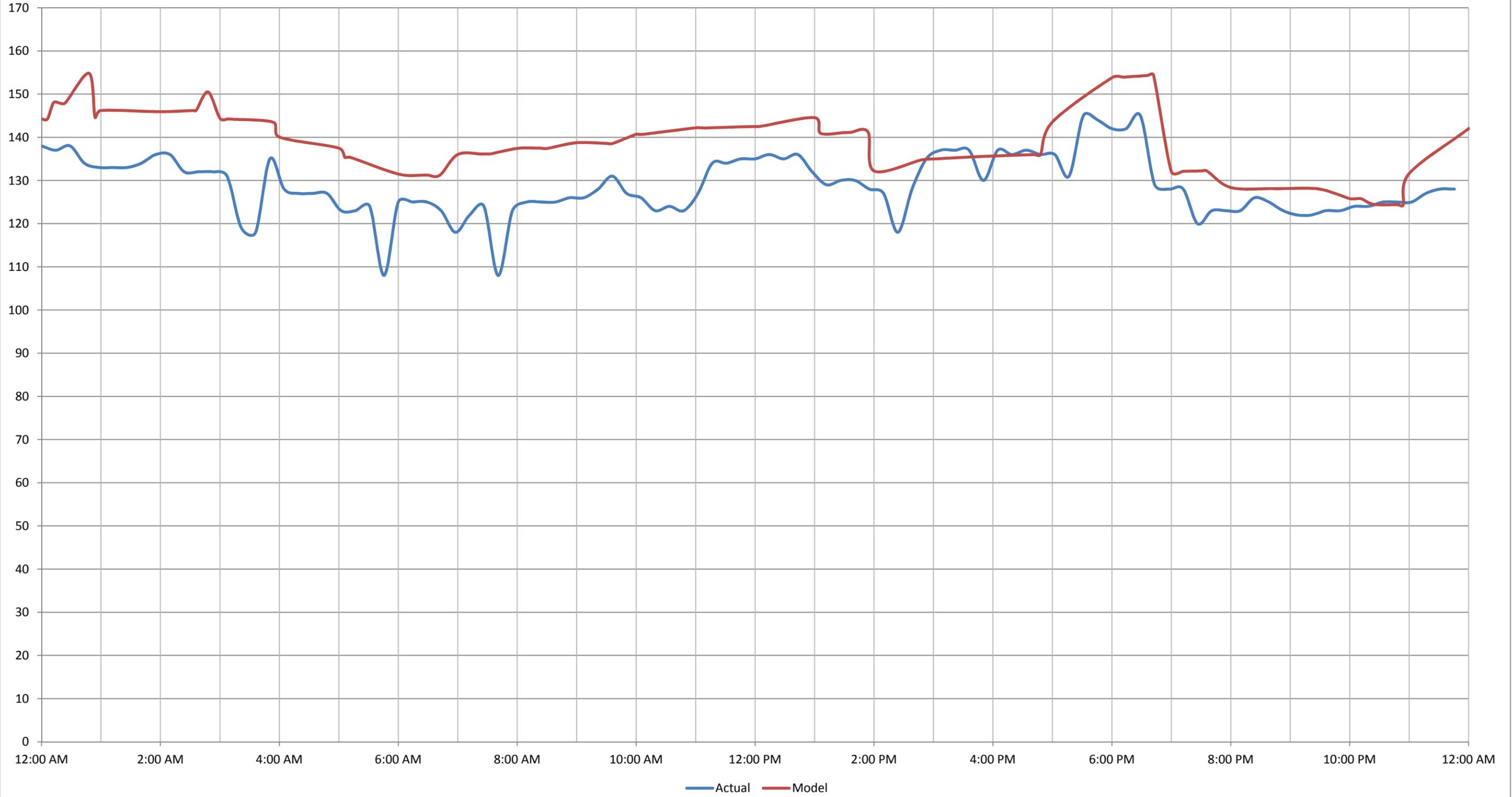
Franklin Pressure Plane

(7/1/2011-7/11/2011)

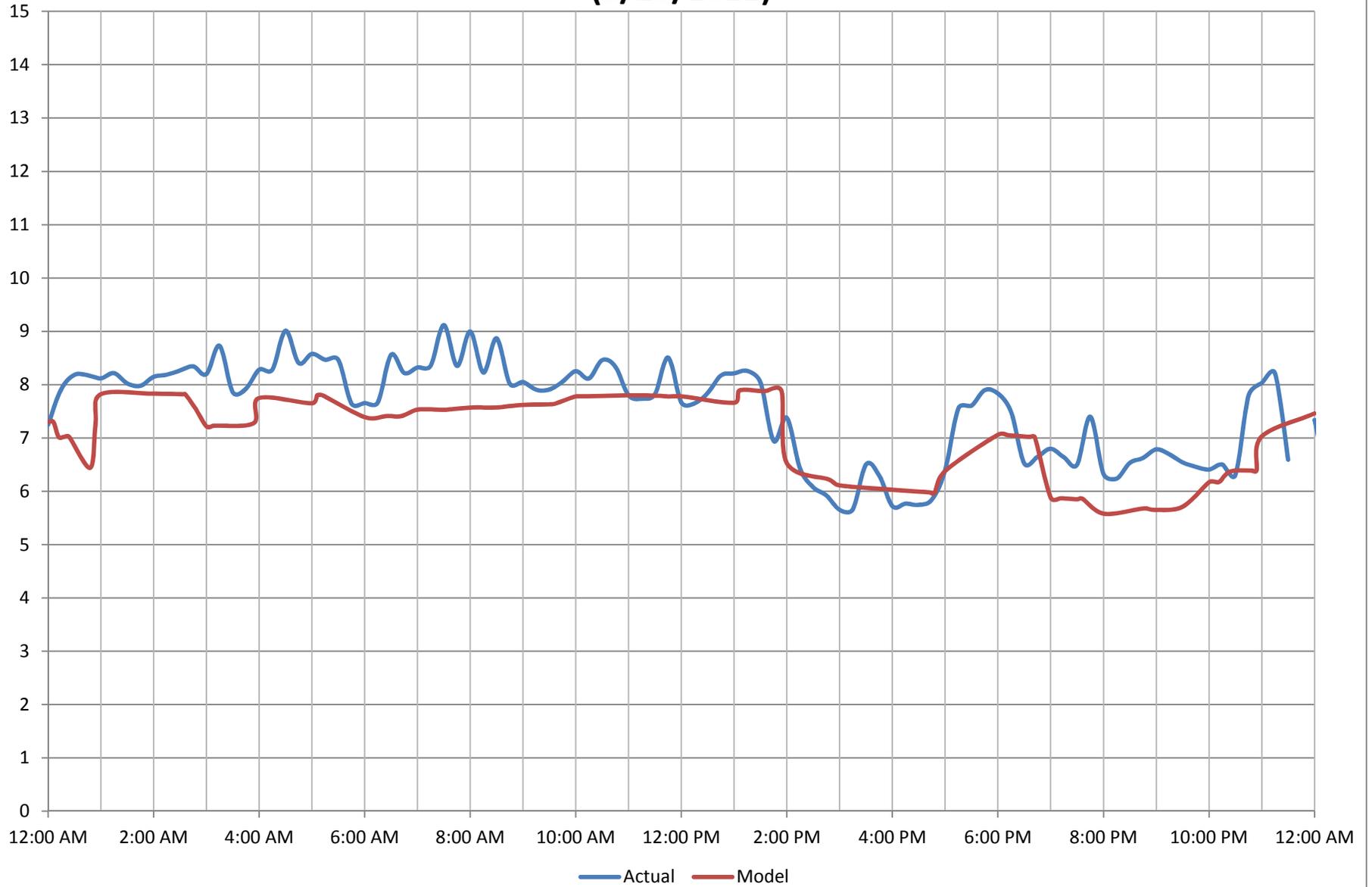


**APPENDIX C
CALIBRATION GRAPHS**

**Weatherford Water Treatment Plant
Discharge Pressure at the Plant
6/29/2011**



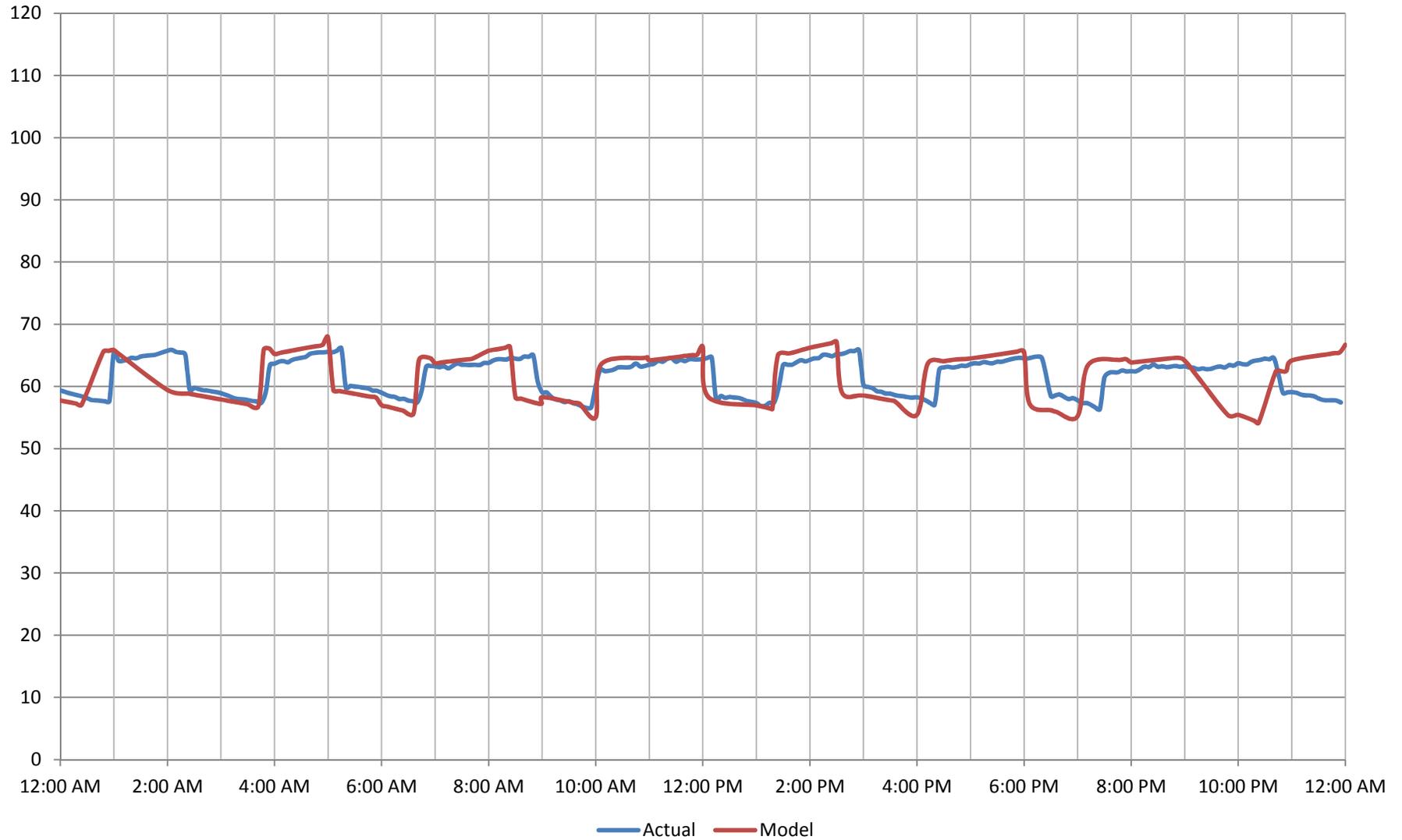
Water Treatment Plant Flow (6/29/2011)



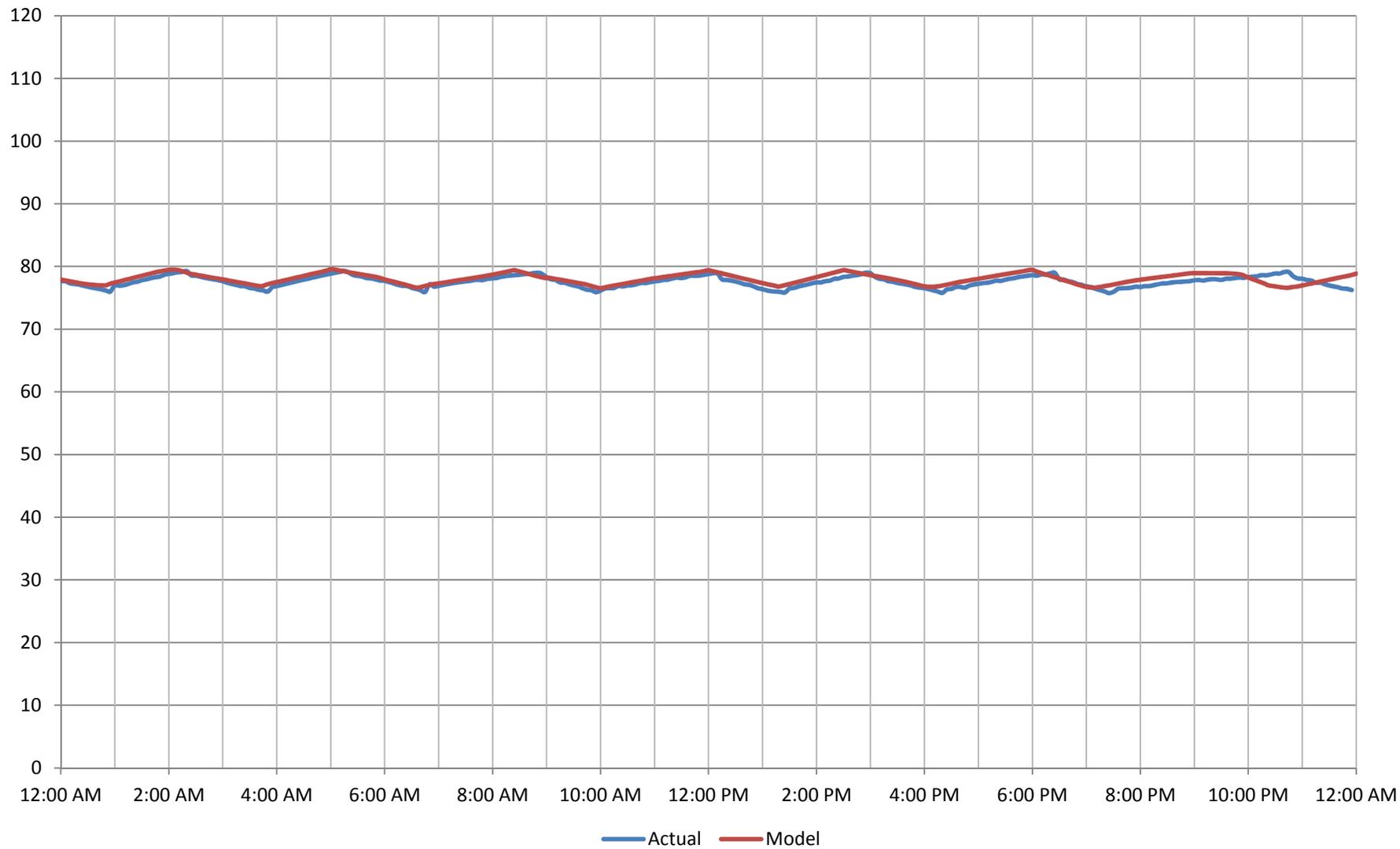
Dubellette Pump Station (#1670)

