BEXAR METROPOLITAN WATER DISTRICT

BexarMet

FINAL REPORT: HILL COUNTRY AREA

LAND USE ASSUMPTIONS & CAPITAL IMPROVEMENT PROJECTS (CIPS)

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TABLE OF CONTENTS

Page No.

TABLE OF CONTENTS i

SERVICE AREA DESCRIPTION iv

HILL COUNTRY AREA VICINITY MAP v

Part A: CASTLE HILLS DISTRICT

Section 1: Introduction 1

Section 2: Land Use Analysis Methodology & Growth Predictions 1
Section 2.1. Land Use Methodology 1
Section 2.2. Land Use Category Definitions 2
Section 2.3. System Growth & Demands 3

Section 3: Evaluation of System 4
Section 3.1. Water Resources 4
Section 3.2. System Evaluation under TCEQ Minimum Requirements 4
Section 3.3. System Evaluation under AWWA M32 Peak Day Requirements 5

Section 4: Recommended Capital Improvement Projects 6

Section 5: Conclusion 7

LIST OF TABLES

Table 1 – Comparison between existing & ultimate development land uses 2

Table 2 – System growth & demands 4

Table 3 – System capacity according to TCEQ requirements 5

Table 4 – Peak demand & peak demands with unmetered losses by account type 5

Table 5 – Existing & ultimate peak day requirements 6

Table 6 – Peak day demands for each design year 9

LIST OF EXHIBITS

Exhibit 1 – Castle Hills District: 2008 Existing Land Use Map

Exhibit 2 – Castle Hills District: Ultimate Development Land Use Map

Exhibit 3 – Castle Hills District: Ultimate CIP Layout Map

LIST OF APPENDICES

Appendix A – CIP Cost Estimate

Appendix B – Existing Facility & Infrastructure Inventory

Page No.

Part B: HILL COUNTRY DISTRICT

Section 1: Introduction **1**

Section 2: Existing & Future Land Use Analysis & Growth Predictions **1**
Section 2.1. Land Use Category Definitions 1
Section 2.2. Land Use Methodology 2
Section 2.3. System Growth & Demands 5

Section 3: Evaluation of System **7**
Section 3.1. Water Resources 7
Section 3.2. System Evaluation under TCEQ Minimum Requirements 7
Section 3.3. System Evaluation under AWWA M32 Peak Day Requirements 8

Section 4: Recommended Capital Improvement Projects **9**
Section 4.1. 2008 Existing System CIPs 9
Section 4.2. 2013 CIPs 13
Section 4.3. 2018 CIPs 14

Section 5: Summary **15**

LIST OF TABLES

Table 1 – Existing & future conditions based upon land use categories 4

Table 2 – Existing & future conditions based upon land use categories. 5

Table 3 – System growth & demands 6

LIST OF FIGURES

Figure 1 – PRV & 12-in pipe on north side of Evans Road.

Figure 2 – 2008 CIP Project: Treasure Trail Dr. & Tomahawk Trail Pipe Replacement & Bitters Road Extension

LIST OF EXHIBITS

Exhibit 1 – Hill Country District: 2008 Existing Land Use Map

Exhibit 2 – Hill Country District: 2013 Future Land Use Map

Exhibit 3 – Hill Country District: 2018 Future (Ultimate Conditions) Land Use Map

Exhibit 4 – Hill Country District: CIP Layout Map

LIST OF APPENDICES

Appendix A – Graphs of System Growth Trends

Appendix B – TCEQ Minimum Criteria Analysis for 2008, 2013, & 2018

Appendix C – AWWA Peak Day Demand Criteria Applied to System

Appendix D – CIP Cost Estimate

Appendix E – Existing Facility & Infrastructure Inventory

SERVICE AREA DESCRIPTION

The Hill Country Area encompasses two distinct sub-areas; the Hill Country District and the Castle Hills District. Both districts are stand alone water systems that are owned and operated by Bexar Metropolitan Water District (BexarMet). The Vicinity Map on the following page depicts both the Hill Country and Castle Hills Districts. Shown on this map are descriptions of the various pressure zones in the district, their existing network of water mains, and the cities that are located within each district.

Lockwood, Andrews, & Newnam, Inc. (LAN) contracted with BexarMet to create water master plans for the Castle Hills and Hill Country Districts to aide in planning for the next ten year time period. This report describes the land use analysis and methodology used to evaluate the existing development of each district, as well as the prediction of future growth rates and development patterns for each area. Additionally, this report describes the hydraulic analysis and spreadsheet calculations that were completed for each district. The report also recommends capital improvement projects (CIPs) for each district. Reasons for each CIP is given as well as estimated costs.

See

Hill Country

Map 1

Part A: CASTLE HILLS DISTRICT
LAND USE ASSUMPTIONS & CAPITAL IMPROVEMENT PROJECTS

Section 1: Introduction

Bexar Metropolitan Water District's (BexarMet) Castle Hills District water system is a small stand alone water system that serves the City of Castle Hills. Castle Hills is located just west of Blanco Road and spans north and south of Loop 410. The system is comprised of three wells, two high service pumps, two elevated storage tanks (EST), one ground storage tank (GST), and one small pressure tank. The locations and sizes of these facilities are:

- One 750,000 gallon EST on Amhurst Drive
- One 1,444 gpm well and one 500,000 gallon EST near the intersection of NW Military Drive and West Avenue
- One 2,100 gpm well, a 1,000,000 gallon GST, and two high service pumps (rated at 1,200 gpm and 2,200 gpm) at the intersection of Lemonwood and Persimmon Drive
- One 2,047 gpm well and one 10,000 gallon pressure tank along Wottlin Road.

Lockwood, Andrews, & Newnam (LAN) evaluated the land use of the Castle Hills District and determined that this area is presently 96% developed. This area is expected to see minimal growth in the future. Based on this, the Castle Hills District water system was evaluated under existing and fully developed (*ultimate development*) conditions. It is not known when ultimate development conditions will occur.

Section 2 of this report summarizes the methodology used to evaluate the existing and ultimate land uses of the Castle Hills District. This section also shows the predicted ultimate number of service connections and equivalent dwelling units (EDUs) in this area. Section 3 of this report provides a summary of existing system deficiencies as well as evaluates the system according to ultimate (fully developed) conditions. BexarMet asked LAN to perform a "paper exercise" evaluation of this system to develop capital improvement projects (CIPs). Therefore, deficiencies are based solely on demand calculations and not pressure fluctuations. Section 4 of this report describes the CIPs needed to meet existing demand deficiencies and the projects needed to meet ultimate demand conditions for the Castle Hills District.

Section 2: Land Use Analysis Methodology & Growth Predictions

Section 2.1. Land Use Methodology

In accordance with the scope of work for the Castle Hills District Water Master Plan, LAN created an Existing Land Use Map (see Exhibit 1) and a Future (ultimate development conditions) Land Use Map (see Exhibit 2). The maps were created using ArcGIS software and used the most recent Bexar County aerials (2007), Bexar County Appraisal District land parcels shapefile (May 2008), and BexarMet customer accounts (June 2008) to evaluate the existing land uses of the area. LAN performed a "drive-by" check of the area to ensure the existing land uses assigned with these data sources were evaluated correctly. Additionally, LAN made a site visit

to the City of Castle Hills office to compare the existing land use map to the City's Zoning Map and allowable land uses.

As stated before, the existing Castle Hills District Service Area is about 96% developed, so it is likely that this area will see little growth in the future. To create the future land use map, all vacant land parcels were assigned a future land use based upon the City's Zoning Map to represent ultimate development conditions for the area. All land parcels in Castle Hills are already subdivided and have a land use assigned by the City's Zoning Map. There was no need to sub-divide parcels and no room for interpretation of land uses by LAN. It is worthwhile to mention that there is a 136-acre recreational park area owned by the Boy Scouts of America in the northwestern most corner of the Castle Hills Service Area. In the ultimate development conditions map, it is assumed that this area remains undeveloped because the Boy Scout Park is established with buildings, camping facilities, a swimming pool and other recreational facilities.

Section 2.2. Land Use Category Definitions

The following definitions describe the land use categories depicted upon the land use maps (Exhibits 1 and 2). Although true land uses are varied according to the descriptions shown in this section, BexarMet only categorizes water usage by four types in this area: commercial, residential, multi-family residential, and school. LAN and BexarMet consider "churches" to be a commercial service connections type. Also, Table 1 shows a comparison of existing and ultimate development land uses which are depicted on Exhibits 1 and 2.

Castle Hills District						
Land Use Categories	Existing - 2008			Ultimate Development		
	Number of Connections	Area Sum (acre)	Percentage of District Area	Number of Connections	Area Sum (acre)	Percentage of District Area
Agriculture	0	0.0	0.0%	0	0.0	0.0%
BexarMet Property	0	1.2	0.1%	0	2.2	0.1%
Church	16	43.0	2.5%	17	44.4	2.6%
Commercial	131	157.6	9.3%	162	192.0	11.3%
Industrial	0	0.0	0.0%	0	0.0	0.0%
Multi-Family Residential	62	60.7	3.6%	62	60.7	3.6%
Non-Developable	0	13.8	0.8%	0	13.8	0.8%
Park	0	152.0	8.9%	0	151.0	8.9%
Residential	2,400	1,076.9	63.4%	2,444	1,104.8	65.0%
School	13	125.2	7.4%	13	125.2	7.4%
Utility	0	5.5	0.3%	0	5.5	0.3%
Vacant	0	63.7	3.7%	0	0.0	0.0%

Table 1. Comparison between existing & ultimate development land uses.

Definitions for land use categories shown on Table 1 and in Exhibits 1 and 2:

BexarMet Property is a land use category that describes land owned by BexarMet Water District that may or may not already have facilities in place.

Church is a land use category that describes a parcel of land owned by a religious group that has a building upon it or potential to build a building on it.

Commercial is a land use category that describes a property with a business built upon it. This category may include a store, office building, car wash, grocery store, restaurant, medical building, or other miscellaneous commercial uses.

Multi-Family Residential is a land use category that describes an apartment complex, duplex, or condominium.

Park is a land use category that describes a sports field, community park, community swimming pool, green space or open area in a residential neighborhood, landscape buffers used in planned developments, or sidewalk areas adjacent to roadways.

Residential is a land use category that describes a single family dwelling.

School is a land use category that describes a public school (elementary, middle school, or high school) or a private school.

Utility is a land use category that describes property used by a utility company other than BexarMet (i.e. SAWS, CPS, Southwestern Bell, etc.)

Vacant is a land use category that describes a parcel of land that has no functional buildings built upon it, but has the potential to be developed into one of these other land use categories in the future.

Non-Developable is a land use category that describes a parcel of land that is vacant and has no potential for future development. These properties are set aside as drainage easements, are landlocked parcels, or are parcels within the 100-year floodplain.

Section 2.3. System Growth & Demands

Since, the Castle Hills District Water Master Plan scope is only for existing and ultimate conditions, it was not necessary to determine a growth rate for this system. Instead, LAN calculated the maximum possible number of service connections for the area by filling in all vacant properties with the appropriate connection type. Table 2 displays the existing and ultimate number of service connections for the system. Also shown in Table 2, is the number of equivalent dwelling units (EDUs) that is possible to add to the system to reach ultimate conditions. The average daily flow by account category shown in this table was calculated from five years of BexarMet historical customer billing records. The last two columns in this table show the existing and ultimate average water use for the Castle Hills District each year in acre-ft.

CASTLE HILLS DISTRICT ACCOUNT CATEGORY	NO. CONNECTIONS		NEW EDUs	AVG. DAILY FLOW (gpd/connection)	ANNUAL DEMAND (ac-ft/yr)	
	Existing Conditions (2008)	Ultimate Conditions			2008	Ultimate Conditions
Residential	2,400	2,444	57	468	1,258	1,281
Multi-Family	62	62	0	4,556	316	316
Commercial	147	179	122	1,373	226	275
School	13	13	0	4,276	62	62
TOTALS	2,622	2,698	179	-	1,863	1,935

Table 2. System growth & demands.

Note: 1 EDU = 360 gallons/day/connection using average daily flow.

Section 3: Evaluation of System

Section 3.1. Water Resources

BexarMet's Castle Hills District system has the equipment and facilities in place today to produce 5,591 gpm or 9,019 acre-ft/year of water, if available, from the Edward's Aquifer. This volume is more than sufficient than the average annual demand of 1,863 ac-ft/year under existing conditions or 1,935 ac-ft/year under ultimate conditions.

Section 3.2. System Evaluation under TCEQ Minimum Requirements

Section 290.45 – Minimum Water System Capacity Requirements from the TCEQ manual "*30 TAC Chapter 290 Subchapter D: Rules and Regulations for Public Water Systems*" defines requirements for community water systems based upon their number of connections. Through June of 2008, the Castle Hills District has a total of 2,622 connections. According to Section 290.45(b)(1)(D) from the TCEQ manual, a community water system with more than 250 connections has the following requirements:

- **290.45(b)(1)(D)(i)** – Two or more wells having a total capacity of 0.6 gpm per connection.
- **290.45(b)(1)(D)(ii)** – A total storage capacity of 200 gallons per connection.
- **290.45(b)(1)(D)(iii)** – For systems which provide an elevated storage capacity of 200 gallons per connection, two service pumps with a minimum combined capacity of 0.6 gpm per connection are required at each pump station or pressure plane.
- **290.45(b)(1)(D)(iv)** – An elevated storage capacity of 100 gallons per connection is required for systems with more than 2,500 connections.

Table 3 shows the total system capacity for the required components of the water distribution system. A comparison of the total system capacity based on the criteria found in TCEQ section 290.45(b)(1)(D), for existing and ultimate development conditions is also provided in Table 3.

System Component	Total Existing Capacity	Unit	TCEQ "Minimum" Required Design Capacity			
			Existing	Unit	Ultimate	Unit
3 Wells	5,591	gpm	1,574	gpm	1,619	gpm
2 High Service Pumps	3,400	gpm	1,574	gpm	1,619	gpm
1 Ground Storage Tank	1,000,000	gal	262,200	gal	269,800	gal
2 Elevated Storage Tanks	1,250,000	gal	262,200	gal	269,800	gal
Total Storage Capacity	2,250,000	gal	764,400	gal	779,600	gal

Table 3. System capacity according to TCEQ requirements.

The comparison shown in Table 3 indicates that the system has sufficient existing capacity to meet TCEQ "minimum" requirements for existing and ultimate conditions.

Section 3.3. System Evaluation under American Water Works Association (AWWA) M32 Peak Day Requirements

The AWWA M32 Manual, "Distribution Network Analysis for Water Utilities", recommends that a peak day extended period simulation be developed and used to analyze the water system under peak use conditions. BexarMet asked that LAN create a "paper exercise" study of the Castle Hills District only, so an extended period simulation was not performed in this case. The peak day study was performed using spreadsheet calculations only, not a hydraulic model. For the purposes of this study, the peak day demand for each account type was calculated by analyzing 5 years (2003 through June 2008) of customer billing account data. The largest daily demand (gal/connection/day) over the last 5 years for each account type was designated as the peak demand. (Data was reviewed to ensure that there were no anomalies or exaggerated uses.) Additionally, a 10% unmetered loss was added to the peak day demand for each account type. This unmetered loss was estimated by BexarMet and was included to account for the volume of water lost through leaks, fire flow tests, line flushing, water theft, and other non-measured uses of water throughout the system. Table 4 shows the peak demand and peak demand including unmetered losses by account type.

