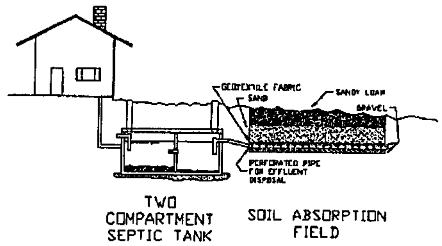
Conventional System



Below Grade Septic System

There are many types of septic systems used for on-site wastewater treatment. These include aerobic treatment units, sand filters, low pressure dose systems and spray irrigation systems. However, currently for the GVSUD CCN service area, the conventional septic system (anaerobic) is the preferred installed system because of its relatively low cost and low required maintenance compared to other systems.

A critical factor in determining the optimum type of septic system to be installed is the soil's ability to absorb water. The soil percolation rate (typically measured in minutes per inch) indicates how quickly water moves through soil and helps evaluate the ability of the soil to absorb and treat effluent. The clay-type soils prevalent in the GVSUD CCN service area have slow percolation rates thus making the use of conventional septic systems using lateral trenches inadmissible. In such areas the installation of a pressure dose system, aerobic system, or other alternative system should be required.

Based on information provided by local on-site sewage facility installers, the cost of installing a typical conventional septic system ranges from $4,000 to $6,000. Low pressure dosing systems cost approximately $6,000 to $8,000 installed, while aerobic systems cost upwards of $8,000.

Additional costs associated with on-site sewage facilities include county permits and inspection fees. These fees vary between counties. Guadalupe County charges a fee of $200 per lot. Comal County charges a fee of $150 for on-site facilities less than 500 gallons per day and $180 for facilities greater than 500 gallons per day.

2.2 Threat of On-Site Septic Systems

Several concerns arise when on-site treatment or septic systems are installed in rapidly developing areas. The primary concern is inadequate and improperly treated effluent entering the water supply sources. The Treasure Island area located adjacent to the Guadalupe River on the East side of the GVSUD CCN service area contains high density aging septic systems. As these existing high-density septic systems age and deteriorate, the probability of improperly treated sewage leaching into water supply sources (Guadalupe River) may pose a public health concern.

Another concern is the limitation placed on developments that require septic systems. Septic systems require large areas of land for effluent discharge. This land used for effluent discharge has limited use. (Septic tank, drain field, sanitary zones, etc.) septic systems increase minimum lot sizes within subdivisions. This limits the number of lots the developer can sell. The GVSUD service area is contained in Bexar County, Guadalupe County and Comal County. Each county has subdivision regulations regarding lot sizes and percolation tests if a central wastewater collection and disposal system is not provided.

Guadalupe County requires single-family residences to provide lots having at least 22,000 square feet (approximately ½ acre) of surface area if it is served by a public water supply. If the residences are served by an individual water supply well and on-site sewage facilities, the well is required to have a 150-foot radius sanitary zone and lot sizes must be a minimum of 44,000 square feet (approximately 1 acre).

In 1997, Comal County began requiring home sites with septic tanks to be at least 3.17 acres. The Commissioner's Court then imposed a moratorium on subdivision development. The rules have since been revised and the current subdivision regulations require a 5.1-acre minimum for home sites with water wells and septic tanks.

In the event a county has not sought delegation of authority from the Texas Commission on Environmental Quality (TCEQ) to regulate septic tanks, then the rules and regulatios of TCEQ aply. In order to obtain delegation, the standards of the county must be at least as strit as those of the TCEQ. TCEQ requires residential lots in a platted or un-platted subdivision served by a public water supply to be at least ½ acre and residential lots not served by a public water supply to be at least one acre (Title 30 Part 1 Chapter 285 Rule §285.4 of Texas Administrative Code).

GVSUD has discussed proposed projects with numerous developers that have indicated they would be interested in high-density subdivisions if wastewater services were available. With the development of wastewater services, GVSUD wastewater CCN service area will likely see an increase in commercial development.

3.0 <u>Existing Wastewater Treatment Facilities Adjacent to GVSUD</u>

3.1 City of Marion

The City of Marion is located near the center of the GVSUD wastewater CCN service area. The City of Marion has wastewater collection and a treatment facility that provides service for its 1,925 residents. Under TPDES Permit No. 10048-001, the City of Marion is permitted to discharge 200,000 gallons per day to Santa Clara Creek. They currently discharge an average of 60,000 to 80,000 gallons per day. Thus, the City of Marion Wastewater Treatment Facility has extra capacity available for a potential wholesale partnership. Some Marion treated effluent is used by Marion ISD for beneficial re-use (irrigation).

The City of Marion has indicated an interest in providing wholesale wastewater treatment for GVSUD. Due to the central location of the City of Marion Facility within the GVSUD wastewater CCN service area (Drainage Basin E), the potential for partnership with the City of Marion could be beneficial. Also, GVSUD may have the opportunity to take advantage of existing experienced City of Marion wastewater personnel.

(see **Attachment 1**, Exhibit 1 - GVSUD Existing Wastewater CCN 20973 Boundary)
(see **Attachment 3**, Exhibit 3 City of Marion Wastewater Treatment Facility Permit)

3.2 City of Santa Clara

The City of Santa Clara has no wastewater collection system or treatment. All wastewater is disposed of with individual on-site septic systems.

3.3 Cibolo Creek Municipal Authority (CCMA)

CCMA wastewater treatment plant located south of the City of Cibolo. The majority wastewater comes from the City of Cibolo, the City of Schertz, and areas west of the GVSUD wastewater CCN service area.

CCMA currently offers wholesale wastewater treatment to areas in the GVSUD western water CCN service area. CCMA is currently permitted by the TCEQ to discharge an average flow of 6.20 million gallons per day of treated effluent into the Cibolo Creek. However, an application to reduce this discharge to an average discharge of 4.50 million gallons per day was filed on May 3, 2002. The 1.7 million gallons not discharged to the Cibolo Creek is used for beneficial re-use. The wastewater treatment facility is located approximately 2.25 miles northeast of the center of Randolph Air Force Base on the south bank of the Cibolo Creek.

The location of the CCMA plant is inconvenient for GVSUD gravity sewer flow. Any potential utilization of the CCMA wastewater treatment facility would require pumping through the existing City of Cibolo collection system. The City of Cibolo has indicated an interest working with GVSUD in providing wastewater services. Even though the CCMA plant has available capacity, the lack of gravity flow makes this option expensive for GVSUD, and a partnership opportunity would be limited.

(see **Attachment 1**, Exhibit 1 - GVSUD Existing Wastewater CCN 20973 Boundary).
(see **Attachment 3**, Exhibit 1 - CCMA Wastewater Treatment Facility Permit)

3.4 Guadalupe Blanco River Authority (GBRA)

GBRA serves a wastewater CCN service area northeast of the GVSUD CCN wastewater service area. Included in this GBRA CCN service area is a wastewater treatment plant (Dunlap WWTP). Even though the plant has received recent upgrades and modifications, the plant capacity is already expended due to rapid development activity in the GBRA wastewater CCN service area.

(see **Attachment 1**, Exhibit 1 - GVSUD Existing Wastewater CCN 20973 Boundary).

Dunlap WWTP

The GBRA Dunlap WWTP is located in the Northeast portion of the GVSUD water service area approximately one mile east of FM 725 and 3.1 miles southeast of the intersection of IH-35 and FM 725. The present wastewater permit, TPDES Permit No 11378-001, is for 160,000 gallons per day. The GBRA Dunlap WWTP is currently operating at 90,000 gallons per day or approximately 56 % capacity. While wastewater effluent can be discharged to Lake Dunlap, it is presently being pumped to the Guadalupe Partners Power Plant for beneficial re-use. The GBRA has stated that it is possible to expand the Dunlap Wastewater Treatment Facility to 1,000,000 gallons per day.

A partnership relationship with the GBRA Lake Dunlap Plant for wholesale wastewater treatment would probably provide limited benefit for GVSUD. The GVSUD wastewater service area is located downstream of the treatment facility. This would create costs associated with pumping wastewater uphill through existing GBRA collection system. There would not be any opportunities to take advantage of a gravity system. The GVSUD service area is located several miles from the Lake Dunlap Plant. It would be expensive for GVSUD to utilize the GBRA Dunlap Wastewater treatment plant.

(see **Attachment 1**, Exhibit 1-GVSUD existing wastewater CCN 20973 boundary).
(see **Attachment 3**, Exhibit 2 – GBRA (Lake Dunlap) Wastewater Treatment Facility Permit).

Northcliffe WWTP

The GBRA is authorized to treat and dispose of effluent from the Northcliffe WWTP. This facility is located near the intersection of FM 1103 and IH-35, approximately five miles northeast of the City of Schertz in southern Comal County. Under TPDES Permit No 11751-001, a non-discharge permit, the facility is authorized to dispose of treated domestic wastewater effluent at a daily average flow not to exceed 300,000 gallons per day by land application irrigation of 117 acres on the Northcliffe Country Club golf course.

In addition, GBRA was issued a second permit to treat and dispose of effluent from the GBRA-Municipal Utility District No. 2 Wastewater Reclamation Facility also located near the intersection of FM 1103 and IH 35. This permit, TPDES No. 11751-002, allows for the discharge of 350,000 gallons per day to an unnamed tributary of Dry Comal Creek.

This Northcliffe Municipal Utility District No. 2 facilityies are located upstream of the GVSUD wastewater CCN service area and would not benefit GVSUD as a beneficial partnership option.

Other

GBRA also has wastewater permits for two other facilities in Guadalupe and Comal Counties. The Springs Hill Wastewater Treatment Facility, located in the City of Seguin, south of the Guadalupe River on State Highway 123, is allowed to discharge 300,000 gallons per day (TPDES Permit No. 11427-001). The Canyon Park Estates Wastewater Treatment Facility (TPDES Permit No 11496-001), is located in northern Comal County. Both facilities are outside of the GVSUD service area and would not pose an available partnership opportunity.

3.5 Meadow View Park

The Meadow View Park Ltd., a private investor owned utility, has obtained a wastewater permit; TPDES permit number 14153-001, which allows their facility to treat and dispose of waste from the Meadow View Park Wastewater Treatment Facility to Town Creek. The facility is located approximately 3 miles west-southwest of the intersection of State Highway 78 and State Highway 465. The permit allows Meadow View Park to discharge a daily average effluent flow of 120,000 gallons per day, with a two-hour average flow peak not to exceed 250 gpm, from the 0.24 MGD facility. No construction has been initiated on this project.

3.6 City of New Braunfels

The New Braunfels Utilities (NBU) wastewater service area is adjacent to the GVSUD northern boundary. At this time no expansion is planned by NBU into the GVSUD wastewater CCN service area. NBU has developed a guideline limiting provision of providing wastewater services only to areas within their water service area.

3.7 San Antonio River Authority (SARA)

SARA operates several wastewater treatment plants South East of the GVSUD service area. Currently these plants are located some distance away from the GVSUD wastewater CCN service area. If the opportunity arises for wastewater growth to extend to the downstream portion of drainage basin G, there could exist an opportunity for GVSUD to partner with SARA.

3.8 Harvest Hills Subdivision

Harvest Hills is a subdivision located within the GVSUD wastewater CCN service area. The development has already obtained a wastewater facilities permit for an irrigation type discharge facility. The wastewater treatment plant, a package type facility has been installed on the development site. There is additional irrigation equipment that still remains for installation. This facility is located approximately 2.5 miles North of the City of Marion.

This facility is an excellent opportunity for GVSUD to take ownership and enter into the wastewater business. There are a few houses built with total build-out expected to be 412 homes. There are also several developers interested in property surrounding the Harvest Hills Subdivision. There may exist an opportunity for GVSUD to provide wastewater service to adjacent developments utilizing the existing Harvest Hill Wastewater treatment Plant Facility.

(see **Attachment 1**, Exhibit 1-GVSUD existing wastewater CCN 20973 boundary).
(see **Attachment 3**, Exhibit 4 – Harvest Hills Wastewater Treatment Facility Permit).

4.0 <u>Proposed Main Sewage Collection System</u>

4.1 Wastewater Collection System Design Approach

To determine the layout of the future wastewater collection system, the GVSUD wastewater CCN service area was divided into seven (7) primary drainage areas, A through G. The proposed location of the main collection system is based on the concept of aligning along major creek beds. This method insures optimal use of gravity for main trunk lines. It is expected that this concept will present itself as the most cost effective means of providing wastewater collection because it minimizes areas that must be served by lift stations (pumps).

(see **Attachment 1**, Exhibit 2 - GVSUD Drainage Basins)

Areas A through G were further divided into smaller drainage areas. These smaller drainages areas were used to develop future build-out wastewater flows for each collection point. From wastewater flows required at each collection point, the main wastewater collection pipes were sized to accommodate the required flow. Each diameter was selected to accommodate 80% of the design flow.

In locations where the diameter of main collection pipes became so large that one large pipe would be not economical to install, two smaller diameter parallel pipes can be an option to accommodate the required flowrate. This parallel method is beneficial for GVSUD because it allows each pipe to be installed one at a time in phases. This allows GVSUD to offer adequate wastewater service, and prepare for ultimate future build-out demand. This approach may prove economical for GVSUD. Addition ROW or utility easement will need to be considered to accommodate this parallel pipes instead of one large pipe.

4.2 Wastewater Standard Design Criteria

Under State Law, the Texas Commission on Environmental Quality (TCEQ) has jurisdictional responsibility for review and monitoring of wastewater facilities for all entities within the State of Texas. With regards to wastewater collection facilities, their design criteria dictate minimum slope requirements for various sizes of pipe as well as alignment and manhole spacing requirements.

Complete design criteria required by TCEQ can be found in Chapter 317 under Title 30 of the Texas Administrative Code, Sections §317.2 and §317.3. The design criteria used in this study meets or exceeds that imposed by the TCEQ.

(see **Attachment 4**, Exhibit 1 – Texas Commission on Environmental Quality (TCEQ)

Presently, GVSUD has not adopted design standards for wastewater collection systems and wastewater treatment facilities. For this reason, the design criteria used for this master plan was modeled after design requirements presented in the City of San Antonio and City Of Austin utilities criteria manuals. Section 2.9.0 of the City of Austin Utilities Criteria Manual provides design criteria for determination of wastewater flows, pipe sizing, lift stations and force mains as well as other design considerations.

(see **Attachment 4**, Exhibit 2 – San Antonio Water System Design Criteria)
(see **Attachment 4**, Exhibit 3 – City of Austin Design Criteria)

This document provides wastewater design criteria standards for both the City of Austin (COA) and the San Antonio Water System (SAWS). The purpose of providing both COA and SAWS design standards is for GVSUD to use as a guide to establish their own preferred set of GVSUD wastewater design criteria standards. TCEQ wastewater design standards should be used as a minimum guide. It is important for GVSUD to adopt a wastewater design criteria standards. This will prepare GVSUD for negotiation with the development community and standardize the GVSUD wastewater system. GVSUD will benefit from reduced operation and maintenance costs by developing a standardized system.

4.3 Equivalent Dwelling Unit (EDU) and Wastewater Design Flows

Wastewater design flows were developed using the EDU (Equivalent Dwelling Unit) concept. An Equivalent Dwelling Unit is defined as an amount of capacity or demand on a daily basis that an average single-family residence requires.

Residential Single Family Units (EDU) = 3.5 capita/EDU

Green Valley Special Utility District
EDU Calculation Summary
Total EDU Calculations

Drainage Basin ID	Total Area (acres)	Development Density (1 EDU/acre)	Total EDU 1	Development Density (3 EDU/acre)	Total EDU 3
A	9,211	1	9,211	3	27,633
B	4,690	1	4,690	3	14,070
C	5,636	1	5,636	3	16,908
D	6,688	1	6,688	3	20,064
E	35,618	1	35,618	3	106,854
F	6,515	1	6,515	3	19,545
G	7,511	1	7,511	3	22,533
	75,869		**75,869**		**227,607**

As shown in this above table, the land use assumptions play an important role in determining the total quantity of EDU. The total of 227,607 EDU with 3 EDU/Acre development densities is substantially greater than 75,869 EDU considering 1 EDU/Acre development densities. GVSUD can expect and prepare for actual EDU growth to fit within the above range.

