10 - Infrastructure

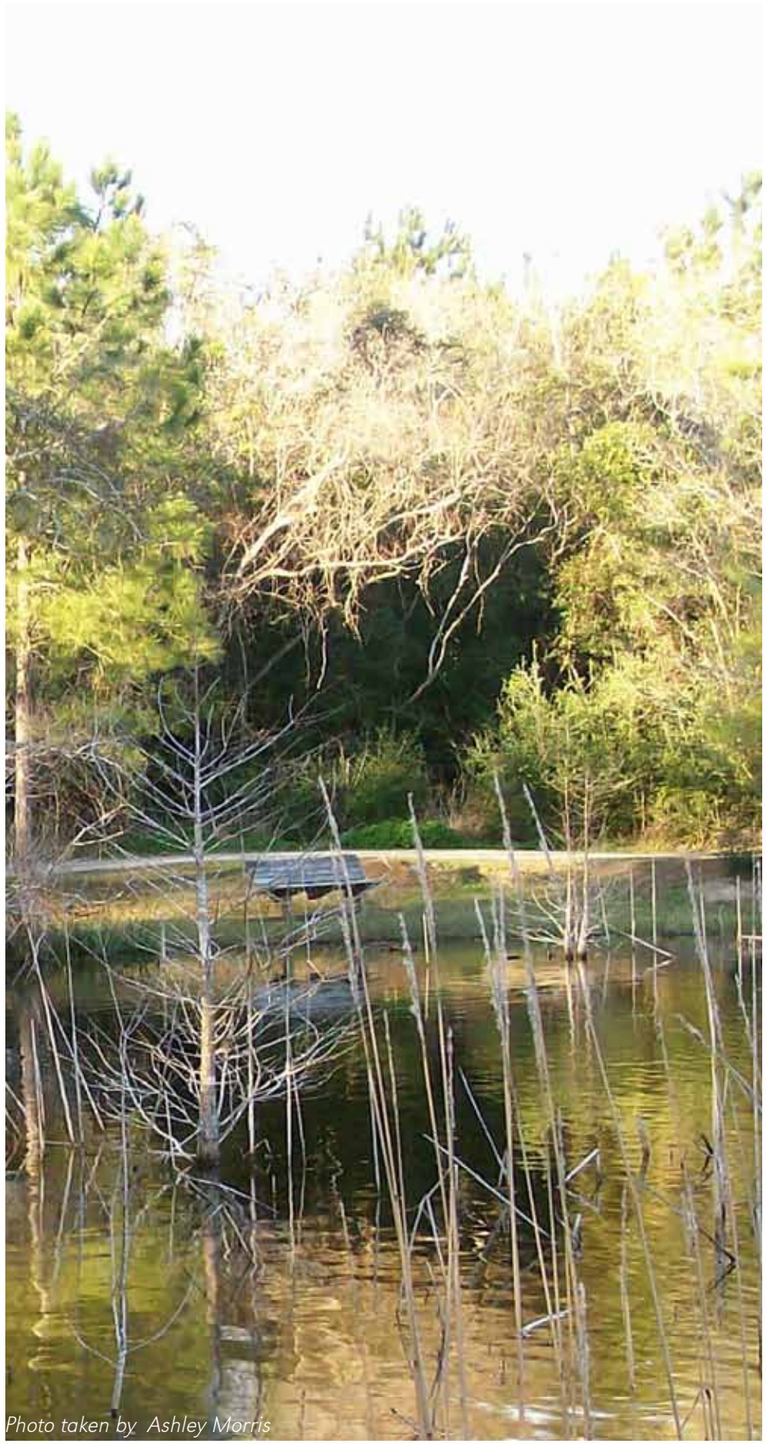


Photo taken by Ashley Morris

Infrastructure systems serve as the physical backbone of a community and provide households and businesses with the basic requirements to function on a daily basis. The City's infrastructure consists of several systems including transportation, communications, utilities, water, wastewater and drainage. Roadways and transportation are addressed in the Mobility Chapter and therefore this chapter focuses on water, wastewater and drainage systems. Master plans for all these elements have recently been completed or are in the process of being completed and their findings and assumptions are incorporated into this Comprehensive Plan. The preferred growth scenario and recommended development patterns in Chapter 5 - Land Use, balance accommodating growth with resource protection and promote the efficient use of infrastructure, water conservation and stormwater best management practices.