Account Type	Peak Demand (gal/conn/day)	% of Unmetered Losses	Peak + Unmetered Losses (gal/conn/day)	Usage for Future Planning (gal/conn/day)
Commercial	1,755	10%	1,930	**1,930**
Residential	868	10%	954	**954**
Multi-Family	6,739	10%	7,413	**7,413**
School	8,244	10%	9,068	**9,068**

Table 4. Peak demand & peak demands with unmetered losses by account type.

Table 5 provides comparison between the existing system capacity and the required capacity to meet existing and ultimate peak day (including unmetered losses) conditions. Total storage requirements for existing and ultimate peak design scenarios were calculated by multiplying the total peak demand (i.e., peak demand + unmetered losses) by the number of connections in each category resulting in the total required volume of storage in gallons per day. (Refer to Table 2 for the number of connections by account type for existing and ultimate development conditions.) Well and high service pump capacity was calculated as the total gallons/minute (gpm) needed to provide the sum of all peak + unmetered losses daily water demand converted into a gpm flow rate. Additionally, a fire flow requirement of 2000 gpm for two hours is added to the required capacity to meet peak day demands. By incorporating the fire flow, LAN has evaluated the system according to the worst case scenario – peak day demands with unmetered losses and a fire flow.

System Component	Existing System Capacity	Unit	Required Capacity to Meet Peak Day Demands			
			Existing	Unit	Ultimate Conditions	Unit
3 Wells	5,591	gpm	4,188	gpm	4,260	gpm
2 High Service Pumps	3,400	gpm	4,188	gpm	4,260	gpm
1 Ground Storage Tank	1,000,000	gal	N/A	N/A	N/A	N/A
1 Elevated Storage Tank	1,250,000	gal	N/A	N/A	N/A	N/A
Total Storage Capacity	2,250,000	gal	3,150,800	gal	3,254,536	gal

Table 5. Existing & ultimate peak day requirements.

For the existing total peak day conditions, the well capacity is more than sufficient for the Castle Hills water system. High service pump capacity is lacking with the addition of fire flow demands and the total storage capacity of 2.25 million gallons did not satisfy total peak day demand requirements. Additional high service pump capacity of 788 gpm is needed and additional storage of about 900,000 gallons is needed to fully satisfy these demands.

For the ultimate development conditions, the well capacity is still adequate. Additional high service pump capacity of 860 gpm is needed and additional storage of 1,004,536 gallons will be needed to meet the total peak day demands.

Section 4: Recommended Capital Improvement Projects

The following CIPs are recommended to meet existing system deficiencies and to serve the future growth of the system under peak day requirements with unmetered losses and with fire flow loads.

- 1.25 MG EST on corner of Boy Scout Park
- 2 – 450 gpm high service pumps added to existing facilities in the system.

Since Castle Hills is 96% developed, only four percent of the total CIP cost can contribute to the impact fee calculations. Also, it is recommended that these projects be constructed as soon as is feasible since the majority (96%) of the need is to fix existing system deficiencies. (See Exhibit

3 for a map depicting these CIPs.) Appendix A contains the CIP cost estimate and accompanying assumptions. The total estimated cost for these projects is about $3.7 million.

Section 5: Conclusion

An evaluation of the City of Castle Hills existing and future land uses was conducted. This area is presently 96 percent developed; therefore there is room for minimal future growth. All land parcels are already sub-divided and land uses have been assigned according to the City of Castle Hills Zoning Map. According to the Water Master Plan scope, existing and ultimate conditions land use maps were created along with determination of system demands under existing and ultimate conditions. The system was evaluated under both existing and ultimate conditions scenarios.

All components of the Castle Hills District water distribution system satisfy the TCEQ minimum water distribution requirements for existing and ultimate development conditions. However, after examination of the total peak day demands, it was determined that additional storage is needed for both existing and ultimate development conditions to satisfy peak demands on the system. A total of 0.9 million gallons (existing conditions) and 1.05 million gallons (ultimate conditions) of additional storage are needed to meet AWWA M32 Peak Day Requirements. Additionally, these volumes include adequate water storage for fire flows in the event that a fire occurs. Also, under peak day demands (including unmetered losses) and a fire flow, the system is lacking high service pump capacity. A total of 788 gpm under existing conditions or 860 gpm under ultimate conditions is needed.

APPENDIX A:
CIP COST ESTIMATE

CASTLE HILLS 10 YR. ESTIMATED IMPACT FEE (2008-2018)

Existing System CIPs Estimate of Probable Cost (2008 dollars)		Construction Costs
1. 1.25 MG EST with Land on Boy Scout Property		$3,500,174
2. 2-450 GPM HSP added to existing facilities (Location to be determined)		$186,000
	Total	$3,686,174

4% New Growth Cost **$147,447**

ASSUMPTIONS

OVERALL:
3% Interest Applied per year
7% increase applied for engineering costs of facility design
10% increase applied for engineering cost of infrastructure design
10% increase applied for construction contingency
5% increase applied for construction phase services
2% increase applied for program management

EXISTING SYSTEM CIPs

#1
- Total cost includes cost for 2 acres of land
- Total cost includes cost for on-site improvements such as grading, piping, fencing etc.
- Total cost does not include electrical to the site or offsite improvements

#2
- Total cost does not include electrical to the site or offsite improvements

APPENDIX B:
EXISTING FACILITY & INFRASTRUCTURE INVENTORY

Castle Hills Inventory

System Component	Total Existing Capacity	Unit
3 Wells	5591.00	gpm
2 High Service Pumps	3400.00	gpm
1 Ground Storage Tank	1000000.00	gal
2 Elevated Storage Tank	1250000.00	gal

Part B: HILL COUNTRY DISTRICT
LAND USE ASSUMPTIONS & CAPITAL IMPROVEMENT PROJECTS

Section 1: Introduction

The Hill Country District (HCD) is a stand-alone water system owned by Bexar Metropolitan Water District (BexarMet). The system, located in north central San Antonio, is west of Highway 281, east of Blanco Road and spans north and south of Loop 1604. The system consists of four different areas, starting from south to north, The City of Hill Country Village, The Town of Hollywood Park, Stone Oak Master Planned Development, Timberwood Park residential development (which contains the Oliver Ranch development). In general, this water system is characterized by high water consumers and is approximately 75 percent developed. The certificate of convenience and necessity (CCN) boundary for the system is not anticipated to be extended. It is bound by the San Antonio Water System (SAWS) CCN to the south and east and southwest, and is bound by Camp Bullis Army Base to the west. There is room for growth to the north, however TCEQ has mandated that BexarMet not grow their system any more until existing deficiencies are remedied. It is important to bring this system up to standard requirements and plan for the continued future growth of the area.

Section 2 of this report will describe the methodology used in the land use analysis. Section 2 also describes the growth trends for the service area. The growth trend for the area is based upon the increase in service connections each year for the system according to data provided by BexarMet. The growth patterns indicate how many parcels of land are populated according to their assigned land use for each design year. Section 3 will evaluate the system with respect to existing system deficiencies, water resources availability, and future design years (2013 and 2018). TCEQ minimum water system criteria are used to evaluate the system first, and then peak day demands. A hydraulic model was used to evaluate the various design scenarios and proposed capital improvement projects (CIPs) in the system. Section 4 of this report will describe the recommended CIPs needed to help alleviate existing deficiencies (2008) and for the future design years (2013 and 2018).

Section 2: Existing & Future Land Use Analysis & Growth Predictions

This section explains the methodology used in the existing and future land use analysis and growth projections for BexarMet's HCD. It should be understood that future projections of land use and growth are a prediction only. These predictions are based upon existing land uses, master development plans, city zoning maps and current growth trends; however, this methodology and the accompanying land use maps may not accurately reflect how development will ultimately occur in these areas.

Section 2.1. Land Use Category Definitions

The following definitions describe the land use categories depicted upon the land use maps (Exhibits 1, 2, and 3). Although true land uses are varied according to the descriptions shown in this section, four major categories of water usage were used in the evaluation of this water

system: commercial, residential, multi-family residential, and school. LAN and BexarMet consider "churches" to be a commercial service connection type.

BexarMet Property is a land use category that describes land owned by BexarMet Water District that may or may not already have facilities in place.

Church is a land use category that describes a parcel of land owned by a religious group that has a building upon it or potential to build a building on it.

Commercial is a land use category that describes a property with a business built upon it. This category may include a store, office building, car wash, grocery store, restaurant, medical building, or other miscellaneous commercial uses.

Multi-Family Residential is a land use category that describes an apartment complex, duplex, or condominium.

Park is a land use category that describes a sports field, community park, community swimming pool, green space or open area in a residential neighborhood, landscape buffers used in planned developments, or sidewalk areas adjacent to roadways.

Residential is a land use category that describes a single family dwelling.

School is a land use category that describes a public school (elementary, middle school, or high school) or a private school.

Utility is a land use category that describes property used by a utility company other than BexarMet (i.e. SAWS, CPS, Southwestern Bell, etc.)

Vacant is a land use category that describes a parcel of land that has no functional buildings built upon it, but has the potential to be developed into one of these other land use categories in the future.

Non-Developable is a land use category that describes a parcel of land that is vacant and has no potential for future development. These properties are set aside as drainage easements, are landlocked parcels, or are parcels within the 100-year floodplain.

Section 2.2. Land Use Methodology

The HCD includes the City of Hill Country Village, the Town of Hollywood Park, Stone Oak Development, and the Timberwood Park Development with surrounding neighborhoods. In accordance with the scope of work for the HCD, LAN created an Existing Land Use Map and Future Land Use Maps in intervals of 5 years until the year 2028 or until maximum development was reached. These maps were created with ArcGIS and used the most recent Bexar County aerials (2007), Bexar County Appraisal District land parcels (May 2008) and BexarMet customer accounts (June 2008) to evaluate the existing land uses of the area. LAN also performed a "drive-by" check of the area to ensure the existing land uses were evaluated correctly.

Northeast Independent School District (ISD) services the majority of the Hill Country District. The Northeast ISD website was consulted to see if there were any future schools planned for this area. Based on information from this website, no future public schools are planned for this area. Additionally, the Stone Oak Master Development Plan (MDP) was reviewed to determine if any vacant properties were set aside for future public schools. No future school properties were located within this area. However, one school (private) parcel along Blanco Road was added by the year 2018 because Rolling Hills Academy owns a 10.25-acre parcel of land adjacent to their existing building. LAN is predicting that the school will expand and construct a new building facility on this site in the future. The northern portion of Timberwood Park is located within the Comal ISD jurisdiction. This is discussed in the Timberwood Park section below.

Hill Country Village and Hollywood Park

Allowable land use and zoning was determined uniquely for each city within the water service area. The City of Hill Country Village and the Town of Hollywood Park's land uses were determined by zoning maps from their respective city's website. This enabled vacant parcels to be assigned the appropriate land use for future years. Both of these cities had only a minimal number of vacant parcels as they are well established neighborhoods that are almost fully developed. All parcels in these two areas were already sub-divided and had an assigned zoning category; therefore there was no need to sub-divide parcels and no room for interpretation of land use by LAN.

Stone Oak

Zoning in Stone Oak was determined by reviewing the Master Development Plans (MDP) from the City of San Antonio (COSA) website. The MDPs described the various neighborhoods and developments in Stone Oak, as well as land uses and school locations. The COSA Development Services GIS website was used along with the MDP to determine specific allowable land uses for each parcel. Vacant or agricultural land parcels were occupied (developed) based on the following methodology.

Established neighborhoods with some empty parcels were the first to be considered developed in the 2013 land use map. Then, areas which had constructed roads and already sub-divided parcels but did not have buildings or connections to the water lines were the next to be developed according to their assigned land use. The majority of areas (with already sub-divided parcels) directly adjacent to major arterials such as Huebner Road, Stone Oak Parkway, Blanco Road and Wilderness Oak etc. which showed up as vacant on the current maps were converted to commercial areas by 2013. Finally, by 2018, large undeveloped parcels (mostly agricultural land in 2008) were sub-divided and assigned a future land use based upon the zoning ordinances, surrounding neighborhoods, and street classifications. For example, a 50-acre agricultural parcel adjacent to a residential neighborhood zoned R5 (single family dwellings with a minimum lot size of 6,000 square feet) was divided into 311 residential lots. This is 50 acres (2,178,000 square feet) divided by 7,000 square feet (an extra 1,000 square feet was allowed for streets and open space) to equal 311 residential lots.

Table 1 summarizes the existing and future (2013 and 2018) land use conditions for Stone Oak, Hollywood Park, and Hill Country Village. By the year 2018, all vacant lots were occupied and all agricultural lots were considered developed, so maps for 2023 and 2028 are not included.

Timberwood Park land uses and growth is accounted for in the next section. BexarMet measures Timberwood Park data separately; therefore LAN also evaluated this area independently.

Hill Country District (Hollywood Park, Stone Oak, Hill Country Village)									
Landuse Categories	Existing - 2008			Projected - 2013			Projected - 2018 (Ultimate Conditions)		
	Number of Connections	Area Sum (acre)	Percentage of District Area	Number of Connections	Area Sum (acre)	Percentage of District Area	Number of Connections	Area Sum (acre)	Percentage of District Area
Agriculture	0	1,068.9	11.0%	0	763	7.9%	0	0.0	0.0%
BexarMet Property	0	10.1	0.1%	0	10.1	0.1%	0	10.1	0.1%
Church	10	181.3	1.9%	10	181.3	1.9%	12	263.6	2.7%
Commercial	831	1,110.2	11.4%	1,069	1,386.2	14.3%	1,308	1,746.7	18.0%
Industrial	1	0.3	0.0%	1	0.3	0.0%	1	0.3	0.0%
Multi-Family Residential	10	140.9	1.5%	12	171.6	1.8%	13	175.3	1.8%
Non-Developable	0	860.1	8.9%	0	860.1	8.9%	0	860.1	8.9%
Park	0	152.9	1.6%	0	152.9	1.6%	0	152.9	1.6%
Residential	12,023	5,093.6	52.5%	13,579	5,629.0	58.0%	15,133	6,244.2	64.4%
School	9	237.8	2.5%	10	248.0	2.6%	10	248.0	2.6%
Utility	0	1.5	0.0%	0	1.5	0.0%	0	1.5	0.0%
Vacant	0	845.8	8.7%	0	299.0	3.1%	0	0.0	0.0%

Table 1. Existing & future conditions based upon land use categories.

Timberwood Park

Timberwood Park is located outside the city limits of San Antonio, therefore there are no official zoning restrictions on the land. The area is mostly residential with a few commercial parcels on major arterial streets like Blanco Road, Borgfield Road, Overlook Parkway, and along Highway 281. The area is comprised mostly of the Timberwood Park Development with additional developers building residential neighborhoods around the fringe and just west of Highway 281 on Overlook Parkway in an area named Oliver Ranch Development. The northern portion of the Timberwood Park area is served by Comal Independent School District (ISD).

