moving into the future

By Russell K. Williams, Jr., Donna K. Fisher, Ph.D., and Cheryl Tatum

Gateway Regional Industrial Park in Bulloch County has quickly emerged as one of Georgia's fastest-growing industrial centers. Located three miles south of Statesboro, Georgia, on U.S. Highway 301, Gateway encompasses 953 acres and is just six miles from Interstate 16. The park is currently occupied by Wal-Mart's 2 million square foot distribution center which is located on a 164-acre site, Statesboro's Briggs & Stratton manufacturing facility and Viracon's glass fabrication facility. Growth in manufacturing and distribution has contributed to the increased demand for housing in the county.

Russell K. Williams, Jr., is director of expansion and colony operations, Delta Chi Fraternity, Inc. (russellkwilliams@yahoo.com)

Donna K. Fisher, Ph.D., is assistant professor, School of Economic Development, Georgia Southern University, Statesboro, GA. (dkfisher@georgiasouthern.edu)

Cheryl Tatum is an instructor, School of Accountancy, Georgia Southern University, Statesboro, GA. (ctatum@georgiasouthern.edu)

INTRODUCTION

Nelson & Lang (2007) suggest that the US will add the next 100 million people by the year 2037. This growth implies that 70 million additional housing units will be needed over the same period. Moreover, Nelson (2006) speculates that housing demand for detached houses on large lots will continue to decline. This article transforms these phenomenal growth numbers to the local level by looking at how a rural county in southeast Georgia might achieve sustainable growth in housing and population. Rural areas, without sewer service, rely on individual septic systems for wastewater disposal. In 2006, more than 59 percent of Bulloch County's 63,207 residents lived outside the incorporated areas, up from 51 percent in 2004 (Census, 2006). The county's population growth of 19.2 percent over the last decade (UGA, 2008) indicates a need to examine environmentally friendly alternatives to traditional septic systems. This article details the options being considered by Bulloch County in its attempt to adapt sustainable, smart growth policies.

Coastal Georgia, as one of the state's fastest growing regions in terms of population and economic growth, has experienced two major droughts over the last decade. New York City's Department of Environmental Protection Commissioner Joel Miele, Sr., P.E. indicates, "[a]s a sanitary engineer, I would not want to install a septic system in an area that may be dry in a drought, but have saturated soils during years of normal rainfall. That can only lead to improperly functioning septic systems, causing contamination of the environment, streams and reservoirs, as well as problems for the owner of the defective system down the road," (NYC DEP, 2001). Moreover, C. Ronald Carroll, professor of ecology at the University of Georgia, affirms that to promote sustainable growth means "saying no to new developments that depend on septic tanks," (Hoslinger, 2007).

Nevertheless, throughout the state of Georgia, rural areas rely on septic tanks to dispose of bodily waste for small commercial, industrial, and residential construction. Septic tanks act as the most conventional system when properties fall outside the service areas of municipal and private wastewater treatment facilities. However, anecdotal evidence suggests that perhaps up to 30 percent of septic systems fail annually, causing, in the worst case, degradation to groundwater (drinking water) supplies.

SOLUTIONS FOR WASTEWATER TREATMENT IN RAPID GROWTH AREAS

New rural construction, which falls outside the service areas of municipal wastewater treatment facilities, typically relies on septic systems for wastewater treatment. However, anecdotal evidence shows these systems to be less than reliable. In areas experiencing rapid growth, environmentally friendly alternatives need to be explored to ensure continued smart growth. This article focuses on the factors driving economic growth in Bulloch County, a fast growing rural area in southeast Georgia. Next, we compare two waste disposal systems that could substitute for traditional septic systems. When taking into account extreme potential environmental costs associated with septic systems, these smart growth alternative systems become a more attractive option.

Bulloch County is strategically located in rural southeast Georgia about 60 miles west of Savannah (see Figure 1). Employment has increased by 14.5 percent over the last decade, compared to the state's 13 percent increase during the same time period. Quality of life, proximity to major transportation venues (the GA Port in Savannah and interstate I-95), and southern charm enabled Bulloch County to attract a Wal-Mart distribution center (serving the entire east coast at the time of construction), Briggs and Stratton (engine manufacturer), and Viracon (tempered glass products manufacturer). Other strong industry sectors include retail trade, transportation and warehousing, health care, food service, and government. The largest employer, Georgia Southern University, is a public, regional university serving 58 of the 159 counties in the state.