Water Supply

The success of a municipal water system is measured in terms of volume, pressure and quality. Sufficient water must be available to provide daily service during the thirsty summer season with sufficient reserves to fight a major fire event. Consistent pressure ensures that water flow is satisfactory to residents, but it also reduces strain on the delivery system and the opportunity for bacteria to form. Treatment of water prior to entering the system allows the water that residents drink to maintain a healthy and tasty quality.

The water that is daily used for drinking, showering and watering the yards of League City residences and businesses traces through a network of pipelines that ultimately draw from Lake Houston, and the Brazos and Trinity Rivers. Three wells located in League City serve as an additional, but limited, source of water. Treatment occurs at the Thomas Mackey Plant in Dickinson and Southeast Water Purification Plant in Houston. A series of three water towers provide a reserve that can be drawn when needed, particularly during peak demand and firefighting events. The natural pressure provided by the water towers, complemented by a series of pumps at strategic locations, ensures that water delivery is both adequate and regular.

While water quality and pressure in League City appear to be in good condition, water capacity is a growing concern. In fact, water supply is a major issue for the entire region. The Center for Houston's Future estimates that by the year 2060, the greater Houston region will exceed current water supply by 35 percent based on current usage rates *(Source: http://www.futurehouston.com)*. In League City, the average daily water consumption is 9.7 million gallons per day (MGD), with a peak of 18.5 MGD during peak summer periods. The current water supply is 21.5 MGD with an additional 5 MGD available with infrastructure improvements, for a total future capacity of 26.5 MGD. If current water consumption habits remain the norm, additional growth will constrain water resources and lead to shortages.

Put simply, League City will be unable to see substantial additional growth, let alone reach its full potential, unless additional water capacity becomes available. The Water Master Plan will recommend a strategy to procure additional water that may include traditional acquisition of rights to capacity or more innovative solutions such as desalination of brackish or saltwater.

At the same time, with respect to water, habits of residents, businesses and homeowners associations must change. Water is quickly becoming a scarce and expensive commodity, the City must become much smarter and more frugal with the water that is available, including increased water reuse and an aggressive approach to water conservation.

Water Conservation Plan

In November 2010, the City adopted a Water Conservation Plan in accordance with Texas Commission on Environmental Quality (TCEQ) guidelines and requirements. The plan addresses reducing water consumption and loss, efficient use of water, recycling and reuse of water and reducing the rate of growth in demand. The five and ten years goals of the plan are to reduce per capita municipal water use and water loss by five percent in five years and an additional five percent in ten years.

The Plan outlines the following strategies for water conservation:

- Decrease the amount of unaccounted water through replacement of water meters, water audits, continued maintenance of the water distribution system and leak detection and repair
- Increase public education and information on water conservation and reuse through the municipal channel, city web page, school programs, and public events
- Implement an increasing block rate water structure by 2012
- Implement landscape water management regulations including use of naturalized landscaping and rain water harvesting, discouraging water-intensive and poorly designed irrigation systems, and using Type I reclaimed water for irrigation of large public green spaces and amenity water features

Wastewater

Wastewater is the contaminated water that is discharged as part of daily activities from every household and business, including the water and solids associated with toilets, sinks, showers, dishwashers, washing machines and floor drains. Once discharged from a household or business wastewater is transported to one of two wastewater treatments plants in the City. These plants clean and purify the wastewater so it can be discharged safely back into the environment.

The wastewater system consists of a network of pipes that depend upon gravity to naturally move wastewater to one of the city's two wastewater treatment plants for treatment prior to discharge. Because of the city's nearly nonexistent slope, the system is assisted by a number of lift stations located strategically throughout the wastewater network. Success of the system is dependent upon well maintained pipes that are of sufficient size to support the anticipated amount of wastewater, as well as wastewater treatment stations with the capacity and technology to handle the anticipated volume of wastewater.

Recent improvements to treatment facilities has greatly expanded wastewater capacity in League City. The city has two wastewater treatment plants. The Dallas/Salmon Wastewater Treatment Plant currently serves the majority of the City with a recently increased capacity of 12 MGD. Countryside Wastewater Treatment Plant is a smaller plant on the northwest side that complements the Dallas/Salmon Wastewater Treatment Plant, however this plant will be closed with the opening of a new Southwest Wastewater Treatment Plant being built on the southwest side of the City. The Southwest Wastewater Treatment Plant, when fully operational, will provide sufficient capacity to process an additional 12 MGD of wastewater. Current average daily flow is 6.9 MGD.

