CEC

CIVIL ENGINEERING CONSULTANTS

Registration #F-2214

Water and Wastewater

Capital Improvements Plan

City of La Vernia

March 2015

This draft report is released on April 3, 2015 for interim review only under the authority of John T. Mooneyham, P.E., 99502. It is NOT to be used for bidding or construction.

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TRANSPORTATION PUBLIC WORKS DEVELOPMENT SURVEYING

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INTRODUCTION

The City of La Vernia was founded in 1851 by W.R. Wiseman. The city was originally named Live Oak Grove, but was later changed to La Vernia in 1959, most likely due to the abundance of green oaks. The City is currently comprised of approximately 2.64 square miles of land. In 2013, La Vernia had a recorded population of 1,249 residences. The average elevation is 489 feet above sea level. The City of La Vernia is located at 29° 21' 19" North latitude and 98° 7' 5" West longitude, approximately 30 minutes southeast of San Antonio on US Highway 87.

POPULATION & LAND USE EXECUTIVE SUMMARY

An evaluation of the city's current population was conducted in order to determine if current infrastructure was sufficient and meets the requirements set forth by the Texas Commission on Environmental Quality (TCEQ). The evaluation was based on information provided to Civil Engineering Consultants (CEC) by the City of La Vernia which included existing water and sanitary sewer infrastructure information, water consumption records, census records and potential future developments. The information was used to estimate future population growth for the year 2019, to analyze the city's existing water and wastewater systems, and to develop a list of capital improvement projects need to meet the demands of the estimated population growth.

An evaluation of the city's current land use was conducted in order to analyze areas where the potential growth is most likely to occur. The evaluation was based on the city's current Zoning Maps provided to CEC in addition to site observations. The information was used to develop potential future land use scenarios for the year 2019 to be used in the water and wastewater infrastructure analysis section of this report.

WATER DISTRIBUTION SYSTEM EXECUTIVE SUMMARY

An evaluation of the city's water distribution system was conducted in order to determine if the existing system complies with TCEQ regulatory requirements and to design an infrastructure improvement plan to meet the city's growing water demands. The evaluation was based on information provided to CEC including existing infrastructure, water consumption records and projected population growths over the next 10 years.

Improvements to the system are categorized by priority from high to low. A high priority improvement option should be implemented as soon as possible to meet TCEQ regulatory requirements and/or to handle the city's current water demands. The low priority improvements are not as vital, but should be completed over the next 10 years or sooner depending on the city's actual population growth.

CEC also evaluated the existing system for conformance with TCEQ Chapter 290 – Public Drinking Water regulations. The pipeline distribution system was evaluated using an EPANET computer model to simulate system pressures under various existing and future demand conditions. The model was also used to evaluate pressures in the system during simulated fire flow conditions.

Based on the EPANET model and simulation results, the existing water distribution system is functioning adequately under the existing average daily and peak hour demand conditions however improvements should be implemented to alleviate low operating pressures during fire flow operations and to maintain pressures above the minimum allowable operating pressures (35psi) under future peak hour demand conditions. The proposed improvements will improve system performance, provide the necessary measures to comply with state regulations under future projected demand conditions, and increase the level and duration of fire flow service in areas throughout the city.

WASTEWATER SYSTEM ANALYSIS EXECUTIVE SUMMARY

An evaluation of the City of La Vernia's wastewater collection system and treatment facilities was conducted to determine the condition and capacity of the existing system and to develop a capital improvement plan to meet the city's growing population demands. The evaluation of the system was conducted to assist the City in planning so that it may continue to meet the growing demands of collecting and treating wastewater for its citizens.

The study included an evaluation of the City's wastewater collection system, lift stations, and treatment plant. As part of the evaluation the existing system was compared to the state standards for wastewater systems set forth by TCEQ. The system was evaluated for compliance with TCEQ Regulations based on its existing and potential future conditions anticipated through year 2019.

POPULATION AND LAND USE ANALYSIS

POPULATION PROJECTION

The City of La Vernia requested that Civil Engineering Consultants (CEC) update the water and wastewater master plan prepared for the city in 2009. Population data provided by the city supplemented with anticipated future growth from residential development was used to estimate future water and sanitary sewer needs.

A population projection is necessary in order to identify future water and wastewater requirements. It is also important to understand how the population has changed within

recent years. The US Census data, shown in Figure 1, was examined from 2000 to 2013. Data was not available for the years 2006 to 2009, 2011 or 2012. The city did not have any data to provide, so the population for those years is connected by a straight line for those periods. Although the nation was in a recession during those periods, Texas and La Vernia were not significantly affected. Growth in La Vernia has been fairly steady during the last 5 years but could expand faster than historical records suggest if anticipated new residential developments occur.

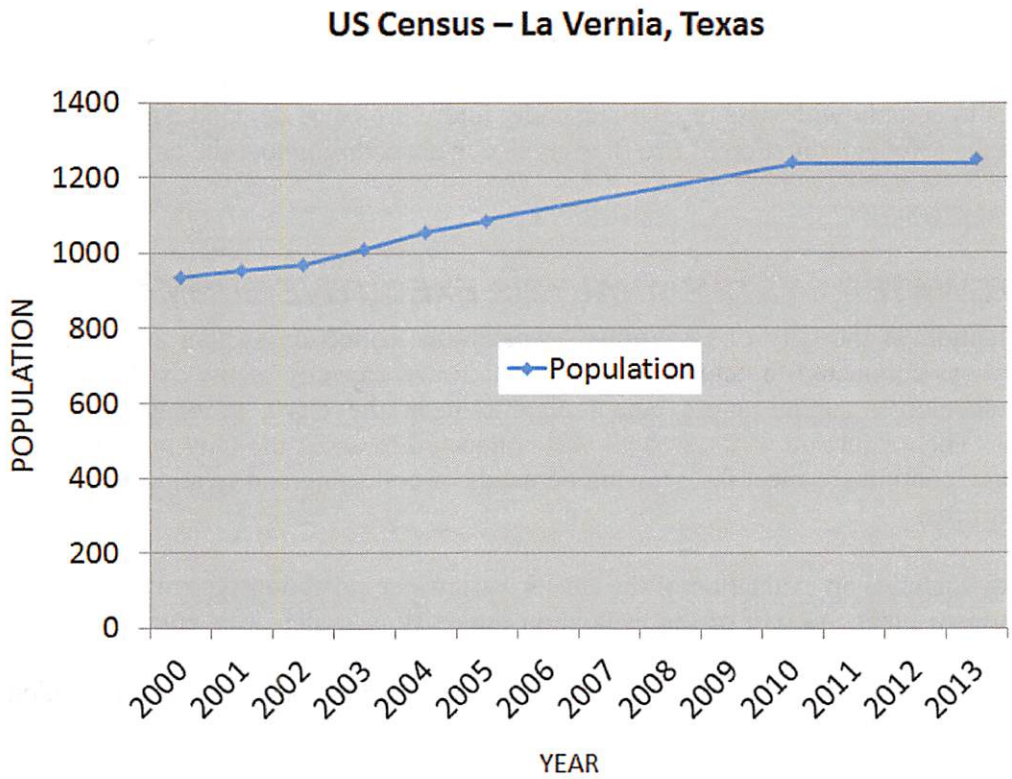


Figure 1- U.S. Census Data

The population in La Vernia since 2000 has increased each year at an average 24 persons per year or 3%. A table showing the actual population increases and percentage growth from 2000 to 2013 is shown below in Table 1 below. Based on this trend of 24 persons per year continuing in 2013 to 2023, the current estimated population would be approximately 1,273 persons. For the purpose of this report, the current 2014 La Vernia population is considered to be 1,273 persons.

Table 1. La Vernia Growth Rate, 2000 to 2013

Year	Population	Increase (#)	Increase (%)
2000	938	-	-
2001	954	16	1.7%
2002	970	16	1.7%
2003	1011	41	4.2%
2004	1054	43	4.3%
2005	1087	33	3.1%
2006	*	-	-
2007	*	-	-
2008	*	-	-
2009	*	-	-
2010	1243	156	-
2011	*	-	-
2012	*	-	-
2013	1249	6	-
	Average	24	3.0%

* No Data available

The Texas Water Development Board Data (TWDB) has produced a table with estimated population projections based on the overall growth in Texas. Their methodology does not consider local impacts that could affect population growth.

The data shown in Figure 2 shows the Texas Water Development Board Data (TWDB) predictions for the population of La Vernia. The TWDB data predicts that La Vernia's population will increase at an average rate of 24 persons per year.

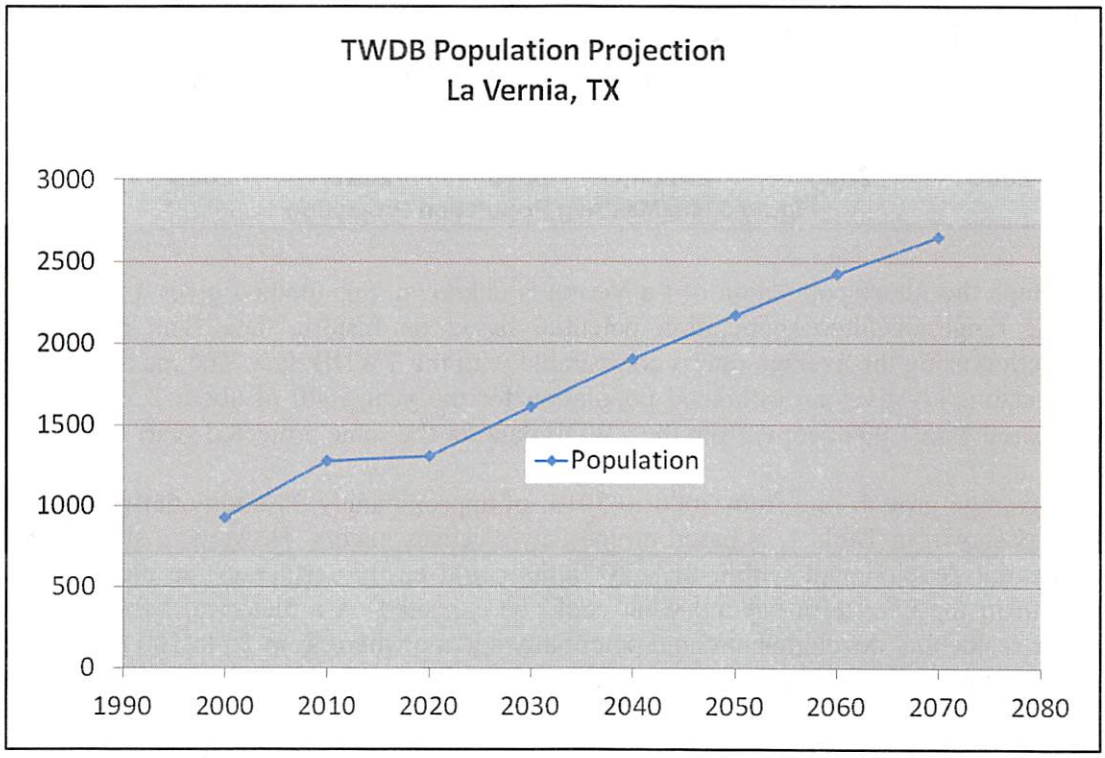


Figure 2 TWDB Population Projections

Another method of population projection is performed by an examination of the current growth rates from recent years and then extrapolating a future population. The minimum, maximum, and average growth rates are calculated and then used to predict future populations. The census data for La Vernia from 2000 to 2013 was analyzed to determine the different growth rates. A graph of this data for the City of La Vernia is shown in Figure 3. The graph shows a linear projection of the population at the maximum, the average, and the minimum growth rate. The maximum growth rate shows the population change at a rate of 40 persons per year over time. The average growth rate shows La Vernia's projected population at an average increase of 24 persons per year. While the minimum growth rate shows La Vernia's population over time at a rate of 16 persons per year.

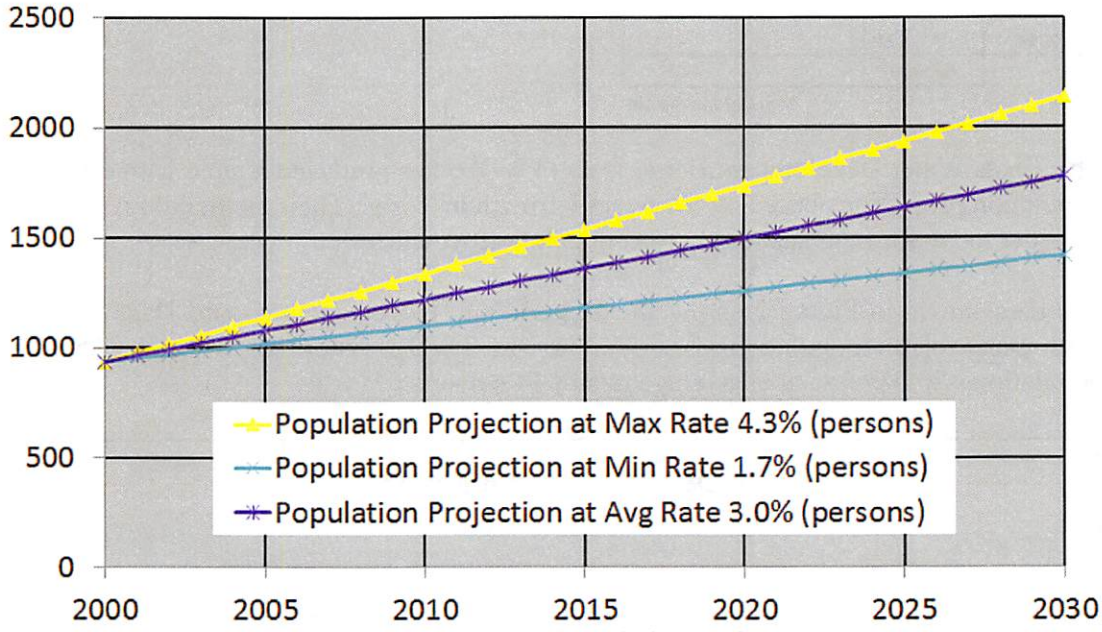


Figure 3 **Min/Max/Avg Population Projection**

Although the future population of La Vernia is unknown, this method gives a projection of the range of future population potential based on historic data. The population projection using the average rate is comparable with the TWDB data. The maximum rate (40 persons/yr) gives an estimated population for the year 2040 of about 2,538 people compared with 1,904 people from the TWDB data for the same projected year.

The average growth rate from 2000 to 2013, of approximately 24 additional people per year as shown in Table 1, is based on the City's census history. However a single large residential development within the city limits could easily accelerate the city's future growth in the near term beyond what could be expected on a historical basis only. A single residential development could potentially add anywhere from 25 to 100 new home sites per year as lots are developed. For this reason, it is our opinion that the City should plan for the worst case scenario assuming that each new residential site could house an average of 2.5 persons per house. For utility planning purposes based on the justification

above, we will use the maximum growth rate of 90 additional persons per year to estimate the City's future population growth over the next five years. This progressive estimate results in a conservative analysis that minimizes opportunities to undersize important infrastructure. At a growth rate of 90 persons per year, the City population could reach up to 1,723 persons by the end of year 2019.

CURRENT LAND USE

An inventory of the current land use throughout La Vernia was needed to properly evaluate water and wastewater infrastructure for the master plan. The *2015 Land Use* map, shown in Exhibit 1, shows how the land within the city limits and surrounding area is divided into various groups according to its primary use. In 2013 La Vernia annexed 238 acres known as the Pierdolla Tract. This annexation is reflected in the current land use plan based on the proposed master development plan prepared by the property owners.

The land was divided into seven (7) major categories as follows: Agriculture, Church, Commercial, Industrial, Multi-Family Residence, Public/Semi-Public, and Single Family Residence. Each of these groups could be subdivided into more specific portions, but categorizing each parcel into one of these broad categories simplifies the city's land uses. This also makes determining system demands simpler as water and wastewater demands will vary depending on land use.

Determining the land use for each portion of land within La Vernia's Extraterritorial Jurisdiction (ETJ) was done visually, from aerial maps, city zoning maps, and site visit observations. Also, information received from the City of La Vernia was used to determine each land use. A description of each type of land use is discussed below.

Farm land or land without development was categorized as *Agricultural.* Agricultural areas are typically found surrounding city limits. This is also the case in La Vernia with agricultural land located along the outer edges of the current city limits and in areas within the flood plain. A large portion of the land within La Vernia's ETJ falls into this category. The highest and best use of this land will determine how long it remains in this category.

Church areas are locations where a known church is established and is not used on a daily basis. There are only a few locations within La Vernia that fall within this category.

Areas designated as *Commercial* are mainly located along major roadways, such as Hwy 87 and FM 775 in order to attract potential customers. Locations along major roadways are less difficult to locate and easier to receive merchandise. Commercial use includes businesses such as fast food establishments, restaurants, car washes, auto repair, grocery stores, etc. For purposes of this analysis, *Offices* have also been included in the commercial category. Offices are often occupied during regular business hours and are used similarly to commercial retail businesses.

The city's dedicated *Industrial* area is located along Industrial Drive and in the northeast portion of the city limits. Older industrial areas were initially developed where railroad tracks used to be which provided easier access to shipping and exporting. Newer industrial areas continued to develop in those areas because they were less likely to impact residential areas.

Multi-Family Residence areas are locations of apartment homes, condominiums, duplexes, or townhomes. La Vernia does not have many locations that fall within this category.

Public/Semi-Public areas include the schools, parks, municipal buildings, and other city owned property. The city's wastewater treatment plant, pump and well sites, city hall and public works buildings also fall into this category. These areas are scattered throughout the city. This category also includes other governmental use areas including the County Offices.

Single-Family Residence areas are located throughout the city. Residential areas contain single-family lots of varying sizes. Areas along the outskirts of the city tend to have larger lots than areas located closer to the city's center.

Developing an existing land use plan was necessary to analyze the existing infrastructure adequacy. This helped determine areas where improvements were needed, and areas that are already sufficient for existing and future growth. The existing land use plan shows the current status of the city.

The information collected to develop the existing land use map was also used to project future land uses. Understanding the current land use of the City helps in preparation of infrastructure and zoning planning for future development in La Vernia.

PROJECTED LAND USE

The *Future Land Use Plan*, shown in Exhibit 2, indicates the anticipated future land use in the year 2019. The map is a depiction of which areas might see development and what type of development will most likely occur in these locations. The data was derived from current development plans and trends in population growth, as well as suggestions from city staff and the Impact Fee Advisory Committee.

The *Future Land Use Plan* was developed under the assumption that the densities for the different types of land use would remain approximately the same over the next ten (10) years. This was done by establishing a density ratio for each of the land use categories; current population to acreage of land use type. An example of this would be persons per acre of residential development or the density of a development. If the existing residential density was 6 persons, or 2 EDUs, per acre of residential land, the future land use residential density would also be 6 persons, or 2 EDUs, per acre of residential land.

The two major land use categories projected to see the most significant growth within the next ten (10) years are residential and commercial. These areas are shown in Exhibit 2,

shaded in yellow and light blue respectively. Both of these areas currently occupy a significant portion of the land in La Vernia and continue to grow at greater rates when compared with the other categories. This trend may or may not continue as the relative growth will be affected by potential industrial users moving into the Industrial Park. This trend could also be affected by economic development incentives to attract new businesses and/or the state of economy. For the purpose of this report, the assumption that growth would continue at the rates previously mentioned was used.

RESIDENTIAL

The majority of residential growth is projected to occur to the south and west areas of the current city limits by infilling undeveloped or agricultural areas. Currently, there are a few developments under construction along FM 1346, just south of Hwy 87. These newer developments will most likely fill up prior to any future locations further away from the city.

Most of the people in La Vernia commute to and from San Antonio on a daily or weekly basis. San Antonio is a much larger city and offers a larger employment and commerce market. Development west of the city provides a shorter commute to San Antonio which makes those areas more desirable for future growth.

Another reason La Vernia's Residential growth will likely occur towards the west and south is due to the existing floodplain boundary. The location of the floodplain is shown on Exhibit 2 shaded in blue which is mostly surrounding the north and east. Areas not included in the study but subject to flooding based on ground elevations are shown in blue cross hatching. The floodplain areas in and around La Vernia restrict future growth and development. These areas form boundaries for new development and affect land use. La Vernia should see little to no development in these areas.

COMMERCIAL

Commercial growth in the City of La Vernia should occur along major roadways such as Hwy 87, FM 1346 and FM 775. Areas anticipated for future growth are shown in light blue on Exhibit 2. Most of the existing commercial properties are located along these roadways and there are plenty of locations available for future growth. Businesses located near major roadways create easy access for consumers and deliveries. These locations also make the commercial property more visible to more consumers.

Currently, there are large tracts of land along the main commercial strip that have not been developed. These areas are most likely to develop within the next ten (10) years as the population increases. Also located along the commercial strip are some areas of residential properties. As La Vernia's population grows and needs for commercial properties increases, these areas should eventually become commercial.

Areas that are projected to see future commercial development are along Hwy 87 towards San Antonio and through the center of La Vernia. Besides having commercial zoning, these locations are ideal for businesses. Other potential locations for future commercial

development are located along FM 1346 and FM 775 surrounding the schools and parks. These roadways see significant amounts of traffic and provide easy access.

OTHER DEVELOPMENT

The remaining areas of La Vernia will have varying degrees of growth based on residential growth and economic factors. *Municipal* areas will need to grow as the city's population grows. The city may expand its business operations to other locations. *Park* land will also grow along with the city. Dedicated park space will be limited unless the city changes its requirements requiring open space in developments or purchases additional land for park use.

Expansion of the school property will be dependent on the population of the school. It appears that the current school site is being utilized near its capacity. Location of new schools would be dependent on land being set aside and the areas experiencing higher residential growth.

Industrial expansion is most likely to be limited for the foreseeable future. La Vernia currently has an Industrial Park, but has few users. Any anticipated industrial expansion would most likely be within the limits of the established industrial park.

WATER DISTRIBUTION SYSTEM ANALYSIS

INTRODUCTION

The existing water distribution system is comprised of various sized mains ranging from 1-inch to 10-inch diameter pipes. The majority of existing water mains are made of PVC, cast or ductile iron materials. The city has previously received complaints in the city's higher elevated areas where water pressures were less than desirable. Investigations by city staff revealed that the only location with water pressure concerns was in the elevated portion of the Woodcreek Subdivision. TCEQ requires that pressures be maintained above 35 psi during peak daily hour demand conditions and above 20 psi during fire flow conditions.

EXISTING SYSTEM

The city has a generally reliable water system but there are some unique aspects to the city's system. Currently, the city has two (2) operating water wells to supply the system. The water system is further supplemented by a metered supply from the Canyon Regional Water Authority (CRWA) which allows La Vernia to purchase up to 400 acre-feet per year. There are operational issues with the elevated storage tank located on County Road 342 (CR 342). Preliminary investigation indicated that the tank is too low to operate properly and thus floats on the system and requires periodic flushing. Field surveys conducted by CEC on January 14, 2009 concluded that the elevated tank is approximately 18-inches below the ground storage tank located at the Woodcreek Subdivision. The ground storage tank at the Woodcreek Subdivision stands at the highest elevation within the water distribution system. The city has recently completed a new water well (Well

#6), filter plant and booster pump station a few miles east of the existing elevated storage tank location. At this time the elevated tank was serviced with new coatings inside and out and the stem pipe into the tank was extended which will allow the elevated tank to cycle under normal operating conditions. A SCADA system for the new facilities was also installed and is capable of adding the Woodcreek and HEB stations.

Pressure maintenance in the system has generally not been a problem. Complaints were received in the Silverado Hills area, but were not substantiated by city staff. In addition, the Woodcreek area has also received some pressure complaints at the higher elevated section of the subdivision. Investigation of these complaints by the city staff has confirmed that low pressure occured at three (3) residences. These residences were reportedly supplied from the pressure tank at the Woodcreek Pump Station and are located at the highest elevations in the system. Two (2) new centrifugal booster pumps replaced the worn out submersibles at this location and since replacement no additional pressure complaints have been received.

The individual components of the water distribution system include the wells, booster pumps, ground and elevated storage tanks, distribution mains and associated control systems. Each of these components is discussed in the following sections. A map of the existing water distribution system is shown in Exhibit 3.

Water Supply Wells

The existing water distribution system for the city is comprised of two (2) active well pump sites. Originally the city had five wells that were used to supply water to the distribution system. Over the years, three of the wells were taken out of service. Well #2 is currently only used for bulk water sales and is not connected to the distribution system. Well #3 had high dissolved solids and was inactivated and is currently being used as a monitoring well by the Evergreen Underground Water Conservation District. Well #4 was also abandoned due to high total dissolved solids. Well #5 was inactivated due to sanding problems and the disintegration of the well casing and was abandoned when Well #6 was drilled. The well sites and capacities are shown in Table 2 below.

Table 2. **Well Capacity Information**

Site	Well Capacity (GPM)
Well #1	170
Well #2	Bulk Water Only
Well #3	Inactive
Well #4	Abandoned
Well #5	Abandoned
Well #6	350

Pump Stations

The City of La Vernia currently has five (5) pump stations in operation, the Maintenance Yard Booster Pump Station, the Woodcreek Booster Pump Station, the HEB Booster Pump Station, the Elevated Booster Pump Station and the Well #6 Booster Pump Station. The city recently took offline and abandoned an existing booster pump station which was referred to as the Highway 87 Water Plant. Each of the active pump stations are discussed below.

At the Maintenance Yard, water is pumped from Well #1 into the ground storage tank. From there, it is pumped into the distribution system via one (1) centrifugal booster pump. The pump is a Crane Deming 20 hp pump capable of pumping 300 gallons per minute. The pump station is equipped with another Crane Deming pump however it is no longer operational.

