5 Infrastructure

Bulverde's Infrastructure Needs

Webster defines *infrastructure* as the underlying foundation or, in the case of a city, the system of public works that is a basic necessity for its very existence as well as its future growth and development. For purposes of this chapter, infrastructure includes streets, water, sanitary sewer and drainage systems. The City of Bulverde as yet does not provide and maintain water and sanitary sewer systems, but is responsible for streets and drainage infrastructure. As the City of Bulverde grows, surface water and wastewater infrastructure will become more prevalent in the area. All of these systems require substantial financial outlays. Growth and expansions to the City's infrastructure must be carefully planned to meet the demands of growth, and timed in accordance with the City's and suppliers' financial resources. Likewise, as the infrastructure ages, the timely maintenance, replacement and improvement of existing systems will present additional challenges.

The Comprehensive Plan Survey revealed that residents are concerned about street conditions, drainage, and the lack of a reliable water source. Sixty-six percent of survey respondents felt that developing a publicly owned water system was either an important or very important priority for successfully coping with growth. Fifty- three percent felt that way about developing a publicly owned sewer system. Regardless, respondents felt that city government should focus on basic health-, safety- and welfare-related issues. When asked about their level of support for the City providing specific services, ninety-one percent were either supportive or very supportive of the city solving traffic problems and seventy-three percent were either supportive or very supportive of providing water utility services. When asked to rate the quality of services already provided by the City, almost two out of three respondents (63%) felt that street maintenance was either poor or very poor. Slightly over half the respondents (53%) felt that drainage was either poor or very poor.

The City of Bulverde faces many challenges as it seeks to develop and manage an infrastructure system. The primary challenge is ensuring that the infrastructure system is shaped by sound policy and design rather than being ad hoc, and that the City takes advantage of the latest technologies and ideas to minimize cost while maximizing results. This chapter takes into account the various infrastructure needs,

the adequacy of current systems, and suggests alternative and innovative approaches to address future infrastructure needs while protecting the quality of life in Bulverde.

5.1 Streets

A Roadway Policy

One of the clear findings of the public input phase of the comprehensive planning process was that the rural or "country-lane" nature of many of the city's streets needs to be maintained. Twisty, narrower roads are considered an asset rather than a liability, and thus efforts must be made to design streets and roads within the context of this vision. This will be a challenge as roads tend to be over-engineered to accommodate fast-moving vehicles rather than fit into the character of the community. Because "vehicle-miles traveled" (VMT) continue to increase rapidly in the area, state and county road designers tend to focus on wider lanes and shoulders with straighter, flatter alignments to obtain the highest vehicular capacity for the roadway. These roadway features often clash with the aesthetics of communities like Bulverde and the narrow, tree-lined country lane.

When traffic engineers propose the replacement of an old stone bridge with a pile of concrete; when they declare that a city street must be doubled in width to be made safe; when they argue that a two-lane country road be converted to a four-lane highway, they are doing it because, at least in their view, the American Association of State Highway and Traffic Officials (AASHTO) *Green Book* dictates that it be done. Recently, new approaches in road design have emerged that focus on aesthetics and sense of place in addition to strict engineering principles. Context sensitive design (CSD) is a collaborative, interdisciplinary approach to road design and placement that involves all stakeholders to develop roads that fit their physical setting and preserve scenic, aesthetic, historic, and environmental resources, while maintaining safety and mobility. CSD is an approach that considers the total context within which a transportation improvement project will exist. This innovation will be discussed in more detail in the next chapter, *Transportation*.

City Street Inventory

The City of Bulverde is responsible for maintaining over 53 miles of streets within its city limits. The maintenance of a quality street system is a fundamental infrastructure need. In 2002, $132,737 (56 percent of the public works budget) was spent on road repair/maintenance. This compares to $240,900 (or 80 percent) in 2001. On February 10, 2004, the City authorized The Hogan Corporation to prepare a Capital Improvements Plan which would cover proposed improvements for street and drainage improvements for the city for the next five years. Part of this plan was conducting a "windshield survey" inventory of all streets in the City and categorizing them according to the following four standards:

1. recently resurfaced (last five years)
2. needs resurfacing
3. needs rehabilitating
4. needs reconstruction

Based on the Hogan plan dated March, 2004, the life of some existing streets can be extended by resurfacing with a single course penetration surface. For other streets, the existing base and surface can be reclaimed by pulverizing the existing pavement and adding more flexible base and cement for stabilization. The plan recommended that some roads such as Bulverde Road be considered for alignment straightening, reconstruction and installation of safety features. Cost projections for each paving project are also included in the draft plan. The projected total cost for all recommended street and drainage improvements is $3,878,345.

The city should continue to conduct a street inventory program that rates the condition of city streets on an annual or biannual basis using visual inspection criteria. The rate of deterioration from one year to the next (or percentage of change in condition) can be measured and documented. This inspection process and the resulting measures of deterioration can enable the city to schedule preventative maintenance such as seal coats, hot mix overlays, and shoulder repairs and to continuously identify streets for reconstruction projects. Table 5.1 identifies five possible rating categories that can be used in the inventorying process.

Table 5.1. Possible Street Inventory Rating

Rate	Condition	Maintenance Schedule
100-92	Very Good	No maintenance required.
91-81	Good	Minor cracks requiring crack sealing; cosmetic deterioration of curbs and joints; weed kill necessary.
80-70	Fair	Major cracks with significant surface deterioration; alligator cracking with minor potholes and subgrade deterioration; requires spot base repair and surface repair such as seal coating.
69-51	Poor	Significant potholes; complete surface deterioration; misaligned curb and pavement; requires major base and surface repairs and realignment of riding surface using asphalt overlay.
50-0	Very Poor	Complete pavement system failure; exhibits bad riding quality, numerous potholes, pavement heaving, water ponding; a high annual maintenance record; total reconstruction recommended.