Miller Pressure Plane

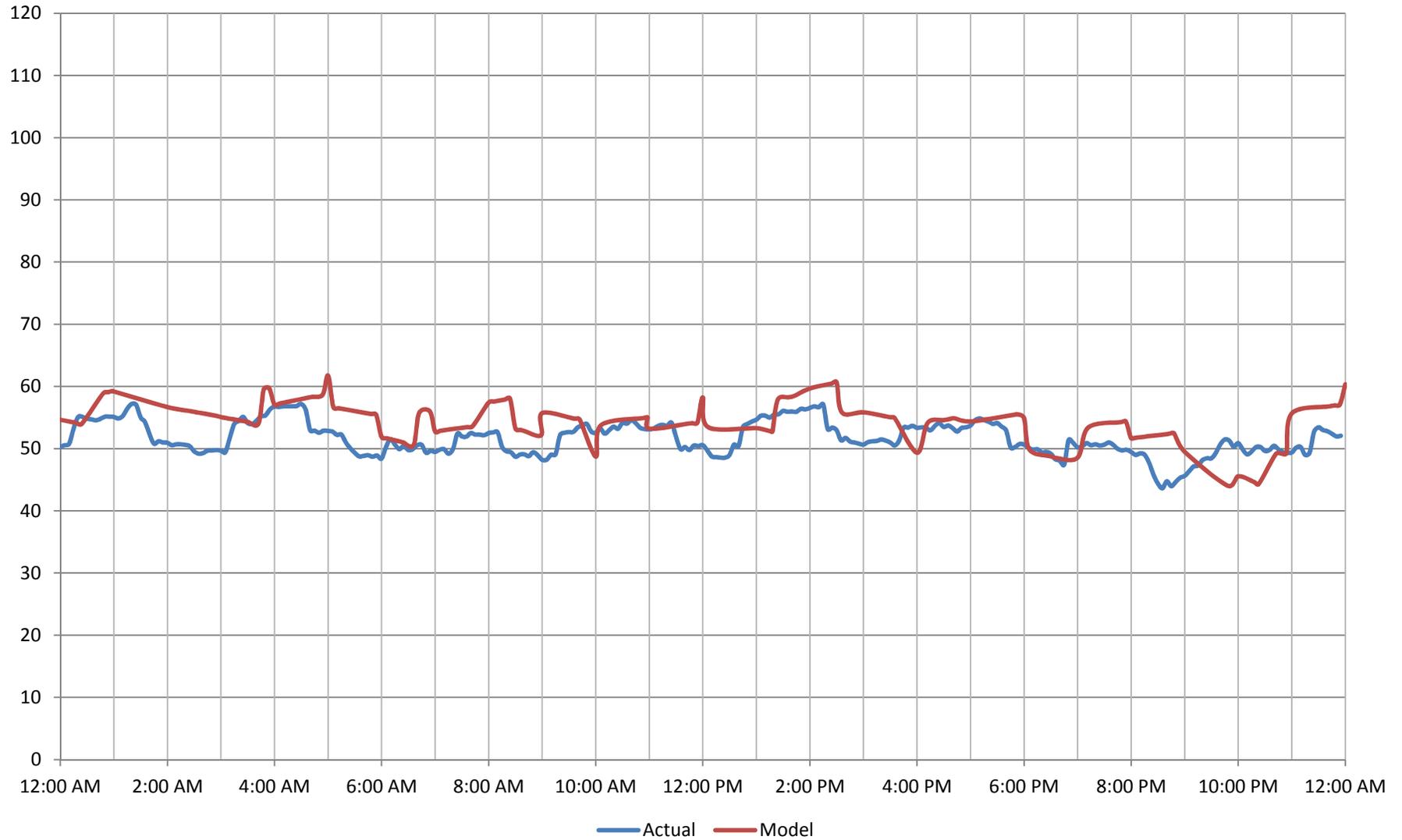
(7/11/2011)



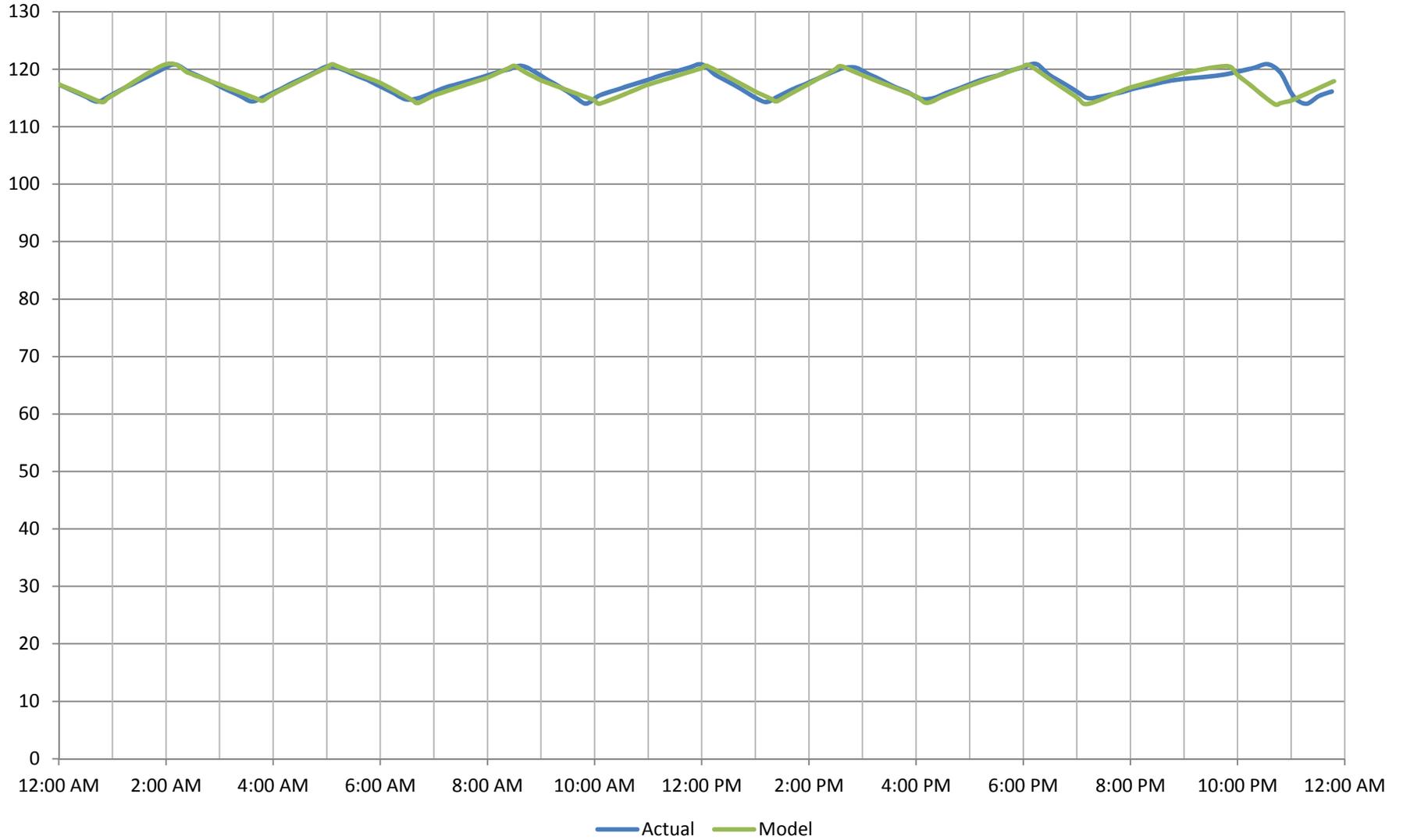
1321 Vine Street (#203435)
Miller Pressure Plane
(7/11/2011)



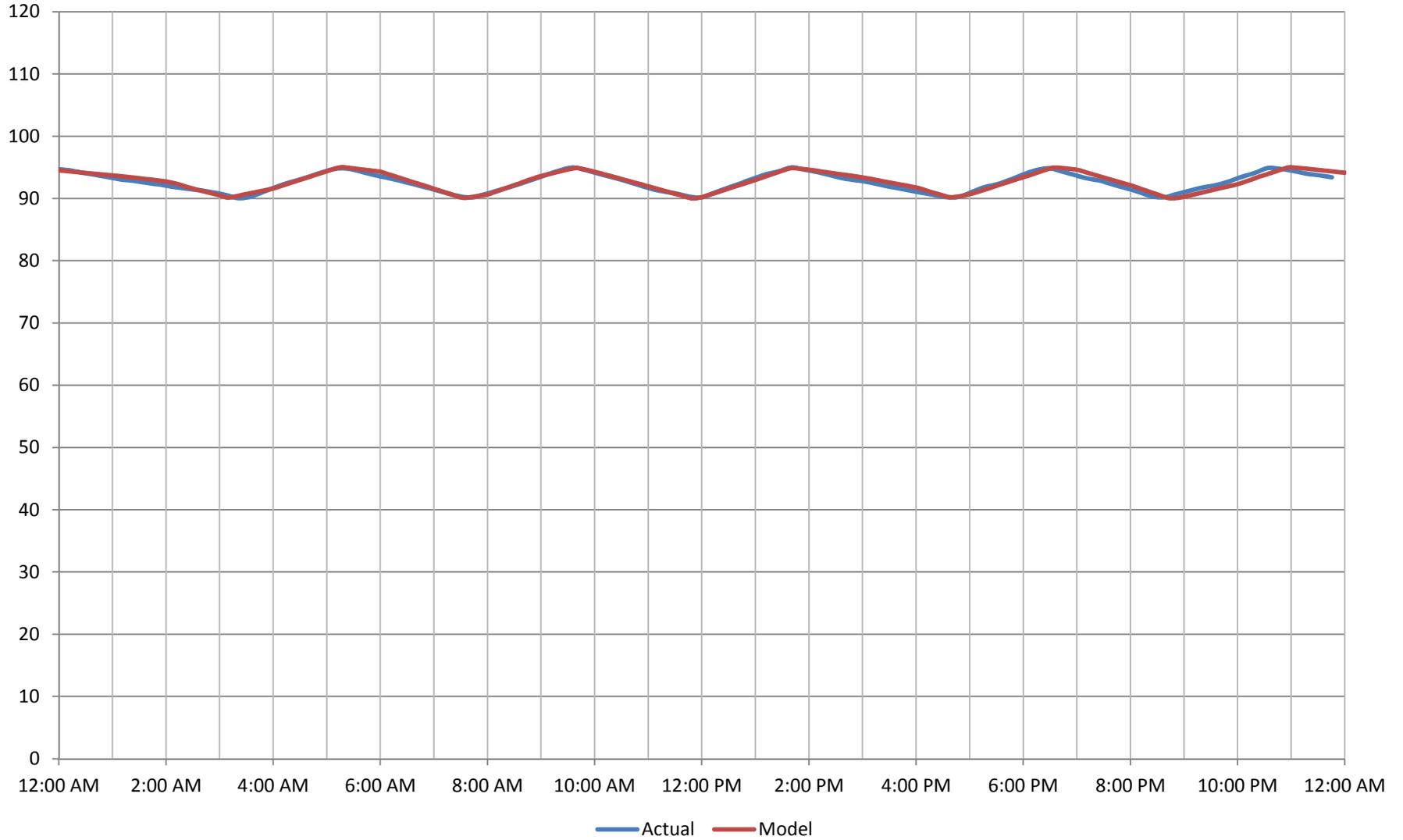
508 Mockingbird and Charles Street (#203018)
Miller Pressure Plane
(7/11/2011)