The Woodcreek Subdivision is serviced by a gravity and pressure system due to the difference in elevation across the subdivision. Water is supplied from the distribution system to a storage tank adjacent to the subdivision. From there, a gravity fed line supplies a portion of the subdivision from the discharge side of the storage tank. The remainder of the subdivision is supplied by two (2) centrifugal pumps capable of pumping 100 gallons per minute and a 2,500 gallon hydro-pneumatic pressure tank set to operate in the range of 60 to 85 psi. The original submersible pumps were replaced with centrifugal pumps in 2010. The pumps are controlled by pressure readings at the pressure tank and can work simultaneously to meet demands if needed. No issues have been reported since the replacement of the pumps.

With the addition of Well #6, a new pump station was created at the elevated storage tank on County Road 342. The pump station consists of three (3) centrifugal booster pumps. Two (2) pumps have a capacity of 255 gallons per minute and one (1) has a capacity of 50 gallons per minute. There are also two (2) booster pumps located at the Well # 6 Site to pump water to the elevated storage tank. Each of the two (2) pumps has a capacity of 170 gallons per minute. Both pumps have a capacity of 170 gallons per minute.

When HEB located a store in La Vernia, the city worked with them to establish fire flow capacity to the HEB store. The agreement was for HEB to install a ground storage tank that was sufficient for fire flows and the city requested the capacity to be increased to 250,000 gallons. HEB complied and also installed two (2) booster pumps with a capacity of 750 gallons per minute to increase pressures on the west side of La Vernia. These pumps have variable frequency drives (VFD) and a control system that monitors and maintains pressure at a fixed set point as determined by the City of La Vernia Public Works staff.

Location	Pump Capacity (GPM)
Well #6 Booster Pump Station	170 x 2
Elevated Storage Booster Pump Station	255 x 2 50 x 1
HEB Booster Pump Station	750 x 2
Woodcreek Booster Pump Station	100 x 2
Maintenance Yard Booster Pump Station	300 x 1

Storage Tanks

The city's system is comprised of ground and elevated storage. Below is a table summarizing storage types and capacities at each tank location.

Table 3. **Storage Tank Capacity**

Site	Ground Storage Capacity (G)	Manufacturer	Year Built	Elevated Storage Capacity (G)	Manufacturer	Year Built
Well #6	49,000	Watco	1999	N/A	N/A	N/A
Hwy 87 Plant	This system was taken offline as a result of the new system associated with the new HEB development.					
Woodcreek	N/A	N/A	N/A	2500 Hydro.	Bulldog Steel	1975
Woodcreek	N/A	N/A	N/A	63,000	Unknown	1975
CR 342	N/A	N/A	N/A	50,000	Phoenix	1993
Maintenance Yard	63,000	Watco	1995	N/A	N/A	N/A
HEB	250,000		2010	N/A	N/A	N/A

The total ground storage capacity is 362,000 gallons. The total elevated storage capacity is 113,000 gallons. The elevated tank has not been fully operational since its installation due to a problem with the height of the tank. With the recent upgrades, the elevated tank works as storage for the booster pump station that is located at the tank site.

Piping

The distribution piping is comprised of approximately 22 miles of 1- to 10-inch diameter pipe. Pipe materials most likely include ductile iron, cast iron, PVC and asbestos cement. The system contains approximately 600 linear feet of 1-inch, 670 linear feet of 1½-inch, 15,685 linear feet of 2-inch, 1,451 linear feet of 3-inch, 6,155 linear feet of 4-inch, 50,100 linear feet of 6-inch, 30,205 linear feet of 8-inch and 2,570 linear feet of 10-inch pipes. It

was reported by the city's Public Works Department staff that the pipe network system generally does not encounter main breaks within the system. The National Fire Protection Agency (NFPA) recommends that the minimum diameter of pipe be 6-inches for fire protection distribution systems that are looped. Pipe diameters of no less than 8 inches should be used in congested and commercial areas. TCEQ requires that mains be at least 2-inches in diameter. Exhibit 3 is a map of the existing water distribution system showing locations of well sites, storage sites and booster pump sites.

System Operation

There is a fairly significant difference in elevation across the city's current service area. Currently the city is divided into two (2) operating areas, the first being the main portion of the city and the other area being the Woodcreek Subdivision. Within the Woodcreek Subdivision there are two (2) operating levels of service, one being a pressure system and the other is a gravity system. The main portion of the city is on a gravity fed system. The water distribution system is operated on level sensors and water elevation in the storage tanks to maintain pressure throughout the system. Water is pumped from the wells into ground storage tanks. It is then either pumped directly into the distribution system or into elevated storage tanks for pressure maintenance. With the recent addition of Well #6, the booster pump station at the elevated tank site and HEB booster pump station, pressure issues appear to have been resolved and no complaints have been received.

The water distribution system is operated by an outdated control system. The current control system only has the capability to perform a dial-up to a specified number when a problem occurs. The responding personnel have to troubleshoot the problem without the aid of much information. Little information is available about the control system but the operation of the controls is fairly well understood. However, there is no documentation to support the operation. At the time of this report, a new SCADA system was being installed that should allow the city to monitor the Well #6 site, Elevated Booster Pump Station, HEB Booster Pump Station and the Woodcreek Booster Station.

Regulatory Compliance

The City of La Vernia currently operates under a Certificate of Convenience and Necessity (CCN) Water Service Area ID No. 10689, issued by the Texas Commission Environmental Quality (TCEQ). TCEQ is the state regulatory agency that oversees the planning, construction and operation of municipal water facilities, and has issued the City of La Vernia CCN Water System ID number 0070003.

The water distribution system for the city must comply with current TCEQ regulations under the Texas Administrative Code, Chapter 290, Subchapter D "*Rules and Regulations for Public Water Systems.*" The system must meet the minimum requirements set forth under Rule § 290.45(b)(d) *Minimum Water System Capacity Requirements with more than 250 connections.*

The minimum operating pressure for public water systems must be greater than 35 pounds per square inch during normal operations and maintain operating pressures

greater than 20 pounds per square inch during fire flow conditions, line flushing and other unusual conditions.

Based on data provided by city staff on December 9, 2014, the current total number of connections which is comprised of residential, commercial, schools, etc. is 631 connections which equates to just over 2 persons per connections. The city is currently required to have 378.6 gallons per minute of well capacity based on the regulatory requirement of 0.6 gallons per minute per connection. The city currently has 520 gallons per minute of well supply. Currently make up water, if necessary, is made by purchasing water from the Canyon Regional Water Authority (CRWA). The city purchases water from the CRWA at a point near the city limits on FM 1346. This purchased water keeps the distribution system functioning at the required levels and helps provide service, although at a higher cost. Per TCEQ regulations additional well capacity will not be required until the number of water service connections reaches 866. In accordance with the city's population projections (90 per year), additional well capacity will be required within the next 7 to 8 years or around the year 2021 if anticipated population projections are realized.

For ground storage, the city is required to have 126,200 gallons (200 gallons per connection) of storage based on the TCEQ regulatory requirement of 200 gallons per connection. It currently has 362,000 gallons of ground storage capacity. Additional ground storage capacity will not be required according to TCEQ's ground storage requirements until the number of water system connections exceeds 1,810. According to population projections additional ground storage capacity will not be needed until the year 2053.

Elevated storage capacity shall be at the rate of 100 gallons per connection or a pressure tank capacity of 20 gallons per connection. The city has a total of 631 connections which is comprised of 573 connections within the gravity fed system and 58 connections within a pressurized service area located in the Woodcreek Subdivision. The city is required to have 57,300 gallons of elevated storage and 1,160 gallons of pressure tank capacities. It currently has capacity for 113,000 gallons of elevated tank storage and 2,500 gallons of pressurized storage which meets the minimum capacity requirements. Per TCEQ's elevated storage requirements, additional elevated storage will not be required until the number of connections exceeds 1,130 which is projected to occur in the year 2032.

The Woodcreek Subdivision has a 2,500 gallon hydropneumatic tank providing pressurized water supply to the higher elevations within the subdivision. The hydropneumatic tank conveys water supply through 58 water service connections within the Woodcreek Subdivision. Prior to 2010 the Woodcreek pressure system was not maintaining adequate pressures to all residences in the subdivision during peak operating conditions. This was most likely due to the age of the system and normal wear and tear of the pump impellers. Since replacement of the two booster pumps in 2010, the system has been operating adequately.

For the minimum pump capacity requirements, the city must have 2 or more pumps per station and a total pump capacity of 1,262 gallons per minute to meet the regulatory requirement of 2.0 gallons per minute per connection. It currently has a total of 2,900 gallons per minute and a total of ten (10) operational pumps of various sizes ranging from 10 to 25 horsepower. At the time of this report, one of the pumps at the Main Yard Booster Station was reported to be old and not used. Per TCEQ's minimum pump requirements, each station is required to have at least two (2) operational pumps. Additional pump capacity will be required once the number of service connections exceeds 1,450. According to population projections additional pump capacity will not be required until the year 2041.

In addition, TCEQ requires sanitary easements for each well used for potable water supply. Since these easements would have been necessary to obtain drilling permits to install the wells, the city most likely can locate these records. If the records cannot be located in the city's files or the courthouse, new easements should be obtained to meet the requirements of 30 TAC 290.41(c)(1).

CEC has previously reviewed the water Certificate of Convenience and Necessity (CCN) for the city. This review indicated that there are some areas of concern for the CCN. The boundary to the North with East Central is a sound boundary and supported by a good legal description. The remaining portions however, do not integrate well. The primary issue is the boundary with the Sutherland Springs Water Supply Corporation (SSWSC). The SSWSC boundary is shown to overlap areas where the city of La Vernia is the current water provider. The area is comprised of approximately 165 acres. Conversely, there is an area of approximately 133 acres that is being served by SSWSC and is currently shown in the city's CCN.

MODEL DEVELOPMENT

CEC prepared a water distribution system model using EPANET II software available through the U.S. Environmental Protection Agency internet website. The software applications include calculations using the Hazen-Williams formulas as a basis for calculating friction losses throughout the pipe network system. The city staff provided CEC with an existing water distribution map illustrating locations and sizes of pipes, storage tanks, wells and booster stations. CEC further compared the water model with as-built records and updated the model to simulate approximate existing conditions. A map illustrating the existing water distribution system is shown in Exhibit 3.

With exception of the HEB and Well # 6 booster stations, the booster pump stations at each site were modeled to allow the pumps to operate in parallel under high demand conditions. For example, the HEB and Well # 6 site pump stations contain two booster pumps each; however the EPANET model was prepared using only one. Conversely, the elevated tank and Woodcreek booster stations were modeled allowing all pumps to operate as needed to maintain demands. Control data for each pump station would be needed to better model actual pump operating conditions. Pump control assumptions were made and inputted into the model to simulate actual operating conditions.

To simulate maximum daily peak hour demands, a peaking factor of 3.0 was applied to the annual average daily demand based on the City's 2013 water consumption records. The 3.0 peak hour multiplier was used in conjunction with a 24 hour simulation in order to simulate current conditions and to evaluate future improvement alternatives. The peak hours used in the simulations were between the hours of 6:00 AM to 8:00 AM and 4:00 PM to 8:00 PM. During these times an increase in demand typically occurs.

To calibrate the water model, CEC compared the model results to the records of a recent fire flow test performed by the Fire Protection Consulting Group (FPCG), LLC on December 12th, 2014. An equivalent fire flow scenario was simulated using the water model and the results were then compared with the fire flow test results. The average static and residual pressure results were within ± 5 psi of the results reported in the actual fire flow test performed by FPCG. The simulated results of the fire flow test are included in Appendix C as Scenario # 1.

Once the water distribution system model was complete and calibrated to the best available data, it was used to analyze the pressures and operations throughout the city. Areas of high and low pressures were determined as demand fluctuates throughout the day. The model and information were used to assist in the development and priority of each proposed project and to see which of the projects provided the most benefit to the system.

In addition, CEC conducted several scenarios using the water model to simulate system improvement alternatives in conjunction with average daily demand conditions, peak hour daily demand conditions and fire flow conditions. The simulations were conducted as follows and the results of the simulations are illustrated in Appendices B and C:

(1) Existing Average Daily Demand Conditions;
(2) Scenario # 1 – Fire Flow Simulation – Existing Average Daily Demand Conditions with 1680 GPM Fire Flow (1 Hour Duration);
(3) Existing Peak Hour Demand Conditions (3.0 Peak Factor);
(4) Scenario # 2 - Future Peak Hour Demand Conditions (3.0 Peak Factor);
(5) Scenario # 3 – Main Yard Pump Out with Future Peak Hour Demand Conditions;
(6) Scenario # 4 – San Antonio St. & D.L. Vest St. – 8" Improvements with Future Peak Hourly Demand Conditions;
(7) Scenario # 5 - San Antonio St. & D.L. Vest St. – 8" Improvements Plus HWY 87 – 12" Interconnect Improvements with Future Peak Hour Demand Conditions;
(8) Scenario # 6 - San Antonio St. & D.L. Vest St. – 8" Improvements Plus HWY 87 – 12" Interconnect Improvements Plus FM 775 – 12" Improvements with Future Peak Hour Demand Conditions;
(9) Scenario # 7 – 1500 Fire Flow Simulation with Existing Average Daily Demand Conditions;
(10) Scenario # 8 - 1500 Fire Flow Simulation with San Antonio St. & D.L. Vest St. – 8" Improvements with Future Average Daily Demand Conditions;

(11) Scenario # 9 - 1500 Fire Flow Simulation with San Antonio St. & D.L. Vest St. – 8" Improvements Plus HWY 87 – 12" Interconnect Improvements with Future Average Daily Demand Conditions;
(12) Scenario # 10 - 1500 Fire Flow Simulation with San Antonio St. & D.L. Vest St. – 8" Improvements Plus HWY 87 – 12" Interconnect Improvements Plus FM 775 – 12" Improvements with Future Average Daily Demand Conditions;
(13) Scenario # 11 – 2 Hour 1500 Fire Flow Simulation with Peak Hour Demand Conditions;
(14) Scenario # 12 – 2 Hour 1500 Fire Flow with Proposed Improvements during Future Peak Hour Demand Conditions

The water model simulation results are further discussed within the System Evaluation, Water Capital Improvement Plans and Fire Flow Analysis sections found later in this report.

SYSTEM EVALUATION

The overall condition of the existing infrastructure was assessed as well as the ability to supply current demands and meet future needs. Three (3) previous reports were available for review, 1) *2000 Planning/Capacity Building Project Comprehensive Plan* by Raymond K. Vann & Associates and Southwest Engineers, Inc. in 2000, 2) *Preliminary Engineering Report Water System Evaluation* by River City Engineering in 2002 and 3) *Water and Wastewater Capital Improvements Plan* by Civil Engineering Consultants in 2009. In general, the studies indicate the need for continued planning and installation of infrastructure to keep up with the growth of the city with a primary focus on basic services. The details of each system component are discussed below.

Water Supply

At the present time, the city has two (2) operational water wells. The first well is located at the Maintenance Yard and has a capacity of approximately 170 gallons per minute. The second well is located southeast of town and has a capacity of 350 gallons per minute. Well #5 was abandoned with the installation of Well #6.

In addition to the water wells, the city has a connection to the CRWA. Water is supplied to the city through a 4-inch meter via a 10-inch line on FM 1346. Here water enters a ground storage tank located just north of the existing HEB. The ground storage tank supplies water to the HEB booster pump station where two (2) pumps pump water into the distribution system. Since Well #6 is on line, it is anticipated that the city will reduce its use of the CRWA connection.

Storage Tanks

The distribution system has three (3) ground storage tanks, two (2) elevated storage tanks and one (1) pressure tank which are located throughout the system. The tanks were inspected in 2002 by Ron Perrin Water Technologies and in 2008 by Underwater Services.

The system has two (2) 63,000 gallon tanks. One (1) located at the Maintenance Yard and one (1) located at the Woodcreek Subdivision. The tank at the woodcreek subdivision is used as a standpipe functioning as elevated storage due to its elevation in the system. The Maintenance Yard tank was constructed in 1995 and is made of ¼-inch steel plate manufactured by Watco Tanks. The Woodcreek tank was installed in 1975 and is made of ¼-inch steel plate manufactured by Watco Tanks. The 2002 inspections revealed that both tanks were in good condition. The 2008 inspections revealed that the tank at Woodcreek is in need of some repairs to the access ladder and hatch. Both tanks were also reported to be accumulating debris on the floors and are in need of cleaning. Maintenance painting was also recommended.

The elevated storage tank was constructed in 1993 and has a capacity of 50,000 gallons. The 2002 inspection report indicated that there was some corrosion and staining on the inside of the tank and significant sediment on the tank bottom. The exterior was in good condition and no other deficiencies were noted. The 2008 inspection revealed similar results. The tank was recently serviced in 2014 with new internal and external coatings and reported to be in good condition.

Continued inspection and rehabilitation of the storage tanks will be needed to maintain compliance with TCEQ regulations. The tanks were inspected by US Underwater Services in December of 2008. The inspection revealed that most of the tanks need cleaning, fall protection devices, intruder deterrent devices, installation of signage, new vents or vent screens, and ladder installation or replacement. There are some areas where the steel substrate of the walkways has become corroded and immediate repairs to prevent further deterioration are necessary. The report indicated that all the tanks were showing signs of deteriorating coatings, both internally and externally. The preceding items are maintenance related and the costs associated with making these repairs cannot be included in the capital improvements plan. No additional inspection reports were made available for this report.

Pump Stations

There are a total of five (5) pump stations that provide water to the existing system and are as follows: (a) Well #6 Booster Pump Station, (b) Maintenance Yard Booster Pump Station, (c) Woodcreek Booster Pump Station, (d) Elevated Booster Pump Station and (e) HEB Booster Pump Station. The pump station at the Hwy 87 Plant was taken offline. One (1) of the Maintenance Yard pumps was replaced in 2008 and the other is no longer in operation and needs to be replaced to stay in compliance with TCEQ's regulations. The Woodcreek Booster Pumps were recently replaced in 2010. The HEB Booster Pump Station was also installed in 2010. The Elevated Booster Pump Station and the Well #6 Booster Pump Station were installed in 2014. The results of the water model showed that average daily demands can be met with the existing system without use of the redundant booster station pumps while maintaining pressures within the system above the required 35 psi. The model further suggests that the system requires the parallel operation of the booster station redundant pumps to meet the peak hour daily demand conditions while maintaining system pressures above the required 35 psi. The city should seek to replace

the second pump at the Maintenance Yard as soon as possible to provide additional redundancy to the system.

Piping

The current pipe system consists of 1-inch thru 10-inch diameter pipes of various materials, with some mains that were installed more than thirty years ago. The results of the water model showed that average daily domestic demands can be met with the existing system. It has been reported that the smaller diameter PVC pipes in service were found to be brittle and of insufficient wall thickness. These lines should be replaced when they are encountered.

Extended durations of fire flow operations exceeding 1,500 gallons per minute will not meet TCEQ minimum pressure requirements throughout the city. Existing water mains must be upgraded to a minimum diameter of 6-inches to satisfy TCEQ pressure and fire flow requirements. To adequately meet the future water demands and provide adequate fire protection, the city should be investing in short and long term improvements to ensure continued operation in compliance with TCEQ requirements.

WATER CAPITAL IMPROVEMENTS PLAN

Based on the updated system review, a Capital Improvements Plan has been developed. The projects listed below are listed according to priority from high to low. The priorities were established using the water model to analyze the best projects to produce higher pressures in the system as well as the needs of the city to reduce its need for purchasing water from CRWA.

The cost for each proposed project was estimated from the best current information within the San Antonio region. The estimates are preliminary and will be revised and updated as the scope of each project is refined in greater detail. Projects in TxDOT right-of-way will require additional permits. Most of the proposed projects will require TCEQ approval. See Exhibit 4 for a map of the proposed improvements.

Improvement 1: New Supervisory Control and Data Acquisition (SCADA) (Completed as Part of 2009 CIP)

This proposed project was part of the 2009 CIP and is currently in progress by the City of La Vernia as part of the Well #6 and booster pump station improvements.

Improvement 2: Woodcreek Subdivision (Completed as Part of 2009 CIP)

This project was part of the 2009 CIP and has been completed by the City of La Vernia. The project consisted of upgrading pumps, plumbing, electrical, pressure reducing valves, among other appurtenances related to this project.

Improvement 3: Miscellaneous Undersized Water Main Replacement

The current water distribution system contains many undersized water mains that will require to be upgraded to a minimum 6-inch water main to provide adequate pressures for domestic use and fire flow capabilities. This proposed project consists of installing 850 linear feet of 6-inch C-900 PVC water main in various locations throughout the city as needed. A proper assessment is required to determine the locations of higher importance to upgrade the pipe sizes. This estimate includes fittings, gate valves, fire hydrants, water tie-ins and other appurtenances related to this project as needed. The estimated cost of the improvement is shown in Table 4 below.

Table 4. Miscellaneous Undersize Water Main Replacement

Item No.	Item Description	Quantity	Units	Unit Price	Total
1	6" PVC C900 Water Line	850.0	LF	$54.00	$45,900.00
2	6" Gate Valve	3.0	EA	$1,400.00	$4,200.00
3	Fire Hydrant	5.0	EA	$5,060.00	$25,300.00
4	Water Tie-ins	6.0	EA	$1,865.00	$11,190.00
				Subtotal	$86,590.00
				Utility Adjustment (12%)	$10,390.80
				Permits (1%)	$865.90
				Mobilization (10%)	$8,659.00
				Prepare ROW (5%)	$4,329.50
				Engineering (10%)	$8,659.00
				Surveying (3%)	$2,597.70
				Right-of-way and Easement Investigations (2%)	$1,731.80
				Geotechnical (2.5%)	$2,164.75
				Contingency (25%)	$21,647.50
				Grand Total:	**$147,635.95**

Improvement 4: FM 1346 8-inch Water Main Extension (Completed as Part of 2009 CIP)

This proposed project was part of the 2009 CIP and has been completed.

Improvement 5: Dry Hollow 6-inch Water Main Replacement

This proposed project consists of installing 2,600 linear feet of 6-inch C-900 PVC water main along Dry Hollow Road, Kyle Street, King Street, and Forest Street. The streets are located approximately 1/4 mile north of Dry Hollow Road and Chihuahua Street (Spur 321) intersection. The purpose of this project is to provide adequate pressures for domestic use and fire flow capabilities to the local community. This project also eliminates water mains smaller than 2-inches in diameter, which is not allowed by TCEQ. This estimate includes fittings, gate valves, fire hydrants, water tie-ins and other appurtenances related to this project. The estimated cost of the improvement is shown in Table 5 below.

Table 5. Dry Hollow 6-inch Water Main Replacement

Item No.	Item Description	Quantity	Units	Unit Price	Total
1	6" PVC C900 Water Line	1,800.0	LF	$54.00	$97,200.00
2	6" Gate Valve	5.0	EA	$1,400.00	$7,000.00
3	Fire Hydrant	6.0	EA	$5,060.00	$30,360.00
4	Water Tie-ins	2.0	EA	$1,865.00	$3,730.00
				Subtotal	$138,290.00
				Utility Adjustment (12%)	$16,594.80
				Mobilization (10%)	$13,829.00
				Prepare ROW (5%)	$6,914.50
				Engineering (10%)	$13,829.00
				Surveying (3%)	$4,148.70
				Right-of-way and Easement Investigations (2%)	$2,765.80
				Geotechnical (2.5%)	$3,457.25
				Contingency (25%)	$34,572.50
				Grand Total:	**$234,401.55**

Improvement 6: McCoy Street 6-inch Water Main Replacement

This proposed project consists of installing 2,700 linear feet of 6-inch C-900 PVC water main along McCoy Street, Kinsdale Street, S. Crews Street, and Boeck Street. The purpose of this project is to provide adequate pressures for domestic use and fire flow capabilities to the local community. This project also eliminates water mains smaller than 2-inches in diameter, which are not permitted by TCEQ. This estimate includes fittings, gate valves, fire hydrants, water tie-ins and other appurtenances related to this project. The estimated cost of the improvement is shown in Table 6 below.

Table 6. McCoy Street 6-inch Water Main Replacement

Item No.	Item Description	Quantity	Units	Unit Price	Total
1	6" PVC C900 Water Line	2,700.0	LF	$54.00	$145,800.00
2	6" Gate Valve	6.0	EA	$1,360.00	$8,160.00
3	Fire Hydrant	9.0	EA	$5,060.00	$45,540.00
4	Water Tie-ins	6.0	EA	$1,865.00	$11,190.00
				Subtotal	$210,690.00
				Utility Adjustment (12%)	$25,282.80
				Permits (.5%)	$1,053.45
				Mobilization (10%)	$21,069.00
				Prepare ROW (5%)	$10,534.50
				Engineering (10%)	$21,069.00
				Surveying (3%)	$6,320.70
				Right-of-way and Easement Investigations (2%)	$4,213.80
				Geotechnical (2.5%)	$5,267.25
				Contingency (25%)	$52,672.50
				Grand Total:	**$358,173.00**

Improvement 7: San Antonio & D.L. Vest St. 8-inch Water Main

The San Antonio & D.L. Vest 8-inch water main projects were originally two separate projects. After an analysis in EPANET it was determined that they should be grouped together and if possible completed at the same time. Each project by itself did not improve the overall system that much. However, when the projects were input simultaneously, a significant improvement to the system was shown.