For design purposes, three different wastewater flow rates were estimated to represent sizing of different portions of the wastewater collection and treatment systems.

An average dry weather flow or average daily flow of 245 GPD per EDU was derived from the following formula:

Average Dry Weather Flow

$$\text{Residentia l Single Family Units (EDU)} = 3.5\,\frac{\text{capita}}{\text{EDU}} \times 70\,\frac{\text{GPD}}{\text{capita}} = 245\,\frac{\text{GPD}}{\text{EDU}}$$

Population per LUE = 3.5 capita/ EDU

Wastewater Demand = 70 GPD/capita

Using the average dry weather flow, a maximum dry weather flow was calculated using the following formula:

Maximum Dry Weather Flow

$$\text{Maximum Dry Weather Flow} = 245\frac{\text{GPD}}{\text{EDU}} \times 3\,\text{PFF} = 735\frac{\text{GPD}}{\text{EDU}}$$

$$\text{Average Dry Weather Flow} = 245\frac{\text{GPD}}{\text{EDU}}$$

$$\text{Maximum Flow Peak Factor} = 3\text{PFF}$$

Adding inflow and infiltration of 750 gallons/acres served

Maximum Wet Weather Flow

$$\text{Maximum Wet Weather Flow} = 735\frac{\text{GPD}}{\text{EDU}} + \left(750\frac{\text{GPD I/I}}{\text{acre}} \times \frac{\text{acre}}{3\,\text{EDU}}\right)$$

$$\text{Maximum Wet Weather Flow} = 985\frac{\text{GPD}}{\text{EDU}} \quad \text{or} \quad 0.7\frac{\text{GPM}}{\text{EDU}}$$

A summary of the wastewater design flow parameters considering the development density range of 1 EDU/Acre to 3 EDU/Acre is summarized in the below table:

Green Valley Special Utility District
Design Flow Summary

Design Flow	Development Density	
	1 EDU/Acre	**3 EDU/Acre**
Average Dry Weather Flow	245 GPD/EDU	245 GPD/EDU
Maximum Dry Weather Flow	735 GPD/EDU	735 GPD/EDU
Maximum Wet Weather Flow	1485 GPD/EDU	985 GPD/EDU

The drainage basins A through G were further divided into smaller drainage areas. The surface area (acres) of these smaller drainage areas were calculated and assumed to contribute wastewater to collection points situated periodically down the main trunk line. The location of collection points for each drainage area and the anticipated flow at each point were calculated to determine the total wastewater flow required for design proposes. By multiplying EDU by the above flows per EDU, the required flow at each collection point was calculated for collection system pipe sizing.

(see **Attachment 1**, Exhibit 3 – GVSUD Area Calculations and Collection Points)
(see **Attachment 2**, Exhibit 1 – Total EDU Calculations)

(see **Attachment 2,** Exhibit 2 – Wastewater Collection System Design Calculations)

Green Valley Special Utility District
Wastewater Design Flows
Three Design Flow Conditions

				Development Density of 1 EDU/acre			Development Density of 3 EDU/acre		
Drainage Basin	Total Area (acres)	Total LUE 1 (EDU/acre)	Total LUE 3 (EDU/acre)	Average Dry Weather Flow (GPD)	Maximum Dry Weather Flow (GPD)	Maximum Wet Weather Flow (GPD)	Average Dry Weather Flow (GPD)	Maximum Dry Weather Flow (GPD)	Maximum Wet Weather Flow (GPD)
Drainage Basin A	9,211	9,211	27,633	2,256,695	6,770,085	13,678,335	6,770,085	20,310,255	27,218,505
Drainage Basin B	4,690	4,690	14,070	1,149,050	3,447,150	6,964,650	3,447,150	10,341,450	13,858,950
Drainage Basin C	5,636	5,636	16,908	1,380,820	4,142,460	8,369,460	4,142,460	12,427,380	16,654,380
Drainage Basin D	6,688	6,688	20,064	1,638,560	4,915,680	9,931,680	4,915,680	14,747,040	19,763,040
Drainage Basin E	35,618	35,618	106,854	8,726,410	26,179,230	52,892,730	26,179,230	78,537,690	105,251,190
Drainage Basin F	6,515	6,515	19,545	1,596,175	4,788,525	9,674,775	4,788,525	14,365,575	19,251,825
Drainage Basin G	7,511	7,511	22,533	1,840,195	5,520,585	11,153,835	5,520,585	16,561,755	22,195,005

The above table summarizes the cumulative design flows generated from each drainage basin at the most downstream location. The Average Dry Weather Flow, Maximum Dry Weather Flow, and the Maximum Wet Weather Flow were calculated by multiplying design flows by the total EDU for each drainage basin. There is a substantial flow difference between development densities of 1 EDU/acre versus 3 EDU/acre. GVSUD should prepare for maximum wastewater flows to fall between these two development densities.

4.4 Wastewater Collection System Design

Peak flow (Maximum Wet Weather Flow) was used to size the main gravity wastewater collection system assuming natural ground slope and 80% line capacity to maintain a minimum line velocity of 2 feet per second (Section 2.9.3, City of Austin Utilities Criteria Manual). A minimum diameter of 8 inches was used for all gravity wastewater mains. Additionally, 8-inch, 10-inch, 12-inch, 15-inch, 18-inch, 21-inch, 24-inch, 27-inch, 30-inch, 33-inch, 36-inch, 42-inch, 48-inch, 54-inch, 60-inch, 66-inch, and 72-inch diameter pipes were considered as standard wastewater pipe diameter sizes.

However, pipe diameters greater than 48" may not prove economical for initial trunk line installation. An alternative option is to prepare for installation of two smaller diameter parallel pipes whose combined cross sectional area equals the required future ultimate build-out cross sectional area. This option allows GVSUD to install one pipe to meet the immediate demand and wait until future ultimate build-out to install the second parallel pipe. This approach allows GVSUD to economically phase wastewater infrastructure to match the rate of development growth. Additional foresight must be taken into consideration in obtaining utility easements wide enough to accommodate two parallel pipes.

Lift station design capacity is determined by the Maximum Wet Weather Flow. All lift stations will be designed to handle the Maximum Wet Weather Flow for the designated service area. The wet well volume is sized to provide adequate storage volume at peak design flows and a sufficient pump cycle time. A minimum of two (2) pumps will be required for all lift stations and pumping capacity will be such that the Maximum Wet Weather Flow can be handled with the largest pump out of service (Section 2.9.3, City of Austin Utilities Criteria Manual). Lift Station design shall be refined during actual project considerations.

Force mains will be designed using C-909 PVC (poly-vinyl chloride) pipe. Force mains will be sized so that the flow velocity is between three (3) and six (6) feet per second (Section 2.9.3, City of Austin Utilities Criteria Manual). Any force main designs shall be refined during actual projects.

Green Valley Special Utility District

1 EDU/acre

Pipe Diameter Design Summary

Pipe Diameter (in)	Basin A Pipe Length (ft)	Basin B Pipe Length (ft)	Basin C Pipe Length (ft)	Basin D Pipe Length (ft)	Basin E Pipe Length (ft)	Basin F Pipe Length (ft)	Basin G Pipe Length (ft)	Total Pipe Length (ft)
8								0
10								0
12	5,600							5,600
15	8,200	2,600	2,600				2,700	16,100
18	19,800	5,600	5,600			2,500	2,700	36,200
21	9,000	7,000	5,600	2,500	7,350	2,500	5,000	38,950
24	3,500	5,000	5,200	2,500	17,200	5,000	2,500	40,900
27	2,500		5,000	5,300	22,300	5,000	2,800	42,900
30	2,500			5,600	15,450	12,200	2,900	38,650
33	11,400				21,650		3,000	36,050
36					5,800			5,800
42								0
48					7,000			7,000
54					18,500			18,500
60					9,600			9,600
66								0
72								0
Total	62,500	20,200	24,000	15,900	124,850	27,200	21,600	296,250
							56	Miles

The above table is a summary of the required main wastewater collection system pipe diameters to service a development density of 1 EDU/Acre.

Green Valley Special Utility District
3 EDU/acre
Pipe Flow Design Summary

Pipe Diameter (in)	Basin A Pipe Length (ft)	Basin B Pipe Length (ft)	Basin C Pipe Length (ft)	Basin D Pipe Length (ft)	Basin E Pipe Length (ft)	Basin F Pipe Length (ft)	Basin G Pipe Length (ft)	Total Pipe Length (ft)
8								0
10								0
12								0
15	2,600							2,600
18	11,200	2,600	2,600				2,700	19,100
21	13,800	2,800	2,800				2,700	22,100
24	9,500	2,800	2,800		4,600	2,500	2,500	24,700
27	5,500	2,600	2,800	2,500	7,350	2,500	2,500	25,750
30	3,500	9,400	5,400		12,600	5,000	2,500	38,400
33			7,600	2,500	13,000	2,500	2,800	28,400
36	5,000			5,300	14,450	7,700	2,900	35,350
42	11,400			5,600	31,950	7,000	3,000	58,950
48					5,800			5,800
54								0
60					7,000			7,000
66					5,000			5,000
72					23,100			23,100
Total	62,500	20,200	24,000	15,900	124,850	27,200	21,600	296,250
							56	Miles

The above table is a summary of the required main wastewater collection system pipe diameters to service a development density of 3 EDU/Acre. There is a greater quantity of larger diameter pipes required for the greater development density of 3 EDU/Acre.

The contrast in development density between 1 and 3 EDU/Acre provides a range on which to anticipate future development. The 1 EDU/Acre represents low development density and 3 EDU/Acre represents high development density. GVSUD can expect future development density to fall in between these two EDU densities.

(see **Attachment 1**, Exhibit 4 – GVSUD Proposed Wastewater Main Collection System)
(see **Attachment 2**, Exhibit 2 – Wastewater Collection System Design Calculations)

5.0 Wastewater Treatment Plant Capacity and Costs

GVSUD has several options for wastewater treatment. One option is to partner with existing adjacent wastewater providers. GVSUD would provide the trunk lines and provide retail service to the customers. The partnership would provide wholesale treatment services and the existing adjacent wastewater providers would provide wholesale wastewater treatment.

One potential partnership that would be beneficial for GVSUD is the City of Marion. The City of Marion is considering expanding their wastewater CCN to provide service to areas within their water service area. They have expressed a desire to reserve available treatment capacity in their wastewater treatment plant for this expansion and for anticipated growth within their service area. The City of Marion may be willing to contract to provide wholesale wastewater treatment for GVSUD wastewater retail service.

Another opportunity exists at the Harvest Hills Subdivision. This 250,000 GPD facility already exists and soon will be on-line. The owner has expressed an interest for GVSUD to take ownership and operate. If an agreement can be negotiated between GVSUD and the treatment plant private owner, then GVSUD could see a relatively easy entry into the wastewater business.

The other option would be to construct new wastewater treatment facilities. Final scope and budget for the construction of new facilities would need to be determined on an individual basis and were only estimated in this report. Initially, these treatment plants would serve individual development projects. As these individual developments start to populate portions of the GVSUD wastewater CCN service area, GVSUD could utilize capital investment for wastewater infrastructure to provide a more regional wastewater collection and treatment opportunities.

These plants would initiate as small plants servicing the local development. As development increases, these small plants would be replaced with connecting infrastructure and larger regional facilities. These larger facilities would be phased to expand as capacity requires, and also be replaced with larger regional facilities which would locate downstream of major drainage basins.

The optimal result would be for GVSUD to own and operate large regional wastewater treatment facilities located at the most downstream locations in each drainage basin. Several drainage basins that flow in a common direction could be combined to share a regional wastewater treatment facility. A potential partnership with other entities could assist with economical means of developing large regional wastewater treatment plant facilities. These large regional facilities would only be justified when the GVSUD wastewater service area reaches ultimate build-out and wastewater demand exists.

Green Valley Special Utility District Wastewater Treatment Capacity Summary Most Downstream Drainage Basin Location		
Design Flow	**1 EDU/Acre**	**3 EDU/Acre**
	Capacity (MGD)	**Capacity (MGD)**
Drainage Basin A	2.3	6.8
Drainage Basin B	1.1	3.4
Drainage Basin C	1.4	4.1
Drainage Basin D	1.6	4.9
Drainage Basin E	8.7	26.2
Drainage Basin F	1.6	4.8
Drainage Basin G	1.8	5.5

The above table shows the wastewater capacity per 1 and 3 EDU/Acre development densities at the most downstream location in each drainage basin.

The exhibits in the attachments show theoretical wastewater treatment plants distributed along major trunk lines in each drainage basin. As the plants locate further downstream, there is a need for larger wastewater treatment plants. This shall be useful as a working guide to quickly estimate wastewater treatment capacity and costs at any pointy in the GVSUD wastewater collection system.

(see **Attachment 1,** Exhibit 5 - GVSUD Proposed Wastewater Treatment Capacity and Cost vs. Downstream Locations)
(see **Attachment 2**, Exhibit 4 – Wastewater Treatment Plant Capacity and Costs)

6.0 Capital Improvement Projects (CIP)

Presently, there are no GVSUD CIP projects to discuss. Each major trunk line along with the associated costs can be considered a preliminary list of CIP. As further communication with the development a community transpires, GVSUD shall develop list of CIP.

The adoption of the Harvest Hills Wastewater Treatment Plant could be considered an initial GVSUD Wastewater CIP.

7.0 Discharge Options and Permits

There are three basic types of effluent discharge permits. There is land application type, or zero discharge, where the effluent is discharged onto the surface of the land for evaporation or further filtration through the soil. This application is the easier permit to obtain from the TCEQ. However, this permit requires a great deal of land space that cannot be used for residential purpose.

The second type of permit is an effluent discharge permit. This type of permit allows wastewater effluent to be discharged into surface waters. This type of permit does not require as much land to support, but takes a great deal of time and is not a simple process to obtain a permit with TCEQ.

The third type of effluent discharge would be an opportunity for reuse or possibly sell the effluent. These options have revenue merit as well as benefit to society merit. There could be a great deal of costs associated with this type of discharge if there is not a reuse facility conveniently located nearby. The opportunity for wastewater effluent reuse would require additional study on a per project basis. As wastewater opportunities begin to surface, GVSUD should always explore wastewater effluent reuse opportunities from both customer service and potential additional revenue stream.

8.0 Estimated Costs

8.1 Wastewater Main Collection System Costs

For the purpose of determining long range feasibility and probable impact fees, a cost estimate was prepared for the wastewater collection system for Drainage Areas A through G. The estimates include costs associated with construction, basic engineering, easement acquisition, and survey. The cost estimates are shown in the below tables represent estimated cost for the proposed main wastewater collection system. The table identifies the costs of wastewater collection system per 1 and 3 EDU/Acre development densities.

Green Valley Special Utility District
Summary Costs
Proposed Main Wastewater Collection System
Engineer's Opinion of Probable Costs

Basin	Total Costs 1 (EDU/acre)	Total Costs 3 (EDU/acre)	Variance
A	$ 11,212,950.00	$ 13,229,734.00	$ 2,016,784.00
B	$ 3,379,449.00	$ 3,848,841.00	$ 469,392.00
C	$ 4,151,280.00	$ 4,773,440.00	$ 622,160.00
D	$ 3,072,068.00	$ 4,188,876.00	$ 1,116,808.00
E	$ 34,601,813.00	$ 43,682,177.00	$ 9,080,364.00
F	$ 5,230,109.00	$ 6,739,925.00	$ 1,509,816.00
G	$ 3,963,086.00	$ 4,673,334.00	$ 710,248.00
Total	**$ 65,610,755.00**	**$ 81,136,327.00**	$ 15,525,572.00

This cost estimate is based on River City Engineering's experience and qualifications, and represents River City Engineering's best judgment. This cost estimate was prepared for feasibility analysis purposes only. River City Engineering does not guarantee that the actual construction cost will not vary from this estimate. Unit prices were used from SAWS average unit price list revised October 2005. Units prices will not remain constraint and will vary due to market variations such as inflation.