Street Standards

Increased maintenance alone will not solve the long-term problem of street conditions. The key to good streets is their being built to last in the first place. As new streets are added and existing streets are widened or rebuilt, they should be constructed with the best practicable pavement standards. The city's current minimum construction standards and cross-sections are outlined in the Subdivision Ordinance. Whether streets are built or reconstructed by the city, or constructed by developers and dedicated to the city, the highest possible standards are needed to reduce the long-term cost to taxpayers for future maintenance. These standards

should be reviewed on a periodic basis to assure they are up-to-date with the latest improvements in roadway construction technology.

Street Classifications/Designs

The Subdivision Ordinance also outlines the different street classifications and designs allowable in the city. These are listed in Table 5.2. The rural road classification fits with the low-impact design principles outlined in Chapter 3 of this Plan. In this design, stormwater is slowed down and allowed to percolate into the ground. In the urban design storm water is channeled into curb and gutter along streets and then on to drainage infrastructure and creeks. Use of the rural road classification can minimize the necessity for expensive drainage infrastructure and lower the design capacities of any required drainage structures. Also, the rural design is more in keeping with the wishes of the citizens of the City of Bulverde to keep the city's country ambience. Urban roads should be reserved for traditional suburban development and compact commercial/mixed use development.

Table 5.2. Street Geometry per the City of Bulverde Subdivision Ordinance

	Minimum ROW	Min Pavement Width	Design Speed (mph)	Curb and Gutter
Local Rural	60'	22'	30	No
Local Urban	50'	30'	30	Yes
Collector Rural	72'	40'	40	No
Collector Urban	40'	44'	45	Yes
Minor Thoroughfare	86'	48'	50	Yes
Major Thoroughfare	120'	48'-72'	60	Yes

Source: City of Bulverde Subdivision Ordinance.

Consideration should be given to adding street design alternatives to the subdivision ordinance. An alley classification would enable developers to place garages facing the rear of houses, thus improving the street appearance of neighborhoods.

Houses with garage entrances off rear alley

Houses with front garages on cul-de-sac with excessively wide pavement requirements

Traffic calming measures should also be promoted to increase the livability of streets by slowing the volume and speed of traffic. There is more to controlling speed than speed limit signs and speed bumps. Speed control devices can include chicanes or staggering, gateway thresholds, narrowing or throttling, neck-downs, nubs, and speed tables or plateaus.

Traffic island

Speed platform

Throttling

Chicane or 'curvy' road in Austin

Also, consideration should be given to lowering speeds on local streets. At 20 mph drivers can anticipate conflicts and have time to stop for pedestrians and bicyclists. According to a 1992 survey by Durkin and Pheby published in *Traffic Management and Road Safety*, the chances of a pedestrian surviving a traffic accident increase from 60% at 30 mph to 95% at 20 mph. Lowering design speeds on rural collectors and minor arterials through the heart of the community from 40 and 50 mph to 35 mph can turn no man's lands along roadsides into something more compatible with walking, cycling and a rural atmosphere.

Also in keeping with the Bulverde area's rural ambience, residential streets should be designed for the minimum required pavement width needed to support travel lanes, on-street parking, and emergency, maintenance and service vehicle access. Widths should still be based on traffic volume. Keeping all streets as narrow as possible uses less asphalt, and these narrower roads have less effect on ambient air temperatures, save development costs, help calm traffic, and result in less impervious cover that alleviates storm water quantity and quality issues. Streets, particularly local streets,

should be designed for everyday use, not the worst case scenario, the occasional service vehicle, emergency vehicle, parked car on access streets, or the 30th highest hourly traffic volume of the entire year for higher order streets. Table 5.3 lists some alternative street widths used by other communities or states. In summary, principles that can be used when considering alternative street designs and classifications include:

Landscaped cul-de-sac

Standard cul-de-sac

- Residential street right-of-way widths should reflect the minimum required width to accommodate the travel-way, sidewalks or asphalt/crushed stone jogging paths, and vegetated open channels. Utilities and storm drains (as necessary) should be located within the pavement section of the ROW whenever feasible.
- Reduce the total length of residential streets by examining alternative street layouts to find the best option for increasing the number of homes per unit length.
- Minimize residential cul-de-sacs and incorporate landscaped areas in them to reduce their impervious cover. The radius of cul-de-sacs should be the minimum required to accommodate emergency and maintenance vehicles, and alternative turnarounds should be considered.
- Use pervious materials in spillover parking areas to reduce the overall imperviousness associated with parking lots.

Table 5.3. Alternative Residential Street Widths

	Urban Land Institute	Bucks County, PA	Orange County, FL	Best Development Practices
Locals	22-24' (access streets)	16-26' access streets depending on lot width	18' (0-300 average daily traffic volume)	18' (access streets with parking on only one side or in parking bays)
	26-28' (subcollectors)	20-36' subcollectors depending on lot width and on-street parking policies	20' (301-800 average daily traffic volume) 22' (801-1200 average daily traffic volume)	26' (subcollectors with a stripped parking lane on one side)
Collectors	24-36' minimum applies to streets with no fronting residences	20-24' depending on daily traffic - no provision for on-street parking	24' (1201-1500 average daily traffic volume 36' (1501-3500 average daily traffic volume)	28' (with extra-wide curb lanes) 30' (with striped bike lanes on both sides) 34-36' (with striped parking lanes on both sides)

Source: Best Development Practices by Reid Ewing published in cooperation with the Urban Land Institute and other entities.