This proposed project will replace the existing water lines with approximately 3,000 linear feet of 8-inch C-900 PVC water main along San Antonio Street between Warren Street and US Highway 87 and along D.L. Vest Street. This estimate includes fittings, gate valves, fire hydrants, water tie-ins and other appurtenances related to this project. The estimated cost of the improvement is shown in Table 7 below.

Table 7. San Antonio & D.L. Vest Street 8-inch Water Main Replacement

Item No.	Item Description	Quantity	Units	Unit Price	Total
1	8" PVC C900 Water Line	3,000.0	LF	$50.00	$150,000.00
2	8" Gate Valve	3.0	EA	$1,650.00	$4,950.00
3	Fire Hydrant	10.0	EA	$5,060.00	$50,600.00
4	Water Tie-ins	3.0	EA	$2,550.00	$7,650.00
				Subtotal	$213,200.00
				Utility Adjustment (12%)	$25,584.00
				Mobilization (10%)	$21,320.00
				Prepare ROW (5%)	$10,660.00
				Engineering (10%)	$21,320.00
				Surveying (3%)	$6,396.00
				Contingency (25%)	$53,300.00
				Grand Total:	**$351,780.00**

Improvement 8: US Highway 87 12-inch Interconnect Water Main

This proposed project consists of installing approximately 8,600 linear feet of 12-inch C-900 PVC water main along US Highway 87 and approximately 4,950 linear feet of 12-inch C-900 PVC water main along FM 775. The water main shall tie-in at the existing 8-inch water main located along FM 1346. This estimate includes fittings, gate valves, fire hydrants, water tie-ins and other appurtenances related to this project. The estimated cost of the improvement is shown in Table 8 below.

Table 8. US Highway 87 12-inch Interconnect Water Main

Item No.	Item Description	Quantity	Units	Unit Price	Total
1	12" PVC C900 Water Line	13,550.0	LF	$75.00	$1,016,250.00
2	12" Gate Valve	12.0	EA	$2,750.00	$33,000.00
3	Fire Hydrant	40.0	EA	$5,060.00	$202,400.00
4	Water Tie-ins	8.0	EA	$3,000.00	$24,000.00
				Subtotal	$1,275,650.00
				Utility Adjustment (12%)	$153,078.00
				Permits (1%)	$12,756.50
				Mobilization (10%)	$127,565.00
				Prepare ROW (5%)	$63,782.50
				Engineering (10%)	$127,565.00
				Surveying (3%)	$38,269.50
				Right-of-way and Easement Investigations (2%)	$25,513.00
				Geotechnical (2.5%)	$31,891.25
				Contingency (25%)	$318,912.50
				Grand Total:	**$2,174,983.25**

Improvement 9: US Highway 87 8-inch Water Main Extension West (Partially Completed as Part of 2009 CIP)

This proposed project consists of installing 2,300 linear feet of 8-inch C-900 PVC water main along US Highway 87 approximately 1/2 mile west from the intersection of FM 1346 and US Highway 87. This project will provide water to undeveloped portions of the city towards San Antonio. This estimate includes fittings, gate valves, fire hydrants, water tie-ins and other appurtenances related to this project. The estimated cost of the improvement is shown in Table 9 below.

Table 10.US Highway 87 8-inch Water Main Extension West

Item No.	Item Description	Quantity	Units	Unit Price	Total
1	8" PVC C900 Water Line	2,300.0	LF	$50.00	$115,000.00
2	8" Gate Valve	5.0	EA	$1,650.00	$8,250.00
3	Fire Hydrant	8.0	EA	$5,060.00	$40,480.00
3	Boring Across Hwy 87	150.0	LF	$400.00	$60,000.00
4	Casing	150.0	LF	$150.00	$22,500.00
5	Water Tie-ins	1.0	EA	$2,550.00	$2,550.00
				Subtotal	$248,780.00
				Utility Adjustment (12%)	$29,853.60
				Permits (1%)	$2,487.80
				Mobilization (10%)	$24,878.00
				Prepare ROW (5%)	$12,439.00
				Engineering (10%)	$24,878.00
				Surveying (3%)	$7,463.40
				Right-of-way and Easement Investigations (2%)	$4,975.60
				Geotechnical (2.5%)	$6,219.50
				Contingency (25%)	$62,195.00
				Grand Total:	**$424,169.90**

Improvement 10: New Water Well and 8-Inch Transmission Line (New Well Completed as Part of 2009 CIP)

This proposed project was partially completed as part of the 2009 CIP. A new 8-inch well was recently completed by the City of La Vernia and is known Well #6. Per the 2009 CIP Report, the addition of the new well would have eliminated the city's need to purchase water from the CRWA. However; due to the abandonment of the HWY 87 Well # 5 it is recommended that the city maintain the CRWA connection as back up should any problems or needed maintenance issues arise with the existing city wells and also to assist in the delivery of fire flows. It was noted in the 2009 CIP Report that when well flow exceeds 450 gpm, a new 8-inch transmission line from Well # 6 to the elevated tank will need to be installed to meet the flow requirements of the system. The estimated cost of upgrading the existing transmission line is shown in Table 10 below.

Table 10. New 8-Inch Water Transmission Line

Water from Well to System 8" (Future Development)

Item No.	Item Description	Quantity	Units	Unit Price	Total
1	8" PVC C900 Water Line	23,900.0	LF	$52.00	$1,242,800.00
2	8" Gate Valve	8.0	EA	$1,260.00	$10,080.00
3	Water Tie-ins	2.0	EA	$2,550.00	$5,100.00
4	Air Release & Flush Valves	8.0	EA	$1,700.00	$13,600.00
5	Bore & Driveway repair	1.0	LS	$134,400.00	$134,400.00
6	Restoration & Fencing	1.0	LS	$25,000.00	$25,000.00
				Subtotal	$1,430,980.00
				Site Prep. & Mobilization (10%)	$143,098.00
				Engineering (10%)	$143,098.00
				Surveying (3%)	$42,929.40
				Right-of-way and Easement (LS)	$196,150.00
				Contingency (25%)	$357,745.00
				Grand Total:	**$2,314,000.40**

Construction Cost Comparison

The previous estimates are based on cost if the project were to be fully design, advertised, bid and constructed by an outside contractor. However, the city has expressed some desire to construct some of the smaller projects themselves. Constructing the smaller projects would greatly affect the overall cost of the project, allowing the city to save money. Below in Table 11 is an estimate if the city were to bid the project out and have it constructed by a contractor.

Table 11. San Antonio & D.L. Vest Street 8-inch Water Main Replacement (Bid)

Item No.	Item Description	Quantity	Units	Unit Price	Total
1	8" PVC C900 Water Line	3,000.0	LF	$50.00	$150,000.00
2	8" Gate Valve	3.0	EA	$1,650.00	$4,950.00
3	Fire Hydrant	10.0	EA	$5,060.00	$50,600.00
4	Water Tie-ins	3.0	EA	$2,550.00	$7,650.00
				Subtotal	$213,200.00
				Utility Adjustment (12%)	$25,584.00
				Mobilization (10%)	$21,320.00
				Prepare ROW (5%)	$10,660.00
				Engineering (10%)	$21,320.00
				Surveying (3%)	$6,396.00
				Contingency (25%)	$53,300.00
				Grand Total:	**$351,780.00**

By comparison, Table 12 shows an estimate if the city were to construct this same project using city crews and renting the necessary equipment.

Table 12. San Antonio & D.L. Vest Street 8-inch Water Main Replacement (City)

Item No.	Item Description	Quantity	Units	Unit Price	Total
1	8" PVC C900 Water Line	3,000.0	LF	$7.59	$22,770.00
2	8" Gate Valve	3.0	EA	$961.40	$2,884.20
3	6" Valve Box, Complete	3.0	EA	$60.06	$180.18
4	8" - 90 degree bend	6.0	EA	$126.28	$757.68
5	8" - 45 degree bend	12.0	EA	$109.37	$1,312.48
6	8" - 22.5 degree bend	6.0	EA	$110.00	$660.00
7	8"x 8" Tee	1.0	EA	$168.56	$168.56
8	Water Tie-ins	3.0	EA	$3,000.00	$9,000.00
9	Service Connections	15.0	EA	$234.67	$3,520.05
10	Disenfection	1.0	LS	$500.00	$500.00
11	Fire Hydrant	10.0	EA	$1,987.00	$19,870.00
12	Pavement Repair	833.0	SY	$36.00	$29,988.00
13	Pipe Bedding, Pea Gravel	463.0	CY	$10.00	$4,630.00
14	Excess Soil Removal	1.0	LS	$750.00	$750.00
15	Machinery Rental	4.0	MONTH	$10,060.00	$40,240.00
16	Fuel	4.0	MONTH	$3,210.00	$12,840.00
17	Traffic Control	4.0	MONTH	$3,000.00	$12,000.00
				Subtotal	**$162,071.15**
				Misc. Expenses (LS)	$4,000.00
				Prepare ROW (5%)	$8,103.56
				Engineering (10%)	$16,207.12
				Surveying (3%)	$6,533.40
				Contingency (25%)	$40,517.79
				Grand Total:	**$237,433.01**

The cost estimate shown in Table 12 includes all the incidentals that have to be priced separately if the city were to construct this project. The overall cost of the project is reduced when compared with the estimated contractor price. The cost savings when the

city completes the project in house for the San Antonio & D.L. Vest Water Main Project, would be approximately 33%.

When comparing the cost of the options of either bidding the project or completing it themselves, there are additional factors to consider. Some of these include additional labor/employees, machinery availability and condition, and expertise.

The cost of the city completing the work assumes that the city has employees that are available and able to focus their efforts on the project. At times, city employees can be extremely busy with daily tasks, such as meter reading, that they would not be able to take on additional work.

FIRE HYDRANT ANALYSIS

In addition to analyzing the water distribution systems, the current fire hydrant coverage was examined. The analysis was based on the City of La Vernia's ordinance that requires fire hydrants to be placed at maximum intervals of 300 feet. The approximate locations of each fire hydrant were plotted with a corresponding range circle with a radius of 300 feet. The existing fire hydrant coverage is shown in Exhibit 5. Based on our analysis, the city has fairly good coverage for fire hydrants. In areas where water main replacements are proposed, new fire hydrants can be installed with the project to increase coverage. In other areas, spot installation of new fire hydrants can be performed by the city.

FIRE FLOW ANALYSIS

Existing Conditions:

Typically, needed fire flow is based on a number of factors including distance between buildings, square footage of building, building height (stories), building occupancy, and building construction class as per the *ISO Guide for Determination for Needed Fire Flow.* Fire flow rate requirements can range from 500 gallons per minute to over 3,500 gallons per minute. Needed fire flow (NFF) requirements are also typically enforced by the Fire Marshall during the construction permitting process. Currently, the city does not have an adopted ordinance to enforce needed fire flow rates greater than 500 gallons per minute; however, the city enforces a minimum 250 gallon per minute flow rate issued by the city Police/Fire Chief for needed fire flow (NFF). A Fire flow test performed recently by the FPCG in December of 2014 indicated a flow of 1,680 gallons per minute (GPM) with a residual pressure reading of 45 psi. The test was performed on a fire hydrant attached to an 8-inch water main on Hwy 87 across from the H.E.B. The test report did not indicate the duration of the 1,680 GPM fire flow test, however the water model suggests that the existing system would only be able to maintain such flows for no longer than an hour. Prior to installation of the HEB storage tank and booster pumps, the fire flow tests were all below 860 gallons per minute at different locations within the system. The recent fire flow results were moderately good and indicated that the existing system could provide adequate fire flow during non-peak hour conditions while maintaining system pressures above the minimum required 20 psi system pressure.

Proposed Improvement Conditions:

As part of the water system analysis, fire flow tests were modeled for the existing system without use of the booster pumps intended for redundancy and for the different improvement options at selected locations under peak hour daily demand conditions. The needed fire flow results were based on the worst case conditions conducted from one selected location for each fire flow test. The local high school was used as a location that could encounter the highest water demand during a worst case event. Below are the following scenarios included within this report:

Scenario # 1 – Fire Flow Simulation – Existing Average Daily Demand Conditions with 1680 GPM Fire Flow
Results: The existing system can provide the rated fire flow for a limited duration under average daily demand conditions while maintaining pressures above the required 20 psi.

Scenario # 7 – 1500 Fire Flow Simulation with Existing Average Daily Demand Conditions
Results: The existing system can provide the rated fire flow during average daily demand conditions while maintaining pressures above the required 20 psi.

Scenario # 8 - 1500 Fire Flow Simulation with San Antonio St. & D.L. Vest St. – 8" Improvements with Future Average Daily Demand Conditions
Results: The proposed improvements will provide increased residual pressures above the required 20 psi during future fire flow conditions.

Scenario # 9 - 1500 Fire Flow Simulation with San Antonio St. & D.L. Vest St. – 8" Improvements Plus HWY 87 – 12" Interconnect Improvements with Future Average Daily Demand Conditions
Results: The proposed improvements will provide increased residual pressures above the required 20 psi during future fire flow conditions.

Scenario # 10 - 1500 Fire Flow Simulation with San Antonio St. & D.L. Vest St. – 8" Improvements Plus HWY 87 – 12" Interconnect Improvements Plus FM 775 – 12" Improvements with Future Average Daily Demand Conditions
Results: The proposed improvements will provide increased residual pressures above the required 20 psi during future fire flow conditions.

Scenario # 11 – 2 Hour 1500 Fire Flow Simulation with Existing Peak Hour Demand Conditions
Results: The existing system cannot supply the rated fire flow during existing peak hour demand conditions for 2 hours without pressures in the system dropping below the required minimum 20 psi. The existing system is however capable of providing additional flows and pressures through parallel operations of the redundant booster station pumps.

Scenario # 12 – 2 Hour 1500 GPM Fire Flow with Proposed Improvements during Future Peak Hour Demand Conditions
Results: The proposed system shows substantial increased fire flow capacity improvement but cannot supply the rated fire flow during Future peak hour demand conditions for more than 2 hours without pressures in the system dropping below the required minimum 20 psi. The existing system is however capable of providing additional flows and pressures through parallel operations of the redundant booster station pumps.

The simulated fire flow tests were typically performed for duration of one (1) hour unless otherwise noted and the minimum pressure nodes are acceptable during existing and future average daily demand conditions. The existing system cannot supply the 1500 GPM fire flow during future peak hour demand conditions for more than 2 hours without pressures in the system dropping below the required minimum 20 psi. The existing system is however capable of providing additional flows and pressures through parallel operations of the redundant booster station pumps. Refer to Appendices B and C for the fire flow test result illustrations from the EPANET model simulations.

RECOMMENDATIONS

After analyzing the above information, it is CEC's opinion that the following items should be implemented based on the Capital Improvements Plan.

The city should implement an ongoing maintenance budget to inspect, repair and maintain the ground and elevated storage tanks. Waiting to implement the required maintenance repairs will allow for further deterioration of the tanks and increased repair costs.

The City of La Vernia should adopt the above capital improvement projects and begin to budget for their implementation. Some of these projects will be eligible for inclusion in the impact fee program that is programmed for adoption. Only projects that are attributable to future development are eligible for inclusion in the Impact Fee. Projects that upgrade existing facilities are not eligible for inclusion in the Impact Fee.

Following the completion of a Well #6, the existing wells can be taken out of service and have their condition reviewed. Once the wells can be video-inspected, further planning can be performed if the wells are suitable for continued use. If the wells are not suitable for continued use, they should be properly plugged and abandoned.

The City of La Vernia should work with SS Water Supply Corporation to resolve the conflicts with the CCN boundaries so that ultimate water distribution limits can be planned for and agreed upon.

WASTEWATER SYSTEM ANALYSIS

INTRODUCTION

The city has a generally sound wastewater collection system. It is, however, fairly old and is most likely constructed with vitrified clay pipe. This type of pipe has a tendency to crack and break which allows infiltration of groundwater into the pipe, which subsequently increases treatment plant capacity requirements.

EXISTING SYSTEM

The individual components of the system include the collection system, lift stations and the treatment plant. These components are discussed below.

Collection System

A drawing of the existing sewer collection system is shown in Exhibit 6. For the purposes of this analysis, the collection system is presumed to be comprised of vitrified clay and PVC pipe. Due to their location and age, 6-inch lines are assumed to be made of vitrified clay pipe. Lines that are 8-inch and larger are assumed to be made of PVC due to their location. Vitrified clay pipe has been in service in La Vernia for over 30 years and the condition of this pipe is predicted to be poor. Sewer lines in the collection system range from 6-inches to 12-inches in diameter.

Recent improvements include the replacement of a portion of the Hillcrest sewer. The San Antonio River Authority ran a video camera in this section of line, which was vitrified clay pipe, and found that the line was in poor condition. This condition is likely representative of the remaining vitrified clay pipe in the system.

Lift Stations

The city currently operates three (3) lift stations in the collection system. The oldest lift station is located in the Hillcrest area and serves the northwestern portion of the city. When the HEB development occurred, a new lift station was installed at that site to handle wastewater flows from the development as well as some future growth. The newest lift station is located at the La Vernia Crossing development. This lift station will only serve its development.

Treatment Plant

The original treatment plant was constructed in 1976 and consisted of a lift station, aerator, clarifier, chlorine contact chamber and two (2) sludge drying beds. In 2000 a new lift station was installed and two (2) additional sludge drying beds were added. The plant was upgraded in 2005 with the addition of a new clarifier and chlorine contact tank. In 2008, use of the sludge drying beds was stopped and a sludge dewatering box was installed to process sludge. The current process is to receive influent at the lift station and pump raw wastewater to the oxidation ditch. From here wastewater passes to the clarifier. Settled sludge from the clarifier is sent to a digester. Water from the clarifier enters the chlorine contact chamber before being sent to Cibolo Creek. Digested sludge and scum from the clarifier are sent to the sludge dewatering box. The dried sludge is

taken to a landfill for disposal. See Appendix D for a current plant schematic. The plant is authorized to discharge treated wastewater to the Lower Cibolo Creek in Segment No 1902 of the San Antonio River Basin under TCEQ permit number WQ0011258-001. It has an Environmental Protection Agency (EPA) ID number of TX0052850.

The permit has the following discharge parameters shown in the table below. The maximum 2-hour peak flow cannot exceed 694 gallons per minute. The maximum daily flow is 0.250 million gallons per day. Flow is to be continuously monitored with a totalizing meter. Biochemical Oxygen Demand (BOD5) and Total Suspended Solids (TSS) are to be monitored as noted in Table 13 below. Additional discharge parameters are also noted in the table. The effluent shall contain no floating solids or visible foam other than in trace amounts and no discharge of visible oil.

Table 13. La Vernia Wastewater Treatment Plant Permitted Discharge Parameters

EFFLUENT	Discharge Limitations				Minimum Reporting	
	Daily Avg. mg/l	7-day Avg. mg/l	Daily Max. mg/l	Single Grab mg/l	Freq	Type
FLOW	Report	N/A	Report	N/A	5/Week	Instantaneous
BOD5	20	30	45	65	1/Week	Grab
TSS	20	30	45	65	1Week	Grab
Chlorine	1 (min)	N/A	4	N/A	5/Week	Grab
pH	6 (min)	N/A	9	N/A	1/month	Grab
DO	2	N/A	N/A	N/A	1/Week	Grab

Electrical power is provided to the plant by Guadalupe Valley Electric Corporation (GVEC). In the event of a power failure, a standby generator is available to provide power to the entire plant. This power capability means that no wastewater should leave the plant untreated. The standby generator and the plant electrical switchgear were modified to be above anticipated flood elevations.

The plant is in good condition with an expansion and improvements being completed in 2005. The plant is operated by the San Antonio River Authority. The plant is neat and kept in a clean condition. No unusual odors were noted during the site visit. The walkways were kept clear and access to operational areas was easy. The clarifier weirs were properly adjusted.

SYSTEM EVALUATION

Collection System

The collection system was analyzed and is divided into five (5) sewersheds, the West Sewershed, North Sewershed, Northeast Sewershed, Southeast Sewershed and South Sewershed. See Exhibit 6 for an illustration depicting the sewersheds. The West Sewershed is the area roughly from FM 775 east to Cibolo Creek, and then following the Cibolo and the ETJ line to FM 1346. The North Sewershed is roughly North and West of the Cibolo from the City Limit Line to the ETJ line to the West where it joins with West

Sewershed. The Northeast Sewershed is located North and East of the Cibolo to the ETJ line. The Southeast Sewershed is that area South of FM 775 and East of US Hwy 87 to the Cibolo and the ETJ line. The South Sewershed is that area South of FM 775 and West of US Hwy 87 to the ETJ line. The North and Northeast Sewersheds do not currently have any connections to the wastewater treatment plant. The North Sewershed is almost entirely located in the floodplain for Cibolo Creek and therefore sewer connections are not expected to be made in this sewershed. The Northeast Sewershed has some areas located in the Cibolo Creek floodplain and connections to the wastewater treatment plant would have to cross Cibolo Creek, making connections from this area less likely.

Based on conversations with City staff, there are few known problems with the collection system. Primary issues with the collection system are related to an incomplete map of the system and pipe conditions. The manholes are reported to be in fairly good condition, with some covers stuck and difficult to open due to road paving projects. There are no reports of sewer overflow problems, though the area has not seen significant rainfall in some time. The main 10-inch sewer trunk line leading to the treatment plant was recently videotaped and was reported to be flowing at least half full. An analysis of the existing trunkline capacity was performed. Assuming minimum allowable pipe slopes and a 4.0 peaking factor applied to the average maximum daily flow value recorded over recent years indicates that it is getting close to full capacity. In order to provide service for the future population it is recommended that the existing 10-inch sewer main be upsized to a 15-inch diameter main from the treatment plant to Newton Street. A 12-inch diameter main would be sufficient to handle the anticipated flows based on the 5 year growth projection however a 15-inch diameter pipe would provide additional capacity for several additional years and would justify the additional costs to upgrade from a 12-inch pipe to a 15-inch pipe.

For the purposes of our analysis, all sewer lines less than 8-inches in diameter were assumed to be made of vitrified clay pipe. This type of pipe is susceptible to cracking and joint failure.

The best method for determining the condition of the existing sewer system is to perform a camera inspection of the lines and visual inspection of the manholes. The lines would then be scored using the National Association of Sewer Service Companies (NASSCO) standards. After each line is ranked, a systematic replacement or repair of the system can be performed. The lines with the poorest condition would be rehabilitated first, followed by the remaining lines. This replacement would be performed until all sewer lines that meet the criteria for replacement have been addressed. This systematic replacement will help to reduce any problems from infiltration/inflow (I/I) and reduce the load on the wastewater treatment plant. Manholes needing rehabilitation will be coordinated with the line repair/replacement work.

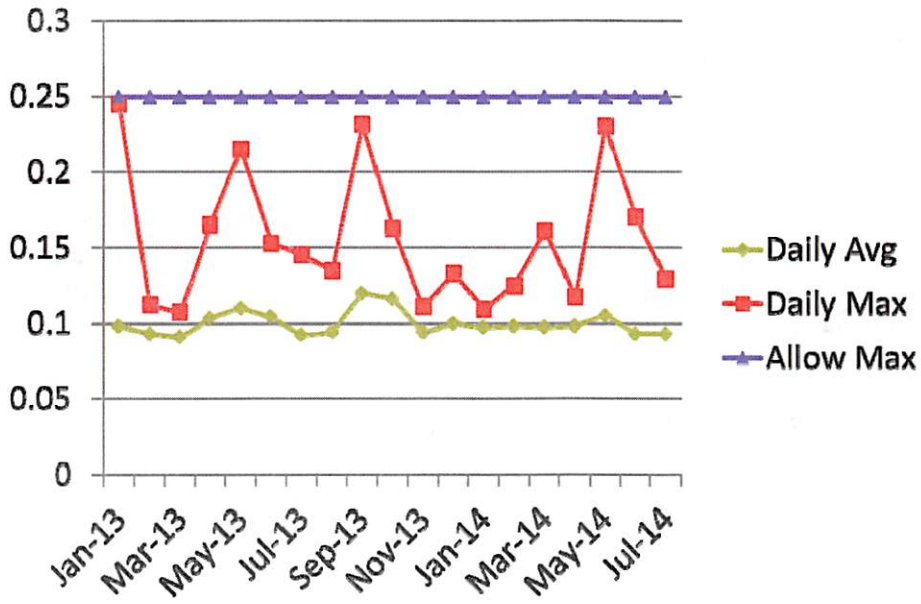
Treatment Plant

The Wastewater Treatment Plant is currently being operated under contract by San Antonio River Authority (SARA) personnel. These employees are committed to operating the plant in an efficient and effective manner. Their commitment is shown in

the condition of the plant and its operation. The operators have a demonstrated ability to keep the plant operating in compliance with TCEQ parameters.

