CDM

San Gabriel Regional Wastewater Master Plan

October 2006

TEXAS WATER DEVELOPMENT BOARD

GEORGETOWN UTILITY SYSTEMS

LCRA
ENERGY • WATER • COMMUNITY SERVICES

Final Report

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10/31/06

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Executive Summary

Phase I Summary

Williamson County is one of the fastest growing counties in the State of Texas. Continued growth in the region will rely on the sustainability of the three main sources of water: Lakes Granger and Georgetown and ground water from the Edwards Aquifer.

In response to concerns by the City of Georgetown over the growing number of septic systems in the San Gabriel River watershed, the Brazos River Authority, Lower Colorado River Authority, and the City of Georgetown combined forces with the Texas Water Development Board to initiate the San Gabriel Regional Wastewater Master Plan. This planning effort focused on identifying long-term regional wastewater solutions throughout Williamson County to ultimately provide source water protection of the existing water resources. CDM was hired to develop this regional master plan.

Phase I of the San Gabriel Regional Wastewater Master Plan was completed by CDM in August 2004. The purpose of Phase I was to define the study area, characterize the current and future population and wastewater flows within the study area, and evaluate several organizational long-term approaches to managing wastewater in the study area. The final report documenting the results of Phase I was submitted to the Brazos River Authority on 4 August 2004. Based upon input from all of the potential parties involved in managing wastewater within the study area, Phase I concluded that the preferred long-term wastewater management strategy is for a single river authority or the Alliance (the collective of the Brazos River Authority and the Lower Colorado River Authority) to take responsibility for a regional wastewater system.

Phase II

Phase II of the San Gabriel Regional Wastewater Master Plan builds on the results of Phase I by accomplishing the following tasks:

- The population and wastewater flow projections for the study area were extended to 2060;
- The population and wastewater flow projections were geographically distributed on a more discrete basis;
- Several regional wastewater infrastructure alternatives for accommodating future wastewater flows were identified;
- A planning level hydraulic model of select alternatives was configured and used for testing and validation. The model interfaces with the City of Georgetown's sewer system hydraulic model;
- Select alternatives were evaluated on hydraulic and economic bases; and

- An implementation schedule and plan and cash flow analysis was completed for the best management strategy.

Planning Summary

Growth was projected using the institutional knowledge of stakeholders regarding specific developments and the WillCo[1] population projections. Based upon this information, population in the study area is projected to double over the next 25 years to 170,000 and increase to approximately 450,000 by 2060. Prior to 2030, 90% of that growth will be at population densities significant enough to warrant centralized wastewater collection and treatment.

Growth was located geographically using CCN boundaries and planned transportation corridors. Short-term growth is strongest in the Middle and South Fork watersheds, accounting for 60% of the growth through 2030. The Middle and South Fork watersheds are located west and southwest of central Georgetown. As these areas increase in density, population growth shifts to the east of Georgetown.

Several major wastewater infrastructure projects are currently being planned and/or designed in the San Gabriel watershed. The Northlands or Cowan Creek WWTP and an associated lift station are being planned in the Cowan Creek watershed (within the Berry Creek sub-basin) upstream of the Sun City development. The Mankins WWTP is being planned in the Lower San Gabriel watershed near the intersection of the San Gabriel River and County Road 100. This study assumed these projects would move forward and incorporated them into the analysis.

Conceptual Model Analysis

A conceptual model was developed to streamline the alternative evaluation process. The results of the conceptual model analysis indicate that managing flows from the Middle and South Fork watersheds would be the most challenging due to constraints associated with treatment at the source, the relative distance these flows need to be transmitted for treatment, and challenges associated with transmitting the flows through central Georgetown. As a result, this study focused its alternative development and analysis on managing future flows from these two basins.

Future flows from the Berry Creek basin can be accommodated with either treatment at the source or gravity transmission to the planned Mankins WWTP.

Much of the flow from the North Fork will have to be lifted to another basin as locating a treatment plant in the North Fork basin is not feasible. Some flow can potentially be lifted to Berry Creek for treatment at the planned Northlands WWTP, while other flow can be lifted to Middle/South Forks for conveyance.

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[1] Williamson County Water Supply Facilities Plan, HDR Engineering, Inc., Sept 2001

Recommended Infrastructure

Economic analyses identified little relative difference between the alternatives evaluated. As a result, this study recommends that the implementation of specific combinations of the projects identified be tailored to meet the development needs of the watershed, as well as economic and cash flow requirements. Discussions to date with stakeholders have resulted in limited commitment to the full-scale implementation of the projects identified herein. Unless external funding is made available, all stakeholders who plan to use regionalized wastewater infrastructure would have to share in the associated planning and capital costs. Table ES-1 identifies the alternative projects and their associated schedule that would cost effectively meet the San Gabriel watershed's long-term wastewater needs. In addition, this study recommends limiting wastewater treatment capacity on the South and Middle Forks to the capacity of the Cimarron Hills WWTP and planned capacity of the future Liberty Hill WWTP due to regulatory and permitting constraints as well as limited wastewater treatment service area.

Berry Creek Watershed	**Cost Estimate**	**Schedule**
Berry Creek Interceptor Phase I	$4,217,000	2009
Berry Creek Interceptor Phase II	$2,958,000	2020
Pecan Branch WWTP Diversion	$84,000	2020
Northlands WWTP Phase I (1.5 MGD New WWTP)	$7,239,000	2009
Northlands WWTP Phase II (1.5 MGD Expansion)	$4,953,000	> 2030
Dry Berry Creek Interceptor	$7,215,000	> 2030
Northlands Lift Station Phase I & Force Main	$1,225,000	2009
Northlands Lift Station Phase II	$765,000	> 2030
Cowan Creek & Northlands Gravity Systems	$3,794,000	> 2030
North Fork Watershed		
North Fork Interceptor	$1,853,000	> 2030
North Fork Lift Station	$1,469,000	> 2030
Lower San Gabriel Watershed		
Mankins WWTP Phase 1 (2.5 MGD)	$12,500,000	2009
Mankins WWTP Phase 2 (2.5 MGD Expansion)	$9,500,000	2011
Mankins WWTP Phase 3 (2.5 MGD Expansion)	$12,500,000	>2030
Mankins Lift Station and Force Main	$2,041,000	> 2030
Mankins Branch Interceptor	$4,012,000	2009
Transmission Through Central Georgetown		
Alternative 1		
Upgrade Wolf Ranch LS & 2nd Force Main	$2,000,000	2009
Upgrade Park LS & FM	$2,600,000	2010
SH 29 Tunnel	$18,908,000	2024
Retire and Replace Interceptor LS w/ Tunnel	$2,000,000	2010
Alternative 2		
SH 29 Tunnel	$18,908,000	2009
Transmission from Central Georgetown to Mankins WWTP		
Alternative 1		
New Smith Branch Lift Station	$3,000,000	2009
Lower Gabriel WW Interceptor	$19,430,000	2040
Lower San Gabriel Lift Station	$7,600,000	2009
Alternative 2		
Lower San Gabriel/Smith Branch Diversion Structure	$120,000	2009
Lower Gabriel WW Interceptor	$19,430,000	2009
South & Middle Fork Watersheds		
South Fork Interceptor Ph I	$8,459,000	2007
South Fork Interceptor Ph II	$2,115,000	2010
Middle Fork Interceptor Ph I	$812,000	2007
Middle Fork LS / Force Main Ph I	$3,455,000	2007
Middle Fork Interceptor Ph II	$6,770,000	> 2030
Alternative 1		
Middle Fork LS / Force Main Ph II	$6, 770,000	> 2030
Alternative 2		
Middle Fork Tunnel	$8,976,000	2030

Table ES-1 Recommended Projects and Alternatives

Section 1
Planning

1.1 Population Projections

A tremendous amount of growth is expected in Williamson County over the next 50 years. Some sources project more than a tripling of the population between 2005 and 2060. Since population determines the projected wastewater flows, it is imperative that population growth is both projected and geographically distributed in the most prudent manner.

To this end, local knowledge is preferred when projecting and distributing population. After completing Phase I, the general consensus of the stakeholders was that the projections reflected in Senate Bill 1 and Senate Bill 2 under-estimated growth trends in the area for the most part. For this reason, the projections developed in the Williamson County Water Supply Facilities Plan[2] (the WillCo report) were used to best represent growth in the study area. The Phase I report compares the various growth projections that were considered. This study reflects the WillCo report population projections and associated growth rates as the basis for growth in the study area. Some modifications to the WillCo projections were made to incorporate current information on planned development. The following methodology was used to develop the final population projections and geospatially distribute future population.

- Multiple meetings were held with the stakeholders to identify planned developments. Information was collected on the boundaries, living unit equivalents (LUEs) at buildout, and the rate of development in LUEs per year if known. Planned developments are generally not known more than 10 to 15 years into the future.

- Planned development areas were considered first priority areas for assigning future population.

- Future transportation corridors and areas adjacent to urban centers were considered second priority locations for geographically distributing population.

- The maximum allowable population density for any given area that does not currently have any plan for development was set at 5.3 people per acre in the 2060 scenario.

- Growth rates from the WillCo study were used as the primary reference for population projections, as opposed to the absolute projection at a given planning horizon.

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[2] Williamson County Water Supply Facilities Plan, HDR Engineering, Inc., Sept 2001

- To develop the 2060 population projections, WillCo growth rates from 2040 to 2050 were applied to the 2050 to 2060 time period.

Table 1-1 summarizes the final population projections by water CCN and compares the Phase II projections to the WillCo projections. These projections include those portions of CCN service areas within Williamson County. To ensure a population balance with the WillCo numbers, the area outside of the San Gabriel basin but within the county **were** included. Section 1.2 provides further detail on this point.

San Gabriel Phase II Population Projections				
CCN	**2000**	**2015**	**2030**	**2060**
Georgetown	36,712	67,213	97,479	188,405
Granger	1,598	2,309	3,115	7,748
Chisholm Trail SUD	6,126	25,685	45,577	178,862
Jonah SUD	8,419	15,038	21,477	68,658
Liberty Hill WSC	1,361	1,738	1,914	2,814
Bertram	1,122	1,416	1,746	4,363

WillCo Population Projections				
CCN	**2000**	**2015**	**2030**	**2050**
Georgetown	36,677	73,700	106,002	147,302
Granger	1,574	2,285	3,091	3,947
Chisholm Trail SUD	6,729	21,342	46,180	127,727
Jonah SUD	8,990	14,265	21,453	38,750
Liberty Hill WSC	1,332	1,709	1,885	1,957

Table 1-1 Phase II Population Projections

It is important to note that 2060 population projections do not represent buildout conditions. Using the above criteria, a considerable portion of the study area is projected to remain at population densities less than 1 person per acre at the 2060 planning horizon.

1.2 Subcatchment Delineations

Figure 1-1 shows the major watershed basins along with the various geopolitical boundaries represented in the population projections in Table 1-1. More discrete subcatchment delineations were defined to geographically allocate the study population into distinct locations. Based on the methodology outlined in Section 1.1, population was "assigned" to the defined sub-basins until the target San Gabriel Phase II Population in Table 1-1 was reached.

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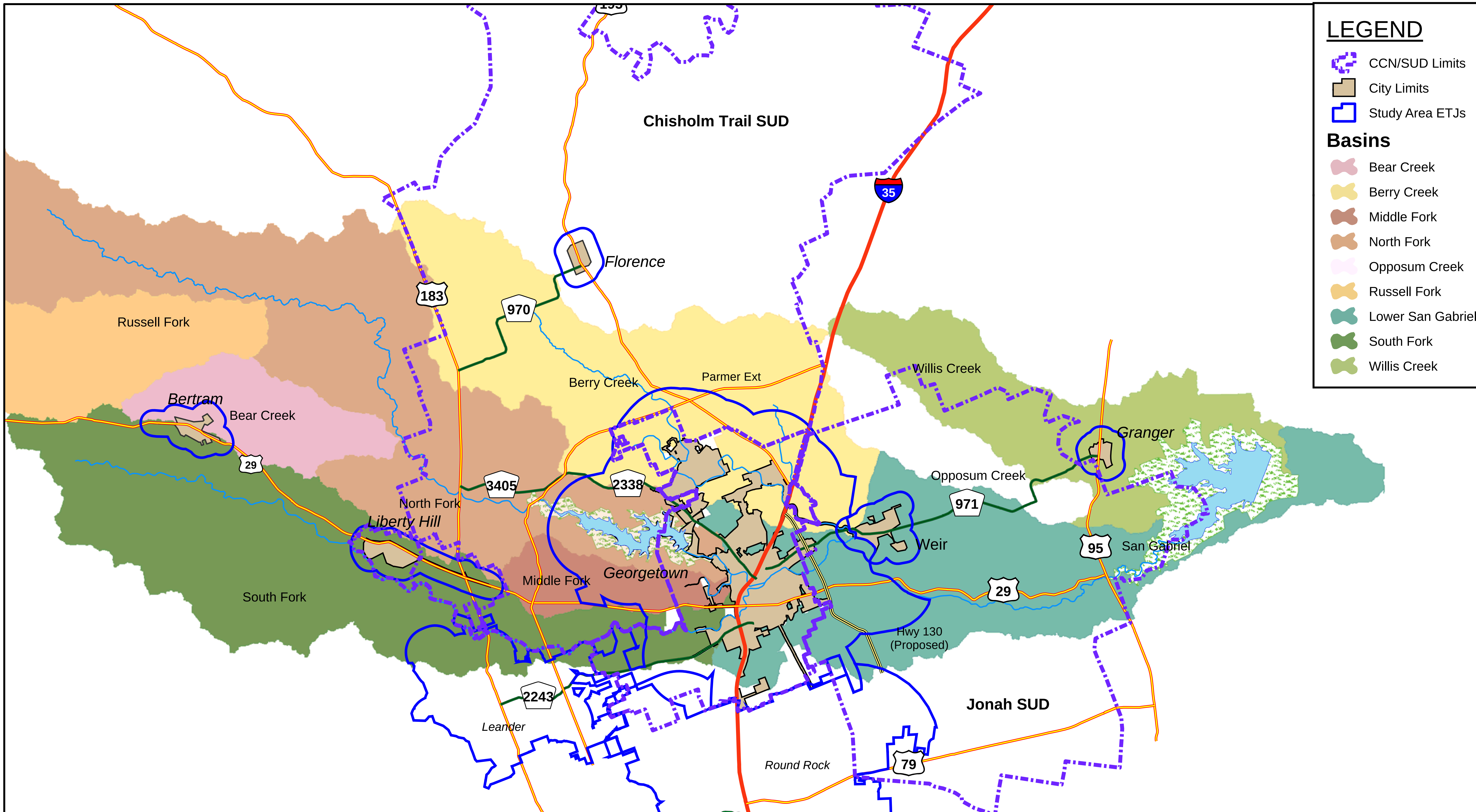


1 inch equals 20,000 feet

N

CDM

SAN GABRIEL WATERSHED WASTEWATER MASTER PLAN
PHASE II

GEOPOLITICAL AND SUB-BASIN BOUNDARIES

Figure 1-1 **Geopolitical and Sub-basin Boundaries**

Figures 1-2 through 1-5 show the geographically distributed population densities for the 2005, 2015, 2030, and 2060 planning horizons based on known projected developments and/or the growth trends and assumptions presented in Section 1.1. The subcatchment delineations fall within four categories:

1) Within the City of Georgetown's current service area, subcatchments were delineated as part of previous studies.

2) The boundaries of known developments defined the subcatchment boundaries associated with these developments. If significant portions of a development were located in multiple watersheds, the development was split accordingly.

3) In areas outside of the City's current service area but within the City's extra-territorial jurisdiction (ETJ), hydrologic boundaries were used to define subcatchments on the order of 20 – 1,000 acres, which corresponds to developments the size of 40 – 1,900 LUEs.

4) Outside the City's ETJ, hydrologic boundaries were used to define subcatchments on the order of 1,000 – 5,000 acres, which corresponds to developments the size of 1,900 – 9,500 LUEs.

Areas projected to be less dense than 1 person per acre were assumed to pursue local treatment, such as septic systems, as opposed to regionally treating flows based on the disproportionately large cost associated with accommodating remote, low density regions. Figure 1-6 shows the sub-basins that were used to model wastewater flow projections in the hydraulic model. Note that when comparing the sub-basins from Figures 1-2 through 1-5 with the sub-basins in Figure 1-6, some of them have been dropped out and were not considered in the hydraulic loading. As noted above, less dense areas were assumed to pursue on-site treatment as opposed to central collection and treatment, so were not included in the flow demand calculations. In some cases, sub-basins were within a different geopolitical boundary, so were assumed to be served by that entity and were not considered for the San Gabriel Regional System. An example would be several sub-basins along the south edge of the South Fork basin that are within the Leander ETJ. Table 1-2 presents wastewater flow load population by sub-basin. The population considered to contribute to the system hydraulic load is about 75% of the total study area population. As mentioned above, the other 25% is assumed to use on-site or other alternative treatment options.

Basin	Population
Berry Creek	89,726
Central/Lower Gabriel	130,260
Middle Fork	36,366
North Fork	12,785
South Fork	70,414