The county experienced steady growth over the last several years. In fact, over the last decade, Bulloch County's population grew by 19.2 percent (UGA, 2008). Therefore, with 59 percent of its population living outside incorporated areas (Census, 2006), examining alternatives to the traditional septic systems is warranted if the county wishes to maintain continued sustainable, smart growth.

A variety of community wastewater sewage package units can serve as alternatives to the traditional septic tank system. These units replace the use of septic tanks, and in some cases provide water as well. Furthermore, these units can handle wastewater for larger communities or subdivisions. This article focuses on the factors driving growth in Bulloch county including: population, housing, commercial and industrial development, subdivision development, and future development projections. Next, we compare two waste disposal systems that could substitute for traditional septic systems. Only through smart growth that sustains the environment will the county continue to thrive and prosper.

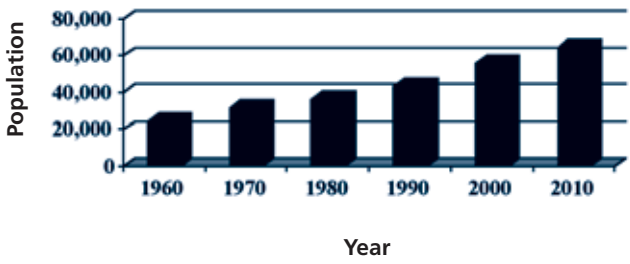
FIGURE 1. Bulloch County

Source: Bulloch County

GROWTH IN BULLOCH COUNTY

As shown in Figure 2, the population of Bulloch County more than doubled between 1960 and 2000 (Census Bureau, 2003). The population in 2006 topped 63,200, well on the way to the 2010 projected level of 64,275 (UGA, 2008). Population growth will continue to drive demand for new housing in the area.

FIGURE 2. Bulloch County Population Estimates



Source: Census Bureau & UGA

Nelson & Lang (2007) point out that a growing population precipitates an increase in the demand for housing. Between 1990 and 2000 permits for both single family dwellings and manufactured homes increased significantly, 24.8 percent and 59 percent respectively (BCBID, 2004). The proliferation of manufactured homes may be attributed in part to the enrollment growth of 16 percent at Georgia Southern University (BCBID, 2004; GSU, 2002; GSU, 2006) and also to the relative cost of manufactured homes compared to site-built homes. The housing permits examined encompass the unincorporated area of Bulloch County, which excludes the municipalities of Brooklet, Portal, Register, and Statesboro. Since 2000, manufactured housing has been declining, while site-built homes have steadily increased during this same period (BCBID, 2004). In 2006, 205 manufactured home permits were issued in the unincorporated areas of the county. Industrial growth since zoning adoption (1994) includes the Wal-Mart Distribution Center, Briggs and Stratton, and Viracon to name a few. These companies also contributed to the housing growth in the county.

When zoning commenced in 1994, 139 subdivisions and 117 mobile home parks existed in Bulloch County (BCBID, 2004). By 2006, these numbers rose to 233 subdivisions and 118 manufactured home parks. Manufactured home parks have not increased substantially, due in part to more stringent regulations for new parks. In addition, manufactured homes are going into subdivisions rather than in manufactured home parks, with over 50 subdivisions now allowing manufactured homes.

TABLE 1. Subdivision Lots and Acreage

Year	Number of Lots	Total Acres
1996	226	109
1997	36	14
1998	21	498
1999	185	944
2000	439	664
2001	340	886
2002	385	668
2003	200	2,587
2004	434	5,547
2005	975	2,768
2006	817	3,026
2007	990	2,279

Source: Bulloch County Tax Assessors

New subdivisions utilized over 2,000 acres in 2003, as shown in Table 1 (BCBID, 2004). This growth has continued during the last several years with over 5,500 acres utilized in 2004, 2,700 acres in 2005, 3,000 acres in 2006, and 2,200 acres in 2007 (Bulloch County Tax Assessors, 2007). Population growth projections indicate that subdivision growth will continue in the near term, even though it may not be as rapid as in the past three years. Therefore, the Bulloch County Zoning Department is studying alternatives which allow for continued growth, yet limit the number of acres being consumed by subdivisions. In some subdivision locations, lot sizes range between one to 10 acres. While smaller lot sizes would encourage development with less land, smaller lot sizes are restricted by current sewage disposal standards.