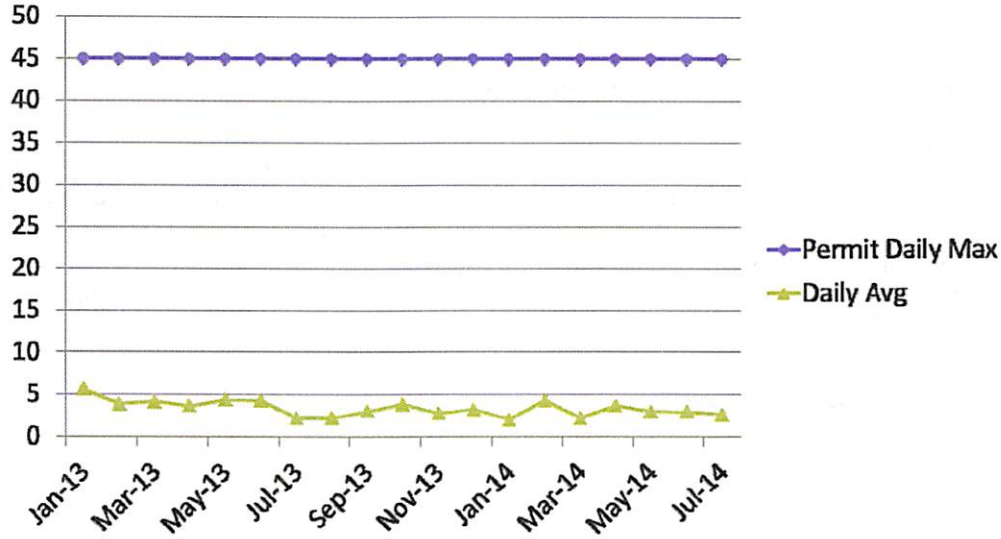
The plant annual average flow is critical in planning for expansion. The TCEQ requires an owner to begin planning for expansion when 75% of the average annual flow is reached. The July 2014 average annual flow is 0.089 MGD or 36% of the permitted maximum daily discharge. Since December of 2007 the values have ranged from 0.089 to 0.249 MGD. In general, the average annual flow has been decreasing due to the lack of rain in the area. The reduction in flow to the plant is most likely attributable to lower infiltration rates associated with dry weather. In addition, the city public works staff has been rehabilitating manholes where infiltration is discovered. See Figure 6 for the plant effluent flow data.

Figure 6 La Vernia WWTP Effluent Flow
Millions of Gallons per Day



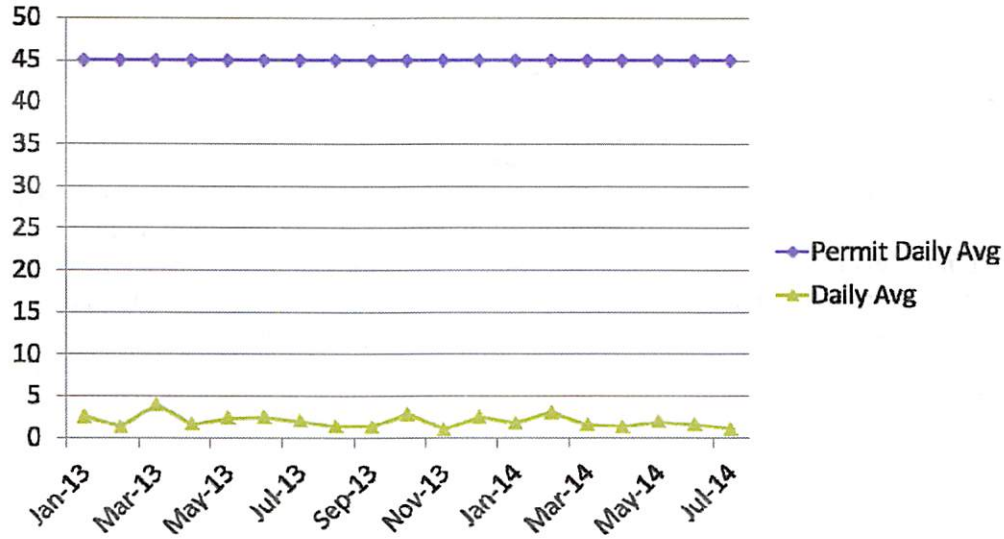
Biochemical oxygen demand (BOD) is a standard method for estimating the pollution effects of wastewater effluent. It involves the measurement of dissolved oxygen used by microorganisms in the biochemical oxidation of organic matter. This is a widely used test, but it has several limitations. The permitted daily maximum for BOD is not to exceed 45 milligrams per liter or 83 pounds per day. Figure 7 indicates that the plant has not exceeded these values during the period evaluated. In fact, the plant is operating significantly below permitted requirements. This is a good indication of plant operations and that dissolved oxygen is being maintained in the processing of the wastewater.

Figure 7 La Vernia WWTP Effluent BOD
Milligrams per Liter



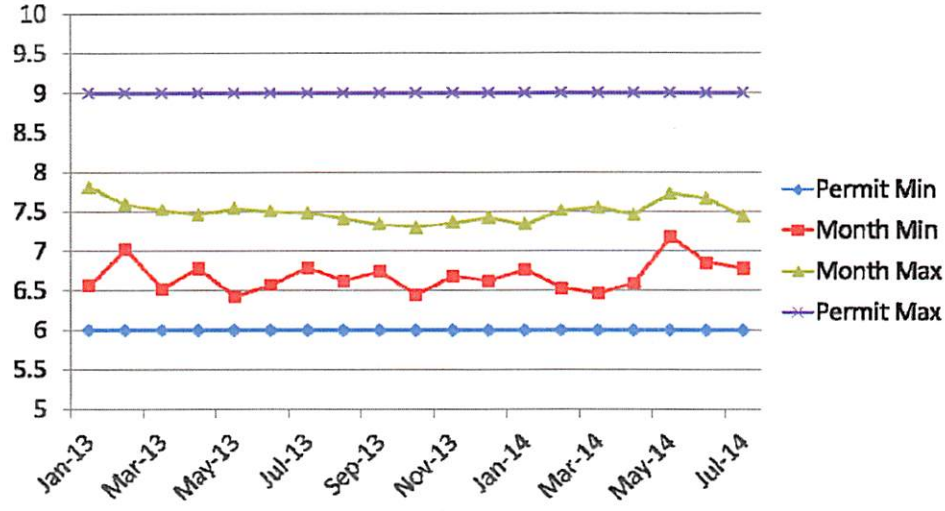
Total Suspended Solids (TSS) is a measure of the solids that will settle to the bottom of an Imhoff Cone in a 60-minute period. Measurement of this characteristic of effluent is important because suspended solids can lead to the development of sludge deposits and anaerobic conditions when discharged to the aquatic environment. The permitted daily maximum is 45 milligrams per liter or 83 pounds per day. In Figure 8 you can see that the effluent is of good quality and that the samples indicate values significantly below permitted requirements.

Figure 8 La Vernia WWTP Effluent Total Suspended Solids
Milligrams per Liter



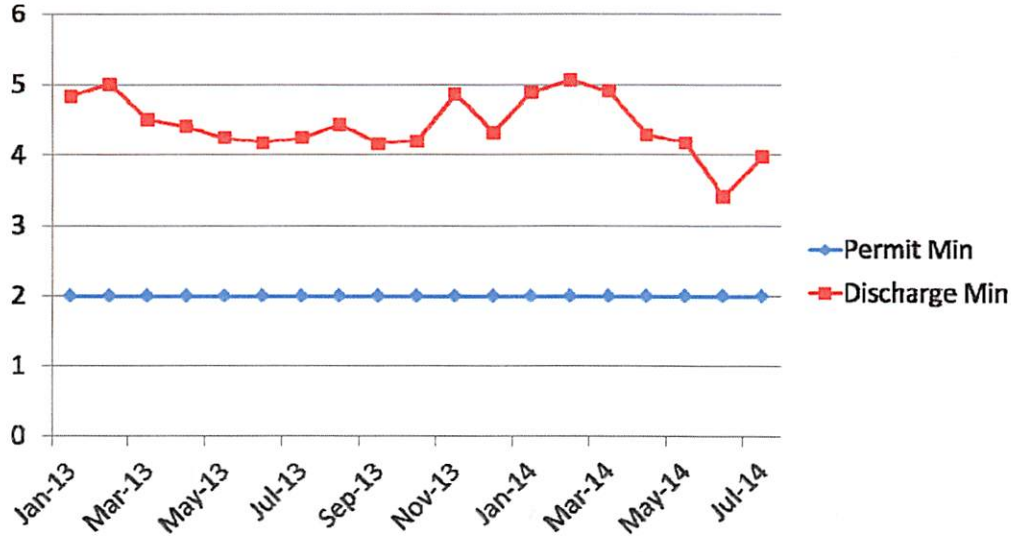
The hydrogen ion concentration or pH is an important quality indicator of the receiving stream. The concentration range suitable for the existence of most biological life is narrow and critical. The permitted range for pH is from six (6) to nine (9) standard units. Figure 9 shows that the pH of the effluent has consistently been maintained within the permitted limits.

Figure 9 La Vernia WWTP Effluent pH
Standard Units



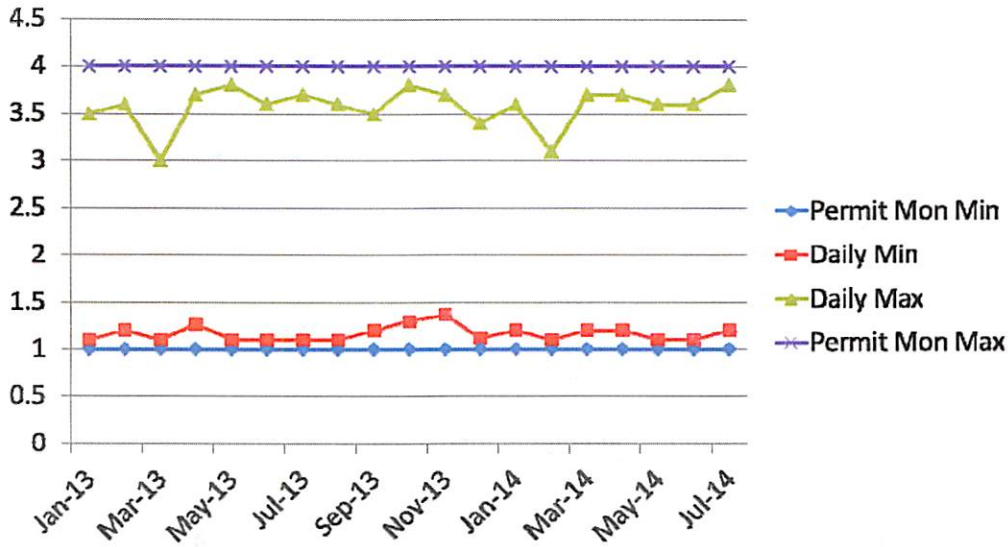
Dissolved Oxygen is important to stream health and the survival of fish. The minimum DO level for effluent from the plant is two (2) milligrams per liter. The plant has consistently maintained DO levels above the minimum standard for the evaluation period as shown in Figure 10.

Figure 10 La Vernia WWTP Effluent Dissolved Oxygen
Milligrams per Liter



The final regulated component of the WWTP is the chlorine residual. This parameter is vital to ensure destruction of bacteria. It must be maintained between 1 and 4 milligrams per liter. Figure 11 shows that the plant has been meeting this guideline on a regular basis.

Figure 11 La Vernia WWTP Effluent Chlorine Residual
Milligrams per Liter



Based on current population projections, it is projected that the wastewater treatment plant will need to begin expansion planning after the year 2030. As the City continues replacing aging sewer lines, this date may vary. Replacement of older vitrified clay sewer lines with expected high infiltration/inflow rates lowers the volume of infiltration from rain water received at the plant. Conversely, this means that all sewage is reaching the plant during periods of dry weather. The city should also implement a system to check for cross connections or other entry points of storm water into the sanitary sewer system. This actual date to begin expansion planning will vary according to when actual development occurs and changes in flow conditions. One option to extend the date of expansion planning is to "re-rate" the plant capacity during permit renewal. If the plant can be successfully re-rated to a higher flow capacity, this will extend the time until expansion planning will need to begin.

Based on the review of the plant permit, data and operations, the city should continue to monitor the average annual plant flow and when it reaches 0.1875 MGD, expansion planning should begin.

The plant is located next to Cibolo Creek and is susceptible to flood events. This creates two problems related to the plant. First, bank erosion is moving towards the oxidation ditch and at some point may overtake the ditch and render it useless and causing a spill of untreated wastewater into Cibolo Creek. Secondly, there is the possibility that a future

flood event could inundate the plant. New regulations require that all facilities be built with a minimum of one foot of freeboard above the existing floodplain elevations. Any plant improvements will have to comply with this regulation.

WASTEWATER CAPITAL IMPROVEMENTS PLAN

Based on review of the system, a Capital Improvements Plan was previously developed in 2009. The projects listed below are listed according to priority from highest to lowest. Projects that have been completed by the City since the 2009 CIP are noted accordingly. The list of projects also includes development related projects. The priorities were established based on the condition of the collection system and anticipated development.

The cost for each proposed project was estimated from the best current information within the San Antonio region. Projects in TxDOT right-of-way will require additional permits. All of the proposed projects will require TCEQ review. See Exhibit 7 for a map of the proposed improvements.

PROPOSED COLLECTION SYSTEM IMPROVEMENTS

Improvement 1: 15-Inch Sewer Pipe from Wastewater Treatment Plant to Newton Street

This proposed project is required based on the sewer capacity analysis and projected future population growth. It would upgrade the existing 10-inch sanitary sewer main from the wastewater treatment plant to the intersection of River Road and Newton Street. Costs include upgrading the existing 10-inch main to a 15-inch main along with new manholes. The estimated cost of the improvement is shown in Table 14 below.

Table 14. 15-Inch Sewer Pipe from Wastewater Treatment Plat to Newton Street

Item No.	Item Description	Quantity	Units	Unit Price	Total
1	15" PVC Sanitary Sewer	1,880.0	LF	$120.00	$225,600.00
2	Manholes	6.0	EA	$3,500.00	$21,000.00
3	Trench Excavation Protection	1,880.0	LF	$2.60	$4,888.00
				Subtotal	$251,488.00
				Utility Adjustment (12%)	$30,178.56
				Permits (1%)	$2,514.88
				Mobilization (10%)	$25,148.80
				Prepare ROW (5%)	$12,574.40
				Engineering (10%)	$25,148.80
				Surveying (3%)	$7,544.64
				Right-of-way and Easement Investigations (2%)	$5,029.76
				Geotechnical (2.5%)	$6,287.20
				Contingency (25%)	$62,872.00
				Grand Total:	**$428,787.04**

Improvement 2: Clay Sewer Pipe Replacement Program

This proposed project would clean and video all existing 6" clay sewer lines and rate their current condition. This would establish an order of priority of replacement to stop storm water infiltration and other related problems. This project consists of cleaning and televising each sewer segment, review of video, rating according to NASSCO standards, prioritizing most critical to least, and completion of a pipe condition report. This project should be completed prior to beginning sewer Improvement 3, Phases 1 through 9. The estimated cost of the improvement is shown in Table 15 below.

Table 15. Clay Sewer Pipe Replacement Program

Item No.	Item Description	Quantity	Units	Unit Price	Total
1	Cleaning	27,600.0	LF	$1.50	$41,400.00
2	Televising/Video	27,600.0	LF	$1.75	$48,300.00
3	Grading Video to NASSCO	1.0	LS	$42,000.00	$42,000.00
4	Sewer Line Ranking	1.0	LS	$11,400.00	$11,400.00
5	Pipe Line Condition Report	1.0	LS	$9,600.00	$9,600.00
				Subtotal	$152,700.00
				Surveying (3%)	$4,581.00
				Contingency (25%)	$38,175.00
				Grand Total:	**$195,456.00**

Improvement 3: US Highway 87 8-inch Sewer Line Extension West

This proposed project would extend sewer service along Highway 87 towards San Antonio for future development. This project would extend sewer service west along Hwy 87 to the city limits and would require one (1) lift station and a boring across FM 1346. This estimate includes the installation of sewer mains, sewer service lines, manholes, lift station, bore and casing and other appurtenances related to this project. The estimated cost of the improvement is shown in Table 16 below.

Table 16. US Highway 87 8-inch Sewer Line Extension West

Item No.	Item Description	Quantity	Units	Unit Price	Total
1	8" PVC Sanitary Sewer	2,500.0	LF	$68.00	$170,000.00
2	Manholes	6.0	EA	$3,500.00	$21,000.00
3	4" Force Main	2,800.0	LF	$50.00	$140,000.00
4	Lift Station	1.0	LS	$125,000.00	$125,000.00
5	Site Purchase	1.0	LS	$7,500.00	$7,500.00
6	Site Improvements	1.0	LS	$5,000.00	$5,000.00
7	Trench Excavation Protection	2,500.0	LF	$2.60	$6,500.00
8	Boring	300.0	LF	$300.00	$90,000.00
9	12" Steel Casing	300.0	LF	$70.00	$21,000.00
				Subtotal	$475,000.00
				Utility Adjustment (12%)	$57,000.00
				Mobilization (10%)	$47,500.00
				Prepare ROW (5%)	$23,750.00
				Engineering (10%)	$47,500.00
				Surveying (3%)	$14,250.00
				Geotechnical (2.5%)	$11,875.00
				Contingency (25%)	$118,750.00
				Grand Total:	**$795,625.00**

Improvement 4: Clay Sewer Pipe Replacement Program

This proposed project would review sewer Improvement 1 and begin actual replacement of the most critical sewer segments. This project consists of installation of 8" PVC sanitary sewer pipe, manholes and other appurtenances related to this project. The estimated cost of the improvement is shown in Tables 17 to 18 below.

This project should be completed in nine (9) phases over a 10 year period.

Table 17-1. Clay Sewer Pipe Replacement Program – Phase 1

Item No.	Item Description	Quantity	Units	Unit Price	Total
1	8" PVC Sanitary Sewer	3,067.0	LF	$68.00	$208,556.00
2	Manholes	8.0	EA	$3,500.00	$28,000.00
3	Trench Excavation Protection	3,067.0	LF	$2.60	$7,974.20
				Subtotal	$244,530.20
				Utility Adjustment (12%)	$29,343.62
				Mobilization (10%)	$24,453.02
				Prepare ROW (5%)	$12,226.51
				Engineering (10%)	$24,453.02
				Surveying (3%)	$7,335.91
				Geotechnical (2.5%)	$6,113.26
				Contingency (25%)	$61,132.55
				Grand Total:	**$409,588.09**

Table 17-2. Clay Sewer Pipe Replacement Program – Phase 2

Item No.	Item Description	Quantity	Units	Unit Price	Total
1	8" PVC Sanitary Sewer	3,067.0	LF	$70.04	$214,812.68
2	Manholes	8.0	EA	$3,605.00	$28,840.00
3	Trench Excavation Protection	3,067.0	LF	$2.68	$8,213.43
				Subtotal	$251,866.11
				Utility Adjustment (12%)	$30,223.93
				Mobilization (10%)	$25,186.61
				Prepare ROW (5%)	$12,593.31
				Engineering (10%)	$25,186.61
				Surveying (3%)	$7,555.98
				Geotechnical (2.5%)	$6,296.65
				Contingency (25%)	$62,966.53
				Grand Total:	**$421,875.73**

Table 17-3. Clay Sewer Pipe Replacement Program – Phase 3

Item No.	Item Description	Quantity	Units	Unit Price	Total
1	8" PVC Sanitary Sewer	3,067.0	LF	$72.14	$221,257.06
2	Manholes	8.0	EA	$3,713.15	$29,705.20
3	Trench Excavation Protection	3,067.0	LF	$2.76	$8,459.83
				Subtotal	$259,422.09
				Utility Adjustment (12%)	$31,130.65
				Mobilization (10%)	$25,942.21
				Prepare ROW (5%)	$12,971.10
				Engineering (10%)	$25,942.21
				Surveying (3%)	$7,782.66
				Geotechnical (2.5%)	$6,485.55
				Contingency (25%)	$64,855.52
				Grand Total:	**$434,532.00**

Table 17-4. Clay Sewer Pipe Replacement Program – Phase 4

Item No.	Item Description	Quantity	Units	Unit Price	Total
1	8" PVC Sanitary Sewer	3,067.0	LF	$74.31	$227,894.77
2	Manholes	8.0	EA	$3,824.54	$30,596.36
3	Trench Excavation Protection	3,067.0	LF	$2.84	$8,713.62
				Subtotal	$267,204.75
				Utility Adjustment (12%)	$32,064.57
				Mobilization (10%)	$26,720.48
				Prepare ROW (5%)	$13,360.24
				Engineering (10%)	$26,720.48
				Surveying (3%)	$8,016.14
				Geotechnical (2.5%)	$6,680.12
				Contingency (25%)	$66,801.19
				Grand Total:	**$447,567.96**

Table 17-5. Clay Sewer Pipe Replacement Program – Phase 5

Item No.	Item Description	Quantity	Units	Unit Price	Total
1	8" PVC Sanitary Sewer	3,067.0	LF	$76.53	$234,731.62
2	Manholes	8.0	EA	$3,939.28	$31,514.25
3	Trench Excavation Protection	3,067.0	LF	$2.93	$8,975.03
				Subtotal	$275,220.89
				Utility Adjustment (12%)	$33,026.51
				Mobilization (10%)	$27,522.09
				Prepare ROW (5%)	$13,761.04
				Engineering (10%)	$27,522.09
				Surveying (3%)	$8,256.63
				Geotechnical (2.5%)	$6,880.52
				Contingency (25%)	$68,805.22
				Grand Total:	**$460,995.00**

Table 17-6. Clay Sewer Pipe Replacement Program – Phase 6

Item No.	Item Description	Quantity	Units	Unit Price	Total
1	8" PVC Sanitary Sewer	3,067.0	LF	$78.83	$241,773.56
2	Manholes	8.0	EA	$4,057.46	$32,459.67
3	Trench Excavation Protection	3,067.0	LF	$3.01	$9,244.28
				Subtotal	$283,477.52
				Utility Adjustment (12%)	$34,017.30
				Mobilization (10%)	$28,347.75
				Prepare ROW (5%)	$14,173.88
				Engineering (10%)	$28,347.75
				Surveying (3%)	$8,504.33
				Geotechnical (2.5%)	$7,086.94
				Contingency (25%)	$70,869.38
				Grand Total:	**$474,824.85**

Table 17-7. Clay Sewer Pipe Replacement Program – Phase 7

Item No.	Item Description	Quantity	Units	Unit Price	Total
1	8" PVC Sanitary Sewer	3,067.0	LF	$81.20	$249,026.77
2	Manholes	8.0	EA	$4,179.18	$33,433.46
3	Trench Excavation Protection	3,067.0	LF	$3.10	$9,521.61
				Subtotal	$291,981.85
				Utility Adjustment (12%)	$35,037.82
				Mobilization (10%)	$29,198.18
				Prepare ROW (5%)	$14,599.09
				Engineering (10%)	$29,198.18
				Surveying (3%)	$8,759.46
				Geotechnical (2.5%)	$7,299.55
				Contingency (25%)	$72,995.46
				Grand Total:	**$489,069.59**

Table 17-8. Clay Sewer Pipe Replacement Program – Phase 8

Item No.	Item Description	Quantity	Units	Unit Price	Total
1	8" PVC Sanitary Sewer	3,067.0	LF	$83.63	$256,497.57
2	Manholes	8.0	EA	$4,304.56	$34,436.47
3	Trench Excavation Protection	3,067.0	LF	$3.20	$9,807.26
				Subtotal	$300,741.30
				Utility Adjustment (12%)	$36,088.96
				Mobilization (10%)	$30,074.13
				Prepare ROW (5%)	$15,037.07
				Engineering (10%)	$30,074.13
				Surveying (3%)	$9,022.24
				Geotechnical (2.5%)	$7,518.53
				Contingency (25%)	$75,185.33
				Grand Total:	**$503,741.68**

Table 17-9. Clay Sewer Pipe Replacement Program – Phase 9

Item No.	Item Description	Quantity	Units	Unit Price	Total
1	8" PVC Sanitary Sewer	3,067.0	LF	$86.14	$264,192.50
2	Manholes	8.0	EA	$4,433.70	$35,469.56
3	Trench Excavation Protection	3,067.0	LF	$3.29	$10,101.48
				Subtotal	$309,763.54
				Utility Adjustment (12%)	$37,171.62
				Mobilization (10%)	$30,976.35
				Prepare ROW (5%)	$15,488.18
				Engineering (10%)	$30,976.35
				Surveying (3%)	$9,292.91
				Geotechnical (2.5%)	$7,744.09
				Contingency (25%)	$77,440.89
				Grand Total:	**$518,853.93**

Improvement 5: US Highway 87 12" Chamber of Commerce Sewer Main

The proposed project would provide sewer service to existing residences and businesses along HWY 87 towards the Chamber of Commerce as well as provide sewer service for new development in that area. This estimate includes installation of a 10" to 12" sewer main, manholes, and all other appurtenances related to this project. The estimated cost of the improvement is shown in Table 18 below.

Table 18. US Highway 87 12" Chamber of Commerce Sewer Main

Item No.	Item Description	Quantity	Units	Unit Price	Total
1	12" PVC Sanitary Sewer	2,200.0	LF	$90.00	$198,000.00
2	Manholes	5.0	EA	$3,500.00	$17,500.00
3	Trench Excavation Protection	2,200.0	LF	$2.60	$5,720.00
				Subtotal	$221,220.00
				Utility Adjustment (12%)	$26,546.40
				Permits (1%)	$2,212.20
				Mobilization (10%)	$22,122.00
				Prepare ROW (5%)	$11,061.00
				Engineering (10%)	$22,122.00
				Surveying (3%)	$6,636.60
				Right-of-way and Easement Investigations (2%)	$4,424.40
				Geotechnical (2.5%)	$5,530.50
				Contingency (25%)	$55,305.00
				Grand Total:	**$377,180.10**

Improvement 6: FM 775 8" Sewer Service Extension West

This proposed project would provide new sewer service to commercial development and residences westward along FM 775. This project would require a boring across FM 775. This estimate includes the installation of sewer mains, manholes, boring/casing, and other appurtenances related to this project. The estimated cost of the improvement is shown in Table 19 below.