Table 1-2 Population Load by Basin

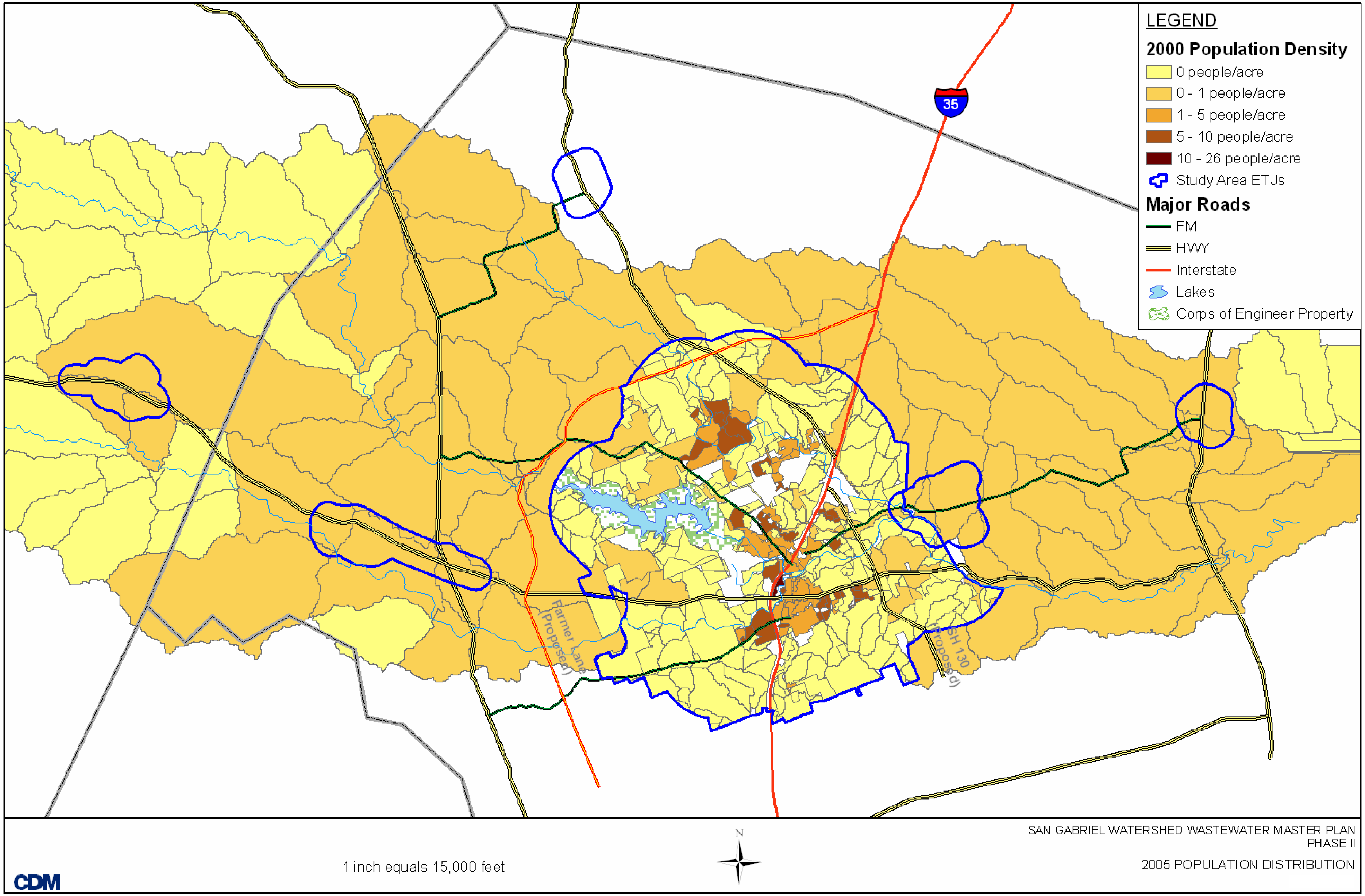


Figure 1-2 Current (2005) Population Estimates

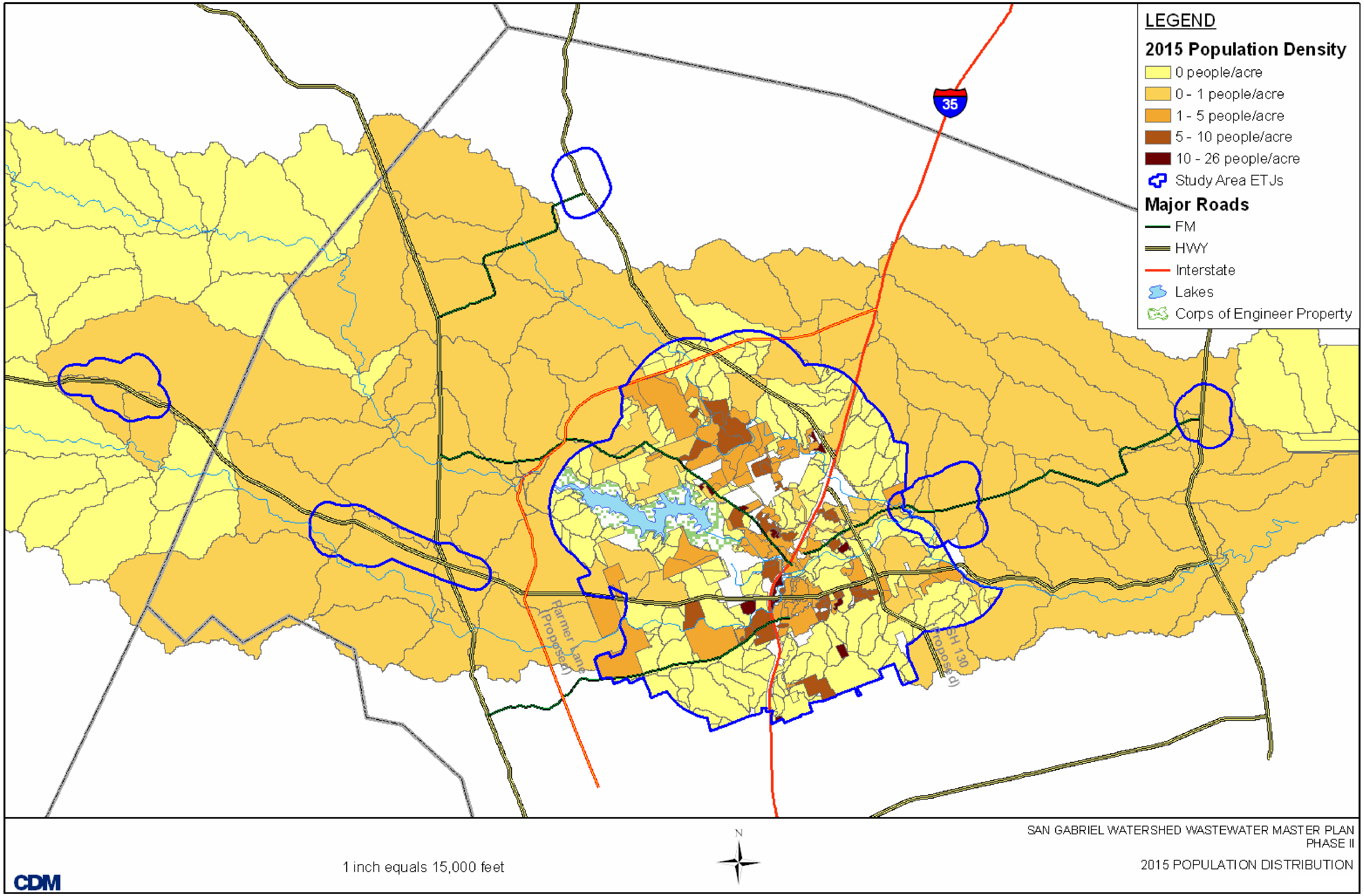


Figure 1-3 2015 Population Projections

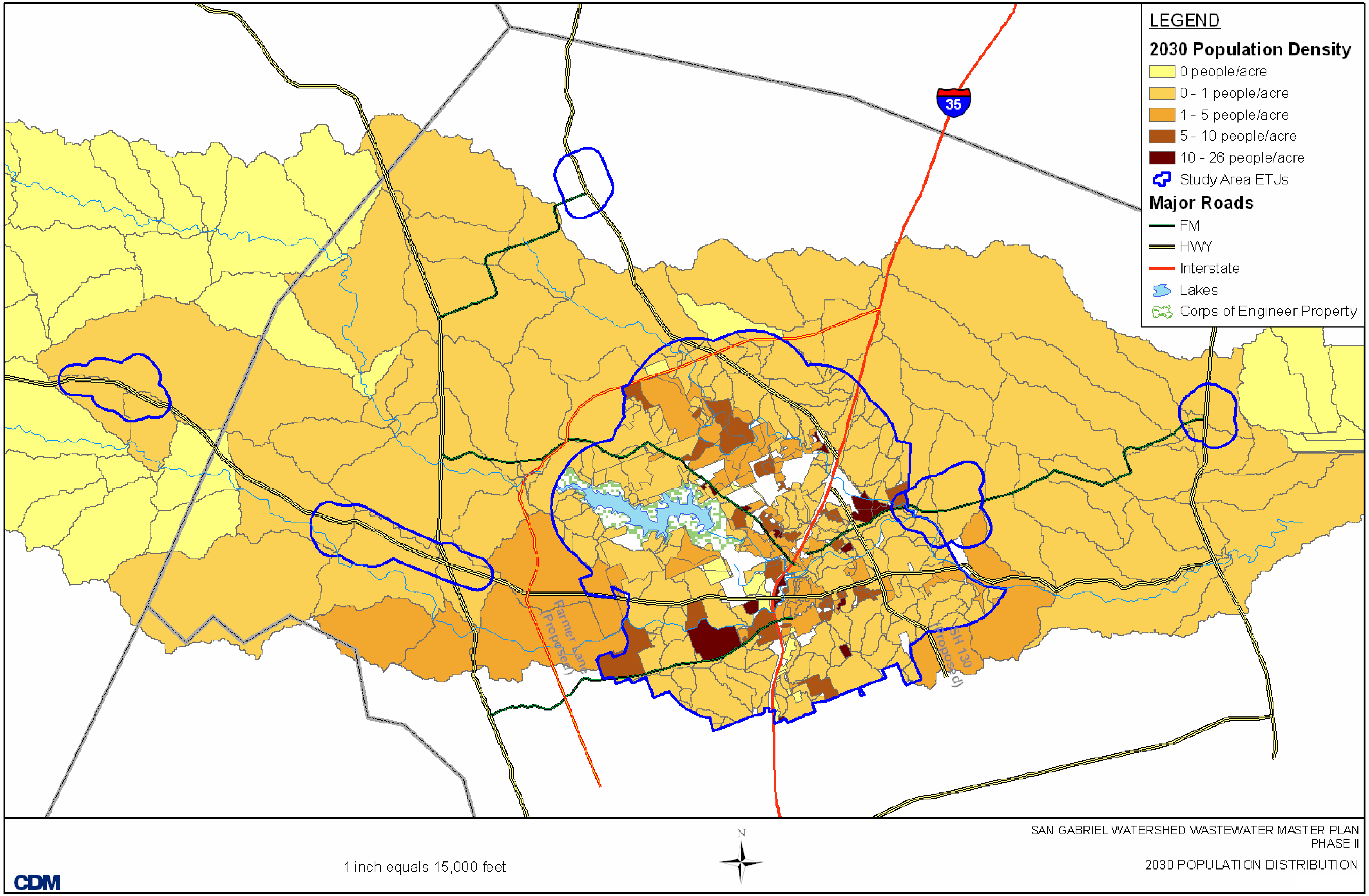


Figure 1-4 2030 Population Projections

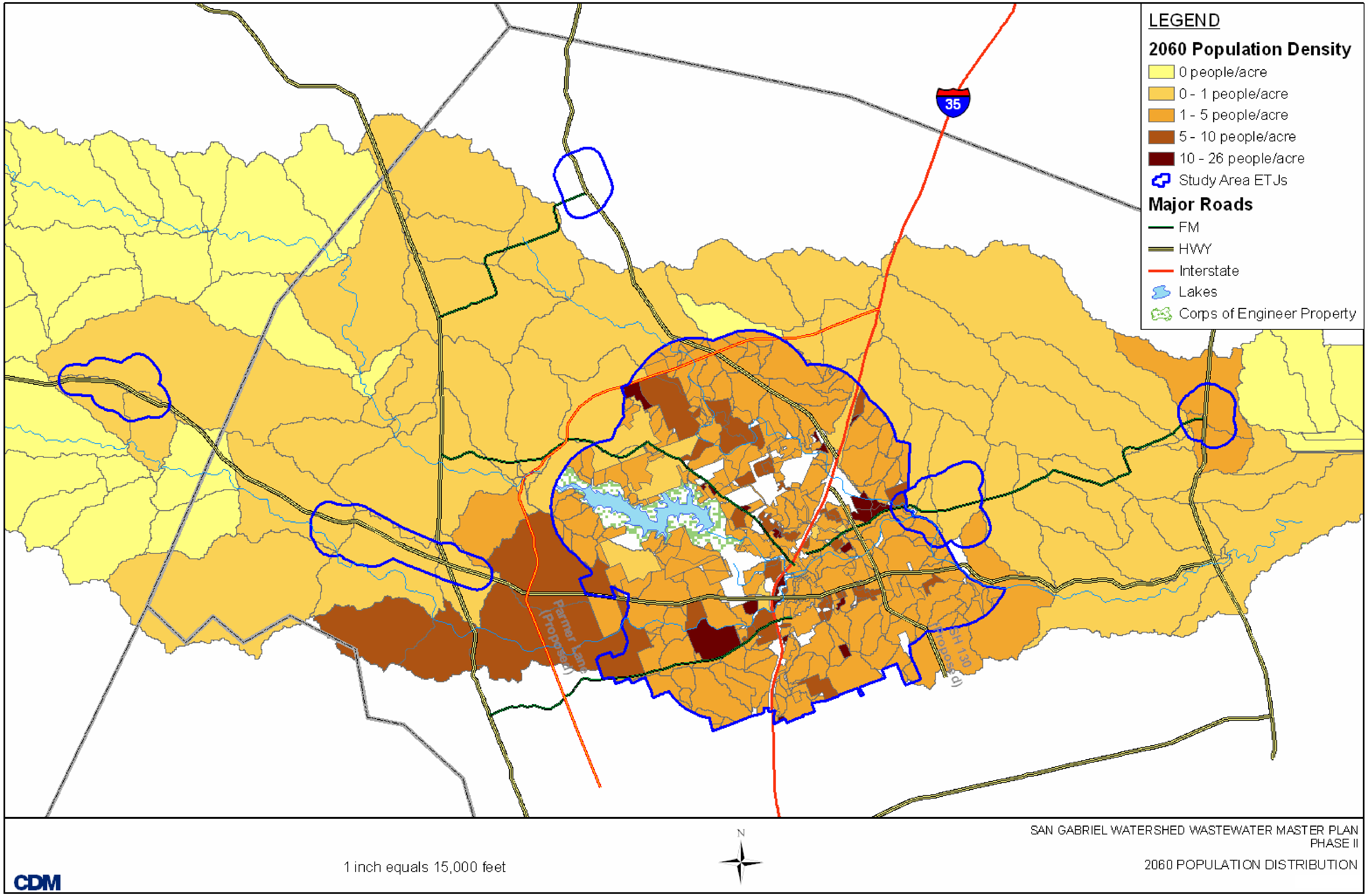
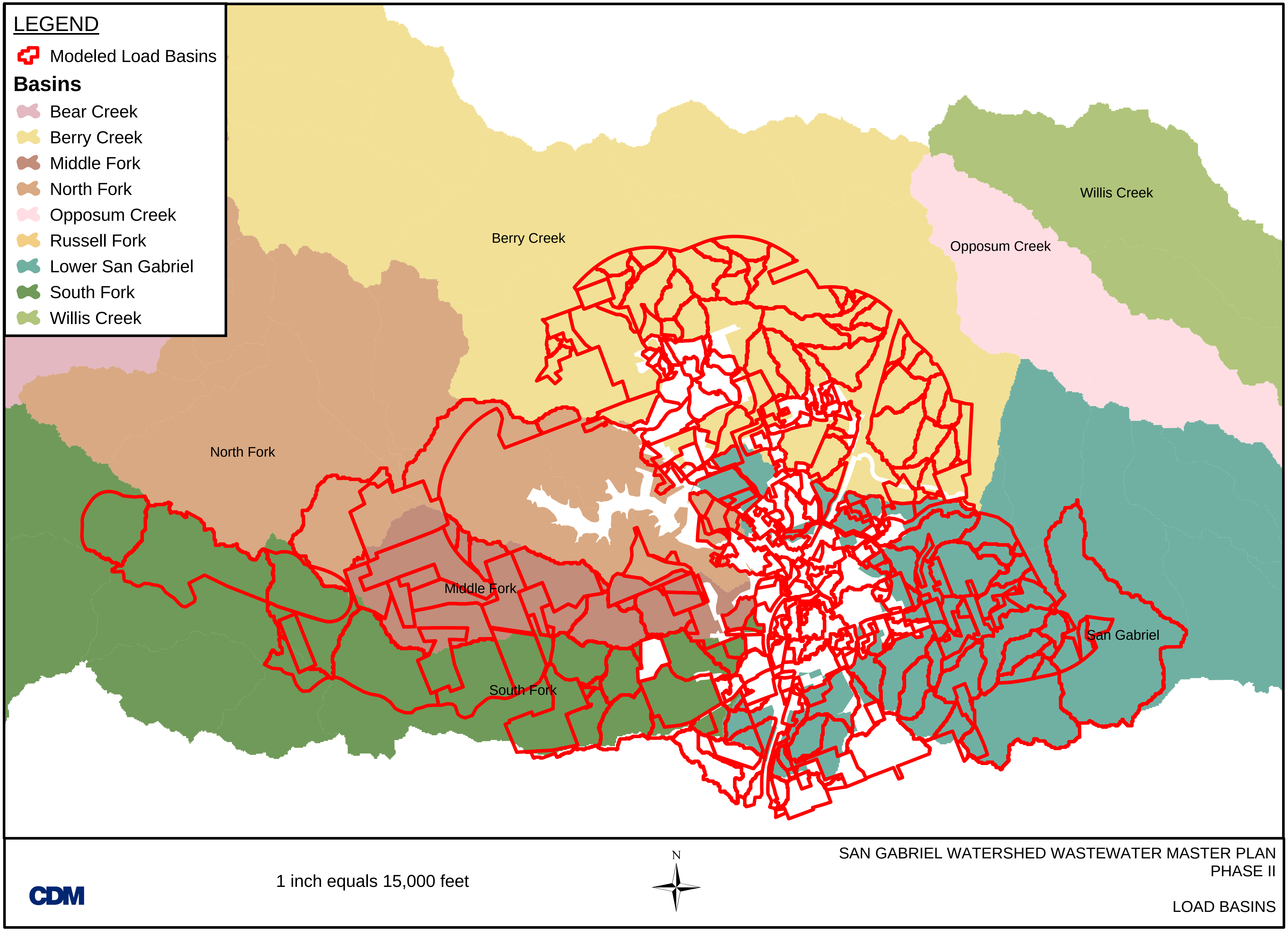


Figure 1-5 2060 Population Projections



SAN GABRIEL WATERSHED WASTEWATER MASTER PLAN
PHASE II

LOAD BASINS

Figure 1-6 **Load Basins**

Section 2
Conceptual Model

It is prudent to develop a basic conceptual model of the study area prior to modeling and economic analyses. The conceptual model consists of consideration of growth patterns and planned infrastructure expansion, capacity analysis by watershed, identification of regulatory and permitting constraints, constructability issues, and a preliminary set of future wastewater service alternatives to be analyzed in further detail. Conceptual models highlight the wastewater service challenges associated with future growth, identify critical paths, and streamline the modeling and alternative evaluation process.

2.1 Growth Patterns and Planned Infrastructure

It is anticipated that the San Gabriel basin is going to see rapid development in the coming years. This development, in general, will spread outwards from the City of Georgetown. There are a number of thoroughfares that are planned or are being developed that will also attract growth. In particular, the Parmer Lane extension and State Highway 130 are already attracting substantial developer interest.

The South Fork and Middle Fork sub-basins of the San Gabriel have received intense interest from developers. Many of these developers want to have homes on the ground as early as 2006. A key constraint in supporting development in the South and Middle Fork areas is conveying flows through the Georgetown City Limits to the Lower San Gabriel sub-basin. The city's infrastructure is not sized to accommodate such potentially large flows. For this reason, several alternatives involving pumping, larger interceptors, and tunneling were considered.

Discussions have been ongoing for some time to build a WWTP southeast of Georgetown, in the vicinity of the intersection of Hwy 29 and CR 100 in the Lower San Gabriel sub-basin. These discussions **have** included consideration of its use as a regional facility. This plant has been referred to as the Mankins Plant. Natural topography supports bringing much of the flow generated in the entire basin to this plant. In particular, flows from the South and Middle Fork sub-basins will ultimately be conveyed to the Mankins Plant for treatment. This plant will also serve to take excess flows from existing plants that are not readily or easily expanded. As mentioned above, conveying flows from west to east will present some challenges.

There is also immediate interest in developing the area in the Berry Creek sub-basin to the northwest of Sun City. A WWTP, referred to as the Northlands Plant, is already being discussed to serve that area. This proposed plant was assumed to be the appropriate alternative to serve most, if not all of the development in this immediate area.

Finally, there is additional development proposed in the Berry Creek area that is downstream of the proposed Northlands WWTP. Natural topography indicates that these flows can be conveyed via gravity to the Pecan Branch WWTP and/or further downstream to the proposed Mankins WWTP. As discussed later in this section, there are few, if any, constraints to conveying flows via a gravity interceptor in this area. Since gravity conveyance typically is the most cost effective method, an assumption was made that this would be preferential to other alternatives.

Table 2-1 presents information on anticipated developments that will require sewer service, including overall acreage and the anticipated number of units at buildout. Figure 2-1 shows the planned developments, along with the sub-basin boundaries and existing and future wastewater treatment plants.

Development ID	Acres	Total # of Units	Type of Units[1]
Al Peterson Tract	225	450	SFU
Berkett Property	172	500	SFU
Berry Creek Sec 5	32	150	SFU
Brinklim	268	300	SFU
Carlson Tract	57	300	SFU
Carrothers	447	500	SFU
Celebration	19	100	COM
Cim Hills I	825	250	SFU
Cowan Springs Pt A	1793	6064	SFU/MFU
Cowan Springs Pt B	221	1145	COM
CT - Wolf Tract	111	300	MFU/RET
Davidson Tract	61	450	SFU
Domal	184	300	SFU
Escalara	1150	550	SFU
Faubion	195	600	SFU
Frost Weir Trust	881	3500	SF/MFU/RET
Georgetown Village	1057	3273	SFU/MFU
Gibraltar Homes	416	700	SFU
Hawes Ranch	257	400	SFU
Hawthorne	20	175	MFU
HEB & Apartments	289	300	MFU/COM
HEB Grocery	36	100	RET/COM
Heritage Oaks	203	398	ARU
Hinkley Tract	60	80	SFU
Industrial	15	0	COM
JL Enterprises Tract	301	600	SFU
Kimbro	90	150	SFU
Lackey Creek Subd	246	600	SFU
Meadows	58	150	SFU
MUD 12	676	1500	SFU
MUD 13	330	1300	SFU/RET
MUD 17	241	400	COM

Table 2-1 Anticipated Development

Table 2-1, continued

Development ID	Acres	Total # of Units	Type of Units[1]
MUD 18	196	400	SFU
MUD 19 - Part A	264	1000	SFU/COM
MUD 19 - Part B	1578	3600	SFU
New Berry Creek	73	136	SFU
North of SH 29	39	143	COM
Northwest Apartments	49	300	MFU
Owens I	313	1200	SFU
Owens II	148	400	SFU
Owens III	187	1000	MFU
Owens IV	146	350	SFU
Parker Tract	281	400	SFU
Pinnacle	82	475	SFU
Public Facility	348	250	COM
Remaining Wolfe Property	126	1330	COM/SFU
Rivery Park	47	200	MFU
Rothell	283	560	SFU
Shadow Canyon	316	850	SFU/MRU/RET
Simon Property	99	940	COM
Snow Woods	57	35	SFU
Stonewall Commercial	22	50	COM
Stonewall Ranch	225	1300	SFU/PUB
Sun City Age Restricted	170	340	ARU
Terra Vista	380	250	SFU
The Berry Creek Estates	507	2000	SFU
University Park	40	200	SFU
Villages of Berry Creek	45	244	SFU
Wade Crossing	124	250	MFU/PUB
Weir Ranch	1042	3000	SFU/MFU/RET
Wesleyan	25	200	ARU
Wolf Ranch E of I-35	36	175	SFU
Wolfe Property	281	1500	COM
Wood Hall Property	261	2000	SFU
Woodlake	44	470	SFU/COM

Notes: 1) SFU = Single Family Unit; MFU = Multi-Family Unit; ARU = Age-Restricted Unit; RET = retail; COM = Commercial; PUB = public

2.2 Watershed Capacity Analysis

Figure 2-2 shows a schematic representation of the hydraulically critical components of the City of Georgetown's wastewater system, along with a simplistic representation of the hydrology in the study area. The City's system is the only major infrastructure currently in the basin. Consideration was given to the portion of the regional wastewater flow, if any, that could be conveyed or treated by this existing infrastructure, even if only on a temporary basis. Figure 2-2 reflects permitted capacities of existing WWTPs. Section 2.5 presents additional detailed information on treatment considerations.