(see **Attachment 2**, Exhibit 3 Wastewater Collection System Costs for unit prices)

8.2 Wastewater Treatment Plant Costs

For the purpose of determining long range feasibility and probable impact fees, a cost estimate was prepared for the wastewater treatment plant facilities. The wastewater treatment plant facilities were located at several locations along the downstream path of the main trunk line through each watershed or drainage basin. The estimates include the capacity of the plant if the plant was to be located at the location shown on the trunk line. These plant locations are not intended to represent actual recommended locations for wastewater treatment plants, but do represent what capacity and associated costs would exist periodically down the stream of the trunk line. The costs estimates includes construction, basic engineering, easement acquisition, and survey. The cost estimates shown (Attachment 1 Exhibit 5 GVSUD proposed wastewater treatment capacity and costs vs. downstream locations) represent theoretical wastewater treatment plant locations, required capacity at the assumed location, and costs of proposed wastewater treatment facilities. This method allows GVSUD to estimate wastewater treatment capacity and costs anywhere along the collection system.

The following table represents wastewater treatment costs at the most downstream location within each drainage basin.

Green Valley Special Utility District
Wastewater Treatment Costs Summary
Most Downstream Drainage Basin Location

Design Flow	1 EDU/Acre Costs ($)	3 EDU/Acre Costs ($)
Drainage Basin A	$ 7,898,433	$ 20,310,255
Drainage Basin B	$ 4,021,675	$ 12,065,025
Drainage Basin C	$ 4,832,870	$ 14,498,610
Drainage Basin D	$ 5,734,103	$ 17,202,308
Drainage Basin E	$ 26,179,965	$ 39,269,948
Drainage Basin F	$ 5,586,613	$ 16,759,838
Drainage Basin G	$ 6,440,683	$ 16,561,755

(see **Attachment 2**, Exhibit 4, Wastewater Treatment Plant Capacity and Costs for unit prices (Costs/GPD)

From the above table the required cost to provide wastewater treatment is substantially different between 1 EDU/Acre and 3 EDU/Acre development densities. The actual wastewater capacity and costs will be somewhere between these two EDU densities.

9.0 Proposed Financing Opportunities

GVSUD has several financing options when determining projects. The projects can be funded through equity, debt, or arrangements with the development community. For the debt arrangement, GVSUD could utilize the existing revenue streams from the water service to raise funds for wastewater. However, due to the political disagreement with water users who do not get wastewater services, this would probably not help GVSUD.

Through legislation, GVSUD could also designate portions of the GVSUD wastewater CCN service area as a taxing entity. This could also cause political disagreement with water service customers who do not get wastewater service.

9.1 Community Development Block Grant, Rural Development – U. S. Department of Agriculture

The U. S. Department of Agriculture provides loans and grants for water and sanitary sewer projects through its Rural Development Program. First time water and sanitary sewer service projects usually receive favorable consideration.

The Rural Development Program has a Colonias grant program for which the entire amount of the requested funds is allowed. To be eligible for this program, the community has to be a declared or listed "Colonia". Further study is required to determine if any areas within the GVSUD wastewater CCN service area qualifies.

The typical grant program for this agency requires a match from the applicant. The match amount may vary from between 25 and 40 percent of the amount of the grant. We note that should the District receive funds from other programs, these funds could be used to meet the amount required for local participation. The Rural Development Program also has a low interest loan program for applicants to use to meet their match.

The Rural Development programs require that funds not be released to the applicant until a construction contract is entered into. Although engineering fees are eligible for grant funds, interim payments from the grant funds are not allowed. These fees would include the cost of a preliminary engineering report required for the program as well as the basic design fees. Design drawings and specifications must be accepted by Rural Development prior to bid. The bid package must incorporate standard forms and terminology required by the program. Typically, the process of applying for and receiving a grant from the Department of Agriculture, Rural Development, takes a long time requiring between 24 and 30 months from submittal to approval for bid.

These grants are favorable for improvement of low income area infrastructure. New high density development would not be favored for these types of grants.

9.2 Economic Development Administration

The Economic Development Administration is part of the U. S. Department of Commerce. The purpose of this organization is to promote business growth and thus provide jobs for a service area. Grants for this program require written commitments from potential employers that will move to a service area if services are provided or statements from existing employers that they will move out if the services are not provided. The number of new jobs which can be attributed to the completion of the project is an important consideration for grants from this agency. Grants for this program typically require a 20 to 30 percent match from the applicant.

Processing time for the Economic Development Administration grant is typically between 12 and 18 months from submittal to approval for bid. Interim costs prior to construction will be paid as part of the process.

This approach could be utilized as commercial development increases along the IH-10 corridor.

9.3 Impact Fees from Prospective Developers

Special Utility Districts may develop and institute an impact fee program to share the costs of providing infrastructure improvements to their service area. The operation of such a program is governed by state laws and must be adopted by the Texas Commission on Environmental Quality.

In this approach, a master plan for infrastructure improvements for a projected population at some time in the future and the associated costs for these improvements is developed. These costs are prorated to the total projected number of services, and per service costs assigned to each new service. As construction on lots for new developments begin, the impact fees for that lot are paid. Existing developments are not required to pay these impact fees.

The establishment of an impact fee program allows GVSUD to have the costs of infrastructure improvements to be partially borne by new development. Funds collected from new development are assigned to an audited account and then used to construct the proposed improvements, as they are required. GVSUD shall establish a wastewater impact fee subcommittee to manage the program.

It is extremely important that GVSUD establish a wastewater impact fee for new development. The GVSUD strategy to develop wastewater service through new development requires GVSUD to have Impact Fee policy in-place.

9.4 Municipal Bonds

The District may issue revenue bonds for the financing of the proposed improvements based on the collection of future income from the project. The bonds would be issued based on the estimated costs of the proposed improvements in addition to associated issuance costs. Bonds are typically sold to Government agencies Federal – Rural Development Assistance (RDA), State of Texas Water Development Board (TWDB) and Private Bond Market. Interest rates and terms vary based on associated risk, taxable or tax-exempt issuance and lender. Bonds typically are 20-30 years in duration with a "call" period, minimum finance period of 10 years. Rates are typically 1 to 4 points over-prime lending rates. Presently these rates are 5-7%.

The bonds could be established through three different mechanisms. First, GVSUD could sell bonds based on the income from the water service revenues. This could be a political issue due to some water rate payers would not be benefiting from wastewater services, but are charged the rate of the bonds on their water bill. Second, GVSUD could establish its wastewater service area as a special taxing unit. This approach would require passed legislation for the special taxing entity. Again with this approach, the political turmoil would exist from some tax payers not benefiting from wastewater services.

Third, GVSUD would establish itself in the wastewater business by first taking ownership and operation of the Harvest Hills wastewater treatment plant. This would start revenues flowing into GVSUD. As additional developments come on line, increased revenues could assist GVSUD to sell bonds for the capital required to install wastewater infrastructure to connect the new developed areas. The infrastructure increase would grow at the same pace as development and would slowly lead itself to more desirable regional wastewater collection systems and treatment facilities.

9.5 USDA Rural Development, TWDB, or Co Bank

As GVSUD develops a wastewater customer base, further opportunities for the third-party debt financing option will materialize. A USDA Rural Development loan for wastewater infrastructure under 7 USCA §1926 will provide GVSUD with CCN protection from competing wastewater providers.

10.0 Proposed Impact Fees

Communities as well as utility districts may develop and institute an impact fee program. The impact fee allows developers to share the costs of providing infrastructure improvements to their area. Wastewater impact fees and rates for local wastewater service providers are presented below.

New Braunfels Utilities charges a wastewater impact fee and a sewer tap fee. The wastewater impact fee is $1,160 per connection and the sewer connection fee is $655 per tap.

The City of Seguin also charges a sewer impact fee and a sewer tap fee. The sewer impact fee is $500 and the sewer tap fee is $470.

Cibolo Creek Municipal Authority (CCMA), who offers wholesale wastewater treatment to areas in the Green Valley SUD, charges a sewer impact fee of $985 per EDU (equivalent dwelling unit). The cost of treatment is $1.60 per 1,000 gallons.

GBRA charges a monthly service fee as well as a connection fee for the wastewater service it provides. The connection fee is $1,000 per EDU and the monthly service fee is $32.

Green Valley Special Utility District
Wastewater impact Fees and Rates
Neighboring Utilities

Neighboring Utility	Wastewater Impact Fee	Wastewater Connection Fee	Cost of Treatment ($/1000 gal)	Monthly Service Fee
New Braunfels Utilities	$1,160	$655		
City of Seguin	$500	$470		
CCMA	$985		$1.60	
GBRA		$1,000		$32

The surrounding wastewater providers approach impact fees differently. These rates for the surrounding entities are considered normal for area developers. GVSUD should establish an impact fee rate schedule that benefits GVSUD and remains within the range of the surrounding wastewater providers. Further, GVSUD should consult with an accountant to establish the required rate necessary for GVSUD to recover the proper amount of capital.

To evaluate feasibility and determine probable impact fees, the total project cost of each drainage area was divided by the expected number of EDU's in each respective drainage area. It should be noted that these costs do not include any costs associated with operation and maintenance of the wastewater treatment facilities or service lines from customers to the collection system.

Green Valley Special Utility District Wastewater Impact Fees Main Wastewater Collection System (Trunk Lines)						
Drainage Basin	Total LUE 1 (EDU/acre)	Total LUE 3 (EDU/acre)	Dev Density of 1 EDU/acre		Dev Density of 3 EDU/acre	
			Total Costs	Potential Impact Fee	Total Costs	Potential Impact Fee
Drainage Basin A	9,211	27,633	$11,212,950	$1,217	$13,229,734	$479
Drainage Basin B	4,690	14,070	$3,379,449	$721	$3,848,841	$274
Drainage Basin C	5,636	16,908	$4,151,280	$737	$4,773,440	$282
Drainage Basin D	6,688	20,064	$3,072,068	$459	$4,188,876	$209
Drainage Basin E	35,618	106,854	$34,601,813	$971	$43,682,177	$409
Drainage Basin F	6,515	19,545	$5,230,109	$803	$6,739,925	$345
Drainage Basin G	7,511	22,533	$3,963,086	$528	$4,673,334	$207
Total	**75,869**	**227,607**	**$65,610,755**	**$865**	**$81,136,327**	**$356**

Green Valley Special Utility District Wastewater Impact Fees Wastewater Treatment Facility						
Drainage Basin	Total LUE 1 (EDU/acre)	Total LUE 3 (EDU/acre)	Dev Density of 1 EDU/acre		Dev Density of 3 EDU/acre	
			Total Costs	Potential Impact Fee	Total Costs	Potential Impact Fee
Drainage Basin A	9,211	27,633	$7,898,433	$858	$20,310,255	$735
Drainage Basin B	4,690	14,070	$4,021,675	$858	$12,065,025	$858
Drainage Basin C	5,636	16,908	$4,832,870	$858	$14,498,610	$858
Drainage Basin D	6,688	20,064	$5,734,103	$857	$17,202,308	$857
Drainage Basin E	35,618	106,854	$26,179,965	$735	$39,269,948	$368
Drainage Basin F	6,515	19,545	$5,586,613	$858	$16,759,838	$858
Drainage Basin G	7,511	22,533	$6,440,683	$858	$16,561,755	$735
Total	**75,869**	**227,607**	**$60,694,342**	**$800**	**$136,667,739**	**$600**

The above two tables estimate the impact fee range that GVSUD may need to require for new wastewater development. The top table represents potential impact fees associated with the main wastewater collection system, the bottom table shows potential impact fees associated with construction of wastewater treatment facilities.

The following table is a summary of the above two tables combined.

Green Valley Special Utility District Wastewater Impact Fee Summary Wastewater Collection and Treatment Combined						
Drainage Basin	Dev Density of 1 EDU/acre			Dev Density of 3 EDU/acre		
	Wastewater Collection Impact fee	Wastewater Treatment Impact fee	Total Impact Fee	Wastewater Collection Impact fee	Wastewater Treatment Impact fee	Total Impact Fee
Drainage Basin A	$1,217	$858	**$ 2,075**	$479	$735	**$1,214**
Drainage Basin B	$721	$858	**$ 1,578**	$274	$858	**$1,131**
Drainage Basin C	$737	$858	**$ 1,594**	$282	$858	**$1,140**
Drainage Basin D	$459	$857	**$ 1,317**	$209	$857	**$1,066**
Drainage Basin E	$971	$735	**$ 1,706**	$409	$368	**$776**
Drainage Basin F	$803	$858	**$ 1,660**	$345	$858	**$1,202**
Drainage Basin G	$528	$858	**$ 1,385**	$207	$735	**$942**

From the above impact fee summary, GVSUD may need to charge a wastewater impact fee of approximately $2000 per EDU.

11.0 Recommendations

As previously developed, the cost of facilities to provide centralized wastewater service is less than or comparable to that provided by individual private on-site septic disposal systems. The benefits of public health and safety, water quality, both surface and groundwater protections are clearly evident.
The attached list of items are action items for consideration and implementation by the GVSUD Board of Directors.

1. Assume ownership and operation of Harvest Hills Property wastewater treatment plant.
2. Explore partnership opportunities with the City of Marion.
3. Aggressively pursue potential wastewater collection and treatment projects.
4. Limit Indendently Owner Utility (IOU) systems.
5. Adopt design criteria standards.
6. Adopt Impact Fees.
7. Identify develop density to stay consistent across entire GVSUD wastewater CCN.
8. GVSUD Attorney Mr. Mark Zeppa has recommended amending GVSUD by-laws to clearly delineate its ability to provide wastewater service to its customers. Mr. Zeppa has suggested draft rules changes for adoption.
9. Establish wastewater management team as shown in the below hierarchy diagram.
10. Establish GVSUD wastewater subcommittee.
11. Establish and adopt official GVSUD wastewater policies, tariffs, and by-laws.

12. Establish contract with Harvest Hills as wastewater owner and operator. GVSUD shall develop a service plan to provide wastewater service to this tract and possibly adjacent tracts.
13. Revise service applications (standard and non-standard) and easement applications forms to reflect not only water but wastewater as well.
14. Establish sales and marketing strategy for wastewater services.
15. GVSUD should meet with City of Santa Clara officials to discuss wastewater service plans. The above No. 5 Harvest Hills tract is in Santa Clara's political limits. To prevent future wastewater utilities from entering GVSUD wastewater CCN service area, a development plan to resolve these issues should be explored.
16. The City of Marion has expressed a desire to provide wastewater service outside its city limits. Discussions should be held to formalize a service plan between GVSUD and the City of Marion to insure infrastructure for wastewater service.
17. Discussion with GBRA on further regional long range wastewater facilities of much larger scale. Future wastewater needs for the GBRA CCN located to the Northeast of GVSUD's CCN will exceed current site capacity and a new larger site will be required.
18. New developments will fund wastewater systems with new construction. GVSUD should look for possible grants and innovative funding options to provide centralized service to existing subdivisions and developments. This would allow retrofitting and abandonment of their onsite systems for conversion to a centralized system. This can occur as service plans are developed.
19. Discuss with the residents of Treasure Island area the necessity to do away with existing individual below grade septic systems that could be potentially contaminating the Guadalupe River (Lake McQueeney). Propose GVSUD options to provide quality wastewater service to this area.
20. Adopt a formal development density to stay consistent throughout the GVSUD wastewater CCN service area.
21. Consider USDA Rural Development Assistance or TWDB type loans for CCN protection from competing wastewater providers who may attempt to take portions of GVSUD wastewater CCN service area.
22. Establish GVSUD wastewater design criteria standards.
23. Further study to implement wastewater impact fees.
24. Promote and advertise public meeting with development community.
25. Hire wastewater operator

River City Engineering, Ltd. is prepared to assist GVSUD with this long-term planning and assessment to implement this much needed utility service. Mutual cooperation with area utility systems and regulator authority will insure proper service and development.