5.2 Stormwater Management

Many rural settlements in Texas were located near or along waterways because of the availability of water for irrigation and the flat or gently sloping lands which are easier to farm and build on. The City of Bulverde is no exception, having been located near and along the Cibolo Creek and its tributaries including West Fork, Dripping Springs, Lewis and Indian Creeks. As such, storm water drainage and flooding is a major issue in the Bulverde area. Situated on the banks of the Cibolo Creek, the city is subject to major flooding resulting from intense rain events which occur in the Texas Hill Country, especially near the Balcones escarpment. Such floods occurred as recently as October 1998 and June-July 2002. Staying dry has and will be a challenge for Bulverde as the city grows. Minor flooding can occur in low-lying areas near the old-town center and in Oak Village North from relatively minor rain events. Currently, Lewis and Indian Creeks cause local flooding, and the Cibolo affects access on Farm/Market 1863 and to San Antonio on U.S. Highway 281. Oak Village North can be cut off from the rest of the city when the Cibolo floods. As more land is developed for residential, commercial, institutional and light industrial purposes, these problems can be exacerbated without proper planning.

Climate and Terrain

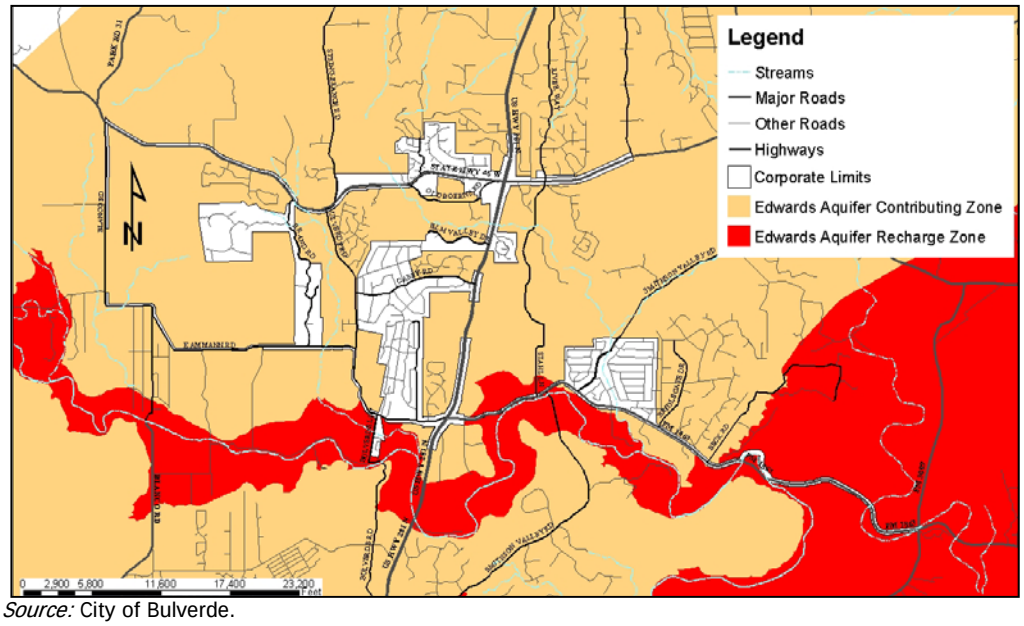
It is important to understand the physical and ecological characteristics of the region's natural environment when developing a long-range plan. Mean annual precipitation reported by the U.S. Weather Bureau for Comal County is 30.73 inches (78.1 cm). May and September have the maximum rainfall, with lows in the winter and summer. August typically has the lightest rainfall with an average of 1.83 inches, and May has the highest with an average of 3.34 inches. Thunderstorms occur an average of 39 days per year. Tropical weather disturbances during the late summer and early fall are responsible for large thunderstorms and increased rainfall.

The Balcones Escarpment is the geologic fault zone that extends across Texas in a general southwest-to-northeast trending band from the Rio Grande to the Red River. The area above the Balcones fault where the City of Bulverde is located is known as the Edwards Plateau. Much of the original tableland has been removed by erosion, and deep valleys have been cut by streams that originate on the plateau. High rolling divides, smooth tablelands remnants, steep-walled canyons and gorges are prevalent throughout the area. The Balcones Escarpment has an uplifting effect on warm, moist tropical air masses moving inland from the Gulf of Mexico, causing increased rainfall. Cold fronts moving across the state also may stall in the vicinity of the Edwards plateau and Balcones Escarpment causing major thunderstorms. The climate and terrain conditions make the Texas Hill Country one of the most flash flood-prone areas in the country and rest of the world.

The Edwards Aquifer

The City of Bulverde lies within the Edwards Aquifer contributing and recharge zones (see Figure 5.3). The Aquifer is divided into three main zones: the contributing

Figure 5.3. City of Bulverde and Edwards Aquifer Recharge and Contributing Zones



Source: City of Bulverde.

zone, the recharge zone, and the artesian zone. The contributing zone occurs on the Edwards Plateau and is approximately 4,400 square miles in area with elevations ranging between 1,000 and 2,300 feet above sea level. The contributing zone is also called the drainage area or the catchment area because the land surface 'catches' water from rainfall, and water runs off into streams or infiltrates into the water table aquifer of the plateau. Runoff from the land surface and spring flow then feed streams that flow over relatively impermeable limestones until they reach the recharge zone. The recharge zone is a 1,500 square mile area where highly faulted and fractured Edwards's limestone outcrops at the land surface, allowing large quantities of water to flow into the Aquifer. Cibolo Creek forms the border between Bexar and Comal counties and contributes much of its flow to Edwards recharge. Francis T. Bryan provided one of the earliest descriptions in 1849 of what happens to streams that cross the recharge zone:

> After passing the Cibolo, four miles from Misenbergs, the road becomes very good, being smooth and level. The Cibolo, where the road crosses it, is a dry ravine. About two miles above there is plenty of pure water.

It is not uncommon for the Cibolo to flow 30 feet wide and a foot deep and, in the space of a quarter mile, disappear completely into the Edwards formation.