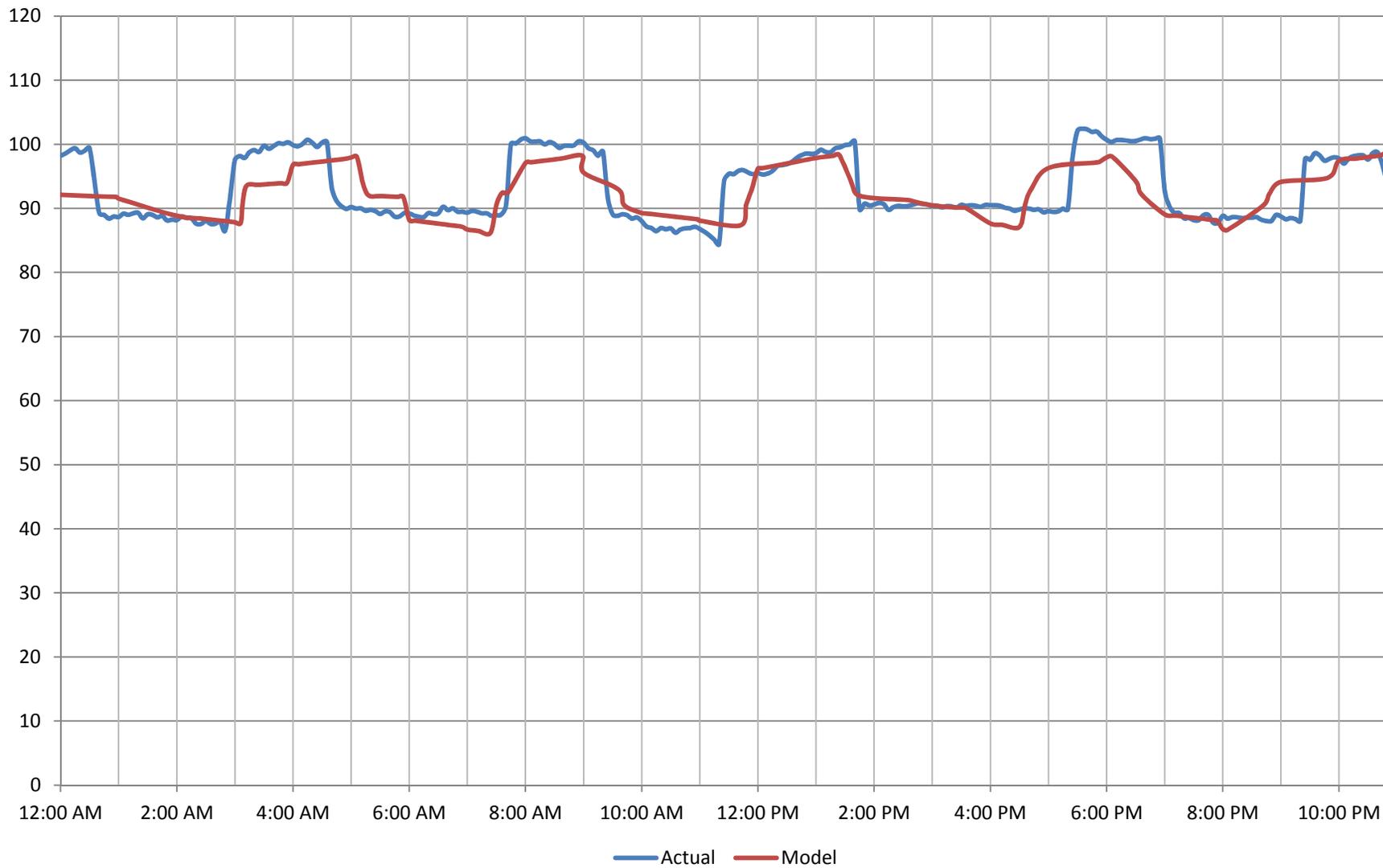
Miller Elevated Storage Tank Miller Pressure Plane (7/11/2011)



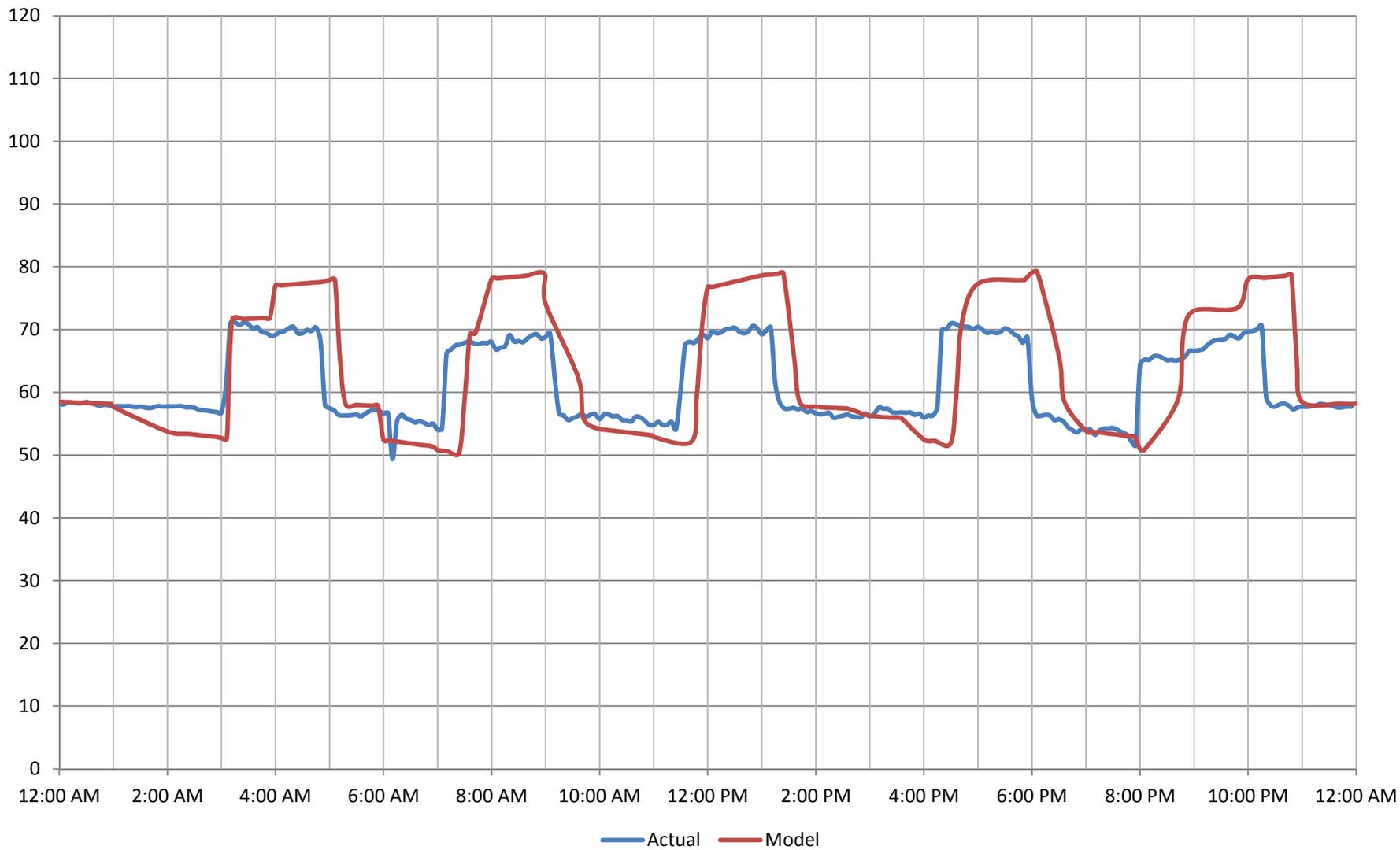
Franklin Elevated Storage Tank Franklin Pressure Plane 7/11/2011



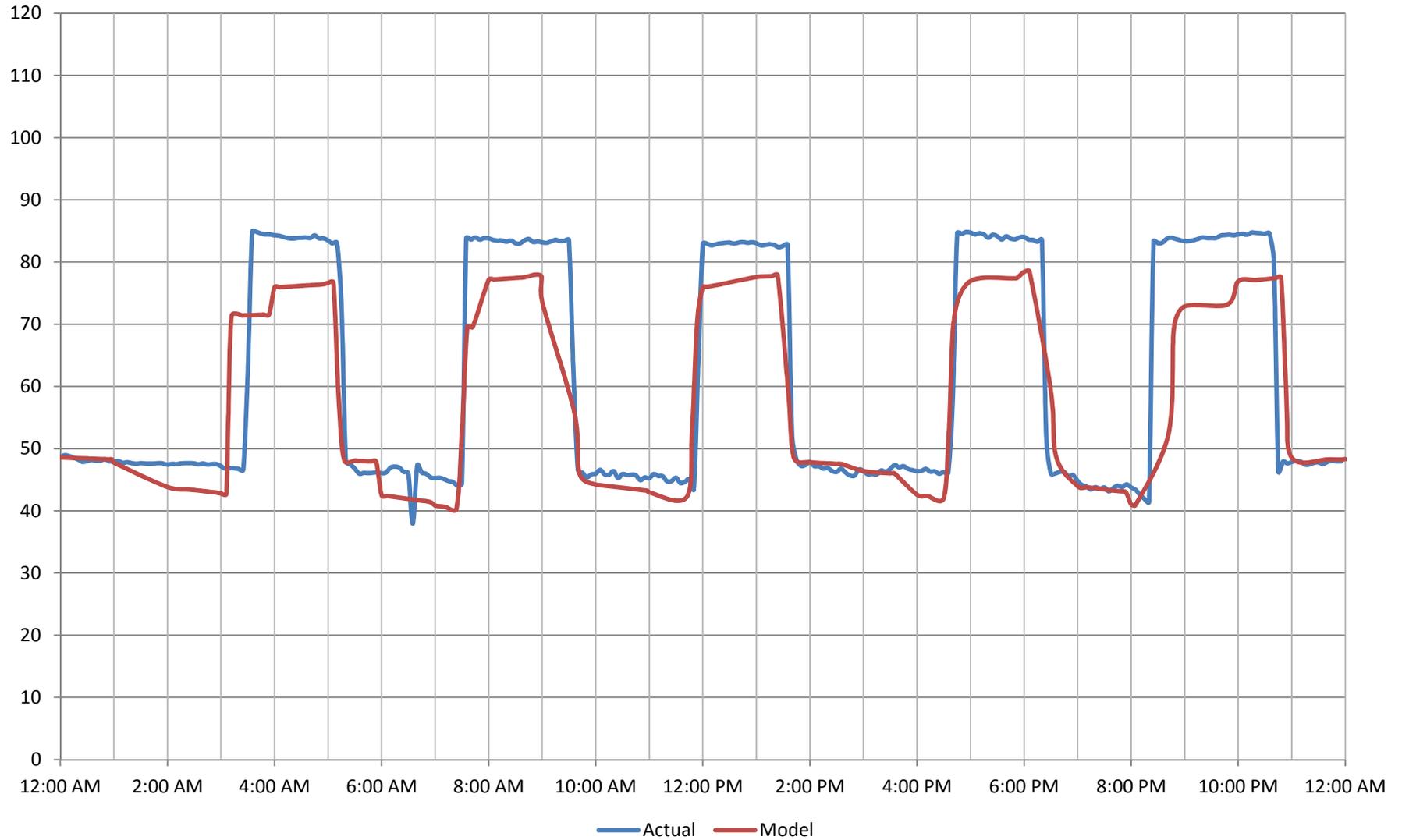
500 Block of West 4th Street (#1668) Franklin Pressure Plane (7/11/2011)



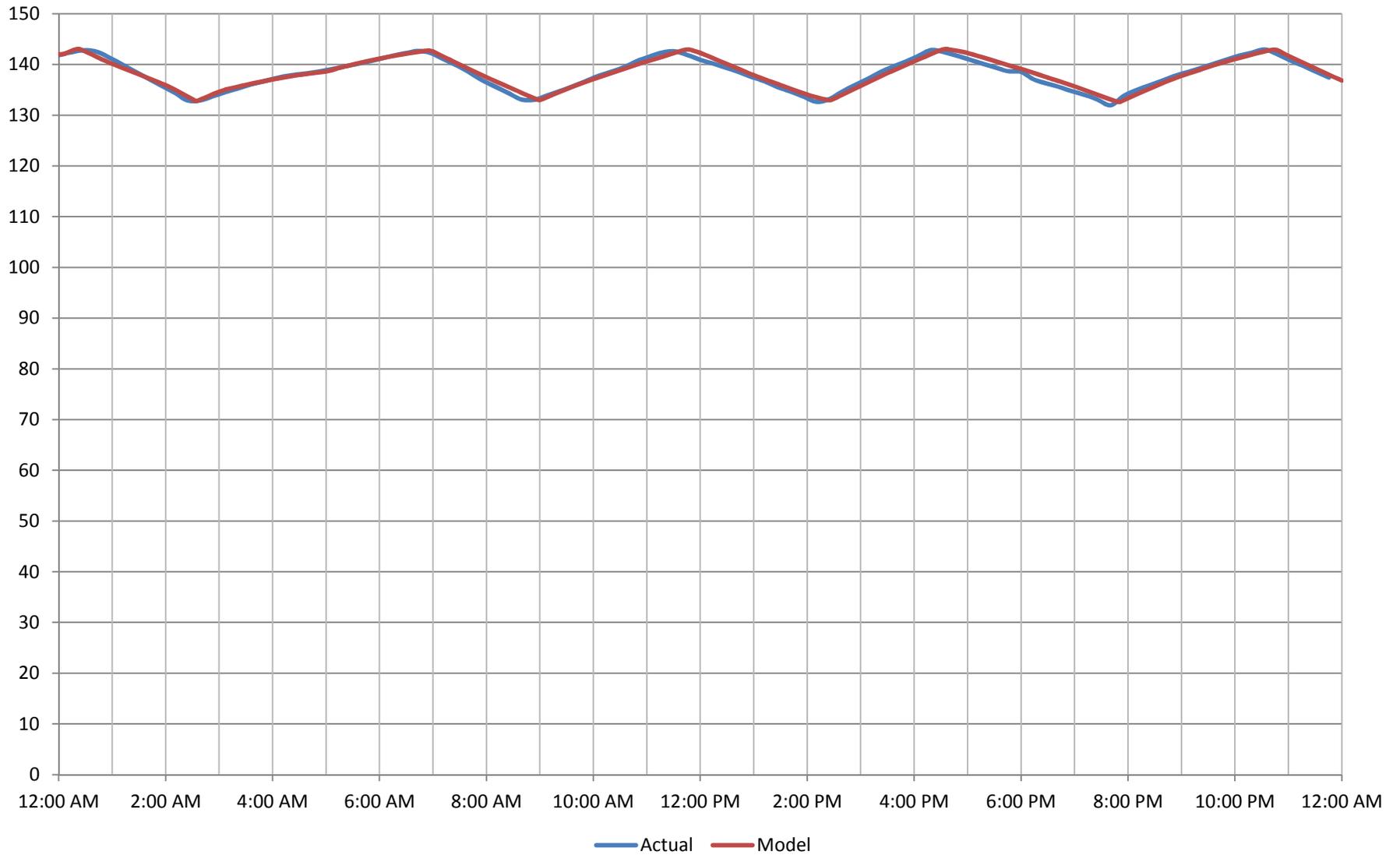
East 7th Street and North Elm (#203271) Franklin Pressure Plane (7/11/2011)