Table 19. FM 775 8" Sewer Service Extension West

Item No.	Item Description	Quantity	Units	Unit Price	Total
1	8" PVC Sanitary Sewer	2,100.0	LF	$68.00	$142,800.00
2	Manholes	9.0	EA	$3,500.00	$31,500.00
3	Trench Excavation Protection	2,100.0	LF	$2.60	$5,460.00
4	Boring/Casing	1.0	LS	$50,000.00	$50,000.00
				Subtotal	$229,760.00
				Utility Adjustment (12%)	$27,571.20
				Mobilization (10%)	$22,976.00
				Prepare ROW (5%)	$11,488.00
				Engineering (10%)	$22,976.00
				Surveying (3%)	$6,892.80
				Geotechnical (2.5%)	$5,744.00
				Contingency (25%)	$57,440.00
				Grand Total:	**$384,848.00**

Improvement 7: Woodcreek Subdivision Sewer Service

This proposed project would provide new sewer service to residences in the Woodcreek Subdivision. The terrain in this area would require a minimum of two (2) lift stations and extensive work to make this possible. This estimate includes the installation of sewer mains, sewer service lines, manholes, lift stations, and other appurtenances related to this project. Due to many factors this project is not economically feasible at this time. The estimated cost of the improvement is shown in Table 20 below.

Table 20. Woodcreek Subdivision Sewer Service

Item No.	Item Description	Quantity	Units	Unit Price	Total
1	8" PVC Sanitary Sewer	8,600.0	LF	$68.00	$584,800.00
2	Manholes (Deep)	18.0	EA	$3,500.00	$63,000.00
3	6" Force Main	1,500.0	LF	$75.00	$112,500.00
4	Lift Stations	2.0	EA	$60,000.00	$120,000.00
5	Trench Excavation Protection	9,000.0	LF	$2.60	$23,400.00
				Subtotal	$903,700.00
				Utility Adjustment (12%)	$108,444.00
				Mobilization (10%)	$90,370.00
				Prepare ROW (5%)	$45,185.00
				Engineering (10%)	$90,370.00
				Surveying (3%)	$27,111.00
				Geotechnical (2.5%)	$22,592.50
				Contingency (25%)	$225,925.00
				Grand Total:	**$1,513,697.50**

RECOMMENDATIONS

After analyzing the above information, it is CEC's opinion that the following items should be implemented based on the capital improvement plan.

It is recommended that a systematic evaluation of the sewer system should take place. The recommended method for the evaluation is to a perform camera inspection of all sewer lines that are 6-inches in diameter. The evaluation program should be conducted

using the National Association of Sewer Service Companies (NASSCO) standards. Using the NASSCO standards will allow for a prioritization of sewer line replacement.

It is recommended that the city implement an ongoing sewer replacement program based on the sewer improvements listed above. In addition, the city should incorporate any significant findings from the I/I and evaluation programs into the sewer replacement program. This will reduce the overall load on the plant and delay 75% flow planning requirements.

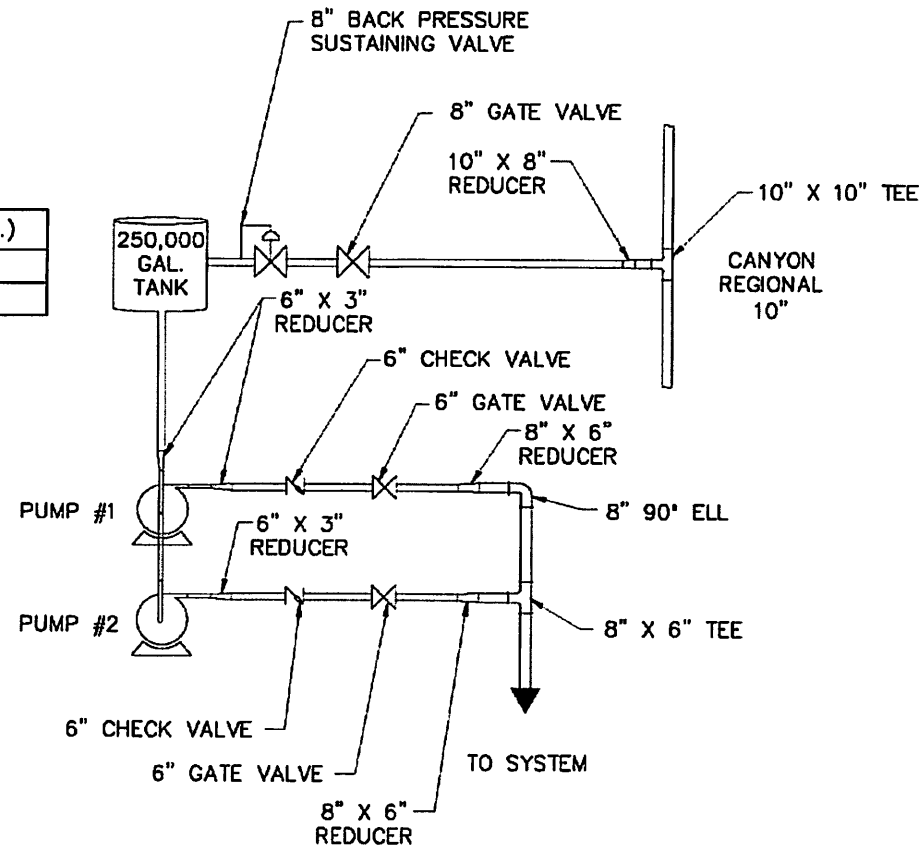
It is also recommended that the city begin a program to set aside funds for the future wastewater treatment plant improvements. Specifically, funds should be set aside to relocate the oxidation ditch away from Cibolo Creek. In addition, a contingency plan should be developed to address the needs of the city in the event that the wastewater plant is either inundated or washed away during a flood event. The contingency plan should not only address the actions to be taken in the event of one of the above emergencies, but should also address the availability and response times of suppliers and contractors and contracting requirements.

Relocation of the oxidation ditch may be necessary in the future as floods continue to erode the backs of Cibolo Creek. Since the oxidation ditch is located close to the creek continued bank erosion will make relocation necessary. When the ditch is relocated it will need to meet the TCEQ requirements in effect at the time of design. Currently this requires the top of the treatment tank to be located at least one foot above the flood elevation of Cibolo Creek. A preliminary estimate of $1.50 per gallon of treated waste or $375,000 should be set aside.

The City of La Vernia should adopt the above capital improvement projects and begin to budget for their implementation. Some of these projects will be eligible for inclusion in the impact fee program that is programmed for adoption. Only projects that are attributable to future development are eligible for inclusion in the Impact Fee. Projects that upgrade existing facilities are not eligible for inclusion in the Impact Fee.

APPENDIX A
PUMP STATION DIAGRAMS

	CAPACITY (G.P.M.)
PUMP #1	750
PUMP #2	750



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HEB BOOSTER STATION

CITY OF LA VERNIA CAPITAL IMPROVEMENT PLAN

DECEMBER 2014

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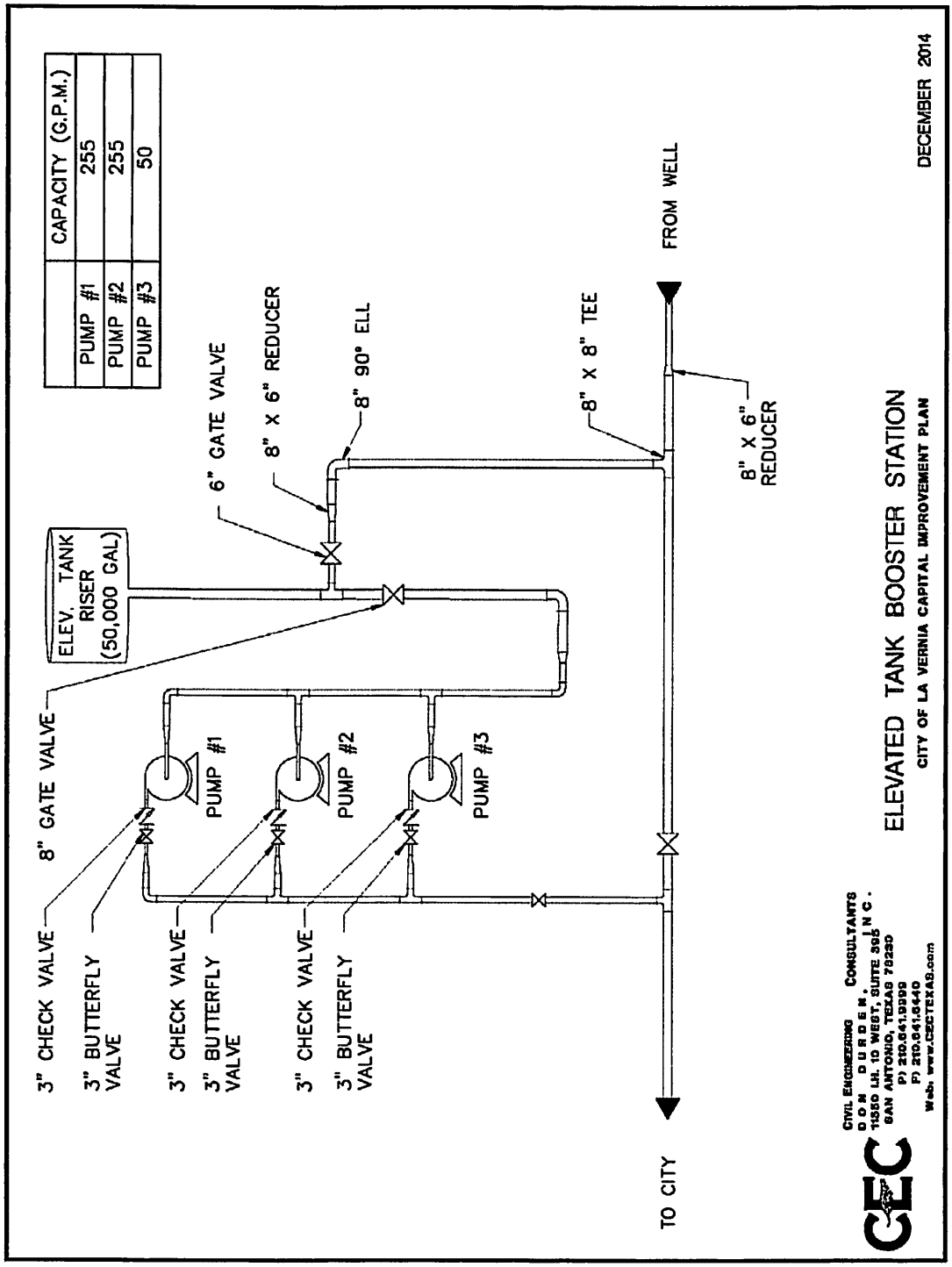
CEC
DOWNTOWN YARD SCHEMATIC
CITY OF LA VERNIA CAPITAL IMPROVEMENT PLAN
DECEMBER 2014
CAPACITY (G.P.M.)
PUMP #1 300
PUMP #2 (OLD/NOT USED)
WELL PUMP 170
WELL #1
4" METER
4" X 4" TEE
4" GATE VALVE
63,000 GAL. TANK
8" GATE VALVE
8" X 6" REDUCER
6" X 6" TEE
6" X 3" REDUCER
PUMP #2
6" 90° ELL
6" GATE VALVE
6" X 3" REDUCER
EXPANSION JOINT
6" 90° ELL
TO DISTRIBUTION SYSTEM
PUMP #1
6" GATE VALVE
EXPANSION JOINT
6" X 6" TEE


CAPACITY (G.P.M.)
PUMP #1 255
PUMP #2 255
PUMP #3 50
ELEV. TANK RISER (50,000 GAL)
8" GATE VALVE
6" GATE VALVE
8" X 6" REDUCER
8" 90° ELL
8" X 8" TEE
FROM WELL
8" X 6" REDUCER
3" CHECK VALVE
3" BUTTERFLY VALVE
3" CHECK VALVE
3" BUTTERFLY VALVE
3" CHECK VALVE
3" BUTTERFLY VALVE
PUMP #1
PUMP #2
PUMP #3
TO CITY
ELEVATED TANK BOOSTER STATION
CITY OF LA VERNIA CAPITAL IMPROVEMENT PLAN
DECEMBER 2014
CEC
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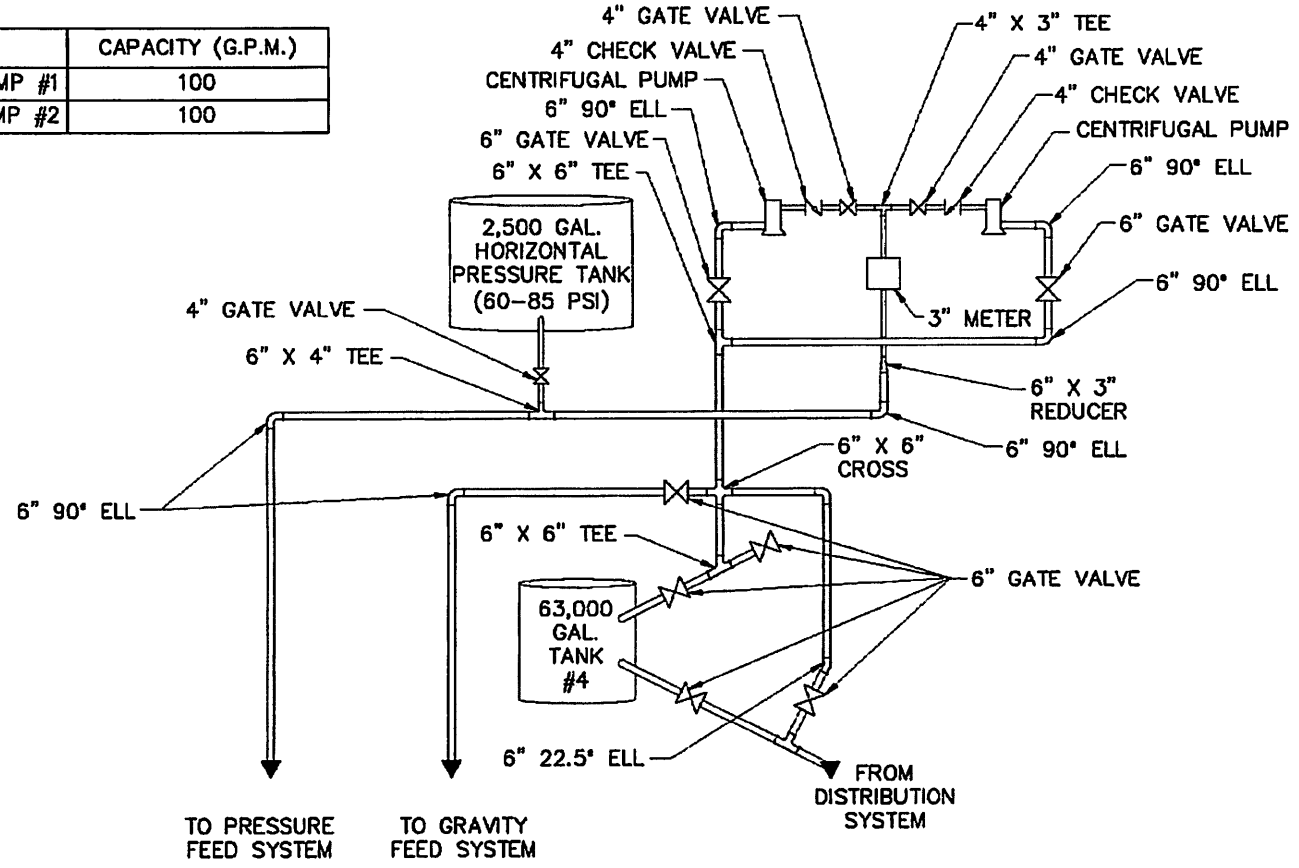
Web: www.CEDTEXAS.com

	CAPACITY (G.P.M.)
PUMP #1	100
PUMP #2	100



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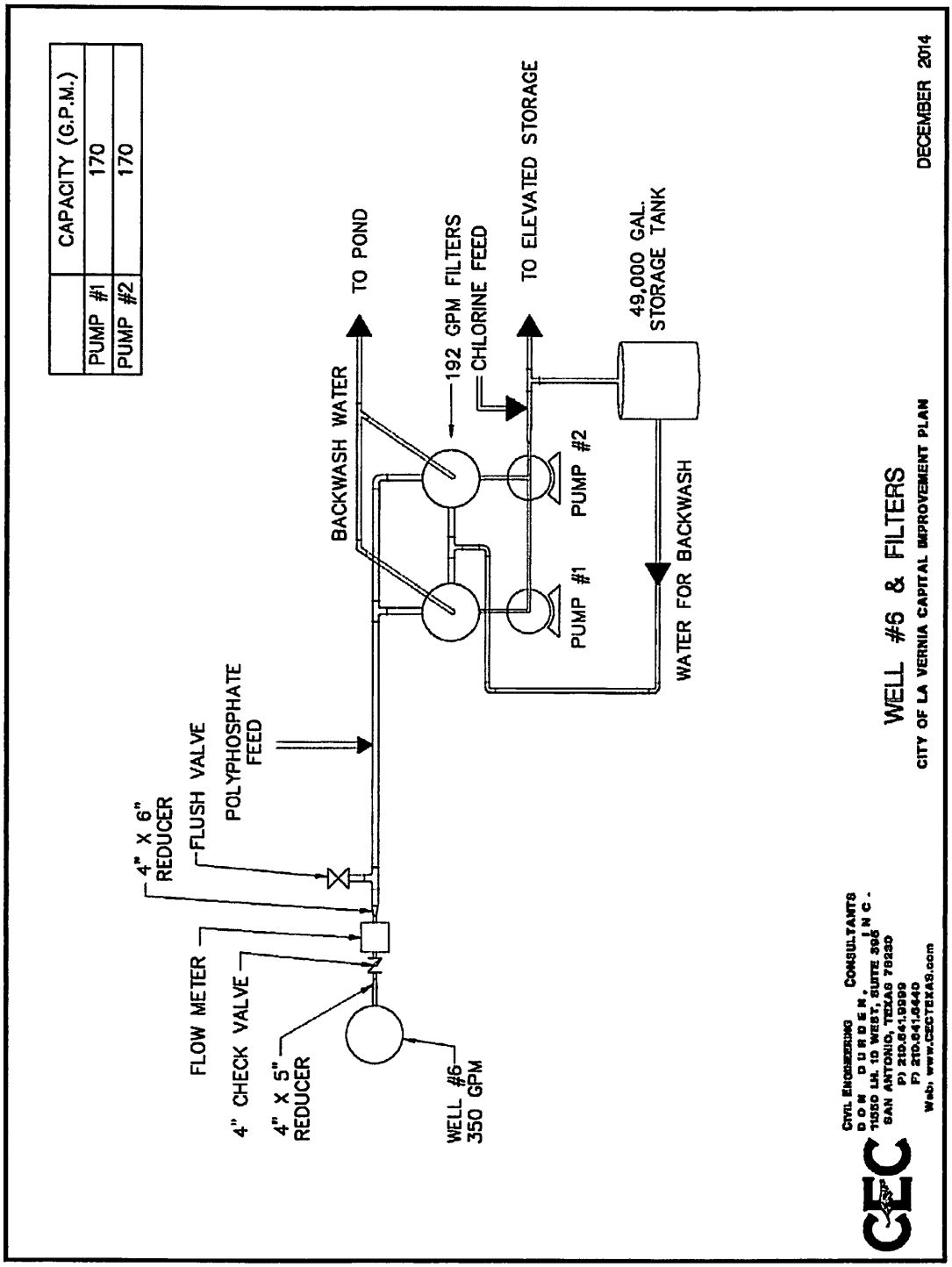
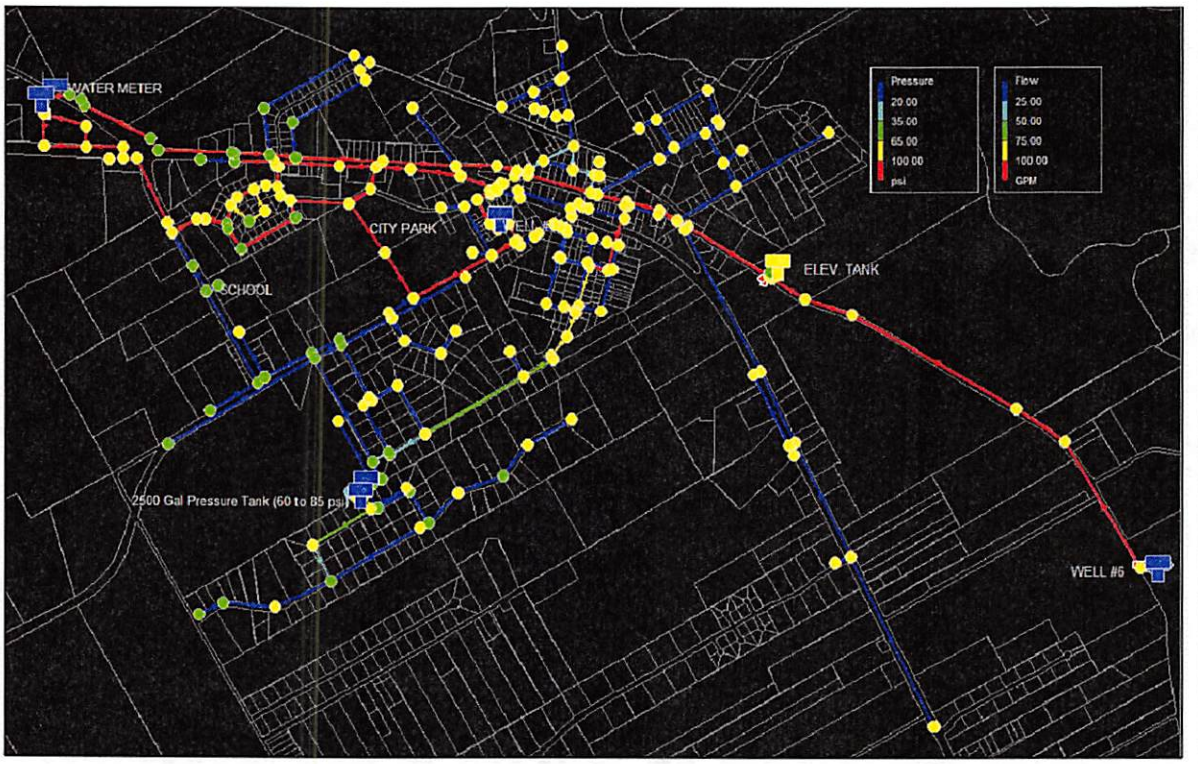
WOODCREEK TANK SCHEMATIC

CITY OF LA VERNIA CAPITAL IMPROVEMENT PLAN

DECEMBER 2014


CAPACITY (G.P.M.)
PUMP #1 170
PUMP #2 170
TO POND
BACKWASH WATER
192 GPM FILTERS
CHLORINE FEED
TO ELEVATED STORAGE
49,000 GAL.
STORAGE TANK
PUMP #2
PUMP #1
WATER FOR BACKWASH
4" X 6"
REDUCER
FLUSH VALVE
POLYPHOSPHATE
FEED
FLOW METER
4" CHECK VALVE
4" X 5"
REDUCER
WELL #6
350 GPM
WELL #6 & FILTERS
CITY OF LA VERNIA CAPITAL IMPROVEMENT PLAN
DECEMBER 2014
CEC
CIVIL ENGINEERING CONSULTANTS
DON DURGEN, INC.
7550 LM. 10 WEST, SUITE 308
SAN ANTONIO, TEXAS 78230
P) 210.641.9999
F) 210.641.6440
Web: www.CEGTEXAS.com

APPENDIX B
WATER DISTRIBUTION SYSTEM MODELS



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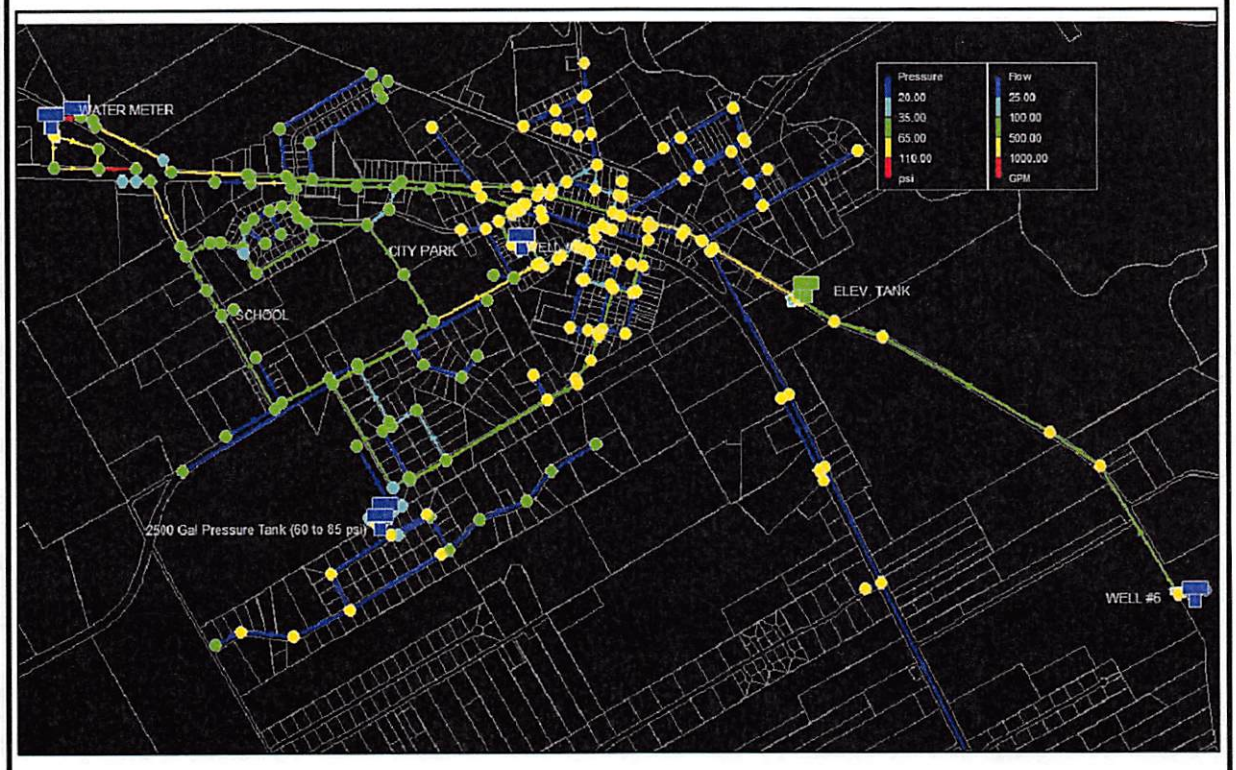
EPANET WATER SYSTEM MODEL
CITY OF LA VERNIA
WATER DISTRIBUTION SYSTEM ANALYSIS