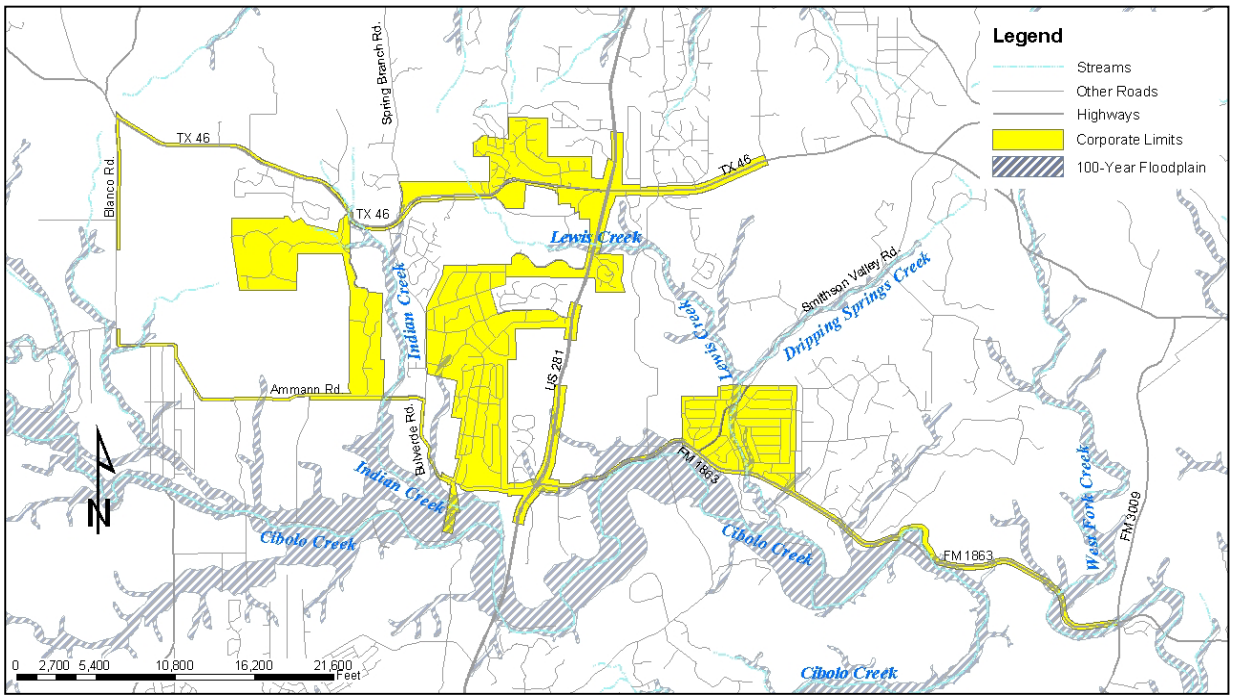
Since 1993, the protection and use of the southern portion of the Aquifer has been overseen by the Edwards Aquifer Authority (EAA) created by the Texas legislature. Their responsibilities include implementation of aquifer pumpage limits for major users, enforcement of water management practices to ensure the flow of the Comal and San Marcos springs, a comprehensive water management plan and a critical period management plan. The EAA's goal is to reduce pumpage to preserve the flow of the springs from over 500,000-acre feet to 400,000-acre feet by 2007.

Floodplains and Floodways

There are floodplains and floodways along the Cibolo Creek and its contributing waterways in the Bulverde area. A generalized illustration of the designated areas is shown in Figure 5-4. For identification of specific floodplain areas and elevations, consult the Flood Insurance Rate Maps prepared by the Federal Emergency Management Agency (FEMA). Management of areas within the designated floodplain areas is governed by regulations of FEMA and by the Flood Damage Prevention Ordinance of the City of Bulverde. The Mayor is the designated Floodplain Administrator.

The term *floodplain* means any and all land area adjoining the channel of a river, stream, lake, watercourse, marshy area, or other drainage element, which has been or may be inundated by storm water runoff. The extent of floodplain areas is determined by the crest of a base flood having an average frequency of occurrence equal to one percent in any given year. A flood of this magnitude may occur in any year, and equal or greater floods may reoccur during the same year or in multiple years in succession. Although sometimes called the 100-year floodplain, this does not mean the chance of flooding is once in a hundred years. The *floodway* is the portion of the channel of a river or other watercourse and the adjacent land areas that must be kept open in order to convey the base flood without cumulatively increasing the water surface elevation more than one foot. Fill and obstructions that would restrict the discharge of flood waters should not be placed within designated floodway areas.

Figure 5.4 Flood Plain and Drainage Basins in the Bulverde Area



Source: City of Bulverde.

A Drainage Policy

In accordance with the existing Subdivision Ordinance, the Hogan Plan recommended specific drainage improvements such as enlarging culverts or installing new culverts, pipes, drainage channels or other drainage structures. The plan noted that Lewis Creek has a drainage area of approximately 13,118 acres and the city should participate in any conferences or proposed programs for the "improvement" of the creek. Such improvements could include "widening and deepening of the channel."

While the Hogan study is a good start, at some point in the future the City of Bulverde should conduct a watershed management study to develop a full set of ordinances and support documents to implement a comprehensive stormwater management policy that integrates water quantity and quality management for the city and its extraterritorial jurisdiction (ETJ). Such a study should address:

- The benefits, drawbacks, design criteria and costs of drainage channel improvements to convey storm water runoff;
- Storage and retention of storm water where the conveyance approach is inadequate or not practical;
- Incorporating additional watershed management program and design requirements into the City's Subdivision Ordinance; and
- Revenue requirements for a watershed management program for existing and future facility maintenance.

The city's watershed management program should include techniques identified in the GBRA's Sustainable Solutions workshops held in the region in 2001 and 2002. These techniques address stormwater issues for areas experiencing rapid growth and are concerned with the potentially detrimental impact that this growth can have on water quality and quantity. The report's recommendations include:

- Conservation incentive program - a voluntary program to provide incentives to developers for reduction in impervious cover, natural pollutant removal processes and stream buffer systems.
- Water resource management coordination process to coordinate the activities of public and private water and waste water provision (local government entities, groundwater conservation districts, public and private water and wastewater utility providers and river authorities).
- Optional open space development design - an optional site development technique with a compact form of development that concentrates density on a portion of a site in exchange for reduced density elsewhere. The same number of homes can be built in a less land consumptive manner.