Vacant land parcels in the Timberwood Park area were developed based on the following methodology. LAN spoke with Mr. Ryan Gale, developer of Timberwood Park, to determine the plan for this area as well as the amount of vacant property. Mr. Gale said that Timberwood Park property is 99% sold out and that there are about 2700 homes constructed of a possible 3263 lots. In general, most lots in Timberwood Park have been sub-divided as of 2008. Mr. Gale pointed out a 70 lot garden home development and 39 half acre to one and a half acre lots neighborhood that will be developed by early 2009. Per this conversation, these lots were considered developed by the 2013 land use map. Additionally, Mr. Gale pointed out a parcel of land adjacent to Timberwood Park Elementary School that has been set aside for Comal ISD to build a future middle school on if/when it is needed. This new school is reflected in the 2013 Future Land Use Map. Presently, there are 2 schools located in the Timberwood Park area (occupying 3 parcels of land). The new middle school will occupy two parcels of land, resulting in schools occupying 5 total land parcels in the future.

Similar to Stone Oak, vacant subdivided lots were considered to be occupied in future years first. After all the subdivided lots were filled, large undeveloped parcels (mostly agricultural land as of 2008) were sub-divided and assigned a future land use based upon the surrounding land uses and lot sizes. A few commercial lots were added along arterial streets in this area like Blanco Road, Overlook Parkway, Highway 281, and Canyon Golf Road.

Table 2 summarizes the existing and future (2013 & 2018) land use conditions for Timberwood Park. By the year 2018, all vacant lots were occupied and all agricultural lots were considered developed. Additionally, maps for 2023 and 2028 are not included or needed for this area or the HCD as a whole.

Timberwood Park									
Landuse Categoies	Existing - 2008			Projected - 2013			Projected - 2018 (Ultimate Conditions)		
	Number of Connections	Area Sum (acre)	Percentage of District Area	Number of Connections	Area Sum (acre)	Percentage of District Area	Number of Connections	Area Sum (acre)	Percentage of District Area
Agriculture	0	368.7	9.4%	0	202.5	5.2%	0	0.0	0.0%
BexarMet Property	0	18.5	0.5%	0	18.5	0.5%	0	18.5	0.5%
Church	0	0.0	0.0%	1	24.8	0.6%	1	24.8	0.6%
Commercial	13	16.3	0.4%	34	66.7	1.7%	55	99.2	2.5%
Industrial	1	12.5	0.3%	1	12.5	0.3%	1	12.5	0.3%
Multi-Family Residential	1	27.2	0.7%	1	27.2	0.7%	1	27.2	0.7%
Non-Developable	0	145.0	3.7%	0	145.0	3.7%	0	145.0	3.7%
Park	0	40.2	1.0%	0	40.2	1.0%	0	40.2	1.0%
Residential	4,428	2,343.4	59.7%	5,703	2,996.4	76.4%	6,977	3,516.1	89.6%
School	2	26.5	0.7%	3	32.7	0.8%	3	32.7	0.8%
Utility	0	6.0	0.2%	0	6.0	0.2%	0	6.0	0.2%
Vacant	0	917.8	23.4%	0	349.7	8.9%	0	0.0	0.0%

Table 2. Existing & future conditions based upon land use categories.

Section 2.3. System Growth & Demands

Development growth rate assumptions were made for Hill Country Village, Hollywood Park, and Stone Oak all together and then the Timberwood Park area separately. They were divided into these two categories because BexarMet collects data separately for Timberwood Park. The growth projection methodology is based upon records received from BexarMet describing the number of residential, commercial, school, multi-family, and total connections for each of the two areas. Hill Country Village, Hollywood Park, and Stone Oak together have monthly connection data recorded for the year 1998 and then for 2001 to 2008. The Timberwood Park area has connection data recorded from 2003 to 2008.

The number and type of connections at the end of each year were tabulated for each development area by BexarMet. LAN plotted these data points and applied trend lines to the plots to forecast future growth in the areas. Various types of trend lines (i.e. – linear, exponential, logarithmic, and power) were applied to each data set to determine the trend which produced the best fit line

(highest R-squared value) and still produced a realistic forecast. After determining the best fit curve for the data, the resulting trendline equation was used to extrapolate the predicted number of connections for the upcoming years. Generally, a linear trendline was not selected for the growth projections because it predicted that development continue at an unrealistic fast pace, predicting more future connections than could physically fit on the available vacant properties according to zoning regulations. In most cases, a power or logarithmic trend line was used because it predicted that the growth rate would level off as time increased. The tables and plots for each development area follow at the end of this report in Appendix A.

According to the projections used, Hill Country Village, Hollywood Park, and Stone Oak together had enough vacant property to experience growth until the year 2018. Timberwood Park has enough vacant property to experience growth until the year 2018 as well. Therefore, the 2018 land use map is the final map created for the entire HCD Service Area and represents ultimate development conditions. Maps for the 2023 and 2028 design years were not needed.

Table 3 shows the existing and future number of service connections for the HCD system. Also shown, is the number of equivalent dwelling units (EDUs) that is possible to add to the system to reach ultimate conditions (design year 2018). The average daily flow by account category (used in the new EDU calculation) shown in this table was calculated from five years of BexarMet historical customer billing records. The last three columns of this table show the existing, future, and ultimate average water use for the HCD each design year in acre-ft.

HILL COUNTRY DISTRICT	NO. CONNECTIONS			NEW	AVG. DAILY FLOW	ANNUAL DEMAND (ac-ft/yr/total conn.)		
ACCOUNT CATEGORY	2008	2013	2018	EDUs	(gpd/connection)	2008	2013	2018
Hill Country Village								
Residential	351	358	365	37	960	377	385	392
Commercial	176	179	182	25	1,488	293	298	303
Hollywood Park								
Residential	1,273	1,280	1,286	19	519	740	744	748
Commercial	126	129	132	30	1,774	250	256	262
Stone Oak								
Residential	10,399	11,941	13,482	4,539	530	6,174	7,089	8,004
Multi-Family	10	12	13	137	16,404	184	211	239
Commercial	537	772	1,007	2,857	2,188	1,316	1,892	2,468
School	9	10	10	n/a	7,750	78	82	87
Timberwood Park								
Residential	4,428	5,703	6,977	3,753	530	2,629	3,385	4,142
Multi-Family	1	1	1	0	16,404	18	18	18
Commercial	14	36	57	182	1,526	24	61	97
School	2	3	3	n/a	7,750	17	22	26
TOTALS	**17,326**	**20,421**	**23,515**	**11,578**		**12,101**	**14,444**	**16,787**

Table 3. System growth & demands.

Note: 1 EDU = 360 gallons/day/connection applied to average daily flow.

Section 3: Evaluation of System

Section 3.1. Water Resources

The greatest challenge in the HCD service area is continuing to locate and develop water resources to meet the large demands of this growing system. This area is characterized by high consumptive end users. Timberwood Park is located over the Trinity Aquifer which according to BexarMet's Water Resources Planning Department can accommodate new wells. The challenge in Timberwood Park is that new wells are not as high of producers as a similarly sized Edward's Aquifer wells. Therefore, more wells must be drilled in the Trinity Aquifer to produce an equivalent amount of water from the Edward's Aquifer. Hill Country Village, Hollywood Park, and Stone Oak are located over the Edward's Aquifer. Presently, the well site on Bitters Road at the southern most tip of Hill Country Village is the location of the highest producing Edward's wells in the HCD and the single water source for Stone Oak. This single water source will not be sufficient to meet the increasing water demands in future design years. An alternate water source must be developed to supplement these wells. An additional concern is that all water delivered to Stone Oak Development is transported by a 48-in transmission main from the Bitters Road well field. If this source or pipeline ever failed for any reason, Stone Oak would be out of water.

Sections 3.2 and 3.3 evaluate the HCD system under TCEQ minimum criteria and under American Water Work Association (AWWA) M32 Manual peak day requirements. Additionally, LAN developed a hydraulic model of the system to identify general problem areas and test recommended CIPs.

Section 3.2. System Evaluation under TCEQ Minimum Requirements

Section 290.45 – Minimum Water System Capacity Requirements from the TCEQ manual "*30 TAC 290 Subchapter D: Rules and Regulations for Public Water Systems*", defines requirements for community water systems based upon their number of connections. Through the month of June 2008, the Hill Country District has a total of 17,326 connections categorized as commercial, residential, multi-family, and school uses. Table 3 shows the distribution of connections by account type for present (June 2008) as well as for future design year conditions (2013 and 2018).

According to Section 290.45(b)(1)(D) from the TCEQ manual, a community water system with more than 250 connections has the following requirements:

- **290.45(b)(1)(D)(i)** – Two or more wells having a total capacity of 0.6 gpm per connection.
- **290.45(b)(1)(D)(ii)** – A total storage capacity of 200 gallons per connection.
- **290.45(b)(1)(D)(iii)** – For systems which provide an elevated storage capacity of 200 gallons per connection, two service pumps with a minimum combined capacity of 0.6 gpm per connection are required at each pump station or pressure plane.
- **290.45(b)(1)(D)(iv)** – An elevated storage capacity of 100 gallons per connection is required for systems with more than 2,500 connections.

Appendix B compares the total design capacity of the system to the criteria found in TCEQ section 290.45(b)(1)(D) for existing and future year (2013 and 2018) development conditions loads. The comparisons shown in this appendix indicates that the system has sufficient existing capacity to meet TCEQ "minimum" requirements for existing (2008), 2013, and 2018 (ultimate conditions).

Additionally, Section 290.44(d) from the TCEQ manual states minimum pressure requirements for normal and fire flow conditions:

- **290.44(d)** – The system must be designed to maintain a minimum pressure of 35 psi at all points within the distribution network at flow rates of at least 1.5 gallons per minute per connection. When the system is intended to provide fire fighting capability, it must also be designed to maintain a minimum pressure of 20 psi under combined fire and drinking water flow conditions.

These minimum criteria are not always met under existing conditions. The fire flow and minimum system pressure criteria were tested in the hydraulic model. Many of the existing system deficiencies identified relate to pressures dropping too low under normal or fire flow conditions. If the CIPs recommended in Section 4.1 of this report are constructed, that will help meet this TCEQ criterion regarding minimum pressures.

Section 3.3. System Evaluation under AWWA M32 Peak Day Requirements
The AWWA M32 Manual, "Distribution Network Analysis for Water Utilities", recommends that a peak day extended period simulation be developed and used to analyze the water system under peak use conditions. This means historical peak demands were input into an existing conditions 2008 hydraulic model, 2013 future conditions model, and a 2018 future conditions hydraulic model to determine system's performance for each design year. Additionally, spreadsheet calculations were completed for each study period using peak day demands to determine the big picture of where the system falls short of meeting the peak day demands for each design year (see Appendix C). Table 4 shows the historical peak daily flow for each area in the system as well as the peak daily demands applied to each design year. In the hydraulic and spreadsheet analysis of each future design year, the growing system repeatedly fell short of being able to meet the peak daily demands. Therefore, CIPs were recommended for each design year, which will help alleviate the deficiencies. If the CIPs recommended in Section 4.2 and 4.3 are constructed, this will help the system serve peak day demands according to both the hydraulic model and the spreadsheet analysis.

HILL COUNTRY DISTRICT ACCOUNT CATEGORY	CONNECTIONS			Peak Daily Flow		PEAK DAILY DEMAND (GPM/ total conn.)		
	2008	2013	2018	(gpm)	(gpd)	2008	2013	2018
Hill Country Village								
Residential	351	358	365	1.34	1,933	471	481	490
Commercial	176	179	182	1.40	2,013	246	250	254
Hollywood Park								
Residential	1,273	1,280	1,286	0.75	1,074	949	954	959
Commercial	126	129	132	2.54	3,664	321	328	336
Stone Oak								
Residential	10,399	11,941	13,482	0.64	925	6,680	7,670	8,660
Multi-Family	10	12	13	21.38	30,785	214	246	278
Commercial	537	772	1,007	2.34	3,369	1,256	1,806	2,356
School	9	10	10	8.95	12,891	81	85	90
Timberwood Park								
Residential	4,428	5,703	6,977	0.64	925	2,844	3,663	4,482
Multi-Family	1	1	1	21.38	30,785	21	21	21
Commercial	14	36	57	2.37	3,418	33	84	135
School	2	3	3	8.95	12,891	18	22	27
TOTALS	**17,326**	**20,421**	**23,515**			**13,135**	**15,612**	**18,088**

Table 4. Peak day demands for each design year.

Section 4: Recommended Capital Improvement Projects

Each recommended CIP is described in bulleted lists in Sections 4.1, 4.2, and 4.3 along with the reason the project is needed. Exhibit 4 displays the location of each proposed CIP and color codes the CIPs according to the year that they need to be in service. Appendix D contains a summary of the cost estimate for each CIP. It can be assumed that design of the facility needs to begin two years before the in-service date and construction should begin a minimum of one year before the in-service date.

Section 4.1. 2008 Existing System CIPs

The following CIPs are needed as soon as possible to meet existing system deficiencies. This section only includes projects not under construction as of the date of this report, November 2008.

- **2 million gallon (MG) ground storage tank (GST) with high service pumps (HSPs) at the Stein Tract:** Page 1 of Appendix C shows that the Hill Country District is lacking approximately 3.6 million gallons of storage under peak day requirements. The addition of this 2 MG GST to the system will eliminate some of the storage deficiency. Another benefit to constructing this storage tank is that each of the Stein well pump capacities will increase when they pump directly to the tank (per BexarMet's Production Department). Presently, without a GST at this site, the well pumps are pushing against the pressure gradient, which decreases their well pumping capacity.

- **2.5 MG elevated storage tank (EST) at the Hardy Oaks and Blanco Road Site:** Constructing an EST at the Hardy Oaks and Blanco site will fulfill the remaining peak day storage requirements needed in 2008 (shown on page 1 of Appendix C). LAN strongly recommends that this tank be elevated and not just a GST is because there is presently not an EST in the 1395-ft pressure zone. An EST will provide constant, steady

pressures to the system, especially in the northern portion of the 1395-ft pressure zone where meeting fire flow requirements under existing conditions is a problem. An EST is simple in operation (when compared to a GST with HSPs) and will provide a buffer between pumps and the water distribution system. BexarMet has this EST at Hardy Oaks and Blanco on their 2008/2009 CIP list.

- **5,800 linear feet (LF) of 24" ductile iron (DI) pipeline from Hardy Oaks EST to the Panther Creek Subdivision:** This 24" pipeline will connect the Hardy Oaks EST to the 12" line near the entrance of the Panther Creek Subdivision (Calico Landing Rd. and Blanco Rd). A PRV will be installed on this line at a hydraulic grade line of 1325-ft. This 24" pipeline will allow the Hardy Oaks EST to feed the Panther Creek Subdivision, which is presently in the 1290-ft pressure zone with a greater hydraulic grade. This neighborhood experienced very low pressures (< 20 psi) when residential fire flow tests (1500 gpm) were run on nodes within the neighborhood. Therefore, this subdivision needs to be connected to the higher pressure zone via a water line and PRV to remedy these problems.