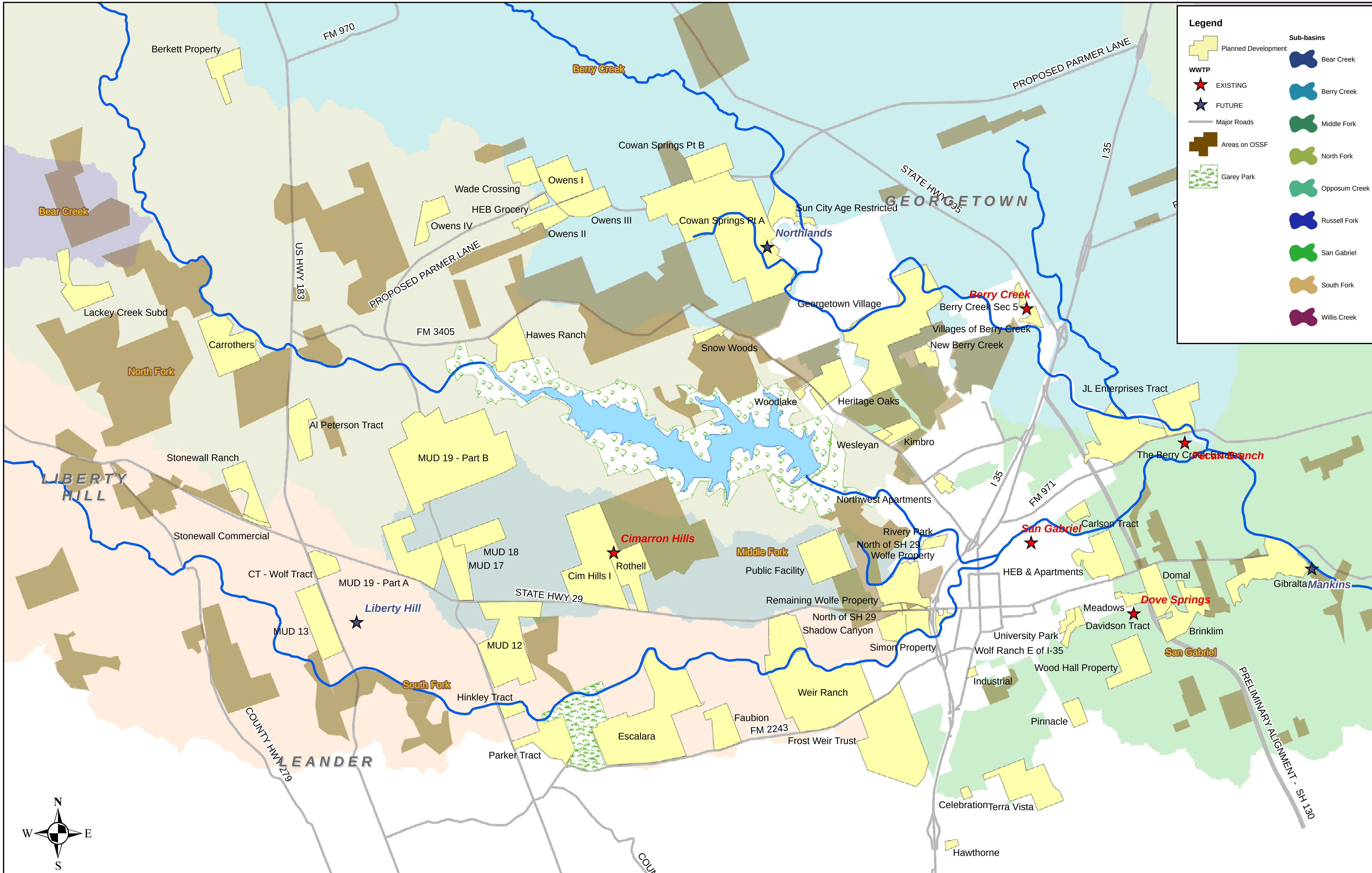


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Figure 2-1. **Planned Development in the San Gabriel Basin**

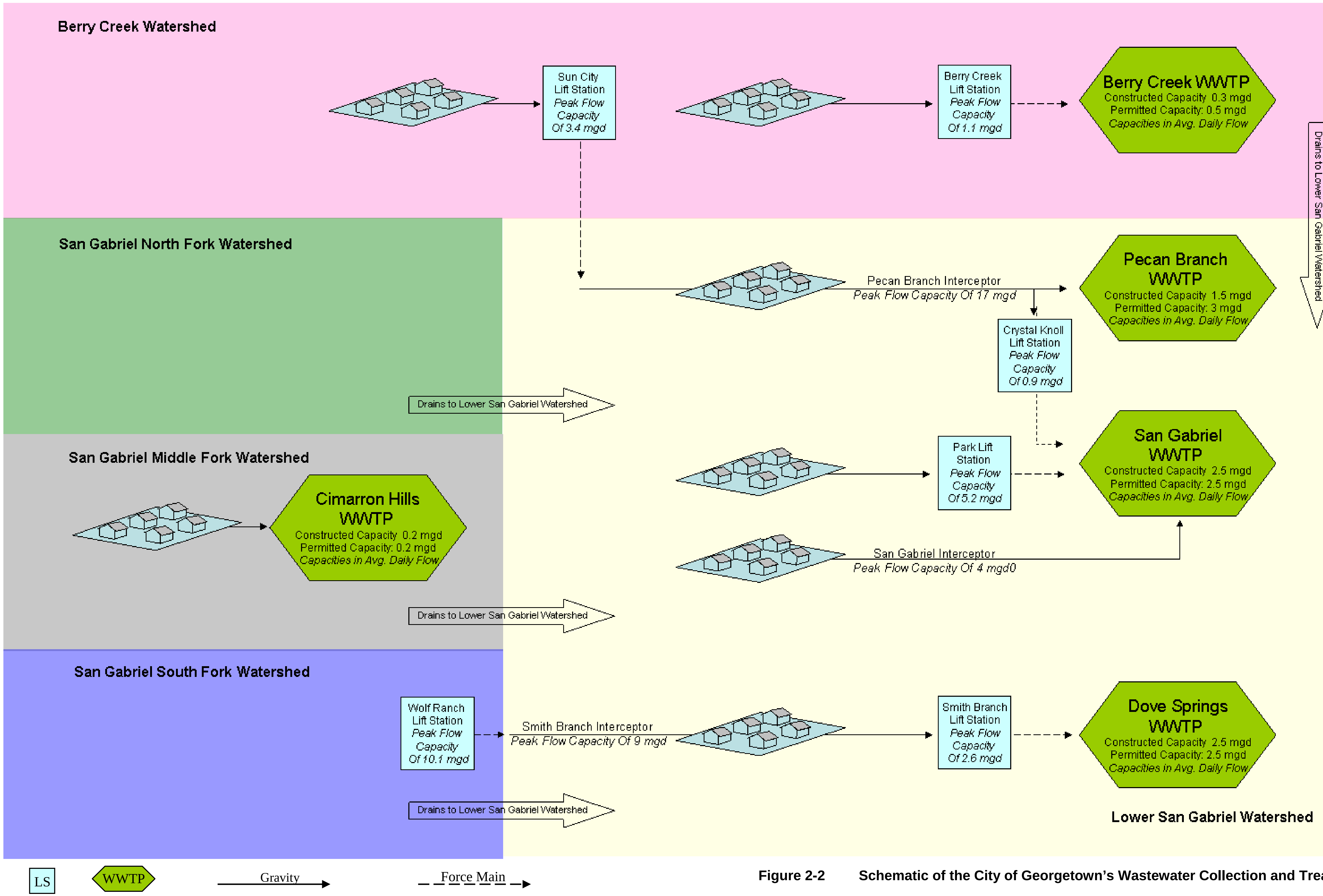

Figure 2-2 **Schematic of the City of Georgetown's Wastewater Collection and Treatment System**

It is important to note that all of the major watersheds in the study area ultimately drain to the Lower San Gabriel sub-basin. As a result of this hydrologic feature, any future wastewater flows must either:

1) Be transmitted through and treated within the Lower San Gabriel watershed;

2) Treated prior to entering the Lower San Gabriel watershed; or

3) Be pumped further upstream within or outside of the San Gabriel basin.

Option 3 above is not considered a practical solution. Table 2-2 compares the wastewater flow projections to the current wastewater service capacities for each basin. By comparing the peak projected flows to the current transmission capacity, Table 2-2 indicates that the North Fork, Middle Fork, and Berry Creek watersheds will all need additional transmission capabilities by 2015. The information in Table 2-2, along with the schematic data in Figure 2-2, indicate that while the South Fork watershed has pumping capacity beyond 2030, additional interceptor capacity will need to be provided as growth spreads geographically within the watershed.

The Lower San Gabriel watershed has transmission capacity to handle peak flows produced within its own watershed beyond 2030. However, Table 2-2 indicates that the Lower San Gabriel basin interceptor cannot accommodate any flow from the four upstream contributing sub-basins. A similar conclusion can be made in regards to treatment capacity. These limitations are highlighted in Figure 2-3. If the all of the region's flow enters the Lower San Gabriel watershed, the transmission and treatment capacity of the Lower San Gabriel watershed will be exhausted within 10 years.

	Total Peak Flow (mgd)			Current Transmission Capacity (mgd)	Average Dry Weather Flow (mgd)			Permitted Treatment Capacity (mgd)
Watershed	**2015**	**2030**	**2060**		**2015**	**2030**	**2060**	
North Fork	0.3	0.3	1.3	0.0	0.1	0.1	0.4	0
Middle Fork	3.0	4.7	10.1	1.2	0.9	1.5	3.3	0.2
South Fork	6.1	6.9	15.8	10.1	2.6	3.4	6.1	0
Berry Creek	9.8	11.0	24.2	5.5	3.1	4.0	9.8	0.5
Lower San Gabriel	21.3	23.0	53.5	28.8	7.6	8.7	19.5	8
				Totals =	14.3	17.7	39.0	8.7

Table 2-2 Projected Wastewater Flow and Current Capacity by Watershed

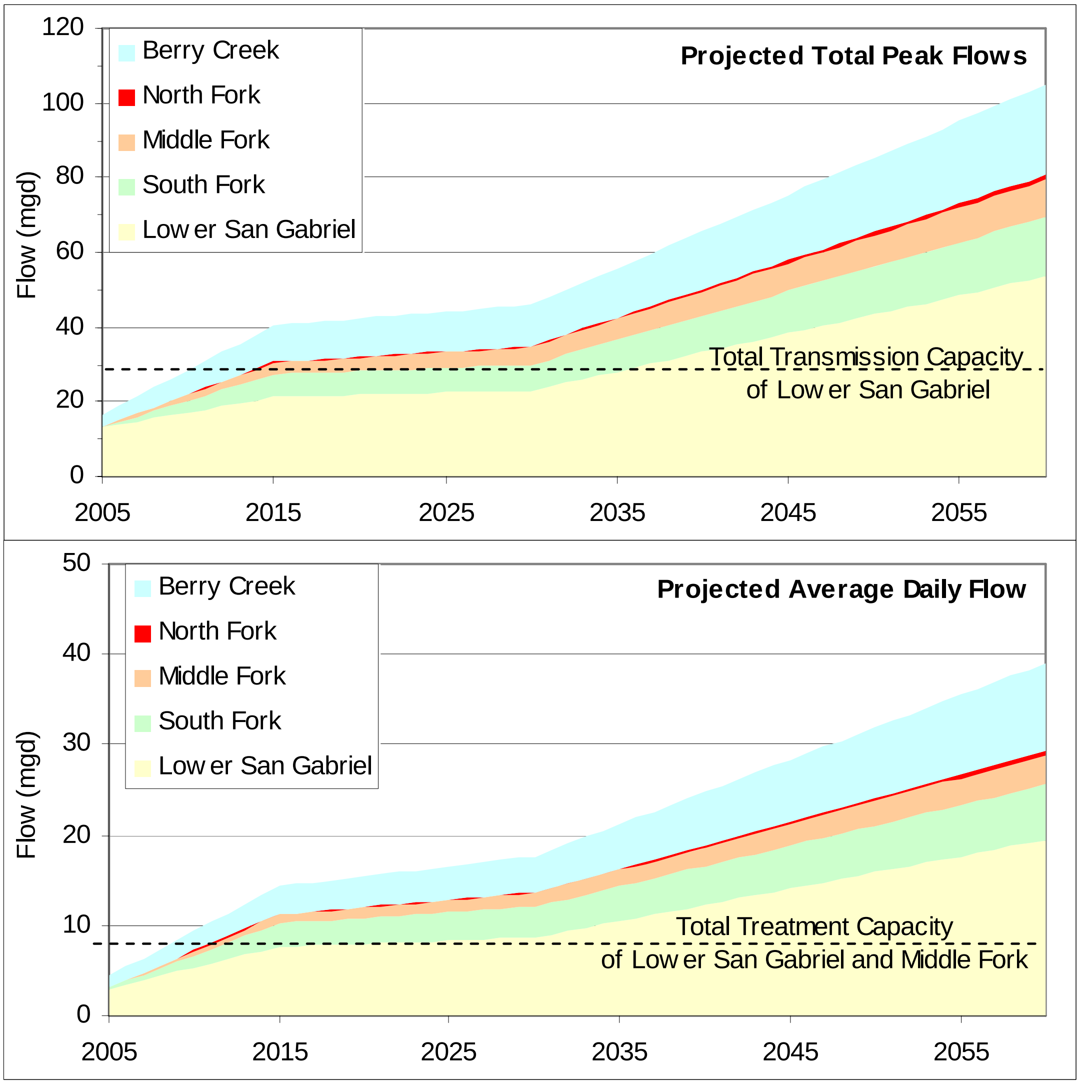

Figure 2-3 Projected Total Peak and Average Daily Flows

2.3 Regulatory and Permitting Constraints

Figure 2-4 shows that all of the North Fork and approximately half of the projected service area in the South Fork are located in the Edwards Aquifer Recharge Zone.

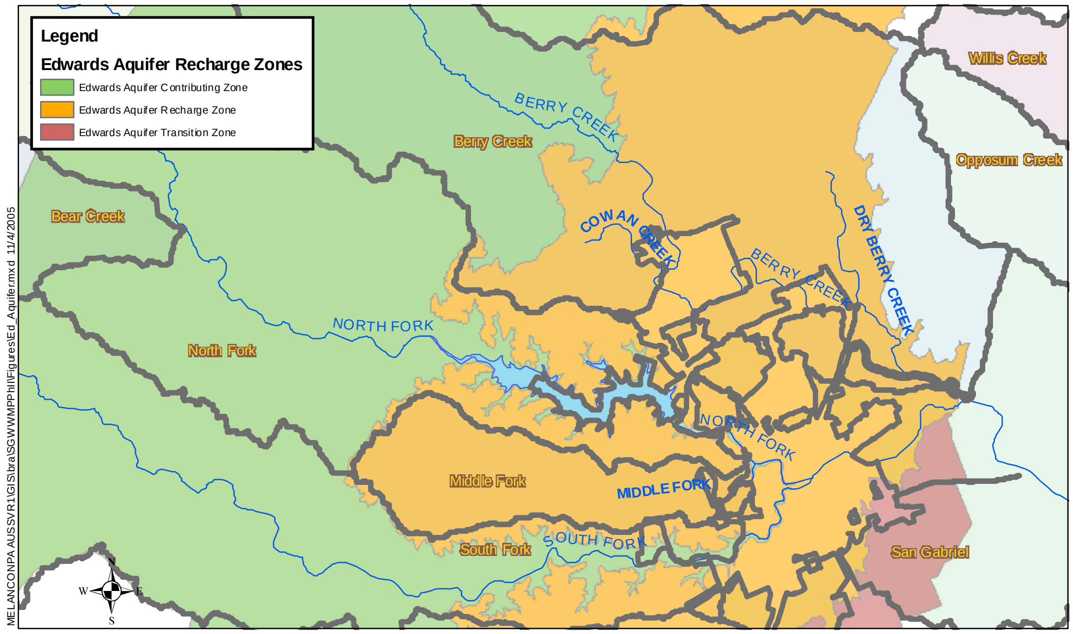

Figure 2-4 Edwards Aquifer Recharge Zones

Texas Commission on Environmental Quality (TCEQ) Chapter 213 rules prohibits discharge from wastewater treatment facilities within the Edwards Aquifer Recharge Zone. No-discharge facilities do exist in central Texas. However, these facilities are generally more expensive. If irrigation land is not immediately available and land purchases are necessary, no-discharge facilities can be up to twice as expensive as facilities that will discharge to a water body.

Approximately half of the projected service area in the South Fork is on the Edwards Aquifer Contributing Zone. Wastewater treatment facilities are permitted to discharge treated effluent in the Contributing Zone. However, the permitting of such a plant at the downstream end of the South Fork may be difficult or impossible due to proximity to the Recharge Zone. While moving a discharge facility upstream in the watershed may make it easier to obtain a permit, the plant would not be ideally located to serve the entire watershed.

While there is limited development in the North Fork watershed, it is important to note that severe permitting challenges would nearly prohibit the discharge of wastewater effluent immediately upstream of Lake Georgetown. The nitrogen, phosphorous, and ammonia discharge requirements alone would make any wastewater treatment plant very costly. In addition, Lake Georgetown also serves as a drinking water supply for several central Texas communities, exacerbating these permitting difficulties.

2.4 Constructability Constraints

The North, Middle, and South Fork watersheds drain to the Lower San Gabriel watershed near downtown Georgetown. As a result, constructing a new gravity interceptor and/or pump station to route flows through the City presents construction challenges. Acquiring right-of-ways would likely be difficult and expensive.

The Berry Creek sub-basin downstream of the existing Sun City is relatively undeveloped and should have very few constraints in terms of constructability of a new interceptor.

Expanding the existing wastewater treatment plants would be challenging due to lack of space and the expense of acquiring new land. The San Gabriel plant would be the most difficult to expand, as it currently discharges onto the Edwards Aquifer Recharge Zone.

2.5 Treatment Considerations

All existing, constructed treatment plants in the San Gabriel basin are owned and operated by the City of Georgetown. Figure 2-5 shows the current constructed capacity and potential permitted capacity for each of the region's WWTPs, along with anticipated future plants.

Completed as part of a separate effort, the City's wastewater master plan projected flows within the City's ETJ at 2015. These projected flows are also shown on Figure 2-5. Figure 2-5 indicates that all of the City's permitted capacity will be used by development within the City's ETJ within the next 10 years. As a result, the City is not currently poised to handle flows outside of its ETJ. However, it may be possible for the City to provide short-term treatment of regional flows in an effort to delay the need for regional facilities.   This short-term accommodation will not likely exceed 10 years and will probably expire in less than 10 years, depending on the actual rate of development that occurs within the City's ETJ.

There is a 0.4 MGD plant under construction that will serve the Liberty Hill ETJ. Its permitted capacity is 1.2 MGD. This study assumed that the plant will serve only the Liberty Hill ETJ and that it would not be expanded past the initial construction of 0.4 MGD. In keeping with a regional system, any additional flow would be sent downstream to the regional Mankins WWTP.

There has also been much discussion about a plant to the north in the Berry Creek watershed, referred to as the Northlands Plant.   This plant is still in the conceptual phase and does not yet even have a discharge permit. However, it was considered and sized based on the projected growth and is anticipated to be operational prior to 2015. The 2060 service area includes all of the Cowan Creek watershed and the entire area upstream of the existing service area within Berry Creek.

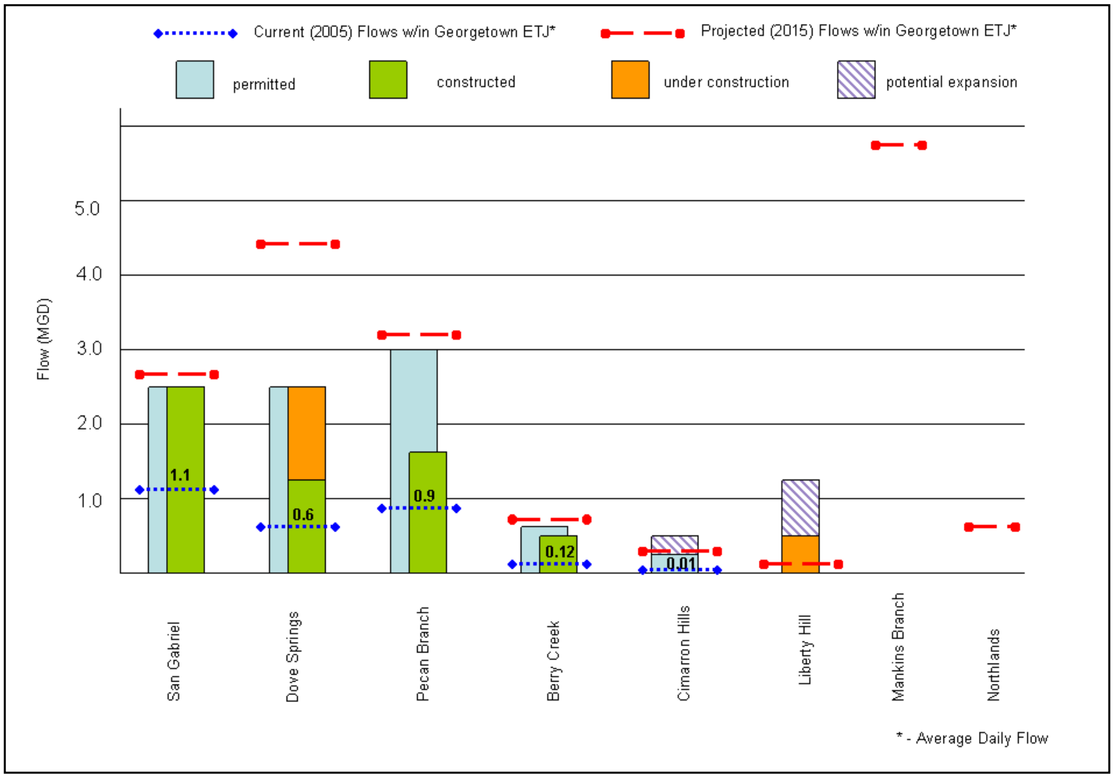

Figure 2-5 Wastewater Treatment Plant Capacity

2.6 Summary of Conceptual Model Analysis

The major conclusions that can be drawn from analysis of the conceptual model are

1) Wastewater flows from the North Fork, Middle Fork, South Fork, and Berry Creek watersheds will need additional transmission capabilities within the source watershed within 5 years;

2) Wastewater flows from the North Fork, Middle Fork, and South Fork watersheds will either have to be transmitted through central Georgetown or treated before entering the Lower San Gabriel watershed

3) The existing transmission capacity of the Lower San Gabriel watershed is not adequate to accommodate projected regional flows from the South, Middle, and North Fork watersheds even at the 2015 planning horizon. Constructability issues may prohibit the construction of a new gravity sewer through central Georgetown from Interstate 35 to Smith Branch.

4) The City of Georgetown's treatment capacity will be exceeded by 2015 by flows generated within the City's ETJ. Additional treatment capacity is needed within 5-10 years and must consider the following constraints:

   a. Regulatory constraints prohibit the discharge of wastewater effluent on the Middle Fork, which may make treatment in the Middle Fork watershed cost prohibitive. Similar constraints exist in the North Fork watershed.

   b. While no discharge facilities are a possible alternative, the projected flows are larger than typical no-discharge facilities and limited land has been dedicated for irrigation. As a result, no-discharge facilities may be cost prohibitive.

   c. Constructability challenges prohibit the expansion of the San Gabriel WWTP and would make expansion of the Dove Springs and Pecan Branch WWTPs very costly.

Based on analysis of the conceptual model, there are a number of alternatives or components that are available to assemble to meet the needs of the basin. These alternatives were assembled in various combinations and evaluated based economics, as will be presented in Section 5. These components are related to transmitting flows from the Middle and South Fork Basins through Central Georgetown and then through the Lower San Gabriel Basin to the proposed Mankins WWTP. These components are as follows and can be seen in Figures 2-6 through 2-13 :

- Middle/South Fork Area

  - *South Fork Interceptor* – Two Phases (2007 and 2010), this component is common to all options;

  - *Middle Fork Interceptor* – Two Phases in some alternatives (2007 and 2030), this component is common to all options;

  - *Middle Fork Lift Station Phase I* – This component lifts flows from Middle Fork Phase I generated in the Upper Middle Fork over to the South Fork Interceptor - this option maybe phased out after Phase II of Middle Fork Interceptor is constructed;

  - *Middle Fork Lift Station Phase II* – This component lifts flows from the entire Middle Fork over to the Wolf Ranch Lift Station – the timing of this component depends on the timing of the second phase of the Middle Fork Interceptor; and

  - *Middle Fork Tunnel* – This component would be constructed instead of the Middle Fork Lift Station Phase II and would transmit flows via gravity to either the Wolf Ranch Lift Station or to the Hwy 29 tunnel.

- Central Georgetown Area
  - *Hwy 29 Tunnel* – This component is common to all options, but could be considerably delayed by implementation of other intermediate components; and
  - *Temporary Upgrades and Changes to the Collection System to San Gabriel WWTP* – This component involves early upgrades to the Wolf Ranch Lift Station, construction of a second Wolf Ranch Force Main to lift flows toward the gravity system which flows to Interceptor Lift Station, replacement of the Interceptor Lift Station and Force Main with a tunnel, and upgrades to the Park Lift Station and Force Main to transmit flows to the San Gabriel WWTP – this option would be temporary and could only transmit flows up to the plant capacity limit.
- Lower Gabriel Basin
  - *Lower Gabriel Interceptor* – This component is common to all options, but could be considerably delayed by implementation of other intermediate components; and
  - *New Smith Branch Lift Station and Force Main* – This component provides for early transmission of flows directly to the Mankins WWTP; eventually the capacity will be exceeded and will require construction of the Lower Gabriel Interceptor.