12.0 Management Plan

GVSUD Board of Directors, General Manager, and Staff

For GVSUD to aggressively enter into the wastewater business there must be a wastewater team established. Due to the start-up nature of GVSUD involvement with wastewater, GVSUD needs internal motivation and aggressive wastewater board of directors, general manager, and staff. Included with duties of GVSUD should be the development of vision and mission statement to clearly define to its customers the long term wastewater goals.

GVSUD wastewater manager should continuously search for wastewater business opportunities to gain the competitive advantage with potential competition in the GVSUD wastewater CCN service area. GVSUD should organize wastewater subcommittee who can spend the time required to properly manage and get wastewater action items completed.

Engineering Consultant

GVSUD has hired River City Engineering, Ltd. (RCE) to develop this overall wastewater master plan. RCE is prepared to provide GVSUD technical direction beyond the adoption of this master plan and assist GVSUD into the wastewater business.

Legal Consultant

Mark Zeppa has been hired to represent GVSUD to establish formal policies and tariff rates. Also, Mr. Zeppa provides advice with general legal approach for GVSUD policy, rate structure and tariffs, rules and regulations, by-laws, and the eventual implementation of development impact fees.

Financial Consultant

GVSUD has several options to consider for funding of wastewater projects. GVSUD needs to establish a capital budgeting procedure. The procedure should at a minimum define the process of project identification, evaluation, selection, and verification.

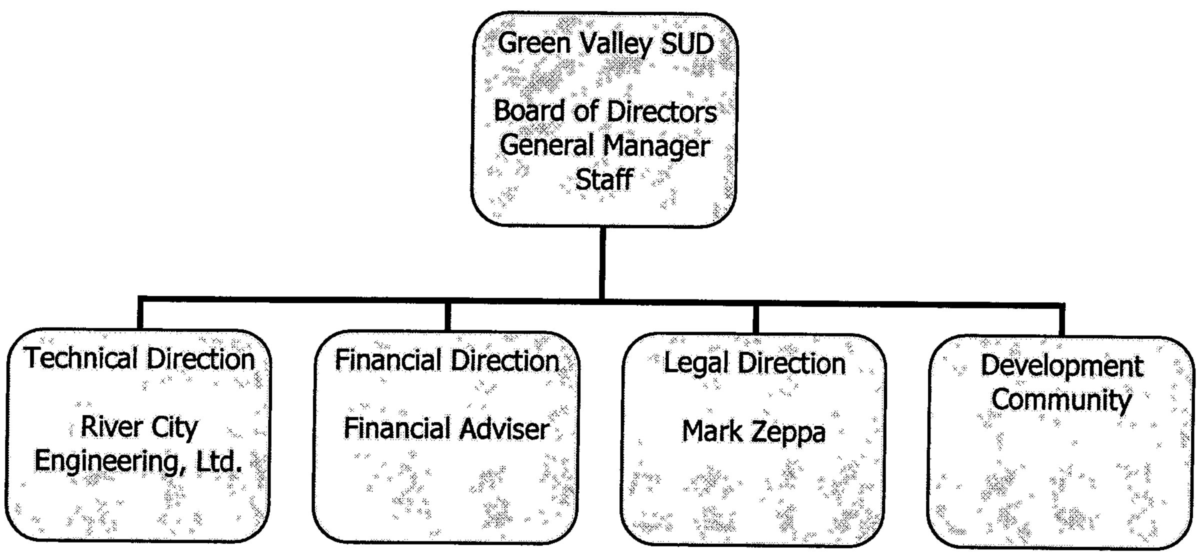
GVSUD should hire a financial adviser to assist with bond opportunities. The financial adviser shall assist GVSUD with capital through equity versus capital through debt, financial consultation and direction, and bond management.

GVSUD should also be aware of available grants and loans.

Development Community

The development community shall provide direction and assistance with initial wastewater start-ups dealing with new development. The area is prime for growth and the development community can assist bringing wastewater customers to GVSUD. There is a great deal of negotiation and dialog between GVSUD and the development community dealing with subjects like project phasing and cost assistance.

The Green Valley Special Utility District
Wastewater Business Team

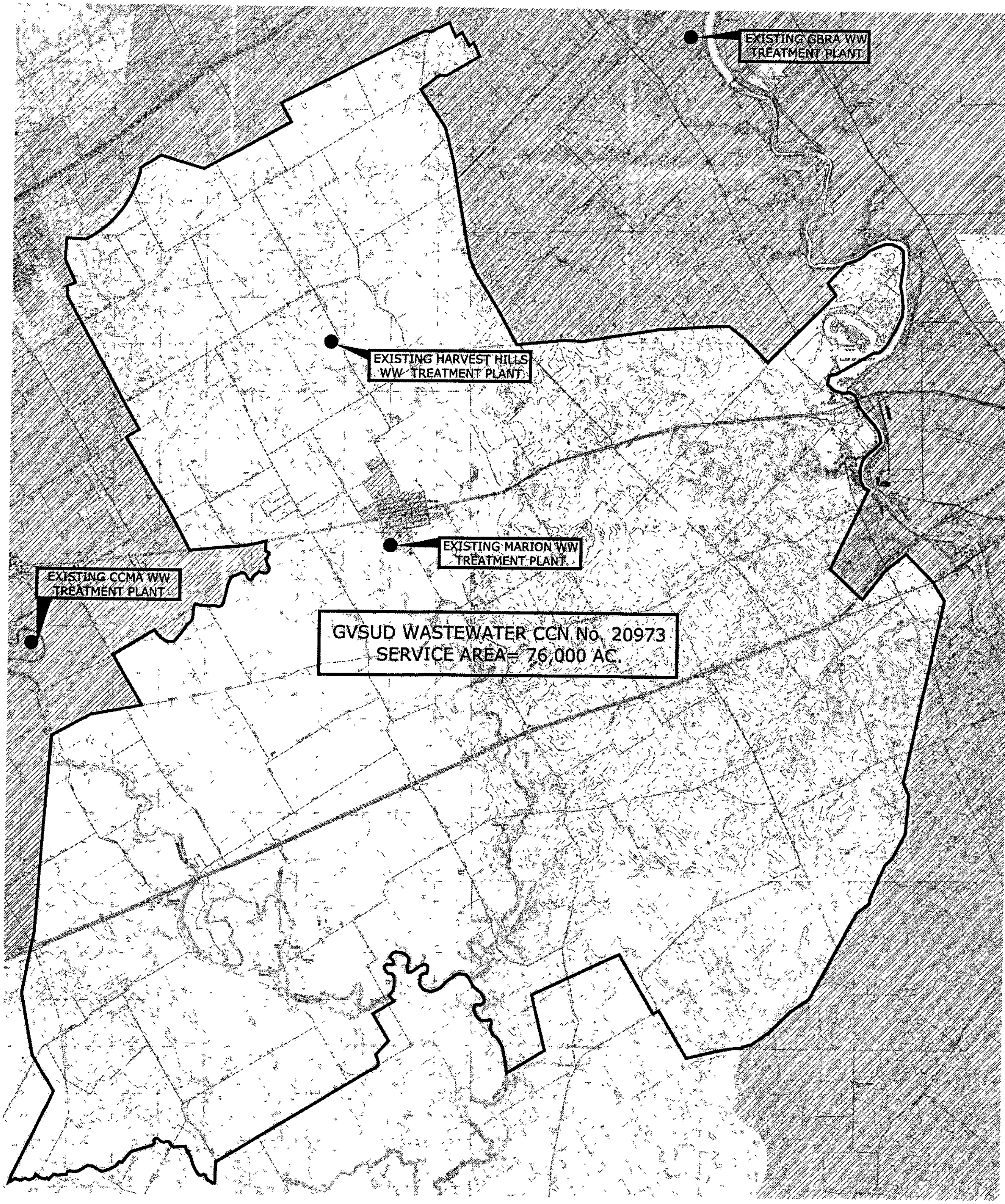


13.0 Conclusion

RCE looks forward to working with GVSUD with the wastewater venture in the future. The GVSUD wastewater CCN service area is prime for development and RCE recognizes GVSUD for the leadership and vision required to bring wastewater services to their customers. With continued support from the above wastewater team, GVSUD should prove itself to be the leader for quality wastewater service in the region.

Attachment 1
Exhibit Drawings

- Exhibit 1 GVSUD Existing Wastewater CCN No. 20973 Boundary
- Exhibit 2 GVSUD Drainage Basins
- Exhibit 3 GVSUD Area Calculations and Collection Points
- Exhibit 4 GVSUD Proposed Wastewater Main Collection System
- Exhibit 5 GVSUD Theoretical Locations of Wastewater Treatment Capacity and Costs vs. Downstream Locations
- Exhibit 6 GVSUD Proposed Growth and Development



LEGEND

- MARION SEWER CCN
- CIBOLO CITY LIMITS AND ETJ CCN
- SPRINGS HILL WSC CCN
- GBRA SEWER CCN
- EAST CENTRAL CCN
- NEW BRAUNFELS CCN
- SCHERTZ SEWER CCN
- SCHERTZ WATER CCN
- GREEN VALLEY WATER/SEWER CCN

SCALE 1"=3000'

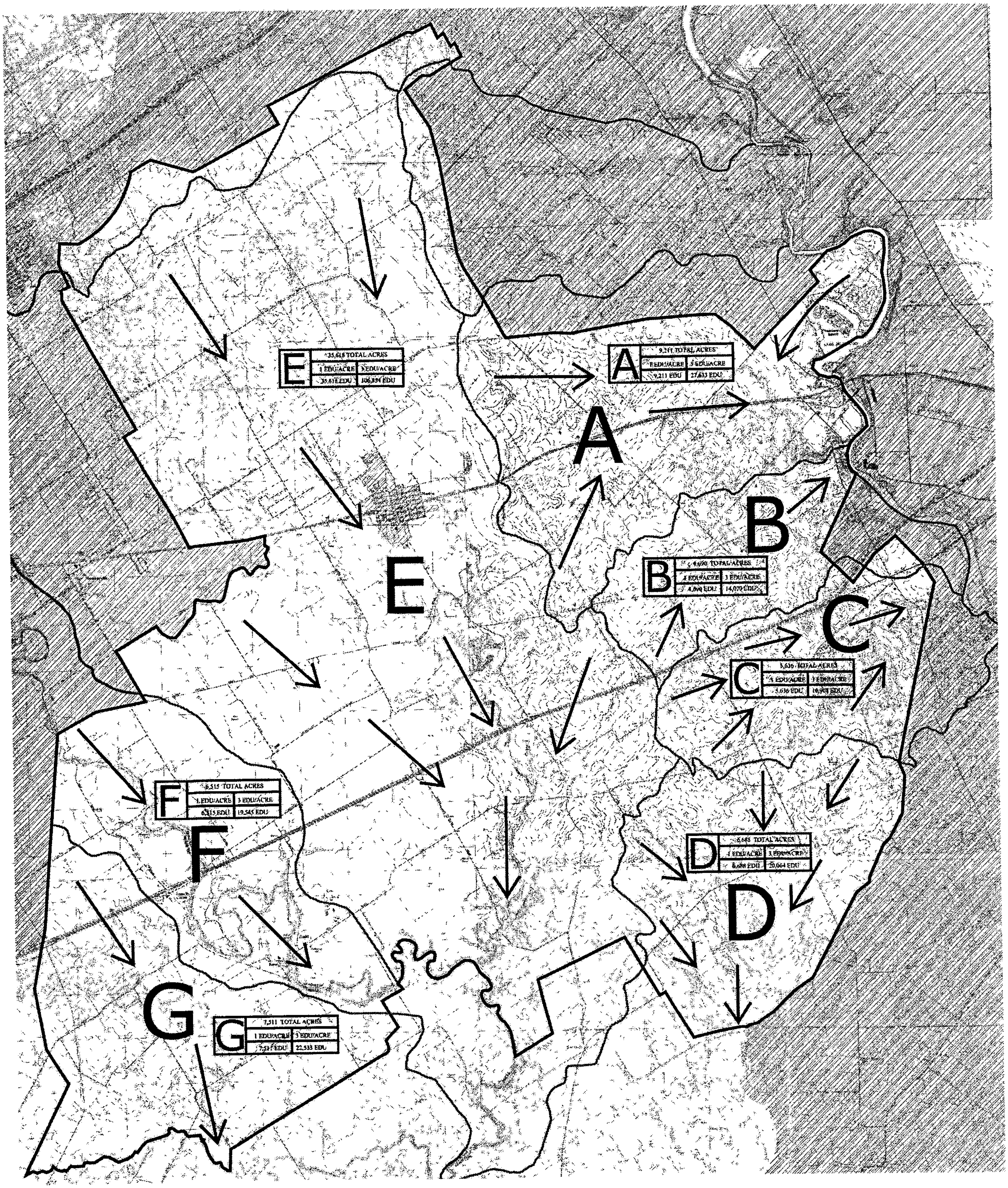
EXHIBIT-1
EXISTING GVSUD WASTEWATER CCN BOUNDARY

DESIGNED: SH	PROJECT NO. 6096-07	DATE: 11/2006	SHEET NO. 1 OF 6

RIVER CITY ENGINEERING, LTD.
CONSULTING CIVIL ENGINEERS

3801 SOUTH 1ST STREET
AUSTIN, TEXAS 78704-7047
PHONE-(512) 442-3008
FAX-(512) 442-6522

1011 W. COUNTY LINE ROAD, SUITE C
NEW BRAUNFELS, TEXAS 78130
PHONE-(830)-626-3588
FAX-(830)-626-3601



LEGEND

- MARION SEWER CCN [illegible]
- CIBOLO CITY LIMITS AND ETJ CCN [illegible]
- SPRINGS HILL WSC CCN [illegible]
- GBRA SEWER CCN
- EAST CENTRAL CCN [illegible]
- NEW BRAUNFELS CCN
- SCHERTZ SEWER CCN [illegible]
- SCHERTZ WATER CCN [illegible]
- MAJOR BASINS
- GREEN VALLEY WATER/SEWER CCN
- DRAINAGE FLOW DIRECTIONS

SCALE 1" 2000'