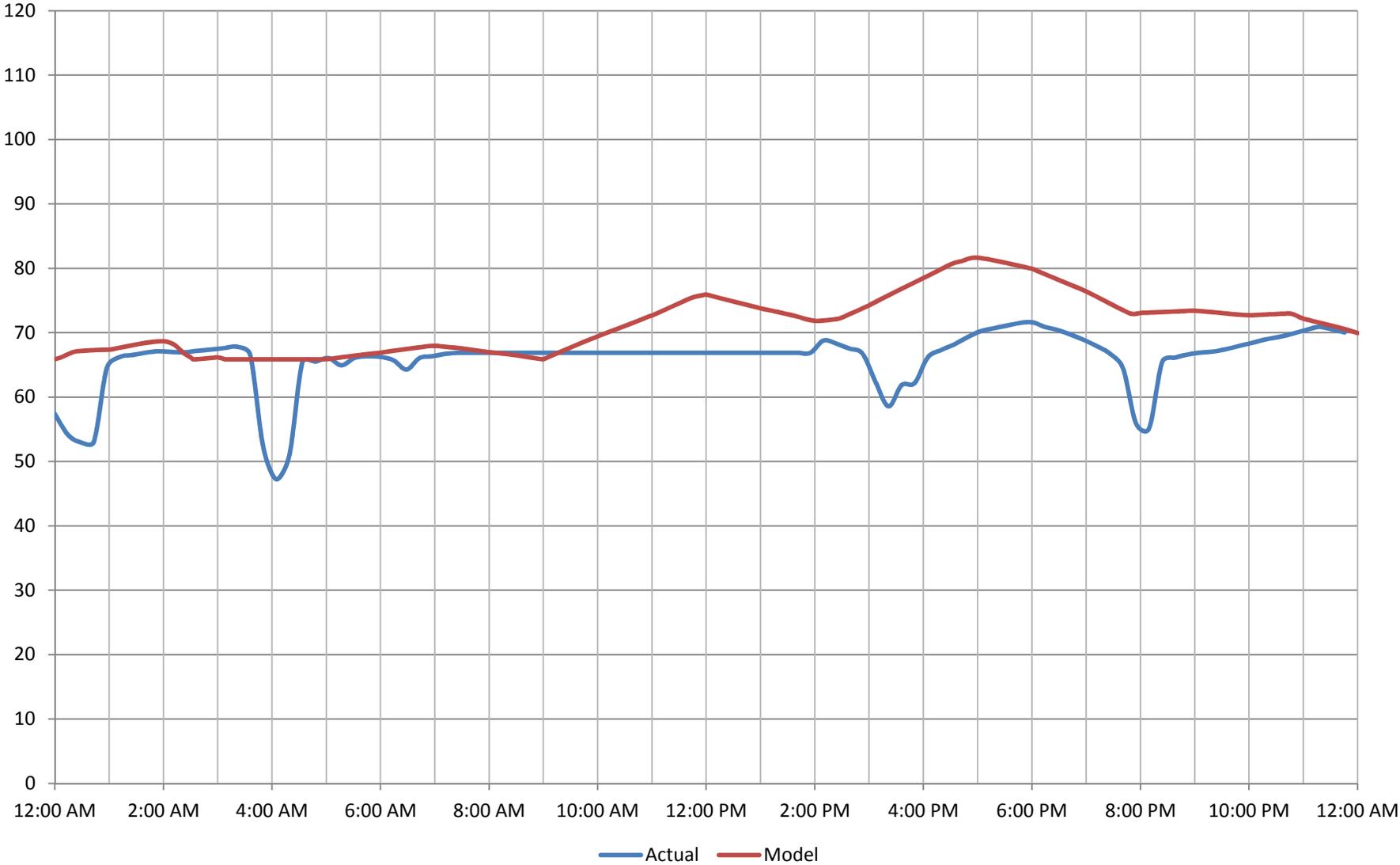
Harberger Hill Pump Station (#204229) Franklin Pressure Plane (7/11/2011)



West Park Elevated Storage Tank Dubellette Pressure Plane (7/11/2011)



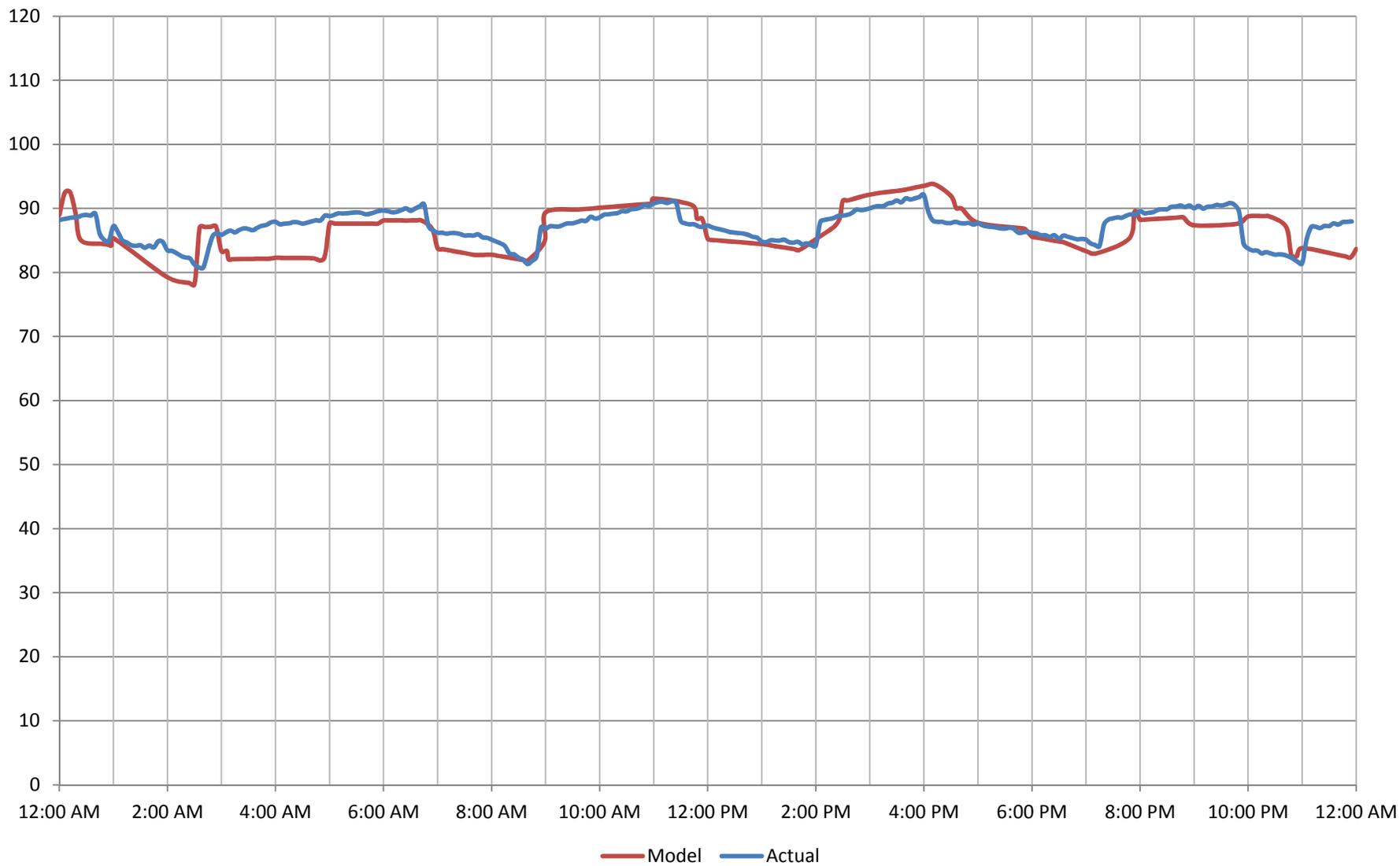
**Dubellette Elevated Storage Tank
Dubellette Pressure Plane
(7/11/2011)**



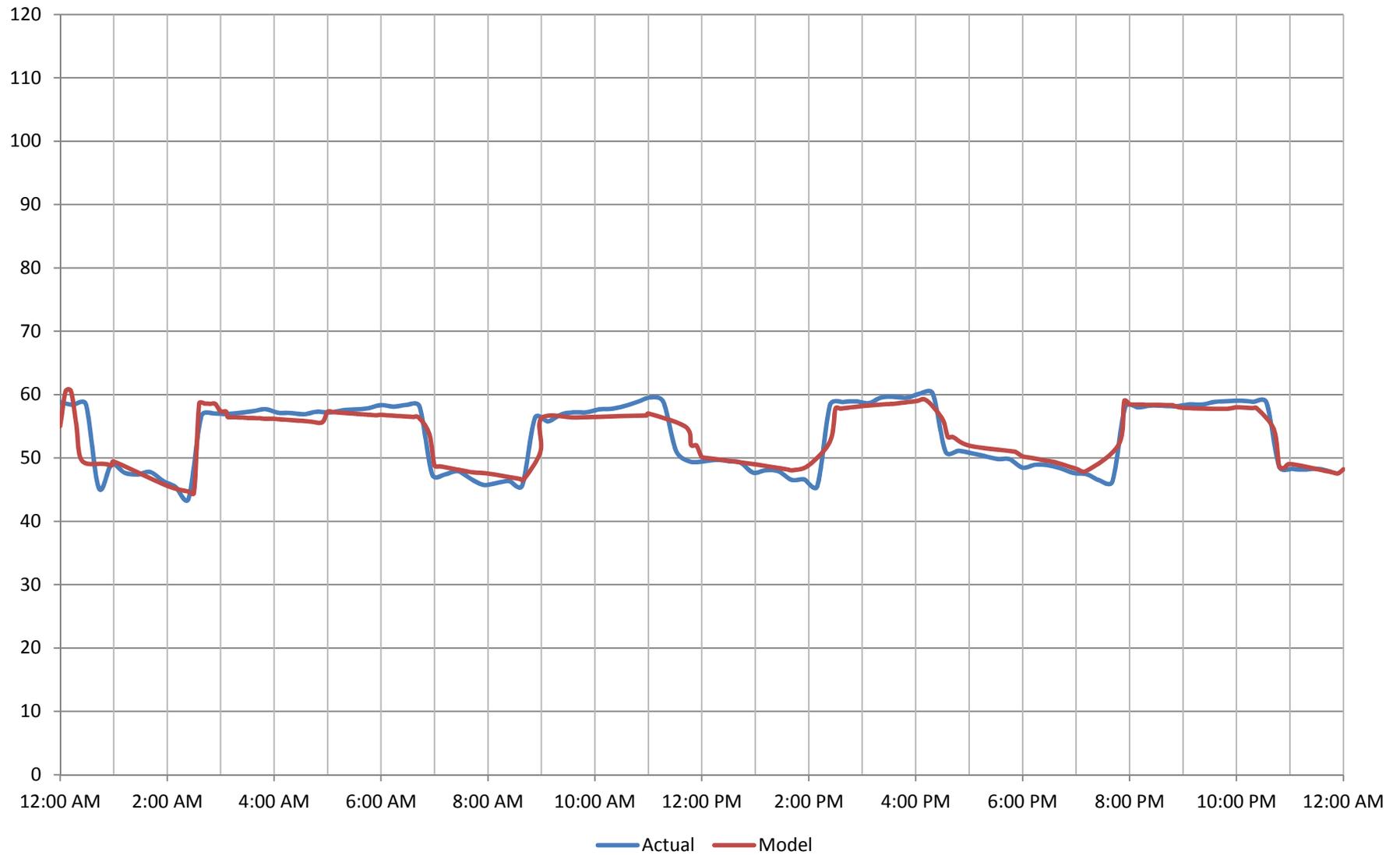
900 Block of Randall Road (#1667)

Dubellette Pressure Plane

(7/11/2011)



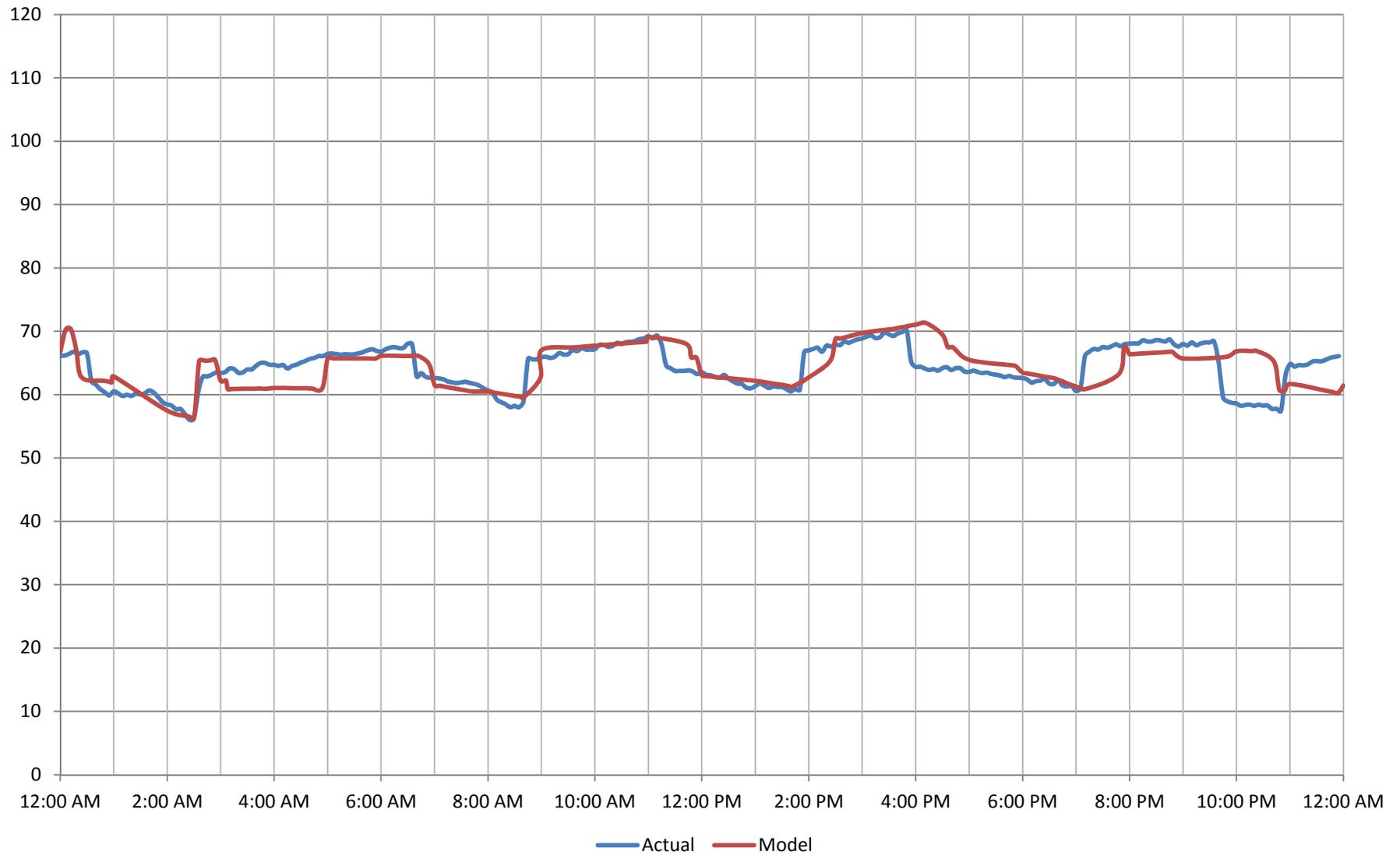
College Hill Discharge Pressure Dubellette Pressure Plane (7/11/2011)