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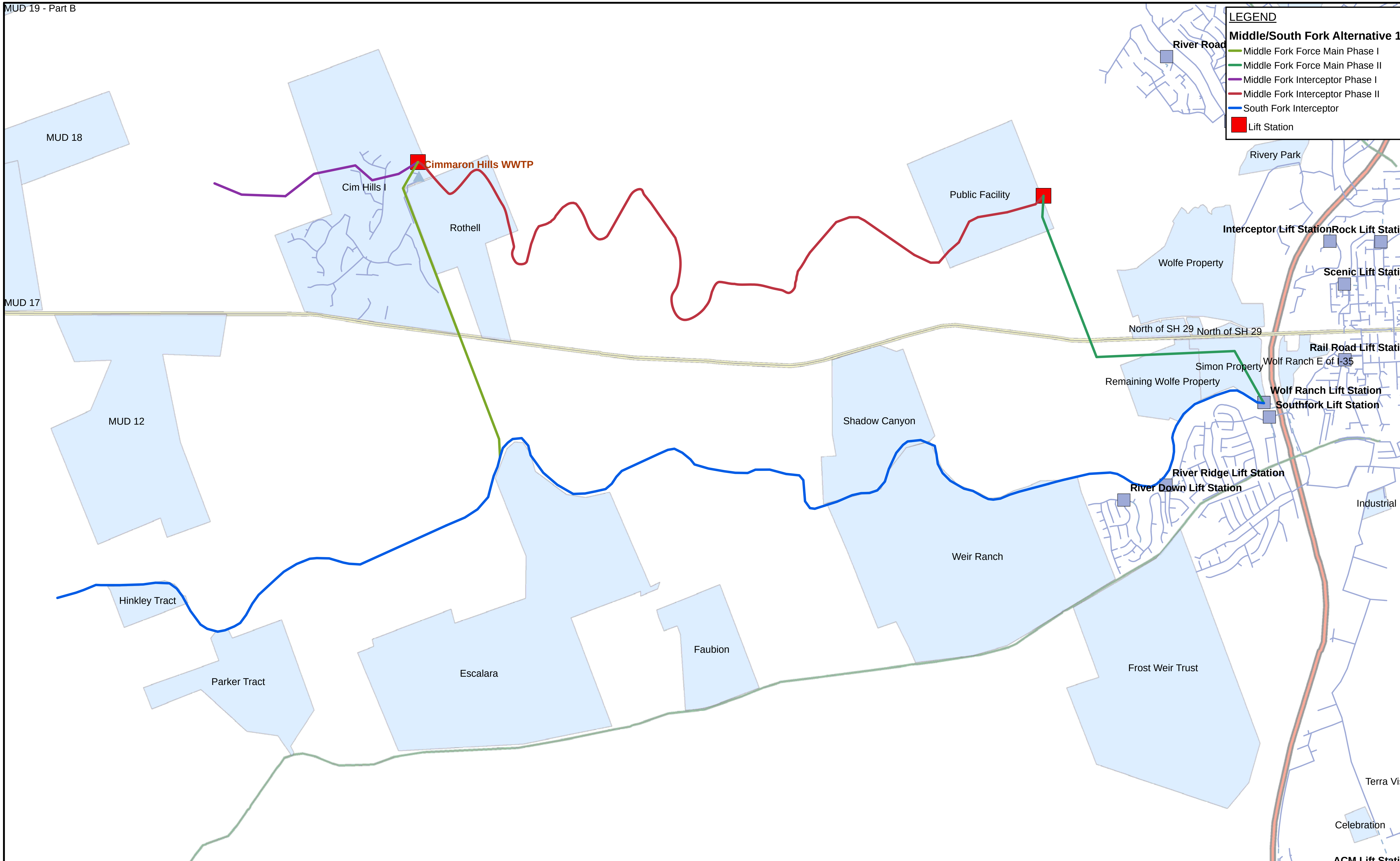

CDM

MIDDLE AND SOUTH FORK - ALTERNATIVE 1
OCTOBER 2006

Figure 2-6. Middle and South Fork - Alternative 1

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CDM

MIDDLE AND SOUTH FORK - ALTERNATIVE 2
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Figure 2-7. Middle and South Fork - Alternative 2

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MIDDLE AND SOUTH FORK - ALTERNATIVE 3
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Figure 2-8. Middle and South Fork - Alternative 3

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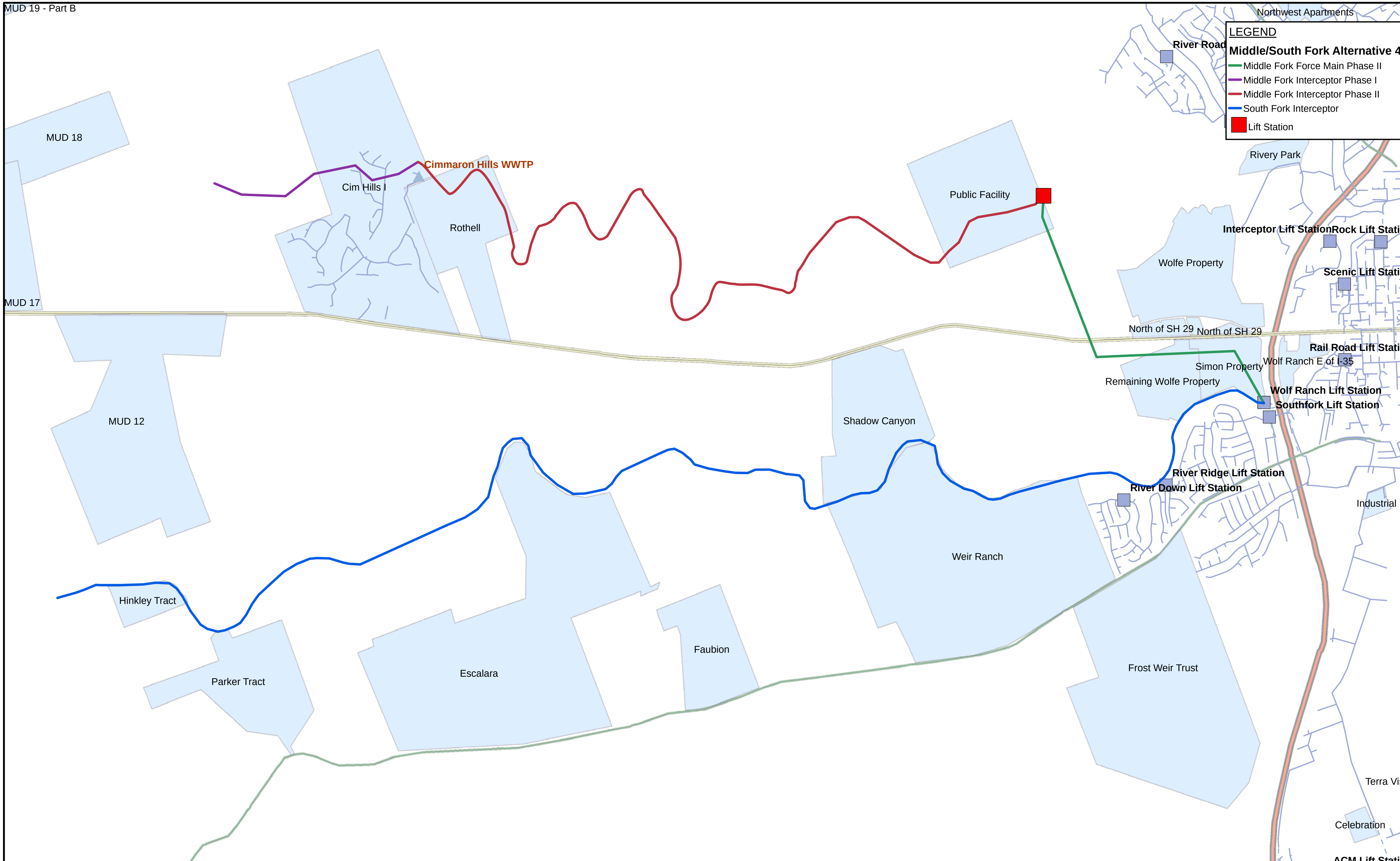

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MIDDLE AND SOUTH FORK - ALTERNATIVE 4
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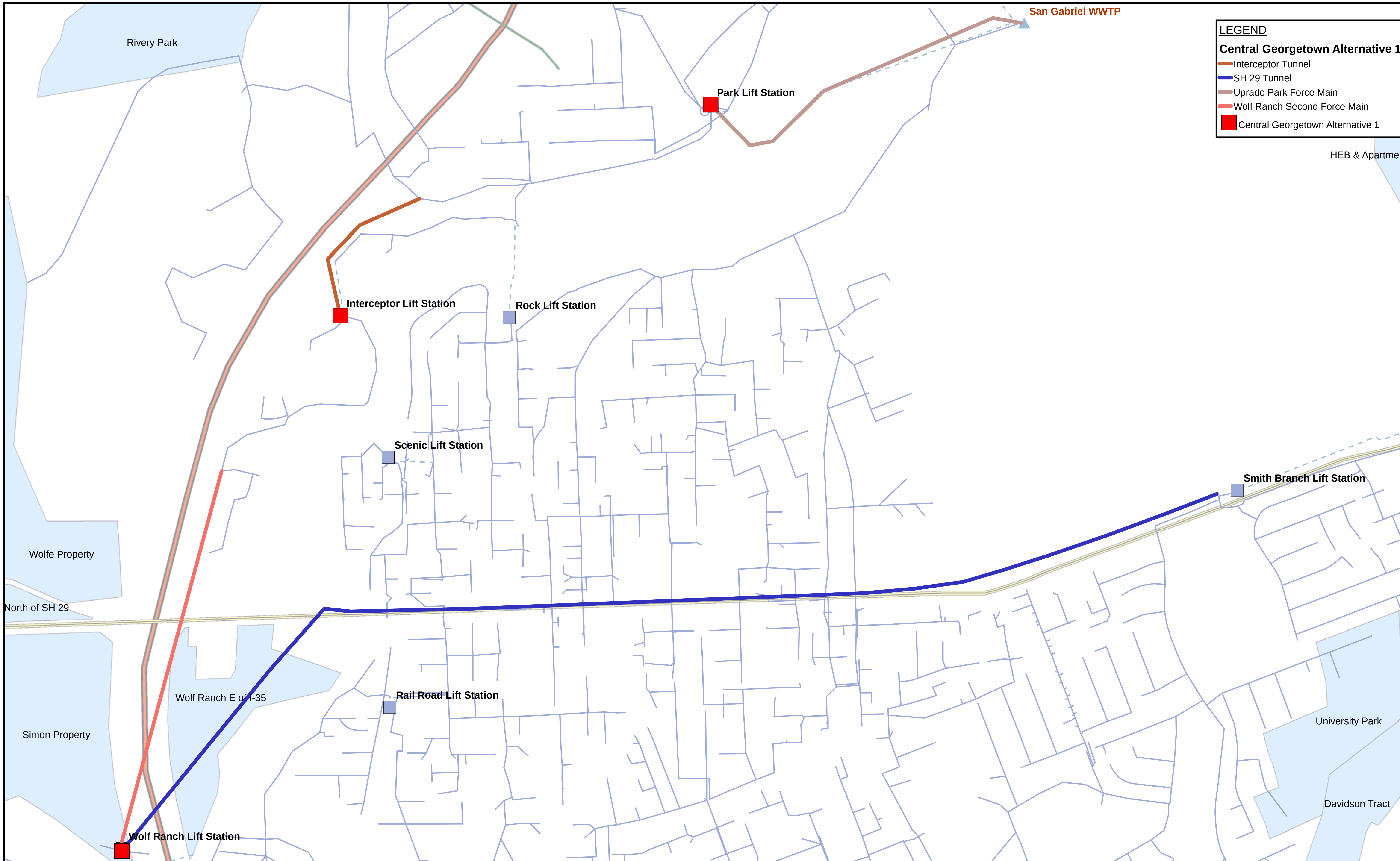
Figure 2-9. Middle and South Fork - Alternative 4



CDM

CENTRAL GEORGETOWN - ALTERNATIVE 1
OCTOBER 2006

Figure 2-10. Central Georgetown - Alternative 1

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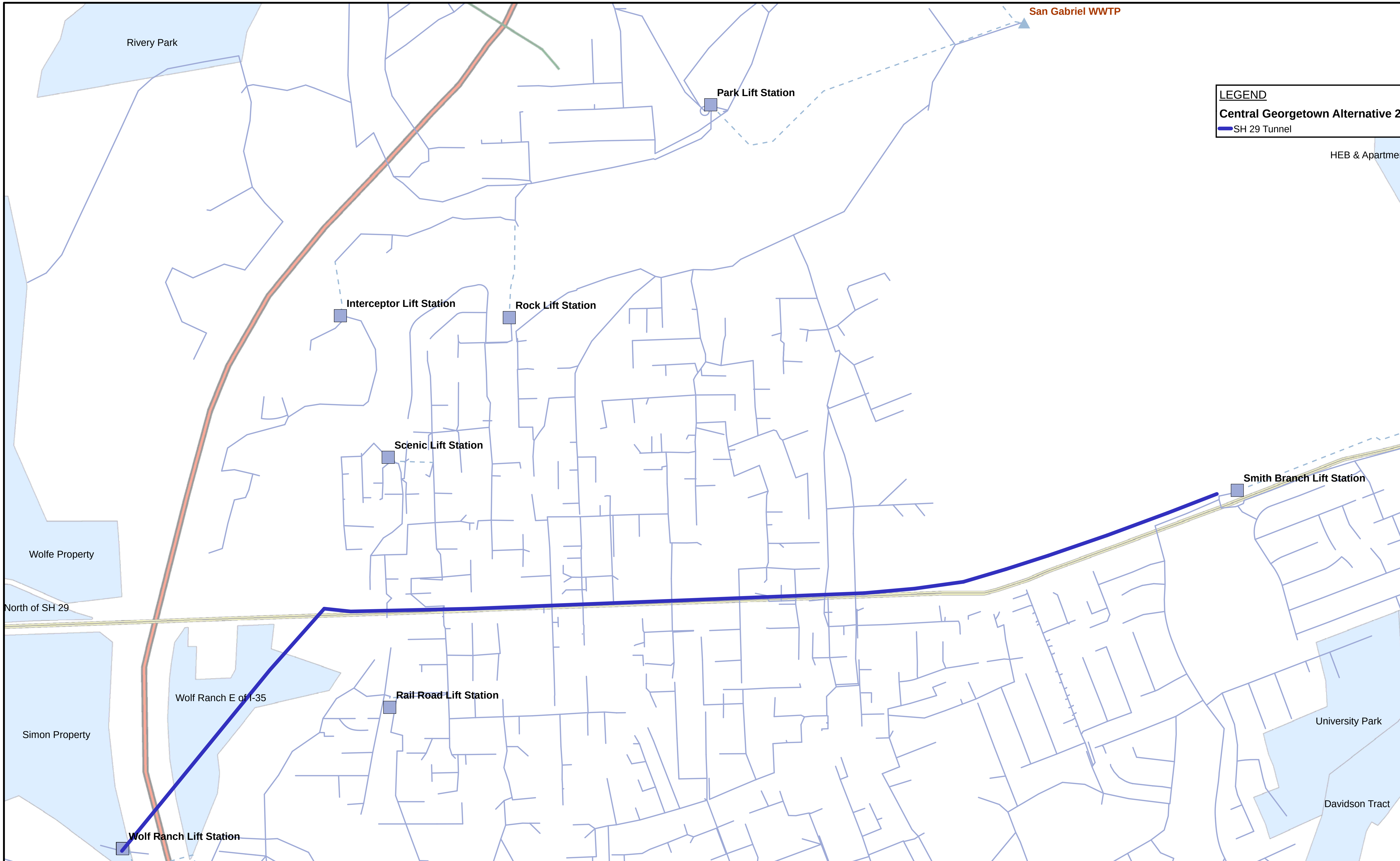

CDM

CENTRAL GEORGETOWN - ALTERNATIVE 2
OCTOBER 2006

Figure 2-11. Central Georgetown - Alternative 2

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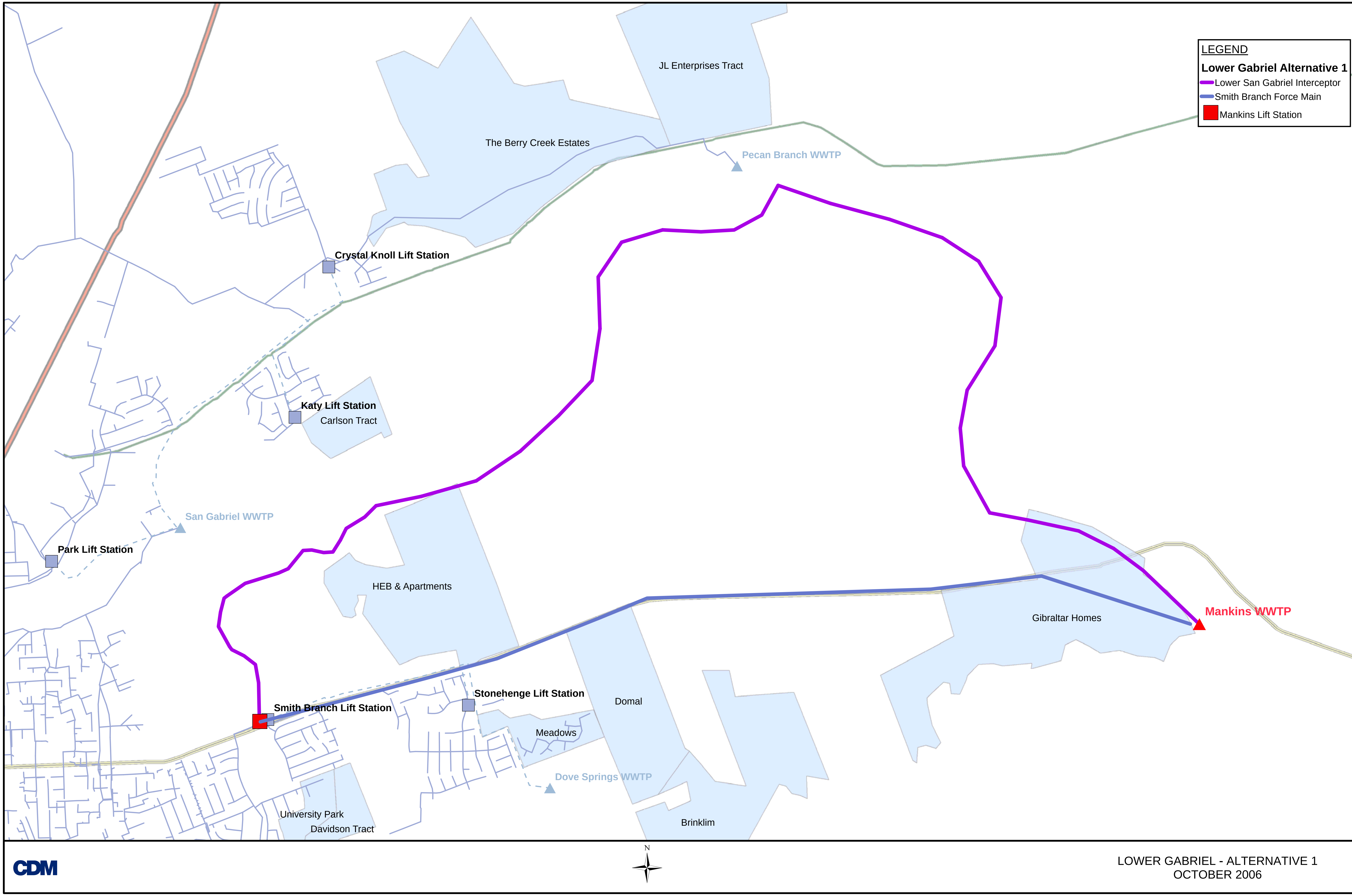

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LOWER GABRIEL - ALTERNATIVE 1
OCTOBER 2006

Figure 2-12. **Lower San Gabriel - Alternative 1**

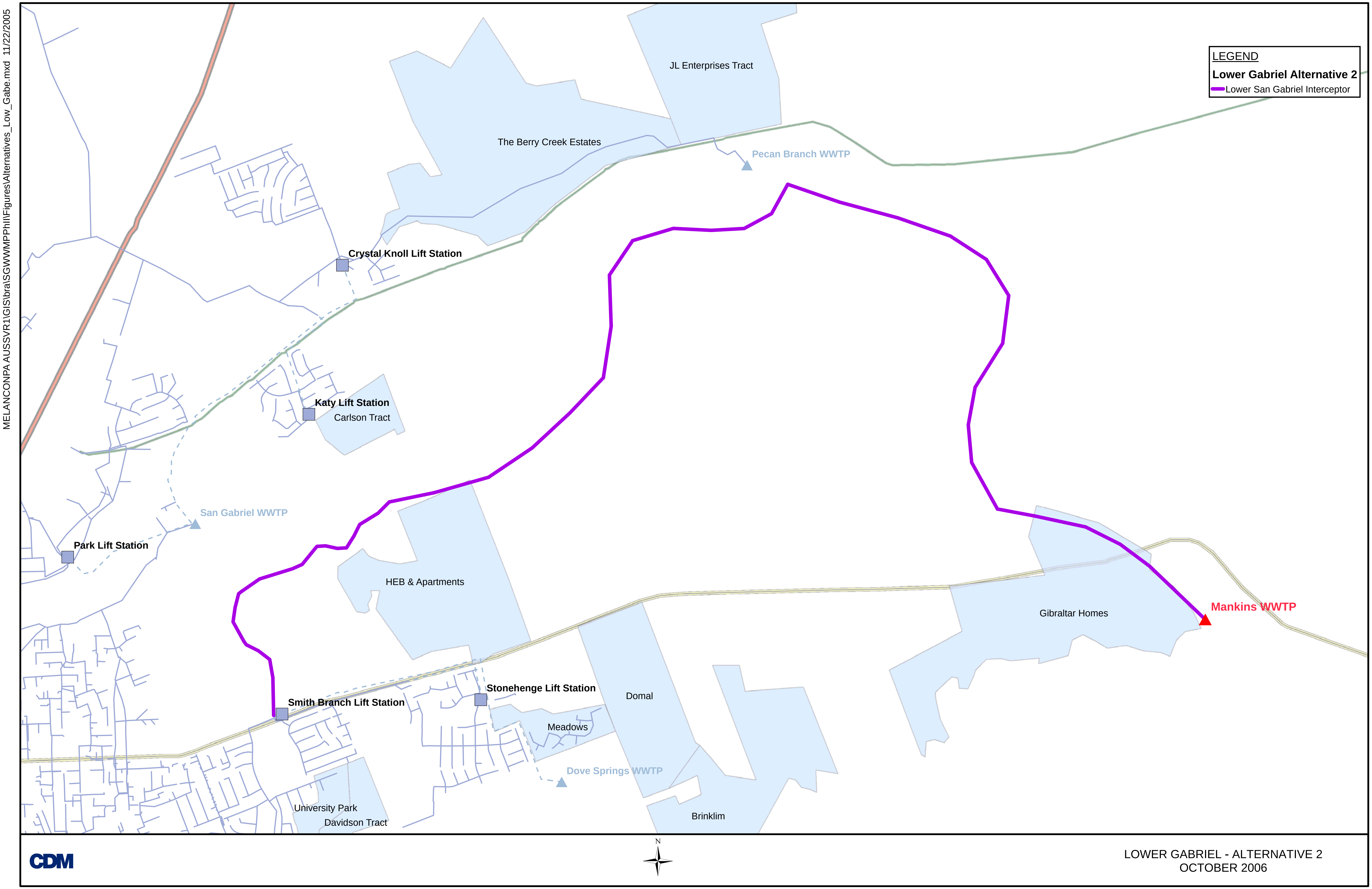


Figure 2-13. **Lower San Gabriel - Alternative 2**

Section 3
Collection System Hydraulic Model

3.1 General Assumptions

A planning-level sewer system hydraulic model was developed using the InfoWorks Collection System Software published by Wallingford Software. As part of a separate project, a detailed hydraulic model of the City of Georgetown's sewer collection system was configured and calibrated. The planning-level regional system model was configured to interface with the City's model.