The quality of wastewater service delivery may be most dependent upon maintenance of the system's infrastructure, particularly the network of pipes that draw wastewater to treatment facilities. Stormwater inflow and infiltration into the wastewater system (I&I) caused by cracks in pipelines and illegal stormwater connections by residents place an unnecessary burden on the system. Soils in the area make League City's system more susceptible to I&I issues as constant movement causes pipe breaks.

As noted in the Water Conservation Plan, water reuse will play an increasingly critical role in League City as the demand for water continues to expand. Water reuse has a particularly positive future in western League City where substantial land remains available for development. Wastewater reclamation requires treatment prior to release for reuse to ensure adequate removal of solids, bacteria and any additional contaminants. Application of reused water is largely dependent upon the level of treatment that is applied. Type II reclaimed water is generally suitable for evening irrigation use over areas such as commercial landscaping, golf courses or other areas that do not involve substantial human contact. The City is currently providing Type II reclaimed water to the 27 hole South Shore Harbour Country Club private golf course. Type I reclaimed water allows for expanded use, including daytime application that may involve limited human contact. Future application of reclaimed water in League City will most often require Type I treatment.

Neither Type I or Type II reclaimed water is suitable for drinking, however, other communities, such as El Paso have treated reclaimed water to the point that it can be added into the water delivery system.

Stormwater

League City's very low elevation and extremely limited slope result in a location that is slow to drain and, if not managed appropriately, prone to flooding. In natural areas, stormwater is either slowly absorbed into the soil or gradually moves toward the lowest points and channels before reaching ponds, low lying wetlands or waterways. In urban and suburban areas, a significant portion of the land surface is covered by buildings and pavement. When it rains these "impervious surfaces" do not allow water to soak into the ground. To accommodate the excess water, League City maintains a stormwater drainage network composed of local swales, drainage ditches and concrete storm drains that feed into larger storm outfalls. The majority feed into Clear Creek and Dickinson Bayou (or one of many tributaries such as Robinson's Gully or Magnolia Creek) before reaching the waters of Galveston Bay and the Gulf of Mexico. On-site detention ponds collect rainfall and gradually release it into the storm system to ensure that the location does not shed water at a rate or volume that could prove detrimental to surrounding areas. Nevertheless, during heavy rainfall events flooding often occurs in parts of the City due, at least in part, to location of development, the pattern of development and the approach to dealing with stormwater.

The existing system began as a means of moving water quickly and safely from developed areas. However, as an unintended consequence, the history of channelizing drainage eliminated or avoided the natural systems intended to "treat" stormwater prior to release into waterways. As a result, for decades storm water has carried sediment, grass clippings, trash, pesticides, fertilizer and other urban pollutants directly into the water system to the extent that both Clear Creek and Dickinson Bayou are classified as "impaired" by the Texas Commission on Environmental Quality.

Today, drainage has evolved into an elaborate effort intended to manage stormwater volume, speed and quality, including during major rain events and, to the extent possible, appropriate it for local use.

League City Master Drainage Plan

The City is currently preparing a Master Drainage Plan that recognizes drainage as a regional issue in which every change in development and drainage patterns can have a cascading positive or negative effect. The Master Drainage Plan takes a holistic and regional approach to stormwater management and includes best management practices including the preservation of native habitats and wetland and prairie creation. In addition to the Master Drainage Plan, League City has adopted Harris County Flood Control District's Policy Criteria and Procedure Manual. The manual regulates the planning, design and construction of all flood control facilities within the jurisdiction of the Harris County Flood Control District.

Dickinson Bayou Watershed Protection Plan.

