INFRASTRUCTURE DATA AND ANALYSIS

STORMWATER MANAGEMENT

INTRODUCTION

The following is the Data and Analysis necessary to support the adopted Smart Charlotte 2050 Plan goals, objectives and policies.

This Stormwater Management section guides Charlotte County's existing stormwater management programs and provides a framework for future programs. Stormwater management is very important to the County because it controls surface runoff in the urban and rural environments to prevent flooding and water pollution. The development of land for human use through the construction of homes, structures, and other impervious surfaces tends to increase the volume and rate of runoff from storm events, and prevents water from seeping into the ground. The increase in stormwater runoff may result in flooding, soil erosion, and water pollution on a development site as well as downstream. A sound stormwater management program will reduce the damage caused to our environment from land development.

Stormwater management is the planned control of surface water runoff resulting from rainfall in order to prevent flooding and pollution. All development creates an impact to the overland flow of rain water, and this section provides direction for ensuring that development impacts are mitigated by stormwater management facilities. This section of the Infrastructure element establishes a goal for minimizing the flooding of lands and the degradation of water quality caused by storm events to ensure that the County's potable water is drinkable and that recreational water is usable for swimming, fishing, and other activities.

A number of factors influence stormwater management in Charlotte County. These include the topography of the County's drainage basins, the rate and location of development, the age and condition of existing stormwater management facilities, and Federal, State, and local regulations.

Charlotte County lies within two water management districts, the Southwest Florida Water Management District and the South Florida Water Management District. Both districts review stormwater management applications and issue permits for the construction of facilities within their jurisdiction. The Southwest Florida Water Management District's (SWFWMD) jurisdiction covers the majority of Charlotte County including all of the urbanized areas. The South Florida Water Management District's (SFWMD) area of jurisdiction is located in the southeastern portion of the County and includes relatively large and vacant tracts of land such as Babcock Ranch and the Telegraph-Cypress Swamp. While these lands are generally designated on the Future Land Use Map as Agricultural or Resource Conservation, the Babcock Ranch development

itself is intended to develop into an urbanized area with all of the potential stormwater management issues associated with such development.

In addition to the water management district permitting process, the County reviews subdivision plats and development proposals to ensure that development is approved and constructed in accordance with the standards established by the water management districts and the Comprehensive Plan.

Charlotte County developed a Master Stormwater Management Plan in 1996. It included the development and mapping of a drainage basin inventory, structural inventory and condition inspection, survey data, hydrologic and hydraulic analysis, prioritization and ranking of basins needing improvement, and a capital improvement plan. This management plan has been used to maintain, repair, and replace stormwater management facilities, and will continue to be used in the future to ensure that adequate stormwater management facilities are available.

The Supporting Policy and Analysis Map (SPAM) Series Map #71 identifies the 73 drainage basins in Charlotte County. This data is important as the County is responsible for maintaining drainage from surface water run-off and its potential impacts to the existing areas as well as the future development and residents. The County also has over 370 miles of man-made canals for a total area of 1,819,418.25 acres that drain into surface water bodies such as Charlotte Harbor, Lemon Bay, and Shell and Prairie Creeks.

According to the 2002 Southwest Florida Regional Policy Plan, prepared by the Southwest Florida Regional Planning Council (SWFRPC), the water quality of Charlotte Harbor is generally good. This plan identifies accelerated urban runoff as the predominant pollution problem, and non-point sources represent the highest percentages of pollution loadings.

The Stormwater Management Goals, Objectives, and Policies propose that Charlotte County will perform maintenance of existing stormwater facilities and construct new ones according to the County's Level of Service (LOS) standards. The County will also work towards meeting or exceeding the standards of the Federal government's National Pollutant Discharge Elimination System (NPDES). Minimum levels of service are established for new roadways and parking facilities, new construction, subdivision stormwater management facilities, and freshwater canals used for stormwater retention. Finally, in order to meet the concurrency requirement established by Rule 9J-5 of the *Florida Administrative Code* (F.A.C.), Charlotte County will not issue a certificate of occupancy until the necessary facilities are in place to mitigate the impact of development or there is an enforceable development agreement or a development order issued pursuant to the *Florida Statutes* (F.S.).

RELATIONSHIP TO 2050 PLAN

All terrestrial alteration creates impacts to stormwater runoff. The Comprehensive Plan must ensure that stormwater management impacts are reduced. This section, in conjunction with the others in the Comprehensive Plan, seeks to accomplish this.

The Stormwater Management section of the Infrastructure element is related to the Future Land Use element because development creates impervious surfaces and the density and intensity of land use is controlled by that element. It is also related to the Natural Resources element because of concerns pertaining to flooding and surface and groundwater quality issues. The section is tied to the Intergovernmental Coordination element as drainage basins generally extend beyond political boundaries and many agencies are involved in water management. Finally, stormwater management is a major consideration when constructing transportation systems and must be evaluated in this respect.

LEGISLATION

This section, as required by Rule 9J-5.011 (1) (h) *F.A.C.*, contains existing regulations and programs which govern land use and development of natural drainage features. The regulations and programs will be identified for their strengths and deficiencies in maintaining the functions of the natural drainage features.

FEDERAL

- **U.S. Public Law 92-500**, ***the "Federal Water Pollution Control Act,"*** commonly referred to as the "Clean Water Act," was amended in 1977 to cover stormwater runoff into the waters of the United States. In 1990, the Federal Environmental Protection Agency (EPA) issued regulations for implementation of the NPDES.
- **The "National Water Quality Inventory**, 1986 Report to Congress," provided a general assessment of water quality, based on biennial reports submitted by the states under Section 305(b) of the Clean Water Act. In the assessment, pollution from diffuse sources, such as runoff from agricultural and urban areas, is cited by the states as the leading cause of water quality impairment. Congress responded in 1987 by requiring that the EPA begin dealing with the stormwater runoff pollution problem. The Water Quality Act of 1987 required that the EPA issue or deny permits for industrial and certain municipal stormwater discharges. Permitting responsibility has since been transferred to the states. In Florida, the Department of Environmental Protection (DEP) has the responsibility of issuing permits.
- ***National Pollutant Discharge and Elimination System (NPDES).*** In 1987, the Federal Clean Water Act required the EPA to establish the NPDES and ensuing Municipal Separate Storm Sewer System (MS4) permitting programs. The EPA gave

the regulatory authority of the NPDES program in Florida to the Florida DEP. The program requires local governments to comply with certain conditions in order to obtain permits for existing and future stormwater management systems.

Receipt of a permit requires the preparation of an extensive baseline inventory of stormwater conveyances including ditches, paved channels and man-made canals that discharge into the waters of the United States. Stormwater outfalls must be mapped. Further, a water quality management plan is required that meets Federal standards. The County is also required to develop a comprehensive stormwater quality management program, demonstrate the legal authority to control the quality of stormwater runoff, and fund the implementation of the stormwater quality management programs. Charlotte County has obtained a Phase II MS4 NPDES Permit, and has entered into a five-year Phase II MS4 NPDES permitting cycle. The most recent permit renewal was in January of 2008.

An additional element of the NPDES Program affects local industry by requiring industries that have been identified by the EPA as significant contributors to the pollutant load of stormwater to obtain their own NPDES permit. Affected industries include landfills, recycling centers, sewage treatment facilities, many transportation-related industries, mining, drilling, and timbering operations, and many different types of manufacturing, from primary metals production to the manufacture of electronic equipment to the processing of foodstuffs. In short, nearly every industry that may produce a residue of dust or liquid that might be carried off by stormwater runoff is required to obtain an NPDES permit. An NPDES general construction permit is required for any construction projects that disturb one acre of land or more.

- ***Total Maximum Daily Load Program*** **(TMDL).** In 2006, the Clean Water Act was amended to include the Total Maximum Daily Load program. The law requires that states are required to develop lists of impaired waters, or waters for which technology-based regulations and other required controls are not stringent enough to meet the water quality standards set by states, and to establish priority rankings for waters on the lists and develop Total Maximum Daily Loads (TMDLs) for these waters. A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still safely meet water quality standards. In Florida, FDEP is the agency responsible for implementing the TMDL program, and the Department has adopted a five-year cycle that divides the State into five groups of surface water basins where different activities occur each year. This cycle is reiterated continuously to evaluate the success of the program. The five-year cycle of activities includes preliminary basin assessment, identification of pollutant-impaired waters, targeted water quality monitoring and data analysis, TMDL development and adoption, basin planning with local stakeholders to establish the actions necessary to reduce pollution, implementation through regulatory actions, funding, pollution and prevention strategies, and other measures.
- ***Charlotte Harbor National Estuary Program (CHNEP).*** In 1995, Charlotte Harbor was accepted into the National Estuary Program which is administered locally through the SWFRPC. The mission of the CHNEP is to assess the condition of Charlotte Harbor

and establish requirements and targets for preservation and restoration of its natural resources. These efforts culminated in the development of a Comprehensive Conservation and Management Plan (CCMP) and a financing plan for Charlotte Harbor, a blueprint that will prioritize actions and identify the means to complete them. In developing and implementing the plans, the CHNEP coordinates with the Surface Water Improvement and Management (SWIM) program of SWFWMD.