EXISTING AVERAGE DAILY DEMAND CONDITIONS

DATE 2/9/15
JOB NUMBER E0305911
SHEET 1
OF 14



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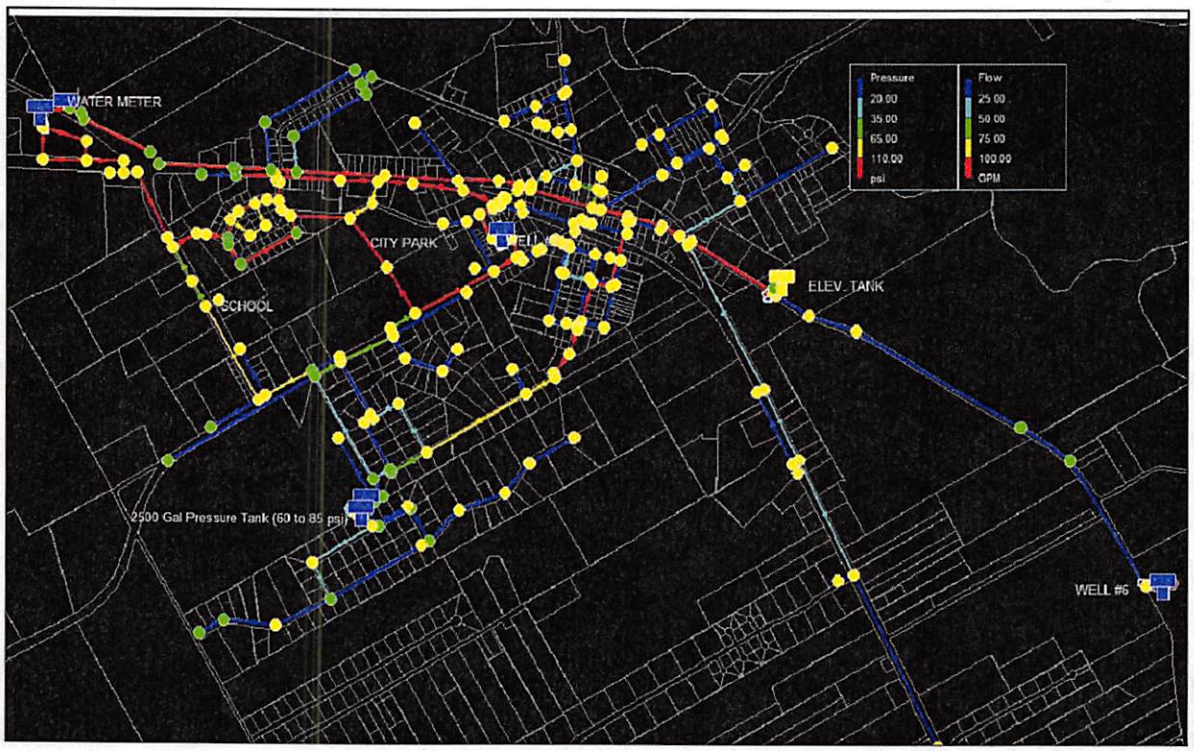
EPANET WATER SYSTEM MODEL
CITY OF LA VERNIA
WATER DISTRIBUTION SYSTEM ANALYSIS

SCENARIO # 1– FIRE FLOW SIMULATION
EXISTING AVERAGE DAILY DEMAND CONDITIONS WITH
1680 GPM FIRE FLOW (1 HOUR DURATION)

DATE	2/9/15
JOB NUMBER	E0305911
SHEET	2
OF	14



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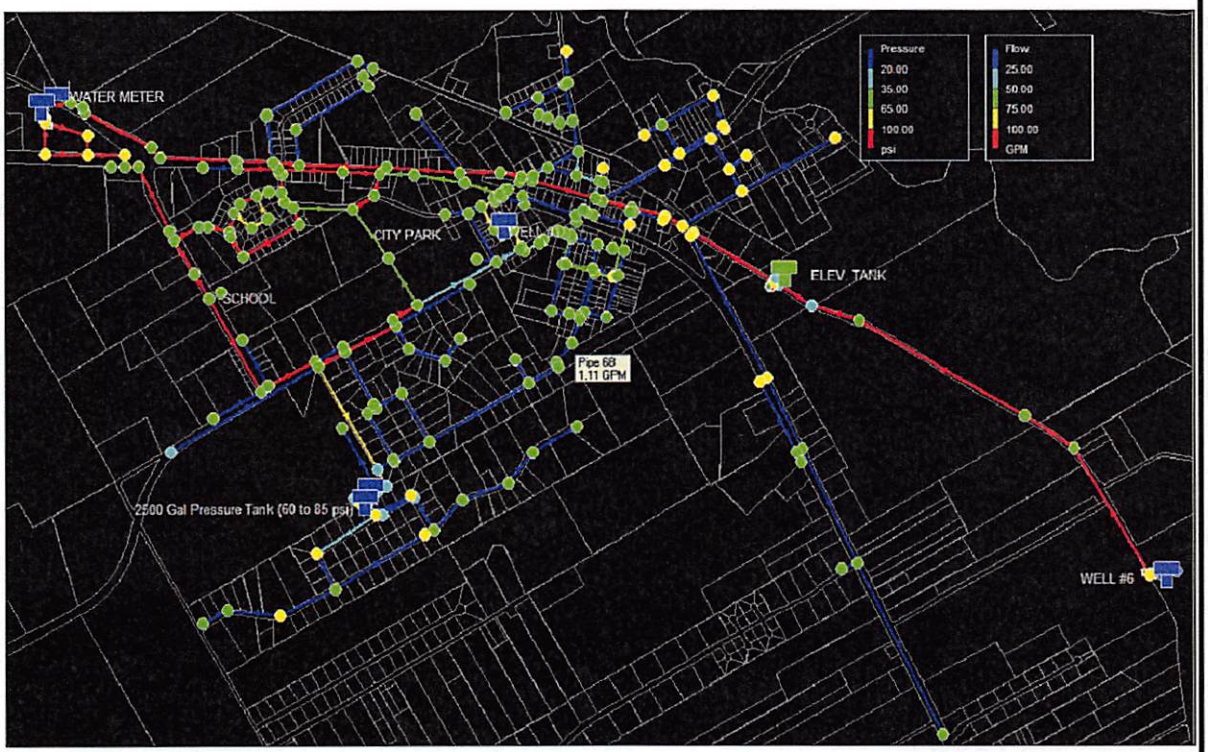
	EXISTING PEAK HOUR DEMAND CONDTIONS (3.0 PEAK FACTOR)	SHEET 3 OF 14



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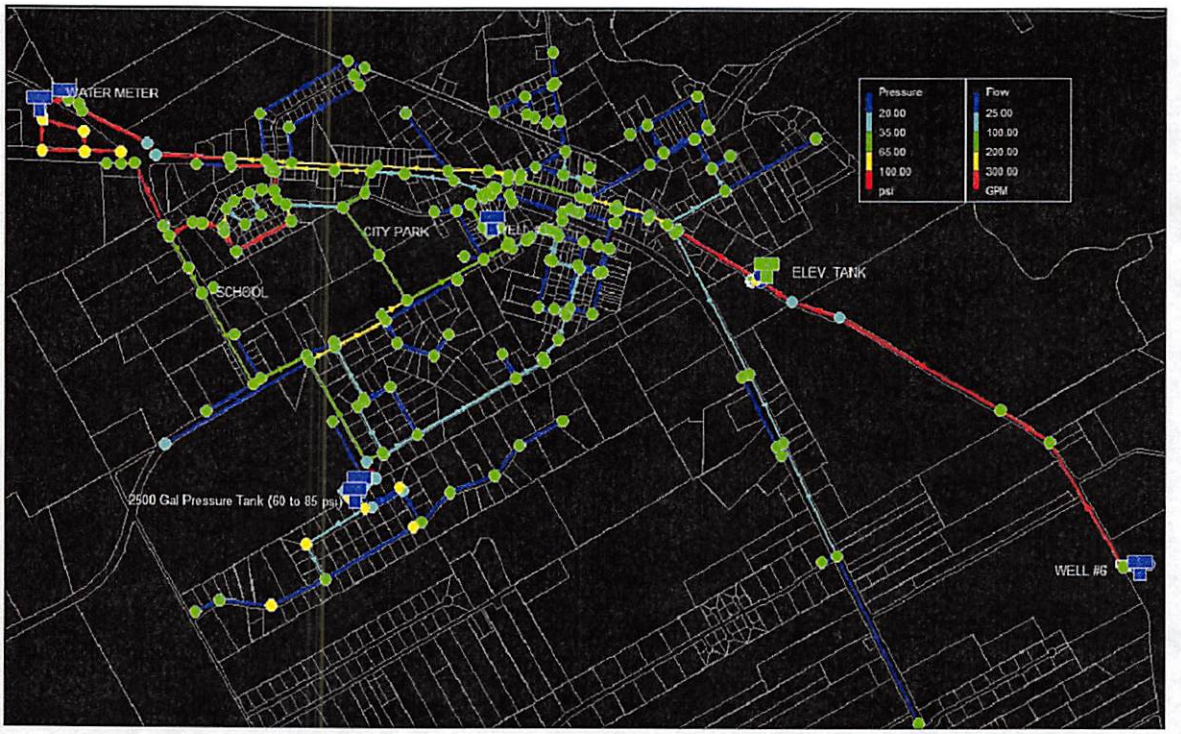
EPANET WATER SYSTEM MODEL
CITY OF LA VERNIA
WATER DISTRIBUTION SYSTEM ANALYSIS

FUTURE PEAK HOUR DEMAND CONDITIONS
(3.0 PEAK FACTOR)

DATE 2/9/15
JOB NUMBER E0305911
SHEET 4
OF 14



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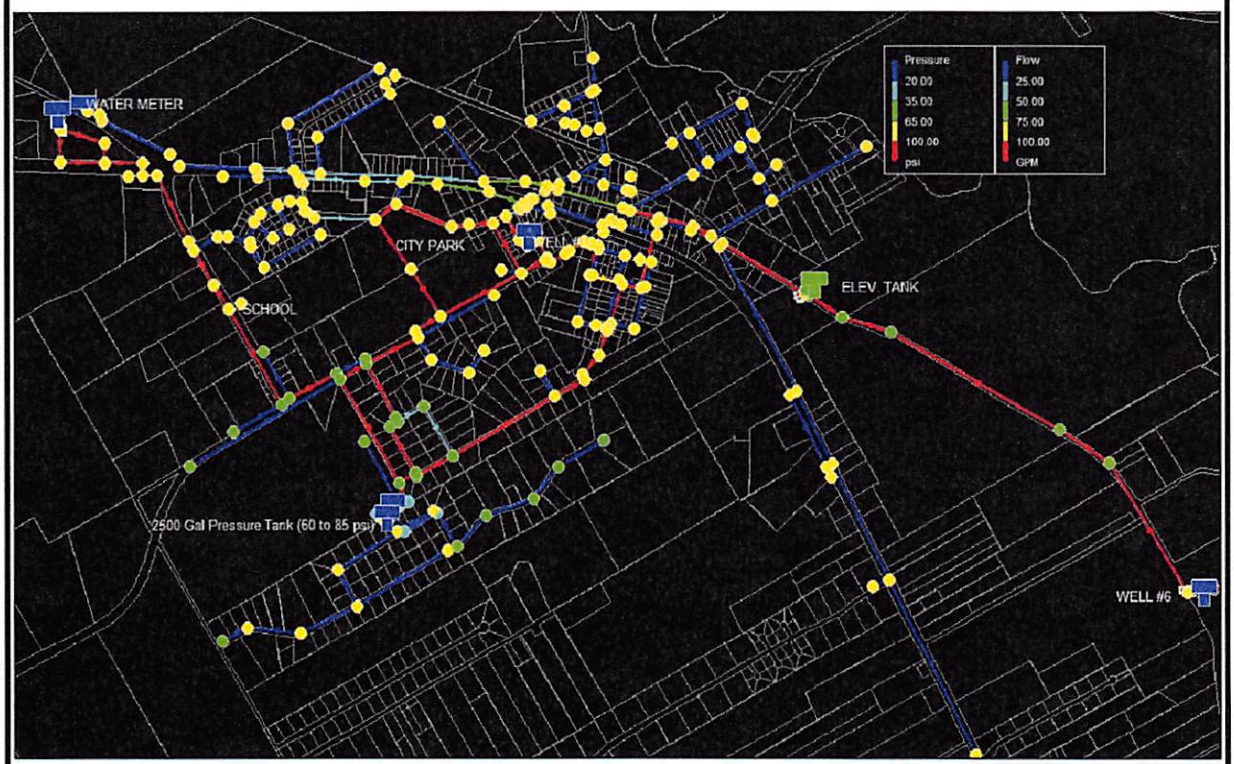
CEC Civil Engineering Consultants DON DURDEN, INC. 11550 I.H. 10 WEST, SUITE 395 SAN ANTONIO, TEXAS 78230 P) 210.641.9999 F) 210.641.6440 Web: www.CECTEXAS.com	EPANET WATER SYSTEM MODEL CITY OF LA VERNIA WATER DISTRIBUTION SYSTEM ANALYSIS SCENARIO # 3 – MAIN YARD PUMP OUT WITH FUTURE PEAK HOUR DEMAND CONDITIONS	DATE 2/9/15 JOB NUMBER E0305911 SHEET 5 OF 14



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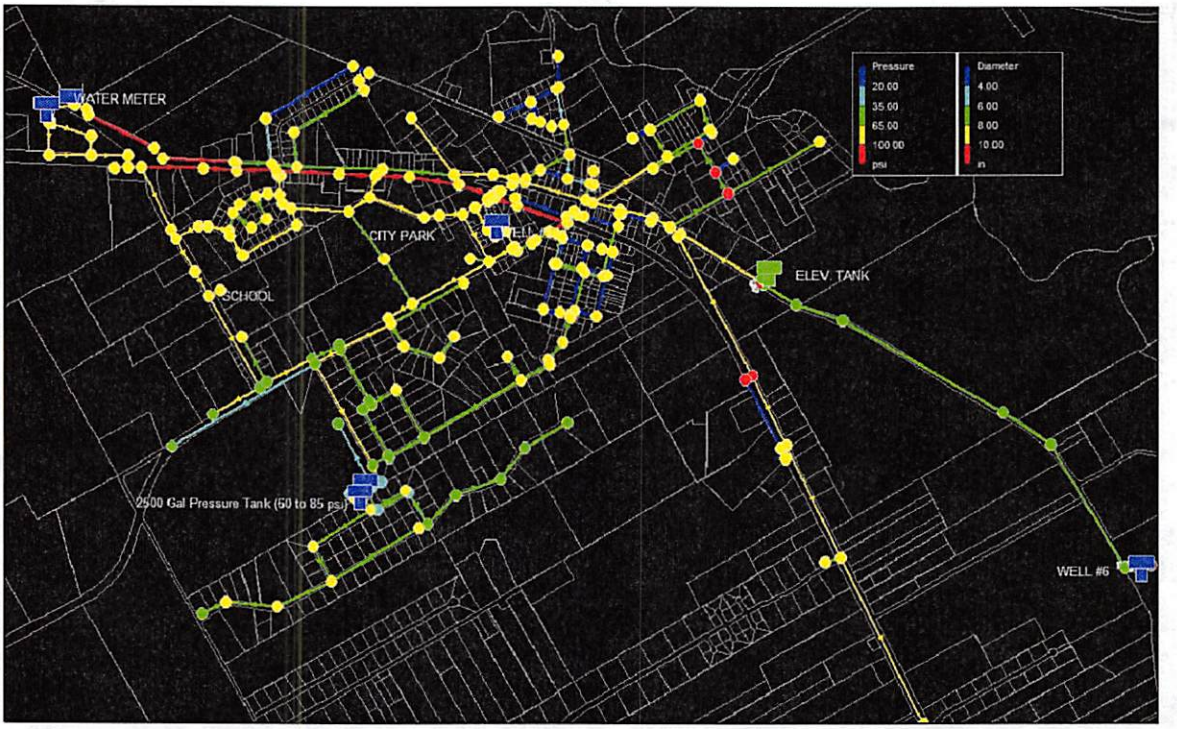
EPANET WATER SYSTEM MODEL
CITY OF LA VERNIA
WATER DISTRIBUTION SYSTEM ANALYSIS

SCENARIO # 4 – SAN ANTONIO ST. & DL VEST ST. – 8" IMPROVEMENTS WITH FUTURE PEAK HOUR DEMAND CONDITIONS

DATE 2/9/15
JOB NUMBER E0305911
SHEET 6
OF 14



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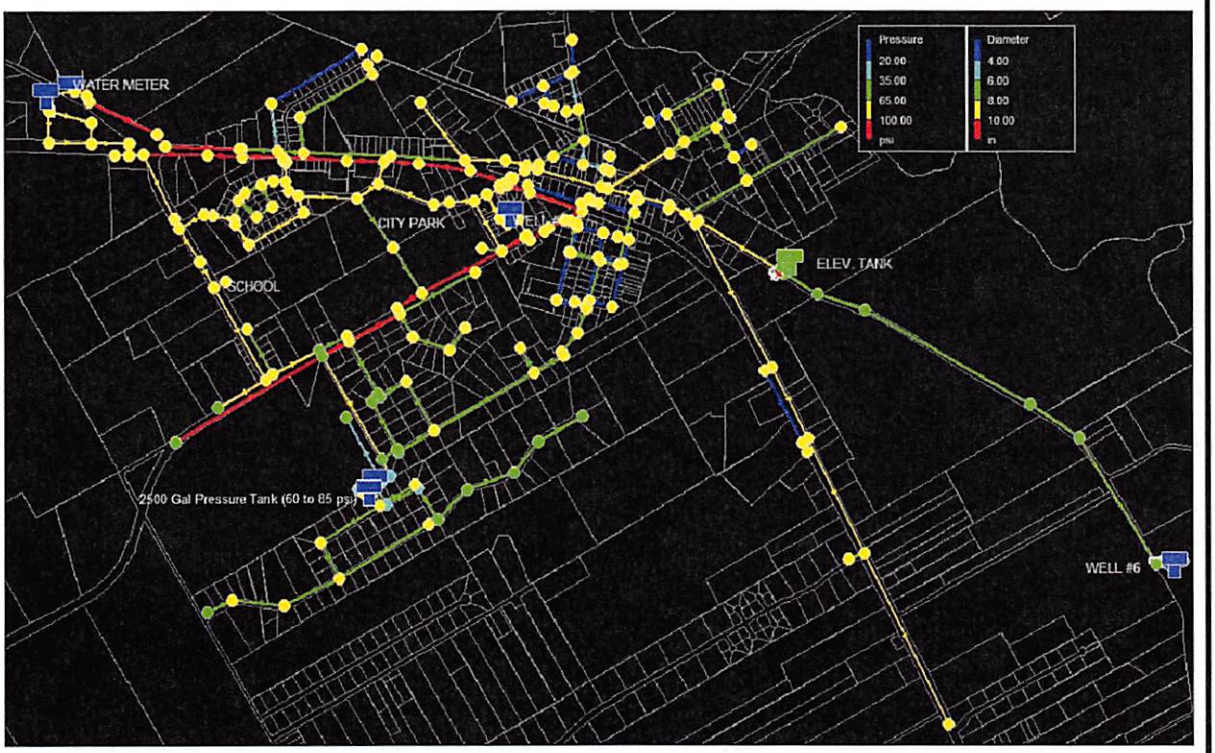
EPANET WATER SYSTEM MODEL
CITY OF LA VERNIA
WATER DISTRIBUTION SYSTEM ANALYSIS

SCENARIO # 5 – SAN ANTONIO ST. & DL VEST ST. – 8" IMPROVEMENTS PLUS HWY 87 – 12" INTERCONNECT IMPROVEMENTS WITH FUTURE PEAK HOUR DEMAND CONDITIONS

DATE 2/9/15
JOB NUMBER E0305911
SHEET 7
OF 14



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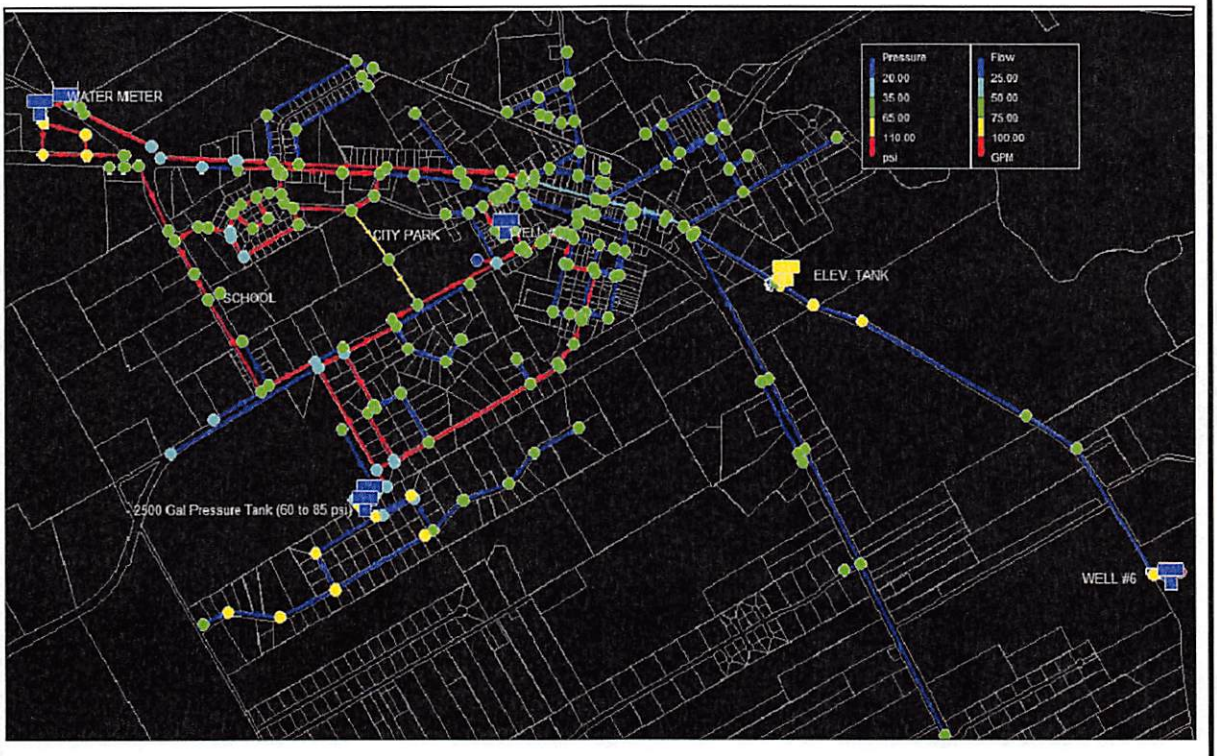
EPANET WATER SYSTEM MODEL
CITY OF LA VERNIA
WATER DISTRIBUTION SYSTEM ANALYSIS

SCENARIO # 6 – SAN ANTONIO ST. & DL VEST ST. – 8" IMPROVEMENTS
PLUS HWY 87 – 12" INTERCONNECT IMPROVEMENTS
PLUS FM 775 – 12" IMPROVEMENTS
WITH FUTURE PEAK HOUR DEMAND CONDITIONS