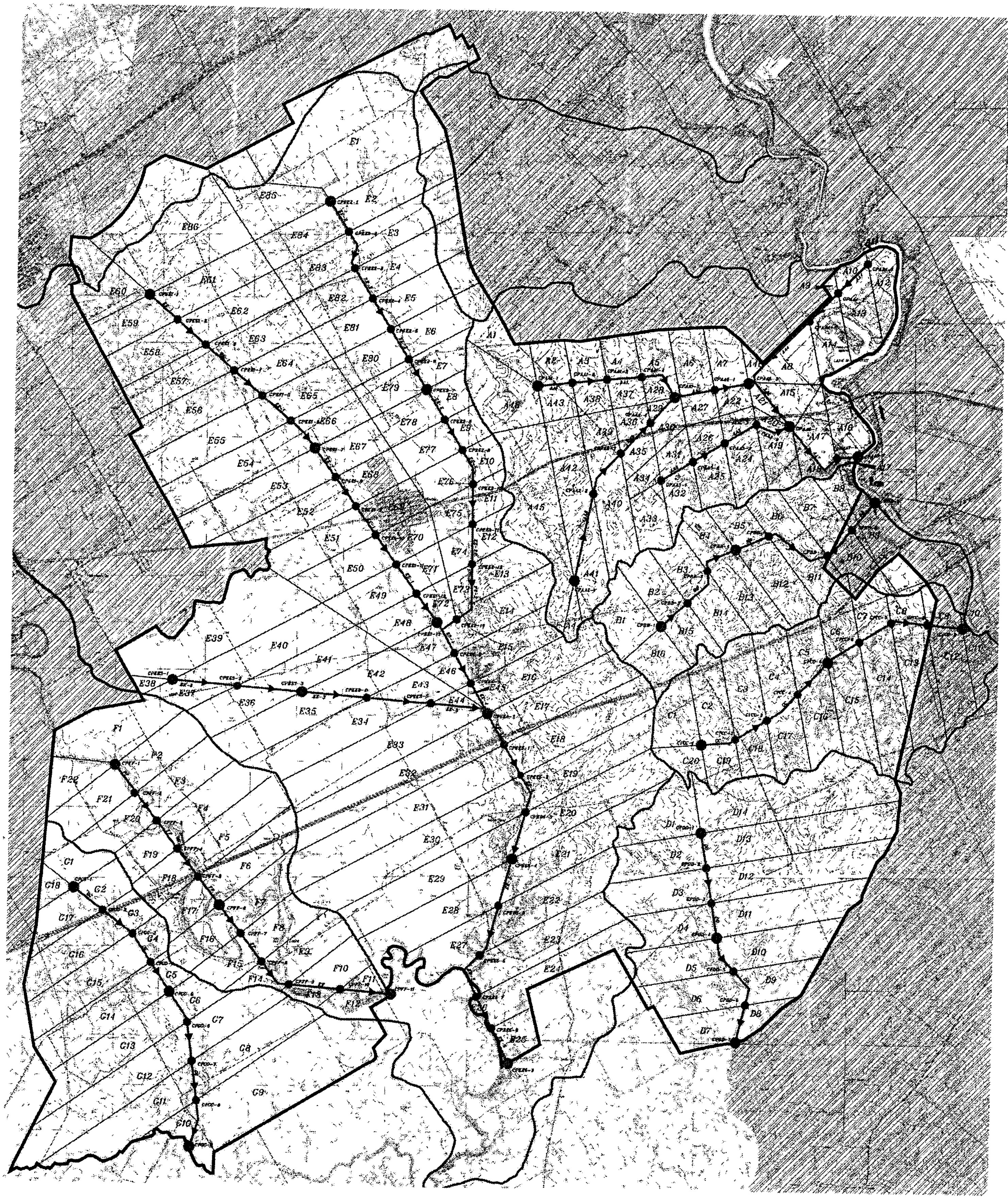
EXHIBIT-2
GVSUD DRAINAGE BASINS

DESIGNED: SH	PROJECT NO. 6096-07	DATE: 11/2006	SHEET NO. 2 OF 6

RIVER CITY ENGINEERING, LTD.
CONSULTING CIVIL ENGINEERS

3801 SOUTH 1ST STREET
AUSTIN, TEXAS 78704-7047
PHONE-(512) 442-3008
FAX-(512) 442-0522

1011 W. COUNTY LINE ROAD, SUITE C
NEW BRAUNFELS, TEXAS 78130
PHONE-(830)-626-3588
FAX-(830) 626-3601



LEGEND

MARION SEWER CCN 20[illegible]
CIBOLO CITY LIMITS AND ETJ CCN [illegible]
SPRINGS HILL WSC CCN [illegible]
GBRA SEWER CCN
EAST CENTRAL CCN [illegible]
NEW BRAUNFELS CCN
SCHERTZ SEWER CCN [illegible]
SCHERTZ WATER CCN [illegible]

GREEN VALLEY WATER/SEWER CCN
MAJOR BASINS
DRAIN TRUNKS
SUB BASINS
COLLECTION POINTS
E19 AREA IDENTIFICATION
CPEBS-1 COLLECTION POINT ID
EB-5 MAIN TRUNK ID

SCALE 1" 2000'

EXHIBIT-3
GVSUD AREA CALCULATIONS AND COLLECTION POINTS

DESIGNED: SH	PROJECT NO. 6096-07	DATE: 11/2006	SHEET NO. 3 OF 6

RIVER CITY ENGINEERING, LTD.
CONSULTING CIVIL ENGINEERS

3801 SOUTH 1st STREET
AUSTIN, TEXAS 78704-7047
PHONE-(512) 442-3008
FAX-(512) 442-6522

1011 W. COUNTY LINE ROAD, SUITE C
NEW BRAUNFELS, TEXAS 78130
PHONE-(830)-626-3588
FAX-(830)-626-3601

LEGEND

- MARION SEWER CCN 2069
- CIBOLO CITY LIMITS AND ETJ CCN 2088
- SPRINGS HILL WSC CCN 10646
- GBRA SEWER CCN
- EAST CENTRAL CCN 10655
- NEW BRAUNFELS CCN
- SCHERTZ SEWER CCN 20271
- SCHERTZ WATER CCN 10645

- GREEN VALLEY WATER/SEWER CCN
- MAJOR BASINS
- DRAIN TRUNKS
- 30" PIPE DIAMETER PER 1 EDU/ACRE DEVELOPMENT DENSITY
- 42" PIPE DIAMETER PER 3 EDU/ACRE DEVELOPMENT DENSITY
- COLLECTION POINTS
- CPEE5-1 COLLECTION POINT ID

SCALE 1" 2000'

EXHIBIT-4

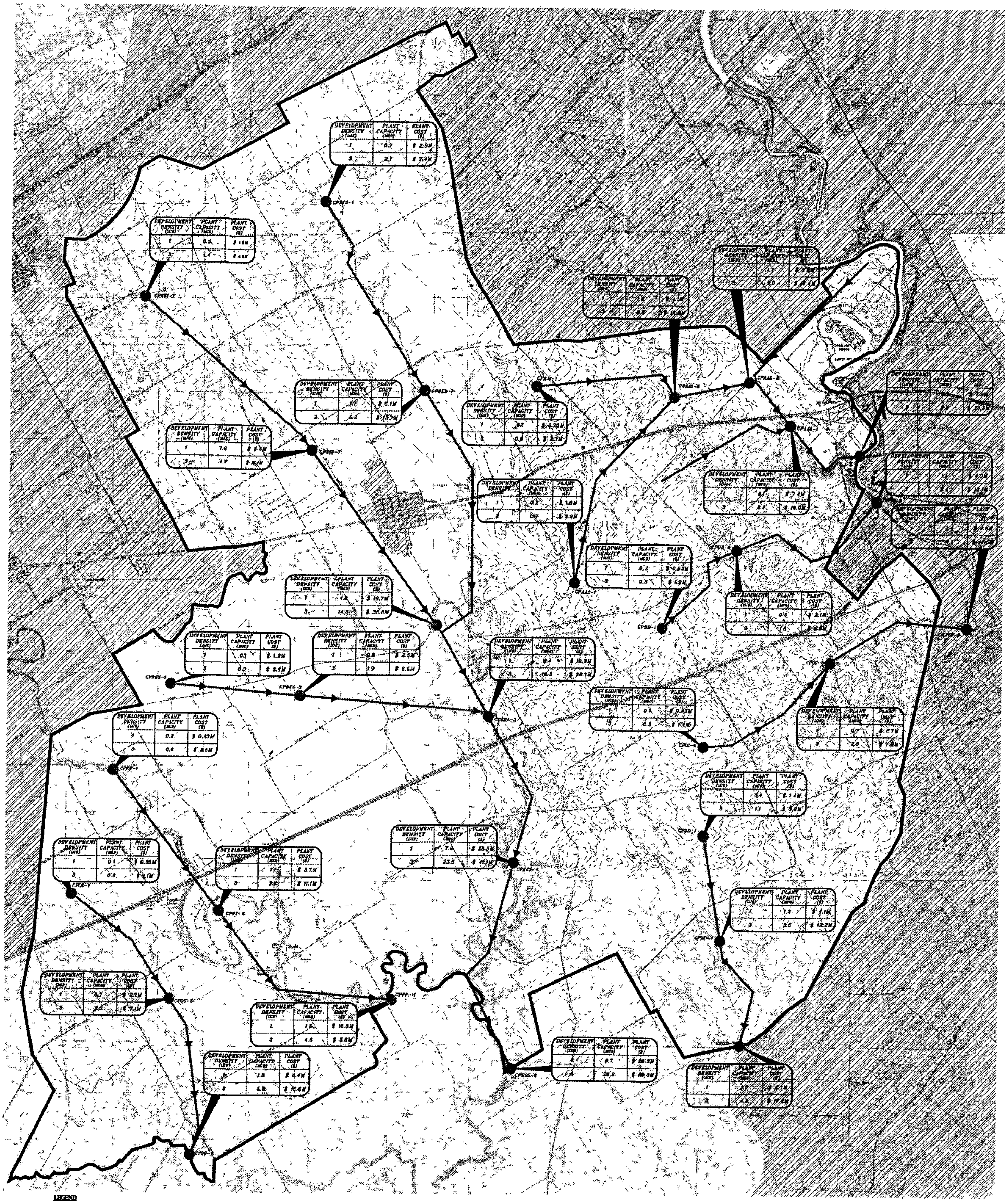
GVSUD PROPOSED WASTEWATER MAIN COLLECTION SYSTEM

DESIGNED: SH	PROJECT NO. 6096-07	DATE: 11/2006	SHEET NO. 4 OF 6

RIVER CITY ENGINEERING, LTD.
CONSULTING CIVIL ENGINEERS

3801 SOUTH 1st STREET
AUSTIN, TEXAS 78704-7047
PHONE-(512) 442-3008
FAX-(512) 442-6522

1011 W. COUNTY LINE ROAD, SUITE C
NEW BRAUNFELS, TEXAS 78130
PHONE-(830)-626-3588
FAX-(830)-626-3601



LEGEND

MARION SEWER CCN 20669
CIBOLO CITY LIMITS AND ETJ CCN 1802
SPRINGS HILL WSC CCN 20606
GBRA SEWER CCN
EAST CENTRAL CCN 10625
NEW BRAUNFELS CCN
SCHERTZ SEWER CCN 20275
SCHERTZ WATER CCN 10645
GREEN VALLEY WATER/SEWER CCN
DRAIN TRUNKS

COLLECTION POINTS
CPEE5-1 COLLECTION POINT ID

SCALE 1" 2000'

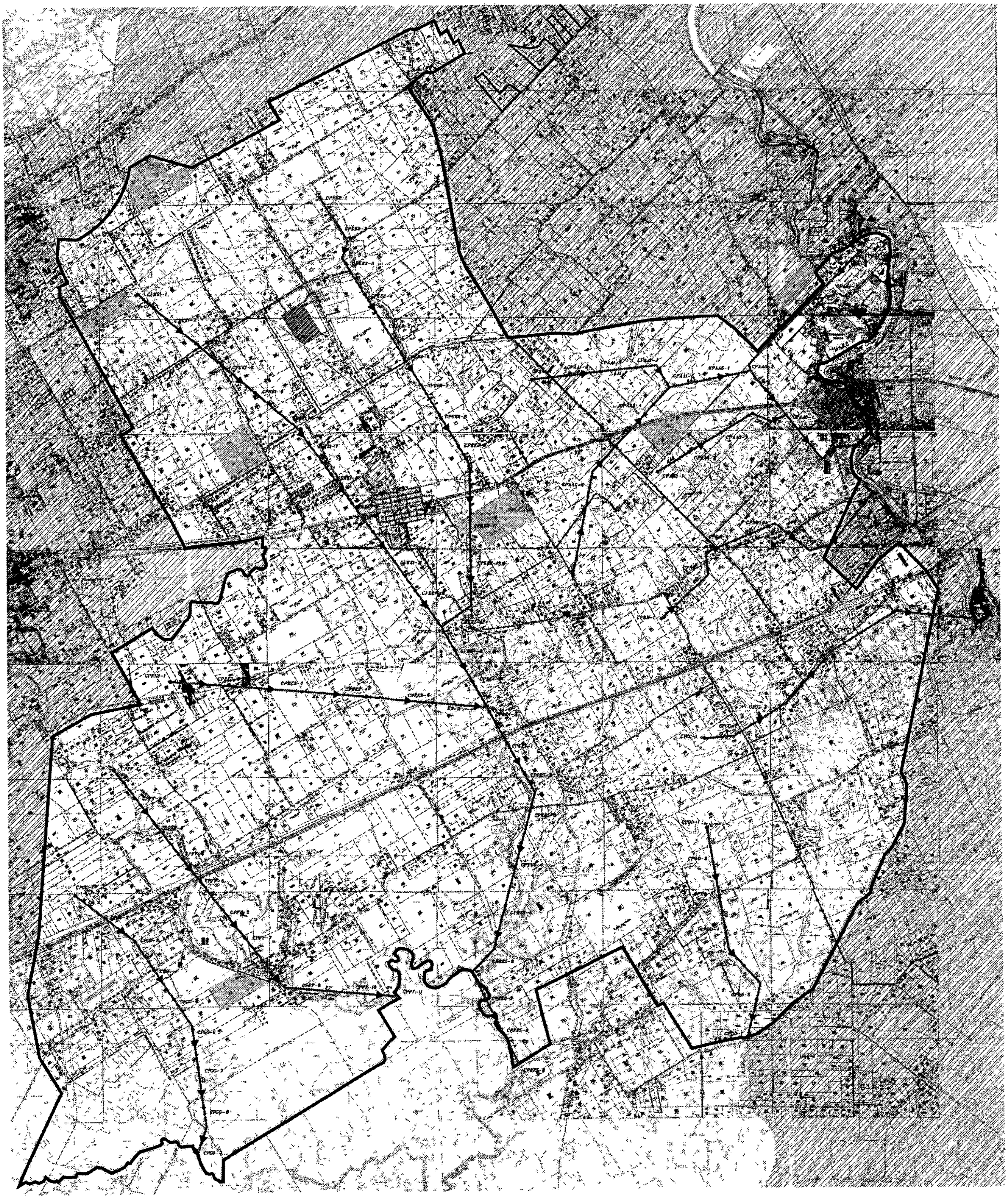
EXHIBIT-5
GVSUD THEORETICAL LOCATIONS OF WASTEWATER TREATMENT CAPACITY AND COST VS. DOWNSTREAM LOCATIONS

DESIGNED: SH	PROJECT NO. 6096-07	DATE. 11/2006	SHEET NO. 5 OF 6

RIVER CITY ENGINEERING, LTD.
CONSULTING CIVIL ENGINEERS

3801 SOUTH 1ST STREET
AUSTIN, TEXAS 78704-7047
PHONE-(512) 442-3008
FAX-(512) 442-6522

1011 W. COUNTY LINE ROAD, SUITE C
NEW BRAUNFELS, TEXAS 78130
PHONE-(830)-626-3588
FAX-(830)-626-3601



LEGEND

- MARION SEWER CCN 20669
- CIBOLO CITY LIMITS AND ETJ CCN 10903
- SPRINGS HILL WSC CCN 10666
- GBRA SEWER CCN
- EAST CENTRAL CCN 10635
- NEW BRAUNFELS CCN
- SCHERTZ SEWER CCN 20271
- SCHERTZ WATER CCN 10665
- GREEN VALLEY WATER/SEWER CCN
- DRAIN TRUNKS

- COLLECTION POINTS
- CPEES-1 COLLECTION POINT ID
- EE-5 MAIN TRUNK ID

SCALE 1" = 2000'

EXHIBIT-6
GVSUD PROPOSED GROWTH AND DEVELOPMENT

DESIGNED: SH	PROJECT NO. 6096-07	DATE: 11/2006	SHEET NO. 6 OF 6

RIVER CITY ENGINEERING, LTD.
CONSULTING CIVIL ENGINEERS

3801 SOUTH 1st STREET
AUSTIN, TEXAS 78704-7047
PHONE (512) 442-3008
FAX (512) 442-6522

1011 W. COUNTY LINE ROAD, SUITE C
NEW BRAUNFELS, TEXAS 78130
PHONE (830)-626-3588
FAX (830)-626-3601

Attachment 2
Calculation Tables

- Exhibit 1 Total Equivalent Dwelling Unit (EDU) Calculations
- Exhibit 2 Wastewater Main Collection System Calculations
- Exhibit 3 Proposed Costs for Wastewater Main Collection System
- Exhibit 4 Wastewater Treatment Plant Capacity and Costs

Green Valley Special Utility District
EDU Calculation Summary
Total EDU Calculations

Drainage Basin ID	Total Area (acres)	Development Density (1 EDU/acre)	Total EDU 1	Development Density (3 EDU/acre)	Total EDU 3
A	9,211	1	9,211	3	27,633
B	4,690	1	4,690	3	14,070
C	5,636	1	5,636	3	16,908
D	6,688	1	6,688	3	20,064
E	35,618	1	35,618	3	106,854
F	6,515	1	6,515	3	19,545
G	7,511	1	7,511	3	22,533
	75,869		**75,869**		**227,607**

