

**STORMWATER, NATURAL GROUNDWATER AND
AQUIFER RECHARGE SUB-ELEMENT**

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STORMWATER, NATURAL GROUNDWATER AND AQUIFER RECHARGE SUB-ELEMENT

INTRODUCTION

This sub-element addresses the stormwater and natural groundwater aquifer recharge issues for the City of Port St. Lucie as outlined in Section 9J-5.011 Florida Administrative Code (FAC). The stormwater and aquifer recharge issues have been combined in this sub-element because they are intimately related and should be viewed in this perspective.

EXISTING CONDITIONS

Surface Water

Prior to development by man, the area that presently comprises St. Lucie County had drainage patterns that were controlled by major topographic features such as the Atlantic Coastal Ridge and more subtle features such as minor relict beach dunes (U.S. 1 south of Fort Pierce), Green Ridge (south central County), Osceola Plain (southwest County), Ten Mile Ridge (north central County), and overall a gentle slope from west to east (about 60 feet to about 5 feet). The alignment of these surface features generally parallels the existing coastline and thus traditionally served to impede sheetflow; the St. Johns Marsh, Allapattah Flats, and the Savannahs were wetlands formed by these impediments. The Allapattah Flats and the south portion of the St. Johns Marsh slowly flowed east and south to form the headwaters of the North Fork of the St. Lucie River (NFSLR), which drained almost all of mainland St. Lucie County (450 sq. mi.). The Savannahs normally percolated through the Atlantic Coastal Ridge to the Indian River, but during extremely high water stages there could be overflow to the North Fork of the St. Lucie River through Platts Creek. These wetland marshes stored water and provided recharge to the shallow aquifer.

Within the City of Port St. Lucie there were minor drainageways such as Howard Creek, Blakeslee Creek and Winters Creek, but the NFSLR was, and remains, the dominant drainage feature of both the City and the County. The NFSLR varies from 200 to 400 feet in width and meanders through a lush floodplain that is approximately one-half mile wide in the City. The floodplain has been subjected to very little development in the City and the Future Land Use Plan proposes continued restriction of floodplain development.

Most of the natural tributaries of the NFSLR have been channelized as part of the original drainage plan and, due to the upland placement of control structures, brackish water can now penetrate further into the upland than before development. Additionally, these drainageways promote a greater ground water discharge to tidewater than would occur naturally.

Groundwater

There are two distinct sources of groundwater in the City of Port St. Lucie: the shallow unconfined or semi-confined surficial aquifer, and the deep artesian Floridan aquifer. These aquifer systems are separated by a layer of relatively impermeable green clay, known as the Hawthorne formation, which is approximately 400 feet thick and starts at approximately 150-180 feet below the average land surface.

The shallow aquifer system is comprised of one to five feet of fine-grained sands and silts of the Pamlico Sand that overlie the Anastasia formation. The latter formation is variable and consists of interbedded layers and lenses of sand, shell, sandy limestone, and sandstone. Beds and lenses tend to be elongated in a direction that parallels the coast. Most of the permeable zones, which are primarily shell beds, are thin and, as a result, well yields generally are low to moderate. (USGS, FBOG, Water Available in Canals and Shallow Sediments in St. Lucie County, Florida, 1972.) A thorough exploration of the shallow aquifer has not been conducted.

Water quality in the shallow aquifer in St. Lucie County varies from fair to brackish, but within the City the water quality is generally acceptable for domestic use without additional treatment and acceptable as a public supply with conventional (i.e., lime softening) treatment. The hazards of salt water intrusion by way of the uncontrolled portions of the City drainage system have not been assessed. Groundwater quality is further described in the Potable Water Sub-Element.

The natural groundwater recharge that was afforded by ponding on the flat terrain during the rainy season has essentially been eliminated by drainage. The fine textured soils do not allow rapid infiltration of rainfall and a major portion of potential recharge is now lost as runoff. Although some recharge occurs through bank storage in canals, this is of relative short duration and small area extent. The canals are normally groundwater discharge areas.

There are no defined natural groundwater aquifer recharge areas in the City of Port St. Lucie. The SFWMD has not developed nor adopted any topographic map depicting City recharge areas. Both the DEP Mining Atlas and Water Resources Atlas of Florida indicate there are no recharge areas to the Floridan aquifer located within the City.