Drainage cannot continue to be managed in a "take it to the street and let it go" manner, especially in the Edwards aquifer region. Watersheds in the Bulverde area are facing development pressure which can exacerbate flood hazards. Watersheds must be managed and developed in an innovative manner to protect and preserve water resources, the natural environment, and recreational opportunities. Waterways and their associated watersheds in the Bulverde area represent significant and irreplaceable recreational and aesthetic resources and contribute directly to the

community's public health and welfare. A comprehensive means of handling stormwater drainage must be implemented, and should include minimization of runoff, infiltration, retention, detention, and channeling as a last resort. In the past stormwater management has focused on tax-supported public works, but today it is evolving towards on-site development ordinances and stormwater impact fees. The City of Bulverde, Comal and Kendall Counties, the Alamo Area Council of Governments (AACOG) and the City of San Antonio should coordinate regional watershed management and drainage improvements to see that adequate drainage is provided as new development occurs.

Adopting appropriate development rules and regulations for the purpose of protecting watersheds will ensure the minimization of storm water runoff and the installation of adequate drainage infrastructure where necessary. The development of elevated lands increases the runoff of stormwater and causes increased amounts of runoff to flow onto adjoining lands of lower elevation. The owner of elevated land has the responsibility to prevent increased runoff from doing damage to other downstream properties. This duty will be met more easily and with less cost if low-impact and/or conservation development is promoted.

Drainage Design Issues - Development Patterns, and Stormwater Quantity and Quality

Being in such a sensitive environmental area, Bulverde's drainage/stormwater strategy should include the elimination and/or reduction of pollutants within storm water runoff to limit the pollution that enters the Cibolo Creek and the Edwards aquifer. Water quality must be protected from non-point source pollution carried in urban runoff. This is especially important since the City of Bulverde lies within the Edwards aquifer contributing and recharge zones. All watersheds within the City's jurisdiction, and especially those with abrupt topography, sparse vegetation, and thin and easily disturbed soils, are potentially vulnerable to non-point source pollution and sedimentation resulting from construction activity.

Well-designed conservation/cluster developments and subdivision requirements for open space in traditional subdivisions can benefit the community in terms of storm water management. Open space provides more pervious cover for water infiltration. This helps reduce the amount of runoff leaving a property and thus decreases the chances that the new development can cause flooding problems "downstream." Although traditional subdivisions may be required to build culverts and other drainage structures, the issue of where the water goes must still be addressed. Natural areas in cluster developments can not only reduce the volume of runoff but also help clean the water during the infiltration process. Conservation developments require less grading that compacts soil and increases runoff even in areas where there is no construction or impervious cover. Road ditches in cluster developments are often grass swales instead of curb and gutter, allowing more infiltration and being less costly to the developer, and requiring less maintenance. Approaches which delay stormwater movement or which reduce its force maximize settling and deposition of particles. Natural pollutant removal processes occur in vegetated open spaces.

Filtration occurs as stormwater moves through surface vegetative layer and various soil layers. Some low-impact strategies include:

- Vegetated open channels should be used in the street ROW to convey and treat stormwater runoff.
- Provide stormwater treatment for parking lot runoff using bioretention areas, filter strips, and other practices that can be integrated into landscaping areas and traffic islands.
- Limit the amount of clearing and grading of wooded areas and natural vegetation by promoting conservation development.
- Create a variable width naturally vegetated stream buffer system along perennial streams that also encompasses critical environmental features such as the 100-year floodplain, steep slopes and wetlands.
- Buffer averaging will allow developers to narrow stream buffer width at some points providing flexibility in arranging the buffer system around existing house-lots. Density compensation can be offered to offset the loss of buildable land or house lots due to implementation of buffers.

Future land use assumptions will be needed to estimate the stormwater drainage runoff rates for the city, evaluate the performance of existing drainage improvements and recommend future drainage strategies and improvements. The city will need to evaluate the effects of a proposed development on downstream land. Future development (any construction of impervious cover, such as concrete, asphalt or rooftops) should have to be mitigated in some way, by either detention or other design alternatives.

5.3 Water Service

The Bulverde area is serviced by several water companies. Bexar Metropolitan Water Company (Bexar Met) provides water to Bulverde Hills and Oakland Estates; Diamond Water Company supplies water to Windmill Ranch and to Rim Rock Ranch northeast of Oak Village North. Other subdivisions are served by private centralized water systems. Shepherd's Ranch, Persimmon Hills, Bulverde Estates, Palmer Heights, Elm Valley, The Highlands, and Brand Ranch are served by individual private water wells.

The GBRA-Bulverde Service Area

The City of Bulverde holds the Certificate of Convenience and Necessity (Number 2001-0697-UCR) issued by the Texas Commission on Environmental Quality to serve the area. The City has contracted with the Guadalupe Blanco River Authority (GBRA) to build and maintain its future water system. As such GBRA will be the water purveyor for the city, providing and paying for infrastructure to be installed. The entire GBRA-Bulverde Service Area is within the GBRA's statutory boundaries, and the majority of the GBRA-Bulverde Service Area is within the San Antonio River Basin. The GBRA-Bulverde service area covers approximately 59,600 acres and will receive up to 1,700 acre-feet of treated water from the Western Canyon

Regional Water Supply System. The service area will be provided water by GBRA in conjunction with their commitment to provide water to the GBRA-Johnson Ranch Service Area (CCN No. 12977) in what is termed the Bulverde Lower East Service Area.