Green Valley Special Utility District
Drainage Area A
Total EDU Calculations

A

Sub-Area Left ID	Sub-Area Right ID	Sub-Area Left (acres)	Sub-Area Right (acres)	Total Area (acres)	Development Density (1 EDU/acre)	Total EDU	Development Density (3 EDU/acre)	Total EDU
Pipe AA1								
A1	A46	256	520	776	1	776	3	2,328
A2	A43	177	144	321	1	321	3	963
A3	A38	169	129	298	1	298	3	894
A4	A37	175	114	289	1	289	3	867
A5	A28	210	73	283	1	283	3	849
			Total Acres =	**1967**	**Total EDU =**	**1,967**	**Total EDU =**	**5,901**
Pipe AA 2								
A45	A44	931	71	1002	1	1,002	3	3,006
A42	A41	486	287	773	1	773	3	2,319
A39	A40	234	394	628	1	628	3	1,884
A36	A35	131	119	250	1	250	3	750
A29	A30	34	133	167	1	167	3	501
			Total Acres =	**2820**	**Total EDU =**	**2,820**	**Total EDU =**	**8,460**
Pipe AA3								
A34	A33	93	246	339	1	339	3	1,017
A31	A32	127	195	322	1	322	3	966
A26	A25	93	262	355	1	355	3	1,065
A23	A24	127	220	347	1	347	3	1,041
A20	A19	50	240	290	1	290	3	870
			Total Acres =	**1653**	**Total EDU =**	**1,653**	**Total EDU =**	**4,959**
Pipe AA4								
A12	A11	211	17	228	1	228	3	684
A13	A10	314	69	383	1	383	3	1,149
A14	A9	252	36	288	1	288	3	864
A8	A48	269	72	340	1	340	3	1,021
			Total Acres =	**1239**	**Total EDU =**	**1,239**	**Total EDU =**	**3,718**
Pipe AA5								
A6	A27	233	103	336	1	336	3	1,008
A7	A22	266	118	384	1	384	3	1,152
			Total Acres =	**720**	**Total EDU =**	**720**	**Total EDU =**	**2,160**
PipeAA6								
A15	A21	181	62	243	1	243	3	730
			Total Acres =	**243**	**Total EDU =**	**243**	**Total EDU =**	**730**
PipeAA7								
A47	A18	208	92	301	1	301	3	902
			Total Acres =	**301**	**Total EDU =**	**301**	**Total EDU =**	**902**
PipeAA8								
A16	A17	253	15	268	1	268	3	804
			Total Acres =	**268**	**Total EDU =**	**268**	**Total EDU =**	**804**
			Basin A (acres) =	**9,211**	**Basin A (EDU) =**	**9,211**	**Basin A (EDU) =**	**27,633**

Green Valley Special Utility District
Drainage Area B
Total EDU Calculations

B

Sub-Area Left ID	Sub-Area Right ID	Sub-Area Left (acres)	Sub-Area Right (acres)	Total Area (acres)	Development Density (1 EDU/acre)	Total EDU	Development Density (3 EDU/acre)	Total EDU
Pipe BB								
B1	B16	367	267	634	1	634	3	1,903
B2	B15	287	207	494	1	494	3	1,482
B3	B14	229	251	480	1	480	3	1,439
B4	B13	216	366	582	1	582	3	1,747
B5	B12	190	384	574	1	574	3	1,723
B6	B11	285	206	491	1	491	3	1,474
B7	B10	306	209	515	1	515	3	1,545
B8	B9	216	704	920	1	920	3	2,759
			Basin B (acres) =	**4690**	**Basin B (EDU) =**	**4,690**	**Basin B (EDU) =**	**14,071**

Green Valley Special Utility District
Drainage Area C
Total EDU Calculations

C

Sub-Area Left ID	Sub-Area Right ID	Sub-Area Left (acres)	Sub-Area Right (acres)	Total Area (acres)	Development Density (1 EDU/acre)	Total EDU	Development Density (3 EDU/acre)	Total EDU
Pipe CC								
C1	C20	314	150	464	1	464	3	1,391
C2	C19	365	173	537	1	537	3	1,612
C3	C18	373	192	565	1	565	3	1,694
C4	C17	331	271	602	1	602	3	1,807
C5	C16	233	332	565	1	565	3	1,696
C6	C15	259	457	716	1	716	3	2,149
C7	C14	203	584	788	1	788	3	2,363
C8	C13	119	520	639	1	639	3	1,916
C9	C12	152	405	557	1	557	3	1,670
C10	C11	9	194	203	1	203	3	610
			Basin C (acres) =	**5636**	**Basin C (EDU) =**	**5,636**	**Basin C (EDU) =**	**16,908**

Green Valley Special Utility District
Drainage Area D
Total EDU Calculations

D

Sub-Area Left ID	Sub-Area Right ID	Sub-Area Left (acres)	Sub-Area Right (acres)	Total Area (acres)	Development Density (1 EDU/acre)	Total EDU	Development Density (3 EDU/acre)	Total EDU
Pipe DD								
D14	D1	1068	401	1468	1	1,468	3	4,405
D13	D2	815	374	1189	1	1,189	3	3,567
D12	D3	725	411	1135	1	1,135	3	3,406
D11	D4	610	326	936	1	936	3	2,809
D10	D5	466	376	842	1	842	3	2,527
D9	D6	283	407	690	1	690	3	2,071
D8	D7	128	297	426	1	426	3	1,277
			Basin D (acres) =	**6688**	**Basin D (EDU) =**	**6,688**	**Basin D (EDU) =**	**20,063**

Green Valley Special Utility District
Drainage Area E
Total EDU Calculations

E

Sub-Area Left ID	Sub-Area Right ID	Sub-Area Left (acres)	Sub-Area Right (acres)	Total Area (acres)	Development Density (1 EDU/acre)	Total EDU	Development Density (3 EDU/acre)	Total EDU
Pipe EE 1								
E86	E60	1455	442	1897	1	1,897	3	5,691
E61	E59	476	311	787	1	787	3	2,361
E62	E58	424	365	789	1	789	3	2,366
E63	E57	383	419	802	1	802	3	2,406
E64	E56	343	517	860	1	860	3	2,579
E65	E55	302	58	360	1	360	3	1,080
E66	E54	267	625	892	1	892	3	2,676
E67	E53	259	646	905	1	905	3	2,715
E68	E52	255	471	725	1	725	3	2,176
E69	E51	248	416	664	1	664	3	1,993
E70	E50	224	381	605	1	605	3	1,816
E71	E49	167	312	479	1	479	3	1,438
E72	E48	130	250	381	1	381	3	1,142
			Total Acres =	**10146**	**Total EDU =**	**10,146**	**Total EDU =**	**30,438**
Pipe EE 2								
E1	E85	2297	574	2871	1	2,871	3	8,612
E2	E84	519	347	866	1	866	3	2,598
E3	E83	484	322	806	1	806	3	2,417
E4	E82	464	279	743	1	743	3	2,230
E5	E81	419	273	692	1	692	3	2,076
E6	E80	406	266	673	1	673	3	2,018
E7	E79	229	260	489	1	489	3	1,466
E8	E78	151	253	404	1	404	3	1,213
E9	E77	135	247	382	1	382	3	1,146
E10	E76	142	232	374	1	374	3	1,122
E11	E75	161	183	345	1	345	3	1,034
E12	E74	151	140	291	1	291	3	874
E13	E73	291	110	401	1	401	3	1,204
			Total Acres =	**9337**	**Total EDU =**	**9,337**	**Total EDU =**	**28,011**
Pipe EE 3								
E39	E38	1168	50	1218	1	1,218	3	3,655
E40	E37	619	179	797	1	797	3	2,392
E41	E36	477	32	509	1	509	3	1,526
E42	E35	334	509	843	1	843	3	2,530
E43	E34	192	628	820	1	820	3	2,460
E44	E33	51	805	856	1	856	3	2,568
			Total Acres =	**5044**	**Total EDU =**	**5,044**	**Total EDU =**	**15,132**
Pipe EE 4								
E14	E47	466	184	649	1	649	3	1,948
E15	E46	414	106	520	1	520	3	1,560
E16	E45	578	28	606	1	606	3	1,817
			Total Acres =	**1775**	**Total EDU =**	**1,775**	**Total EDU =**	**5,325**
Pipe EE 5								
E17	E32	607	925	1532	1	1,532	3	4,596
E18	E31	644	1036	1679	1	1,679	3	5,038
E19	E30	585	1003	1588	1	1,588	3	4,764
E20	E29	67	801	868	1	868	3	2,603
E21	E28	621	650	1271	1	1,271	3	3,813
E22	E27	567	375	942	1	942	3	2,825
E23	E26	665	17	682	1	682	3	2,045
E24		564		564	1	564	3	1,692
E25		191		191	1	191	3	574
			Total Acres =	**9317**	**Total EDU =**	**9,317**	**Total EDU =**	**27,950**
			Basin E (acres) =	**35,618**	**Basin E (EDU) =**	**35,618**	**Basin E (EDU) =**	**106,855**

Green Valley Special Utility District
Drainage Area F
Total EDU Calculations

F

Sub-Area Left ID	Sub-Area Right ID	Sub-Area Left (acres)	Sub-Area Right (acres)	Total Area (acres)	Development Density (1 EDU/acre)	Total EDU	Development Density (3 EDU/acre)	Total EDU
Pipe FF								
F1	F22	614	233	847	1	847	3	2,542
F2	F21	379	343	722	1	722	3	2,166
F3	F20	389	291	680	1	680	3	2,040
F4	F19	451	229	680	1	680	3	2,041
F5	F18	500	239	739	1	739	3	2,216
F6	F17	452	229	681	1	681	3	2,042
F7	F16	313	284	597	1	597	3	1,791
F8	F15	295	233	528	1	528	3	1,585
F9	F14	363	89	451	1	451	3	1,354
F10	F13	250	86	337	1	337	3	1,010
F11	F12	82	171	253	1	253	3	758
			Basin F (acres) =	**6515**	**Basin F (EDU) =**	**6,515**	**Basin F (EDU) =**	**19,544**

Green Valley Special Utility District
Drainage Area G
Total EDU Calculations

G

Sub-Area Left ID	Sub-Area Right ID	Sub-Area Left (acres)	Sub-Area Right (acres)	Total Area (acres)	Development Density (1 EDU/acre)	Total EDU	Development Density (3 EDU/acre)	Total EDU
Pipe GG								
G1	G18	267	96	363	1	363	3	1,088
G2	G17	187	268	455	1	455	3	1,365
G3	G16	144	452	596	1	596	3	1,789
G4	G15	129	552	681	1	681	3	2,043
G5	G14	90	594	685	1	685	3	2,054
G6	G13	160	661	821	1	821	3	2,463
G7	G12	387	838	1225	1	1,225	3	3,674
G8	G11	563	600	1163	1	1,163	3	3,488
G9	G10	1410	113	1523	1	1,523	3	4,569
			Basin G (acres) =	**7511**	**Basin G (EDU) =**	**7,511**	**Basin G (EDU) =**	**22,534**

Green Valley Special Utility District
Design Flow Summary

Design Flow	Development Density	
	1 EDU/Acre	3 EDU/Acre
Average Dry Weather Flow	245 GPD/EDU	245 GPD/EDU
Maximum Dry Weatherh Flow	735 GPD/EDU	735 GPD/EDU
Maximum Wet Weather Flow	1485 GPD/EDU	985 GPD/EDU

Green Valley Special Utility District Wastewater Design Flows Three Design Flow Conditions									
				Development Density of 1 EDU/acre			Development Density of 3 EDU/acre		
Drainage Basin	Total Area (acres)	Total EDU 1 (EDU/acre)	Total EDU 3 (EDU/acre)	Average Dry Weather Flow (GPD)	Maximum Dry Weather Flow (GPD)	Maximum Wet Weather Flow (GPD)	Average Dry Weather Flow (GPD)	Maximum Dry Weather Flow (GPD)	Maximum Wet Weather Flow (GPD)
Drainage Basin A	9,211	9,211	27,633	2,256,695	6,770,085	13,678,335	6,770,085	20,310,255	27,218,505
Drainage Basin B	4,690	4,690	14,070	1,149,050	3,447,150	6,964,650	3,447,150	10,341,450	13,858,950
Drainage Basin C	5,636	5,636	16,908	1,380,820	4,142,460	8,369,460	4,142,460	12,427,380	16,654,380
Drainage Basin D	6,688	6,688	20,064	1,638,560	4,915,680	9,931,680	4,915,680	14,747,040	19,763,040
Drainage Basin E	35,618	35,618	106,854	8,726,410	26,179,230	52,892,730	26,179,230	78,537,690	105,251,190
Drainage Basin F	6,515	6,515	19,545	1,596,175	4,788,525	9,674,775	4,788,525	14,365,575	19,251,825
Drainage Basin G	7,511	7,511	22,533	1,840,195	5,520,585	11,153,835	5,520,585	16,561,755	22,195,005

Green Valley Special Utility District 1 EDU/acre Pipe Diameter Design Summary								
Pipe Diameter (in)	Basin A Pipe Length (ft)	Basin B Pipe Length (ft)	Basin C Pipe Length (ft)	Basin D Pipe Length (ft)	Basin E Pipe Length (ft)	Basin F Pipe Length (ft)	Basin G Pipe Length (ft)	Total Pipe Length (ft)
8								0
10								0
12	5,600							5,600
15	8,200	2,600	2,600				2,700	16,100
18	19,800	5,600	5,600			2,500	2,700	36,200
21	9,000	7,000	5,600	2,500	7,350	2,500	5,000	38,950
24	3,500	5,000	5,200	2,500	17,200	5,000	2,500	40,900
27	2,500		5,000	5,300	22,300	5,000	2,800	42,900
30	2,500			5,600	15,450	12,200	2,900	38,650
33	11,400				21,650		3,000	36,050
36					5,800			5,800
42								0
48					7,000			7,000
54					18,500			18,500
60					9,600			9,600
66								0
72								0
Total	62,500	20,200	24,000	15,900	124,850	27,200	21,600	296,250
							56	Miles

Green Valley Special Utility District
Drainage Area A - 1 EDU
Pipe Flow Design Calculations