STATE

Florida Administrative Code:

- **Chapter 40D-2, *F.A.C.***, "Basis of Review," includes stormwater system design criteria, as well as technical and administrative information for applicants and permits.
- **Chapter 40D-4 and Chapter 40D-40, *F.A.C.***, "Management and Storage of Surface Waters (MSSW)," states that SWFWMD governs surface water permitting and stormwater runoff. The rule implements the comprehensive surface water management permit system authorized in the Florida Water Resources Act (373 *Florida Statutes*, Part IV), and 62-25, *F.A.C.* A surface water management permit under 40D-4 must be obtained prior to construction, alteration, abandonment or removal of any dam, impoundment, reservoir, appurtenant work or works. SWFWMD retains permitting authority for large projects (over 100 acres), and projects where wetland resource (dredge and fill) applications are required. The rule regulates new surface water management systems and alterations to existing surface water management systems that will have a significant impact on the water resources of the District, including wetlands and other natural resources. This rule specifically does not apply to the use of wetlands for stormwater treatment.
- **Chapter 40D-6, *F.A.C.***, "Works of the District Permit," states that a permit must be obtained prior to connecting with, placing construction across, discharging into or otherwise making use of works of the Southwest Florida Water Management District. The rule protects existing works, and works for which planning is underway (e.g., canals, water control structures, rights-of-way, lakes and streams) from actions which would impair their ability to function as intended. Chapter 40E-6, F.A.C. establishes similar permitting rules involving the works of the South Florida Water Management District.
- **Chapter 40D-8, *F.A.C.***, "Lake Levels Program," establishes guidelines (primarily in the floodplain) for development bordering lakes, conservation water storage, and recharge capabilities of lakes in the SWFWMD area. It also provides levels for operation of lake control structures and a means for providing information on district consumptive use permitting (CUP) activities. Chapter 40E-8, F.A.C. establishes similar rules for SFWMD.
- **Chapter 62N-16, *F.A.C.***, " Prohibition of Pollutant Discharges," covers the powers and duties of the DEP, as they relate to prohibition of pollutant discharges (as defined in 403.803(13) F.S.), and the removal of prohibited discharges.
- **Chapter 62-25, *F.A.C.***, "Regulations of Stormwater Discharge," provides minimum criteria for discharge into surface waters and groundwater of the State. The rule's basic

objective is to achieve the removal of 80 to 90 percent of all stormwater pollutants before discharging into receiving waters. The rule states that facilities must treat the runoff from the first one inch of rainfall, or as an option for projects with drainage areas less than 100 acres, facilities which provide retention, or detention with filtration, of the first one-half inch of runoff. The rule also emphasizes that "no discharge from a stormwater discharge facility shall cause or contribute to a violation of water quality standards in waters of the State" and continues by stating that erosion and sediment control "best management practices" shall be used as necessary during the construction to retain sediment on-site. Further, stormwater discharge facilities which receive stormwater from areas that are a potential source of oil and grease contamination shall include mechanisms suitable for preventing the contaminants from leaving the stormwater discharge facility in concentrations that would cause or contribute to violations of applicable water quality standards in the receiving water.

- **Chapter 62-3, *F.A.C.***, "Water Quality Standards," provides minimum criteria which govern stormwater drainage necessary to protect the designated uses of State waters. These regulations provide detailed criteria for both surface water and groundwater protection.
- **Chapter 62-302, *F.A.C.***, "State Surface Water Quality Standards," classifies surface waters into one of five different categories based upon the expected uses of each water body. Establishes minimum criteria for each surface water classification in order to protect public health and enhance the quality of waters of the State.
- **Chapter 62-312, F.A.C.**, "Dredge and Fill Activities," requires permits for dredge and fill activities in surface waters of the State. Requires permits for dredging and filling in, on, or over navigable waters. Provides for mitigation criteria and exemptions.
- **Chapter 62-340, *F.A.C.***, "Delineation of Wetlands and Surface Waters," provides the methodology for delineating wetlands and surface waters. Chapter 62-4, *F.A.C.*, "Permits," establishes DEP rules regarding permit standards (standards for issuing dredge and fill, stormwater, and water quality permits). Provides for the classification and exemption of certain water bodies for permitting purposes. Includes water quality standards. The rule also provides that permits cannot be issued for sewage facilities that directly discharge to an Outstanding Florida Water (OFW) and which would lower ambient water quality, or for discharges which would degrade a downstream OFW. In order to receive permits, discharges must be in accordance with DEP standards as set out in 62-600 *F.A.C.*
- **Chapter 62-40, *F.A.C.***, "State Water Policy," addresses many different aspects of water resource protection and management. The stormwater and surface water management components are critical to this topic of stormwater utilities and levels of service. The definition of "stormwater management system" covers aspects of the issues that are addressed in the County's level of service.

  "Stormwater management system" means a system which is designed and constructed or implemented to control stormwater, incorporating methods to collect, survey, store, absorb, inhibit, treat, use, or reuse stormwater to prevent or reduce

flooding, over-drainage, environmental degradation and water pollution, or otherwise affect the quantity and quality of discharges from the system. In 1990, the State Water Policy was revised to include policies relating to stormwater discharge rates, volume, and pollution loads discharged from a site.

- **Chapter 62-43, *F.A.C.***, "Surface Water Improvement and Management Act (SWIM)," establishes criteria for surface water priority lists, approval of priority ranking lists, review of plans for ranked water bodies, and the establishment of uniform and consistent water body management plans. The rule directs the Water Management Districts to "design and implement plans and programs for the improvement and management of surface waters." The program ranks water bodies of statewide and regional significance for preparation of action-oriented management plans. These plans serve as a guide to local governments and water management districts in protecting and restoring these water bodies through specific projects. Under this Act, SWFWMD has prioritized those surface waters most in need of environmental restoration, and is developing plans, along with the respective local governments, for their restoration.
- **Chapter 62-600, *F.A.C.***, "Grizzle-Figg Advanced Waste Treatment Act," is intended to protect Florida's coastal waters and estuaries by requiring that effluent discharged from waste treatment facilities into certain Florida waters be treated to advanced waste treatment (ATW) standards where deemed necessary by DEP. Establishes criteria for the discharge of wastewater to certain wetlands.
- **Chapter 62-620, *F.A.C.***, "Wastewater Facility Permitting," provides for permits for constructing, modifying, or operating a domestic or industrial wastewater facility or activity which discharges pollutants into waters of the State.
- **Chapter 62-625, *F.A.C.***, "Pollutant Pre-Treatment Requirements," provides the pre-treatment requirements for existing and new sources of pollution.

Florida Statutes:

- **Chapter 373, *Florida Statutes***, "Florida Water Resources Act (FWRA)," regulates the construction, alteration, maintenance, operation, and abandonment of dams, appurtenant works, impoundments, reservoirs, and works affecting waters of the State. The goal of the Act is to prevent harm to the water resources of the State. Provides for the permitting of various activities including management and storage of surface waters (Part IV) and consumptive uses of water (Part II). The Act creates Water Management Districts, who together with the DEP are the agencies responsible for implementing the regulatory components of the FWRA. The FWRA establishes minimum flow levels from surface water courses and minimum water levels for lakes and groundwater aquifers.
- **Chapter 380, *Florida Statutes***, "The Florida Environmental Land and Water Management Act of 1972," ensures a water management system that will reverse the deterioration of water quality and provide optimum utilization of our limited water resources. The chapter also facilitates orderly and well-planned development and protects the health, welfare, safety, and quality of life of the residents of the State.
- **Chapter 403, *Florida Statutes***, "Water Resources Act," provides the Department of

Environmental Protection with the authority to establish water quality guidelines and recognizes stormwater runoff as an important resource. The act also sets water pollution permitting conditions, establishes the National Pollution Discharge and Elimination System (NPDES) program, the Total Maximum Daily Load (TMDL) program, and allows the formation of stormwater management programs. In addition, the act gives the County the power to establish and administer a local pollution control program if it complies with this act.

Programs

- ***Surface Water Improvement and Management Plan (SWIM).*** The Surface Water Improvement and Management Act of 1987 (Chapter 373.451-373.4595 *Florida Statutes*) created the Surface Water Improvement and Management Trust Fund for the purpose of providing State-appropriated funds for the implementation of SWIM plans (373.459 *Florida Statutes*). Each individual water management district is required to make an annual request for funding of its SWIM plans. These requests may include funds for the purchase of lands and waters for the purpose of protecting surface waters, but may not be used for the planning, construction, or expansion of treatment facilities for domestic or industrial waste disposal.