The Dickinson Bayou Watershed Partnership has proposed the Dickinson Bayou Watershed Protection Plan as a tool for voluntary improvements to the watershed that includes Dickinson's Bayou, its tributaries and surrounding land that use these waterways for stormwater drainage. The Plan establishes a series of short term and long term goals for the watershed including:

Short term

- Preserve 1,000 acres of habitat in the watershed
- Complete an on-site sewage facility replacement study
- Install 150 stormwater best management practices at businesses and private residences
- Install and monitor three stormwater wetland demonstration projects
- Obtain 50 additional acres of urban parkland in the watershed
- Continue to monitor the water quality in Dickinson Bayou to gauge the effectiveness of Watershed Plan recommendations

Long Term

- Preserve 4,200 acres of habitat in the watershed
- Create and implement an on-site sewage facility remediation plan
- Treat runoff from 10,000 acres of developed land with on-site stormwater best management practices
- Treat all runoff from currently developed land with stormwater wetlands
- Obtain 750 additional acres of urban parkland in the watershed
- Continue to monitor the water quality in Dickinson Bayou to gauge the effectiveness of Watershed Plan recommendations

BIG Implementation Plan

The Bacteria Implementation Group (BIG), is preparing an implementation plan (I-Plan) to remedy high levels of bacteria in waterways in the Houston Region. Clear Creek is included in this project as its bacteria levels are higher than the State's standards for contact recreation. The I-Plan recommends best management practices designed to reduce the pollutants and restore the waterways to their designated use. Many of the implementation activities in this I-Plan are directed towards reducing bacteria loading from possible point and non-point sources. The sources of bacteria include wastewater treatment facilities, sanitary sewer systems, on-site sewage facilities, storm water runoff, illicit discharges, agriculture, livestock, wildlife, pets, sediment resuspension, and bacterial regrowth.

The Focus of the implementation activities include the following:

- Wastewater Treatment Facilities - Increase monitoring requirements, impose stricter bacteria limits than those designated by the state, require updates to facilities not able to comply with limits, and increase enforcement.
- Sanitary Sewer Systems - Require all systems to develop and implement a utility asset management program and to protect against power outages at lift stations.
- On-site Sewage Facilities - Address failing systems and inadequate maintenance.
- Storm Water and Land Development - Expand storm water quality programs, develop a recognition program, and petition TCEQ to facilitate reimbursement of bacteria reduction measures.
- Construction - Improve compliance and enforcement of existing storm water quality permits.
- Illicit Discharges and Dumping - Increase efforts to address direct and dryweather discharges, and better control waste hauler activities.
- Agriculture and Animal - Expand existing cost-share programs and the management of feral hog populations.
- Residential - Expand public education efforts.
- Monitoring and I-Plan Revisions - Maintain databases of ambient and non-ambient water quality monitoring data and implementation activities, review I-Plan progress, and update I-Plan.
- Research - Examine effectiveness of storm water activities, bacteria persistence and regrowth, and appropriate indicators for use in water quality monitoring.
- Geographic Priority Network - Consider recommended criteria when selecting geographic locations for projects.

Natural Water Quality

Water quality is impacted by point and nonpoint source pollution. Point source pollution can be traced to specific points of discharge from wastewater treatment plants or industrial sites. Nonpoint source pollution typically originates from rainfall that moves over the ground and picks up natural and human pollutants and then deposits them into lakes, rivers, wetlands and coastal waters.

Point source pollution is regulated through the National Pollutant Discharge Elimination System (NPDES) permit program. In order to meet the requirements of this program the City adopted an ordinance regulating storm water permits in July 2009. The ordinance regulates storm water runoff from new development and redevelopment, construction activities, and industrial and high risk facilities.

Non point source pollution has emerged as a major contributor to water quality problems. Stormwater runoff is harmful to the environment as it often carries pollutants such as oil, dirt, chemicals, and lawn fertilizers directly to streams and rivers. Additionally when runoff leaves the storm drains and empties into a stream, its excessive volume and power can damage streamside vegetation and aquatic habitat. To protect water quality, development should be designed and built to minimize increases in runoff through conservation of natural areas, cluster development, use of pervious surfaces and other best management practices.

Utilizing natural systems/processes and taking a comprehensive approach to managing water can help meet several of the community's goals including improved water quality, water conservation and flooding. Natural systems including wetlands, native habitat areas and waterways are often referred to as "green infrastructure". These natural systems are very important in managing stormwater and water quality along with built engineered solutions like curb and gutter. Managing stormwater occurs at the regional, community and site scale. Regional systems may include natural lands and waters, community scale elements include compact, mixed use development, urban forestry, reduction in impervious surfaces, and site solutions include trees, vegetation, porous pavement, green roofs, and rain barrels.

Goals & Policies

The following goals and policies provide direction in making land development decisions that encourage the efficient use of infrastructure and promote water conservation and reuse.