1 EDU A

Sewer Main Location			Contributing Area			Population		Average Dry Weather Flow		Maximum Wet Weather				Pipe Design							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Pipe ID	Up Stream Collection Point	Down Stream Collection Point	Left Side Area (acres)	Right Side Area (acres)	Total Area (acres)	Development Density (1 EDU/acre)	Total EDU (EDU)	Dry Weather Flow (GPD)	Cumulative Dry Weather Flow (GPD)	Wet Weather Flow (GPD)	Wet Weather Flow (gpm)	Wet Weather Flow (cfs)	Cumulative Wet Weather Flow (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Pipe Length (ft)	Pipe Slope (ft)	Pipe Diameter Actual (inches)	Pipe Diameter 80% Full (inches)	Pipe Diameter Nominal (inches)	Pipe Velocity Nominal (ft/sec)
Pipe AA1	Upstream	CP AA1-1	256	520	776	1.0	776	190,120	190,120	1,152,360	800	1.78	1.78								
Pipe AA1	CP AA1-1	CP AA1-2	177	144	321	1.0	321	78,645	268,765	476,685	331	0.74	2.52	600	585	2,500	0.0060	11.60	14.50	15	4.09
Pipe AA1	CP AA1-2	CP AA1-3	169	129	298	1.0	298	73,010	341,775	442,530	307	0.68	3.21	585	570	2,500	0.0060	12.70	15.87	18	4.62
Pipe AA1	CP AA1-3	CP AA1-4	175	114	289	1.0	289	70,805	412,580	429,165	298	0.66	3.87	570	555	2,500	0.0060	13.62	17.03	18	4.62
Pipe AA1	CP AA1-4	CP AA1-5	210	73	283	1.0	283	69,335	481,915	420,255	292	0.65	4.52	555	540	3,500	0.0050	14.94	18.68	21	4.67
1	Total		987	980	1967		1967	481,915		2,920,995	2,028	4.52				11,000	0.0058				
Pipe AA2	Upstream	CP AA2-1	931	71	1002	1.0	1002	245,490	245,490	1,487,970	1033	2.30	2.30								
Pipe AA2	CP AA2-1	CP AA2-2	486	287	773	1.0	773	189,385	434,875	1,147,905	797	1.78	4.08	590	578	3,500	0.0050	14.38	17.97	18	4.21
Pipe AA2	CP AA2-2	CP AA2-3	234	394	628	1.0	628	153,860	588,735	932,580	648	1.44	5.52	578	565	3,000	0.0050	16.11	20.14	21	4.67
Pipe AA2	CP AA2-3	CP AA2-4	131	119	250	1.0	250	61,250	649,985	371,250	258	0.57	6.10	565	553	2,500	0.0050	16.72	20.90	21	4.67
Pipe AA2	CP AA2-4	CP AA1-5	34	133	167	1.0	167	40,915	690,900	247,995	172	0.38	6.48	553	540	3,500	0.0050	17.10	21.38	24	5.11
2	Total		1816	1004	2820		2820	690,900		4,187,700	2,908	6.48				12,500	0.0050				
Pipe AA3	Upstream	CP AA3-1	93	246	339	1.0	339	83,055	83,055	503,415	350	0.78	0.78								
Pipe AA3	CP AA3-1	CP AA3-2	127	195	322	1.0	322	78,890	161,945	478,170	332	0.74	1.52	600	581	2,600	0.0073	9.25	11.56	12	3.89
Pipe AA3	CP AA3-2	CP AA3-3	93	262	355	1.0	355	86,975	248,920	527,175	366	0.82	2.33	581	563	2,700	0.0067	11.05	13.81	15	4.31
Pipe AA3	CP AA3-3	CP AA3-4	127	220	347	1.0	347	85,015	333,935	515,295	358	0.80	3.13	563	545	2,800	0.0064	12.42	15.53	18	4.78
Pipe AA3	CP AA3-4	CP AA6-1	50	240	290	1.0	290	71,050	404,985	430,650	299	0.67	3.80	545	525	2,500	0.0080	12.82	16.02	18	5.33
3	Total		490	1163	1653		1653	404,985		2,454,705	1,705	3.80				10,600	0.0071				
Pipe AA4	Upstream	CP AA4-1	211	17	228	1.0	228	55,860	55,860	338,580	235	0.52	0.52								
Pipe AA4	CP AA4-1	CP AA4-2	314	69	383	1.0	383	93,835	149,695	568,755	395	0.88	1.40	550	543	3,000	0.0050	9.64	12.05	12	3.22
Pipe AA4	CP AA4-2	CP AA4-3	252	36	288	1.0	288	70,560	220,255	427,680	297	0.66	2.07	543	536	3,000	0.0050	11.14	13.93	15	3.73
Pipe AA4	CP AA4-3	CP AA5-2	269	72	341	1.0	341	83,545	303,800	506,385	352	0.78	2.85	536	530	6,000	0.0050	12.57	15.71	18	4.21
4	Total		1046	194	1240		1240	303,800		1,841,400	1,279	2.85				12,000	0.0050				
Pipe AA1	Upstream	CP AA1-5	987	980	1967	1.0	1967	481,915	481,915	2,920,995	2028	4.52	4.52								
Pipe AA2	Upstream	CP AA1-5	1816	1004	2820	1.0	2820	690,900	1,172,815	4,187,700	2908	6.48	11.00								
Pipe AA5	CP AA1-5	CP AA5-1	233	103	336	1.0	336	82,320	1,255,135	498,960	347	0.77	11.77	540	535	2,500	0.0050	21.40	26.75	27	5.52
Pipe AA5	CP AA5-1	CP AA5-2	266	118	384	1.0	384	94,080	1,349,215	570,240	396	0.88	12.65	535	530	2,500	0.0050	21.98	27.48	30	5.92
5	Total		3302	2205	5507		5507	1,349,215		8,177,895	5,679	12.65				5,000	0.0050				
Pipe AA4	Upstream	CP AA5-2	1046	194	1240	1.0	1240	303,800	303,800	1,841,400	1279	2.85	2.85								
Pipe AA5	CP AA1-5	CP AA5-2	3302	2205	5507	1.0	5507	1,349,215	1,653,015	8,177,895	5679	12.65	15.50								
Pipe AA6	CP AA5-2	CP AA6-1	181	62	243	1.0	243	59,535	1,712,550	360,855	251	0.56	16.06	530	525	4,500	0.0050	24.04	30.05	33	6.31
6	Total		4529	2461	6990		6990	1,712,550		10,380,150	7,208	16.06				4,500	0.0050				
Pipe AA3	Upstream	CP AA6-1	490	1163	1653	1.0	1653	404,985	404,985	2,454,705	1705	3.80	3.80								
Pipe AA6	CP AA5-2	CP AA6-1	4529	2461	6990	1.0	6990	1,712,550	2,117,535	10,380,150	7208	16.06	19.86								
Pipe AA7	CP AA6-1	CP AA7-1	208	92	300	1.0	300	73,500	2,191,035	445,500	309	0.69	20.55	525	510	4,900	0.0050	26.37	32.96	33	6.31
7	Total		5227	3716	8943		8943	2,191,035		13,280,355	9,222	20.55				4,900	0.0050				
Pipe AA7	CP AA6-1	CP AA7-1	5227	3716	8943	1.0	8943	2,191,035	2,191,035	13,280,355	9222	20.55	20.55								
Pipe AA8	CP AA7-1	CP AA8-1	253	15	268	1.0	268	65,660	2,256,695	397,980	276	0.62	21.16	510	495	2,000	0.0075	24.71	30.89	33	7.73
8	Total		5480	3731	9211		9211	2,256,695		13,678,335	9,499	21.16				2,000	0.0075				

Design Parameters:

Residential Single Family Units (EDU) =	245	GPD
Population per EDU =	3.5	capita/EDU
Development Average Density =	1	EDU/acre
Wastewater Demand =	70	GPD/capita
Maximum Flow Peak Factor =	3	
Inflow/Infiltration =	750	gallon/acres served

Average Dry Weather Flow =	245	GPD/EDU
Maximum Dry Weather Flow =	735	GPD/EDU
Maximum Wet Weather Flow =	1485	GPD/EDU

Manning's Roughness Coefficient =	0.013
Percent of Pipe Flowing Full =	80%

Green Valley Special Utility District

Drainage Area B - 1 EDU

Pipe Flow Design Calculations

1 EDU B

Sewer Main Location			Contributing Area			Population		Average Dry Weather Flow		Maximum Wet Weather				Pipe Design							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Pipe ID	Up Stream Collection Point	Down Stream Collection Point	Left Side Area (acres)	Right Side Area (acres)	Total Area (acres)	Development Density (1 EDU/acre)	Total EDU (EDU)	Dry Weather Flow (GPD)	Cumulative Dry Weather Flow (GPD)	Wet Weather Flow (GPD)	Wet Weather Flow (gpm)	Wet Weather Flow (cfs)	Cumulative Wet Weather Flow (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Pipe Length (ft)	Pipe Slope (ft)	Pipe Diameter Actual (inches)	Pipe Diameter 80% Full (inches)	Pipe Diameter Nominal (inches)	Pipe Velocity Nominal (ft/sec)
Pipe BB	Upstream	CP BB-1	267	367	634	1.0	634	155,330	155,330	941,490	654	1.46	1.46								
Pipe BB	CP BB-1	CP BB-2	207	287	494	1.0	494	121,030	276,360	733,590	509	1.14	2.59	600	580	2,600	0.0077	11.19	13.99	15	4.63
Pipe BB	CP BB-2	CP BB-3	251	229	480	1.0	480	117,600	393,960	712,800	495	1.10	3.69	580	560	2,800	0.0071	12.96	16.20	18	5.04
Pipe BB	CP BB-3	CP BB-4	366	216	582	1.0	582	142,590	536,550	864,270	600	1.34	5.03	560	540	2,800	0.0071	14.55	18.19	18	5.04
Pipe BB	CP BB-4	CP BB-5	384	190	574	1.0	574	140,630	677,180	852,390	592	1.32	6.35	540	520	2,600	0.0077	15.66	19.57	21	5.79
Pipe BB	CP BB-5	CP BB-6	206	285	491	1.0	491	120,295	797,475	729,135	506	1.13	7.48	520	490	4,400	0.0068	17.03	21.29	21	5.45
Pipe BB	CP BB-6	CP BB-7	209	306	515	1.0	515	126,175	923,650	764,775	531	1.18	8.66	490	470	2,500	0.0080	17.46	21.83	24	6.46
Pipe BB	CP BB-7	CP BB-8	704	216	920	1.0	920	225,400	1,149,050	1,366,200	949	2.11	10.78	470	450	2,500	0.0080	18.95	23.69	24	6.46
Total			2594	2096	4690		4690	1,149,050		6,964,650	4,837	10.78				20,200	0.0076				

Design Parameters:

Residential Single Family Units (EDU) =	245	GPD
Population per EDU =	3.5	capita/EDU
Development Average Density =	1	EDU/acre
Wastewater Demand =	70	GPD/capita
Maximum Flow Peak Factor =	3	
Inflow/Infiltration =	750	gallon/acres served

Average Dry Weather Flow =	245	GPD/EDU
Maximum Dry Weather Flow =	735	GPD/EDU
Maximum Wet Weather Flow =	1485	GPD/EDU

Manning's Roughness Coefficient =	0.013
Percent of Pipe Flowing Full =	80%

Green Valley Special Utility District
Drainage Area C - 1 EDU
Pipe Flow Design Calculations

1 EDU C

Sewer Main Location			Contributing Area			Population		Average Dry Weather Flow		Maximum Wet Weather				Pipe Design							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Pipe ID	Up Stream Collection Point	Down Stream Collection Point	Left Side Area (acres)	Right Side Area (acres)	Total Area (acres)	Development Density (1 EDU/acre)	Total EDU (EDU)	Dry Weather Flow (GPD)	Cumulative Dry Weather Flow (GPD)	Wet Weather Flow (GPD)	Wet Weather Flow (gpm)	Wet Weather Flow (cfs)	Cumulative Wet Weather Flow (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Pipe Length (ft)	Pipe Slope (ft)	Pipe Diameter Actual (inches)	Pipe Diameter 80% Full (inches)	Pipe Diameter Nominal (inches)	Pipe Velocity Actual (ft/sec)
Pipe CC	Upstream	CP CC-1	150	314	464	1.0	464	113,680	113,680	689,040	479	1.07	1.07								
Pipe CC	CP CC-1	CP CC-2	173	365	538	1.0	538	131,810	245,490	798,930	555	1.24	2.30	600	580	2,600	0.0077	10.70	13.38	15	4.63
Pipe CC	CP CC-2	CP CC-3	192	373	565	1.0	565	138,425	383,915	839,025	583	1.30	3.60	580	560	2,800	0.0071	12.83	16.04	18	5.04
Pipe CC	CP CC-3	CP CC-4	271	331	602	1.0	602	147,490	531,405	893,970	621	1.38	4.98	560	540	2,800	0.0071	14.50	18.12	18	5.04
Pipe CC	CP CC-4	CP CC-5	332	233	565	1.0	565	138,425	669,830	839,025	583	1.30	6.28	540	520	2,800	0.0071	15.81	19.77	21	5.58
Pipe CC	CP CC-5	CP CC-6	457	259	716	1.0	716	175,420	845,250	1,063,260	738	1.65	7.93	520	500	2,800	0.0071	17.25	21.57	21	5.58
Pipe CC	CP CC-6	CP CC-7	584	203	787	1.0	787	192,815	1,038,065	1,168,695	812	1.81	9.74	500	480	2,600	0.0077	18.38	22.97	24	6.33
Pipe CC	CP CC-7	CP CC-8	520	119	639	1.0	639	156,555	1,194,620	948,915	659	1.47	11.20	480	460	2,600	0.0077	19.37	24.22	24	6.33
Pipe CC	CP CC-8	CP CC-9	405	152	557	1.0	557	136,465	1,331,085	827,145	574	1.28	12.48	460	440	2,500	0.0080	20.03	25.03	27	6.99
Pipe CC	CP CC-9	CP CC-10	194	9	203	1.0	203	49,735	1,380,820	301,455	209	0.47	12.95	440	420	2,500	0.0080	20.31	25.38	27	6.99
Total			3278	2358	5636		5636	1,380,820		8,369,460	5,812	12.95				24,000	0.0075				

Design Parameters:

Residential Single Family Units (EDU) =	245	GPD
Population per EDU =	3.5	capita/EDU
Development Average Density =	1	EDU/acre
Wastewater Demand =	70	GPD/capita
Maximum Flow Peak Factor =	3	
Inflow/Infiltration =	750	gallon/acres served

Average Dry Weather Flow =	245	GPD/EDU
Maximum Dry Weather Flow =	735	GPD/EDU
Maximum Wet Weather Flow =	1485	GPD/EDU

Manning's Roughness Coefficient =	0.013
Percent of Pipe Flowing Full =	80%

Green Valley Special Utility District
Drainage Area D - 1 EDU
Pipe Flow Design Calculations

1 EDU D

Sewer Main Location			Contributing Area			Population		Average Dry Weather Flow		Maximum Wet Weather				Pipe Design							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Pipe ID	Up Stream Collection Point	Down Stream Collection Point	Left Side Area (acres)	Right Side Area (acres)	Total Area (acres)	Development Density (1 EDU/acre)	Total EDU (EDU)	Dry Weather Flow (GPD)	Cumulative Dry Weather Flow (GPD)	Wet Weather Flow (GPD)	Wet Weather Flow (gpm)	Wet Weather Flow (cfs)	Cumulative Wet Weather Flow (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Pipe Length (ft)	Pipe Slope (ft)	Pipe Diameter Actual (inches)	Pipe Diameter 80% Full (inches)	Pipe Diameter Nominal (inches)	Pipe Velocity Actual (ft/sec)
Pipe DD	Upstream	CP DD-1	401	1068	1469	1.0	1469	359,905	359,905	2,181,465	1515	3.38	3.38								
Pipe DD	CP DD-1	CP DD-2	374	815	1189	1.0	1189	291,305	651,210	1,765,665	1226	2.73	6.11	570	562	2,500	0.0050	16.73	20.91	21	4.01
Pipe DD	CP DD-2	CP DD-3	411	725	1136	1.0	1136	278,320	929,530	1,686,960	1172	2.61	8.72	562	554	2,500	0.0050	19.12	23.90	24	4.39
Pipe DD	CP DD-3	CP DD-4	326	610	936	1.0	936	229,320	1,158,850	1,389,960	965	2.15	10.87	554	546	2,500	0.0050	20.77	25.96	27	4.64
Pipe DD	CP DD-4	CP DD-5	376	466	842	1.0	842	206,290	1,365,140	1,250,370	868	1.93	12.80	546	538	2,800	0.0050	22.08	27.60	27	4.83
Pipe DD	CP DD-5	CP DD-6	407	283	690	1.0	690	169,050	1,534,190	1,024,650	712	1.59	14.39	538	530	3,000	0.0050	23.07	28.84	30	4.97
Pipe DD	CP DD-6	CP DD-7	297	128	425	1.0	425	104,125	1,638,315	631,125	438	0.98	15.37	530	522	2,600	0.0050	23.64	29.56	30	5.05
Total			2592	4095	6687		6687	1,638,315		9,930,195	6,896	15.37				15,900	0.0050				

Design Parameters:

Residential Single Family Units (EDU) =	245	GPD
Population per EDU =	3.5	capita/EDU
Development Average Density =	1	EDU/acre
Wastewater Demand =	70	GPD/capita
Maximum Flow Peak Factor =	3	
Inflow/Infiltration =	750	gallon/acres served

Average Dry Weather Flow =	245	GPD/EDU
Maximum Dry Weather Flow =	735	GPD/EDU
Maximum Wet Weather Flow =	1485	GPD/EDU