The following guidelines were followed when configuring potential future gravity sewers in the model:

- Alignments generally follow stream centerlines;
- Sewer slopes generally follow natural grade. A consistent slope was maintained between low points so long as the cover did not increase beyond 20 feet;
- Proposed slopes meet the State of Texas minimum slope standards;
- Pipe diameters were selected based upon the slopes and required flows and the requirement to minimize surcharging;

The following unit flows were used to configure the model:

- Residential dry weather flow was assumed to be 70 gallon/capita-day (gpcd);
- Dry weather groundwater infiltration (GWI) was assumed to average 17 gpcd outside the Georgetown service area;
- Commercial, industrial, and institutional flows were assumed to be 500 gallons/day/living unit equivalent;
- Wet weather flows (infiltration/inflow) were configured at approximately 1,000 gallons/acre-day.

These flows are consistent with CDM's experience in processing wastewater flow in Williamson County.

The model was used to determine the infrastructure requirements for each alternative combination of components identified in Section 2.

3.2 Flow Calculation Methodology

Flows within the Georgetown ETJ were estimated based on actual wastewater flow data processing combined with demographic data. More detailed data on these flows can be found in the *City of Georgetown, Texas Wastewater Master Plan*, February 2006. All projected commercial and industrial developments in the study area at the time were inside the City of Georgetown's ETJ. Commercial and industrial flows were estimated at 500 gallons per acre per day.

For the service areas outside of Georgetown's ETJ, dry weather flows were split into groundwater infiltration and residential sanitary flow. Groundwater infiltration was estimated to average 17 gallons per capita per day (gpcd). Sanitary flow was estimated to be 70 gpcd with a peaking factor of 1.5. Wet weather flow volumes were estimated to be 1% of the 2-year, 24-hour design storm. The rainfall depth for this design storm is 4.1 inches (TP 40). Therefore, wet weather flow volumes were estimated to be 0.41 inches. Modeling hydrograph routing parameters were adjusted to match a peak wet weather flow of 1,000 gallons per acre per day, which is consistent with observations of flow data recorded in the City of Georgetown.

The service area was divided into 488 modeling basins, which are indicated in the population density figures shown in Section 1. The anticipated developments presented in Section 2 were assigned to a basin based on geographic location. In many cases a development became one of the modeling basins. The rest of the projected population was assigned based on the methodology presented in Section 2.

The population combined with unit flow factors above generated the dry weather flow loads in the model. The acres, a design storm hyetograph, and the modeling routing factors discussed above generated the wet weather flows in the model. Flow generated from each of these basins was loaded into the system at a nearby manhole.

Section 4
Economic Analyses

Results of the conceptual model analysis identified four transmission alternatives in the Middle and South Fork watersheds, two transmission alternatives in the Lower San Gabriel watershed, and two alternatives for transmitting flows through Central Georgetown. The wastewater collection system hydraulic model was used to determine the infrastructure requirements for all projects associated with each alternative. For economic and constructability reasons, infrastructure was sized for future flows. Therefore, the 2060 projected flows were used to estimate the required size of each project.

4.1 Unit Costs

Current cost data supplied by vendors and historical cost data from similar transmission projects were used to develop cost estimates for each transmission alternative. Unit costs were developed for site preparation, pipe installation via open cut excavation or tunneling, manholes, tunnel access shafts, easement acquisition, trench safety, sedimentation and erosion control measures, hydroseeding and revegetation of disturbed areas, and concrete encasement. Additionally, cost estimates for each transmission alternative included mark-ups for contingencies, bonds and mobilization, and professional services.

The unit cost assigned for site preparation was dependent on the linear footage of the transmission line and the method of installation. For alternatives involving open cut excavation, a unit cost equal to approximately $10/linear foot (LF) was used in the cost estimates. Alternatives requiring tunneling used a unit cost of $10,000 to account for site preparation.

Pipe vendors were contacted to develop unit costs for PVC and ductile iron pipe installed via open cut excavation. These unit costs included material and installation costs. The material cost of PVC pipe varied from $21 to $66 per linear foot for pipe sizes ranging from 21-inch to 42-inch diameter, respectively, while the material cost of ductile iron pipe ranged $70 to $180 per linear foot for pipe sizes ranging from 42-inch to 66-inch diameter. The cost of installing pipe via open cut excavation was assumed to be 100% of the material cost for excavation depths less than 20 feet and 200% of the material cost for excavation depths more than 20 feet. For example, the unit cost for a 21-inch PVC pipe was $42 per linear foot for excavation depths less than 20 feet and $63 per linear foot for excavation depths greater than 20 feet. An assumption of the cost evaluation was that fifty percent of the transmission line was installed at depths less than 20 feet while the remaining fifty percent was installed at depths greater than 20 feet.

TCEQ spacing and sizing requirements were used to determine the number and sizes of manholes required for each transmission alternative. Unit costs of $5000, $6000, and $10,000 were used for the following manholes: 5-foot diameter, 6-foot diameter, and junction box. A 5-foot diameter manhole was used for pipe sizes between 21 and 27 inches. A 6-foot diameter manhole was used for pipe sizes between 30 and 42 inches. Pipe sizes greater than 42 inches required a junction box.

Two of the transmission alternatives involve the installation of ductile iron pipe via tunneling. Based on CDM's experience with transmission projects involving tunneling, a unit cost of $480 per linear foot was used to develop the cost for tunneling a 27-inch pipe. This unit cost was based on a cost factor of $18 per linear foot per diameter inch of pipe. For the 66-inch pipe, this cost factor was reduced to $16 per linear foot per diameter, resulting in a unit cost of $1050 per linear foot. For estimating purposes, it was assumed that each tunnel had an access shaft at each end. A unit cost of $20,000 was assigned to each tunnel access shaft.

Easement acquisition was included in the cost evaluation of each transmission alternative. It was assumed that a 30-foot permanent utility easement and a 50-foot wide temporary construction easement would be required to install the transmission line via excavation. The cost of easement acquisition was generally assumed to be approximately five percent of the construction cost prior to mark-ups for contingencies, bonds, and mobilization. For transmission alternatives involving tunneling, the cost of easement acquisition was lowered from five to one percent of the construction cost.

Historical cost data from similar transmission projects was used to develop unit costs for trench safety, sedimentation and erosion control measures, revegetation of disturbed areas, and concrete encasement. A unit cost of $2 per linear foot was used for trench safety while a unit cost of $5 per linear foot was used for sedimentation and erosion control measures. Hydroseeding and revegetation of disturbed areas was priced at $2250 an acre. A unit cost of $250 per linear foot was used to estimate the cost of encasing pipe with concrete. For estimating purposes, it was assumed that five percent of the pipe installed below excavation depths of 20 feet required concrete encasement.

The total project cost of each transmission alternative included mark-ups to the construction cost. Mark-ups of 15% for contingencies and 7% for bonds and mobilization were added to the construction cost. A 15% mark-up for professional services was then applied to the subtotal to obtain a total project cost.

4.2 Discounting

The process of discounting is used to make dollar values comparable over time. Discounting does not account for inflation or for risk, but rather the "time preference" of money. For example, a million dollars today is worth more than a million dollars 10 years from now because of the potential interest earnings during those 10 years.

The process of discounting yields the "present value" of a future sum of money. The rate used to convert future dollars into present dollars (i.e., the discount rate) is typically the available interest rate.

Economic analyses are often most readily accomplished using real or constant-dollar values, i.e., by measuring benefits and costs in units of stable purchasing power. The difference between real and nominal values is attributed to inflation. Nominal and real values must not be combined in the same analysis. The nominal interest rate is the real interest rate plus inflation. The appropriate discount rate for any given analysis depends on whether the benefits and costs are measured in real or nominal terms: real dollars should be calculated using real interest rates and nominal dollars should be calculated using nominal interest rates.

All cost estimates presented in this study are in 2005 dollars, which are real dollars. However, market interest rates are typically nominal rates unless stated otherwise. This study used a nominal market interest rate of 5.2 percent, listed by the U. S. Office of Management and Budget for 30-year maturities (OMB Circular A-94, Appendix C, revised January 2005). Consequently, this nominal rate was converted to a real interest rate by assuming an inflation rate of 2 percent, recommended by the U. S. Office of Management and Budget. Removing the effect of inflation (two percent) gives the final discount rates used in this study - 3.2 percent.

A 55 year planning horizon (2005-2060) was used to evaluate alternatives. Gravity sewers and force mains were assumed to last through 2060. The usable lifetime of a pump was assumed to be 30 years.

Section 5
Alternative Evaluation

The various sub-basins have unique characteristics and limitations. In addition, there are some plans for additional infrastructure that are already moving forward. In general, if these plans provided adequate and feasible solutions, it was assumed that they would be implemented as a default solution. This section describes either the default solution or the alternatives that were selected for economic evaluation. Figure 5-1 shows the various sub-basins and waterways. Figures depicting infrastructure required for the sub-basins are presented at the end of this section.

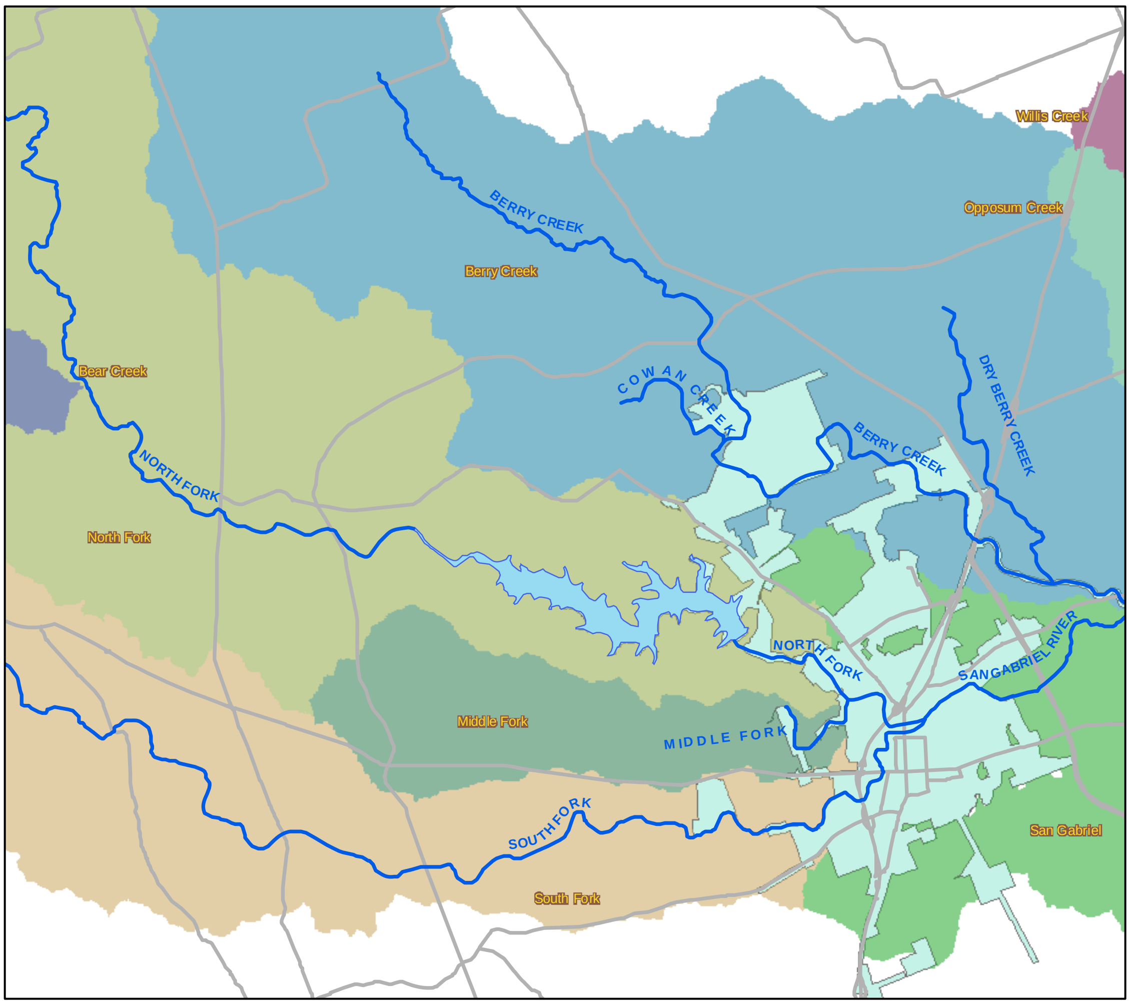


Figure 5-1 Study Area Sub-Basins and Waterways

5.1 North Fork Watershed

The conceptual model analysis identified severe permitting challenges that would nearly prohibit the discharge of wastewater effluent into Lake Georgetown. This study assumed that no wastewater treatment would occur in the North Fork watershed.

Upstream of Lake Georgetown, all flows in the North Fork must be transmitted via gravity to a master lift station and pumped to an adjacent basin. Implementing gravity sewers adjacent to Lake Georgetown would likely not be possible. As a result, this study assumed flows from the North Fork would be lifted to the Middle Fork watershed either through a master lift station upstream of Lake Georgetown or through pressure wastewater collection systems adjacent to Lake Georgetown.

The North Fork will require an interceptor, lift station, and force main to transmit flow to the Middle Fork. The interceptor cost estimate is $1,853,000. The lift station and force main cost estimate is $1,469,000. Figure 5-2, at the end of this section, shows this infrastructure.

5.2 Middle Fork, South Fork, and Lower San Gabriel Watersheds

5.2.1 Middle Fork Watershed

The City of Georgetown currently owns and operates the Cimarron Hills WWTP, a no-discharge facility located in the Middle Fork watershed with a total permitted capacity of 0.2 MGD. This facility currently serves to irrigate the Cimarron Hills Golf Course. Generally speaking, it is believed that the existing golf course could support an expansion of the Cimarron Hill WWTP to 0.4 MGD while maintaining its no-discharge status. While it is possible to permit an additional no-discharge facility on the Middle Fork or expand the permitted capacity of the Cimarron Hills WWTP, the total service area of the Middle Fork watershed is relatively limited. As a result, constructing a WWTP on the Middle For watershed would be a short-term solution and is not consistent with the long-range planning nature of this study. As a result, this study assumed that the Cimarron Hills WWTP would be the only treatment facility on the Middle Fork watershed and that it would only be expanded to a capacity of 0.4 MGD, based on current irrigation demands that would allow that facility to remain a no-discharge facility.

5.2.2 South Fork Watershed

Approximately half of the South Fork watershed is within the Edwards Aquifer Recharge Zone. TCEQ Chapter 213 prohibits discharge from wastewater treatment facilities within the Edwards Aquifer Recharge Zone. There are currently plans underway to construct a 0.4 MGD WWTP that is permitted for a final capacity of 1.2 MGD to serve the City of Liberty Hill and its ETJ. The planned Liberty Hill WWTP is far enough upstream of the recharge zone to permit the discharge of wastewater effluent. Permitting another discharge WWTP between the Liberty Hill WWTP and the Recharge Zone may be difficult or impossible due to proximity to the Recharge Zone. This study assumed that the Liberty Hill WWTP would be the only treatment facility on the South Fork watershed.

5.2.3 Lower San Gabriel Watershed

A majority of the City of Georgetown's wastewater service area is in the Lower San Gabriel watershed. As part of the City of Georgetown's Wastewater Master Plan, CDM developed a 10-year capital improvement plan to accommodate future growth associated with Georgetown only. This report was submitted under separate cover, and detailed sewer improvements discussed with the City's WWMP report will not be presented in this report.

With the exception of the City of Georgetown's three WWTPs, there are no other major treatment facilities in the Lower San Gabriel watershed. There is not available capacity in the City's WWTPs to accommodate future regional flows. As discussed in Section 2.1, multiple stakeholders have been planning a new WWTP to be located on the San Gabriel River downstream of the City. This new WWTP is often referred as the "Mankins" WWTP because it is to be located at what is locally known as Mankins Crossing. This study assumed that the planned Mankins WWTP would be constructed on the Lower San Gabriel watershed.

There is some infrastructure that will be required regardless of the options for getting flows from the Middle and South Fork to the Lower Gabriel. As has been mentioned, there will be a regional WWTP, known as the Mankins Plant built to the southeast of Georgetown proper. This plant would be built in 3 phases. Mankins Plant Phase I would be constructed by 2009 at an estimated cost of $12.5M. Phase II would be constructed by 2011 at an estimated cost of $9.5M. And finally Phase III would be constructed by 2030 at an estimated cost of $12.5M.

Finally, there is some area of development expected to occur downstream of the Mankins WWTP. This area will require a trunk interceptor system at an estimated cost of $4M. Because this area is downstream of the plant, it will require a lift station and force main. The cost for the lift station and force main is $2M.

Figure 5-3, at the end of this section, shows this anticipated infrastructure.

5.2.4 Alternative Identification

As a result of these treatment restrictions, future wastewater flows from the Middle and South Fork watersheds must be transmitted through the source watershed and through central Georgetown for treatment. Flows from the South and Middle Fork may be diverted to the Pecan Branch WWTP, Dove Springs WWTP, or San Gabriel WWTP service areas within City of Georgetown. However, these treatment plants do not have adequate capacity and could not be expanded enough to meet the long-term projected South and Middle Fork flows. These alternatives would be short-term solutions. In the long term, the South and Middle Fork flows should be transmitted further downstream to the planned Mankins WWTP.

The transmission components identified as part of this study can be conceptualized in three segments: transmission through the source watershed, transmission through central Georgetown, and transmission further downstream through the Lower San

Gabriel watershed to the proposed Mankins WWTP. This study identified four transmission alternatives in the South and Middle Fork watersheds, two transmission alternatives through central Georgetown, and two transmission alternatives to the Mankins WWTP in the Lower San Gabriel watershed. These components are summarized in Table 5-1. They were presented graphically in Section 2.6. These alternatives for wastewater collection group various combinations of the possible components that were presented in Section 2.6 to provide a complete alternative solution.

5.2.5 Project Phasing

In order to develop appropriate cash flows for economic analysis, the phasing of each project needed to be identified for each alternative. Project phasing was developed based upon the projected wastewater flows and current and future infrastructure capacity. Table 5-2 shows the project phasing associated with each alternative.

Transmission Segment →	South & Middle Fork Watersheds	Transmission Through Central Georgetown	Lower San Gabriel Watershed to Mankins WWTP
Alternative 1	Complete Middle Fork Interceptor Ph I, South Fork Interceptor Ph I, and Middle Fork Lift Station and Force Main Ph I by 2007. Complete South Fork Interceptor Ph II by 2010. Once the South Fork Interceptor capacity has been exhausted (about 2030), complete Middle Fork Ph II and Middle Fork Lift Station and Force Main Phase II to transmit Middle Fork flows to Wolf Ranch Lift Station. Middle Fork Lift Station and Force Main Ph I can be made obsolete.	By 2009, install upgrade Wolf Ranch lift station and divert a portion of the discharge to the Interceptor lift station. By 2010, retire Interceptor Lift Station and replace with a tunnel and upgrade Park Lift Station. When San Gabriel WWTP has reached capacity (about 2024), construct a gravity tunnel across the City along or parallel to State Highway 29.	Lift flows to the Mankins WWTP along or parallel to State Highway 29 in the short-term via New Smith Branch Lift Station and Force Main (2009). Construct the Lower San Gabriel gravity interceptor for long-term transmission to the Mankins WWTP (2040).
Alternative 2	Same completion as Alternative 1 except that the Middle Fork Tunnel is installed instead of the Middle Fork Lift Station and Force Main Ph II.	Construct a gravity tunnel across the City along or parallel to State Highway 29 by 2009.	Construct the Lower San Gabriel gravity interceptor immediately for short- and long-term transmission to the Mankins WWTP (2009).
Alternative 3	Complete Middle Fork Interceptor in its entirety, South Fork Interceptor Ph I, and Middle Fork Tunnel by 2007. Complete South Fork Interceptor Ph II by 2010.		
Alternative 4	Complete Middle Fork Interceptor in its entirety, South Fork Interceptor Ph I, and Middle Fork Lift Station and Force Main Ph II by 2007. Complete South Fork Interceptor Ph II by 2010.		