2350 Trace Ridge Drive (#204228)

Dubellette Pressure Plane

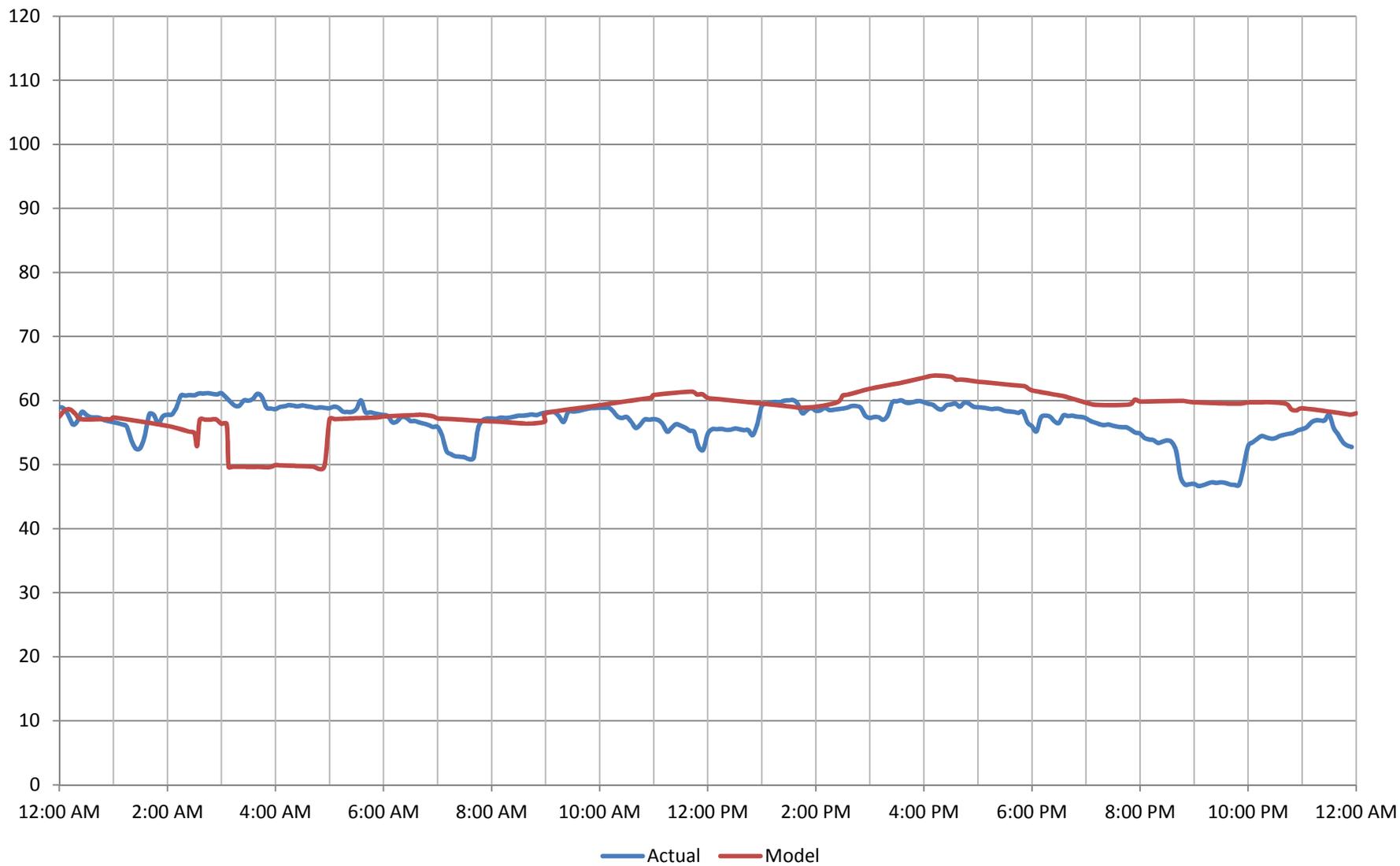
(7/11/2011)



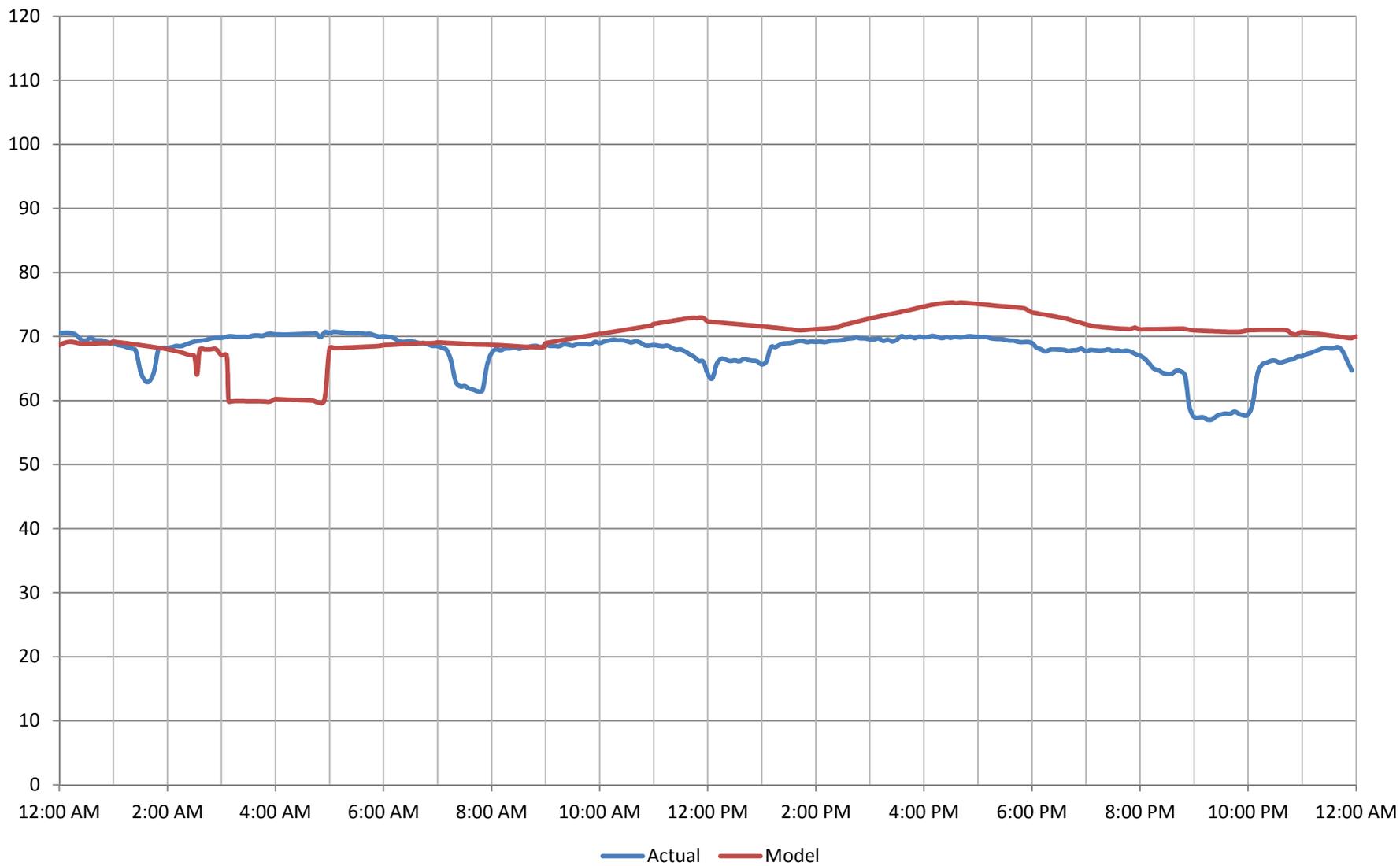
415 Josephine Street (#203019)

Dubellette Pressure Plane

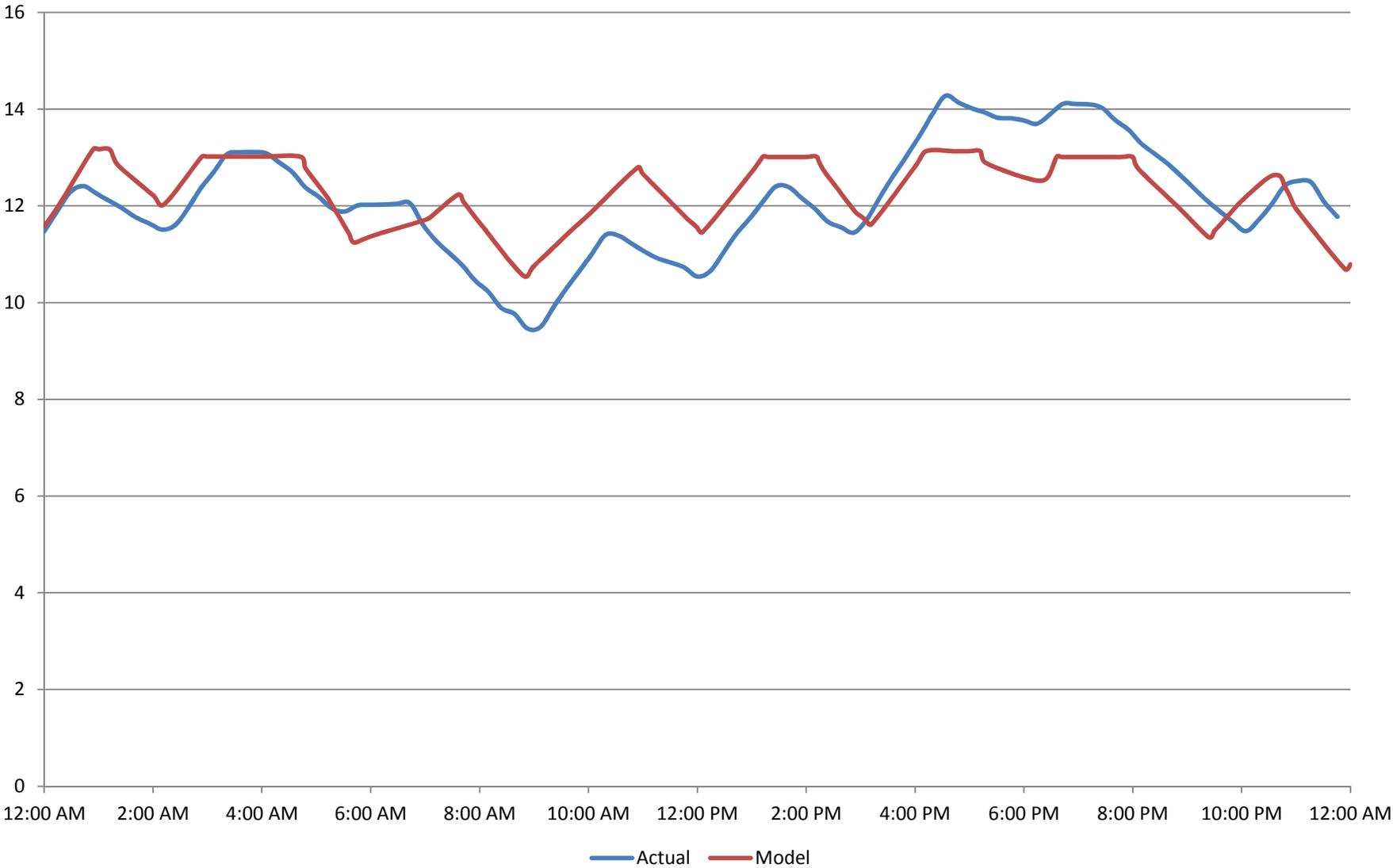
(7/11/2011)