DATE	2/9/15
JOB NUMBER	E0305911
SHEET	8
OF	14

APPENDIX C
FIRE FLOW TEST RESULTS



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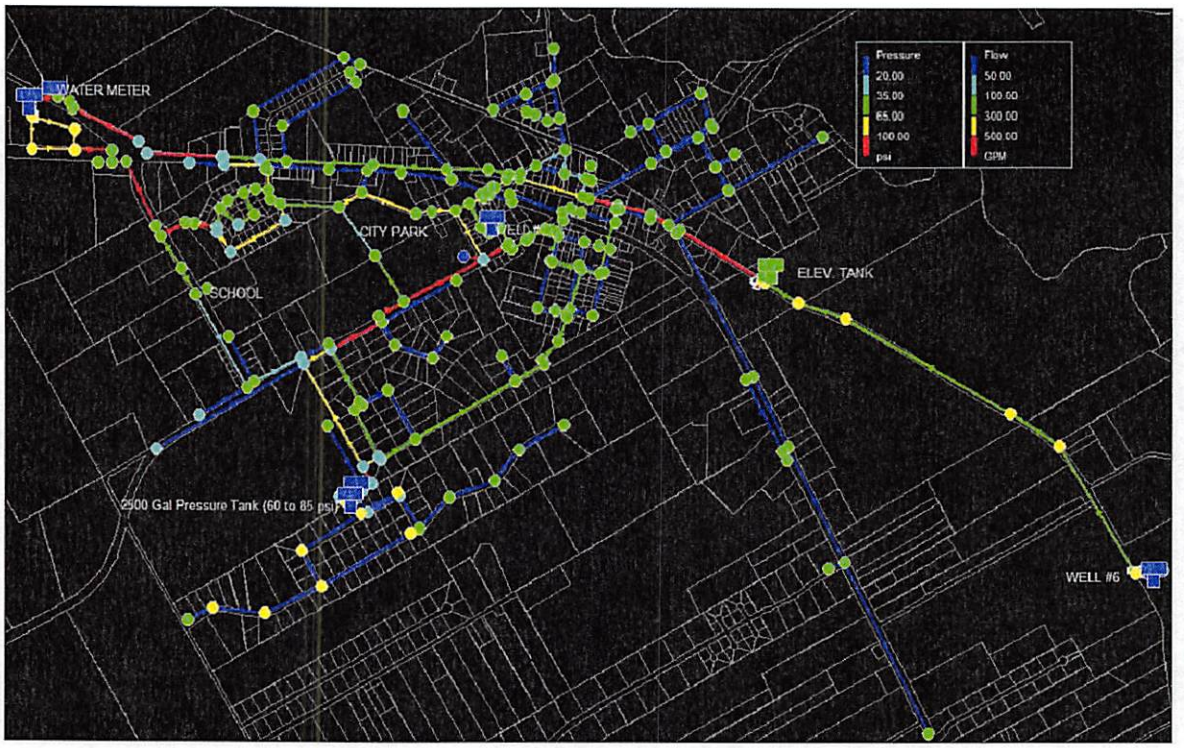
CEC CIVIL ENGINEERING CONSULTANTS DON DURDEN, INC. 11550 I.H. 10 WEST, SUITE 395 SAN ANTONIO, TEXAS 78230 P) 210.6419999 F) 210.6416440 Web: www.CECTEXAS.com	EPANET WATER SYSTEM MODEL CITY OF LA VERNIA WATER DISTRIBUTION SYSTEM ANALYSIS SCENARIO # 7 – 1 HOUR 1500 FIRE FLOW SIMULATION EXISTING AVERAGE DAILY DEMAND CONDITIONS	DATE 2/9/15 JOB NUMBER E0305911 SHEET 9 OF 14



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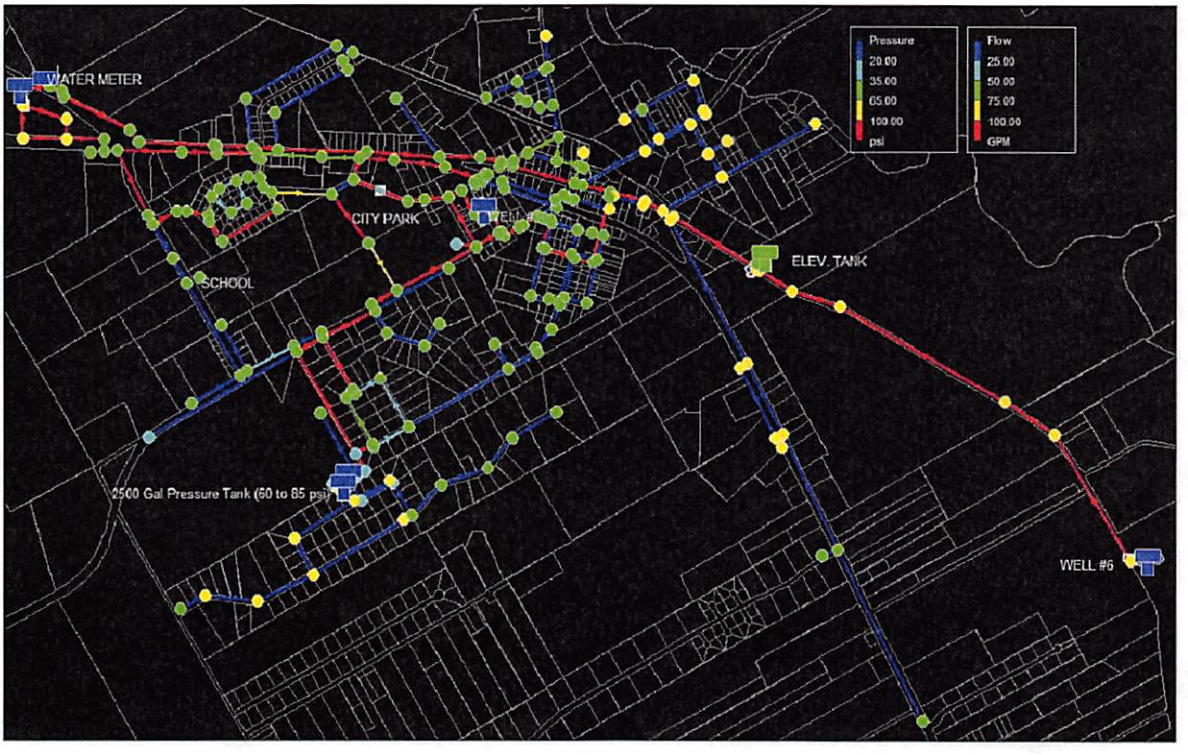
CEC CIVIL ENGINEERING CONSULTANTS DON DURDEN, INC. 11550 I.H. 10 WEST, SUITE 395 SAN ANTONIO, TEXAS 78230 P) 210.6419999 F) 210.6416440 Web: www.CECTEXAS.com	EPANET WATER SYSTEM MODEL CITY OF LA VERNIA WATER DISTRIBUTION SYSTEM ANALYSIS SCENARIO # 8 – 1 HOUR 1500 FIRE FLOW SIMULATION WITH SAN ANTONIO ST. & DL VEST ST. – 8" IMPROVEMENTS FUTURE AVERAGE DAILY DEMAND CONDITIONS	DATE 2/9/15 JOB NUMBER E0305911 SHEET 10 OF 14



NOT TO SCALE

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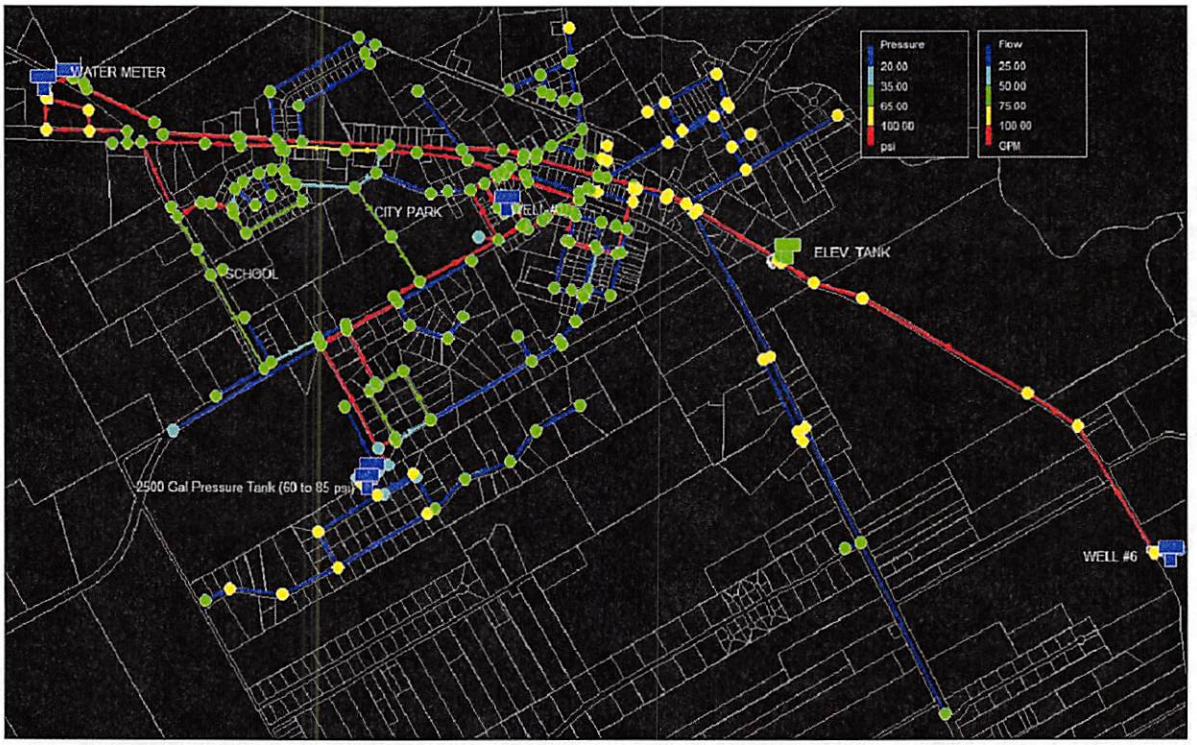
EPANET WATER SYSTEM MODEL
CITY OF LA VERNIA
WATER DISTRIBUTION SYSTEM ANALYSIS

SCENARIO # 9 – 1500 FIRE FLOW SIMULATION
WITH SAN ANTONIO ST. & DL VEST ST. – 8" IMPROVEMENTS
PLUS HWY 87 – 12" INTERCONNECT IMPROVEMENTS
FUTURE AVERAGE DAILY DEMAND CONDITIONS

DATE	2/9/15
JOB NUMBER	E0305911
SHEET	11
OF	14



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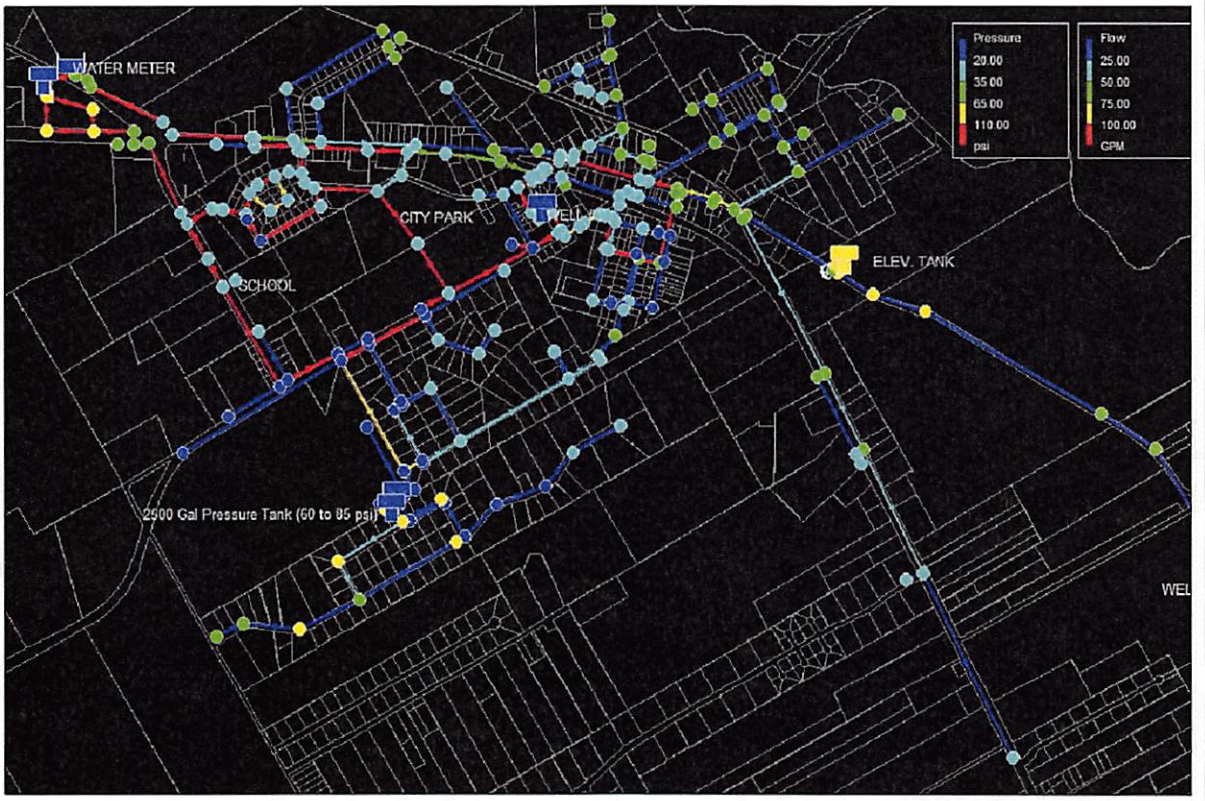
EPANET WATER SYSTEM MODEL
CITY OF LA VERNIA
WATER DISTRIBUTION SYSTEM ANALYSIS

SCENARIO # 10 – 1500 FIRE FLOW SIMULATION WITH SAN ANTONIO ST. & DL VEST ST.–8" IMPROVEMENTS PLUS HWY 87 – 12" INTERCONNECT IMPROVEMENTS PLUS FM 775 – 12" IMPROVEMENTS FUTURE AVERAGE DAILY DEMAND CONDITIONS

DATE 2/9/15
JOB NUMBER E0305911
SHEET 12
OF 14



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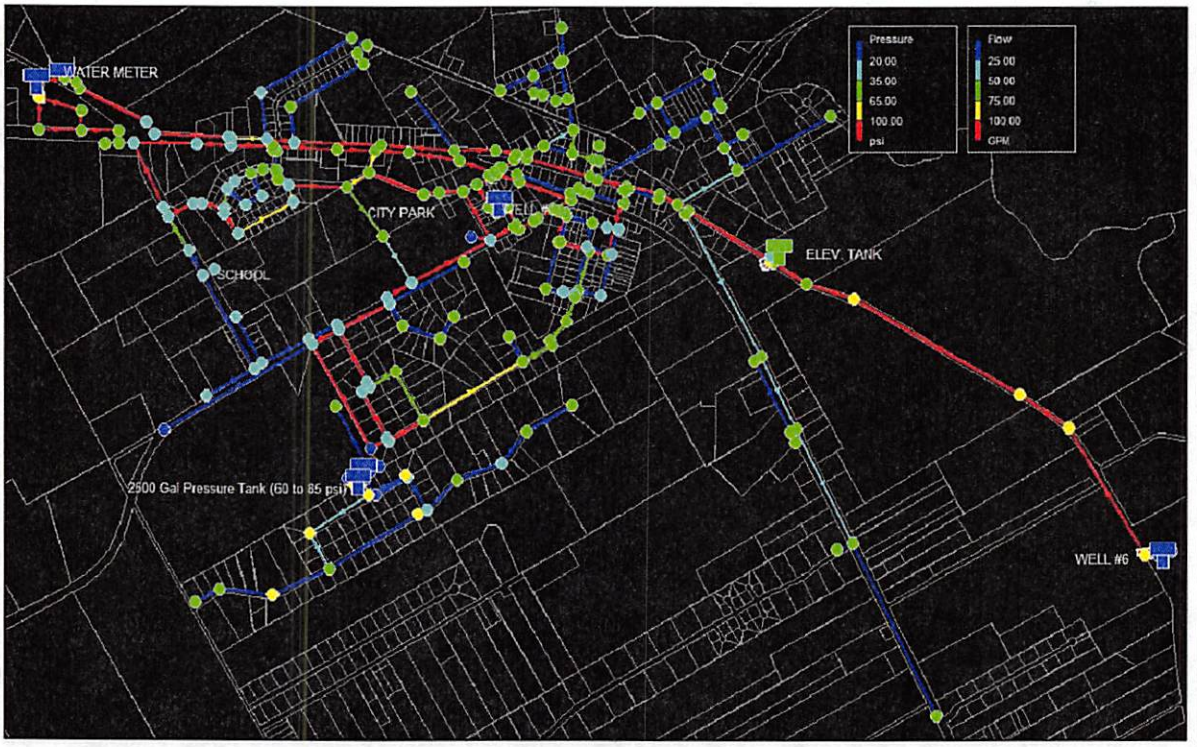
EPANET WATER SYSTEM MODEL
CITY OF LA VERNIA
WATER DISTRIBUTION SYSTEM ANALYSIS

SCENARIO # 11 – 2 HOUR 1500 FIRE FLOW SIMULATION EXISTING WITH PEAK HOUR DEMAND CONDITIONS

DATE 2/9/15
JOB NUMBER E0305911
SHEET 13
OF 14



NOT TO SCALE

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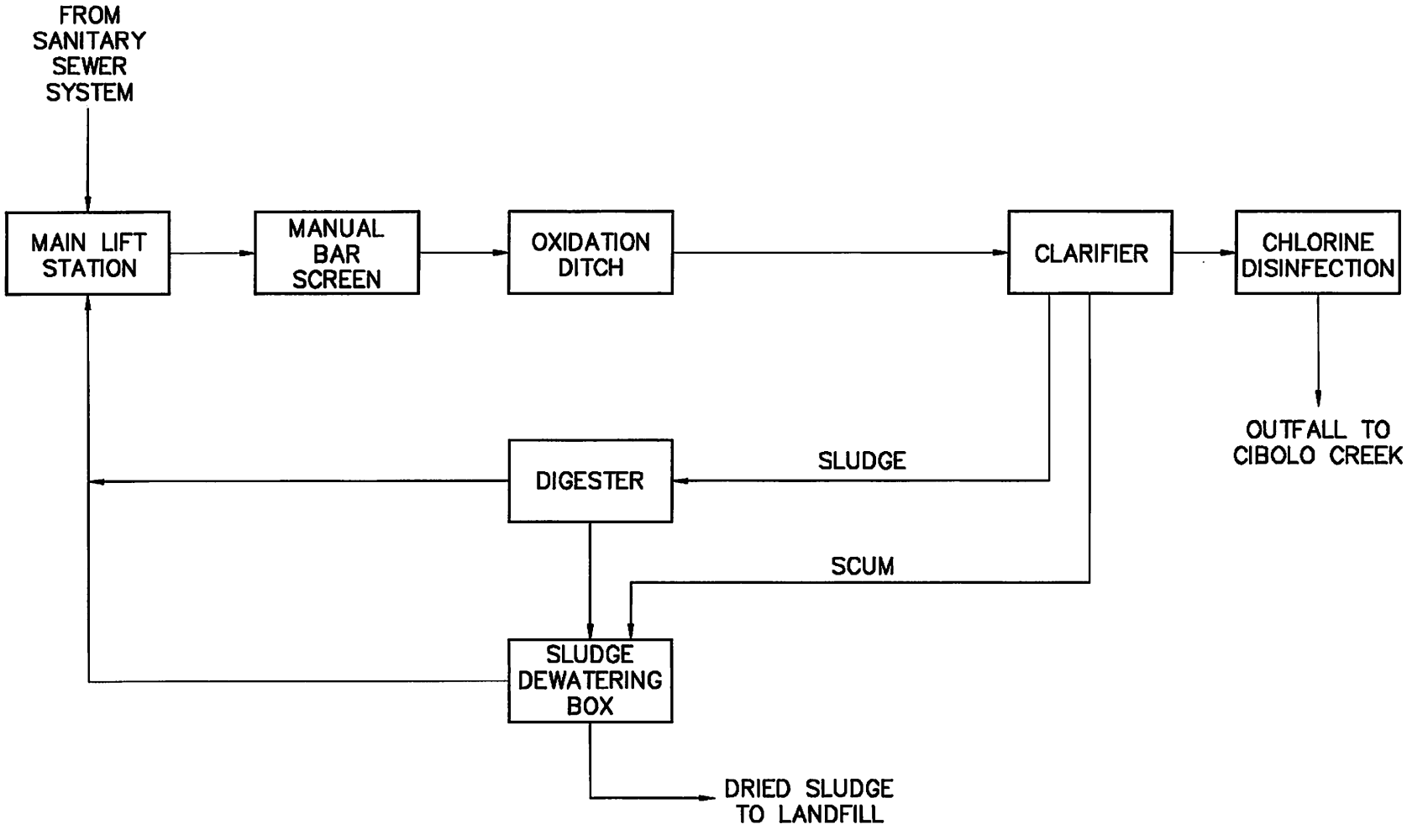
Web: www.CECTEXAS.com

EPANET WATER SYSTEM MODEL
CITY OF LA VERNIA
WATER DISTRIBUTION SYSTEM ANALYSIS

SCENARIO # 12 – 2 HOUR 1500 FIRE FLOW WITH PROPOSED IMPROVEMENTS DURING FUTURE PEAK HOUR DEMAND CONDITIONS

DATE	2/8/15
JOB NUMBER	E0305911
SHEET	14
OF	14

APPENDIX D
WWTP PROCESS DIAGRAM



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PROCESS FLOW DIAGRAM

CITY OF LA VERNIA WASTEWATER TREATMENT PLANT

JANUARY 2009

EXHIBITS

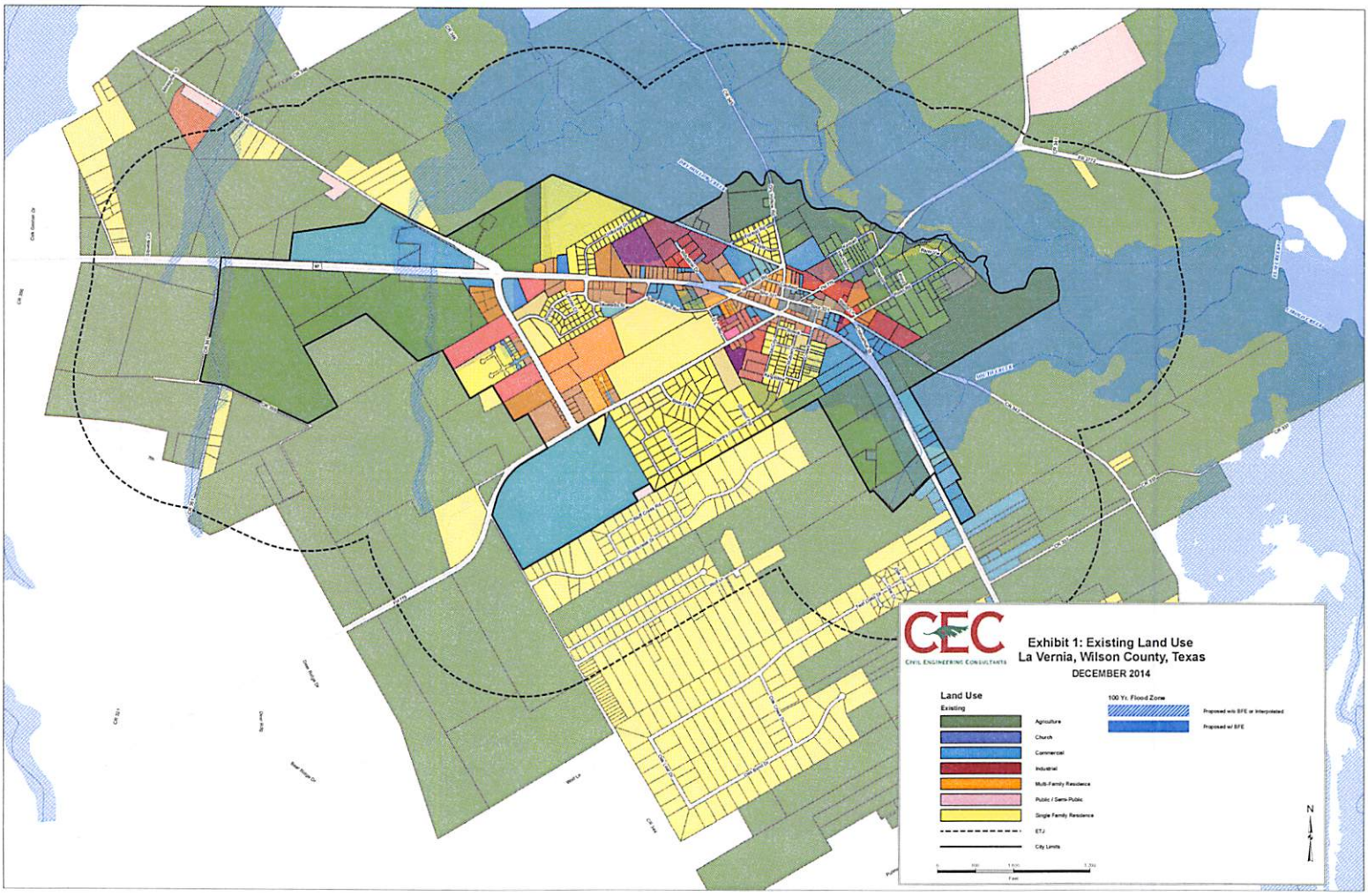
CEC
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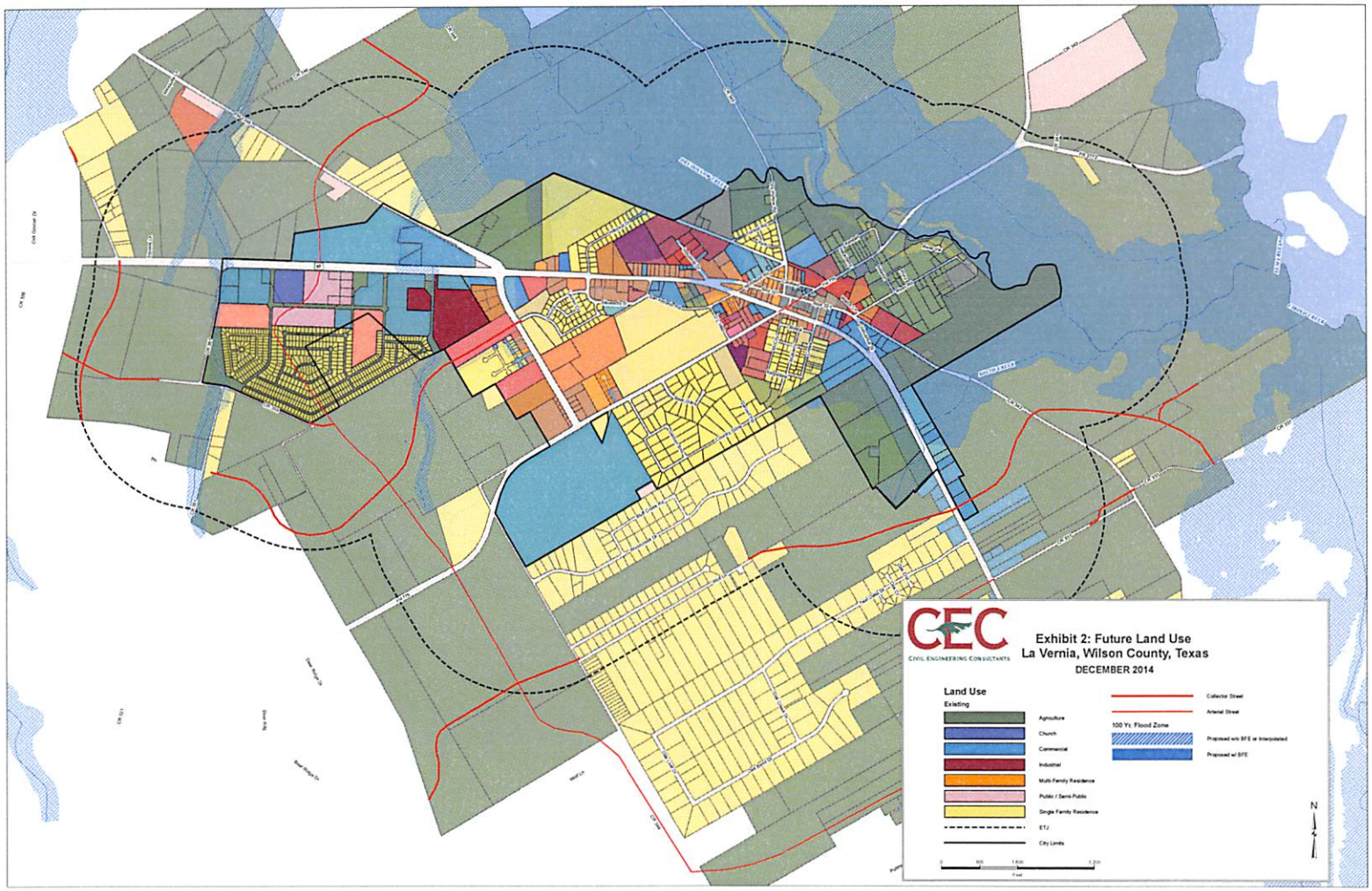
Exhibit 1: Existing Land Use
La Vernia, Wilson County, Texas
DECEMBER 2014
Land Use
Existing
Agriculture
Church
Commercial
Industrial
Multi-Family Residence
Public / Semi-Public
Single Family Residence
ETJ
City Limits
100 Yr. Flood Zone
Proposed w/o BFE or Interpolated
Proposed w/ BFE
N