Table 5-1 Summary of Components Considered for Analysis

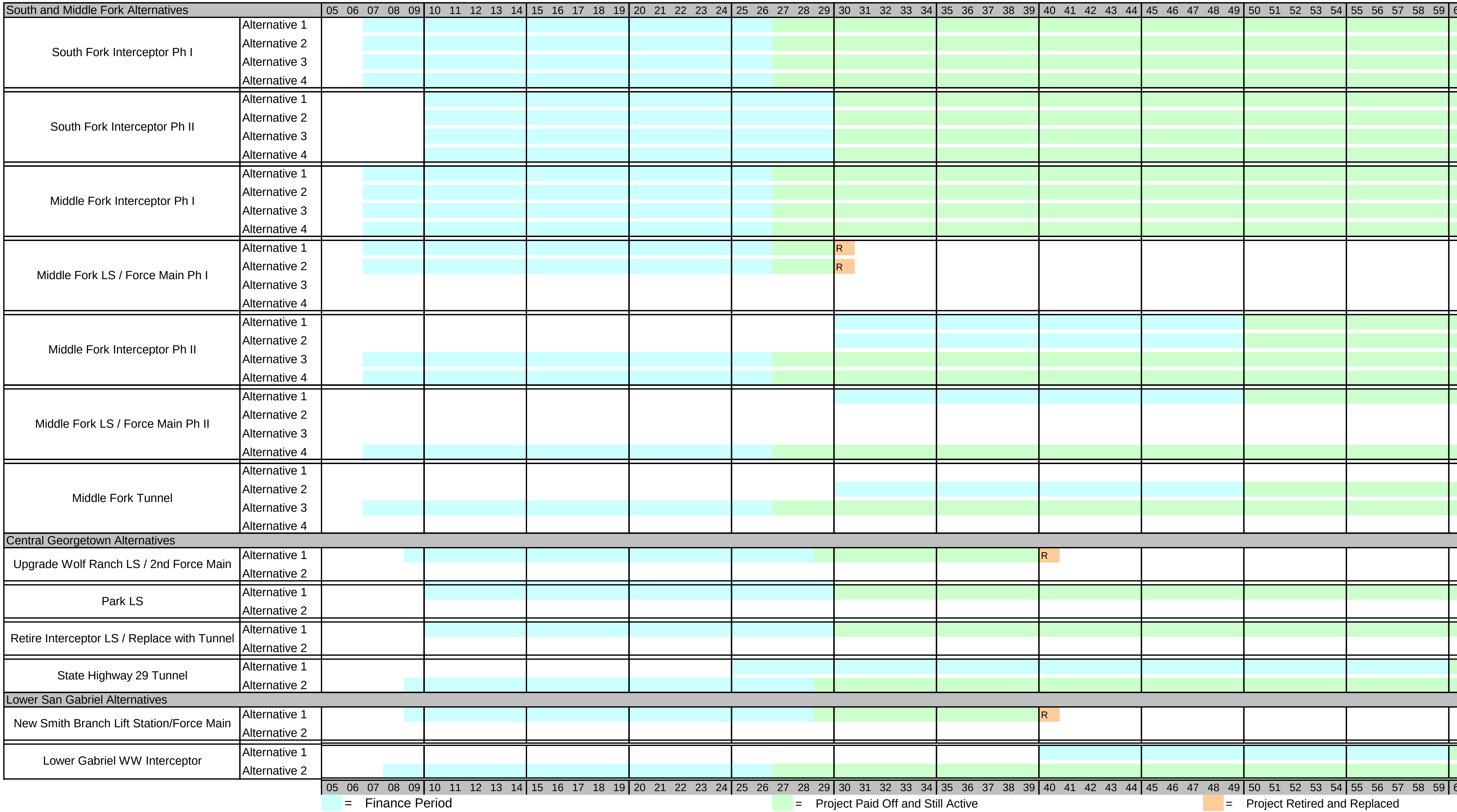


Table 5-2 Project Phasing

5.2.6 Net Present Value

The net present values for each alternative are summarized in Table 5-3. Details of the net present value analysis are located in Appendix A. Results indicate that Alternatives 1 and 2 for both the South/Middle Fork watershed and the Lower San Gabriel watershed are the least expensive alternatives. The difference between Alternatives 1 and 2 for each watershed is certainly within the estimation error inherent to a planning study. Alternatives 3 and 4 are more expensive because all of the Middle Fork transmission infrastructure must be built immediately, while Alternatives 1 and 2 provide considerable delay for the construction of Phase II of the Middle Fork interceptor. The detailed net present value data sheets can be found in Appendix A.

	South & Middle Fork Watersheds	Central Georgetown	Lower San Gabriel Watershed
Alternative 1	**$20.83**	**$17.09**	**$15.01**
Alternative 2	**$21.60**	**$17.20**	**$17.68**
Alternative 3	$25.91	-	-
Alternative 4	$24.14	-	-

Table 5-3 Net Present Value (Millions) Of Alternatives

5.2.7 Cash Flow Analysis of Select Alternatives

A cash flow model was developed for Alternatives 1 and 2 for transmission through the South and Middle Fork watersheds, central Georgetown, and the Lower San Gabriel watershed. These alternatives have the lowest net present value. Short-term cash flow is equally important to net present value analyses because funding must be available to initiate projects. Like the net present value analysis, the cash flow analysis was focused on development in the South Fork, Middle Fork, and Lower San Gabriel watersheds.

The cash flow analysis is summarized in Table 5-4 and indicates that any combination of alternatives for transmission through the South and Middle Fork watersheds, central Georgetown, and the Lower San Gabriel watershed results in a overall net present value averaging $30 million, ranging from $25.4M to $31.1M, and a benefit cost ratio averaging 1.36, with a range from 1.31 to 1.41. The differences between the possible combinations of transmission alternatives for the South and Middle Fork watersheds, central Georgetown, and the Lower San Gabriel watershed is within the cost estimation errors and the inherent unpredictability of planning. Therefore, any combination of these alternatives is economically equivalent over the lifetime of the project.

Middle & South Fork	Alt 1	Alt 1	Alt 1	Alt 1	Alt 2	Alt 2	Alt 2	Alt 2
Central Georgetown	Alt 1	Alt 2	Alt 2	Alt 1	Alt 1	Alt 2	Alt 2	Alt 1
Lower San Gabriel	Alt 1	Alt 2	Alt 1	Alt 2	Alt 1	Alt 2	Alt 1	Alt 2
NPV Expenditures (Millions)	($76.1)	($76.6)	($80.7)	($80.2)	($77.0)	($77.6)	($81.7)	($.2)
NPV Revenues (Millions)	$107.2	$107.2	$107.2	$107.2	$107.2	$107.2	$107.2	$107.2
Total NPV (Millions)	$31.1	$30.6	$26.5	$27.0	$30.1	$29.5	$25.4	$25.9
Benefit Cost Ratio	1.41	1.40	1.33	1.34	1.39	1.38	1.31	1.32

Table 5-4 Summary of Cash Flow Analysis

5.3 Berry Creek Watershed

Prior to 2030, growth in the Berry Creek watershed is projected to be two to four times less than growth in the Middle and South Fork watersheds. While the Berry Creek watershed also drains to the Lower San Gabriel watershed, the point of confluence and drainage alignments associated with Berry Creek flows pass through limited developed area. As a result, accommodating future flows in the Berry Creek watershed may be most easily accomplished by either treating at the source or gravity transmission to the proposed Mankins WWTP. The Berry Creek watershed consists of three sub-watersheds: the Cowan Creek watershed, the Dry Berry Creek watershed, and the Berry Creek watershed.

5.3.1 Cowan Creek Subwatershed

A new WWTP, often referred to as either the "Northlands" WWTP or the “Cowan Creek” WWTP, is being planned near the confluence of Cowan Creek and Berry Creek. This study assumed this plant would be constructed at the proposed location.

A lift station would need to be constructed to accommodate service areas downstream of the proposed WWTP location. This study assumed the lift station would be constructed at the proposed location. The estimated cost for the lift station and force main is $2M and could be constructed in 2 phases. Finally, this area would require a gravity interceptor trunk system, estimated at a cost of $3.8M.

The Cowan Creek subwatershed will require construction of the Northlands Plant. This plant would be constructed in two phases, a new 1.5 MGD plant followed by a 1.5 MGD expansion. Initial construction is estimated at $7.2M. The expansion cost is estimated at $5M.

This infrastructure is shown in Figure 5-4, at the end of this section.

5.3.2 Dry Berry Creek Subwatershed

There are currently no WWTPs in the Dry Berry Creek watershed. The Dry Berry Creek watershed currently drains near the confluence of the Berry Creek and Lower San Gabriel watersheds. Since growth in this area is not robust (average of 2.3 people/acre in 2060) and major gravity transmission projects are planned for the Lower San Gabriel watershed, this study assumed that flows from this watershed would be transmitted via gravity as opposed to treatment in the source watershed. Consequently, this study recommends constructing a gravity interceptor to serve flows in the Dry Berry Creek watershed. The Dry Berry Creek interceptor would intersect with the Berry Creek interceptor near the confluence of the Berry Creek and Lower San Gabriel watersheds, discharging almost directly into the future Lower San Gabriel gravity interceptor. This interceptor cost is estimated at $7.2. Figure 5-5 shows the required infrastructure for the Dry Berry Creek subwatershed.

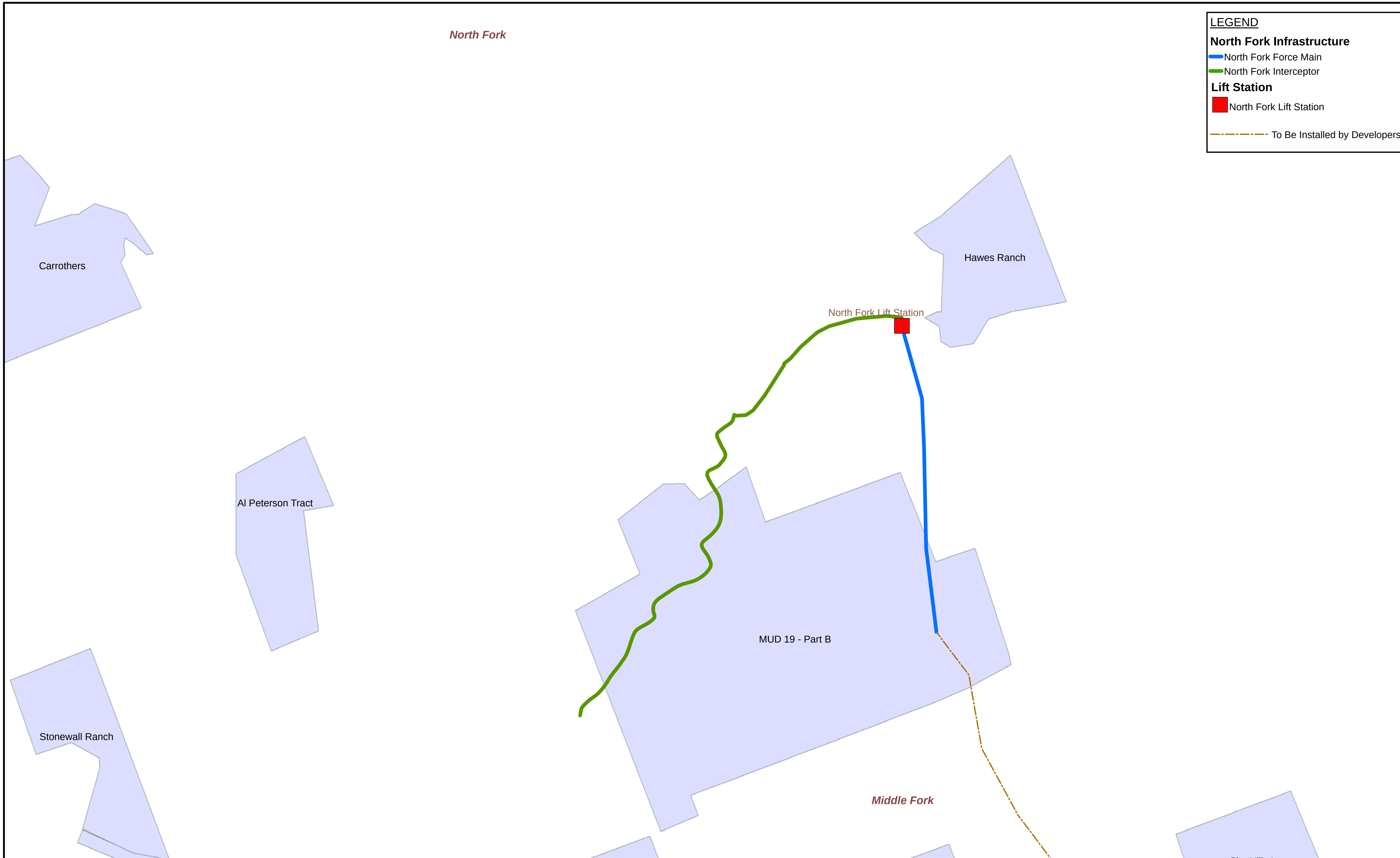
5.3.3 Berry Creek Watershed

The City of Georgetown owns the only current WWTP in the Berry Creek watershed. The current total permitted average daily flow of the Berry Creek WWTP is 0.5 MGD; however, achieving this capacity would require an expansion. While there are plans to build the Northlands WWTP, there are no plans to build an additional plant in the Berry Creek watershed. This study assumed the Berry Creek WWTP would be the only WWTP constructed in the Berry Creek watershed. As a result, future flows must be transmitted to other watersheds.

The City of Georgetown owns and operates a wastewater interceptor and lift station that serves the Sun City development. As part of the City of Georgetown's Wastewater Master Plan, CDM determined that there is little transmission capacity available for future flows in the Sun City interceptor and lift station. Consequently, flows upstream of the existing Sun City development cannot be accommodated by the City of Georgetown's existing infrastructure. Upgrading or paralleling this infrastructure would be costly due to constructability issues. As a result, this study recommends that a lift station be constructed upstream of the Sun City development to lift future flows to the proposed Northlands WWTP.

Planned developments in the City of Georgetown will utilize the capacity of the Berry Creek Interceptor, Lift Station, and WWTP. As a result, this study recommends that a new gravity sewer be constructed to accommodate future flows in the Berry Creek watershed. A short section of existing sewer owned by the City of Georgetown may need to be replaced or paralleled. With the exception of this short section of existing sewer, no additional constructability constraints exist. The Berry Creek interceptor would discharge into the future Lower San Gabriel gravity interceptor, which carries flows to the proposed Mankins WWTP. It is anticipated that this interceptor could be constructed in 2 phases. The first phase cost estimate is $4.2M; the second phase cost estimate is $3M. This infrastructure is shown in Figure 5-5.

MELANCONPA AUSSVR1\GIS\bra\SGWWMPPhII\Figures\North_Fork.mxd 11/22/2005

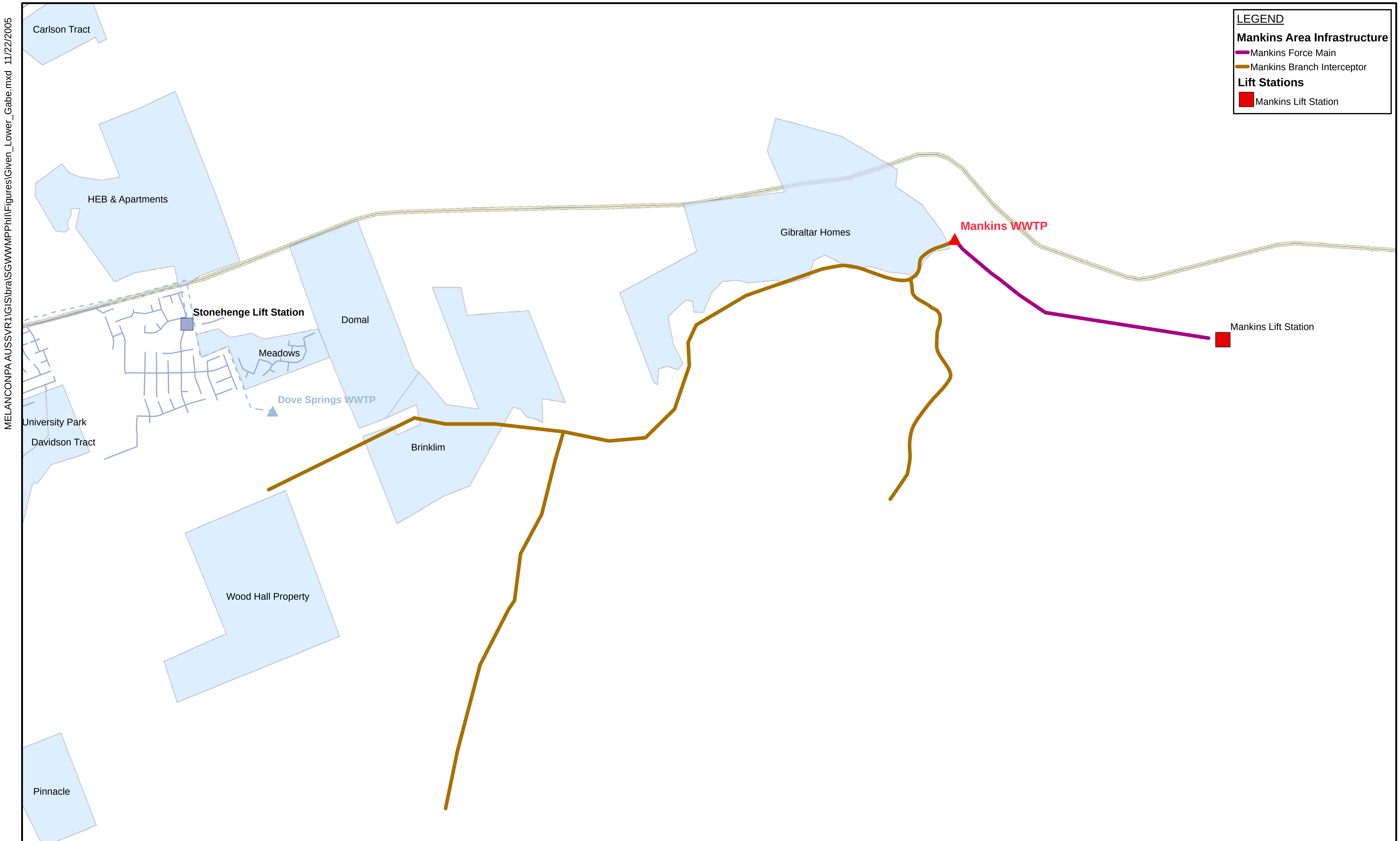


CDM

N

NORTH FORK REQUIRED INFRASTRUCTURE
OCTOBER 2006

Figure 5-2. Infrastructure for the North Fork Basin



CDM

LOWER SAN GABRIEL AREA INFRASTRUCTURE
OCTOBER 2006

Figure 5-3. **Infrastrucutre for the Lower Gabriel Basin**

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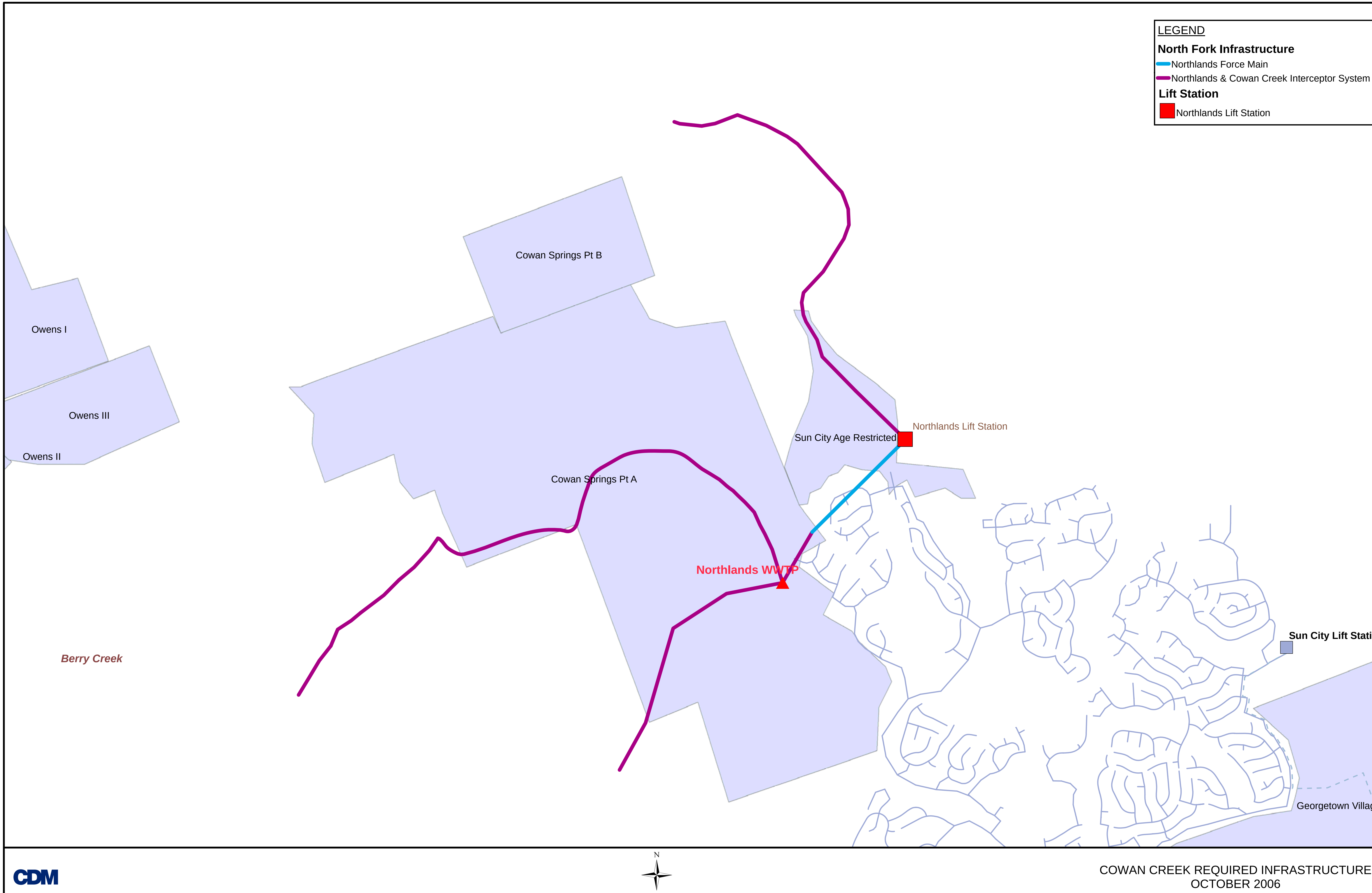

Figure 5-4. **Infrastructure for the Cowan Creek Sub-basin**

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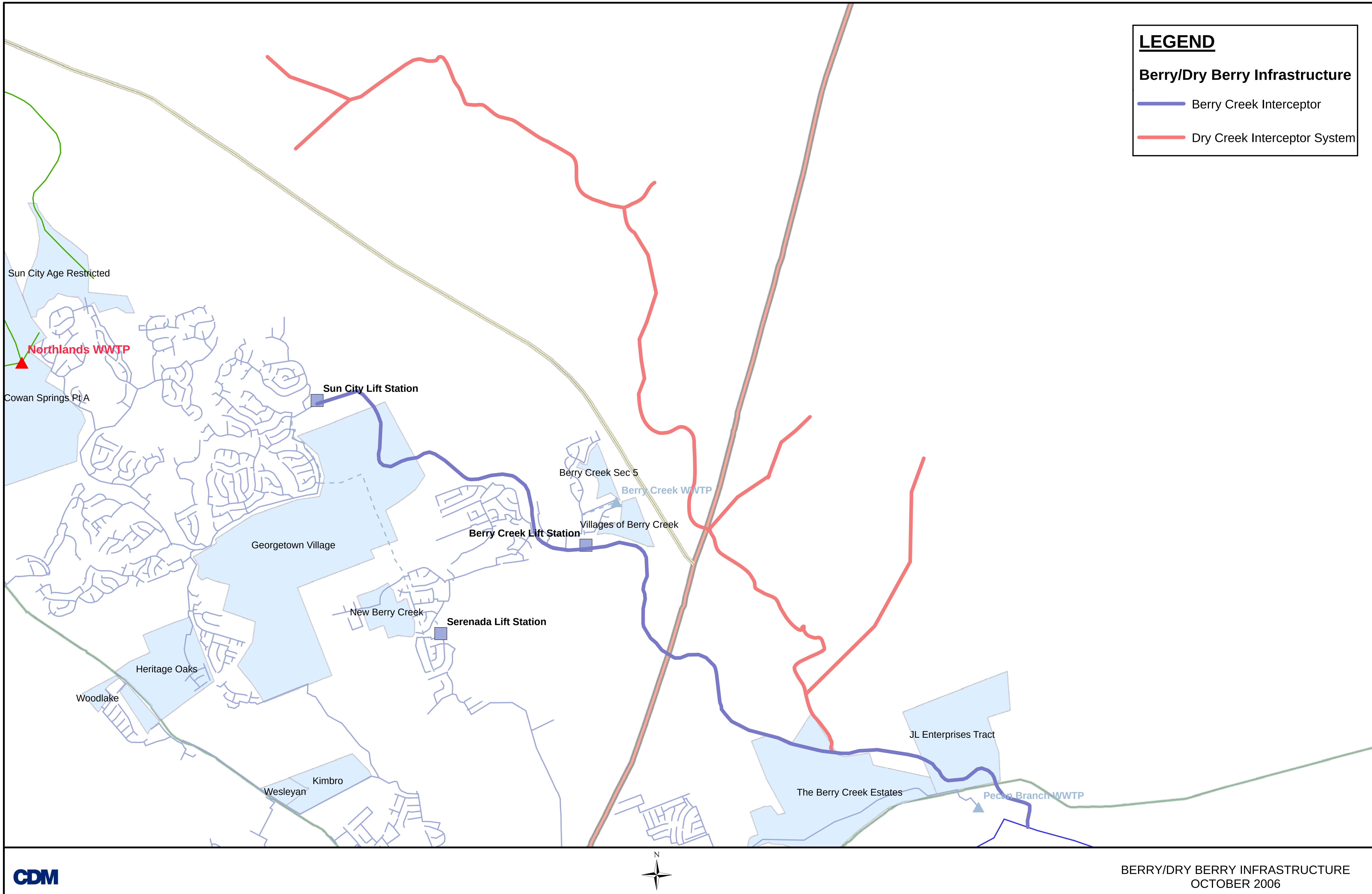

Figure 5-5 **Infrastructure for the Berry Creek/Dry Berry Creek Sub-basins**

Section 6
Recommended Facility and Implementation Plan

Section 5 presented several infrastructure alternatives for long-term wastewater management in the San Gabriel Watershed. The alternatives evaluated focused on transmitting wastewater flow generated in the San Gabriel South and Middle Fork watersheds to the proposed Mankins WWTP located approximately 20 miles downstream. Treatment at the source was not considered feasible due to regulatory and permitting constraints.