  The Charlotte Harbor SWIM program was launched in 1992. The goal of the SWIM program is to protect the 270 square mile Charlotte Harbor estuary by preserving natural and functional components of the ecosystem while, if feasible, restoring degraded portions; preserving or restoring the quantity and quality of water necessary to support biological communities; educating the public to the benefits for conserving and preserving the harbor system; and developing and implementing management plans for each of the harbor's major tributaries.

  After analyzing historical data and water quality monitoring reports in order to determine the past and present conditions of the Harbor, the SWIM program works to identify water quality targets and pollutant load reduction goals. SWIM administrators are also developing a toxic substances database in order to determine current concentrations so that subsequent discharges can be reduced or eliminated through identification of the source.

  The SWIM study analyzed the impacts of the more than 400 linear miles of residential canals which lead to the harbor. In some locations, these canals transport sewage treatment effluent, stormwater runoff, and industrial, agricultural, and other discharges into the harbor. Finally, the program addresses enforcement and compliance monitoring procedures, and provides incentives to local governments for implementation.

  The SWIM program is important to the County stormwater management program because it may determine areas where stormwater runoff is polluting the harbor and which are in need of improved stormwater management. The water quality data obtained through the program may indicate the trouble spots as well as identify the types of pollutants that are affecting the harbor.

The SWIM program was prepared in conjunction with a Charlotte Harbor SWIM Advisory Committee, which included technical personnel from SWFWMD, SFWMD, FDEP, Florida Game and Fresh Water Fish Commission (FGFWFC), Southwest Florida Regional Planning Council (SWFRPC), Charlotte and Lee County governments, the City of Punta Gorda and other municipalities, the Charlotte County Extension Service, local environmental organizations, and private citizens concerned with the preservation, restoration, and protection of the estuary and its watershed. The SWIM Advisory Committee will continue to be used for purposes such as developing and assessing SWIM projects, reviewing progress, and preparing updates of the plan as the management program proceeds.

Funding for the SWIM program comes from the SWIM Trust Fund which distributes funding after approval of projects by the appropriate water management district, DEP, FGFWFC, and advisory committees associated with the SWIM program.

- ***Outstanding Florida Waters (OFW).*** The Outstanding Florida Waters program is administered by the Florida DEP. This program provides a special category of water bodies worthy of special protection because of their special attributes (Chapter 17-3.041(1) *F.A.C.*). Water bodies that occur within national parks, wildlife refuges, national preserves, as well as seashores, wild and scenic rivers, aquatic preserves, State parks and recreation areas, and national marine sanctuaries automatically receive OFW designation. The rules for an OFW are much stricter regarding the management of the water body, and state that permits cannot be issued for direct discharges which would degrade a downstream OFW. The rules also require that dredge and fill projects which are located within an OFW, or which significantly degrade an OFW, must be clearly in the public interest. Additional water quality protection is provided to an OFW with regard to stormwater discharge facilities, which must treat an additional 50 percent of the runoff from a site. In 1979 Gasparilla Sound, Charlotte Harbor, and Cape Haze were named OFW. Lemon Bay was named an OFW in 1988. This additional protection is necessary as the County continues to develop. Protection measures upstream from Charlotte County are also important. Efforts were made to declare Horse Creek, a tributary to Peace River and Charlotte Harbor, an OFW in order to protect the Harbor from future problems due to permitted and proposed mining activities, but those efforts failed.
- ***Environmental Resource Permit (ERP).*** The ERP combines DEP's wetland resource permit with the Water Management Districts' Surface Water Management Permits (SWMPs). It consolidates review of existing dredge and fill, stormwater management and sovereign lands permits, and is generally issued through the water management districts. It will involve the consolidation of parts of Chapter 403, *F.S.* currently implemented by the SWFWMD and DEP under Chapter 373, *F.S.*
- ***Florida Department of Environmental Protection (DEP) Surface Water Sampling Program.*** The DEP operates a local surface water sampling program in Charlotte County to maintain public health and safety. The program collects results from samples of water at various locations to determine water quality. Stations are located on the Elkcam Waterway, Pellam Waterway, West Springlake Waterway, Sunrise Waterway,

Peace River, and several locations on Charlotte Harbor. The program has been in operation since 1990 and the results are logged into the DEP's STORET Data System, which allows the data to be shared with other agencies. The data gathered from this program are useful in determining surface water quality and is used as a method to gauge the amount of pollutants a water body receives and when. It is a tool in determining the success of surface water management programs.

- ***Community Development Block Grants.*** Community Development Block Grants (CDBG) are grant monies available from the Federal government through the State for specific purposes. In the past, CDBG-funded projects involving stormwater management have included re-engineering piped drainage outfalls. Further project funding applications have been made, but competition for the funds is strong, and the requirements are strict. To date, no further CDBG funds have been awarded for stormwater management projects.

LOCAL

- ***Charlotte County Stormwater Management Ordinance #89-37.*** The Charlotte County Stormwater Management Ordinance was established in order to protect, maintain and enhance the immediate and long term health, safety, and general welfare of the citizens of Charlotte County. The Stormwater Management Ordinance establishes Stormwater Management and Conservation Flood Plan approval as a prerequisite to beginning any development activity. The ordinance also sets the content, performance standards, and design standards required of stormwater plans.
- ***Charlotte County Master Stormwater Management Plan (MSMP).*** As previously stated, Charlotte County has 73 drainage basins and over 370 miles of man-made canals that drain into surface water bodies such as Charlotte Harbor, Lemon Bay, and Shell and Prairie Creeks. The Charlotte County Master Stormwater Management Plan (MSMP) assists the Stormwater Division in managing the County's drainage basins and how lands within them are affected by rainfall events of varying magnitudes.
- ***Stormwater Permits and Development Review.*** In cooperation with the water management districts, the County's Building Construction Services Department reviews stormwater permits as a part of the building permit application process. Stormwater applications are reviewed for compliance with the County's stormwater management ordinance, #89-37. The County requires, among other things, that stormwater plans describe contributing drainage areas and the direction, rate, and volume of stormwater flows.

  The water quality element requires retention of the "first flush" of rainfall runoff which contains the highest quantity of pollutants. The required volume of the first flush can vary depending on the system that is designed to treat that water. That variable volume is typically either one-half inch, one inch, or one-and-one-half inches. Water quality retention volumes are usually calculated separately from water quantity retention volumes. Typical treatment systems for water quality include, but are not limited to,

effluent filtration, wet detention, exfiltration, and retention with natural percolation. The additional water arising from impervious areas is known as the *excess runoff*. In determining excess runoff, calculations must be provided for the storm event being analyzed. This analysis will determine pre-development runoff rates for flows associated with the 25-year, 24-hour storm event, and post-development runoff rate or the runoff rate which may be limited through an MSMP or project of regional impact. The reason for limiting the runoff rate to the pre-development rate is to assure that the downstream receiving system is not overloaded by runoff generated from new development. There is one exception to limiting the runoff to the pre-development rate: If the development's discharge is draining to unrestricted, tidally- influenced water bodies, the post-development runoff rate is permittable and, therefore, quantity is not an issue.

The Building Construction Services Department also reviews stormwater management plans for preliminary and final subdivision plat applications. For preliminary plats, County personnel forward recommended changes and comments to the applicant, the Planning and Zoning Board, and the Board of County Commissioners. For final plats, any additional comments and recommendations are forwarded to the applicant and the Board of County Commissioners.

EXISTING CONDITIONS

LEVEL OF SERVICE

Level of service (LOS) standards are important tools for evaluating the performance of storm and surface water management systems and for prioritizing capital improvement needs. Stormwater LOS standards are the primary method for ensuring that new development will provide adequate stormwater facility capacity to handle runoff from the development, and to prevent adverse impacts to water resources and private property. Regulatory programs are tied to LOS requirements to ensure maintenance of the level of service through mitigation of development impacts.

The minimum LOS standards have been met by all new development, both public and private, since the first adoption of the standards in the 1988 Comprehensive Plan. On-site stormwater management facilities are a requirement for many development projects in Charlotte County, including all commercial, industrial, and multi-family residential development. Exceptions to the on-site stormwater management requirements generally only include individual single-family residences, duplexes, triplexes, and accessory uses for those residences. A development may also be exempt if the County Engineer deems its impact "insignificant."

The LOS standards have two major components: quality of discharge and quantity of discharge. Both of these components must be considered to develop a well-rounded storm and surface water management program.