Goals:

- ❖ Coordinated expansion of infrastructure systems with future growth and development.
- ❖ Development patterns that recognize water as an asset and minimize maintenance and cost of infrastructure systems.
- ❖ Efficient use and development/redevelopment of land.
- ❖ Comprehensive approach to stormwater management and water quality protection that includes natural and built systems.
- ❖ Conservation and reuse of water.

Policies

General Policies

- Concurrency requirements are encouraged to ensure that development does not outpace the growth of infrastructure.
- All infrastructure should be considered a regional issue, including the possibility of shared systems for purposes of economies of scale, sustainability, emergency management and disaster recovery.
- Proactive development of strategic infrastructure improvements to spur growth in a desired, cost efficient, and responsible manner is preferable to major infrastructure improvements by the development community.
- Developers should compensate the city for their portion of improvements such as regional detention, that would otherwise be borne on-site or near-site by developers.
- Municipal Utility Districts should be discouraged as tools that accelerate improvements to infrastructure beyond responsible growth through the municipality.
- Development types and patterns should be encouraged that creatively reduce the amount of infrastructure to be maintained.
- Green technology and applications should be applied to new improvements and redevelopment projects at every appropriate opportunity.
- All infrastructure projects, particularly projects that alter the physical or visual composition of an area, should apply context sensitive solutions.

Wastewater Policies

- Reduction of inflow and infiltration (I&I) into the wastewater system should be viewed as a critical tool to reduce capacity and energy requirements, particularly during storm events.
- Septic systems should be strategically targeted for replacement with a tie into the municipal wastewater system.
- Type I water reclamation infrastructure should be required in any new development involving irrigation activities, retention pond management and any other activity in which it is appropriate. Application for personal home sites may be an option if designed appropriately.
- Wastewater conversion to drinking water should be considered as a creative and potentially necessary means of expanding the water supply needed for growth of the community.

Stormwater Policies

- Regional stormwater detention is preferable to numerous, disconnected and poorly maintained on-site detention ponds.
- Utilize large scale stormwater improvements as amenities, particularly for aesthetic or recreation purposes.
- Encourage on-site stormwater improvements to be creatively integrated into site design.
- Use stormwater wetlands at critical areas of the drainage system as a means of slowing and “scrubbing” stormwater prior to release into the region’s waterways.
- Rain gardens in parking areas should be promoted as an environmentally friendly and cost effective alternative to raised landscape improvements.
- Implement on-site best management practices such as green roofs, rain barrels, rain gardens, pervious pavement, and other creative techniques as a means of maintaining the first inch of rainfall during a rain event on site.
- Actively promote (and to the extent possible, require) the use of off-site storm water best management practices that positively impact the amount, speed and quality of storm water prior to its entrance into Clear Creek, Dickinson Bayou or their tributaries. Example BMP’s include bioswales, pervious pavement in all possible places, naturalized detention and retention basins at strategic locations, preservation or creation of stormwater wetlands, preservation and enhancement of the 100-year floodplain, naturalized drainage channels, use of tiered gabion blankets/baskets rather than concrete, and other creative techniques.

CASE STUDY - VILLAGE AT SPRINGBROOK FARMS, LEBANON COUNTY, PA

The Village at Springbrook Farms is a 249 unit residential community located on 59 acres in South Londonderry Township, PA. Prior to development the site had a gently rolling landscape that was used for soybeans and corn cultivation. The site was also shaped like a bowl with the northern side of the site draining into closed depressions, and the southern side draining into surface channels during storm events.

Londonderry Township recognizes problems associated with traditional methods of stormwater management like detention/retention basins that simply slow the discharge of water which can result in damaging the stream and delayed flooding. Therefore they require infiltration as the preferred method in addressing stormwater as part of their subdivision ordinance.

The Village at Springbrook Farms is a an example of how best management practices can be used to keep water on site and let it percolate into the ground instead of collecting it and pushing it down stream. The original plan for Springbrook Farms called for detention basins, however the developers and engineers worked together to create a stormwater management system that mimicked the existing regime of water sinking into the soil. The overall approach was to keep the stormwater as close to the source as possible, cleansing and recycling it with a variety of BMPs (Best Management Practices). Best Management Practices used in this development include, porous asphalt pavement with stone-filled recharge beds built underneath to purify runoff before enabling it to seep back into the ground, infiltration beds underneath non-porous driveways, rain gardens, vegetated swales, and other landscape features.