Artificial Drainage Systems

Major drainage modifications and improvements in St. Lucie County commenced with the formation of the North St. Lucie River Water Management District and the Fort Pierce Farms Water Management District. During the 1940's the US Army Corps of Engineers (USACOE) channelized a portion of the North Fork of the St. Lucie River, although most of this occurred north of the City of Port St. Lucie. During the 1960's, the USACOE constructed canals C-23A, C-24 and C-25 and their control structures. Canal C-24 discharges to the NFSLR in the City and C-23 discharges just south of the City. This was done in order to improve drainage, provide irrigation supply, and to divert a portion of the headwaters of the NFSLR which originates in the marshes to the west. Canal C-25

allowed diversion by a separate route to tidewater. However, almost all of the drainage modifications have been designed for agricultural land use (except for Fort Pierce and Port St. Lucie in the incorporated areas) which is generally one inch per day of rainfall. As land is urbanized, the volumes of stormwater have increased and the times of concentration (run-off times) have decreased. Since the urbanized areas are in the tailwater or downstream areas of much of the drainage system, the potential for flooding has increased in several urban areas.

Agricultural drainage to the west of the urbanized coastal area has removed the major sources of groundwater recharge and lowered the water table. Areas such as the St. John's Marsh and the Allapattah Flats previously stored water above the land surface to provide the hydraulic gradient needed to recharge the slightly permeable surficial aquifer. Because of the lack of recharge and the low storage coefficient of the soils, there is insufficient water for irrigation during the extended dry season. SFWMD canals C-23, C-24, and C-25 provide irrigation supply for many areas, but the Floridan aquifer is also used for much of the irrigation demand. Irrigation return flows from Floridan aquifer water are mineralized and will mineralize the receiving canals. Since flood irrigation is a common practice, the volume of return flows can be significant and recharge from the canals can degrade the water quality in nearby wells as has happened along Belcher Canal (C-25) in Fort Pierce.

The Regional Canal System

The function of the regional canal system is to provide basin-wide flood protection, drainage for agriculture and urban/residential development, management of ground water table elevations to prevent saltwater intrusion, and water supply. This canal system consists of 55 miles of major canals in the local Surface Water Improvement and Management District (SWIM). The control structures associated with this system maintain elevations in the canals by discharging excess water from the basins and by attempting to maintain levels during dry periods. All of the canals discharge to SWIM priority water bodies.

The C-23 canal provides drainage for 168 square miles in southern St. Lucie, northern Martin, and eastern Okeechobee Counties. The C-23 and its structures remove excess water from the C-23 Basin, supply water to the basin (and, occasionally, to the C-24 Basin), and maintain ground water elevations to prevent saltwater intrusion into local ground water.

The C-24 canal provides drainage to 167 square miles in central St. Lucie and east central Okeechobee Counties. The C-23 and its structures remove excess water from the C-24 Basin, supply water to the basin, and maintain ground water table elevation adequate to prevent saltwater intrusion into local ground water.

The C-23A canal is in reality the lower 1.25 miles of Ten Mile Creek from the end of C-24 to the mouth of the St. Lucie River. There are no controlling structures connected with this canal. SFWMD's C-23, C-23A, and C-24 Canals are the only drainage facilities within other local government's jurisdiction which serve the City, not including the North Fork of the St. Lucie River

or the Indian River. Of these major canals built by SFWMD, the City has 21% (11.59 miles) within its City limits. The average depth of these canals is 10 feet although in some areas there are depths of up to 20 feet. The three canals within the City limits are C-23 (4.89 mi), C-23A (1.25 mi), and C-24 (5.45 mi). All of the smaller drainage canals and swales are located within the City limits. There are no City facilities which provide service to areas outside the City.

Surface Water Management Plan

The drainage plan for the City of Port St. Lucie (Planning Areas 1 through 7) was designed in the mid 1960's by General Development Corp. The predominant design consideration at that time was the effluent removal and conveyance of stormwater for urban development. The environmental considerations present in recent surface water management, requirements such as maintaining groundwater levels, recharge, and stormwater treatment, were mostly incidental in the original design. The actual details of the drainage design remain obscure at present since the permit application data have not been located by either the SFWMD or GDC. Available drainage plans purported to be master drainage plans are not record drawings and the City's drainage consultants have found these plans to be unrepresentative of the systems actually in place (Kimley-Horn and Associates, Inc. June 1988).