Quality of Discharge

Stormwater quality is monitored through the Total Maximum Daily Load (TMDL) program, which is operated by FDEP. The TMDL program requires states to develop lists of impaired waters, or waters for which technology-based regulations and other required controls are not stringent enough to meet the water quality standards set by states and to establish priority rankings for waters on the lists and develop TMDLs for these waters. A TMDL is a calculation of the maximum amount of a pollutant allowed to enter a water body (also known as the loading capacity), so that the water body will meet and continue to meet water quality standards for that particular pollutant. The TMDL allocates that load to point sources (Wasteload Allocation or WLA) and non-point sources (Load Allocation or LA) which include both anthropogenic and natural background sources of the pollutant. In many cases, the TMDL analysis is the trigger for determining the source(s) of pollutants.

Charlotte County has 49 water bodies that have been determined to be impaired waterways. Most of these are located in the central part of the County and flow directly in to Charlotte Harbor, or into the Myakka River or Peace River. These impaired waterbodies are indicated on SPAM Map Series #72 and are also shown, along with the pollutants to be addressed, in Table SWM-1. High priority waterbodies are intended to be addressed within five years, Medium priority within five to ten years as resources allow, and Low priority within 10 years.

Table SWM-1: Impaired Water Bodies in Charlotte County

Water Body Name	ID	Water Body Type	Parameters Assessed	Concentration Causing Impairment	Priority for TMDL Development
Prairie Creek	1962	Stream	Dissolved Oxygen	>5.0 mg/L	High
Lemon Bay	1983A	Estuary	Fecal Coliform	>43 MPN/100 mL	Low
			Mercury (based on fish consumption advisory)	>0.3 mg/kg	High
Lemon Bay	1983B	Estuary	Mercury (based on fish consumption advisory)	>0.3 mg/kg	High
Myakka River	1991A	Estuary	Bacteria (in shellfish)	Exceeds Shellfish Evaluation & Assessment Section (SEAS) thresholds	Low
			Mercury (in fish tissue)	>0.3 mg/kg	High
Myakka River	1991B	Estuary	Bacteria (in shellfish)	Exceeds Shellfish Evaluation & Assessment Section (SEAS) thresholds	Low
			Mercury (in fish tissue)	>0.3 mg/kg	High
Lee Branch	2035	Stream	Fecal Coliform	>400 counts/100 mL	Low

Table SWM-1: Impaired Water Bodies in Charlotte County					
Water Body Name	**ID**	**Water Body Type**	**Parameters Assessed**	**Concentration Causing Impairment**	**Priority for TMDL Development**
Shell Creek Below Hendrickson Dam	2041A	Estuary	Mercury (in fish tissue)	>0.3 mg/kg	High
Apollo Waterway	2043	Estuary	Nutrients (Chlorophyll-a)	≤11 µg/L	Medium
Little Alligator Creek	2046	Estuary	Mercury (in fish tissue)	>0.3 mg/kg	High
Manchester Waterway	2047	Estuary	Nutrients (Chlorophyll-a)	≤11 µg/L	Medium
Sam Knight Creek	2048A	Estuary	Dissolved Oxygen	>4.0 mg/L	Medium
			Mercury (in fish tissue)	>0.3 mg/kg	High
			Nutrients (Chlorophyll-a)	≤11 µg/L	Medium
Huckaby Creek	2048B	Estuary	Nutrients (Chlorophyll-a)	≤11 µg/L	Medium
			Dissolved Oxygen	>4.0 mg/L	Medium
Flopbuck Creek	2048C	Estuary	Nutrients (Chlorophyll-a)	≤11 µg/L	Medium
Rock Creek	2052	Estuary	Mercury (in fish tissue)	>0.3 mg/kg	High
Trailer Park Canal	2053	Estuary	Nutrients (Chlorophyll-a)	≤11 µg/L	Medium
Myrtle Slough	2054	Estuary	Dissolved Oxygen	>4.0 mg/L	High
			Fecal Coliform	>400 counts/100 mL	High
			Iron	>0.3 mg/kg	Medium
			Mercury (in fish tissue)	>0.3 mg/kg	High
Tippecanoe Bay	2055	Estuary	Fecal Coliform	>43 MPN/100 mL	Low
			Mercury (in fish tissue)	>0.3 mg/kg	High
Peace River Estuary (Lower Segment)	2056A	Estuary	Iron	>0.3 mg/kg	Medium
			Nutrients (Chlorophyll-a)	≤11 µg/L	High
Middle Peace River Estuary (Middle Segment)	2056B	Estuary	Iron	>0.3 mg/kg	Medium
			Nutrients (Chlorophyll-a)	≤11 µg/L	High
Peace River Estuary (Upper Segment)	2056C	Estuary	Mercury (in fish tissue)	>0.3 mg/kg	High
Alligator Bay	2056D	Estuary	Mercury (in fish tissue)	>0.3 mg/kg	High
			Nutrients (Chlorophyll-a)	≤11 µg/L	Medium
Sunrise Waterways	2056E	Estuary	Nutrients (Chlorophyll-a)	≤11 µg/L	Medium

Table SWM-1: Impaired Water Bodies in Charlotte County					
Water Body Name	**ID**	**Water Body Type**	**Parameters Assessed**	**Concentration Causing Impairment**	**Priority for TMDL Development**
Cleveland Cemetery Ditch	2059	Estuary	Dissolved Oxygen	>4.0 mg/L	Medium
Myakka Cutoff	2060	Estuary	Mercury (in fish tissue)	>0.3 mg/kg	High
Direct Runoff to Stream	2061	Estuary	Iron	>0.3 mg/kg	Medium
			Mercury (in fish tissue)	>0.3 mg/kg	High
Direct Runoff to Bay	2064	Estuary	Mercury (in fish tissue)	>0.3 mg/kg	High
Charlotte Harbor (Upper Segment)	2065A	Estuary	Nutrients (Chlorophyll-a)	≤11 µg/L	Medium
Oyster Creek	2067	Estuary	Mercury (based on fish consumption advisory)	>0.3 mg/kg	High
Buck Creek	2068	Estuary	Mercury (based on fish consumption advisory)	>0.3 mg/kg	High
			Nutrients (Chlorophyll-a)	≤11 µg/L	Medium
Punta Gorda Isles Canal	2069	Estuary	Mercury (in fish tissue)	>0.3 mg/kg	High
			Nutrients (Chlorophyll-a)	≤11 µg/L	Medium
Punta Gorda Isles 2 Canal	2070	Estuary	Mercury (in fish tissue)	>0.3 mg/kg	High
North Prong Alligator Creek	2071	Stream	Fecal Coliform	>400 counts/100 mL	Low
Direct Runoff to Bay	2072	Estuary	Mercury (based on fish consumption advisory)	>0.3 mg/kg	High
Mangrove Point Canal	2073	Estuary	Mercury (based on fish consumption advisory)	>0.3 mg/kg	High
Alligator Creek	2074	Stream	Dissolved Solids	<500 mg/L monthly avg; 1,000 max	Medium
Manasota Key	2075A	Estuary	Mercury (based on fish consumption advisory)	>0.3 mg/kg	High
Barrier Island	2075B	Estuary	Mercury (based on fish consumption advisory)	>0.3 mg/kg	High
Barrier Island	2075C	Estuary	Mercury (based on fish consumption advisory)	>0.3 mg/kg	High
Barrier Island	2075D	Estuary	Mercury (based on fish consumption advisory)	>0.3 mg/kg	High
Lemon Creek	2076	Estuary	Mercury (based on fish consumption advisory)	>0.3 mg/kg	High
Coral Creek	2078A	Estuary	Mercury (based on fish consumption advisory)	>0.3 mg/kg	High
Coral Creek	2078B	Estuary	Dissolved Oxygen	>4.0 mg/L	High

Table SWM-1: Impaired Water Bodies in Charlotte County					
Water Body Name	**ID**	**Water Body Type**	**Parameters Assessed**	**Concentration Causing Impairment**	**Priority for TMDL Development**
(East Branch)			Mercury (based on fish consumption advisory)	>0.3 mg/kg	High
Gator Slough Canal	2082C	Stream	Dissolved Oxygen	>5.0 mg/L	Medium
			Nutrients (Historic Chlorophyll-a)	50% above historic Chl-a value 4.05 µg/L	
Direct Runoff to Bay	2087	Estuary	Mercury (based on fish consumption advisory)	>0.3 mg/kg	High
Direct Runoff to Bay	2090	Estuary	Mercury (based on fish consumption advisory)	>0.3 mg/kg	High
Cypress Creek	3235C	Stream	Fecal Coliform	>400 counts/100 mL	Low
Jacks Branch	3235D	Stream	Fecal Coliform	>400 counts/100 mL	Low
Telegraph Creek	3236A	Stream	Fecal Coliform	>400 counts/100 mL	Low
Chapel Creek/Bayshore Creek	3240B1	Stream	Fecal Coliform	>400 counts/100 mL	Low

Source: Florida Department of Environmental Protection, 2009

Quantity of Discharge

Establishment of LOS standards for quantity of discharge must account for various magnitudes of storm events and acceptable levels of flooding. Roads shall be passable during flooding, meaning that the water depth at the outside edge of the pavement should not exceed six inches. Flooding at sites refers to standing water in agricultural land, developed open or green space (yards and parking lots, etc.) and undeveloped lands designated for future development. Charlotte County's LOS standards are shown in Table SWM-2.