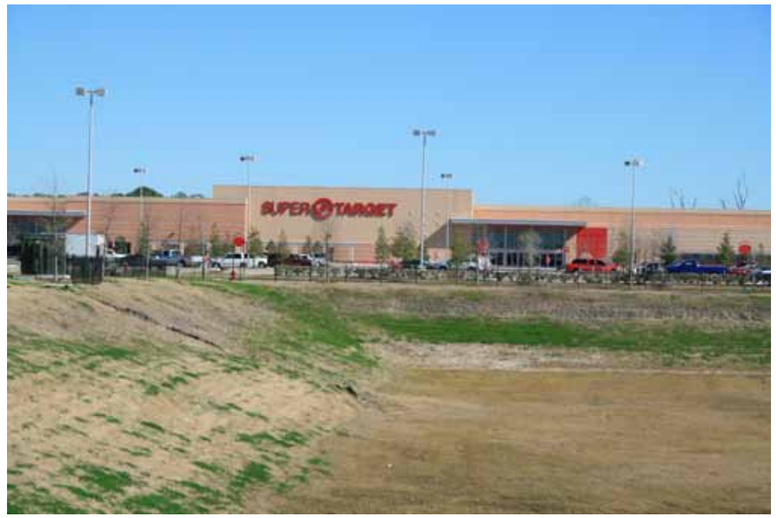
The end result is 100 percent infiltration for this community. More than 100 storage/infiltration BMPs were distributed throughout the site. Each was located and sized according to its drainage area, and accounts for both storage volume and the amount of surface area required to “spread out the water” to avoid over-concentrating infiltration. Overall, Springbrook’s stormwater management system treats pollutants, re-charges the groundwater, and maintains the water table, and provides flood control, while preventing destructive effects downstream.

Source: http://www.stormwaterpa.org/low-impact-development.html

- Individual sites or development projects should be restricted from negatively impacting adjacent property owners through poor storm drainage.
- Specific and cumulative impacts of development and redevelopment on natural drainage features should be fully considered during plan review.
- Storm water detention should count for a certain percentage of open space requirements if certain standards and criteria are met, including successful and creative integration into the landscape, consideration of surrounding context, and ability to positively impact storm water management.
- All capital improvements within League City should set the highest standard in efforts to incorporate best management practices in management of the amount, speed and quality of storm water, both during construction and during use. Projects under complete jurisdiction of a county or state agency should be strongly encouraged to follow the same standards.
- Capital improvements associated with improving storm water management during major storm events should be given strong consideration when selecting projects for incorporation into the Capital Improvements Program and in selecting projects for submission for nonlocal funding (including county, state and federal resources).
- Green infrastructure practices should be integrated into standard roadway construction and retrofit design including use of swales, vegetated islands, rain gardens, pervious pavement etc. Allow streets with green infrastructure to count towards stormwater requirements.
- Minimize impervious surface through reduced street widths, incorporating sunken landscaped islands in the middle of cul-de-sacs, clustering development, preservation of natural areas, reducing parking requirements, and using pavers or porous pavement in parking overflow areas.
- Allow and encourage stormwater reuse for irrigation and other outdoor activities.

Water Policies

- Water supply should, to the extent possible, include a diversity of sources to ensure that the community is not fully dependent upon a single source.
- Innovative sources of water, including desalination and water reclamation should be explored and implemented to the fullest use practical.
- Water storage opportunities should be increased throughout League City for use during peak periods and refill during off-peak periods.
- Promote private use of rain barrels and cisterns for rain capture and reuse, particularly for use with lawn and landscape care and other outdoor activities.
- New development should be required to install devices designed to reduce the amount of water used in a household or business, such as low-flush toilets.
- All new community facilities should incorporate water conservation amenities.
- Owners of existing structures should be strongly encouraged to install new equipment that more effectively uses water and in smaller quantities.
- Consideration should be given to rewarding water customers that reduce use of water, including rate reductions or other creative methods.
- Consideration should be given to providing grants to property owners for the purpose of installing water conservation measures including architectural improvements and site improvements.
- Personal wells should be strategically targeted for replacement with a tie into the municipal water system.



A detention basin is an area where excess stormwater is temporarily stored before slowly draining into the receiving channel.