At a Comprehensive Plan Steering Committee meeting in July 2003, David Welsch of the GBRA led a discussion of present water conditions and future plans for the provision of water in the Bulverde area. He noted that there are several types of water for a municipality. There is a firm yield which is sustainable and can last through a drought of the severity of those in 1947 and 1957. The Canyon Reservoir, built in 1956 by the U.S. Army Corps of Engineers, is the only 'firm' water supply in the Guadalupe River basin and a truly sustainable source of surface water for the City of Bulverde. Trinity Aquifer wells are not. The GBRA has a water plant at Startz Hill and raw water in a tank located there. Water does not have to be pumped once it gets in that tank. Over time water will reach Ralph-Fair Road, bringing a firm water supply to the water short area. There will be 46 miles of pipelines constructed in phases depending on growth. The 30 inch regional main will be routed down Stahl Lane to the Johnson Ranch where GBRA will also be developing a wastewater treatment plant to service the future subdivision. The pipeline will then turn west and run along the existing utility easement through the City of Bulverde to Cordillera Ranch and on into Kendall County on the way to Fair Oaks Ranch and Boerne (see Figure 5.4). According to the GBRA Master Plan, the Johnson Ranch area is a good location for a tank that would serve the City of Bulverde, and that tank should be in place by March of 2005.

Homeowners will have to pay for distribution within an existing subdivision. This will be a major challenge for existing large-lot subdivisions. However, Cordillera Ranch was platted for central water systems instead of individual wells even though centralized water was not available at the time. This sound planning means the infrastructure is already in place awaiting the provision of surface water.

Projections

The 2050 population for the GBRA-Bulverde Service Area is projected to be 38,654 people with a water demand of 4,035 acre-feet per year. The Western Canyon Regional Water Supply System will provide 1,700 acre-feet of treated surface water, an amount that will meet the projected demand of the GBRA-Bulverde Service Area until the year 2030. Additional water after this period could come from development of the Trinity Aquifer, additional surface water supplies, or reclaimed water from a tertiary water treatment plant. Utilizing the Regional Water Plan data of 3.3788 people per connection the estimated connection count in 2050 is 8,071 connections. The water use per year per connection is estimated to be 162,925 gallons or 132 gallons per person per day. To reduce the per capita consumption, policies are needed to minimize water use. It should be pointed out that the GBRA's population projections are higher than those estimates in Table 1.5 in Chapter 1. The GBRA will be able to provide surface water under existing conditions for a population of no more than 23,945.

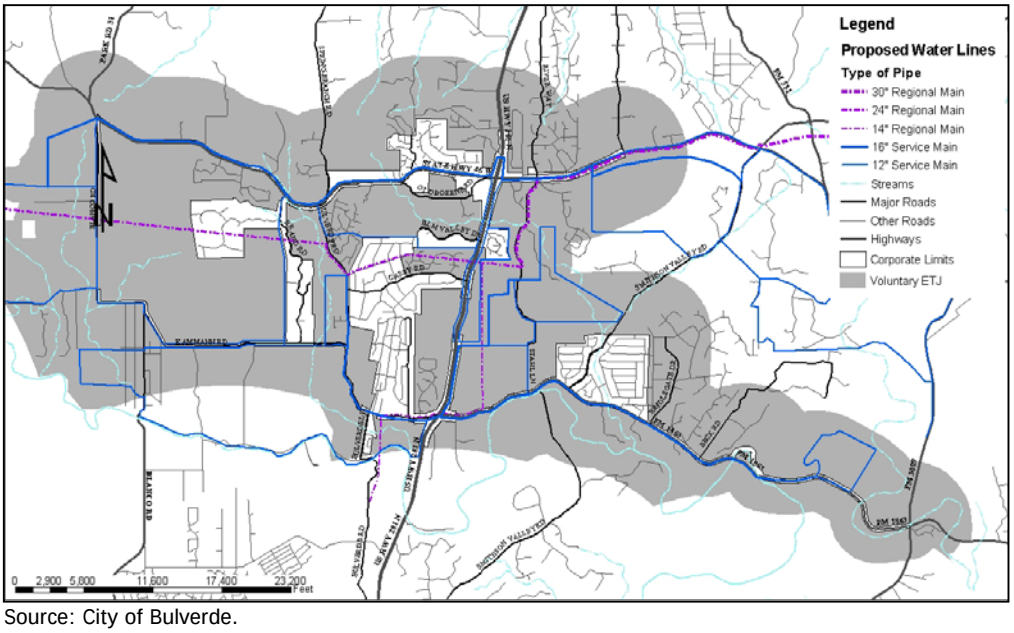
The GBRA desires the water distribution system for the GBRA-Bulverde Service Area to provide 24 hours of storage per connection, which equates to 446 gallons per connection compared to the TCEQ requirement of 300 gallons per connection. The system is designed to maintain a minimum pressure of 35 PSI at all points within the proposed distribution system at flow rates of at least 1.5 gallons per minute (GPM) per connection. The system is also designed to provide a minimum pressure of 20 PSI during fire fighting. Four delivery points and two service levels are being proposed to meet the minimum TECQ requirements. The four delivery points for the two service levels are referred to as:

- Bulverde Upper West Service Area
- Bulverde Upper East Service Area
- Bulverde Lower West Service Area, and
- Bulverde Lower East Service Area.

The west and east service areas are separated by U.S. Highway 281, and the upper and lower service areas are separated by the proposed area pressure zones of 1,500 feet and 1,325 feet. The Bulverde Lower East Service Level (where the Johnson Ranch is located) is anticipated to be the first area to develop, and thus the first elevated tank will be sited on property east of U.S. Highway 281 and adjacent to the western Canyon Region Water Supply Transmission Main.

No more than 24,000 acre feet can be diverted upstream from Canyon Lake per an agreement with Comal County. The GBRA has the rights to 16,000 acre feet of Canyon lake water, and there is not much left after Canyon Lake Water Supply takes

Figure 5.5. City of Bulverde/GBRA Water Supply Plan



Source: City of Bulverde.