Table SWM-2 Stormwater Quantity Level of Service and Design Criteria	
Flooding Reference (buildings, roads, and sites)	**Level of Service (flood intervals in years)**
Buildings	
Emergency Shelters and essential services	>100
Habitable	100
Employment /Service centers	100
Road Access	
Evacuation Corridors	>100
Arterials	100
Collectors	25

Table SWM-2 Stormwater Quantity Level of Service and Design Criteria	
Neighborhood	5
Sites	
Urban (>1 unit/acre)	5
Rural	2
Flow Ways	
Canals	100
Primary Drainage Ditches	25

Source: Charlotte County Public Works Department, Stormwater Management Division 2005

Using these LOS standards will allow all emergency structures to be operational during the 100-year storm. All other habitable buildings, whether residential, commercial, or public should be damage-free during the 100-year flood, with the water level below the first-floor elevation. According to FDOT, major evacuation routes should be passable during the 100-year flood. Arterial roadways should be flood-free in a 100-year event, and collector roadways (four-lane roads) should be flood-free during the 25-year flood, and residential streets and other two-lane roads should be passable during the five-year flood. Canals and open channels should carry the 25-year flood within their banks. Parking lots may have a maximum depth of nine inches during the five-year flood.

Drainage basins or canal networks that do not meet the Charlotte County LOS standards will be targeted for stormwater management improvement projects. In the Charlotte County MSMP, problem area rankings and alternative improvement projects are directly related to LOS goals. The prioritization of drainage basins is indicated on SPAM Series Map #73, and identified projects are shown on SPAM Series Map #74.

Impact of Facilities on Natural Resources

As Charlotte County continues to grow, the amount of impervious surfaces will continue to increase, which will increase the amount of stormwater runoff into surface waters such as creeks, lakes, and bays. Runoff often carries large volumes of litter, automobile wastes, animal wastes, fertilizers, and pesticides and as a result, water quality is often degraded in the transmitting and receiving waters. Stormwater runoff from urban and commercial areas typically contains significant quantities of the same general types of pollutants that are found in wastewaters and industrial discharges, including heavy metals, pesticides, herbicides, and synthetic organic compounds such as fuels, waste oils, solvents, lubricants, and grease. Surface water that receives runoff from agricultural areas often is subject to pollution associated with concentrations of fertilizers, pesticides, and animal wastes. These pollutants cause problems to both human health and the aquatic ecosystems supported by diverse receiving water bodies.

INVENTORY

This section, mandated by Rule 9J-5.010 (1) (e) *F.A.C.*, identifies operating responsibilities of stormwater management facilities, geographic service areas, predominant types of land uses, the design capacity of the stormwater management facilities, current demand, and the level of service provided by the facilities.

Rainfall and Stormwater

Hydrologic Cycle: The hydrologic cycle is the process by which water cycles from water vapor, to precipitation, to surface water, and then back to water vapor. It begins with the warming of surface waters from the sun, which causes evaporation, whereby water vapor rises into the atmosphere. Precipitation begins when evaporated moisture cools and condenses, forming clouds from which water droplets, ice, or snow fall back to earth. When precipitation reaches the ground, as a liquid, it can take one of three paths:

1. Running off the land and collecting in water bodies;
2. Infiltrating the soil to provide moisture to vegetation or percolating downward into the ground to recharge groundwater;
3. Evaporating into the atmosphere.

Water also returns to the atmosphere through transpiration as it passes through the leaves of grass, plants, and trees. The combined process of evaporation and transpiration is called *evapotranspiration*. About half of all precipitation that falls returns to the atmosphere through evapotranspiration, approximately twenty percent of precipitation percolates into groundwater, while about thirty percent runs off as overland flow into surface waters.

The development of land for buildings, parking lots, streets, and other impervious uses increases the amount of rainwater that runs off as overland flow and eventually flows into surface water bodies. Additionally, land development, or urbanization, removes vegetation and compacts the soil. Water no longer seeps into the ground at that location, and this increases the volume of water that moves overland resulting in flooding and soil erosion. As stormwater drains across impervious surfaces, especially streets and parking areas, it becomes more polluted by collecting petroleum wastes from automobiles, fertilizer, chemicals, and other waste products. Therefore, stormwater management programs are necessary to reduce the negative results of land development. Effective stormwater management programs require:

1. Development of a Master Stormwater Management Plan;
2. Enactment of regulatory control over development to satisfy the goals of the County's Master Stormwater Management Plan;
3. Implementation of non-structural and structural controls of stormwater;
4. Allocation of resources to design, construct, and maintain stormwater management facilities.

Rainfall Intensity-Duration-Frequency for Charlotte County: The volume of stormwater generated by a rainstorm depends upon the total amount of rainfall, minus that lost by infiltration, transpiration, evaporation, and surface storage. The amount of these losses is a function of climate, soils, geology, topography, vegetative cover, and land use within a watershed. Data on rainfall intensity and duration for Charlotte County are based on a storm frequency of 2, 5, 10, 50 and 100 years, as summarized in Table SWM-3.

These depths are commonly used parameters for analyzing stormwater management systems.

Table SWM-3 Rainfall Frequency and Precipitation Depth (in inches)

Frequency	Precipitation Depth
2 year	4.3-5.2"
5 year	5.5-6.7"
10 year	6.5-8.0"
25 year	7.8-9.2"
50 year	8.7-10.2"
100 year	9.7-11.8"

Source: Southwest Florida Water Management District

Drainage Features in Charlotte County

Within its approximately 832 square miles of surface area, Charlotte County includes roughly 129 square miles of inland surface waters, dominated by Charlotte Harbor. The Harbor is fed by the confluence of the Peace and Myakka rivers, which divide the County into three distinct geographic regions. Charlotte Harbor is the second largest estuary in Florida, and the floodplains associated with these major water bodies encompass much of the County's developed area since development historically has occurred in proximity to the coast and rivers. According to the "Southwest Florida Regional Planning Council's Report on Hurricane Evacuation Study 2001," Charlotte County's development of man-made canals and the general nature of the County's elevation has made it probably the most vulnerable County in all of Florida to the impacts from hurricanes and tropical storms.

In addition to concerns associated with landfalling storms, Charlotte County has many low lying, poorly draining areas (see Future Land Use Map (FLUM) Series Map #20) that are subject to periodic flooding which can result not only from tropical weather, but also from prolonged periods of heavy rains that may inundate the soils and overwhelm natural and man-made drainage systems. Regardless of the storm, Charlotte County is susceptible to flooding and for this reason the Stormwater Division exists.

Charlotte County's surface water generally drains to the nearest surface water feature. During rain events, stormwater is discharged into defined channels such as creeks and rivers, man-made canals, or by the slow movement of sheet or concentrated flows covering large areas of flat land. Flooding of lands in Charlotte County can result from two situations: Riverine-type

flooding which occurs when the canals, creeks, rivers, storm sewers, or ditches exceed the capacity which they were designed to receive; storm-surge flooding where high winds associated with tropical storms push on the ocean's surface and cause the water to pile up higher than the ordinary sea level. Both types of flooding must be dealt with by stormwater management.

Flooding and stormwater management issues are not analyzed according to political boundaries; rather, they are analyzed by drainage basin or watershed. Charlotte County's 73 drainage basins are based on topography and man-made drainage control features such as dams, dikes, roads, canals, ditches, and other structures. These contributing drainage areas are clarified in the MSMP. SPAM Series Map #71 identifies these basins. Each is important in the maintenance of the County's stormwater program as it relates to the flow of the stormwater for each basin as they drain into the watershed. SPAM Series Map #75 shows the County's watersheds.

Man-made Canals: There are over 370 miles of man-made canals in Charlotte County, all of which were constructed by channeling natural surface water features or excavating uplands (See SPAM Series Map #76). Many of these canals ultimately drain into Charlotte Harbor. The installation of drainage canals alters the hydrology of an area by inducing greater rates of surface runoff and sub-surface flow. Since the drainage canals typically link into natural creek and river systems, which in turn empty into the saltwater bays and Charlotte Harbor estuary, the rain falling within the County is transported more quickly to the Gulf than would be the case if there were no canals. As a consequence, the water table is lowered below natural levels and the estuary systems of the bays and harbor are impacted by changes in freshwater flows.