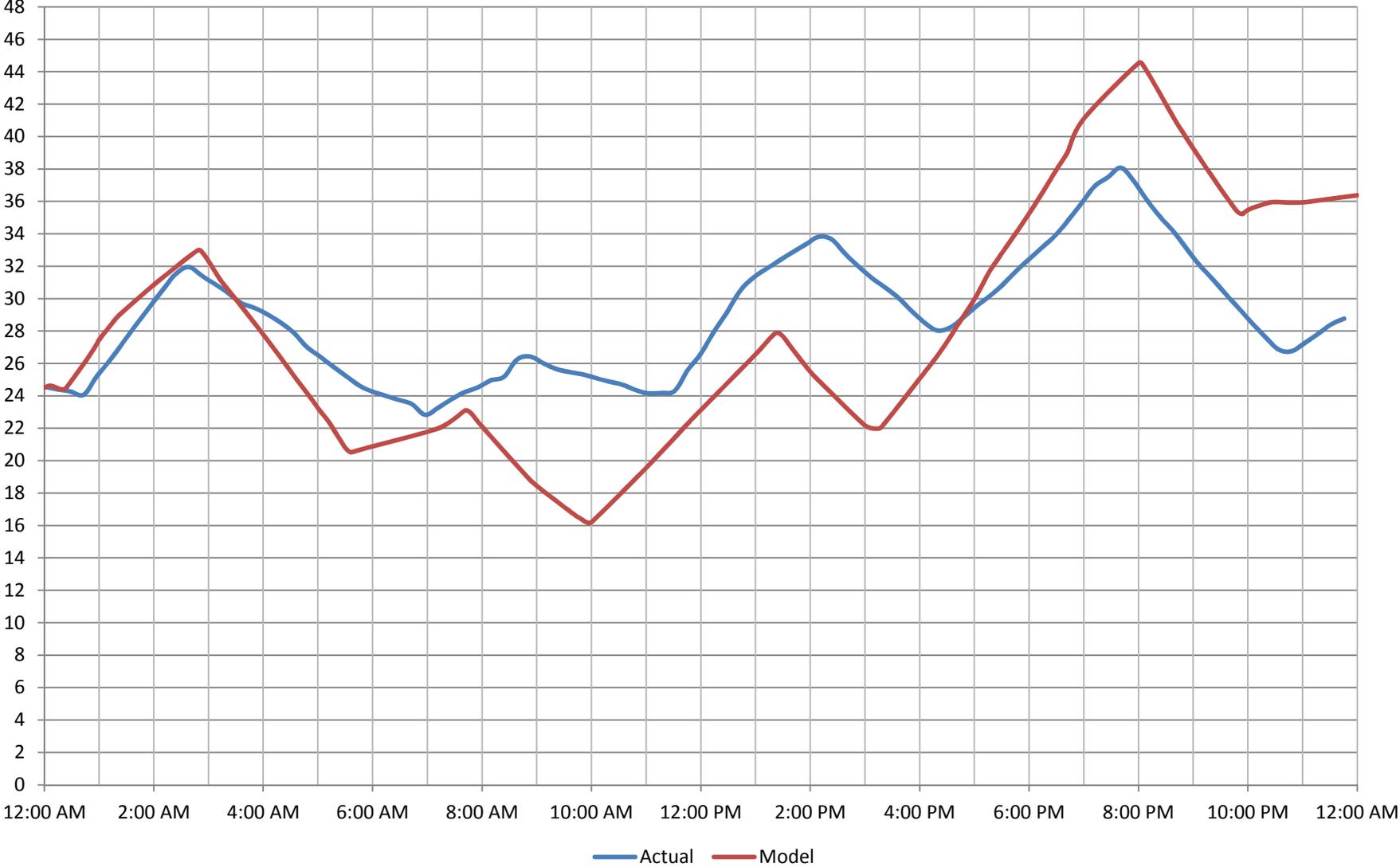
317 Bryan Street (#1666)
Dubellette Pressure Plane
(7/11/2011)



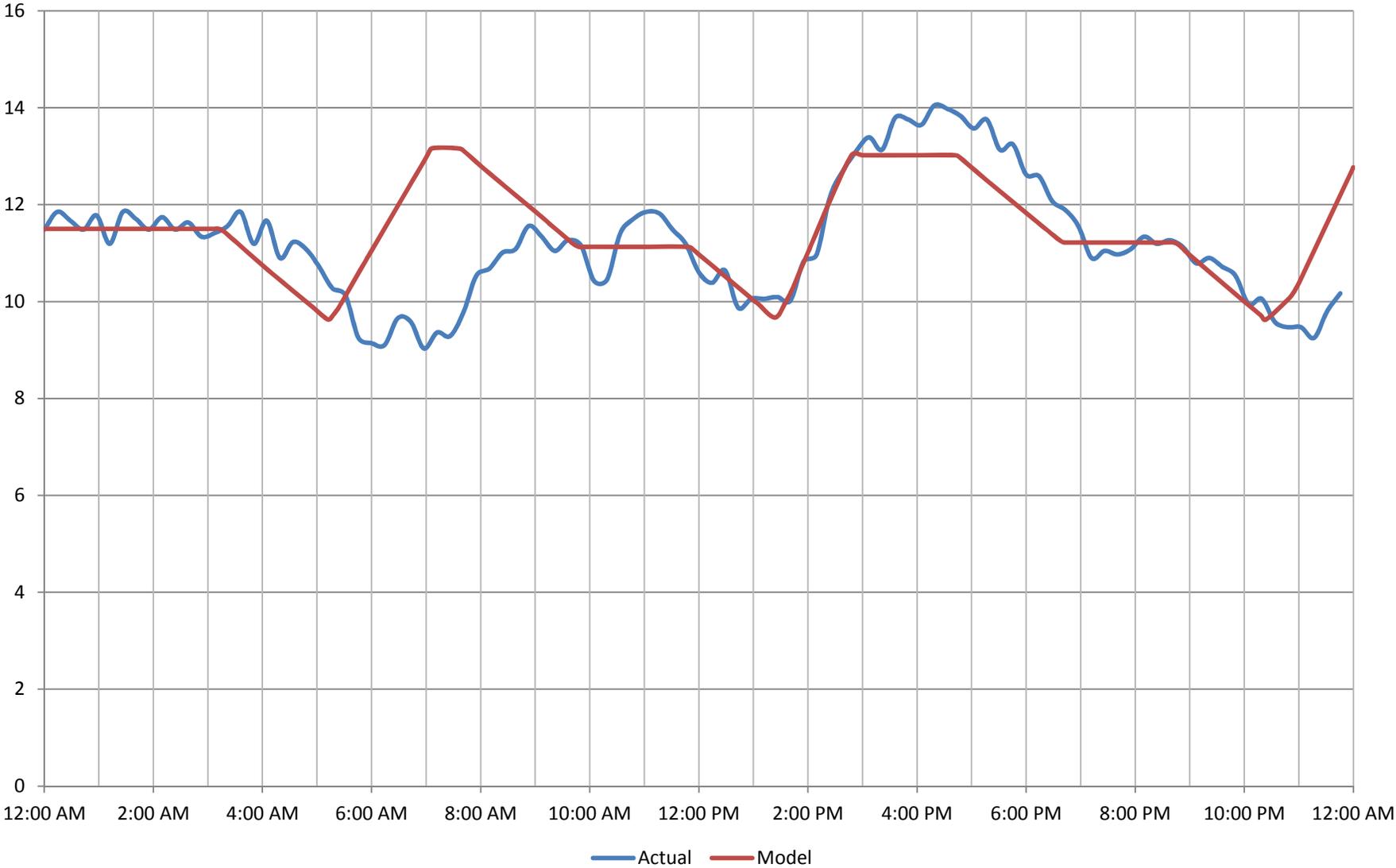
Dubellette GST
Central Pressure Plane
(6/29/2011)



College Hill GST Central Pressure Plane (6/29/2011)



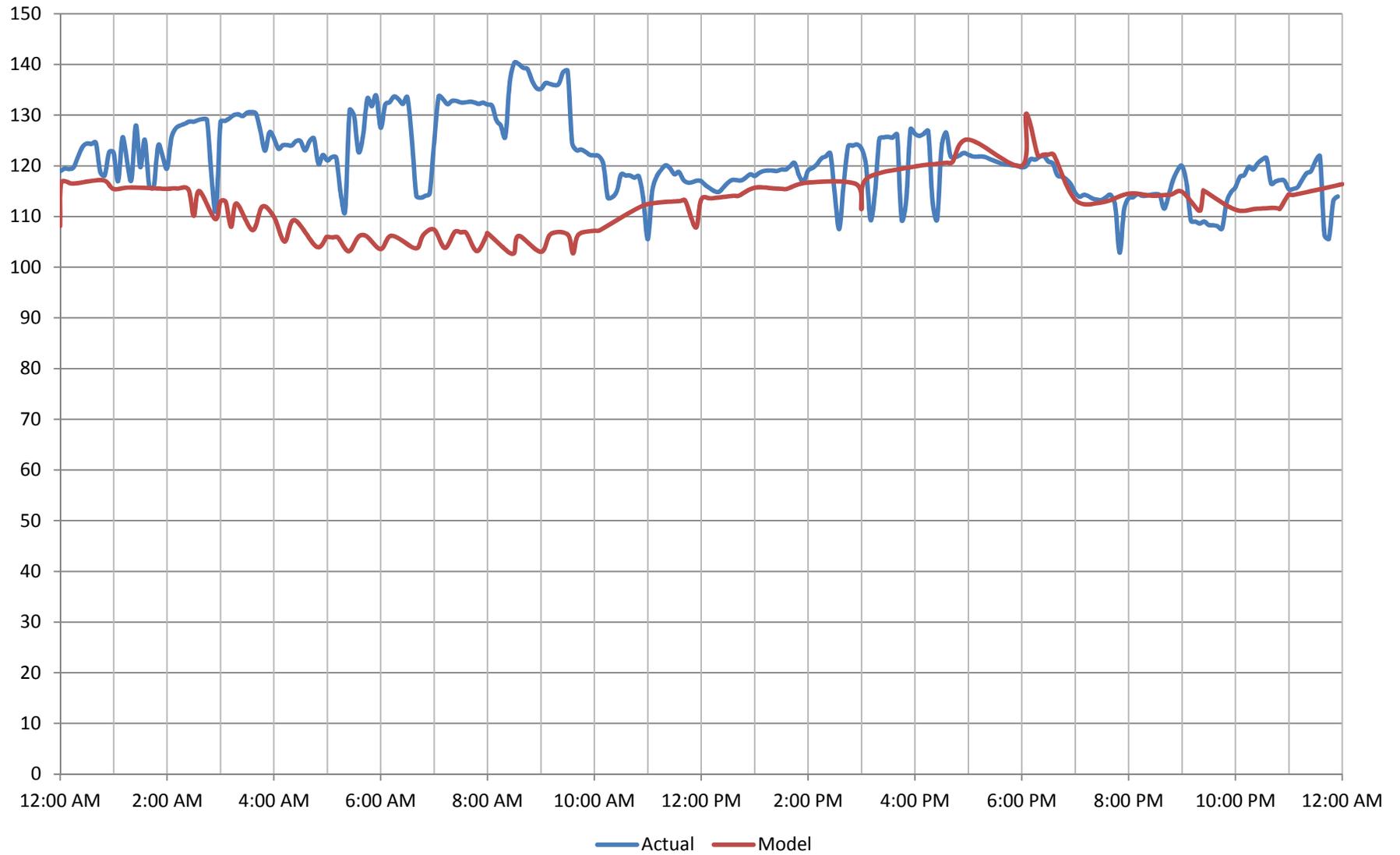
Harberger GST Central Pressure Plane (6/29/2011)



2210 Summer Brook Drive (#1668)

Central Pressure Plane

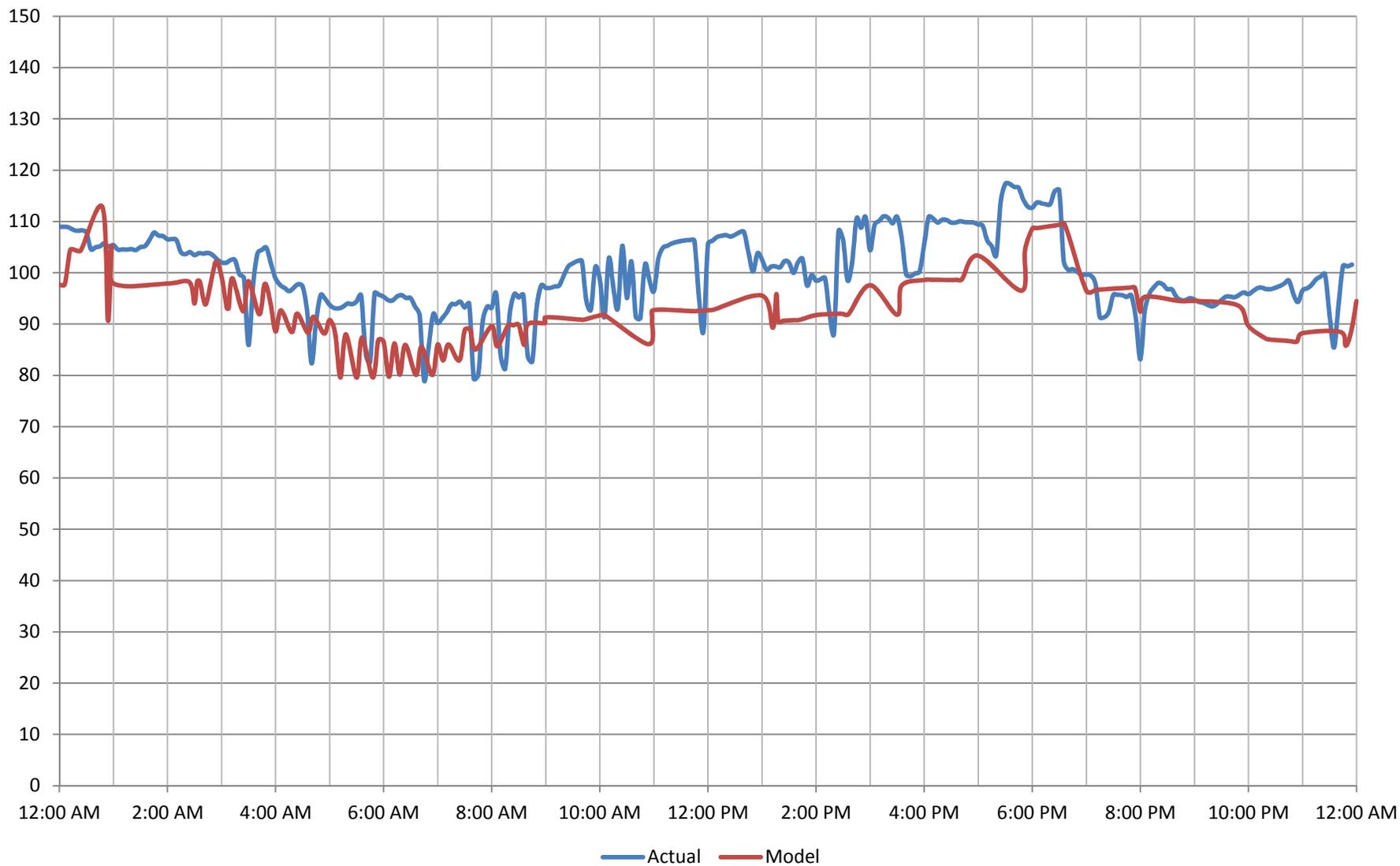
(6/29/2011)