- **1,800 LF of 24" DI pipeline from the Hardy Oaks EST to Hardy Oaks BLVD Tie-In:** This 24" pipeline will connect the Hardy Oaks EST to an existing 12" main running along Hardy Oaks Blvd, just west of the proposed tank. This pipeline will tie the Hardy Oaks EST into the 1395-ft pressure zone.

- **1 - 400 gpm Well and Pump at the Timberline Station:** LAN recommends drilling a third well at the Timberline site to supply the additional necessary well capacity to meet peak day requirements shown on page 7 of Appendix C. This new well will pump into the recently constructed 1 million gallon GST at Timberline Station. This is a new project proposed by LAN that is not currently on the 2007-2008 Hill Country Service Area CIP Plan.

- **Replace all 3", 4", and 5" Water Mains with 87,000 LF of 8" DI Pipe in Timberwood:** The upgrading of all sub-standard 3", 4", and 5" pipe to 8" pipes will eliminate pressure deficiencies during fire flow and peak usage requirements. LAN strongly recommends that BexarMet replace the undersized mains throughout Timberwood Park, because they are a safety concern. The hydraulic model produces pressures less than 20 psi and often closer to zero psi during fire flow analysis of this area. This project is an existing system deficiency and will cost an estimated $15 million. This may be a cost prohibitive project to complete in one year, but possibly BexarMet could begin replacing mains in this area now and budget a certain dollar amount per year to replace mains until the upgrading is complete.

- **6,100 LF of 12" DI pipeline with a pressure reducing valve (PRV) - north side of Evans Rd from Wind Springs to just West of Peacemaker:** This 6,100 LF 12" water line will extend along the north side of Evans Road from Wind Springs to just West of Peacemaker. (See the project area map on the next page.) In the existing system both neighborhoods north and south of Evans Rd. are fed off the existing 12" main which runs along the south side of the road. The topography in this area is varied. The existing PRV

on Evans Rd. is needed to regulate pressures south of Evans Rd. However, because of this existing PRV, the neighborhood north of Evans Rd. does not receive enough water pressure for daily use or fire flows. The proposed main on the north side of Evans Rd. will feed the subdivision off of Harvest Hills Street with the 1290' hydraulic grade. The proposed PRV at Evans Rd. and Wind Springs will provide a second feed to the neighborhood south of Evans Rd. while regulating pressure delivered to that area. This is a new project proposed by LAN that is not currently on the 2007-2008 Hill Country Service Area CIP Plan. Also, extending this line and "double maining" Evans Road is good engineering practice because this is a major road in Stone Oak and this road has future growth potential. This main will serve some new developments and service connections over the next ten years.

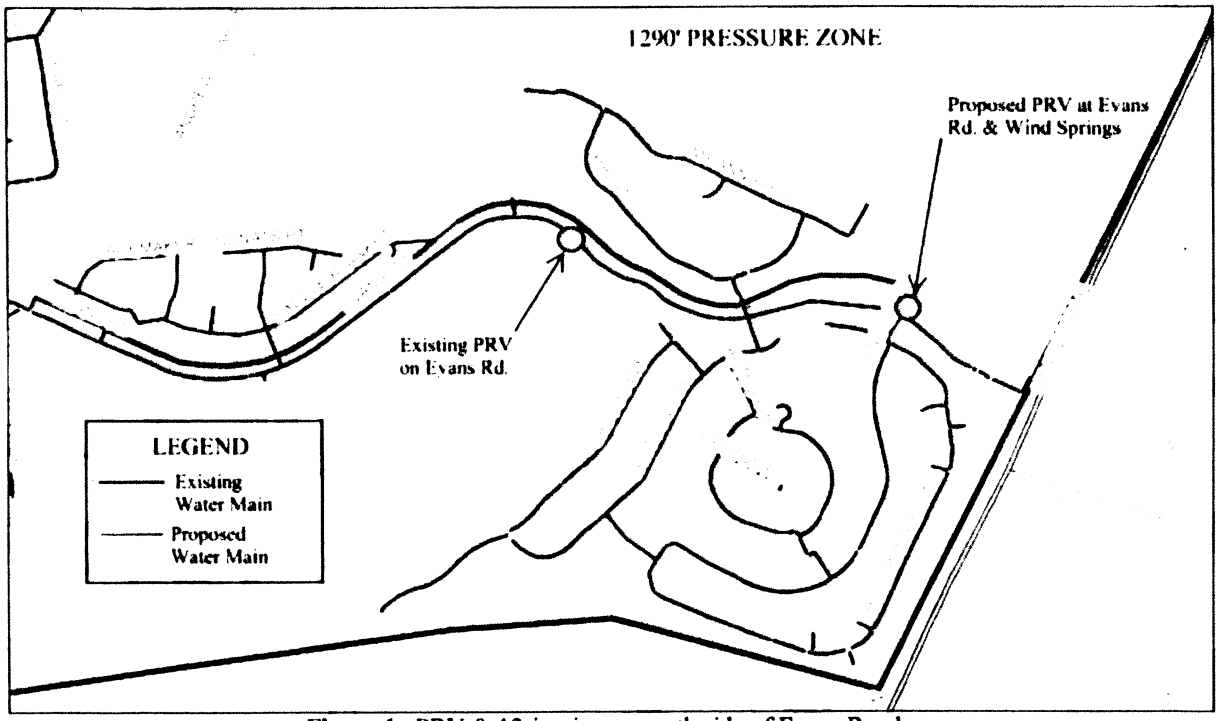


Figure 1. PRV & 12-in pipe on north side of Evans Road.

- **700 LF of 8" DI pipe to extend the main on Hidden Pass Street to Hidden View:** This project is located on a residential street in Hill Country Village. This 8" line will extend from the existing 6" cast iron line at the intersection of Hidden Pass and Village Circle until it 'T's into the to the existing 8" line running along Hidden View. The proposed 8" line is needed to increase pressures in this area under fire flow conditions. This is a new project proposed by LAN that is not currently on the 2007-2008 Hill Country Service Area CIP Plan.

- **3,930 LF of 8" DI pipe to replace 6" pipe on Treasure Trail Drive and Tomahawk Trail. Extend 12" pipe along Bitters Road 1,515 LF from Tomahawk Trail to Treasure Trail:** Treasure Trail Drive and Tomahawk Trail (between Blackhawk Trail Drive and Bitters Road) in Hill Country Village are presently served by 6-in diameter water mains. Fire flow tests were run on each of these streets and the pressure in the line dropped well below 20 psi. Therefore, LAN recommends that these pipes be replaced and upgraded with 8-in ductile iron (DI) water mains. Additionally, an existing 12-in main runs along Bitters Road beginning at Winding Way Drive and truncates at the intersection of Bitters Road and Tomahawk Trail. Presently, this main on Bitters Road does not tie into the existing 6-in main on Tomahawk Trail. It is recommended that this main along Bitters Road be tied into the proposed 8-in DI main on Tomahawk Trail. Also, it is recommended that the existing 12-in main on Bitters Road be extended as a 12-in water main and tied into the proposed 8-in DI main on Treasure Trail Drive. These recommendations will add loops to the existing truncated water mains in this area, thus allowing fire flow demands to be achieved adequately. When this scenario was tested in the hydraulic model with these recommended improvements, all fire flow tests passed. It is recommended that the existing water main sizes in this area are field verified before design of the new water lines begins. (See Figure 2 to view map of this proposed project.)

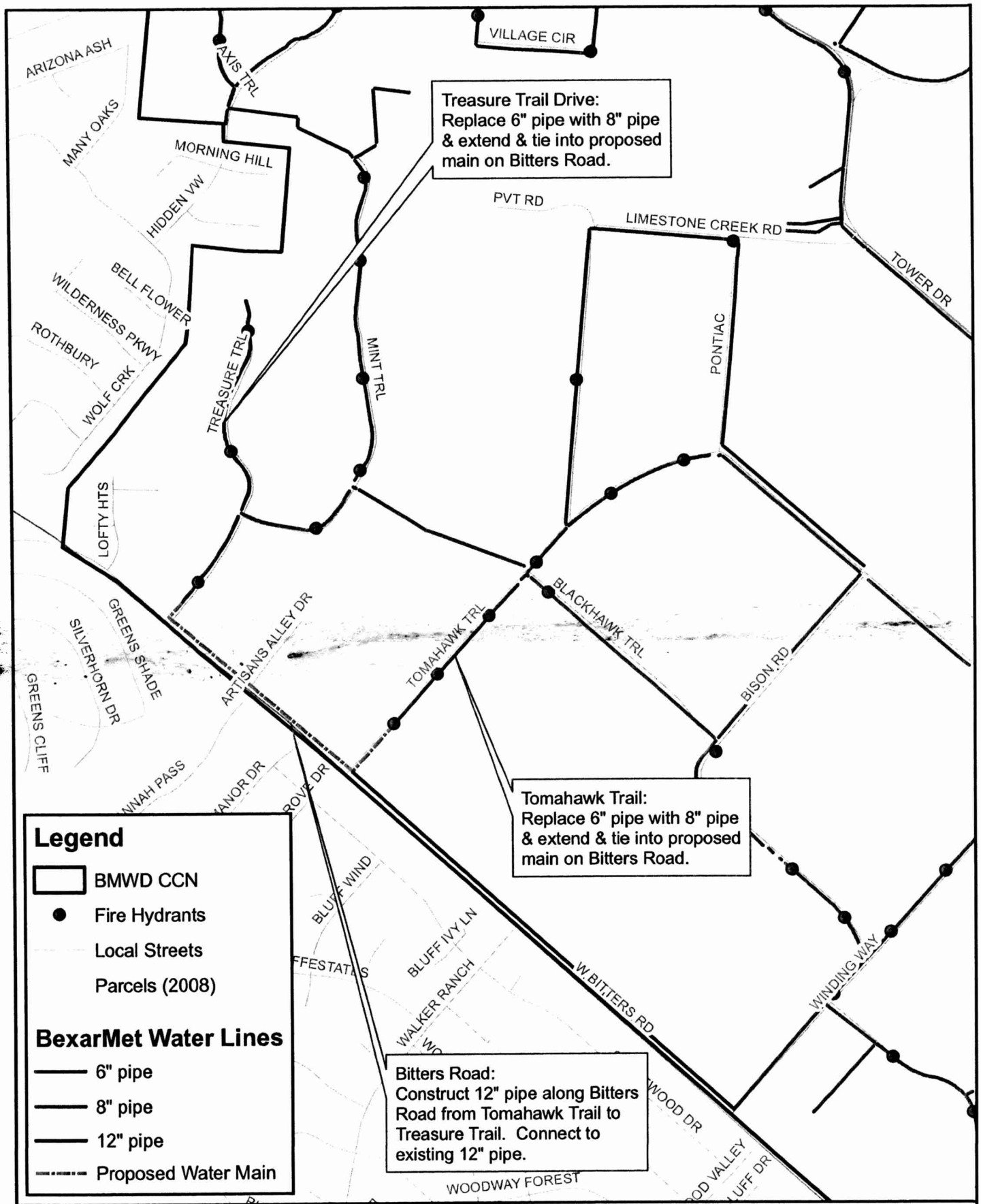


Figure 2: 2008 CIP Project
Treasure Trail Dr. & Tomahawk Trail
Pipe Replacement & Bitters Rd. Extension

BexarMet

Lockwood, Andrews & Newnam, Inc.

Section 4.2. 2013 CIPs
The following CIPs are needed in-service by 2013. Each project is listed in the bulleted list below along with the reason the project is needed.

- **1.25 MG GST & 2 – 925 gpm HSPs at Blackhawk:** A ground storage tank was added at Blackhawk (Facility 66) in the 1096-ft pressure zone to meet the storage capacity requirements in the 2013 peak day model. Page 3 of Appendix C shows that an additional 1.2 million gallons is needed to meet peak day demands in 2013. LAN recommends providing this additional storage to the 1096-ft pressure zone versus the others because the highest peak day users reside in this zone (Hollywood Park and Hill Country Village). In 2013, these two cities are using an estimated 2.9 million gallons of water on peak days, but there is only an existing 1.4 million gallons of storage provided between the Donella ground storage tanks, the Tower standpipe, and the Fleetwood elevated storage tank. The remainder of the water needed by the 1096-ft pressure zone flows down from Stone Oak (pressure zone 1290-ft) via an existing pressure reducing valve set at a hydraulic gradeline of 1103-ft. In addition to the ground storage tank, two high service pumps that can push out a total of 1850 gpm with a head of 1096-ft are needed.

- **Well & Pump (1900 gpm) in Castle Hills at New EST Property:** LAN recommends that a new well be drilled in the Castle Hills area and then piped up to Stone Oak via a 24-in transmission main (described in the next bullet). Page 3 of Appendix C shows that an additional 138 gpm well pump capacity is needed to meet increased demands for this design year. LAN is suggesting providing much more capacity – approximately 1900 gpm. It is unknown how productive the new well in Castle Hills will actually be. However, the other wells in Castle Hills are very productive and 1900 gpm is an average of the existing Castle Hills wells production capacity. The capacity this new well provides will help with the increased water demands of the 2018 design year. Also, this well will provide some, but not total, redundancy to the Hill Country District system. Presently, the only water supply sources for Stone Oak (pressure zones 1290-ft and 1395-ft) are the three Bitters wells (Facilities 65 and 91). This single source allows for the possibility of a single point failure for the system, which would place thousands of BexarMet customers without water. The addition of a Castle Hills well and pipeline will allow for a second feed to the system while providing the additional water needed to meet peak demands.

- **24" Transmission Main (33,600 LF) from New EST at Boy Scout Property in Castle Hills to the GST at Loop 1604 (Facility 63):** This transmission main will begin at the new well and EST site located at the Boy Scout Park on NW Military Highway about 1,000-ft north of it's intersection with West Avenue. The pipeline would go up West Avenue and then turn northwest up Blanco Road. It will continue along Blanco Road until it reaches Facility 63, two existing 2 million gallon GSTs at the intersection of Loop 1604 and Blanco Road. See Exhibit 4 to view path of transmission main. It should be noted that if BexarMet would like to provide a true redundant feed to the Stone Oak Area, this proposed main should be larger in diameter.

- **2 Wells & Pumps (450 gpm/each) at Timberline Station:** Two wells, each with a 450 gpm well pump, were added to the 1520-ft pressure zone for the 2013 peak day model to meet the increasing water demands of Timberwood Park. Page 9 of Appendix C shows that an additional 874 gpm well pump capacity is needed for the 2013 peak day model. With help from BexarMet's Water Resources Planning Department, it was determined that Timberline (Facility 75) could potentially accommodate two additional wells in the Trinity Aquifer.