Zoning has not hindered growth in the county. Even during times of economic downturn, Bulloch County has continued to grow. Part of this growth may be attributed to the increased student enrollment. Part may be attributed to the commercial and industrial growth in the area. Whatever the reason, one thing is certain, with economic growth comes a need for additional housing. Much of this housing development falls outside of the incorporated areas in Bulloch County. In other words, new residential development must rely on waste disposal systems other than those provided by cities in the county. As Bulloch County continues its strong record of economic development, the demand for housing will also increase. Smart growth dictates that alternatives to traditional septic systems be adopted.

WASTE DISPOSAL SYSTEMS

Bulloch County's steady population growth brought about an increase in wells, small community water systems, and septic systems. Consequently, there is rising concern regarding the potential impacts of septic systems and contamination on the county water supply. Issues include septic system failure, inadequate septic system performance, environmental impacts, public health, and public safety.

Traditional Septic Tank Systems

A septic system is, simply put, a private sewage treatment plant receiving all wastewater from a household (De Cloet, 1995). Most are composed of a tank, a network of perforated pipes called the leaching bed or drainage field, and billions of microscopic organisms (Figure 3). The septic system itself has had very few technical improvements since its inception. The average life expectancy of a septic tank, under normal residential home use, is 20 years before the tank needs to be pumped out; however, this takes into consideration that no natural disasters or disruptions to the process of the system occur during the 20-year period.

The cost of a septic system for a single home differs due to numerous variables in a given region such as cost of supplies and labor, as well as the geology and topography of the specific location. The cost of a septic system for a three bedroom-two bathroom home in the Bulloch County area is $5,150 (Adams, 2004). This does not include social costs or externalities for environmental damage or oversized lots (due to septic tank regulations). In the worst case scenario considered here, environmental costs include the soil damage repair and a new septic system installation to correct the faulty system. Resulting is the extreme of soil repair plus installation of a new system for a total cost of $11,800. Soil repair generally refers to the reconstruction of drainage fields and elimination of contaminants from the soil. Ninety percent of septic system failures are due to malfunction of the soil in the drain field (www.septicseep.com).

In a subdivision with 200 homes, the installation cost is calculated by multiplying the per-unit cost by 200. While some economies of scale might be observed when purchasing in bulk, these would be offset by the storage costs of such a volume of materials. Soil conditions and technology determine the

FIGURE 3. Sample Septic Tank System

Source: www.septicseep.com

necessary lot size for an adequate septic drainage field and a safe distance from wells (DCA, 2008).

Over time, a septic tank accumulates solid material that must be removed. Moreover, raw sewage and potentially toxic chemicals will drain into the soil, contaminating wells, lakes, and streams. The environmental hazard affects property values as well. While septic systems do properly dispose of waste for a given amount of time, it has been demonstrated in many areas that over time these systems fail. If the tank is not properly maintained, ground and surface water sources become contaminated. As more septic systems are being placed into the ground, the chance of contaminated water increases (De Cloet, 1995). Table 2 describes Georgia communities with strict ordinances to ensure the proper maintenance of septic systems, and to minimize the adverse effects on the environment.

Bulloch County presently does not provide community water or sewer system services outside the incorporated areas. To date, private developers in the county take the lead in providing their own water and sewer systems to developments outside of current service districts.

Environmental factors and worst case scenarios affect the cost of replacing or repairing a septic system. Depending on the factors that may be affected such as well contamination, or dangerous impediments in the soil, the system may have to be moved to a different location. In the extreme, a new well will have to be drilled in another location. The Environmental Protection Agency (EPA) notes that between 10 and 30 percent of septic systems fail on an annual basis (EPA, 2004). Moreover, 50 percent of operational systems are over 30 years old. Sadly, most systems do not satisfy the EPA Clean Water Act requirements.