Manning's Roughness Coefficient =	0.013
Percent of Pipe Flowing Full =	80%

Green Valley Special Utility District
Drainage Area E - 1 EDU
Pipe Flow Design Calculations

1 EDU E

Sewer Main Location			Contributing Area			Population		Average Dry Weather Flow		Maximum Wet Weather				Pipe Design							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Pipe ID	Up Stream Collection Point	Down Stream Collection Point	Left Side Area (acres)	Right Side Area (acres)	Total Area (acres)	Development Density (1 EDU/acre)	Total EDU (EDU)	Dry Weather Flow (GPD)	Cumulative Dry Weather Flow (GPD)	Wet Weather Flow (GPD)	Wet Weather Flow (gpm)	Wet Weather Flow (cfs)	Cumulative Wet Weather Flow (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Pipe Length (ft)	Pipe Slope (ft)	Pipe Diameter Actual (inches)	Pipe Diameter 80% Full (inches)	Pipe Diameter Nominal (inches)	Pipe Velocity Nominal (ft/sec)
Pipe EE1	Upstream	CP EE1-1	442	1455	1897	1.0	1897	464,765	464,765	2,817,045	1956	4.36	4.36								
Pipe EE1	CP EE1-1	CP EE1-2	311	476	787	1.0	787	192,815	657,580	1,168,695	812	1.81	6.17	830	811	2,750	0.0069	15.80	19.75	21	5.49
Pipe EE1	CP EE1-2	CP EE1-3	365	424	789	1.0	789	193,305	850,885	1,171,665	814	1.81	7.98	811	792	2,750	0.0069	17.41	21.76	24	6.00
Pipe EE1	CP EE1-3	CP EE1-4	419	383	802	1.0	802	196,490	1,047,375	1,190,970	827	1.84	9.82	792	773	2,750	0.0069	18.82	23.52	24	6.00
Pipe EE1	CP EE1-4	CP EE1-5	517	343	860	1.0	860	210,700	1,258,075	1,277,100	887	1.98	11.80	773	754	2,750	0.0069	20.16	25.19	27	6.49
Pipe EE1	CP EE1-5	CP EE1-6	58	302	360	1.0	360	88,200	1,346,275	534,600	371	0.83	12.63	754	735	2,750	0.0069	20.67	25.84	27	6.49
Pipe EE1	CP EE1-6	CP EE1-7	625	267	892	1.0	892	218,540	1,564,815	1,324,620	920	2.05	14.68	735	716	2,750	0.0069	21.87	27.34	27	6.49
Pipe EE1	CP EE1-7	CP EE1-8	646	259	905	1.0	905	221,725	1,786,540	1,343,925	933	2.08	16.76	716	697	2,600	0.0073	22.75	28.43	30	7.16
Pipe EE1	CP EE1-8	CP EE1-9	471	255	726	1.0	726	177,870	1,964,410	1,078,110	749	1.67	18.42	697	678	2,600	0.0073	23.57	29.46	30	7.16
Pipe EE1	CP EE1-9	CP EE1-10	416	248	664	1.0	664	162,680	2,127,090	986,040	685	1.53	19.95	678	659	2,600	0.0073	24.29	30.36	30	7.16
Pipe EE1	CP EE1-10	CP EE1-11	381	224	605	1.0	605	148,225	2,275,315	898,425	624	1.39	21.34	659	640	2,600	0.0073	24.91	31.13	33	7.63
Pipe EE1	CP EE1-11	CP EE1-12	312	167	479	1.0	479	117,355	2,392,670	711,315	494	1.10	22.44	640	621	2,600	0.0073	25.38	31.73	33	7.63
Pipe EE1	CP EE1-12	CP EE1-13	250	130	380	1.0	380	93,100	2,485,770	564,300	392	0.87	23.31	621	600	3,100	0.0068	26.12	32.64	33	7.35
Total			5213	4933	10146		10146	2,485,770		#######	10,463	23.31				32,600	0.0071				
Pipe EE2	Upstream	CP EE2-1	574	2297	2871	1.0	2871	703,395	703,395	4,263,435	2961	6.60	6.60								
Pipe EE2	CP EE2-1	CP EE2-2	347	519	866	1.0	866	212,170	915,565	1,286,010	893	1.99	8.59	700	692	2,500	0.0050	19.01	23.76	24	5.11
Pipe EE2	CP EE2-2	CP EE2-3	322	484	806	1.0	806	197,470	1,113,035	1,196,910	831	1.85	10.44	692	684	2,900	0.0050	20.45	25.57	27	5.52
Pipe EE2	CP EE2-3	CP EE2-4	279	464	743	1.0	743	182,035	1,295,070	1,103,355	766	1.71	12.15	684	676	2,550	0.0050	21.65	27.06	27	5.52
Pipe EE2	CP EE2-4	CP EE2-5	273	419	692	1.0	692	169,540	1,464,610	1,027,620	714	1.59	13.74	676	668	2,550	0.0050	22.67	28.34	30	5.92
Pipe EE2	CP EE2-5	CP EE2-6	266	406	672	1.0	672	164,640	1,629,250	997,920	693	1.54	15.28	668	660	2,550	0.0050	23.60	29.49	30	5.92
Pipe EE2	CP EE2-6	CP EE2-7	260	229	489	1.0	489	119,805	1,749,055	726,165	504	1.12	16.40	660	652	2,550	0.0050	24.23	30.29	30	5.92
Pipe EE2	CP EE2-7	CP EE2-8	253	151	404	1.0	404	98,980	1,848,035	599,940	417	0.93	17.33	652	644	2,550	0.0050	24.74	30.92	33	6.31
Pipe EE2	CP EE2-8	CP EE2-9	247	135	382	1.0	382	93,590	1,941,625	567,270	394	0.88	18.21	644	636	2,500	0.0050	25.20	31.50	33	6.31
Pipe EE2	CP EE2-9	CP EE2-10	232	142	374	1.0	374	91,630	2,033,255	555,390	386	0.86	19.07	636	628	2,700	0.0050	25.64	32.05	33	6.31
Pipe EE2	CP EE2-10	CP EE2-11	183	161	344	1.0	344	84,280	2,117,535	510,840	355	0.79	19.86	628	620	2,800	0.0050	26.03	32.54	33	6.31
Pipe EE2	CP EE2-11	CP EE2-12	140	151	291	1.0	291	71,295	2,188,830	432,135	300	0.67	20.53	620	612	2,800	0.0050	26.36	32.95	33	6.31
Pipe EE2	CP EE2-12	CP EE2-13	110	291	401	1.0	401	98,245	2,287,075	595,485	414	0.92	21.45	612	604	4,400	0.0050	26.80	33.49	36	6.69
Pipe EE2	CP EE2-13	CP EE1-13	0	0	0	1.0	0	0	2,287,075	0	0	0.00	21.45	604	600	1,400	0.0050	26.80	33.49	36	6.69
Total			3486	5849	9335		9335	2,287,075		#######	9,627	21.45				34,750	0.0050				
Pipe EE3	Upstream	CP EE3-1	1168	50	1218	1.0	1218	298,410	298,410	1,808,730	1256	2.80	2.80								
Pipe EE3	CP EE3-1	CP EE3-2	619	179	798	1.0	798	195,510	493,920	1,185,030	823	1.83	4.63	665	646	4,600	0.0050	15.08	18.85	21	4.67
Pipe EE3	CP EE3-2	CP EE3-3	477	32	509	1.0	509	124,705	618,625	755,865	525	1.17	5.80	646	627	4,600	0.0050	16.41	20.51	24	5.11
Pipe EE3	CP EE3-3	CP EE3-4	334	509	843	1.0	843	206,535	825,160	1,251,855	869	1.94	7.74	627	608	4,600	0.0050	18.28	22.85	24	5.11
Pipe EE3	CP EE3-4	CP EE3-5	192	628	820	1.0	820	200,900	1,026,060	1,217,700	846	1.88	9.62	608	589	4,600	0.0050	19.84	24.80	27	5.52
Pipe EE3	CP EE3-5	CP EE4-3	51	805	856	1.0	856	209,720	1,235,780	1,271,160	883	1.97	11.59	589	570	4,000	0.0050	21.27	26.59	27	5.52
Total			2841	2203	5044		5044	1,235,780		7,490,340	5,202	11.59				22,400	0.0050				
Pipe EE1	Upstream	CP EE1-13	5213	4933	10146	1.0	10146	2,485,770	2,485,770	15,066,810	10463	23.31	23.31								
Pipe EE2	Upstream	CP EE1-13	3486	5849	9335	1.0	9335	2,287,075	4,772,845	13,862,475	9627	21.45	44.76								
Pipe EE4	CP EE1-13	CP EE4-1	184	466	650	1.0	650	159,250	4,932,095	965,250	670	1.49	46.26	600	590	2,000	0.0050	35.74	44.68	48	8.10
Pipe EE4	CP EE4-1	CP EE4-2	106	414	520	1.0	520	127,400	5,059,495	772,200	536	1.19	47.45	590	580	2,500	0.0050	36.09	45.11	48	8.10
Pipe EE4	CP EE4-2	CP EE4-3	28	578	606	1.0	606	148,470	5,207,965	899,910	625	1.39	48.84	580	570	2,500	0.0050	36.48	45.60	48	8.10
Total			9017	12240	21257		21257	5,207,965		#######	21,921	48.84				7,000	0.0050				
Pipe EE3	Upstream	CP EE4-3	2841	2203	5044	1.0	5044	1,235,780	1,235,780	7,490,340	5202	11.59	11.59								
Pipe EE4	CP EE1-13	CP EE4-3	9017	12240	21257	1.0	21257	5,207,965	6,443,745	31,566,645	21921	48.84	60.43								
Pipe EE5	CP EE4-3	CP EE5-1	925	607	1532	1.0	1532	375,340	6,819,085	2,275,020	1580	3.52	63.95	570	566	2,500	0.0050	40.36	50.45	54	8.77
Pipe EE5	CP EE5-1	CP EE5-2	1036	644	1680	1.0	1680	411,600	7,230,685	2,494,800	1733	3.86	67.81	566	561	2,500	0.0050	41.26	51.57	54	8.77
Pipe EE5	CP EE5-2	CP EE5-3	1003	585	1588	1.0	1588	389,060	7,619,745	2,358,180	1638	3.65	71.46	561	556	3,000	0.0050	42.08	52.60	54	8.77
Pipe EE5	CP EE5-3	CP EE5-4	801	67	868	1.0	868	212,660	7,832,405	1,288,980	895	1.99	73.46	556	551	3,500	0.0050	42.51	53.14	54	8.77
Pipe EE5	CP EE5-4	CP EE5-5	650	621	1271	1.0	1271	311,395	8,143,800	1,887,435	1311	2.92	76.38	551	546	3,500	0.0050	43.14	53.93	54	8.77
Pipe EE5	CP EE5-5	CP EE5-6	375	567	942	1.0	942	230,790	8,374,590	1,398,870	971	2.16	78.54	546	541	3,500	0.0050	43.60	54.49	54	8.77
Pipe EE5	CP EE5-6	CP EE5-7	17	665	682	1.0	682	167,090	8,541,680	1,012,770	703	1.57	80.11	541	536	4,400	0.0050	43.92	54.90	60	9.40
Pipe EE5	CP EE5-7	CP EE5-8	0	564	564	1.0	564	138,180	8,679,860	837,540	582	1.30	81.41	536	531	2,500	0.0050	44.18	55.23	60	9.40
Pipe EE5	CP EE5-8	CP EE5-9	0	191	191	1.0	191	46,795	8,726,655	283,635	197	0.44	81.85	531	526	2,700	0.0050	44.27	55.34	60	9.40
Total			16665	18954	35619		35619	8,726,655		#######	36,732	81.85				28,100	0.0050				

Design Parameters:

Residential Single Family Units (EDU) = 245 GPD
Population per EDU = 3.5 capita/EDU
Development Average Density = 1 EDU/acre
Wastewater Demand = 70 GPD/capita
Maximum Flow Peak Factor = 3
Inflow/Infiltration = 750 gallon/acres served

Average Dry Weather Flow = 245 GPD/EDU
Maximum Dry Weather Flow = 735 GPD/EDU
Maximum Wet Weather Flow = 1485 GPD/EDU

Manning's Roughness Coefficient = 0.013
Percent of Pipe Flowing Full = 80%

Green Valley Special Utility District
Drainage Area F - 1 EDU
Pipe Flow Design Calculations

1 EDU F

Sewer Main Location			Contributing Area			Population		Average Dry Weather Flow		Maximum Wet Weather				Pipe Design							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Pipe ID	Up Stream Collection Point	Down Stream Collection Point	Left Side Area (acres)	Right Side Area (acres)	Total Area (acres)	Development Density (1 EDU/acre)	Total EDU (EDU)	Dry Weather Flow (GPD)	Cumulative Dry Weather Flow (GPD)	Wet Weather Flow (GPD)	Wet Weather Flow (gpm)	Wet Weather Flow (cfs)	Cumulative Wet Weather Flow (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Pipe Length (ft)	Pipe Slope (ft)	Pipe Diameter Actual (inches)	Pipe Diameter 80% Full (inches)	Pipe Diameter Nominal (inches)	Pipe Velocity Nominal (ft/sec)
Pipe FF	Upstream	CP FF 1	233	614	847	1.0	847	207,515	207,515	1,257,795	873	1.95	1.95								
Pipe FF	CP FF 1	CP FF 2	343	379	722	1.0	722	176,890	384,405	1,072,170	745	1.66	3.61	650	645	2,500	0.0050	13.73	17.16	18	4.21
Pipe FF	CP FF 2	CP FF 3	291	389	680	1.0	680	166,600	551,005	1,009,800	701	1.56	5.17	645	640	2,500	0.0050	15.71	19.64	21	4.67
Pipe FF	CP FF 3	CP FF 4	229	451	680	1.0	680	166,600	717,605	1,009,800	701	1.56	6.73	640	635	2,500	0.0050	17.35	21.69	24	5.11
Pipe FF	CP FF 4	CP FF 5	239	500	739	1.0	739	181,055	898,660	1,097,415	762	1.70	8.43	635	630	2,500	0.0050	18.88	23.60	24	5.11
Pipe FF	CP FF 5	CP FF 6	229	452	681	1.0	681	166,845	1,065,505	1,011,285	702	1.56	9.99	630	625	2,500	0.0050	20.12	25.15	27	5.52
Pipe FF	CP FF 6	CP FF 7	284	313	597	1.0	597	146,265	1,211,770	886,545	616	1.37	11.36	625	620	2,500	0.0050	21.12	26.39	27	5.52
Pipe FF	CP FF 7	CP FF 8	233	295	528	1.0	528	129,360	1,341,130	784,080	545	1.21	12.58	620	615	2,500	0.0050	21.93	27.42	30	5.92
Pipe FF	CP FF 8	CP FF 9	89	363	452	1.0	452	110,740	1,451,870	671,220	466	1.04	13.62	615	610	2,700	0.0050	22.60	28.25	30	5.92
Pipe FF	CP FF 9	CP FF 10	86	250	336	1.0	336	82,320	1,534,190	498,960	347	0.77	14.39	610	605	3,600	0.0050	23.07	28.84	30	5.92
Pipe FF	CP FF 10	CP FF 11	171	82	253	1.0	253	61,985	1,596,175	375,705	261	0.58	14.97	605	600	3,400	0.0050	23.41	29.27	30	5.92
Total			2427	4088	6515		6515	1,596,175		9,674,775	6,719	14.97				27,200	0.0050				

Design Parameters:

Residential Single Family Units (EDU) =	245	GPD
Population per EDU =	3.5	capita/EDU
Development Average Density =	1	EDU/acre
Wastewater Demand =	70	GPD/capita
Maximum Flow Peak Factor =	3	
Inflow/Infiltration =	750	gallon/acres served

Average Dry Weather Flow =	245	GPD/EDU
Maximum Dry Weather Flow =	735	GPD/EDU
Maximum Wet Weather Flow =	1485	GPD/EDU

Manning's Roughness Coefficient =	0.013
Percent of Pipe Flowing Full =	80%