Section 4.3. 2018 CIPs

By the 2018 design year, the Timberwood Park system and the rest of the Hill Country District are considered one working system – they are no longer separated. In the 2008 existing system there is a pressure reducing valve (PRV) located between Timberwood Park and Stone Oak which in the existing system is closed to prevent Timberwood Park water from "bleeding down" into the lower pressure zone of Stone Oak. In the 2018 model, this PRV is opened and set at a hydraulic gradeline of 1395-ft. The PRV was opened because when fire flow loads were placed on the system in northern Stone Oak, the system failed. With the PRV open and set at the hydraulic gradeline of the northern pressure zone of Stone Oak, Timberwood Park can contribute water to Stone Oak when they are experiencing pressure problems. Additionally, Stone Oak will begin serving Timberwood Park with water in 2018 via the pipeline and pump station from the Hardy Oaks elevated storage tank (explained in the bulleted list below).

The following CIPs are needed by 2018. Each project is listed in the bulleted list below along with the reason the project is needed.

- **2.5 MG EST at Overlook Parkway:** Page 5 of Appendix C shows that by 2018, peak day requirements in the Hill Country District have increased again and that about 2.44 million gallons of additional storage capacity is needed. LAN recommends that BexarMet construct a 2.5 MG EST on the property they already own at Overlook Parkway just west of Highway 281. This tank will be designed with a height of 1383-ft, which is the setting of the PRV which separates the western (higher elevation) portion of Timberwood Park from the eastern (lower elevation) area known as Oliver Ranch.

- **Well & Pump (1000 gpm) in Castle Hills at New EST Property to feed transmission main to Facility 63 at Loop 1604:** By the year 2018, Timberwood Park peak day requirements have increased again and another well or source of water is needed. Page 11 of Appendix C shows that an additional 842 gpm well pump capacity is needed. Timberwood Park sits over the Trinity Aquifer, and continually drilling new wells in the Trinity will not result in wells that can meet this increased demand. Drilling too many wells in this area will eventually affect the production of the existing wells adversely. LAN recommends that the surplus water from Castle Hills or an another new well drilled on the Boy Scout property be used to serve Timberwood Park The additional water will be transported to the Loop 1604 GST via the 24-in transmission main constructed by 2013. Then, water will be transferred from Stone Oak to Timberwood Park via the 12-in pipeline described in the next bullet.

- **12-in pipeline (3,500 LF) & HSP from Hardy Oaks EST to tie into existing 12-in main on W. Oak Estates Drive near Blanco Road:** This pipeline will connect the Hardy Oaks elevated storage tank (located on Hardy Oaks and Blanco Road) to a 12-in water main in Timberwood Park. There will be a high service pump on the proposed main which pumps a recommended 1,000 gpm to Timberwood Park to meet their increased water demands for 2018. The HSP must have enough head to pump into the 1520-ft pressure zone.

- **Additional 180,000 gallon GST at a location to be determined in Timberwood Park:** LAN recommends that a small GST be added to the 1520-ft pressure zone by the 2018 design year. Page 11 of Appendix C shows that an additional 175,009 gallons of storage is needed to keep up with increased demands and development in this area. BexarMet can add this small tank to an existing or future facility site in this area.

Section 5: Summary

A thorough analysis of existing system land uses and growth patterns in the HCD area allowed LAN to develop future land use maps with predicted number of connections for design years 2013 and 2018. The predicted number of service connections for each design year was multiplied by historical water demands on the system to determine the future total demand loads on the system. The HCD was modeled hydraulically to determine the system's ability to meet these increased demands for each design year and the system's ability to meet fire flow and peak day requirements. In each instance that the system fell short of meeting one of the criteria, a CIP was recommended which fixed the issue. Some of the most important CIP recommendations are summarized in the following paragraphs.

LAN analyzed the existing water system as of June 2008 under peak day demands and identified any existing system deficiencies. Most of the deficiencies related to the system's inability to deliver adequate pressure under fire flow conditions, especially in Stone Oak (1295-ft and 1395-ft pressure zones). Additionally, the under sizing of water lines (3, 4, and 5-inch lines) in Timberwood Park was identified as a major concern because it prevents adequate fire flows from being delivered. There are also not sufficient storage facilities to meet peak day requirements in the 1290-ft and 1395-ft pressure zones (Stone Oak).

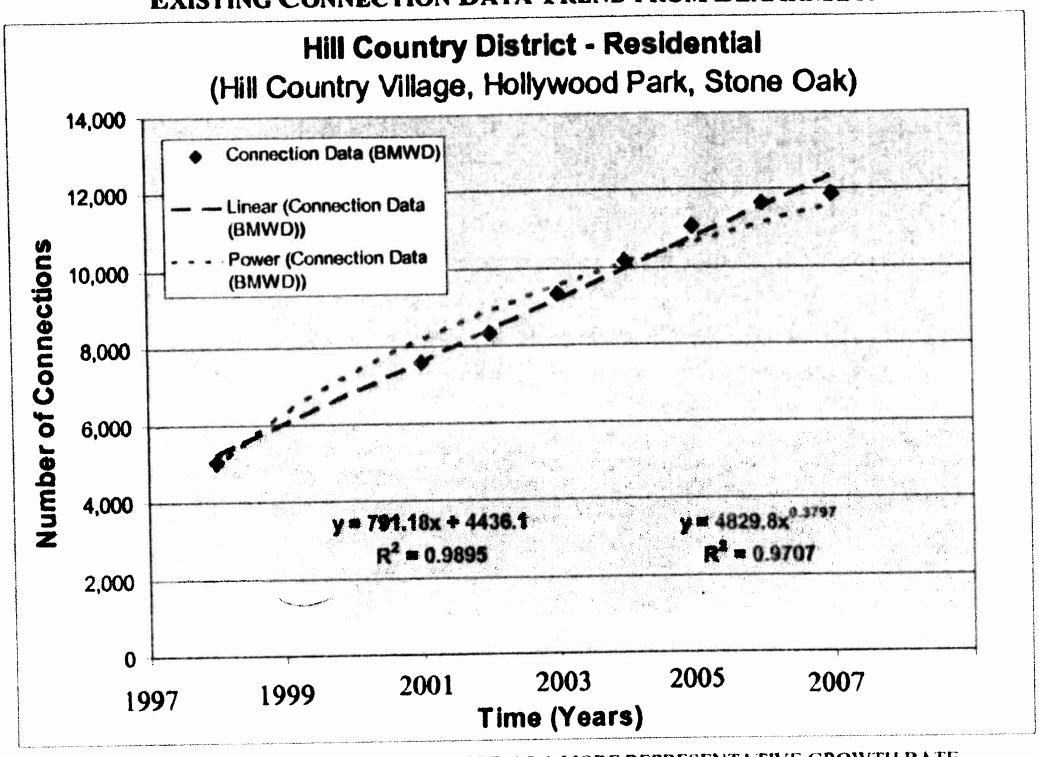
LAN analyzed the system under peak day requirements for the 2013 demand loads and proposed CIPs to meet the deficiencies. The most significant recommendation for this design period is the addition of a transmission main from BexarMet's Castle Hills system to tie into the Hill Country District at the Loop 1604 (Facility 63) ground storage tanks. LAN recommends that a new well be developed in Castle Hills and then the water be pumped to the Hill Country District. This will supply the HCD with an outside water source and will provide some but not total redundancy to the system. Presently, all the water users in Stone Oak depend upon the three Bitters Road wells and the 48-in transmission main which delivers water to the Loop 1604 GSTs. This has been identified as a potential for a single point failure.

LAN analyzed the system under peak day requirements for the 2018 demand loads and proposed CIPs to meet the deficiencies. The 2018 design year represents ultimate development conditions for the HCD. In this design year, the major concern in the 1520-ft pressure zone is the need for new wells and water resources. The Trinity Aquifer, which is located under this pressure zone, is not an unlimited or plentiful supply source and it is believed that a new water supply source needs to be introduced to this area. LAN recommends opening up the 1520-ft pressure zone to the 1395-ft pressure zone via a PRV and sharing water resources between the two. It is recommended a pipeline be constructed from the Hardy Oaks EST with a HSP station to deliver the needed water to Timberwood Park. This additional water will be supplied by developing a second new well in Castle Hills and pumping this additional water through the 24" transmission main and into Stone Oak.

The capital improvement projects recommended in this report are a good starting point. Taking into account the cyclical nature of development, LAN recommends that BexarMet, at a minimum, revisit the Water Master Plan every three to five years to make adjustments to the CIP lists.

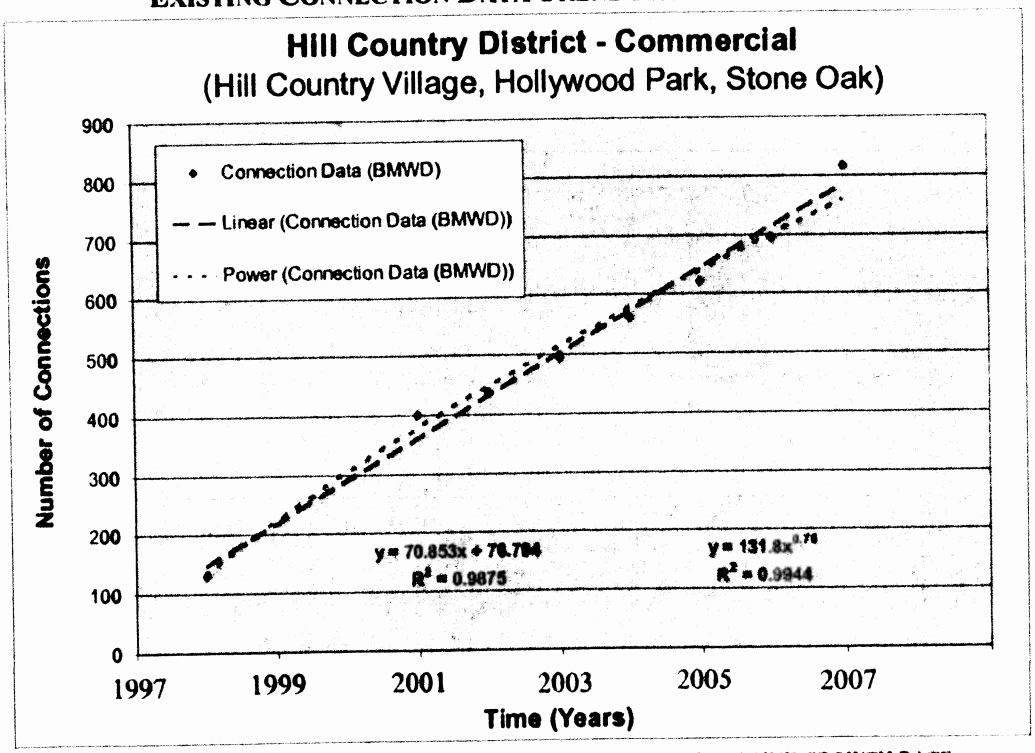
APPENDIX A:
GRAPHS OF SYSTEM GROWTH TRENDS

EXISTING CONNECTION DATA TREND FROM BEXARMET.



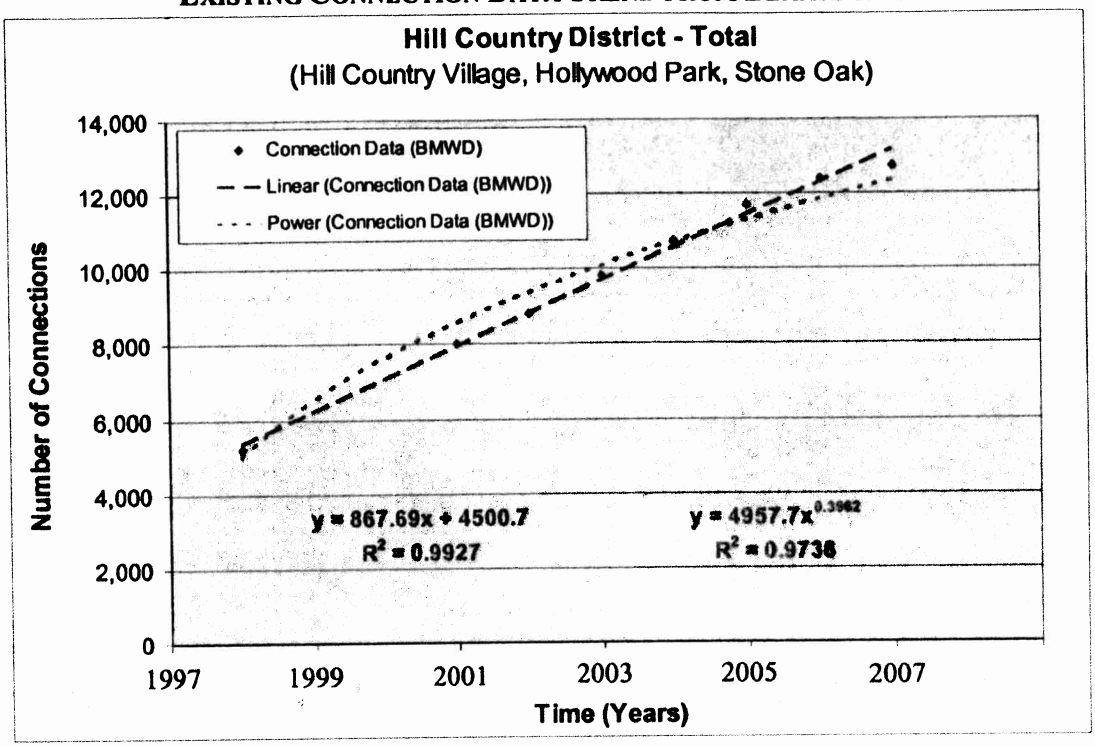
* THE POWER TRENDLINE WAS SELECTED AS A MORE REPRESENTATIVE GROWTH RATE.

EXISTING CONNECTION DATA TREND FROM BEXARMET.



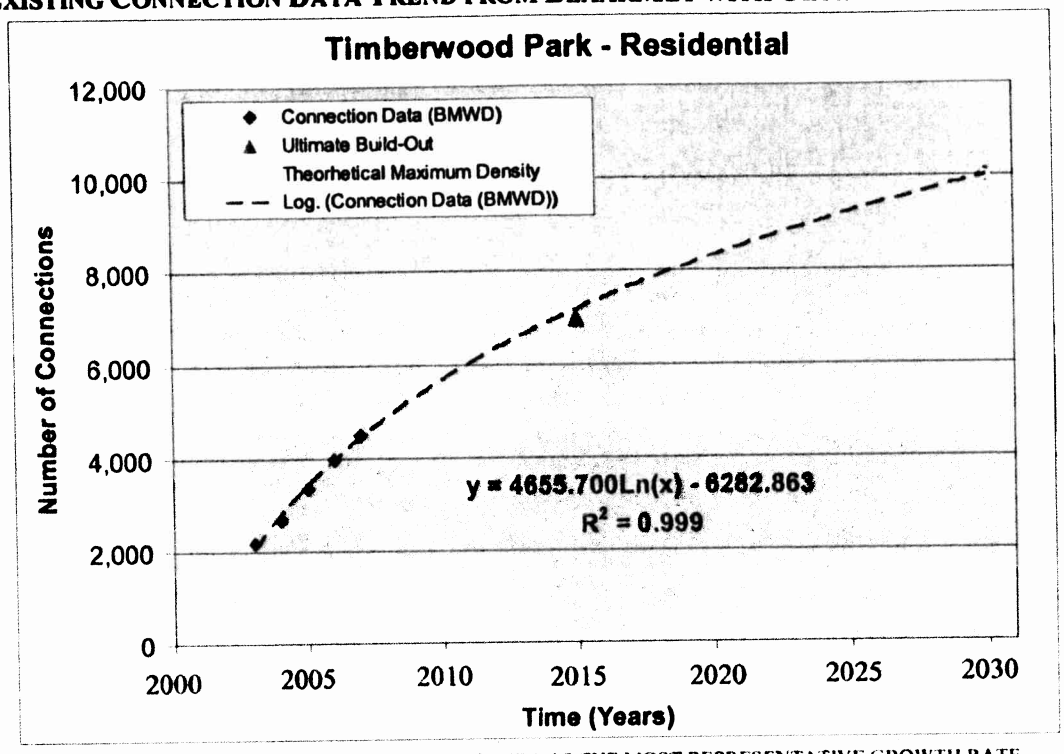
* THE POWER TRENDLINE WAS SELECTED AS A MORE REPRESENTATIVE GROWTH RATE.