The City has instituted a need based program of drainage repairs. Much of the metal culvert used in the initial construction of the drainage system has reached its life expectancy and will require replacement. Since 1990 the City has improved 958,000 feet of swales (150 miles) and installed or replaced 279 standard culverts, replaced 129 cross street paved swales with culvert, and replaced 90 side lot ditches with culvert for a total of 50,000 plus linear feet. (Source: Port St Lucie Public Works Dept. August 1996). The City currently has a tentative schedule of repair projects pertaining to drainage which runs through the year 2002.

At least one area of the City designed by GDC in Planning Area 7 has been designed under current SFWMD water quality and quantity standards. Phase II, Section 40, located along and west of the Green River Parkway and the Savannahs was designed for the 25-year storm event. The major portions of the retention/detention area for this stormwater management system (approximately 130 acres) is located south of the City in Martin County and then outfalls into a canal which provides for spreader flow into the Savannahs east of the City.

Also, Planning Area 5 contains approximately 200 acres of lakes, which provides attenuation and detention for a major portion of Area 4N, south of the C-24 Canal, and Planning Area 4S. In addition, the stormwater management system in the development of St. Lucie West, Planning Area 8, is being designed and constructed in conformance with current SFWMD water quality and quantity standards, including the required 25-year storm event.

Surface Water Quality

The original design(s) of the drainage systems in the City did not address stormwater quality by providing retention or detention areas, but grassy swales were used for much of the conveyance systems. The lack of detention or retention facilities combined with grading the lots to the swales for rapid drainage nullifies much of the swales' abilities to hold sediment and take up nutrients. These conditions were determined from generic water quality studies, and there is very little water quality data within the City for these secondary drainage systems.

The existing drainage system was built as an effluent removal and conveyance system designed to serve urban development. At the time of development environmental considerations were limited. However, current water quality test results indicate that at the current level of development water quality is well within acceptable standards set by NPDES. Tests are completed four times per year and the most recent tests were completed during the spring of 1996 by Post, Buckley, Schuh, and Jernigan, Inc.

Applicable regulations

The existing regulations and programs which govern land use and development of groundwater recharge areas in Port St. Lucie include the following:

- 1) The City, in concert with the County and other municipalities has adopted the "interim St. Lucie County public wellfield protection ordinance." (Ord. 53.01, adopted 5/89) The ordinance provides criteria for regulating contaminants which could effect public water supply wells with permitted withdrawals of 100,000 gpd. or greater.

No development order may be issued for any non-residential activity which stores, handles, produces, or uses any regulated substance within 1,000 feet of a public water supply well. Regulated substances generally include those on Federal and State hazardous, toxic, and restricted use pesticide lists.

- 2) Florida Administrative Code, Chapter 10D-6, Standards for On-site Sewage Disposal Systems requires the issuance of an on-site sewage disposal system construction permit prior to the installation of a septic tank or other on-site sewage disposal system. Standards include a five foot setback from all property lines and a ten foot setback from other septic tanks; a 75 foot separation from private potable water wells, a 200 foot separation from public potable water systems, and a 50 foot separation from non-potable water wells. The code lists criteria concerning size and location of septic tanks. Chapter 10D-6 is administered by the St. Lucie County Health Department, Environmental Health Section.

- 3) Florida Administrative Code, Chapter 10D-4, Water Systems. This code requires a 75 foot separation between private water systems wells and septic tank or drainfields (also in Chapter 10D-6). This code lists criteria concerning construction, operation and maintenance of water systems. The St. Lucie County Health Department, Environmental Health Section, administers this code. Currently, a permit is not required to install private water wells.

NEEDS ASSESSMENT

Storm Water Management System Assessment

The design criteria and as-built details of the secondary drainage system constructed by GDC cannot be located by GDC or the SFWMD. At present, the storm return period, efficiency, levels of service, and compliance with the present day standards of the SFWMD cannot be established by archival research. Therefore, a preliminary Drainage Study was created for the City and it was learned that the existing drainage system could not be changed radically and that it was working well in its current design capacity, but would require a program of maintenance.

A preliminary review of the secondary drainage system by the City's drainage consultants, has found that the basic design is for efficient stormwater conveyance. Stormwater treatment is provided by grassed swales in many areas, but retention or detention areas are not provided in the design. Existing identified drainage facility problems which need to be addressed include reworking portions the swale system citywide.

Performance Assessment

The present methodology of conducting a performance assessment involves documenting areas that flood at frequent intervals and by using the Flood Insurance Rate Maps (FIRM). That part of the City west of the Turnpike has the majority of drainage problems, but there are many low pocket areas that experience roadway flooding or have standing water in the swales throughout the rainy season.