The 73 drainage basins have the following characteristics:

- Twenty-four estuarine water bodies are designated as Class II surface water bodies;
- Twenty-eight surface water bodies are designated as Outstanding Florida Waters (OFW);
- Twenty-one are located in the County's three State Aquatic Preserves;
- Surface waters designated as Class I waters are designated as potable water sources;
- Drainage basins do not follow the Urban Service Area boundaries

Lemon Bay Stormwater Management Area: The Cape Haze Peninsula is divided into twenty drainage basins. The topography of the surface ranges from sea level to fourteen feet along ridge lines. A study by SWFWMD indicated that the original topography and natural drainage patterns had been greatly altered by roads, land filling, man-made lakes, and dead-end canals. These developments, as well as some agricultural uses, contributed to the "wasteloading" of creeks and Lemon Bay, and flood control structures were affecting historic wet season nutrient-laden runoff. This study indicated that it would be difficult for future development of the creek

basins to be compatible with the natural topography and drainage patterns of the area. Lemon Bay was named an Aquatic Preserve by the State in 1986.

Charlotte County Drainage Districts: The Peace River, Myakka River, and Charlotte Harbor divide Charlotte County into three distinct geographic regions and add to the tidal influence during storm events. Three drainage districts, Central Charlotte, Bermont, and East Charlotte, were established to drain, reclaim and protect these typically wet areas, subject to overflow, from the effect of water in an effort to make the lands available for agricultural, settlement, urban, and subdivision. The districts are established for the purpose of paying the cost of administering the affairs of the district generally, and for the purpose of maintaining, operating, preserving, and rendering efficient ditches, canals, drains, dikes, levees, and other improvements.

Stormwater Runoff and Charlotte Harbor: Charlotte Harbor (including the waters around the Cape Haze peninsula and Gasparilla Sound) is designated as an aquatic preserve, a priority water body of the SWFWMD's SWIM program and is included in the National Estuary Program administered by the EPA. Charlotte Harbor is the second largest estuary in Florida and, in addition to being considered one of the State's most productive estuaries for commercial and recreational fishing, it provides habitat for more than 30 endangered species (Hammett, 1988). The 2002 *Southwest Florida Strategic Regional Policy Plan*, (SRPP) also identifies the Charlotte Harbor Estuary as one of Florida's largest bays. Fresh water is fed to the system from the north by the Myakka and Peace Rivers and from the east by several small coastal creeks and canals.

While the Harbor's shoreline is predominantly comprised of mangrove swamps, urban development occurs in some areas of the northernmost section of the Harbor at Port Charlotte and at the mouth of the Peace River at Punta Gorda, and along the southern basin boundary where large, upscale community developments are being developed. CHNEP credits rapid urban development for radically changing the character and ecology of river mouth and coastal waters. This urban development increases impervious surfaces which, in turn, increases both the speed and volume of runoff flowing over the ground. Flow velocity and volume increase significantly when the path is changed from rough surfaces such as woodland, grassland, or natural channels to smoother surfaces such as parking lots, diversions, storm sewers, gutters, and lined channels. The creation of large expanses of impervious surfaces also prohibits water storage in the soils they cover. The creation of impervious surfaces is really a two-fold problem since not only is stormwater volume and flow increased, but natural water storage capacity is lost.

Stormwater Management Systems: In order to minimize the detrimental effects of increased stormwater runoff created by development, stormwater management systems are implemented to channel, direct, collect, and otherwise divert stormwater runoff in ways that may prevent damage to structures, soils, crops, and other features. These systems can be either publicly or

privately owned, and may consist of culverts, swales, ditches, wet or dry detention ponds, weirs, and dams.

Charlotte County Master Stormwater Management Plan

The Charlotte County Master Stormwater Management Plan (MSMP) was prepared in 1996 to analyze the County's existing stormwater management system based upon potential stormwater loads. It is a tool for implementing and achieving the goals, objectives, and policies adopted in the Comprehensive Plan.

The MSMP was prepared in two phases. Phase I involved the development, mapping, and delineation of the drainage basins in Charlotte County, the ranking and prioritizing of the basins based on needs, and a pilot study. The pilot study affected two basins in western Charlotte County known as Oyster Creek and Direct to Myakka River, and was referred to as the Oyster Creek/Newgate Drainage Study. As a result of the pilot study, Charlotte County consulted with a technical contractor to perform a detailed hydrologic and hydraulic analysis of the Oyster Creek/Newgate Area. From this analysis, ten capitol projects for the purpose of improving stormwater management were recommended. Charlotte County has completed construction of these capitol projects.

Phase II involved the development of a hydrologic and hydraulic rainfall-runoff model, project selection criteria, and report preparation, and provided the County with a useful planning tool that could be implemented with diminishing permitting problems, and would be adaptable to the changing conditions of the County. The MSMP was designed for full buildout conditions, based on the existing Future Land Use Map in order for the study and model to be useful well into the future. The model assumes that every quarter-acre lot platted in 1997 (the time of its preparation) will be developed and the runoff in the model is based on the flow from these lots. This will ensure that the water control structures are sized for the future and will not need to be upsized later.

Phase II focused on the ten highest-priority basins as identified in Phase I (See SPAM Series Map #73). These high-priority basins included two in West County, five in Mid-County, and three in South County. Two of these ten were addressed in the pilot study, Oyster Creek and Newgate Area in West County. Of the remaining eight, three in Mid-County received detailed analysis: Pellam/Auburn Basin, Fordham/Niagara Basin, and Little Alligator Basin. The three basins in South County, North Fork Alligator Creek Basin, Broad Creek Basin, and Cleveland Cemetery Ditch Basin were determined to be less dependent on structural controls, conveying overland flow to primary drainage ditches, creeks, or rivers, and therefore any flooding associated within these basins was directly related to the need for a maintenance program. Maintenance of these primary drainage ditches in south Charlotte County can now be addressed and funded through the South Charlotte Stormwater Unit (MSBU).

The completed MSMP inventoried stormwater management facilities and their condition, utilized computer modeling to simulate stormwater effects resulting from rainfall events, prioritized drainage basins for analysis and improvement, addressed pollutant load and flood reduction techniques, made recommendations for capital improvements projects to address stormwater quantity and quality, and addressed funding for capital projects.

The detailed analysis of the three Mid-County basins identified 48 stormwater management structures requiring replacement. These are shown on SPAM Series Map #74. All of them were located within the Little Alligator and Fordham/Niagara basins. To date, 18 of the identified structures have been replaced, and another 20 are scheduled for the five year period between FY 2008-09 and FY 2012-13.

The Greater Port Charlotte Drainage Control Structure Replacement Project (GPC) includes 47 water control structures to be replaced. The water control structures being replaced within GPC are undersized and have exceeded their design life. The prioritization of the replacement of these structures has three levels. The first priority is the structures that are in danger of failing, and the County works to replace these before they fail. The second priority is to replace the structures furthest downstream and gradually work upstream, in order to see greater benefits sooner. The third priority is based on sensitivity to road closures and detours due to the construction. These water control structures often cross busy roadways within Greater Port Charlotte, they take several months to replace, and detours may become a burden to the local residents and other citizens. The County tries to lessen the burden on drivers and residents by not allowing a detour on the same road two years in a row. While GPC has specifically targeted projects in the Little Alligator and Niagara/Fordham basins, additional projects have been completed in the Pellam/Auburn Basin, the third prioritized Mid-County basin. These projects have primarily been completed in conjunction with roadway improvements, or through the efforts of private development to meet concurrency requirements.

The remaining 63 drainage basins in Charlotte County were identified in the original MSMP study as having lower priority due to the conditions of the stormwater management facilities within the basin, and were deemed to be not as likely to create adverse effects from stormwater runoff due to inadequate facilities. Additional analyses of these basins, and any projects that might be recommended, may be performed in the future based upon redevelopment and population growth.

Design Capacity of Roads: According to the Florida Department of Transportation (FDOT), major evacuation routes should be passable during the 100-year flood, meaning that there should be less than one foot of water at the crown of the roadway and the water should be flowing at less than eight feet per second. In Charlotte County, this criterion applies to I-75, US Route 17 and US 41 north of State Route 776, SR 31, SR 776, County Road 74, CR 769, CR 771, and CR 775. Arterial roadways should be flood-free in a 100-year rain event, meaning that water should not exceed the lowest pavement elevation. New or improved collector roadways

(four-lane roads) should be flood-free during the 25-year flood. Residential streets and other two-lane roads should be passable during the five-year flood, meaning that water should not exceed the elevation of the street's centerline. Parking lots may have a maximum depth of nine inches during the five-year flood. The amount of rainfall falling during these events is shown in Table SWM-1.