Table 5.4. Future Water Demand in Acre/Feet for the GBRA-Bulverde Service Area

	2000	2010	2020	2030	2040	2050
Adjusted Demand (Acre feet)	2,230	2,486	2,871	3,918	5,052	6,265
Population	11,384	13,963	17,220	23,945	31,178	38,654
New Population		2,579	5,836	12,561	19,794	27,270
Connections		763	1,727	3,718	5,858	8,071
Upper Connections		496	1,123	2,417	3,808	5,246
Lower Connections		267	605	1,301	2,050	2,825

Source: the GBRA Master Plan Report "Guadalupe – Blanco River Authority's Water Distribution System for the GBRA – Bulverde Service Area (December, 2002)".

their allotment. Welsch expressed concern that we are converting more land to impervious cover, and this in turn causes rapid runoff which diminishes aquifer recharge and causes sedimentation. He also noted that individual wells are a problem and some tough questions will need to be answered. Who is monitoring these wells? Which ones are going dry? Where are we going to be hardest hit first? What will be the effects of Texas' archaic 'right-of-capture' groundwater law on future groundwater use, and how and when will this law be changed for the public benefit?

5.4 Wastewater and Sewer Service

Sewer service is addressed in Section 2.07 of the Bulverde Subdivision Ordinance. All subdivisions must be provided with adequate means for the "collection, treatment and disposal of wastewater in accordance with all applicable state and federal laws." Higher density developments must be served by a central sewage collection system and treatment works.

The Subdivision Ordinance should be revised and/or supplemented to address additional wastewater considerations. When reviewing plat approval for higher density development, consideration should be given to how that development could fit into a sewer/wastewater master plan. Similar to a transportation master plan, this would enable the city to require easements for sewerage infrastructure that could build towards an environmentally sound and economically efficient sewer system for the city that could be constructed in the future.

Additionally, in conservation development wastewater and septic management can take some innovative planning. Developers should be able to install group or cluster systems, most likely located in the common open space areas of such developments. This would require changes to the current thinking that each lot has its own system. Regardless, private septic systems in rural areas have always presented a challenge to communities since it is difficult to ensure proper wastewater treatment with these systems. The traditional practice has been to place a septic drain filed on an

individual homeowner's large lot. While this approach may still be proper in cluster design, some type of alternative layout or system will be required. Placing easements on the common open space can allow drain fields to be established in that area. As technologies improve, other alternatives such as mechanical systems, constructed wetlands, land application, or small community systems might be used.

Since septic systems are inevitable with large lot and some cluster developments, and since it is difficult to ensure proper wastewater treatment with these systems, the city should address the maintenance of them. An aggressive and ongoing educational program would alert homeowners to the maintenance requirements of their systems. The city could also investigate the possibility of a septic system maintenance utility district. State law may enable such an arrangement with the GBRA allowing a fee to be collected on a regular basis and resulting funds used for inspections of private systems and for pumping them out every three years. People naturally tend to forget things that are "out of sight/out of mind", but leaky or poorly maintained on-site disposal systems can cause serious health risks to the region's water supply especially since the City of Bulverde lies within the contributing and recharge zones of the Edwards aquifer.

Finally, the use of gray water systems should be encouraged. Using wastewater from washing machines, sinks, showers and tubs for irrigation purposes reduces demand for potable water and can lower the per capita use of the future surface water supply.

5.5 Water and Wastewater Extension Policy

In the future, water and wastewater services will either be extended by the city or by developers. The city extends water and wastewater mains to serve newly annexed areas and areas where new highways and streets are constructed. Developers should be required to extend oversized water and wastewater mains. For example, if a subdivision requires the extension of an 8" water main (typically the minimum requirement), but a water master plan calls for a 12" main to serve a larger area, the developer is required to install a 12" main. The developer may then enter an Oversize Reimbursement Agreement and receive reimbursement from the city for the cost of over-sizing the main (the cost difference between the 8" main and the 12" main). Such arrangements should be covered in a Capital Improvements Plan addressing infrastructure needs over a five year period.

In the future, the city should consider a mandatory connection policy. Any person who constructs a new building or develops property within ¾ mile of an existing city water or sanitary sewer main would be required to extend and connect to the city systems. This requirement applies whether or not the development is located within the city limits. The regulation would be the same whether the development is a new subdivision (as discussed above), a major commercial development or a single family residence. While such extensions may be feasible for a major development, the extension of 8" water and sewer mains up to ¾ mile for a single home site or small commercial site may be impractical, but sites could be designed for connections at a later date.

5.6 Private Utilities and Communications

Utilities and communication systems provided by private companies are another component of the City of Bulverde's infrastructure system. Through franchise agreements electric, natural gas, telephone, and cable television services are provided to the City of Bulverde residents through the following:

- Electricity - Most of the Bulverde/Spring Branch area receives power from Pedernales Electric Cooperative. The southern part of the area receives power from San Antonio's City Public Service.
- Natural Gas/Propane - None of the area is serviced by Natural Gas pipelines. There are numerous companies in the area that provide and deliver Propane.
- Telephone – Guadalupe Valley Telephone Company furnishes local and long distance telephone service and internet access to Bulverde area customers.
- Cable Television – Time-Warner.

Communications towers

Communications

Telecommunication services and technologies have become essential elements of our lives. Changes in telecommunications technology and an unprecedented proliferation of telecommunications providers have changed the traditional way of carrying out our everyday functions. Increased demand for wireless communication services has prompted providers to increase the number of transmission tower sites needed to provide coverage and calling capacity. The visual impact of such facilities can mar the scenic landscape of the Bulverde area. Like other communities located in scenic areas, the City needs to consider regulating telecommunication transmission sites by imposing co-location, setback and design restrictions for new facilities. At the same time, the city must be mindful of the significance of communications in planning for the city and in building a sound economy.