Economic analyses identified little relative difference between the alternatives evaluated. As a result, this study recommends that the implementation of specific combinations of the projects identified be driven by development. Discussions to date with stakeholders have resulted in limited commitment to the full-scale implementation of the projects identified herein. Unless external funding is made available, all stakeholders who plan to use regionalized wastewater infrastructure would have to share in the associated planning and capital costs. Table 6-1 identifies the alternative projects and the associated schedule that would cost effectively meet the San Gabriel watershed's long-term wastewater needs. In addition, this study recommends limiting wastewater treatment capacity on the South and Middle Forks to the capacity of the Cimarron Hills WWTP and planned capacity of the future Liberty Hill WWTP due to regulatory and permitting constraints, as well as limited wastewater treatment service area.

Berry Creek Watershed	**Cost Estimate**	**Schedule**
Berry Creek Interceptor Phase I	$4,217,000	2009
Berry Creek Interceptor Phase II	$2,958,000	2020
Pecan Branch WWTP Diversion	$84,000	2020
Northlands WWTP Phase I (1.5 MGD New WWTP)	$7,239,000	2009
Northlands WWTP Phase II (1.5 MGD Expansion)	$4,953,000	> 2030
Dry Berry Creek Interceptor	$7,215,000	> 2030
Northlands Lift Station Phase I & Force Main	$1,225,000	2009
Northlands Lift Station Phase II	$765,000	> 2030
Cowan Creek & Northlands Gravity Systems	$3,794,000	> 2030
North Fork Watershed		
North Fork Interceptor	$1,853,000	> 2030
North Fork Lift Station	$1,469,000	> 2030
Lower San Gabriel Watershed		
Mankins WWTP Phase 1 (2.5 MGD Plant)	$12,500,000	2009
Mankins WWTP Phase 2 (2.5 MGD Expansion)	$9,500,000	2011
Mankins WWTP Phase 3 (2.5 MGD Expansion)	$12,500,000	2030
Mankins Lift Station and Force Main	$2,041,000	> 2030
Mankins Branch Interceptor	$4,012,000	2009
Transmission Through Central Georgetown		
Alternative 1		
Upgrade Wolf Ranch LS & 2nd Force Main	$2,000,000	2009
Upgrade Park LS & FM	$2,600,000	2010
SH 29 Tunnel	$18,908,000	2024
Retire and Replace Interceptor LS w/ Tunnel	$2,000,000	2010
Alternative 2		
SH 29 Tunnel	$18,908,000	2009
Transmission from Central Georgetown to Mankins WWTP		
Alternative 1		
New Smith Branch Lift Station	$3,000,000	2009
Lower Gabriel WW Interceptor	$19,430,000	2040
Lower San Gabriel Lift Station	$7,600,000	2009
Alternative 2		
Lower San Gabriel/Smith Branch Diversion Structure	$120,000	2009
Lower Gabriel WW Interceptor	$19,430,000	2009
South & Middle Fork Watersheds		
South Fork Interceptor Ph I	$8,459,000	2007
South Fork Interceptor Ph II	$2,115,000	2010
Middle Fork Interceptor Ph I	$812,000	2007
Middle Fork LS / Force Main Ph I	$3,455,000	2007
Middle Fork Interceptor Ph II	$6,770,000	> 2030
Alternative 1		
Middle Fork LS / Force Main Ph II	$6, 770,000	> 2030
Alternative 2		
Middle Fork Tunnel	$8,976,000	2030

Table 6-1 Recommended Projects and Alternatives

Section 7
San Gabriel Wastewater Institutional Analysis

In the San Gabriel River Basin there is significant growth in the residential and commercial utility customer base. The budget expenditures continue to be largely driven by the needs of a growing residential, commercial and industrial customer base as well as aging utility plants and lines.

Currently, the public services such as water, wastewater and storm water are typically managed in Williamson County either through a City, an Authority, or a District. Each agency bears the burden and expense in managing personnel, outfitting equipment, and maintaining facilities. The need to consider a regional entity to construct and possibly manage wastewater infrastructure within the San Gabriel River Basin continues to be a growing issue as the need for services extend out to areas of the county currently not served.

The purpose of this section is to discuss the development of a regional entity that may provide the financial resources to construct and possibly manage the regional wastewater infrastructure. Agencies in Williamson County that have expressed an interest in the development of a regional entity include the Brazos River Authority (BRA), Chisholm Trail Special Utility District (CTSUD), City of Georgetown, Jonah Special Utility District (JSUD), and the Lower Colorado River Authority (LCRA).

7.1 Wastewater System Criteria

The San Gabriel River Basin wastewater system costs are reflective of expansions required to meet the needs of a larger, gr 7.1 Wastewater System Criteria owing population. In assessing the initial need for the development of a regional authority, the issues with a regional authority begin to narrow when consideration is given to the following criteria:

- Financial self sufficiency – financially the ability to finance long term wastewater projects within the region requiring a significant amount of funding and financial capability
- Regional planning capacity – regional planning that collectively considers the interest of the planning area and reduces conflict between entities encouraging regional co-operative planning
- Legal and regulatory concerns – legal and regulatory ability to meet and use its current capacity to represent the region before the TCEQ and state government
- Implementation ease – ability to implement the construction and operation of the wastewater system using existing staff

7.2 Regional Organizational Structures

The San Gabriel Wastewater Master Plan – Phase I study examined several institutional alternatives that were ranked by agencies participating in the study. The entities considered as stakeholders for this study include:

- Chisholm Trail Special Utility District (SUD)
- Jonah SUD
- City of Georgetown
- Brazos River Authority
- Lower Colorado River Authority

There are numerous alternatives organizational / institutional structures for regional wastewater systems, however based on the Institutional Alternative Ranking developed in the San Gabriel Wastewater Master Plan – Phase I, the two most acceptable regional wastewater system institutional alternatives included the following:

- Ownership and Operation by a River Authority (No. 2, below)
- The BRA/LCRA Alliance Taking Joint Responsibility (No. 3, below)

Alternative	Criteria	Financial	Planning	Legal	Implementation	Acceptance	Total
1.	Autonomous District	1	2	2	1	2	8
2.	River Authority (Owns/ Operates)	2	2	2	2	2	10
3.	BRA & LCRA	2	2	2	2	2	10
4.	Member Ownership	1	2	2	1	1	7
5.	Georgetown Regional	1	2	2	2	1	8

Table 7-1 Institutional Alternatives Ranking

Under the two alternatives the issue becomes which alternative will best support the proposed growth in the region. The anticipated growth will require an entity that can extend to the reaches of the river basin and plan, construct and operate the regional wastewater collection and treatment system. The current model considered a success in the region is the BRA/LCRA Alliance. The Alliance owns and operates the Brushy Creek Wastewater Treatment Plant. The Alliance expands the plant as necessary to accommodate regional treatment which currently includes the cities of Round Rock, Austin, and Cedar Park. The Fern Bluff and Brushy Creek Municipal Utility Districts are also customers of this regional system. The entity has the responsibility for planning, constructing and operating a regional wastewater collection and treatment system.

7.3 Regional Authority

The provision of wastewater services necessarily involves three phases – connection, transport and treatment. Under the proposed system, the municipalities and independent utility providers would remain responsible for the "connect" phase. The regional authority would be responsible for transport and treatment if the current provider wishes to negotiate with the authority. In order to implement this system the regional authority should be further authorized to:

- Enter into service agreements with municipalities, counties, and districts.
- Meter the amount of sewage transported to treatment facilities.
- Review and approve sewer connections and facilitate the development of regional master planning documents.

The municipalities and independent utilities will maintain authority over connections in their service areas and may charge a premium in addition to treatment charges of the regional authority.

In developing a Regional Authority, a Memorandum of Understanding (MOU) between member agencies and the Regional Authority would be a means to establish the structure to manage and organize the Regional Authority. Typically, language in the MOU would authorize the Regional Authority to construct new facilities and acquire existing facilities from municipalities, and districts within the area if the current owners so desire a transfer to the Regional Authority. Agencies that currently own and operate wastewater systems would negotiate with the Regional Authority on the ownership and management of their wastewater systems. These providers would maintain billing and connection responsibilities for their service areas.

The regional system would be authorized for the following activities:

- Construct new and centrally located facilities and build new systems in unincorporated areas that have no service–area entity established.
- Build interceptor lines to existing infrastructure.
- By agreement with municipalities, acquire and rebuild existing plants and systems in municipalities.
- Provide contracts for operation and maintenance of wastewater treatment facilities.

- Provide service area functions such as bill collection and maintenance of lift stations that municipalities and public utility districts may voluntarily choose to transfer to the regional authority.
- Coordinate funding from state and federal resources.

The member agencies would maintain the following activities:

- Provide bill collection and rate setting
- Maintain local infrastructure
- Enter into service agreements with the Regional Authority
- Review and approve sewer connections to the utility
- Develop long term planning documents

7.4 Regional Authority Approval

The option of a Regional Authority assumes the regional provider will need to obtain appropriate local and state permits such as from the Texas Commission on Environmental Quality (TCEQ). It is assumed that the Regional Authority will not provide retail wastewater services; however, if the Regional Authority does provide retail services, they will also need to obtain approval for a Certificate of Convenience and Necessity (CCN) identifying the service areas.

7.5 Recommended Regional Authority Structure

The preferred regional structure will be consistent with the current BRA/LCRA Alliance that would take responsibility for planning, constructing and operating a regional wastewater collection and treatment system. The Regional Authority will be completely outside the framework of any current city and utility district in the area of Williamson County. The proposed organizational structure may eventually evolve to include different activities, however, initially the idea is for the Regional Authority to focus on wastewater services within the region and specific projects that have been identified by local wastewater providers. The rationale for the Regional Authority is that its geographical service area will not necessarily coincide with the boundaries of individual jurisdictions. A primary concern most agencies have in dealing with a Regional Authority is adequate control over the placement and maintenance of the utilities' facilities. Therefore, the organizational structure of the Regional Authority will require members of the Regional Authority be represented by either staff or elected officials.

The LCRA/BRA would serve as the owner operator of the Regional Authority in the San Gabriel River Basin. The authority would be very similar to the current structure of the Alliance.

Middle and South Fork Altenative 1

Effective Interest Rate =	3.20%
Nominal Interest Rate =	5.20%
Finance Period =	20

L (feet) =	9,000	L (feet) =	6,300
D (inches) =	10	D (inches) =	20
Elev Hd (ft) =	70	Elev Hd (ft) =	90

Schedule =	Capital Costs						Operating Costs				NPV (Mill)
	2007	2010	2007	2007	2030	2030					$20.8
2005 $$ =	$8,458,640	$2,114,660	$812,130	$3,455,000	$6,570,870	$6,771,000					
Year	South Fork Interceptor Ph I	South Fork Interceptor Ph II	Middle Fork Interceptor Ph I	Middle Fork LS / Force Main Ph I	Middle Fork Interceptor Ph II	Middle Fork LS / Force Main Ph II	Middle Fork LS Ph I (mgd)	Middle Fork LS Ph I	Middle Fork LS Ph II (mgd)	Middle Fork LS Ph II	Total
2005											**$0**
2006											$0
2007	$579,118	$0	$55,602	$236,546	$0	$0	0.12	$1,284	0.00	$0	$872,551
2008	$579,118	$0	$55,602	$236,546	$0	$0	0.18	$1,927	0.00	$0	$873,193
2009	$579,118	$0	$55,602	$236,546	$0	$0	0.24	$2,569	0.00	$0	$873,835
2010	$579,118	$144,780	$55,602	$236,546	$0	$0	0.30	$3,212	0.00	$0	$1,019,258
2011	$579,118	$144,780	$55,602	$236,546	$0	$0	0.36	$3,854	0.00	$0	$1,019,900
2012	$579,118	$144,780	$55,602	$236,546	$0	$0	0.42	$4,497	0.00	$0	$1,020,543
2013	$579,118	$144,780	$55,602	$236,546	$0	$0	0.48	$5,140	0.00	$0	$1,021,186
2014	$579,118	$144,780	$55,602	$236,546	$0	$0	0.54	$5,783	0.00	$0	$1,021,829
2015	**$579,118**	**$144,780**	**$55,602**	**$236,546**	**$0**	**$0**	**0.60**	**$6,426**	**0.00**	**$0**	**$1,022,472**
2016	$579,118	$144,780	$55,602	$236,546	$0	$0	0.63	$6,712	0.00	$0	$1,022,758
2017	$579,118	$144,780	$55,602	$236,546	$0	$0	0.65	$6,998	0.00	$0	$1,023,044
2018	$579,118	$144,780	$55,602	$236,546	$0	$0	0.68	$7,284	0.00	$0	$1,023,330
2019	$579,118	$144,780	$55,602	$236,546	$0	$0	0.71	$7,570	0.00	$0	$1,023,616
2020	$579,118	$144,780	$55,602	$236,546	$0	$0	0.73	$7,856	0.00	$0	$1,023,902
2021	$579,118	$144,780	$55,602	$236,546	$0	$0	0.76	$8,142	0.00	$0	$1,024,188
2022	$579,118	$144,780	$55,602	$236,546	$0	$0	0.79	$8,428	0.00	$0	$1,024,474
2023	$579,118	$144,780	$55,602	$236,546	$0	$0	0.81	$8,714	0.00	$0	$1,024,760
2024	$579,118	$144,780	$55,602	$236,546	$0	$0	0.84	$9,000	0.00	$0	$1,025,046
2025	$579,118	$144,780	$55,602	$236,546	$0	$0	0.87	$9,286	0.00	$0	$1,025,332
2026	$579,118	$144,780	$55,602	$236,546	$0	$0	0.89	$9,573	0.00	$0	$1,025,618
2027	$0	$144,780	$0	$0	$0	$0	0.92	$9,859	0.00	$0	$154,638
2028	$0	$144,780	$0	$0	$0	$0	0.95	$10,145	0.00	$0	$154,925
2029	$0	$144,780	$0	$0	$0	$0	0.97	$10,431	0.00	$0	$155,211
2030	**$0**	**$0**	**$0**	**$0**	**$449,873**	**$463,575**	**1.00**	**$10,717**	**0.00**	**$0**	**$924,165**
2031	$0	$0	$0	$0	$449,873	$463,575	0.00	$0	1.50	$20,638	$934,086
2032	$0	$0	$0	$0	$449,873	$463,575	0.00	$0	1.56	$21,464	$934,911
2033	$0	$0	$0	$0	$449,873	$463,575	0.00	$0	1.62	$22,289	$935,737
2034	$0	$0	$0	$0	$449,873	$463,575	0.00	$0	1.68	$23,115	$936,562
2035	$0	$0	$0	$0	$449,873	$463,575	0.00	$0	1.74	$23,940	$937,388
2036	$0	$0	$0	$0	$449,873	$463,575	0.00	$0	1.80	$24,766	$938,213
2037	$0	$0	$0	$0	$449,873	$463,575	0.00	$0	1.86	$25,592	$939,039
2038	$0	$0	$0	$0	$449,873	$463,575	0.00	$0	1.92	$26,417	$939,865
2039	$0	$0	$0	$0	$449,873	$463,575	0.00	$0	1.98	$27,243	$940,690
2040	$0	$0	$0	$0	$449,873	$463,575	0.00	$0	2.04	$28,068	$941,516
2041	$0	$0	$0	$0	$449,873	$463,575	0.00	$0	2.10	$28,894	$942,341
2042	$0	$0	$0	$0	$449,873	$463,575	0.00	$0	2.16	$29,720	$943,167
2043	$0	$0	$0	$0	$449,873	$463,575	0.00	$0	2.22	$30,545	$943,993
2044	$0	$0	$0	$0	$449,873	$463,575	0.00	$0	2.28	$31,371	$944,818
2045	$0	$0	$0	$0	$449,873	$463,575	0.00	$0	2.34	$32,196	$945,644
2046	$0	$0	$0	$0	$449,873	$463,575	0.00	$0	2.40	$33,022	$946,469
2047	$0	$0	$0	$0	$449,873	$463,575	0.00	$0	2.46	$33,848	$947,295
2048	$0	$0	$0	$0	$449,873	$463,575	0.00	$0	2.52	$34,673	$948,121
2049	$0	$0	$0	$0	$449,873	$463,575	0.00	$0	2.58	$35,499	$948,946
2050	$0	$0	$0	$0	$0	$0	0.00	$0	2.64	$36,324	$36,324
2051	$0	$0	$0	$0	$0	$0	0.00	$0	2.70	$37,150	$37,150
2052	$0	$0	$0	$0	$0	$0	0.00	$0	2.76	$37,976	$37,976
2053	$0	$0	$0	$0	$0	$0	0.00	$0	2.82	$38,801	$38,801
2054	$0	$0	$0	$0	$0	$0	0.00	$0	2.88	$39,627	$39,627
2055	$0	$0	$0	$0	$0	$0	0.00	$0	2.94	$40,453	$40,453
2056	$0	$0	$0	$0	$0	$0	0.00	$0	3.00	$41,278	$41,278
2057	$0	$0	$0	$0	$0	$0	0.00	$0	3.06	$42,104	$42,104
2058	$0	$0	$0	$0	$0	$0	0.00	$0	3.12	$42,929	$42,929
2059	$0	$0	$0	$0	$0	$0	0.00	$0	3.18	$43,755	$43,755
2060	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**0.00**	**$0**	**3.30**	**$45,406**	**$45,406**

Middle and South Fork Altenative 2

Effective Interest Rate =	3.20%
Nominal Interest Rate =	5.20%
Finance Period =	20

L (feet) =	9,000
D (inches) =	10
Elev Hd (ft) =	70

	Capital Costs						Operating Costs		NPV (Mill) $21.6
Schedule =	2007	2010	2007	2007	2030	2030			
2005 $$ =	$8,458,640	$2,114,660	$812,130	$3,455,000	$6,570,870	$8,976,400			
Year	South Fork Interceptor Ph I	South Fork Interceptor Ph II	Middle Fork Interceptor Ph I	Middle Fork LS/FM Ph I	Middle Fork Interceptor Ph II	Middle Fork Tunnel	Middle Fork LS Ph I (mgd)	Middle Fork LS Ph I	Total
2005									**$0**
2006									$0
2007	$579,118	$0	$55,602	$236,546	$0	$0	0.12	$1,284	$872,551
2008	$579,118	$0	$55,602	$236,546	$0	$0	0.18	$1,927	$873,193
2009	$579,118	$0	$55,602	$236,546	$0	$0	0.24	$2,569	$873,835
2010	$579,118	$144,780	$55,602	$236,546	$0	$0	0.30	$3,212	$1,019,258
2011	$579,118	$144,780	$55,602	$236,546	$0	$0	0.36	$3,854	$1,019,900
2012	$579,118	$144,780	$55,602	$236,546	$0	$0	0.42	$4,497	$1,020,543
2013	$579,118	$144,780	$55,602	$236,546	$0	$0	0.48	$5,140	$1,021,186
2014	$579,118	$144,780	$55,602	$236,546	$0	$0	0.54	$5,783	$1,021,829
2015	**$579,118**	**$144,780**	**$55,602**	**$236,546**	**$0**	**$0**	**0.60**	**$6,426**	**$1,022,472**
2016	$579,118	$144,780	$55,602	$236,546	$0	$0	0.63	$6,712	$1,022,758
2017	$579,118	$144,780	$55,602	$236,546	$0	$0	0.65	$6,998	$1,023,044
2018	$579,118	$144,780	$55,602	$236,546	$0	$0	0.68	$7,284	$1,023,330
2019	$579,118	$144,780	$55,602	$236,546	$0	$0	0.71	$7,570	$1,023,616
2020	$579,118	$144,780	$55,602	$236,546	$0	$0	0.73	$7,856	$1,023,902
2021	$579,118	$144,780	$55,602	$236,546	$0	$0	0.76	$8,142	$1,024,188
2022	$579,118	$144,780	$55,602	$236,546	$0	$0	0.79	$8,428	$1,024,474
2023	$579,118	$144,780	$55,602	$236,546	$0	$0	0.81	$8,714	$1,024,760
2024	$579,118	$144,780	$55,602	$236,546	$0	$0	0.84	$9,000	$1,025,046
2025	$579,118	$144,780	$55,602	$236,546	$0	$0	0.87	$9,286	$1,025,332
2026	$579,118	$144,780	$55,602	$236,546	$0	$0	0.89	$9,573	$1,025,618
2027	$0	$144,780	$0	$0	$0	$0	0.92	$9,859	$154,638
2028	$0	$144,780	$0	$0	$0	$0	0.95	$10,145	$154,925
2029	$0	$144,780	$0	$0	$0	$0	0.97	$10,431	$155,211
2030	**$0**	**$0**	**$0**	**$0**	**$449,873**	**$614,567**	**1.00**	**$10,717**	**$1,075,157**
2031	$0	$0	$0	$0	$449,873	$614,567	0.00	$0	$1,064,440
2032	$0	$0	$0	$0	$449,873	$614,567	0.00	$0	$1,064,440
2033	$0	$0	$0	$0	$449,873	$614,567	0.00	$0	$1,064,440
2034	$0	$0	$0	$0	$449,873	$614,567	0.00	$0	$1,064,440
2035	$0	$0	$0	$0	$449,873	$614,567	0.00	$0	$1,064,440
2036	$0	$0	$0	$0	$449,873	$614,567	0.00	$0	$1,064,440
2037	$0	$0	$0	$0	$449,873	$614,567	0.00	$0	$1,064,440
2038	$0	$0	$0	$0	$449,873	$614,567	0.00	$0	$1,064,440
2039	$0	$0	$0	$0	$449,873	$614,567	0.00	$0	$1,064,440
2040	$0	$0	$0	$0	$449,873	$614,567	0.00	$0	$1,064,440
2041	$0	$0	$0	$0	$449,873	$614,567	0.00	$0	$1,064,440
2042	$0	$0	$0	$0	$449,873	$614,567	0.00	$0	$1,064,440
2043	$0	$0	$0	$0	$449,873	$614,567	0.00	$0	$1,064,440
2044	$0	$0	$0	$0	$449,873	$614,567	0.00	$0	$1,064,440
2045	$0	$0	$0	$0	$449,873	$614,567	0.00	$0	$1,064,440
2046	$0	$0	$0	$0	$449,873	$614,567	0.00	$0	$1,064,440
2047	$0	$0	$0	$0	$449,873	$614,567	0.00	$0	$1,064,440
2048	$0	$0	$0	$0	$449,873	$614,567	0.00	$0	$1,064,440
2049	$0	$0	$0	$0	$449,873	$614,567	0.00	$0	$1,064,440
2050	$0	$0	$0	$0	$0	$0	0.00	$0	$0
2051	$0	$0	$0	$0	$0	$0	0.00	$0	$0
2052	$0	$0	$0	$0	$0	$0	0.00	$0	$0
2053	$0	$0	$0	$0	$0	$0	0.00	$0	$0
2054	$0	$0	$0	$0	$0	$0	0.00	$0	$0
2055	$0	$0	$0	$0	$0	$0	0.00	$0	$0
2056	$0	$0	$0	$0	$0	$0	0.00	$0	$0
2057	$0	$0	$0	$0	$0	$0	0.00	$0	$0
2058	$0	$0	$0	$0	$0	$0	0.00	$0	$0
2059	$0	$0	$0	$0	$0	$0	0.00	$0	$0
2060	$0	$0	$0	$0	$0	$0	0.00	$0	$0