EXISTING CONNECTION DATA TREND FROM BEXARMET.



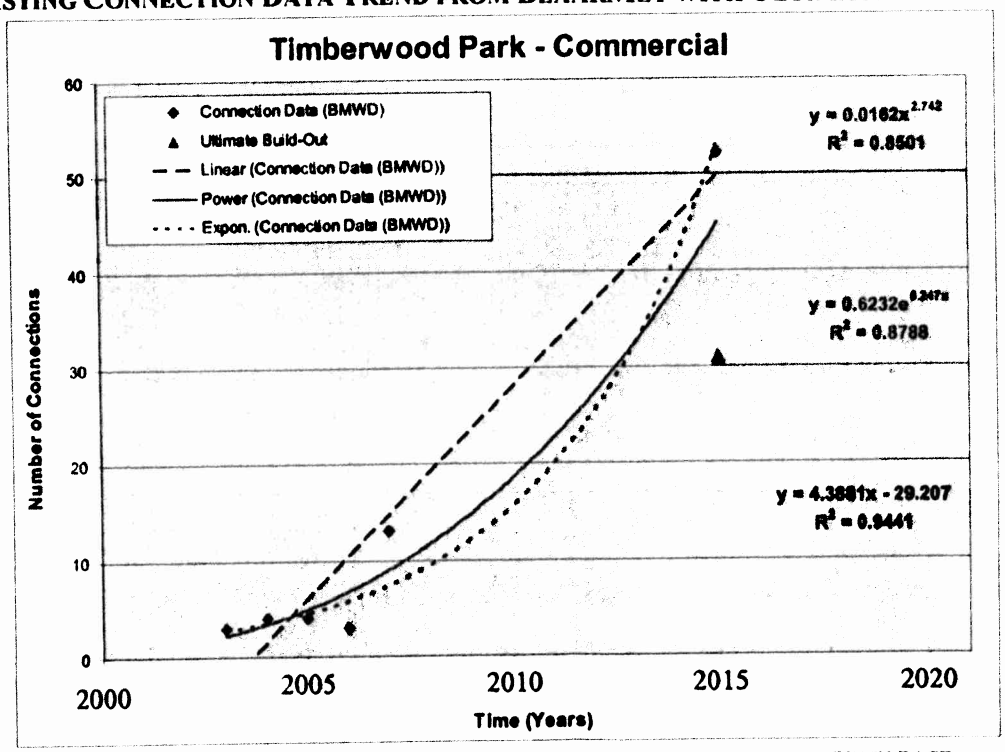
* THE POWER TRENDLINE WAS SELECTED AS A MORE REPRESENTATIVE GROWTH RATE.

EXISTING CONNECTION DATA TREND FROM BEXARMET WITH ULTIMATE BUILD-OUT



* THE LOGARITHMIC TRENDLINE WAS SELECTED AS THE MOST REPRESENTATIVE GROWTH RATE.

EXISTING CONNECTION DATA TREND FROM BEXARMET WITH ULTIMATE BUILD-OUT



* THE LINEAR TRENDLINE WAS SELECTED AS THE MOST REPRESENTATIVE GROWTH RATE.

APPENDIX B:
TCEQ MINIMUM CRITERIA ANALYSIS
FOR 2008, 2013, & 2018

Hill Country District (Hill Country Village, Hollywood Park, Stone Oak)

TCEQ 0150054 -- June 2008

Connections

Account Type	Hill Country Village	Hollywood Park	Stone Oak
Residential	351	1273	10399
Multi-Family	0	0	10
Commercial	176	126	537
School	0	0	9
Total	527	1,399	10,955

12,881 Total Connections - 2008

TCEQ Requirements (more than 250 connections)

System Component	REQUIRED	Current Capacity	Current Capacity per conn	Meets Requirements?
Total Well Capacity (gpm)	7,729	10,577	0.82	yes
Elevated Storage Capacity (gal)	1,288,100	6,500,000	505	yes
Ground Storage Capacity (gal)		4,876,700	379	
Total Storage Capacity (gal)	2,816,200	11,376,700	883	yes
Total Pump Capacity (gpm)	7,729	27,320	2.12	yes

>>> Since system provides an elevated storage capacity of 200 gallons per connection, total pump capacity of 0.6 gpm per connection (minimum combined capacity) is required at each pump station or pressure plane

>>> Total Required Storage Capacity includes fire flow of 240,000 gal (2000 gpm for 2 hrs.)

Hill Country District (Hill Country Village, Hollywood Park, Stone Oak)

TCEQ 0150054 -- 2013

Connections

Account Type	Hill Country Village	Hollywood Park	Stone Oak
Residential	358	1280	11809
Multi-Family	0	0	12
Commercial	179	129	745
School	0	0	10
Total	537	1,409	12,576

14,522 Total Connections - 2013

TCEQ Requirements (more than 250 connections)

System Component	REQUIRED	Current Capacity	Current Capacity per conn	Meets Requirements?
Total Well Capacity (gpm)	8,713	13,550	0.93	yes
Elevated Storage Capacity (gal)	1,452,200	6,500,000	448	yes
Ground Storage Capacity (gal)		4,876,700	336	
Total Storage Capacity (gal)	3,144,400	11,376,700	783	yes
Total Pump Capacity (gpm)	8,713	27,320	1.88	yes

>>> Since system provides an elevated storage capacity of 200 gallons per connection, total pump capacity of 0.6 gpm per connection (minimum combined capacity) is required at each pump station or pressure plane

>>> Total Required Storage Capacity includes fire flow of 240,000 gal (2000 gpm for 2 hrs.)

Hill Country District (Hill Country Village, Hollywood Park, Stone Oak)

TCEQ 0150054 -- 2018

Connections

Account Type	Hill Country Village	Hollywood Park	Stone Oak
Residential	365	1286	13482
Multi-Family	0	0	13
Commercial	182	132	1007
School	0	0	10
Total	547	1,418	14,512

16,477 Total Connections - 2018

TCEQ Requirements (more than 250 connections)

System Component	REQUIRED	Current Capacity	Current Capacity per conn	Meets Requirements?
Total Well Capacity (gpm)	9,886	13,550	0.82	yes
Elevated Storage Capacity (gal)	1,647,700	6,500,000	394	yes
Ground Storage Capacity (gal)		4,876,700	296	
Total Storage Capacity (gal)	3,535,400	11,376,700	690	yes
Total Pump Capacity (gpm)	9,886	27,320	1.66	yes

>>> Since system provides an elevated storage capacity of 200 gallons per connection, total pump capacity of 0.6 gpm per connection (minimum combined capacity) is required at each pump station or pressure plane

>>> Total Required Storage Capacity includes fire flow of 240,000 gal (2000 gpm for 2 hrs.)

Timberwood District

TCEQ 0150270 -- June 2008

Connections

Account Type	Timberwood Park	
Residential	4428	
Multi-Family	1	
Commercial	14	
School	2	
Total	4,445	Total Connections - 2008

TCEQ Requirements (more than 250 connections)

System Component	REQUIRED	Current Capacity	Current Capacity per conn	Meets Requirements?
Total Well Capacity (gpm)	2,667	2,823	0.64	Yes
Elevated Storage Capacity (gal)	444,500	2,500,000	562	Yes
Ground Storage Capacity (gal)		1,104,000	248	
Total Storage Capacity (gal)	1,129,000	3,604,000	811	Yes
Total Pump Capacity (gpm)	2,667	5,754	1.29	Yes

>>> Since system provides an elevated storage capacity of 200 gallons per connection, total pump capacity of 0.6 gpm per connection (minimum combined capacity) is required at each pump station or pressure plane

>>> Total Required Storage Capacity includes fire flow of 240,000 gal (2000 gpm for 2 hrs.)

Timberwood District

TCEQ 0150270 -- 2013

Connections

Account Type	Timberwood Park
Residential	5703
Multi-Family	1
Commercial	36
School	3
Total	5,743

Total Connections - 2013

TCEQ Requirements (more than 250 connections)

System Component	REQUIRED	Current Capacity	Current Capacity per conn	Meets Requirements?
Total Well Capacity (gpm)	3,446	4,523	0.79	Yes
Elevated Storage Capacity (gal)	574,300	2,500,000	435	Yes
Ground Storage Capacity (gal)		4,354,000	758	
Total Storage Capacity (gal)	1,388,600	6,854,000	1,193	Yes
Total Pump Capacity (gpm)	3,446	6,554	1.14	Yes

>>> Since system provides an elevated storage capacity of 200 gallons per connection, total pump capacity of 0.6 gpm per connection (minimum combined capacity) is required at each pump station or pressure plane

>>> Total Required Storage Capacity includes fire flow of 240,000 gal (2000 gpm for 2 hrs.)

Timberwood District

TCEQ 0150270 -- 2018

Connections

Account Type	Timberwood Park	
Residential	6977	
Multi-Family	1	
Commercial	57	
School	3	
Total	7,038	Total Connections - 2018

TCEQ Requirements (more than 250 connections)

System Component	REQUIRED	Current Capacity	Current Capacity per conn	Meets Requirements?
Total Well Capacity (gpm)	4,223	4,523	0.64	Yes
Elevated Storage Capacity (gal)	703,800	2,500,000	355	Yes
Ground Storage Capacity (gal)		4,354,000	619	
Total Storage Capacity (gal)	1,647,600	6,854,000	974	Yes
Total Pump Capacity (gpm)	4,223	6,554	0.93	Yes

>>> Since system provides an elevated storage capacity of 200 gallons per connection, total pump capacity of 0.6 gpm per connection (minimum combined capacity) is required at each pump station or pressure plane

>>> Total Required Storage Capacity includes fire flow of 240,000 gal (2000 gpm for 2 hrs.)

APPENDIX C:
AWWA M32 PEAK DAY SYSTEM ANALYSIS FOR 2008, 2013, & 2018

Peak De[illegible]nd Hill Country District (0150054) -- As of June 2008 A[illegible]ysis

Hill Country Village - Peak Day Requirements

Account Type	# Connections	Peak Daily Flow (gpdpc)	Peak Daily Flow (gpmpc)	Storage Required (gal)	Pump Capacity Required (gpm)	Well Capacity Required (gpm)
Residential	351	1,933	1.34	678,483	471	471
Commercial	176	2,013	1.40	354,288	246	246
			Total	**1,032,771**	**717**	**717**

Hollywood Park - Peak Day Requirements

Account Type	# Connections	Peak Daily Flow (gpdpc)	Peak Daily Flow (gpmpc)	Storage Required (gal)	Pump Capacity Needed (gpm)	Well Capacity Required (gpm)
Residential	1,273	1,074	0.75	1,367,202	949	949
Commercial	126	3,664	2.54	461,664	321	321
			Total	**1,828,866**	**1,270**	**1,270**

Stone Oak - Peak Day Requirements

Account Type	# Connections	Peak Daily Flow (gpdpc)	Peak Daily Flow (gpmpc)	Storage Required (gal)	Pump Capacity Required (gpm)	Well Capacity Required (gpm)
Residential	10,399	925	0.64	9,619,075	6,680	6,680
Multi-Family	10	30,785	21.38	307,850	214	214
Commercial	537	3,418	2.37	1,835,466	1,275	1,275
School	9	12,891	8.95	116,019	81	81
			Total	**11,878,410**	**8,249**	**8,249**

System Totals

System Component	Total Available	Total Required	Satisfy's Peak Day Requirement?		
Well Pump Capacity (gpm)	11,727	12,236	**NO**	**509**	gpm needed to satisfy peak day requirement
HSPump Capacity (gpm)	27,320	12,236	Yes		
Storage Capacity (ga)	11,376,700	14,980,047	**NO**	**3,603,347**	gallons needed to satisfy peak day requirement (Includes fire flow, 2000 gpm for 2 hrs.)

>>> Total Required Storage Capacity includes fire flow of 240,000 gal (2000 gpm for 2 hrs.)
>>> Total Required Well Capacity includes fire flow rate of 2000 gpm
>>> Total Required HSPump Capacity includes fire flow rate of 2000 gpm
>>> Peak Daily Flow values includes past production data + 10% unmetered losses

Peak Den[redacted] Hill Country District (0150054) -- With 2008/2009 CIPs in P[redacted] ASAP

Hill Country Village - Peak Day Requirements

Account Type	# Connections	Peak Daily Flow (gpdpc)	Peak Daily Flow (gpmpc)	Storage Required (gal)	Pump Capacity Required (gpm)	Well Capacity Required (gpm)
Residential	351	1,933	1.34	678,483	471	471
Commercial	176	2,013	1.40	354,288	246	246
			Total	**1,032,771**	**717**	**717**

Hollywood Park - Peak Day Requirements

Account Type	# Connections	Peak Daily Flow (gpdpc)	Peak Daily Flow (gpmpc)	Storage Required (gal)	Pump Capacity Needed (gpm)	Well Capacity Required (gpm)
Residential	1,273	1,074	0.75	1,367,202	949	949
Commercial	126	3,664	2.54	461,664	321	321
			Total	**1,828,866**	**1,270**	**1,270**

Stone Oak - Peak Day Requirements

Account Type	# Connections	Peak Daily Flow (gpdpc)	Peak Daily Flow (gpmpc)	Storage Required (gal)	Pump Capacity Required (gpm)	Well Capacity Required (gpm)
Residential	10,399	925	0.64	9,619,075	6,680	6,680
Multi-Family	10	30,785	21.38	307,850	214	214
Commercial	537	3,418	2.37	1,835,466	1,275	1,275
School	9	12,891	8.95	116,019	81	81
			Total	**11,878,410**	**8,249**	**8,249**

System Totals

System Component	Total Available	Total Required	Satisfy's Peak Day Requirement?
Well Pump Capacity (gpm)	13,550	12,236	Yes
HSPump Capacity (gpm)	27,320	12,236	Yes
Storage Capacity (ga)	15,876,700	14,980,047	Yes

>>> Total Required Storage Capacity includes fire flow of 240,000 gal (2000 gpm for 2 hrs.)
>>> Total Required Well Capacity includes fire flow rate of 2000 gpm
>>> Total Required HSPump Capacity includes fire flow rate of 2000 gpm
>>> Peak Daily Flow values includes past production data + 10% unmetered losses