Bulloch County presently does not provide community water or sewer system services outside the incorporated areas. To date, private developers in the county take the lead in providing their own water and sewer systems to developments outside of current service districts. This has resulted in several residential areas with multiple septic systems within a small geographic area (Thomas & Hutton Engineering Co., 2004). Because much of the population utilizes ground water in this area of the state (Fisher, et al, 2003), it is imperative to minimize contaminated discharges into the ground. In order to support the population influx that resulted from continued economic growth in Bulloch County, smart growth alternatives to traditional septic systems must be considered. The following sections discuss two alternatives which minimize the adverse effects on the environment and thus foster sustainable growth.

Small Diameter Gravity Sewer System

A variety of community wastewater sewage package units exist. These units minimize the use of septic tanks and in some cases provide potable water.[1] More importantly, these units can maintain wastewater for larger communities or subdivisions. Figure 4 illustrates a Small Diameter Gravity Sewer System (SDGS) (EPA, 2000). Approximately 250 SDGS have been partially financed through the EPA, Construction Grants Programs. The cost of this system ranges in price depending on the site area, type of soil, number of consumers, and disposable area. The EPA (2000) estimates the system will cost $57.89 per foot.

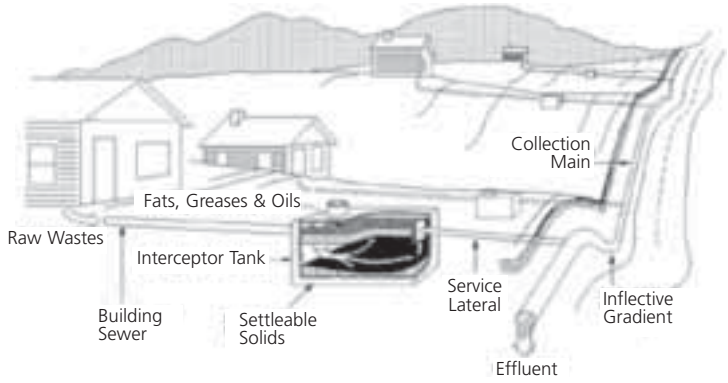
In the SDGS, a pipeline connects each dwelling to an interceptor tank, which catches all suspended solids, pushing these to the bottom of the tank. Fats, greases, and oils flow through the service lateral to the collection main. Unlike a septic system,

TABLE 2. Septic System Ordinances in Georgia

County	Requirement	Consequence
Douglas County	Pump septic tanks every 5 years	Disconnect water to houses along the county drinking water source river
Gwinnett	County provides information on septic system maintenance; has third party identify failing systems; tracks and catalogs septic systems	Not specified
Gwinnett—Berkley Lake	Inspection and service tanks every 5 years (lakefront homes)	$500 fine and 60 days in jail

Source: Georgia Department of Community Affairs

FIGURE 4. Small Diameter Gravity System



Source: EPA, Office of Water, 2000

in some cases water can be purified and redistributed to the homes if the treatment facilities are properly equipped. Otherwise the waste flows to a drip field. Minimal contamination transfers to the ground because sand filters break down the waste (EPA, 2000).

The SDGS allows for fast construction, making it attractive to developers, and unskilled personnel can operate and maintain the system. The system's appeal increases due to minimal manholes, lower excavation cost of digging trenches for pipelines, and reduced material cost because of the small pipelines and one treatment center versus many separate operating septic systems. The operation and maintenance requirements for the SDGS system are similar to the septic system. Disadvantages include limited experience with the system. Also, large commercial wastewater with high grit and large settleable solids levels cause the system to fill faster than it can break down the waste.