Middle and South Fork Altenative 3

Effective Interest Rate =	3.20%
Nominal Interest Rate =	5.20%
Finance Period =	20

Schedule = 2005 $$ = Year	Capital Costs				NPV (Mill) $25.9
	2007 $8,458,640 South Fork Interceptor Ph I	2010 $2,114,660 South Fork Interceptor Ph II	2007 $7,383,000 Middle Fork Interceptor	2007 $8,976,400 Middle Fork Tunnel	Total
2005					**$0**
2006					$0
2007	$579,118	$0	$505,475	$614,567	$1,699,160
2008	$579,118	$0	$505,475	$614,567	$1,699,160
2009	$579,118	$0	$505,475	$614,567	$1,699,160
2010	$579,118	$144,780	$505,475	$614,567	$1,843,940
2011	$579,118	$144,780	$505,475	$614,567	$1,843,940
2012	$579,118	$144,780	$505,475	$614,567	$1,843,940
2013	$579,118	$144,780	$505,475	$614,567	$1,843,940
2014	$579,118	$144,780	$505,475	$614,567	$1,843,940
2015	**$579,118**	**$144,780**	**$505,475**	**$614,567**	$1,843,940
2016	$579,118	$144,780	$505,475	$614,567	$1,843,940
2017	$579,118	$144,780	$505,475	$614,567	$1,843,940
2018	$579,118	$144,780	$505,475	$614,567	$1,843,940
2019	$579,118	$144,780	$505,475	$614,567	$1,843,940
2020	$579,118	$144,780	$505,475	$614,567	$1,843,940
2021	$579,118	$144,780	$505,475	$614,567	$1,843,940
2022	$579,118	$144,780	$505,475	$614,567	$1,843,940
2023	$579,118	$144,780	$505,475	$614,567	$1,843,940
2024	$579,118	$144,780	$505,475	$614,567	$1,843,940
2025	$579,118	$144,780	$505,475	$614,567	$1,843,940
2026	$579,118	$144,780	$505,475	$614,567	$1,843,940
2027	$0	$144,780	$0	$0	$144,780
2028	$0	$144,780	$0	$0	$144,780
2029	$0	$144,780	$0	$0	$144,780
2030	**$0**	**$0**	**$0**	**$0**	$0
2031	$0	$0	$0	$0	$0
2032	$0	$0	$0	$0	$0
2033	$0	$0	$0	$0	$0
2034	$0	$0	$0	$0	$0
2035	$0	$0	$0	$0	$0
2036	$0	$0	$0	$0	$0
2037	$0	$0	$0	$0	$0
2038	$0	$0	$0	$0	$0
2039	$0	$0	$0	$0	$0
2040	$0	$0	$0	$0	$0
2041	$0	$0	$0	$0	$0
2042	$0	$0	$0	$0	$0
2043	$0	$0	$0	$0	$0
2044	$0	$0	$0	$0	$0
2045	$0	$0	$0	$0	$0
2046	$0	$0	$0	$0	$0
2047	$0	$0	$0	$0	$0
2048	$0	$0	$0	$0	$0
2049	$0	$0	$0	$0	$0
2050	$0	$0	$0	$0	$0
2051	$0	$0	$0	$0	$0
2052	$0	$0	$0	$0	$0
2053	$0	$0	$0	$0	$0
2054	$0	$0	$0	$0	$0
2055	$0	$0	$0	$0	$0
2056	$0	$0	$0	$0	$0
2057	$0	$0	$0	$0	$0
2058	$0	$0	$0	$0	$0
2059	$0	$0	$0	$0	$0
2060	$0	$0	$0	$0	$0

Middle and South Fork Altenative 4

Effective Interest Rate =	3.20%
Nominal Interest Rate =	5.20%
Finance Period =	20

L (feet) =	9,000
D (inches) =	10
Elev Hd (ft) =	70

	Capital Costs				Operating Costs		NPV (Mill) $24.1
Schedule =	2007	2010	2007	2007			
2005 $$ =	$8,458,640	$2,114,660	$7,383,000	$6,771,000			
Year	South Fork Interceptor Ph I	South Fork Interceptor Ph II	Middle Fork Interceptor	Middle Fork LS and Force Main	Middle Fork LS Ph II (mgd)	Middle Fork LS Ph II	Total
2005					**0**		**$0**
2006					0.09		$0
2007	$579,118	$0	$505,475	$463,575	0.18	$1,927	$1,550,095
2008	$579,118	$0	$505,475	$463,575	0.27	$2,890	$1,551,059
2009	$579,118	$0	$505,475	$463,575	0.36	$3,854	$1,552,023
2010	$579,118	$144,780	$505,475	$463,575	0.45	$4,819	$1,697,766
2011	$579,118	$144,780	$505,475	$463,575	0.54	$5,783	$1,698,731
2012	$579,118	$144,780	$505,475	$463,575	0.63	$6,748	$1,699,696
2013	$579,118	$144,780	$505,475	$463,575	0.72	$7,713	$1,700,661
2014	$579,118	$144,780	$505,475	$463,575	0.81	$8,679	$1,701,626
2015	**$579,118**	**$144,780**	**$505,475**	**$463,575**	**0.90**	**$9,644**	**$1,702,592**
2016	$579,118	$144,780	$505,475	$463,575	0.94	$10,073	$1,703,021
2017	$579,118	$144,780	$505,475	$463,575	0.98	$10,503	$1,703,450
2018	$579,118	$144,780	$505,475	$463,575	1.02	$10,932	$1,703,880
2019	$579,118	$144,780	$505,475	$463,575	1.06	$11,361	$1,704,309
2020	$579,118	$144,780	$505,475	$463,575	1.10	$11,791	$1,704,739
2021	$579,118	$144,780	$505,475	$463,575	1.14	$12,220	$1,705,168
2022	$579,118	$144,780	$505,475	$463,575	1.18	$12,650	$1,705,598
2023	$579,118	$144,780	$505,475	$463,575	1.22	$13,080	$1,706,027
2024	$579,118	$144,780	$505,475	$463,575	1.26	$13,509	$1,706,457
2025	$579,118	$144,780	$505,475	$463,575	1.30	$13,939	$1,706,887
2026	$579,118	$144,780	$505,475	$463,575	1.34	$14,369	$1,707,316
2027	$0	$144,780	$0	$0	1.38	$14,799	$159,578
2028	$0	$144,780	$0	$0	1.42	$15,228	$160,008
2029	$0	$144,780	$0	$0	1.46	$15,658	$160,438
2030	**$0**	**$0**	**$0**	**$0**	**1.50**	**$16,088**	**$16,088**
2031	$0	$0	$0	$0	1.56	$16,733	$16,733
2032	$0	$0	$0	$0	1.62	$17,379	$17,379
2033	$0	$0	$0	$0	1.68	$18,024	$18,024
2034	$0	$0	$0	$0	1.74	$18,669	$18,669
2035	$0	$0	$0	$0	1.80	$19,315	$19,315
2036	$0	$0	$0	$0	1.86	$19,961	$19,961
2037	$0	$0	$0	$0	1.92	$20,606	$20,606
2038	$0	$0	$0	$0	1.98	$21,252	$21,252
2039	$0	$0	$0	$0	2.04	$21,898	$21,898
2040	$0	$0	$0	$0	2.10	$22,545	$22,545
2041	$0	$0	$0	$0	2.16	$23,191	$23,191
2042	$0	$0	$0	$0	2.22	$23,837	$23,837
2043	$0	$0	$0	$0	2.28	$24,484	$24,484
2044	$0	$0	$0	$0	2.34	$25,130	$25,130
2045	$0	$0	$0	$0	2.40	$25,777	$25,777
2046	$0	$0	$0	$0	2.46	$26,424	$26,424
2047	$0	$0	$0	$0	2.52	$27,071	$27,071
2048	$0	$0	$0	$0	2.58	$27,718	$27,718
2049	$0	$0	$0	$0	2.64	$28,365	$28,365
2050	$0	$0	$0	$0	2.70	$29,013	$29,013
2051	$0	$0	$0	$0	2.76	$29,660	$29,660
2052	$0	$0	$0	$0	2.82	$30,308	$30,308
2053	$0	$0	$0	$0	2.88	$30,955	$30,955
2054	$0	$0	$0	$0	2.94	$31,603	$31,603
2055	$0	$0	$0	$0	3.00	$32,251	$32,251
2056	$0	$0	$0	$0	3.06	$32,899	$32,899
2057	$0	$0	$0	$0	3.12	$33,547	$33,547
2058	$0	$0	$0	$0	3.18	$34,196	$34,196
2059	$0	$0	$0	$0	3.24	$34,844	$34,844
2060	**$0**	**$0**	**$0**	**$0**	**3.30**	**$35,493**	**$35,493**

Central Georgetown Alternatives 1 and 2

Effective Interest Rate =	3.20%
Nominal Interest Rate =	5.20%
Finance Period =	20

Wolf Ranch 1st FM		Wolf Ranch 2nd FM		Park	
L (feet) =	3,000	L (feet) =	4,400	L (feet) =	3,800
D (inches) =	16	D (inches) =	16	D (inches) =	20
Elev Hd (ft) =	80	Elev Hd (ft) =	60	Elev Hd (ft) =	25

	ALTERNATIVE 1									ALTERNATIVE 2
	Capital Costs				Operating Costs				NPV (Mill) $17.1	NPV (Mill) $17.2
Schedule =	2009	2010	2024	2010						2009
2005 $$ =	$2,000,000	$2,600,000	$18,908,300	$2,000,000						$18,908,300
Year	Upgrade Wolf Ranch LS & 2nd Force Main	Upgrade Park LS & FM	SH 29 Tunnel	Retire and Replace Interceptor LS w/ Tunnel	Wolf Ranch LS Both FMs (mgd)	Wolf Ranch	Wolf Ranch 2nd FM & Incremental Flow to Park LS (mgd)	Lower San Gabriel Lift Station	Total	SH 29 Tunnel
2005					0		0		$0	
2006	$0	$0	$0	$0	0.36	$0	0.18	$0	$0	$0
2007	$0	$0	$0	$0	0.72	$7,705	0.36	$1,376	$9,081	$0
2008	$0	$0	$0	$0	1.08	$11,558	0.54	$2,064	$13,621	$0
2009	$136,929	$0	$0	$0	1.44	$15,411	0.72	$2,752	$155,092	$1,294,551
2010	$136,929	$178,008	$0	$136,929	1.8	$19,264	0.9	$3,440	$474,571	$1,294,551
2011	$136,929	$178,008	$0	$136,929	2.16	$23,117	1.08	$4,128	$479,112	$1,294,551
2012	$136,929	$178,008	$0	$136,929	2.52	$26,970	1.26	$4,816	$483,653	$1,294,551
2013	$136,929	$178,008	$0	$136,929	2.88	$30,824	1.44	$5,504	$488,195	$1,294,551
2014	$136,929	$178,008	$0	$136,929	3.24	$34,678	1.62	$6,192	$492,737	$1,294,551
2015	**$136,929**	**$178,008**	**$0**	**$136,929**	**3.60**	$38,532	**1.80**	$6,880	**$497,279**	**$1,294,551**
2016	$136,929	$178,008	$0	$136,929	3.71	$39,470	1.92	$7,339	$498,676	$1,294,551
2017	$136,929	$178,008	$0	$136,929	3.81	$40,408	2.04	$7,797	$500,073	$1,294,551
2018	$136,929	$178,008	$0	$136,929	3.92	$41,347	2.16	$8,256	$501,470	$1,294,551
2019	$136,929	$178,008	$0	$136,929	4.03	$42,285	2.28	$8,715	$502,867	$1,294,551
2020	$136,929	$178,008	$0	$136,929	4.13	$43,223	2.40	$9,174	$504,264	$1,294,551
2021	$136,929	$178,008	$0	$136,929	4.24	$44,161	2.52	$9,632	$505,661	$1,294,551
2022	$136,929	$178,008	$0	$136,929	4.35	$45,100	2.64	$10,091	$507,058	$1,294,551
2023	$136,929	$178,008	$0	$136,929	4.45	$46,038	2.76	$10,550	$508,455	$1,294,551
2024	$136,929	$178,008	$1,294,551	$136,929	4.56	$46,976	2.88	$11,009	$1,804,404	$1,294,551
2025	$136,929	$178,008	$1,294,551	$136,929	4.67	$0	3.00	$0	$1,746,419	$1,294,551
2026	$136,929	$178,008	$1,294,551	$136,929	4.77	$0	3.12	$0	$1,746,419	$1,294,551
2027	$136,929	$178,008	$1,294,551	$136,929	4.88	$0	3.24	$0	$1,746,419	$1,294,551
2028	$136,929	$178,008	$1,294,551	$136,929	4.99	$0	3.36	$0	$1,746,419	$1,294,551
2029	$0	$178,008	$1,294,551	$136,929	5.09	$0	3.48	$0	$1,609,489	$0
2030	**$0**	**$0**	**$1,294,551**	**$0**	**5.20**	$0	**3.60**	$0	**$1,294,551**	**$0**
2031	$0	$0	$1,294,551	$0	5.26	$0	3.67	$0	$1,294,551	$0
2032	$0	$0	$1,294,551	$0	5.33	$0	3.74	$0	$1,294,551	$0
2033	$0	$0	$1,294,551	$0	5.39	$0	3.81	$0	$1,294,551	$0
2034	$0	$0	$1,294,551	$0	5.45	$0	3.88	$0	$1,294,551	$0
2035	$0	$0	$1,294,551	$0	5.52	$0	3.95	$0	$1,294,551	$0
2036	$0	$0	$1,294,551	$0	5.58	$0	4.02	$0	$1,294,551	$0
2037	$0	$0	$1,294,551	$0	5.64	$0	4.09	$0	$1,294,551	$0
2038	$0	$0	$1,294,551	$0	5.71	$0	4.16	$0	$1,294,551	$0
2039	$0	$0	$1,294,551	$0	5.77	$0	4.23	$0	$1,294,551	$0
2040	$0	$0	$1,294,551	$0	5.83	$0	4.30	$0	$1,294,551	$0
2041	$0	$0	$1,294,551	$0	5.90	$0	4.37	$0	$1,294,551	$0
2042	$0	$0	$1,294,551	$0	5.96	$0	4.44	$0	$1,294,551	$0
2043	$0	$0	$1,294,551	$0	6.02	$0	4.51	$0	$1,294,551	$0
2044	$0	$0	$0	$0	6.09	$0	4.58	$0	$0	$0
2045	$0	$0	$0	$0	6.15	$0	4.65	$0	$0	$0
2046	$0	$0	$0	$0	6.21	$0	4.72	$0	$0	$0
2047	$0	$0	$0	$0	6.28	$0	4.79	$0	$0	$0
2048	$0	$0	$0	$0	6.34	$0	4.86	$0	$0	$0
2049	$0	$0	$0	$0	6.40	$0	4.93	$0	$0	$0
2050	$0	$0	$0	$0	6.47	$0	5.00	$0	$0	$0
2051	$0	$0	$0	$0	6.53	$0	5.07	$0	$0	$0
2052	$0	$0	$0	$0	6.59	$0	5.14	$0	$0	$0
2053	$0	$0	$0	$0	6.66	$0	5.21	$0	$0	$0
2054	$0	$0	$0	$0	6.72	$0	5.28	$0	$0	$0
2055	$0	$0	$0	$0	6.78	$0	5.35	$0	$0	$0
2056	$0	$0	$0	$0	6.85	$0	5.42	$0	$0	$0
2057	$0	$0	$0	$0	6.91	$0	5.49	$0	$0	$0
2058	$0	$0	$0	$0	6.97	$0	5.56	$0	$0	$0
2059	$0	$0	$0	$0	7.04	$0	5.63	$0	$0	$0
2060	**$0**	**$0**	**$0**	**$0**	**7.10**	$0	**5.70**	$0	**$0**	**$0**

Lower San Gabriel Alternatives 1 and 2

Effective Interest Rate =	
Nominal Interest Rate =	
Finance Period =	

L (feet) =	24,000
D (inches) =	20
Elev Hd (ft) =	100

	ALTERNATIVE 1					ALTERNATIVE 2
	Capital Costs		Operating Costs		NPV (Mill) $15.0	NPV (Mill) $17.7
Schedule =	2009	2040				2009
2005 $$ =	$7,600,000	$19,432,400				$19,432,400
Year	New Smith Branch Lift Station and Force Main	Lower Gabriel WW Interceptor	New Smith Branch Lift Station (mgd)	New Smith Branch Lift Station	Total	Lower Gabriel WW Interceptor
2005			**0**		**$0**	
2006			0.64	$0	$0	$0
2007	$0	$0	1.28	$19,570	$20,367	$0
2008	$0	$0	1.92	$29,356	$30,555	$0
2009	$520,332	$0	2.56	$39,144	$561,077	$1,330,434
2010	$520,332	$0	3.2	$48,933	$571,269	$1,330,434
2011	$520,332	$0	3.84	$58,724	$581,465	$1,330,434
2012	$520,332	$0	4.48	$68,516	$591,662	$1,330,434
2013	$520,332	$0	5.12	$78,308	$601,863	$1,330,434
2014	$520,332	$0	5.76	$88,102	$612,066	$1,330,434
2015	**$520,332**	**$0**	**6.40**	**$97,898**	**$622,271**	**$1,330,434**
2016	$520,332	$0	6.55	$100,245	$624,345	$1,330,434
2017	$520,332	$0	6.71	$102,592	$626,419	$1,330,434
2018	$520,332	$0	6.86	$104,939	$628,493	$1,330,434
2019	$520,332	$0	7.01	$107,286	$627,618	$1,330,434
2020	$520,332	$0	7.17	$109,633	$629,965	$1,330,434
2021	$520,332	$0	7.32	$111,981	$632,313	$1,330,434
2022	$520,332	$0	7.47	$114,328	$634,660	$1,330,434
2023	$520,332	$0	7.63	$116,676	$637,008	$1,330,434
2024	$520,332	$0	7.78	$119,023	$639,355	$1,330,434
2025	$520,332	$0	7.93	$121,371	$641,703	$1,330,434
2026	$520,332	$0	8.09	$123,719	$644,050	$1,330,434
2027	$520,332	$0	8.24	$126,066	$646,398	$1,330,434
2028	$520,332	$0	8.39	$128,414	$648,746	$1,330,434
2029	$0	$0	8.55	$130,762	$130,762	$0
2030	**$0**	**$0**	**8.70**	**$133,110**	**$133,110**	**$0**
2031	$0	$0	8.90	$0	$0	$0
2032	$0	$0	9.11	$0	$0	$0
2033	$0	$0	9.31	$0	$0	$0
2034	$0	$0	9.51	$0	$0	$0
2035	$0	$0	9.72	$0	$0	$0
2036	$0	$0	9.92	$0	$0	$0
2037	$0	$0	10.12	$0	$0	$0
2038	$0	$0	10.33	$0	$0	$0
2039	$0	$0	10.53	$0	$0	$0
2040	$0	$1,330,434	10.73	$0	$1,330,434	$0
2041	$0	$1,330,434	10.94	$0	$1,330,434	$0
2042	$0	$1,330,434	11.14	$0	$1,330,434	$0
2043	$0	$1,330,434	11.34	$0	$1,330,434	$0
2044	$0	$1,330,434	11.55	$0	$1,330,434	$0
2045	$0	$1,330,434	11.75	$0	$1,330,434	$0
2046	$0	$1,330,434	11.95	$0	$1,330,434	$0
2047	$0	$1,330,434	12.16	$0	$1,330,434	$0
2048	$0	$1,330,434	12.36	$0	$1,330,434	$0
2049	$0	$1,330,434	12.56	$0	$1,330,434	$0
2050	$0	$1,330,434	12.77	$0	$1,330,434	$0
2051	$0	$1,330,434	12.97	$0	$1,330,434	$0
2052	$0	$1,330,434	13.17	$0	$1,330,434	$0
2053	$0	$1,330,434	13.38	$0	$1,330,434	$0
2054	$0	$1,330,434	13.58	$0	$1,330,434	$0
2055	$0	$1,330,434	13.78	$0	$1,330,434	$0
2056	$0	$1,330,434	13.99	$0	$1,330,434	$0
2057	$0	$1,330,434	14.19	$0	$1,330,434	$0
2058	$0	$1,330,434	14.39	$0	$1,330,434	$0
2059	$0	$1,330,434	14.60	$0	$1,330,434	$0
2060	**$0**	**$0**	**14.80**	**$0**	**$0**	**$0**