1 **Added 2MG GST at Stein Tract**
2 **Flow of Stein Wells will increase to 800 gpm with addition of GST (per BexarMet Production Dept.)**
3 **Added 2.5 EST at Hardy Oaks**

Peak Demand Hill Country District (0150054) -- 2013 CIP Analysis

Hill Country Village - Peak Day Requirements

Account Type	# Connections	Peak Daily Flow (gpdpc)	Peak Daily Flow (gpmpc)	Storage Required (gal)	Pump Capacity Required (gpm)	Well Capacity Required (gpm)
Residential	358	1,933	1.34	692,014	481	481
Commercial	179	2,013	1.40	360,327	250	250
			Total	**1,052,341**	**731**	**731**

Hollywood Park - Peak Day Requirements

Account Type	# Connections	Peak Daily Flow (gpdpc)	Peak Daily Flow (gpmpc)	Storage Required (gal)	Pump Capacity Needed (gpm)	Well Capacity Required (gpm)
Residential	1,280	1,074	0.75	1,374,720	955	955
Commercial	129	3,664	2.54	472,656	328	328
			Total	**1,847,376**	**1,283**	**1,283**

Stone Oak - Peak Day Requirements

Account Type	# Connections	Peak Daily Flow (gpdpc)	Peak Daily Flow (gpmpc)	Storage Required (gal)	Pump Capacity Required (gpm)	Well Capacity Required (gpm)
Residential	11,809	925	0.64	10,923,325	7,586	7,586
Multi-Family	12	30,785	21.38	369,420	257	257
Commercial	745	3,369	2.34	2,509,905	1,743	1,743
School	10	12,891	8.95	128,910	90	90
			Total	**13,931,560**	**9,675**	**9,675**

System Totals

System Component	Total Available	Total Required	Satisfy's Peak Day Requirement?		
Well Pump Capacity (gpm)	13,550	13,688	**NO**	**138**	gpm needed.
HSPump Capacity (gpm)	27,320	13,688	Yes		
Storage Capacity (ga)	15,876,700	17,071,277	**NO**	**1,194,577**	gallons needed to satisfy peak day requirement (Includes fire flow, 2000 gpm for 2 hrs.)

>>> Total Required Storage Capacity includes fire flow of 240,000 gal (2000 gpm for 2 hrs.)
>>> Total Required Well Capacity includes fire flow rate of 2000 gpm
>>> Total Required HSPump Capacity includes fire flow rate of 2000 gpm
>>> Peak Daily Flow values includes past production data + 10% unmetered losses

Peak Dem[illegible] Hill Country District (0150054) -- 2013 with CIPs

Hill Country Village - Peak Day Requirements

Account Type	# Connections	Peak Daily Flow (gpdpc)	Peak Daily Flow (gpmpc)	Storage Required (gal)	Pump Capacity Required (gpm)	Well Capacity Required (gpm)
Residential	358	1,933	1.34	692,014	481	481
Commercial	179	2,013	1.40	360,327	250	250
			Total	**1,052,341**	**731**	**731**

Hollywood Park - Peak Day Requirements

Account Type	# Connections	Peak Daily Flow (gpdpc)	Peak Daily Flow (gpmpc)	Storage Required (gal)	Pump Capacity Needed (gpm)	Well Capacity Required (gpm)
Residential	1,280	1,074	0.75	1,374,720	955	955
Commercial	129	3,664	2.54	472,656	328	328
			Total	**1,847,376**	**1,283**	**1,283**

Stone Oak - Peak Day Requirements

Account Type	# Connections	Peak Daily Flow (gpdpc)	Peak Daily Flow (gpmpc)	Storage Required (gal)	Pump Capacity Required (gpm)	Well Capacity Required (gpm)
Residential	11,809	925	0.64	10,923,325	7,586	7,586
Multi-Family	12	30,785	21.38	369,420	257	257
Commercial	745	3,369	2.34	2,509,905	1,743	1,743
School	10	12,891	8.95	128,910	90	90
			Total	**13,931,560**	**9,675**	**9,675**

System Totals

System Component	Total Available	Total Required	Satisfy's Peak Day Requirement?
Well Pump Capacity (gpm)	15,450	13,688	Yes
HSPump Capacity (gpm)	27,320	13,688	Yes
Storage Capacity (ga)	17,126,700	17,071,277	Yes

>>> Total Required Storage Capacity includes fire flow of 240,000 gal (2000 gpm for 2 hrs.)
>>> Total Required Well Capacity includes fire flow rate of 2000 gpm
>>> Total Required HSPump Capacity includes fire flow rate of 2000 gpm
>>> Peak Daily Flow values includes past production data + 10% unmetered losses

1 **Added 1.25 MG GST at Blackhawk**
2 **Added 1900 gpm new well and pump in Castle Hills**
3 **Added 24" pipe line from Castle Hills to Stone Oak along Blanco Road**

Peak Demand Hill Country District (0150054) -- 2018 Analysis

Hill Country Village - Peak Day Requirements

Account Type	# Connections	Peak Daily Flow (gpdpc)	Peak Daily Flow (gpmpc)	Storage Required (gal)	Pump Capacity Required (gpm)	Well Capacity Required (gpm)
Residential	365	1,933	1.34	705,545	490	490
Commercial	182	2,013	1.40	366,366	254	254
			Total	**1,071,911**	**744**	**744**

Hollywood Park - Peak Day Requirements

Account Type	# Connections	Peak Daily Flow (gpdpc)	Peak Daily Flow (gpmpc)	Storage Required (gal)	Pump Capacity Needed (gpm)	Well Capacity Required (gpm)
Residential	1,286	1,074	0.75	1,381,164	959	959
Commercial	132	3,664	2.54	483,648	336	336
			Total	**1,864,812**	**1,295**	**1,295**

Stone Oak - Peak Day Requirements

Account Type	# Connections	Peak Daily Flow (gpdpc)	Peak Daily Flow (gpmpc)	Storage Required (gal)	Pump Capacity Required (gpm)	Well Capacity Required (gpm)
Residential	13,482	925	0.64	12,470,850	8,660	8,660
Multi-Family	13	30,785	21.38	400,205	278	278
Commercial	1,007	3,369	2.34	3,392,583	2,356	2,356
School	10	12,891	8.95	128,910	90	90
			Total	**16,392,548**	**11,384**	**11,384**

System Totals

System Component	Total Available	Total Required	Satisfy's Peak Day Requirement?
Well Pump Capacity (gpm)	15,450	15,423	Yes
HSPump Capacity (gpm)	27,320	15,423	Yes
Storage Capacity (ga)	17,126,700	19,569,271	NO

2,442,571 gallons needed to satisfy peak day requirement (Includes fire flow, 2000 gpm for 2 hrs.)

>>> Total Required Storage Capacity includes fire flow of 240,000 gal (2000 gpm for 2 hrs.)
>>> Total Required Well Capacity includes fire flow rate of 2000 gpm
>>> Total Required HSPump Capacity includes fire flow rate of 2000 gpm
>>> Peak Daily Flow values includes past production data + 10% unmetered losses

Peak Demand Hill Country District (0150054) -- 2018 with CIPs

Hill Country Village - Peak Day Requirements

Account Type	# Connections	Peak Daily Flow (gpdpc)	Peak Daily Flow (gpmpc)	Storage Required (gal)	Pump Capacity Required (gpm)	Well Capacity Required (gpm)
Residential	365	1,933	1.34	705,545	490	490
Commercial	182	2,013	1.40	366,366	254	254
			Total	**1,071,911**	**744**	**744**

Hollywood Park - Peak Day Requirements

Account Type	# Connections	Peak Daily Flow (gpdpc)	Peak Daily Flow (gpmpc)	Storage Required (gal)	Pump Capacity Needed (gpm)	Well Capacity Required (gpm)
Residential	1,286	1,074	0.75	1,381,164	959	959
Commercial	132	3,664	2.54	483,648	336	336
			Total	**1,864,812**	**1,295**	**1,295**

Stone Oak - Peak Day Requirements

Account Type	# Connections	Peak Daily Flow (gpdpc)	Peak Daily Flow (gpmpc)	Storage Required (gal)	Pump Capacity Required (gpm)	Well Capacity Required (gpm)
Residential	13,482	925	0.64	12,470,850	8,660	8,660
Multi-Family	13	30,785	21.38	400,205	278	278
Commercial	1,007	3,369	2.34	3,392,583	2,356	2,356
School	10	12,891	8.95	128,910	90	90
			Total	**16,392,548**	**11,384**	**11,384**

System Totals

System Component	Total Available	Total Required	Satisfy's Peak Day Requirement?
Well Pump Capacity (gpm)	15,450	15,423	Yes
HSPump Capacity (gpm)	27,320	15,423	Yes
Storage Capacity (ga)	19,626,700	19,569,271	Yes

>>> Total Required Storage Capacity includes fire flow of 240,000 gal (2000 gpm for 2 hrs.)
>>> Total Required Well Capacity includes fire flow rate of 2000 gpm
>>> Total Required HSPump Capacity includes fire flow rate of 2000 gpm
>>> Peak Daily Flow values includes past production data + 10% unmetered losses

Added 2.5 MG EST at Overlook Parkway

Peak Demand Timberwood Park (0150270) -- June 2008 Analysis

Timberwood Park - Peak Day Requirements

Account Type	# Connections	Peak Daily Flow (gpdpc)	Peak Daily Flow (gpmpc)	Storage Required (gal)	Pump Capacity Required (gpm)	Well Capacity Required (gpm)
Residential	4,428	925	0.64	4,095,900	2,844	2,844
Multi-Family	1	30,785	21.38	30,785	21	21
Commercial	14	3,418	2.37	47,852	33	33
School	2	12,891	8.95	25,782	18	18
			Total	**4,200,319**	**2,917**	**2,917**

System Totals

System Component	Total Available	Total Required	Satisfy's Peak Day Requirement?		
Well Pump Capacity (gpm)	2,823	4,917	**NO**	**2,094**	gpm to satisfy peak day requirements
HSPump Capacity (gpm)	5,754	4,917	Yes		
Storage Capacity (ga)	3,533,000	4,440,319	**NO**	**907,319**	gallons to satisfy peak day requirements (Includes fire flow, 2000 gpm for 2 hrs.

>>> Total Required Storage Capacity includes fire flow of 240,000 gal (2000 gpm for 2 hrs.)
>>> Total Required Well Capacity includes fire flow rate of 2000 gpm
>>> Total Required HSPump Capacity includes fire flow rate of 2000 gpm
>>> Peak Daily Flow values includes past production data + 10% unmetered losses

Peak D[redacted]and Timberwood Park (0150270) -- With 2008/2009 [redacted]s in Place ASAP

Timberwood Park - Peak Day Requirements

Account Type	# Connections	Peak Daily Flow (gpdpc)	Peak Daily Flow (gpmpc)	Storage Required (gal)	Pump Capacity Required (gpm)	Well Capacity Required (gpm)
Residential	4,428	925	0.64	4,095,900	2,844	2,844
Multi-Family	1	30,785	21.38	30,785	21	21
Commercial	14	3,418	2.37	47,852	33	33
School	2	12,891	8.95	25,782	18	18
			Total	**4,200,319**	**2,917**	**2,917**

System Totals

System Component	Total Available	Total Required	Satisfy's Peak Day Requirement?
Well Pump Capacity (gpm)	4,923	4,917	Yes
HSPump Capacity (gpm)	6,554	4,917	Yes
Storage Capacity (ga)	6,783,000	4,440,319	Yes

>>> Total Required Storage Capacity includes fire flow of 240,000 gal (2000 gpm for 2 hrs.)
>>> Total Required Well Capacity includes fire flow rate of 2000 gpm
>>> Total Required HSPump Capacity includes fire flow rate of 2000 gpm
>>> Peak Daily Flow values includes past production data + 10% unmetered losses

1 **Added 250,000 GST at Dym Tract**
2 **Added 1MG GST at Timberline**
3 **Added 2MG GST at Wild Turkey**
4 **Added 1700gpm wells at Wild Turkey & Timber Line**
5 **Added 800 gpm HSPs at Timber Line**
6 **Added 400 gpm well**

Peak Demand Timberwood Park (0150270) -- 2013 CIP Analysis

Timberwood Park - Peak Day Requirements

Account Type	# Connections	Peak Daily Flow (gpdpc)	Peak Daily Flow (gpmpc)	Storage Required (gal)	Pump Capacity Required (gpm)	Well Capacity Required (gpm)
Residential	5,703	925	0.64	5,275,275	3,663	3,663
Multi-Family	1	30,785	21.38	30,785	21	21
Commercial	36	3,418	2.37	123,048	85	85
School	3	12,891	8.95	38,673	27	27
			Total	**5,467,781**	**3,797**	**3,797**

System Totals

System Component	Total Available	Total Required	Satisfy's Peak Day Requirement?
Well Pump Capacity (gpm)	4,923	5,797	NO
HSPump Capacity (gpm)	6,554	5,797	Yes
Storage Capacity (ga)	6,783,000	5,707,781	Yes

874 gpm needed to satisfy peak day requirements

>>> Total Required Storage Capacity includes fire flow of 240,000 gal (2000 gpm for 2 hrs.)
>>> Total Required Well Capacity includes fire flow rate of 2000 gpm
>>> Total Required HSPump Capacity includes fire flow rate of 2000 gpm
>>> Peak Daily Flow values includes past production data + 10% unmetered losses

Peak D[redacted]and Timberwood Park (0150270) -- 2013 with CIPs[redacted]

Timberwood Park - Peak Day Requirements

Account Type	# Connections	Peak Daily Flow (gpdpc)	Peak Daily Flow (gpmpc)	Storage Required (gal)	Pump Capacity Required (gpm)	Well Capacity Required (gpm)
Residential	5,703	925	0.64	5,275,275	3,663	3,663
Multi-Family	1	30,785	21.38	30,785	21	21
Commercial	36	3,418	2.37	123,048	85	85
School	3	12,891	8.95	38,673	27	27
			Total	**5,467,781**	**3,797**	**3,797**

System Totals

System Component	Total Available	Total Required	Satisfy's Peak Day Requirement?
Well Pump Capacity (gpm)	5,823	5,797	Yes
HSPump Capacity (gpm)	6,554	5,797	Yes
Storage Capacity (ga)	6,783,000	5,707,781	Yes

>>> Total Required Storage Capacity includes fire flow of 240,000 gal (2000 gpm for 2 hrs.)
>>> Total Required Well Capacity includes fire flow rate of 2000 gpm
>>> Total Required HSPump Capacity includes fire flow rate of 2000 gpm
>>> Peak Daily Flow values includes past production data + 10% unmetered losses

1 **Added 900gpm well and pump**

Peak D[redacted]and Timberwood (0150270) -- 2018 Analysis

Timberwood Park - Peak Day Requirements

Account Type	# Connections	Peak Daily Flow (gpdpc)	Peak Daily Flow (gpmpc)	Storage Required (gal)	Pump Capacity Required (gpm)	Well Capacity Required (gpm)
Residential	6,977	925	0.64	6,453,725	4,482	4,482
Multi-Family	1	30,785	21.38	30,785	21	21
Commercial	57	3,418	2.37	194,826	135	135
School	3	12,891	8.95	38,673	27	27
			Total	**6,718,009**	**4,665**	**4,665**

System Totals

System Component	Total Available	Total Required	Satisfy's Peak Day Requirement?		
Well Pump Capacity (gpm)	5,823	6,665	NO	**842**	gpm to satisfy peak day requirements
HSPump Capacity (gpm)	6,554	6,665	NO	**111**	gpm to satisfy peak day requirements
Storage Capacity (ga)	6,783,000	6,958,009	NO	**175,009**	gallons to satisfy peak day requirements (Includes fire flow, 2000 gpm for 2 hrs.)