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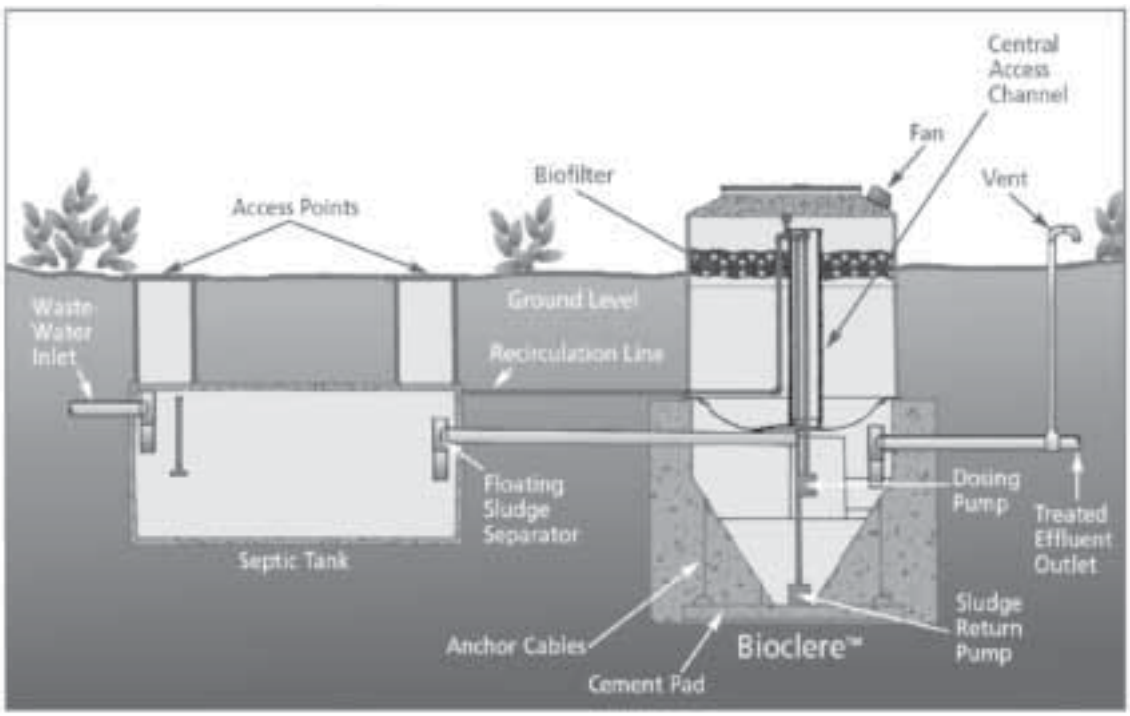
Port Royal Estates, an 80-home subdivision in Texas, installed this system after conventional septic systems failed due to infiltration problems. The cost per residence was roughly $3,500; however, the long term investment has paid off by alleviating the filtration problem (EPA, 2000). Georgia has one cluster type system located in Hall County (Harbour Point). Homeowners are responsible for installation and maintenance of their unit's septic tank and a wastewater filter. The community contracts with a private management company for monthly monitoring and maintenance for the communal drainage field (DCA, 2008).

The estimated cost of an SDGS for a 200-home community is $2,017,233 and the per-unit cost is $10,786, not including any potential EPA subsidies (McLendon Enterprises, 2004). The primary advantage of the SDGS over traditional septic systems is that only one drainage field is required per 80-200

FIGURE 5. Onsite Wastewater Treatment System



Source: Aquapoint Co., 2001

homes. This allows for smaller lot sizes, which appeals to developers. The size of the drainage field depends on the soil conditions and terrain.

Onsite Wastewater Treatment System

Another alternative to septic systems in residential areas is the onsite wastewater treatment (OWT) system. It is designed to handle commercial, residential, institutional, community, and light industrial wastewater. While this system functions quite differently than the SDGS, the distribution of waste is similar.

Figure 5 illustrates the system operations. Wastewater enters the septic tank from the pipelines within the community and separates floating sludge from solids. The waste is then transported to the central access channel of the OWT system where it is broken down by the biofilter. After the wastewater is purified, it can be pumped into a drip field (Aquapoint Company, 2001b).

FIGURE 6. OWT Community System

Source: Aquapoint Co.

This system is easy and relatively inexpensive to install and has a quiet treatment process. A potential disadvantage is the limited experience with long term use of the system. Furthermore, the high demand for these systems has resulted in a waiting list for installation (Aquapoint Company, 2001b).

The cost of the OWT system for a 200-home community is $2,107,233, with a per-unit cost of $10,536. Figure 6 illustrates the OWT system for a subdivision. The OWT system has been implemented in Piperton, TN (a suburb of Memphis), and at the US Naval Air Station, Guantanamo Bay, Cuba.