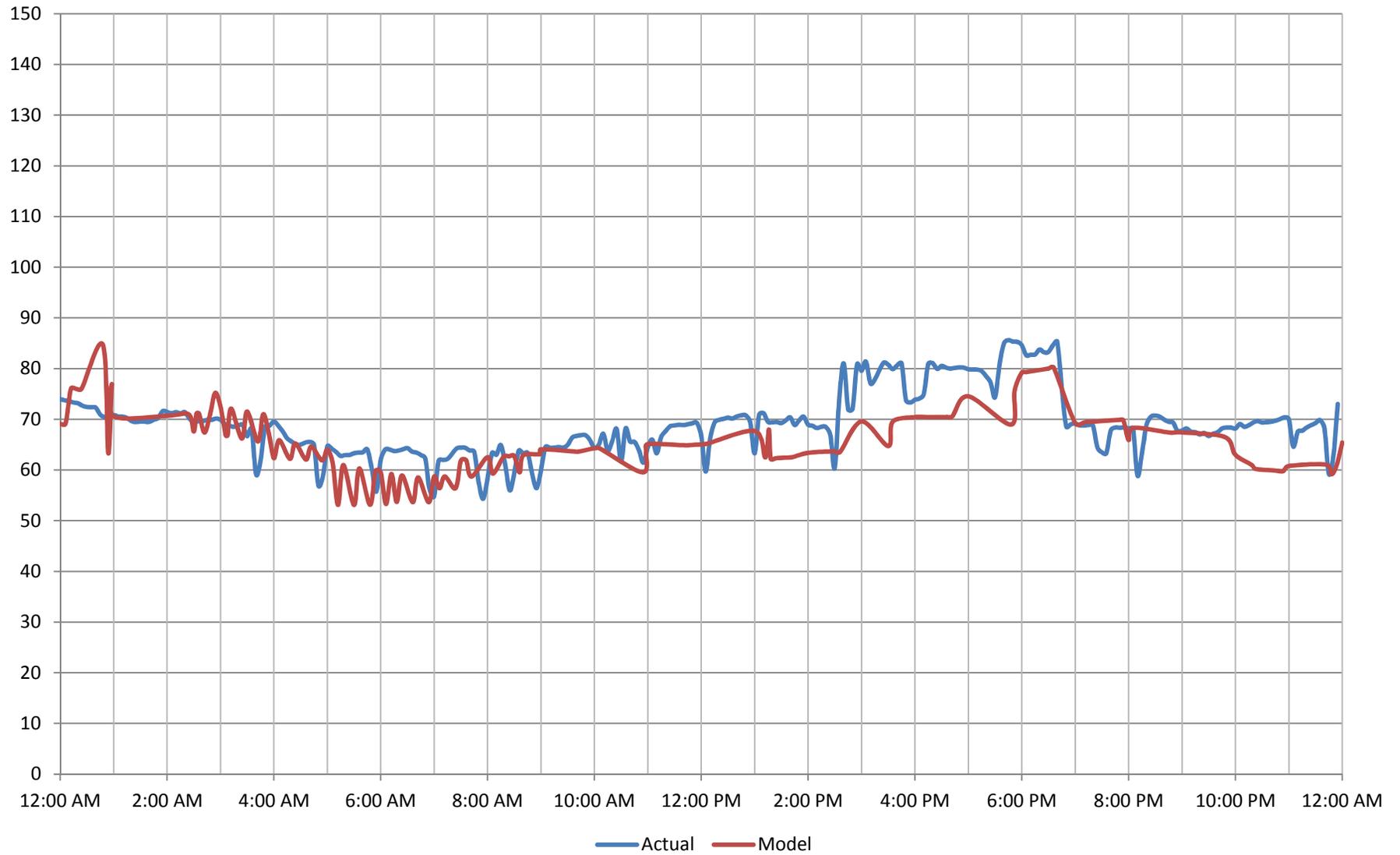
2208 East Bankhead Hwy. (#1667)

Central Pressure Plane

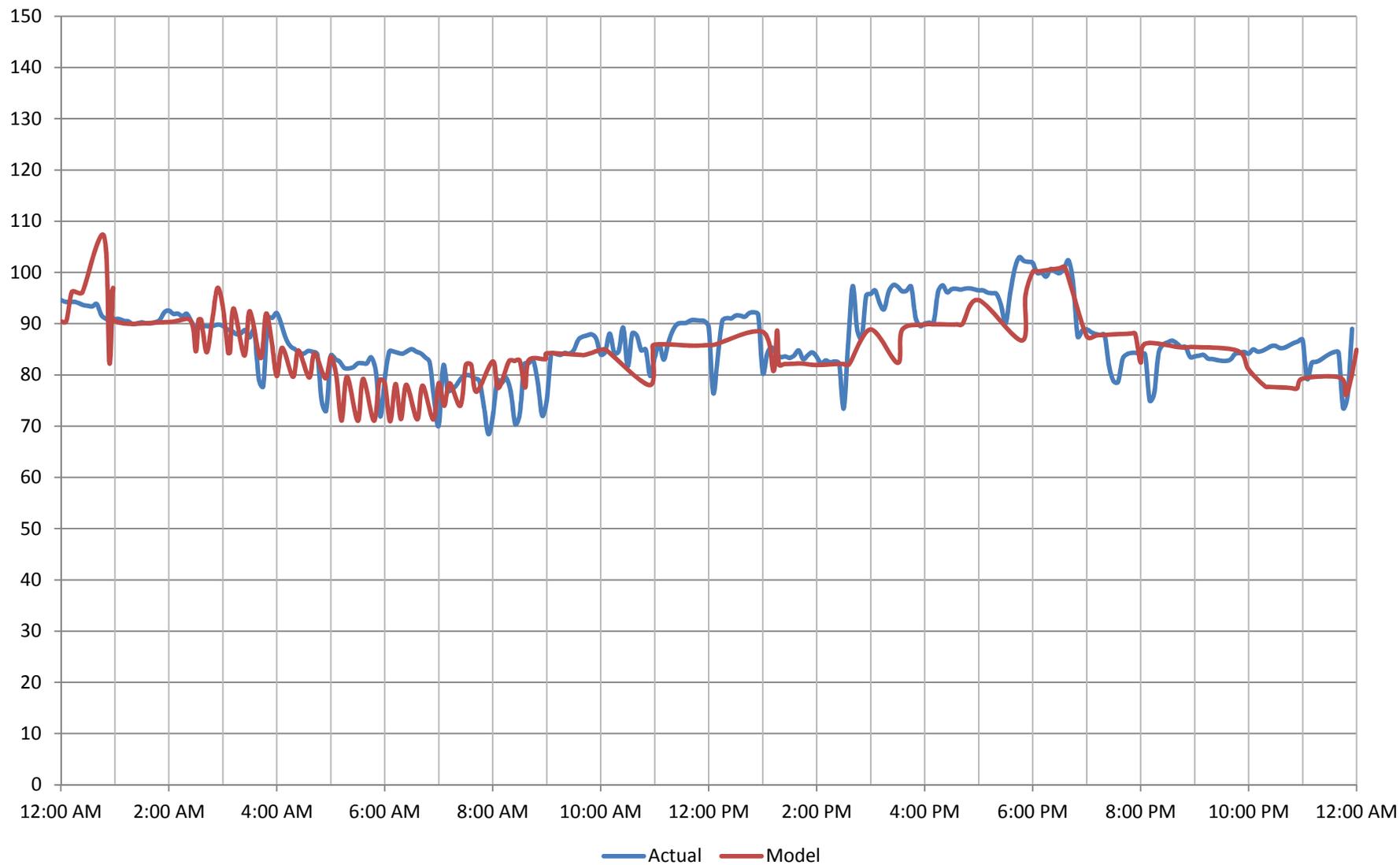
(6/29/2011)



1001 Santa Fe Drive (#1670)
Central Pressure Plane
(6/29/2011)



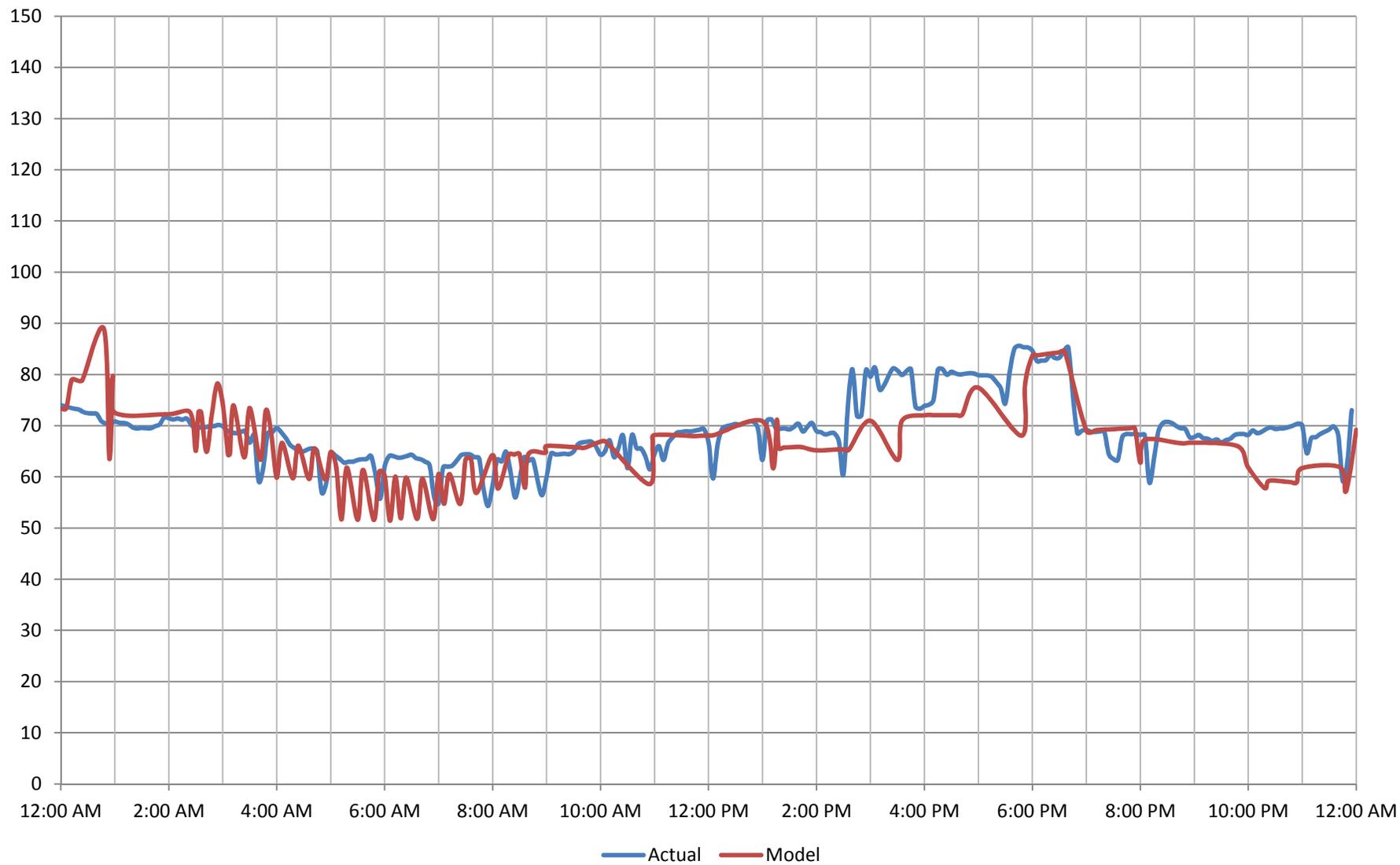
Fort Worth Highway and Mill Street (#203435) Central Pressure Plane (6/29/2011)