>>> Total Required Storage Capacity includes fire flow of 240,000 gal (2000 gpm for 2 hrs.)
>>> Total Required Well Capacity includes fire flow rate of 2000 gpm
>>> Total Required HSPump Capacity includes fire flow rate of 2000 gpm
>>> Peak Daily Flow values includes past production data + 10% unmetered losses

Peak D[redacted]and Timberwood Park (0150270) -- 2018 with CIPs[redacted]

Timberwood Park - Peak Day Requirements

Account Type	# Connections	Peak Daily Flow (gpdpc)	Peak Daily Flow (gpmpc)	Storage Required (gal)	Pump Capacity Required (gpm)	Well Capacity Required (gpm)
Residential	6,977	925	0.64	6,453,725	4,482	4,482
Multi-Family	1	30,785	21.38	30,785	21	21
Commercial	57	3,418	2.37	194,826	135	135
School	3	12,891	8.95	38,673	27	27
			Total	**6,718,009**	**4,665**	**4,665**

System Totals

System Component	Total Available	Total Required	Satisfy's Peak Day Requirement?
Well Pump Capacity (gpm)	6,823	6,665	Yes
HSPump Capacity (gpm)	7,554	6,665	Yes
Storage Capacity (ga)	6,963,000	6,958,009	Yes

gallons to satisfy peak day requirements
(Includes fire flow, 2000 gpm for 2 hrs.)

>>> Total Required Storage Capacity includes fire flow of 240,000 gal (2000 gpm for 2 hrs.)
>>> Total Required Well Capacity includes fire flow rate of 2000 gpm
>>> Total Required HSPump Capacity includes fire flow rate of 2000 gpm
>>> Peak Daily Flow values includes past production data + 10% unmetered losses

1 **Added pipe line (1000gpm) from Hardy Oak EST to Timberwood along Blanco**
2 **Added 1000gpm HSP to Hardy Oak EST to feed Timberwood**
3 **Added 1000gpm well and pump to Castle Hills well site to pump through Blanco pipe line (from Castle Hills to Stone Oak)**
4 **Added 180,000 GST to Timberwood**

APPENDIX D:
CIP COST ESTIMATE

HILL COUNTRY DISTRICT (HCD) COST ESTIMATE (2008-2018)

Existing System CIPs Estimate of Probable Cost (2008 dollars)

		Project Costs
1.	2 MG GST & 3-1,080 GPM HSPs @ Stein Tract	Included on Current CIP List
2.	2.5 MG EST @ Hardy Oaks and Blanco	Included on Current CIP List
3.	5,800 LF 24" DI Pipeline from Hardy Oaks EST to Calico Landing	Included on Current CIP List
4.	1,800 LF 24" DI Pipeline from Hardy Oaks EST to Hardy Oaks BLVD Tie-In (Not on current CIP List)	$593,402
5.	PRV on 24" Line from Hardy Oaks EST to Calico Landing (Not on Current CIP List)	$95,250
6.	250,000 GAL GST & 4-150 gpm Wells @ Dym Tract	Included on Current CIP List
7.	1 MG GST & 2-625 gpm wells @ Timberline	Included on Current CIP List
8.	1-400, 2-200 GPM HSPs @ Timberline	Included on Current CIP List
9.	2 MG GST & 1-500 GPM well @ Wild Turkey	Included on Current CIP List
10.	1-400 GPM Well & Pump @ Timberline Station (Not on current CIP List)	$1,426,000
11.	Replace all 3", 4", & 5" Water Main with 87,000 LF 8" DI Pipe in Timberwood (Not on current CIP List)	$14,993,493
12.	6,100 LF 12" DI Pipeline with PRV (Northside of Evans Rd from Wind Springs to just West of Peacemaker) (Not on current CIP List)	$1,205,865
13.	700 LF 8" DI Pipeline to connect Hidden Pass to Hidden View (Not on current CIP List)	$120,638
14.	Replace 2,121 LF of 6" pipe with 8" DI pipe on Treasure Trail Drive & then extend 8" pipe an additional 125 LF to tie into proposed main on Bitters Rd. (Not on current CIP List) Replace 1,286 LF of 6" pipe with 8" DI pipe on Tomahawk Trail & then extend 8" pipe an additional 398 LF to tie into main on Bitters Rd. (Not on current CIP List) Extend 1,515 LF of 12" DI pipe from the intersection of Bitters Rd. & Tomahawk Trail to Bitters Rd. & Treasure Trail Dr. (Not on current CIP List)	$866,150
	Subtotal	$19,300,798

CIPs Needed by 2013 Estimate of Probable Cost (2013 dollars)

		Project Costs
1.	1.25 MG GST, 2-925 gpm HSPs, MIOX, & land @ Blackhawk	$3,369,317
2.	Well & Pump (1900 gpm) in Castle Hills @ New EST Property	$2,515,626
3.	33,600 LF 24" (min) D.I. pipeline from New EST property in Castle Hills up Blanco Rd to Blanco and 1604 (Stone Oak Area)	$11,029,132
4.	2-450 gpm Well & Pump @ Timberline Station	$3,360,158
	Subtotal	$20,274,233

CIPs Needed by 2018 Estimate of Probable Cost (2018 dollars)

		Project Costs
1.	2.5 MG EST @ Overlook Parkway & land	$7,814,669
2.	3,500 LF 12" D.I. Pipeline from Hardy Oak EST to Timberwood	$866,191
3.	1,000 GPM HSP at Hardy Oak EST to feed Timberwood	$249,972
4.	1,000 GPM Well & Pump @ 1.25 MG EST Site in Castle Hills to feed Blanco Rd Pipeline	$2,291,377
5.	180,000 GAL GST & land (Location to be determined in Timberwood)	$814,900
	Subtotal	$12,037,109

CIPs Total Cost **$32,311,342**

ASSUMPTIONS (from BexarMet)

OVERALL:
3% Interest Applied per year
7% increase applied for engineering costs of facility design
10% increase applied for engineering cost of infrastructure design
10% increase applied for construction contingency
5% increase applied for construction phase services
2% increase applied for program management

ASSUMPTIONS (LAN)

EXISTING SYSTEM CIPs (2008)

#4
- Total cost includes cost of appurtenances
- Total cost includes cost of purchasing a 50' wide easement for length of pipe

#5
- Assumes BexarMet PRV setup is same as SAWS PRV setup
- Total cost of PRV includes box, piping, and valves

#10
- Total cost includes cost for drilling well, on-site improvements (well head, piping, electrical, fencing, grading, etc.), & well pump
- Total cost does not include power to site or any offsite improvements such as access roads and piping
- Total cost does not include cost for water treatment or purification

#11
- Total cost includes cost of appurtenances
- New water main is to be placed in existing Right-of-Way. No easements acquired.

#12
- Total cost includes cost of appurtenances
- New water main is to be placed in existing Right-of-Way. Cost does not include acquiring easements
- Assumes room in Right-of-Way for PRV

#13
- Total cost includes cost of appurtenances
- New water main is to be placed in existing Right-of-Way. No easements acquired.

#14
- Total cost includes cost of appurtenances
- New water main is to be placed in existing Right-of-Way. No easements acquired.

CIPs NEEDED BY 2013

#1
- Includes cost of 1 acre of land, GST, 2 HSPs, & MIOX system

#2
- Total cost includes cost for drilling well, on-site improvements (well head, piping, electrical, fencing, grading, etc.), & well pump
- Total cost does not include power to site, any offsite improvements such as access roads and piping
- Total cost does not include cost for water treatment or purification

#3
- To date, BexarMet has not required that this main provide complete redundancy of the 48-in main from the Bitters well field.
- Total cost includes cost of appurtenances
- New water main is to be placed in existing Right-of-Way. Cost does not include acquiring easements.
- Total cost does not include power to site or any offsite improvements such as access roads and piping
- Total cost does not include cost for water treatment or purification

#4
- Total cost includes cost for drilling well, on-site improvements (well head, piping, electrical, fencing, grading, etc.), & well pump
- Total cost does not include power to site or any offsite improvements such as access roads and piping
- Total cost does not include cost for water treatment or purification

CIPs NEEDED BY 2018

#1
- Total cost includes cost for 1 acre of land, on-site improvements (grading, fencing, piping)
- Total cost does not include power to site or any offsite improvements such as access roads and piping

#2
- Total cost includes cost of appurtenances
- New water main is to be placed in existing Right-of-Way. Cost does not include acquiring easements.
- Length of pipe assumes improvements will be installed near Blanco and West Oak Estates intersection. Location is subject to change

#3
- Total cost does not include power to site or any offsite improvements such as access roads and piping

#4
- Total cost includes cost for drilling well, site improvements (well head, piping, electrical, fencing, grading, etc.), & well pump
- Total cost does not include power to site or any offsite improvements such as access roads and piping
- Does not include cost of property, assumes using EST property
- Total cost does not include cost for water treatment or purification

#5
- Total cost includes cost for 1 acre of land (Location to be determined)
- Total cost includes cost for on-site improvements such as electrical, grading, piping, fencing etc. (does not include electrical offsite)

APPENDIX E:
EXISTING FACILITY & INFRASTRUCTURE INVENTORY

Hill Country (HCV, HP, SO & TP) Pressure Pipes Inventory

Diameter (in)	Ductile Iron (ft)	CI (ft)	Asbestos Cement (ft)	PVC (ft)	Steel (ft)	HDPE (ft)	Cast iron (ft)	Copper (ft)	All Materials (ft)	Volume (gal)
0.8	159	0	0	0	0	0	0	0	159	3.65
1	445	0	0	0	0	0	0	0	445	18.16
1.5	239	0	0	0	0	0	0	0	239	21.94
2	9484	0	0	0	0	0	0	1130	10614	1732.2
2.5	474	0	0	0	0	0	0	0	474	120.87
3	10631	0	0	16021	407	0	0	0	27059	9936.04
4	28150	3448	0	19441	8190	0	0	0	59229	38664.6
5	0	1443	0	0	0	0	0	0	1443	1471.86
6	141503	46857	17273	62162	621	0	0	0	268416	394248.49
8	715256	24032	26617	33394	1121	0	0	0	800420	2090051.78
10	853	6000	0	759	0	0	58	0	7670	31293.53
12	158728	0	0	1778	0	0	0	0	160506	943002.63
16	125201	0	0	0	0	859	0	0	126060	1316668.39
18	2282	0	0	0	0	0	0	0	2282	30166.14
20	4385	0	0	0	0	0	0	0	4385	71563.03
24	26263	0	0	0	0	0	0	0	26263	617200.06
30	29075	0	0	0	0	0	0	0	29075	1067631.49
36	7217	0	0	0	0	0	0	0	7217	381610.97
42	2007	0	0	0	0	0	0	0	2007	144445.86
48	23634	0	0	0	0	0	0	0	23634	2221666.4
All Diameters	1285986	81780	43890	133555	10339	859	58	1130	1557597	9361518.07

Hill Country (HCV, HP, Stone Oak): Inventory

WELL CAPACITY		
PWS NO	WELL ID	GPM
150054	190WP1	0
150054	191WP1	701
150054	193WP1	753
150054	194WP1	723
150054	067WP1	400
150054	066WP1	700
150054	066WP2	1,150
150054	091WP1	1,000
150054	065WP1	2,500
150054	065WP2	3,800
	Total	**11,727**

HIGH SERVICE PUMPS CAPACITY		
PWS NO	HS-ID	GPM
150054	**064HS1**	**1,780**
150054	**064HS2**	**1,780**
150054	**064HS3**	**1,780**
150054	**064HS4**	**1,780**
150054	**064HS5**	**3,000**
150054	**063HS1**	**2,800**
150054	**063HS2**	**2,800**
150054	**063HS3**	**2,800**
150054	**063HS4**	**2,800**
150054	**063HS5**	**2,800**
150054	**063HS6**	**2,800**
150054	**067HS1**	**400**
	Total	**27,320**

GROUND STORAGE TANK		
PWS NO	GT-ID	GAL
150054	**063GT1**	**2,000,000**
150054	**063GT2**	**2,000,000**
150054	**069GT1**	**250,000**
150054	**069GT2**	**500,000**
150054	**067GT1**	**126,700**
	Total	**4,876,700**

ELEVATED STORAGE TANK			
PWS NO	ET-ID	GAL	
150054	**064ET1**	**6,000,000**	KC
150054	**068ET1**	**500,000**	Fleetwood
	Total	**6,500,000**	

Timberwood Park:

WELL CAPACITY		
PWS NO	WELL ID	GPM
150270	082WP1	95
150270	080WP2	120
150270	081WP1	58
150270	095WP1	500
150270	095WP2	500
150270	095WP3	750
150270	095WP4	200
150270	185WP1	150
150270	185WP2	150
150270	185WP3	150
150270	185WP4	150
	Total	**2,823**

Values for June of 2008

HIGH SERVICE PUMPS CAPACITY			
PWS NO	HS-ID	GPM	
150270	**081HS1**	**200**	
150270	**081HS2**	**200**	
150270	**081HS3**	**200**	
150270	**095HS1**	**500**	
150270	**095HS2**	**750**	
150270	**095HS3**	**1,000**	
150270	**095HS4**	**1,000**	
150270	**082HS1**	**285**	Used when Echo Mtn. gets low - kicks on when Echo <115-ft
150270	**082HS2**	**285**	Used when Echo Mtn. gets low - kicks on when Echo <115-ft
150270	**185HS1**	**667**	On-Line by
150270	**185HS2**	**667**	2013
	Total	**5,754**	

GROUND STORAGE TANK		
PWS NO	GT-ID	GAL
150270	**081GT1**	**75,000**
150270	**095GT1**	**500,000**
150270	**082GT1**	**458,000**
	Total	**1,033,000**

ELEVATED STORAGE TANK			
PWS NO	ET-ID	GAL	
150270	**161ET1**	**2,500,000**	EM
	Total	**2,500,000**	

Hill Country PRV Inventory

Id	Label	Diameter (in)
2165	PRV (Evans)	10
2167	PRV (Voight)	8
2168	7th of Sonterra (Blanco Rd)	8
2169	PRV (Granite Spring)	8
2170	PRV (Canyon Golf near Rock Point)	8
2171	PRV-7	16
7510	PRV (Knights Cross)	24
7525	PRV (1604 GST)	42

See

Hill Country

Maps 2