The increased demand for homes in small communities and lower density settings like rural Bulloch County make it costly to provide public sewer access. Available land suitable for conventional septic systems has become increasingly rare. Development in marginal soil forces the use of costly, land-intensive and often complex on-site systems which require additional management. At the same time, local governments and developers must pay for the total sewer costs, previously subsidized by the federal government (EPA, 2000). These decentralized wastewater systems described here fill the gap between central sewer systems and septic tanks, providing a means to develop in more restrictive environments and with more cost-effective systems that can be managed economically (Dix, 1998).

MANAGING RAPID GROWTH

The SDGS and OWT systems provide a way for Bulloch County to manage the rapid growth in unincorporated areas. These systems are typically located on land owned by the developer. If the developer provides the system, the housing density can be increased, thus allowing the costs to be spread across more lots; costs often passed directly on to the homeowners. Initially, costs of these systems seem very expensive to consumers; however, the overall benefits to society of a more environmentally friendly system must be taken into account. The benefits far exceed the drawbacks of developing one of these systems to eliminate the proliferation of septic systems in the area.

The SDGS and OWT systems provide a way for Bulloch County to manage the rapid growth in unincorporated areas. These systems are typically located on land owned by the developer.

Developers who install these systems can provide potential residents with assurance of appropriate water and wastewater capabilities. This replaces the cost to residents of having to install septic systems for each lot and potentially contaminating the area. The developer benefits because residents will be attracted to an area where they can quickly hook up to the inexpensive, alternative system. Other benefits of these alternatives include increasing development density and the ability to overcome soil-based limitations compared to issues associated with traditional septic systems (Dix, 1998). Overall, the OWT system enables sustainable population growth in areas like Bulloch County that have experienced strong economic development.

Table 3 compares the cost of each system. It is up to the developer to decide which system is best suited for their area. The alternatives are clearly the less expensive option. As stated previously, the life expectancy of each system varies from region to region. External factors include construction of the systems, soil types, weather conditions, mainte-

TABLE 3. Sewer Disposal System Comparative Analysis

	Septic System	SDGS	OWT
Cost Per Household	$11,800	$10,786	$10,536
Total (200)homes	$2,360,000	$2,017,233	$2,107,233

nance, skill of labor, technology, and research and development affect the cost and life expectancy of each system.

Where the evidence of maintenance and depreciation of the septic system is clear, no data exist on maintenance and depreciation of the SDGS or OWT system over a 50-year period. However, with the data available and what we currently know about the systems, the major cost and life spans of these systems directly relates to the specific type and quantity of sewage being pumped through the system. Septic systems, when including costs to recover from severe environmental damage to drinking water systems, are the more costly alternative. Moreover, the advantage of the other systems is that they allow for a more dense development because of smaller lot size requirements.

Statesboro's Wastewater Treatment Plant for incorporated areas, while 59 percent of the population must rely on alternative systems.

Growth in Bulloch County will continue for the foreseeable future. In order to maintain environmentally viable economic and population expansion, county planners, economic developers, and zoning officials must adopt smart growth alternatives which enable the most efficient, effective use of scarce resources – in this case land and water.

CONCLUSION

Schultz (2004) identified Bulloch County (Statesboro, the county seat specifically) as a rural area of sustained economic development. Growth in Bulloch County will continue for the foreseeable future. In order to maintain environmentally viable economic and population expansion, county planners, economic developers, and zoning officials must adopt smart growth alternatives which enable the most efficient, effective use of scarce resources – in this case land and water.

Septic systems require significant space (land) to ensure adequate drainage so as not to contaminate ground and surface water supplies. Yet even when the land constraint is satisfied, the potential environmental degradation caused by faulty and failing septic systems must be mitigated. One viable alternative is to transition into more ecological waste management systems.

If Bulloch County decides to use one of these alternate wastewater treatment systems, the growth in the rural areas will be supported with minimal environmental damage in the future. There is no doubt that using alternative wastewater systems will benefit the county, from a governmental, developer, environmental, and residential standpoint. No matter which alternative is chosen, Bulloch County will continue to grow.

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ENDNOTE

1. Analysis of the cost of providing drinking quality water is beyond the scope of this article.

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