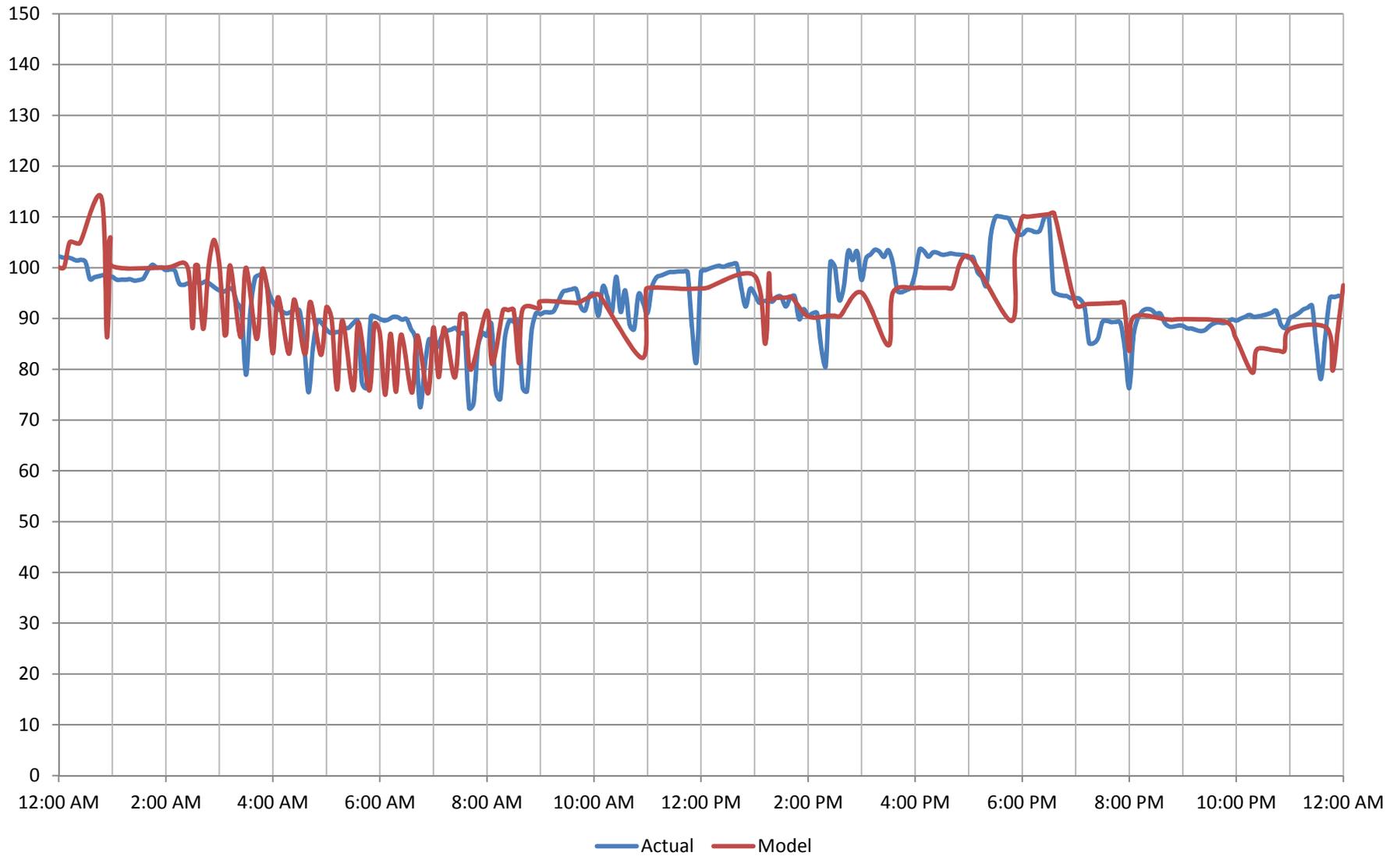
Sweetwater and 1500 Block of Fort Worth Highway (#203018)

Central Pressure Plane

(6/29/2011)



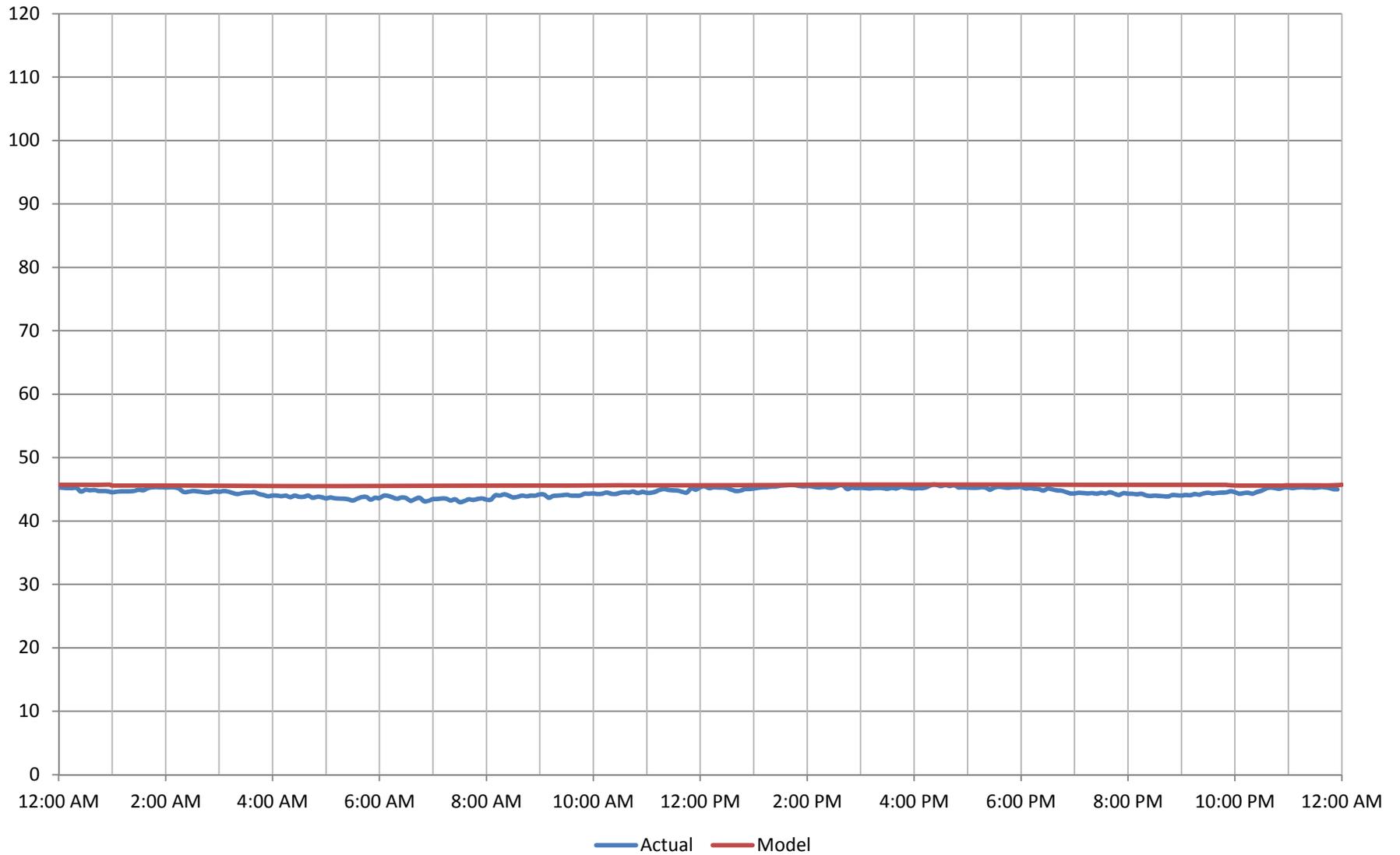
318 Mitchell Blvd. (#1666)
Central Pressure Plane
(6/29/2011)



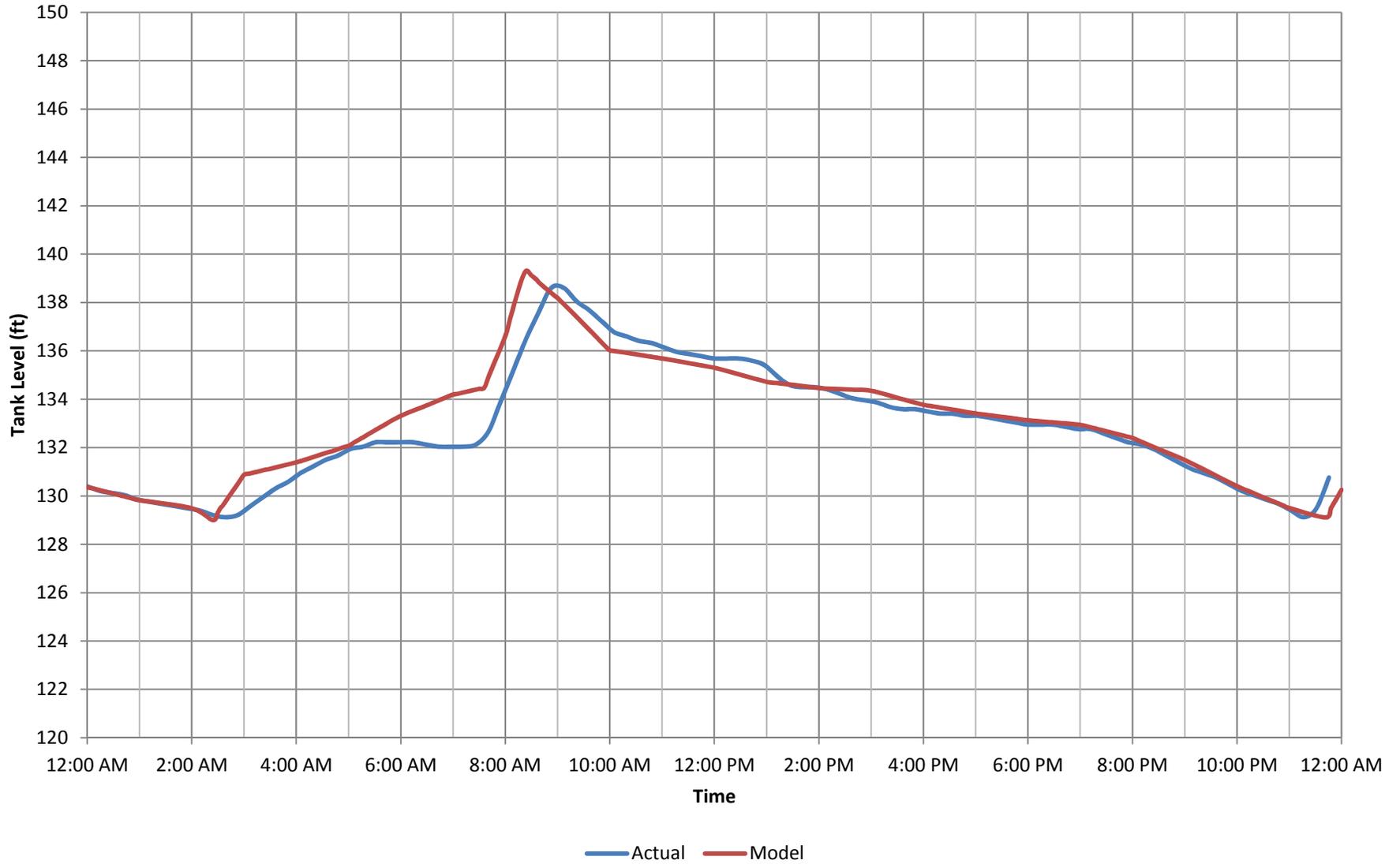
3509 Cliff View Loop (#203019)

Central Pressure Plane

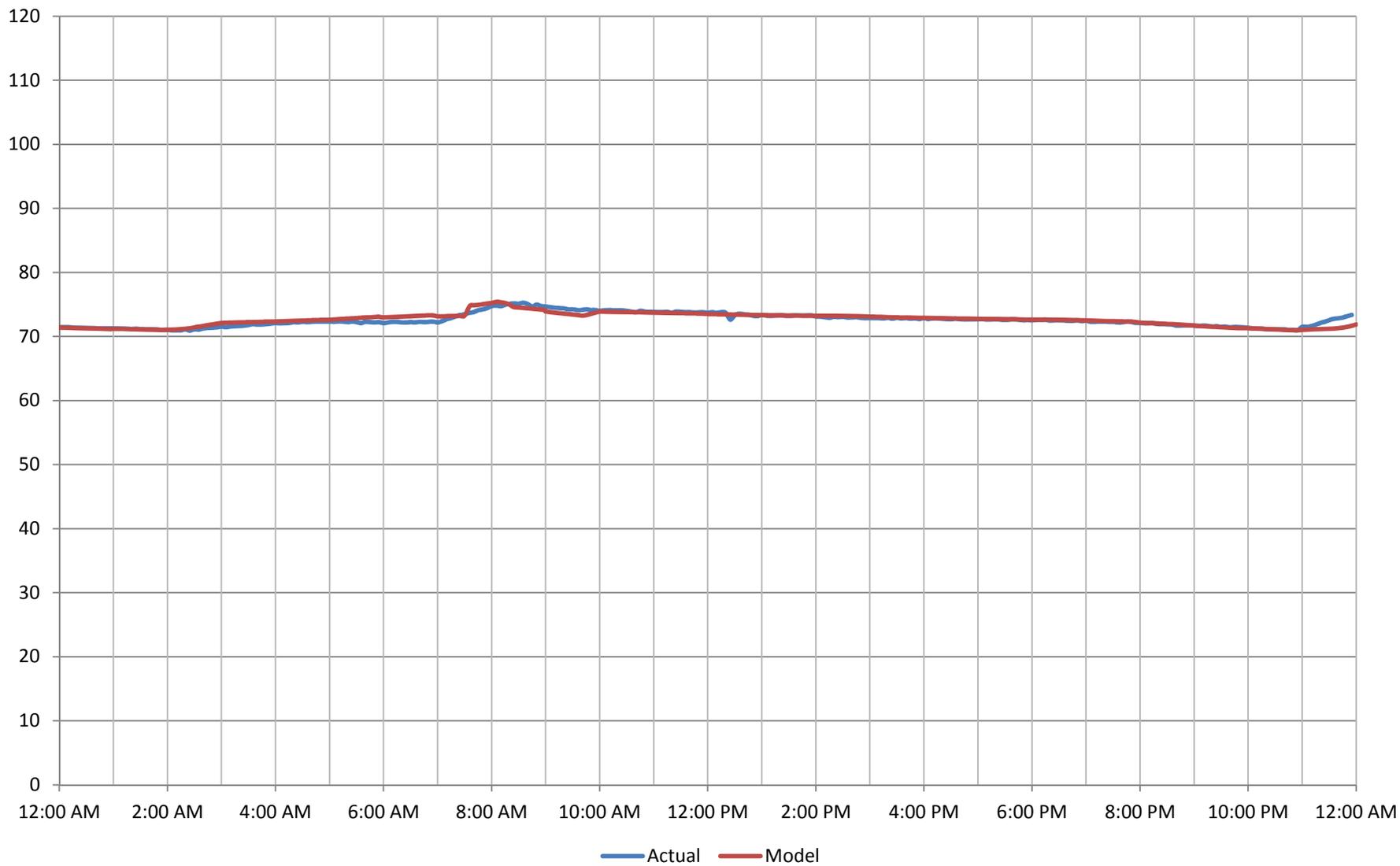
(6/29/2011)



Oak Ridge Elevated Storage Tank Oak Ridge Pressure Plane (6/29/2011)



1637 Salado Trail (#203271)
Oak Ridge Pressure Plane
(6/29/2011)



1100 Block of Reata Drive (#204229)

West Lake Pressure Plane

(6/29/2011)