CEC
CIVIL ENGINEERING CONSULTANTS
Exhibit 2: Future Land Use
La Vernia, Wilson County, Texas
DECEMBER 2014
Land Use
Existing
Agriculture
Church
Commercial
Industrial
Multi-Family Residence
Public / Semi-Public
Single Family Residence
ETJ
City Limits
Collector Street
Arterial Street
100 Yr. Flood Zone
Proposed w/o BFE or Interpolated
Proposed w/ BFE
N

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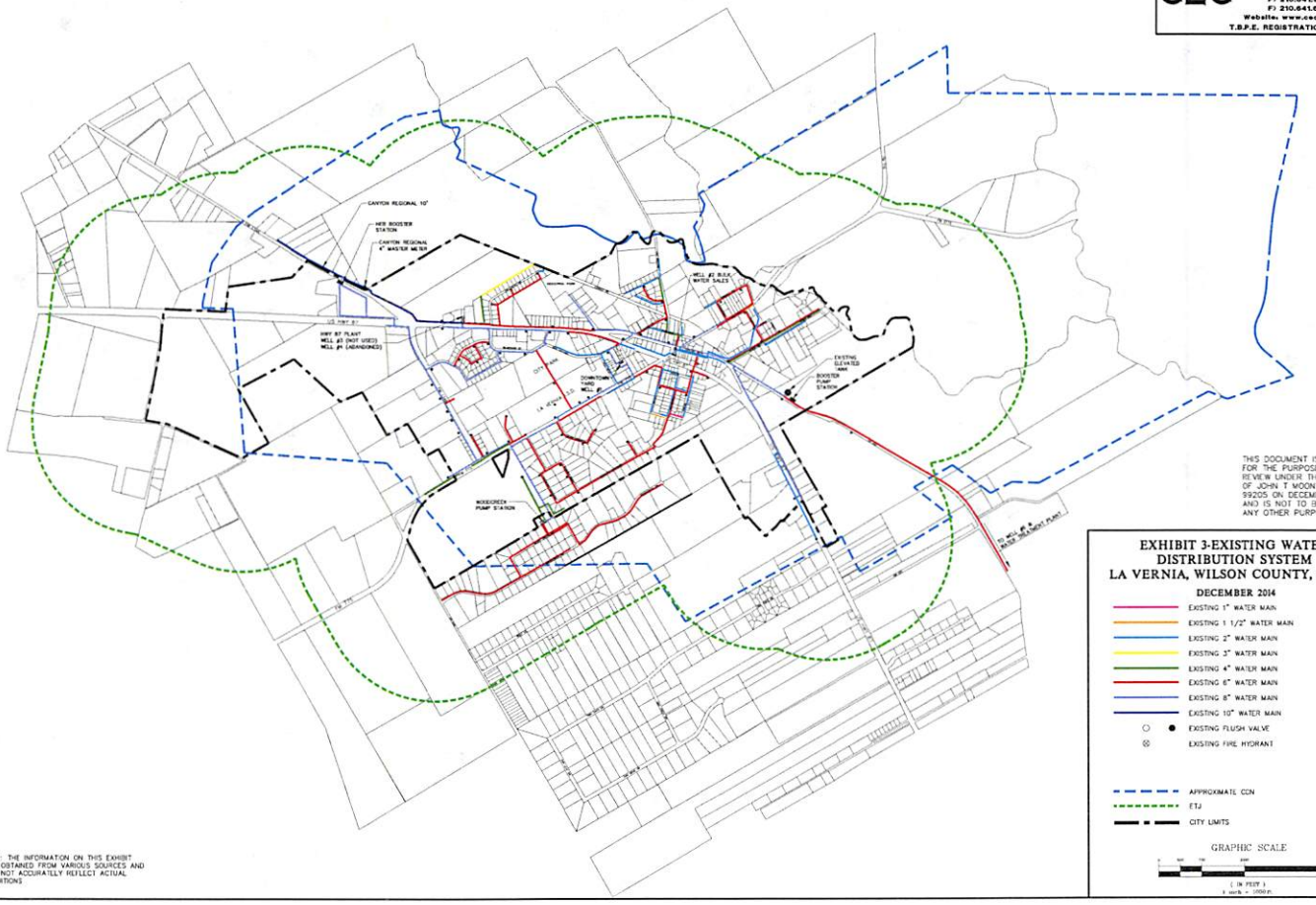

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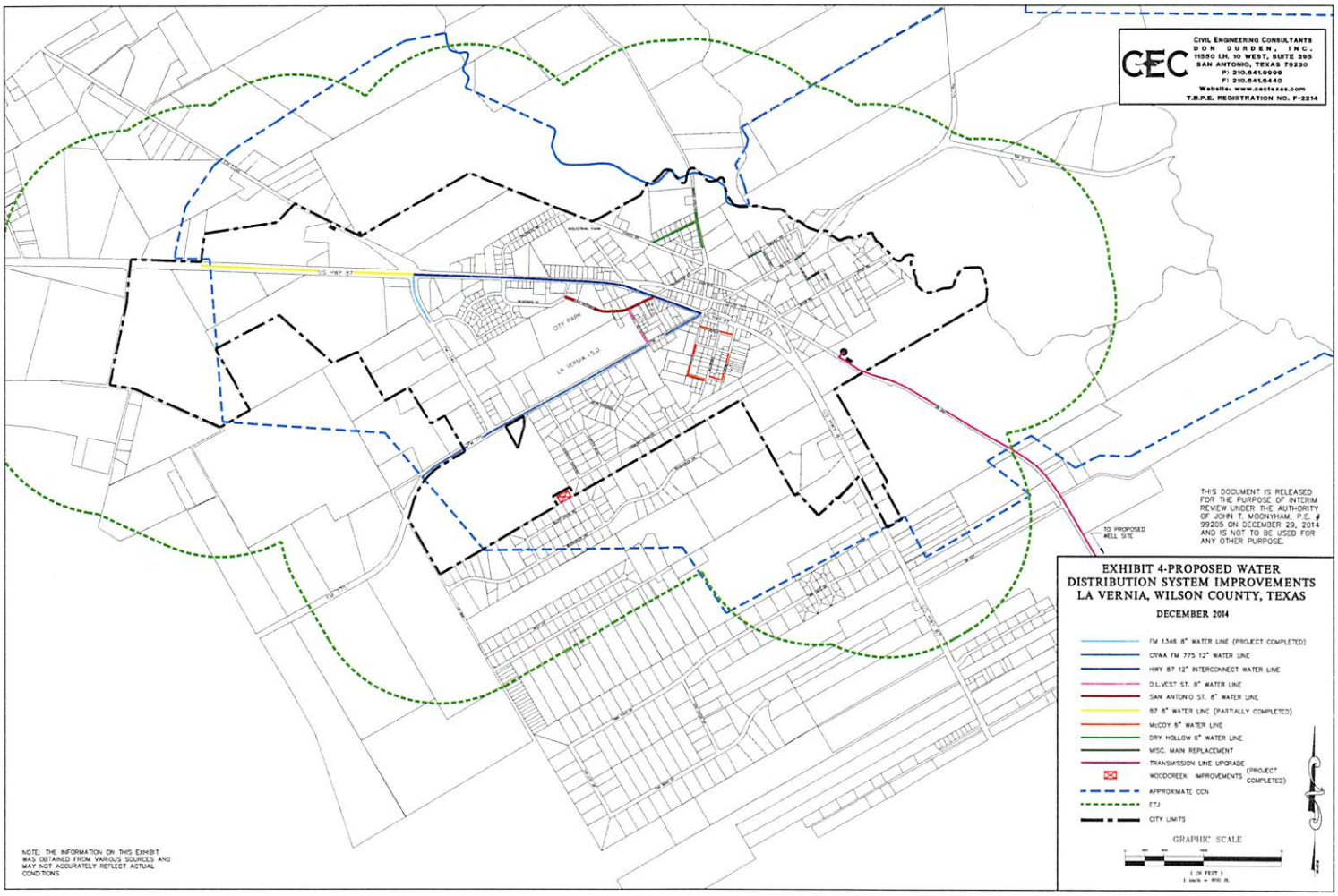
EXHIBIT 3-EXISTING WATER DISTRIBUTION SYSTEM LA VERNIA, WILSON COUNTY, TEXAS

DECEMBER 2014

- EXISTING 1" WATER MAIN
- EXISTING 1 1/2" WATER MAIN
- EXISTING 2" WATER MAIN
- EXISTING 3" WATER MAIN
- EXISTING 4" WATER MAIN
- EXISTING 6" WATER MAIN
- EXISTING 8" WATER MAIN
- EXISTING 10" WATER MAIN
- EXISTING FLUSH VALVE
- EXISTING FIRE HYDRANT
- APPROXIMATE CCN
- ETJ
- CITY LIMITS

GRAPHIC SCALE

NOTE: THE INFORMATION ON THIS EXHIBIT WAS OBTAINED FROM VARIOUS SOURCES AND MAY NOT ACCURATELY REFLECT ACTUAL CONDITIONS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Website: www.cecTexas.com
T.B.P.E. REGISTRATION NO. F-2214
US HWY 87
CITY PARK
LA VERNIA I.S.D.
TO PROPOSED WELL SITE
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EXHIBIT 4-PROPOSED WATER DISTRIBUTION SYSTEM IMPROVEMENTS
LA VERNIA, WILSON COUNTY, TEXAS
DECEMBER 2014
FM 1346 8" WATER LINE (PROJECT COMPLETED)
CRWA FM 775 12" WATER LINE
HWY 87 12" INTERCONNECT WATER LINE
D.L.WEST ST. 8" WATER LINE
SAN ANTONIO ST. 8" WATER LINE
87 8" WATER LINE (PARTIALLY COMPLETED)
McCOY 6" WATER LINE
DRY HOLLOW 6" WATER LINE
MISC. MAIN REPLACEMENT
TRANSMISSION LINE UPGRADE
WOODCREEK IMPROVEMENTS (PROJECT COMPLETED)
APPROXIMATE CCN
ETJ
CITY LIMITS
GRAPHIC SCALE
(IN FEET)
NOTE: THE INFORMATION ON THIS EXHIBIT WAS OBTAINED FROM VARIOUS SOURCES AND MAY NOT ACCURATELY REFLECT ACTUAL CONDITIONS

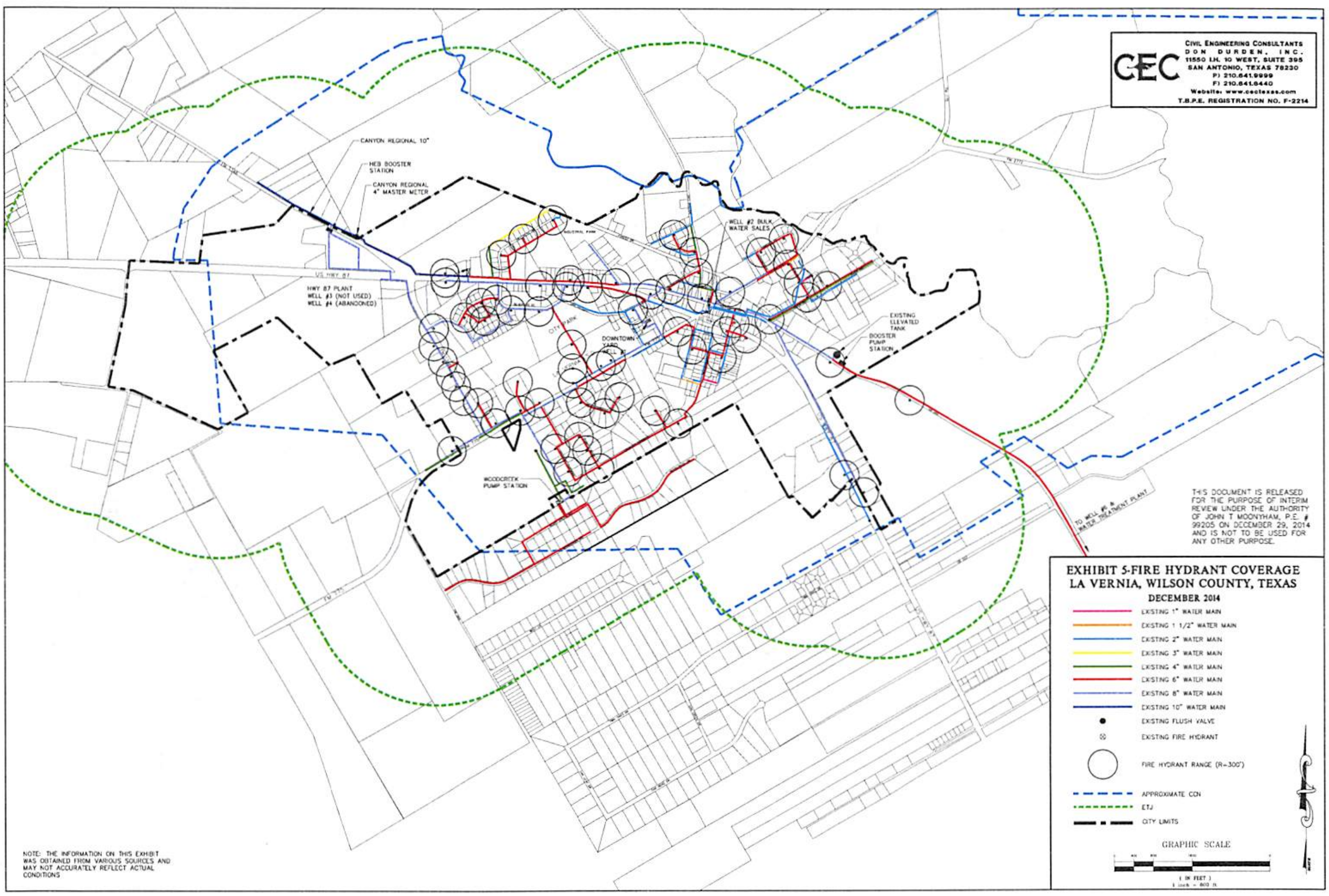
CIVIL ENGINEERING CONSULTANTS
DON DURDEN, INC.
11550 I.H. 10 WEST, SUITE 395
SAN ANTONIO, TEXAS 78230
P) 210.641.9999
F) 210.641.6440
Website: www.cectexas.com
T.B.P.E. REGISTRATION NO. F-2214
CANYON REGIONAL 10"
HEB BOOSTER STATION
CANYON REGIONAL 4" MASTER METER
US HWY 87
HWY 87 PLANT
WELL #3 (NOT USED)
WELL #4 (ABANDONED)
WELL #2 BULK WATER SALES
CITY PARK
DOWNTOWN YARD
EXISTING ELEVATED TANK
BOOSTER PUMP STATION
WOODCREEK PUMP STATION
TO WELL #6 & WATER TREATMENT PLANT
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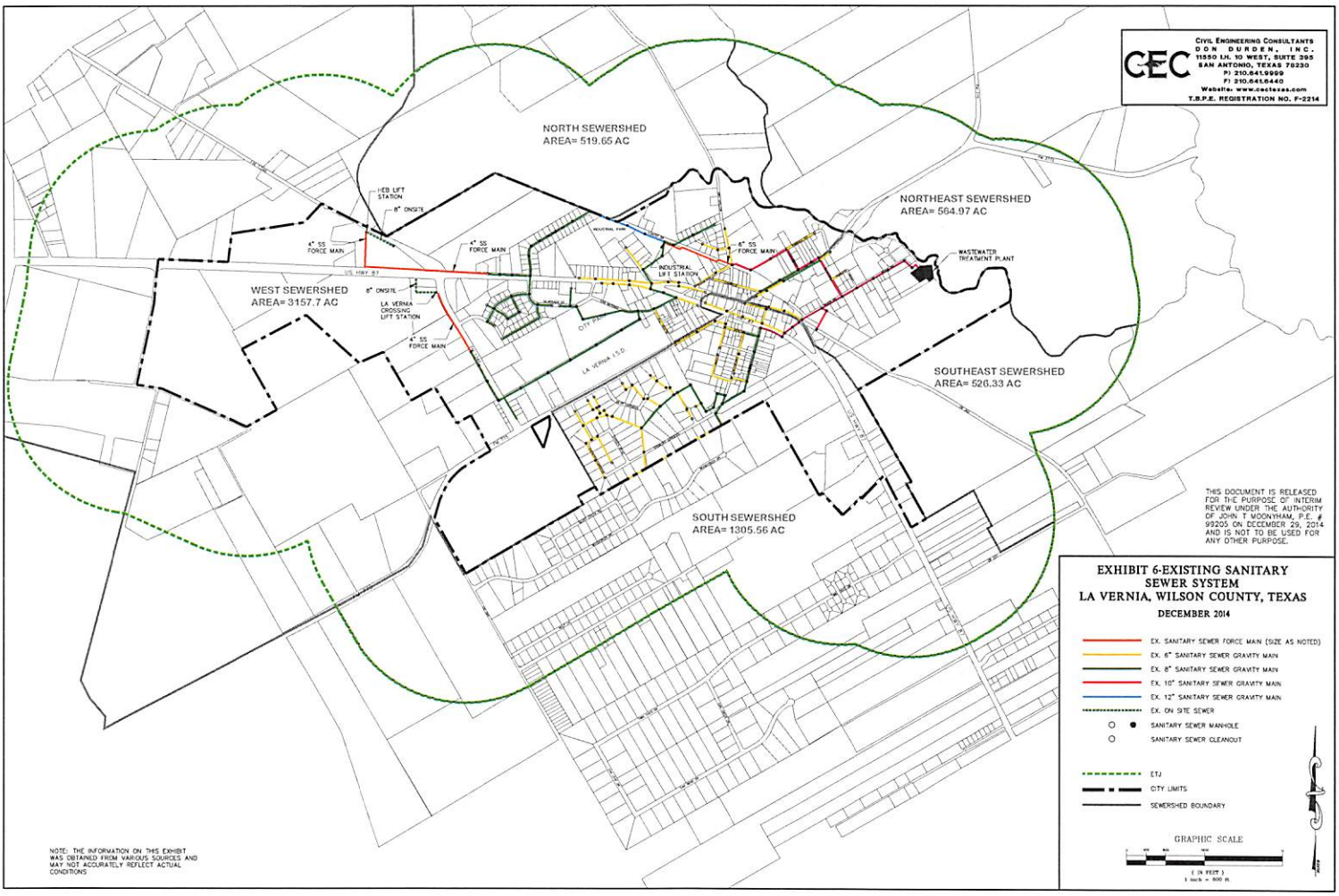
EXHIBIT 5-FIRE HYDRANT COVERAGE
LA VERNIA, WILSON COUNTY, TEXAS
DECEMBER 2014
EXISTING 1" WATER MAIN
EXISTING 1 1/2" WATER MAIN
EXISTING 2" WATER MAIN
EXISTING 3" WATER MAIN
EXISTING 4" WATER MAIN
EXISTING 6" WATER MAIN
EXISTING 8" WATER MAIN
EXISTING 10" WATER MAIN
EXISTING FLUSH VALVE
EXISTING FIRE HYDRANT
FIRE HYDRANT RANGE (R=300')
APPROXIMATE CCN
ETJ
CITY LIMITS
GRAPHIC SCALE
(IN FEET)
NOTE: THE INFORMATION ON THIS EXHIBIT WAS OBTAINED FROM VARIOUS SOURCES AND MAY NOT ACCURATELY REFLECT ACTUAL CONDITIONS


NORTH SEWERSHED
AREA= 519.65 AC
NORTHEAST SEWERSHED
AREA= 564.97 AC
WEST SEWERSHED
AREA= 3157.7 AC
SOUTHEAST SEWERSHED
AREA= 526.33 AC
SOUTH SEWERSHED
AREA= 1305.56 AC
HEB LIFT STATION
8" ONSITE
4" SS FORCE MAIN
6" SS FORCE MAIN
8" SS FORCE MAIN
INDUSTRIAL LIFT STATION
WASTEWATER TREATMENT PLANT
LA VERNIA CROSSING LIFT STATION
US HWY 87
CITY PK
LA VERNIA I.S.D.
CEC
CIVIL ENGINEERING CONSULTANTS
DON DURDEN, INC.
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T.B.P.E. REGISTRATION NO. F-2214
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EXHIBIT 6-EXISTING SANITARY SEWER SYSTEM
LA VERNIA, WILSON COUNTY, TEXAS
DECEMBER 2014
EX. SANITARY SEWER FORCE MAIN (SIZE AS NOTED)
EX. 6" SANITARY SEWER GRAVITY MAIN
EX. 8" SANITARY SEWER GRAVITY MAIN
EX. 10" SANITARY SEWER GRAVITY MAIN
EX. 12" SANITARY SEWER GRAVITY MAIN
EX. ON SITE SEWER
SANITARY SEWER MANHOLE
SANITARY SEWER CLEANOUT
ETJ
CITY LIMITS
SEWERSHED BOUNDARY
GRAPHIC SCALE
(IN FEET)
1 inch = 800 ft.
NOTE: THE INFORMATION ON THIS EXHIBIT WAS OBTAINED FROM VARIOUS SOURCES AND MAY NOT ACCURATELY REFLECT ACTUAL CONDITIONS


NORTH SEWERSHED
AREA= 519.65 AC
NORTHEAST SEWERSHED
AREA= 564.97 AC
WEST SEWERSHED
AREA= 3157.7 AC
SOUTHEAST SEWERSHED
AREA= 526.33 AC
SOUTH SEWERSHED
AREA= 1305.56 AC
LIFT STATION
WASTEWATER TREATMENT PLANT
CITY PARK
US HWY 87
GEC
CIVIL ENGINEERING CONSULTANTS
D.O.N. DURDEN, INC.
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EXHIBIT 7–PROPOSED SANITARY SEWER SYSTEM IMPROVEMENTS
LA VERNIA, WILSON COUNTY, TEXAS
DECEMBER 2014
15" SANITARY SEWER GRAVITY MAIN TO TREATMENT PLANT
6" SANITARY SEWER GRAVITY MAIN–UPGRADE CLAY SEWER LINES
8"SANITARY SEWER GRAVITY MAIN–EXTENTION FOR DEVELOPMENT
HWY 87 12" CHAMBER OF COMMERCE SEWER LINE
ETJ
CITY LIMITS
SEWERSHED BOUNDARY
GRAPHIC SCALE
(IN FEET)
1 inch = 800 ft
NOTE: THE INFORMATION ON THIS EXHIBIT WAS OBTAINED FROM VARIOUS SOURCES AND MAY NOT ACCURATELY REFLECT ACTUAL CONDITIONS