All new roads constructed in Charlotte County conform to these design standards. Older roadways may not meet them if they were built prior to their development and adoption. Any roadway that does not meet the adopted LOS standards, but is improved through widening or other reconstruction, would be reconstructed in such a way as to meet the adopted LOS, but not if the roadway was merely being resurfaced.

Stormwater Management Facilities in Charlotte County: This section, required by Rule 9J-5.011(1)(d) *F.A.C.*, identifies the operational responsibility of stormwater management facilities, geographic service area, and the design capacity of the facilities.

The Charlotte County Department of Public Works is responsible for constructing, maintaining, and inspecting the stormwater management infrastructure on County property, in public rights-of-way, and in drainage easements.

Charlotte County Facilities

Charlotte County falls under two water management districts, with approximately the western two-thirds of Charlotte County within the Southwest Florida Water Management District (SWFWMD) boundaries, and of the eastern one-third within the South Florida Water Management District (SFWMD). See SPAM Series Map #77. Since 1984, the construction or improvement of any stormwater management facility has required a permit from the appropriate Water Management District, and these permits require the owner of the facility, whether public or private, to operate, maintain, inspect and monitor that infrastructure. Upon completion of a permitted infrastructure improvement project, a Statement of Completion and surveyed as-built plans are required to be submitted to the appropriate Water Management District. Once approved, the project is transferred to operation phase. Infrastructure is then scheduled for regular inspections and monitoring (if required), usually every 18 or 24 months. If no maintenance is required as a result of the inspection, a Statement of Inspection for Proper Operation and Maintenance certified by a registered professional engineer is sent to the Water Management District.

The Charlotte County Public Works Department currently inspects 78 County-owned stormwater management facilities. These include weirs, culverts, wet and dry detention ponds, ditches, and swales, located in all areas of the County. The majority of the County's drainage swales in residential areas are shallow, between 6 and 24 inches deep, and vegetated with a minimum slope. County standards establish a maximum slope of four-to-one and a minimum gradient of 0.2%, but since many of the existing swales were constructed by private developers prior to the

adoption of any such standards, they may not all be compliant. Most of the County-owned stormwater management facilities are operated and maintained by the Public Works Department, but others are operated and maintained by the Community Services Department or by the Facilities Management Department. In addition to public facilities, numerous private stormwater management facilities are owned, operated, and maintained by private property owners for the reduction of stormwater flow off of their property that might be detrimental to the public at large.

***Service Area*:** Charlotte County established a stormwater utility in 1992 to perform stormwater management tasks. The utility is funded by special assessment districts in the form of Municipal Services Benefit Units in Mid-County, West County, and South and East County (See SPAM Series Map #78). The Infrastructure element is an integral component of Charlotte County's Smart Growth framework, which aims to prioritize the provision of infrastructure, including stormwater maintenance infrastructure, to certain areas within the County and further encourage new development to locate in those areas with infrastructure. The Smart Growth framework is more fully described in the Future Land Use element.

Population densities are expected to be higher in the Urban Service Area, and therefore stormwater management infrastructure should be delivered to those areas before the Rural Service Area. Other criteria, such as the protection of public health and safety, are also used to guide stormwater management provision within the County, but absent any emergency situations the Smart Growth framework defines prioritization.

SWFWMD Facilities

SWFWMD operates one water management structure in Charlotte County, a salinity barrier within Alligator Creek near Taylor Road in South County. This barrier prevents saltwater from flowing into freshwater canals. As tides rise, the gates on these structures operate automatically to prevent saltwater from moving upstream. During flood events, these gates can be opened to provide for more storage and conveyance capacity in the channels, although this does not always help since the force of tides can retard or even neutralize the channel flow during major events such as hurricanes.

FUTURE CONDITIONS

EXISTING CONDITION AND PROJECTED STORMWATER MANAGEMENT NEEDS:

This section, as required by Rule 9J-5.011 (1) (f) *F.A.C.*, identifies the existing condition, capacity analysis, projected needs, deterioration, problems of stormwater facility development, and expansion of stormwater management facilities.

General Condition

The MSMP emphasizes the replacement of deficient drainage elements. The continuing operation of the County's existing stormwater management system requires periodic maintenance to remove siltation, debris, and nuisance vegetation. Such maintenance requires access to and along canals, ponds, and lakes. But in many cases this access is not available, principally because much of the County's stormwater management system was constructed prior to the establishment of regulations requiring the provision of adequate easements. Some drainage ditches and canals have easements for the structure but not for maintenance access, making maintenance of these facilities difficult. In other cases there are no easements at all, making it impossible for the County to maintain the facility. Without maintenance, drainage conditions can deteriorate and flood hazards can increase.

Throughout the County there are also individual private stormwater management systems with lakes and drainage ways which serve only the on-site drainage requirements of specific developments, and are not considered part of the County-wide stormwater management system. Maintenance responsibility for these on-site private facilities lies with private entities. Monitoring to confirm that these private systems are adequately maintained is the responsibility of the private development for SWFWMD and SFWMD permit criteria.

Facility Capacity Analysis

As the population grows, the area covered by impervious surfaces will also increase, increasing stormwater runoff and surface water pollution. As the quantity of stormwater runoff and the public's desire for higher levels of service increases, the ability of current facilities to handle runoff will decrease. Stormwater management techniques, as described in this element, will be used to protect water quality and prevent flooding. One significant way in which the MSMP has accounted for this is through the development of the stormwater model used in Phase II. In this model, stormwater flow used to test the capacity of the existing stormwater maintenance infrastructure was assumed to be produced by the maximum level of development allowed under the Future Land Use Map as it existed at the creation of the model. All new or replacement structures will be built to accommodate this maximum flow, assuring that they will have adequate capacity to handle stormwater flow well into the future.

Deterioration and Maintenance of Public Stormwater Management Facilities

The Public Works Maintenance and Operations (M&O) Department is tasked with providing routine maintenance of the County's stormwater conveyance systems, stormwater management facilities, and stormwater infrastructure. The Public Works M&O Department receives service requests from residents who require routine maintenance of their stormwater roadside conveyance system (drainage swales). These requests are then inspected and scheduled accordingly.

Service life varies for major stormwater management control facilities. Mechanical and steel components have shorter operational lives than do concrete components of storm systems. Table SWM-4 identifies the estimated service life for stormwater management components.

Table SWM-4 Service Life for Stormwater Management Components

Component	Service Life
Collection systems (storm sewers, manholes, and concrete culverts) and Structures (pump stations and wells)	30 years
Equipment used in freshwater	20 years
Equipment used in brackish water	10 years
Auxiliary equipment, control facilities, pumps, and motors	10 years

Source: Charlotte County Stormwater Procedures Manual prepared by Carter-Burgess and CH2M Hill Fall 1994

Problems of Public Stormwater Management Facility Development

The development of stormwater management facilities in Charlotte County is relatively difficult and expensive due to engineering and real estate constraints. The designing and building of such facilities are generally contracted out to private engineering and construction firms. The primary concerns relating to stormwater management facilities mainly relate to capacity and design life.

Expansion & New Facility Siting

Expansion of stormwater facilities will be based upon those drainage basins that have the potential to improve stormwater management for the lowest levels of service for the greatest number of citizens. The goal of the MSMP maintenance is to improve the overall conveyance system. Stormwater management plans for all private development and for projects in the County's Capital Improvement Plan (CIP) are important elements to achieve the MSMP goals.

Low Impact Development and Green Infrastructure

A future aspect of stormwater management will be the use of low impact development (LID) design criteria and the integration of green infrastructure (that is, existing natural water features) into stormwater management facilities and programs. LID is a more environmentally sensitive approach to developing land and managing stormwater runoff, which aims to control stormwater close to the source and keep pollutants out of the stormwater stream by protecting native vegetation, reducing the amount of hard surfaces and compaction of the soil, treating stormwater runoff close to its source, and slowing the flow of runoff so that it is closer to pre-development flow rates.

The EPA defines low impact development in this way:

> "LID is a site design strategy with a goal of maintaining or replicating the pre-development hydrologic regime through the use of design techniques to create a functionally equivalent hydrologic landscape. Hydrologic functions of storage, infiltration, and ground water recharge, as well as the volume and frequency of discharges are maintained through the use of integrated and distributed micro-scale stormwater retention and detention areas, reduction of impervious surfaces, and the lengthening of flow paths and runoff time (Coffman, 2000). Other strategies include the preservation/protection of environmentally sensitive site features such as riparian buffers, wetlands, steep slopes, valuable (mature) trees, flood plains, woodlands, and highly permeable soils."