5.7 Utility Placement

Community appearance is important to the residents of the Bulverde area. In an effort to maintain and improve their appearance and image, many communities require all public and franchised utilities to be installed underground. The proliferation of utility poles and lines along public rights-of-way results in cluttered and unattractive transportation corridors. There are also safety considerations and service interruptions associated with major storm events such as flooding or high winds and tornadoes. The City of Bulverde should consider requiring all utilities to be underground within a new subdivision as well as along the perimeter of a

subdivision. Likewise, this issue should be considered when new collector and arterial streets are extended, or existing collectors and arterials are widened or reconstructed. Finally, wires and cables could be placed underground rather than replacing deteriorated utility poles.

5.8 Summary

Ability to maintain, improve and expand its infrastructure is vitally important to the City of Bulverde's future. Significant changes will take place as GBRA extends water mains into the area, and the future will present challenges requiring sound decision-making. In order to keep pace with the projected growth through the next twenty years, the city must find ways to simultaneously maintain the provision of a sound infrastructure while keeping taxes competitive. Innovative ways to do this have been addressed in this chapter. The use of low-impact and conservation development can minimize the need for expensive, engineered drainage structures. Rainwater capture and graywater systems should be encouraged to reduce water demand while providing water for irrigation purposes. These challenges clearly point to the need for proper long range planning, the need for changing and supplementing existing ordinances, and the use of Capital Improvements Programming.

5.9 Goals and Objectives

Goal 1: Promote a reliable source of **water** for future development and areas of town that can be economically retrofitted with pipelines.

Objective 1.1: Work with GBRA on a regular basis to facilitate the proposed pipeline down Stahl Lane.

Objective 1.2: Work with GBRA to plan for future expansions of water infrastructure to appropriate areas of the City.

Objective 1.2b: Work with other suppliers of water as necessary.

Objective 1.3: Consider establishing impact fees for water infrastructure.

Objective 1.4: Establish water conservation programs to include rain water collection systems.

Objective 1.5: Promote a tiered payment scale with lower per-gallon fees for the first five or ten thousand gallons used, and higher per-gallon fees for greater amounts used.

Objective 1.5b: Determine how best to use water distribution and availability as a growth management tool.

Objective 1.5c: Address homeland security issues as they relate to any water supplies for the City of Bulverde.

Goal 2: To protect the **environment**, promote the provision of central **sewerage** in appropriate areas.

Objective 2.1: Work with GBRA to facilitate the proposed sewerage facility at the Johnson Ranch.

Objective 2.1b: Work with any other entities that might potentially provide sewerage services in the Bulverde area.

Objective 2.2: Promote the installation of central sewerage in new, higher density developments. Determine who will participate, to what extent and at what costs. Determine what will be the changes in flood prone areas with more impervious cover.

Objective 2.3: Develop a sewerage master plan that must be adhered to in plat review.

Objective 2.3b: Begin the process of determining future location(s) of sewage treatment plant(s), lift stations, projected costs, operation and maintenance costs, projected customer service charges.

Objective 2.4: Begin the process of establishing impact fees for sewer infrastructure.

Objective 2.5: Develop a plan for the maintenance of aging septic systems in existing subdivisions.

Objective 2.5b: Develop a policy on what to do with abandoned septic systems.

Goal 3: Address **stormwater drainage** issues in both existing and future developments.

Objective 3.1: Correct existing drainage problems on a priority basis and within budget constraints.

Objective 3.2: Develop a Storm Drainage Master Plan.

Objective 3.3: Strictly enforce all drainage-related rules and regulations in new developments.

Objective 3.4: Investigate the possibility of promoting "low-impact" type development in the City's subdivision regulations.

Objective 3.4b: Promote use of pretreatment devices and other Best Management Practices to remove major contaminants from storm water before leaving the site.

Objective 3.5: Investigate whether it would be feasible to develop a drainage impact fee or similar funding for meeting infrastructure needs for new development.

Objective 3.5b: Determine the best way to delineate the flood plain; consider the use of GIS to project how the flood plain will change with increasing development.

Objective 3.5c: Develop plans for protection and enhancement of natural drainage channels and structures, i.e. (Cibolo Creek and its tributaries). Develop and/or strengthen erosion and sedimentation control standards for all construction and development.

Objective 3.5d: Regulate development within tributary watersheds that affect the 100-year flood plain to maintain the regulatory floodway and restrict filling and encroachment within the floodplain. Assure a close and positive working relationship with FEMA.

Goal 4: Maintain and improve the condition of existing city **streets** and ensure that future roads are built to lasting standards while preserving aesthetic integrity.

Objective 4.1: Establish a street inventory that includes condition, width and age, and update it on a regular basis.

Objective 4.2: Adopt a street maintenance policy that emphasizes quality repairs that last.

Objective 4.3: Ensure that subdivision standards require quality roads that minimize future maintenance.

Objective 4.4: Ensure that future roads and road improvements take into consideration the rural ambience of the Bulverde area and not just the rapid movement of vehicles.

Objective 4.5: Identify areas of conflict and plan for remedies. Inventory signage and determine additional needs.

Objective 4.6: Plan for a program to address road shoulder maintenance.

Goal 5: Encourage underground utilities.

Objective 5.1: Meet with utility providers (telephone, cable, etc.) to determine the issues involved with underground versus overhead wires/cables.

Objective 5.2: Consider revising the subdivision standards to require underground utilities within new developments.

Objective 5.3: Coordinate efforts to alleviate undue, unwanted upheavals of physical facilities that adversely affect citizens.

Goal 6: Coordinate future infrastructure improvements to ensure the most economical and effective provision and maintenance of infrastructure (water, sewer, drainage, streets, and communications).

Objective 6.1: Develop a Capital Improvements Program (CIP).

Objective 6.2: Use the CIP to encourage growth in areas appropriate to the proposed land use and density.

Objective 6.3: Coordinate the provision of all infrastructure facilities to best use their potential as growth-shapers and customer services.