Traditionally, stormwater management has been approached as a disposal issue. Sites have been designed to achieve good drainage, and to function well under a single design condition such as the 100-year flood event. This does not mean that such sites will perform adequately under other scenarios, however. For example, designing major floodways for the 100-year flood event overdrains the system during more frequent storms, degrades the natural stream system, and causes downstream water quality problems by rapidly transporting pollutants. Furthermore, as multiple sites are each developed to maximize the disposal of stormwater runoff, the hydrology and hydrologic function of the entire area is changed drastically and adversely. By working to maintain a pre-development flow rate for stormwater, proper implementation of LID minimizes the adverse impacts of traditional stormwater management design.

LID is not a land use control strategy, but rather seeks to design the built environment to remain a functioning part of the ecosystem. In this approach, there are five basic tools:

1. The encouragement of conservation measures;
2. The promotion of impact minimization techniques such as the reduction of impervious surfaces;
3. The provision for strategic runoff timing by slowing stormwater flow through the use of landscaping;
4. The use of an array of integrated management practices to reduce and cleanse runoff;
5. The promotion of pollution prevention measures to reduce the introduction of pollutants to the environment.

LID's goal is to mimic a site's pre-development hydrology by using design techniques that infiltrate, filter, store, evaporate, and detain runoff close to the source, and these techniques are based on the premise that stormwater management should not be seen as a disposal problem, but rather as a resource. LID is built around Integrated Management Practices (IMPs), and nearly all components of the urban environment have the potential to serve as IMPs. These include open space, rooftops, streetscapes, parking lots, sidewalks, and medians.

LID encompasses a wide array of practices that, when correctly planned for and accommodated, can simultaneously satisfy regulatory requirements, act as site design elements, protect the environment, and reduce infrastructure costs. These practices are particularly effective when they are integrated into a series of linked, strategically placed and designed elements that each contribute to the management of stormwater. Some sample LID practices include:

- *Vegetated swales, buffers, and strips.* These areas trap and filter sediments, nutrients, and chemicals from surface runoff and shallow groundwater. They also help slow runoff and facilitate infiltration. These areas are best suited for treating runoff from roads and highways, roof downspouts, and other smaller pervious surfaces, but should not be used where channelized flow is likely to develop, as that may increase erosion. These areas are appropriate to be placed around existing natural features that will be maintained on a site, as these buffers will slow and filter any stormwater flow directed to these natural areas.
- *Curb cutaways, median storage, or end-of-island bioretention cells.* These are in-ground containers typically containing street trees in urban areas. These areas can be very effective at controlling runoff water quality, especially when numerous units are distributed throughout a site. Runoff is directed to the container, where it is filtered by vegetation and soil before entering a catch basin.
- *Permeable pavers.* Permeable pavers allow water to seep through regularly interspersed void areas in order to reduce runoff and associated pollutants. By reducing the volume of runoff, permeable pavers help to decrease downstream flooding, the frequency of combined sewer overflows, and the thermal pollution of sensitive waters. These pavers can reduce or eliminate the requirement for underground drainage pipes and conventional stormwater retention and detention systems for the parking areas they cover. Use of these pavers can eliminate problems with standing water, provide for groundwater recharge, control erosion of streambeds and riverbanks, and facilitate pollutant removal. Two issues with permeable pavers are that the same voids that allow water to infiltrate also may become clogged with debris, and that they are in general less durable than ordinary concrete or asphalt surfaces. However, if the permeable pavers are properly maintained, and if they are not used in high-traffic areas such as the travel lanes of a parking lot, then these issues can be minimized.
- *Green roofs.* These are structural components that help to mitigate the effects of urbanization on water quality by filtering, absorbing, or detaining rainfall. Through a variety of physical, biological, and chemical treatment processes that filter pollutants and reduce the volume of runoff, green roofs reduce the amount of pollution delivered to the local drainage system and, ultimately, to receiving waters.
- *Rain gardens and bioretention.* These areas typically have porous backfill under the vegetated surface, and an underdrain that encourages infiltration and water quality filtering while avoiding extended ponding. These areas are used to treat stormwater that

has run over impervious surfaces and is ideal for median strips, parking lot islands, and swales.

- *Rain barrels or cisterns.* Rain barrels and cisterns are placed outside of a building at roof downspouts to store rooftop runoff for later reuse in lawn and garden watering. These are low-cost water conservation devices that reduce runoff volume and can delay and reduce the peak runoff flow rates of very small storm events.
- *In-ground infiltration and storage.* These practices include dry wells and infiltration trenches, pits or trenches that have been back-filled with gravel or stone in order to collect runoff.

LID techniques such as those presented can be applied equally well to new development, retrofitting, and redevelopment. They allow for reductions in the clearing and grading of land, and in the installation of pipes, ponds, inlets, curbs, and paving when compared to traditional stormwater management techniques. These reductions in cost and land disturbance then allow a developer to add value-enhancing features to the property, to be more flexible and competitive in pricing, or even to recover more developable space, all of which might counter-balance any increased expenses due to the increased use of on-site landscaping.

As of March of 2009, DEP and the five Water Management Districts (Northwest Florida WMD, Suwannee River WMD, St. Johns River WMD, Southwest Florida WMD and South Florida WMD) are working together to develop a Uniform Statewide Storm Water Treatment Rule. This new Rule is being developed to address growing concerns about over-enrichment of Florida's surface waters, groundwater, and springs by nutrients deposited through stormwater runoff. Part of this new Rule will include low impact development design guidelines, criteria, and credits, and include such LID techniques as green roofs, bio-landscape areas, pervious pavement, and stormwater reuse. The Rule will allow local governments to develop and implement LID standards of their own that will be compatible with WMD and DEP regulations. This new Rule is anticipated to be adopted no earlier than 2010, after which local governments, including Charlotte County, may begin developing their own standards and requirements.

MUNICIPAL SERVICES BENEFIT UNITS AND MUNICIPAL SERVICES TAXING UNITS

Municipal Services Benefit Units (MSBUs) are specific benefit assessment units, established by the Board of County Commissioners in order to fund the construction and maintenance of infrastructure within the geographic boundaries of the unit. A work program is developed to complete the designated projects, and the cost of this work program is distributed among the Equivalent Residential Units (ERUs) within the MSBU. Typically, a single lot is an ERU. A non-ad valorem assessment is made against every ERU, and the funds collected from this assessment are put towards the implementation of the work plan. The method of assessment per ERU may vary by road or canal frontage, acreage, or other factors, but is established in the ordinance or resolution that creates the MSBU.

Municipal Services Taxing Units (MSTUs) are similar to MSBUs, but in this case their revenue is derived from ad valorem taxes. The millage rate is determined by allocating the cost of the annual work program among the taxable value of all property within the unit. The method of calculating the taxes per unit may vary by value. The method chosen is set forth in the ordinance or resolution that creates the unit.

Charlotte County has established many MSBUs and MSTUs including those for general stormwater maintenance (See SPAM Series Map #78), street and drainage maintenance (See SPAM Series Maps #79 through #81), and Waterway Districts (See SPAM Series Map #82). These funds are used for operation and maintenance of much of the County's stormwater management system. Street and drainage units are created for the purpose of maintaining or improving the infrastructure within the unit such as roads, drainage swales, stormwater pipes and control structures, and sidewalks and bike paths. Traffic signs, road striping, and brush removal to keep lines clear are other associated maintenance activities. Waterway units are created for the purpose of maintaining navigable waterways through dredging waterways, placing signage for safe navigation, and performing lock maintenance.

EMERGENCY MANAGEMENT (FEMA) RATING

Under its Community Rating System (CRS), the Federal Emergency Management Agency (FEMA) issues ratings that encourage and reward community efforts aimed at reducing flood losses and promoting the awareness of flood insurance. A major benefit to residents of CRS-rated communities is that they may receive flood insurance premium rate credits, which lower insurance costs. FEMA rates each community on a scale from one to ten, with one being the best obtainable rating. Currently, Charlotte County has earned a Class 5 rating for its stormwater management efforts.

IMPLEMENTATION

Charlotte County will continue to work to implement the Goals, Objectives, and Policies set forth in the Comprehensive Plan. The County achieves the GOPs by:

- Developing and implementing its Master Stormwater Management Plan;
- Managing stormwater runoff to minimize the flooding of lands and the degradation of water quality;
- Ensuring that stormwater management facilities are in place and available to serve all new development;
- Maintaining and working towards improving our Community Rating System certification under the Federal Emergency Management Agency;
- Ensuring that stormwater management programs are adequately funded and implemented; and
- Managing development within the FEMA100-year floodplain.

Challenges for the County are associated with the impact of development on the stormwater management system and the large number of vacant platted lots. These prevent the County from implementing a large scale stormwater system. However, the development review process, permit issuance, and LOS standards assist the County in offsetting the impact of development on the stormwater management system.