An engineering evaluation is currently being conducted to complete the performance assessment. The causes of local flooding are not easily apparent since most low spots have adequate elevation to be drained to the primary drainage systems. Therefore, water control structures are suspected as one cause, but the lack of upland storage is another consideration. Because of numerous potential causes, each problem drainage area will need to be addressed individually.

The St. Lucie West development has drainage systems designed with detention and retention areas for the 3-day, 25-year storm. The overall drainage plan is still under design and construction.

The following goals, objectives, and policies are based on current inventory data and City drainage programs and maintenance as outlined in this element.

GOALS, OBJECTIVES, AND POLICIES

GOAL 4.C.1: TO PROVIDE ADEQUATE CITYWIDE DRAINAGE AND STORMWATER MANAGEMENT FOR ALL RESIDENTS OF THE CITY.

Objective 4.C.1.2: The City will document efforts to review and refine citywide flood mitigation program.

Policy 4.C.1.2.1: The City will continue to maintain an inventory of flooding complaints.

Policy 4.C.1.2.2: The City will continue to investigate and plan for correcting flooding problems.

Policy 4.C.1.2.4: The City will continue to update the recently completed survey of elevations of street culvert drainage rights-of-ways.

Objective 4.C.1.3: The City will document efforts to continue to review and refine drainage improvements as needed.

Policy 4.C.1.3.1: The City will continue to inventory and map problem areas and determine the adequacy of existing drainage plans in protecting life, property, and the environment.

Policy 4.C.1.3.2: The City will maintain the computer data bases connected with the topographical maps.

Policy 4.C.1.3.3: The City will maintain existing base maps for the sub-basin areas, according to existing and future land use and maintain the existing levels of service.

Policy 4.C.1.3.4: The City will continue to limit development in the floodplain of the NFSLR to preservation, conservation, and public recreation uses and public interest projects of overriding public benefit, such as roads, hurricane evacuation routes, marinas, etc.

Objective 4.C.1.4: The City will maintain base surveys and detailed engineering and water quality studies and update them as necessary.

Policy 4.C.1.4.1: Base surveys and engineering studies will continue to be prepared to include, at a minimum, the data and information required by 9J-5.011(1).

Policy 4.C.1.4.2: The City will insure continuing funding for the preparation of surveys and engineering studies included in the most recent Capital Improvements Element five year plan.

Objective 4.C.1.5: The City shall continue to adopt a schedule of prioritized improvements to be included and funded in the Capital Improvements Element.

Policy 4.C.1.5.2: Funds for the prioritized improvements will be included in the Capital Improvements Element for FY's 1997-2002.

Objective 4.C.1.6: By the year 2000, the City will review existing regulations and enact provisions if needed in the Land Development Code (and other codes and ordinances, as necessary) for the design, construction, maintenance, and monitoring of stormwater management systems and to maximize the use of existing facilities and discourage urban sprawl.

Policy 4.C.1.6.1: At a minimum, the land development regulations have addressed the following management techniques as part of the interim drainage plan, and will continue to do so:

- a. The monitoring, inspection, and maintenance of all existing and future stormwater facilities.
- b. Limiting maximum impervious surface coverage and building coverage on residential, commercial, institutional, and industrial lots.
- c. The use of erosion and runoff control devices during construction.
- d. The existing 10-year or current 25-year level of service requirement, as appropriate.
- e. The protection of the functions of natural drainage features.

Policy 4.C.1.6.2: Property in flood prone areas that is damaged to 50% of its value will not be rebuilt in the flood prone location.

Objective 4.C.1.7: The City shall continue to implement procedures in cooperation with its stormwater management system providers to coordinate the extension of, and/or increase the capacity of, stormwater management facilities in order to meet future needs and to insure that development permits are issued only when adequate facility capacity is available to serve the development.

Policy 4.C.1.7.1: The levels of service standards for drainage are as follows:

- A) The level of service adopted for stormwater management facilities for existing platted development and surface water management systems in Planning Areas 1-7 is the 3-year frequency, storm event.

B) The level of service standard adopted for stormwater management facilities in Planning Areas 1-7 (not included above) and in Planning Area 8, St. Lucie West, is the 25-year frequency storm event.

C) All new development regardless of size must comply with Chapter 17-25, Rule 17-25.025, F.A.C. and Chapter 17-3, Rule 17-3.051, F.A.C. for water quality and direct stormwater discharge to Outstanding Florida Waters and Aquatic Preserves.

GOAL 4.C.2: INCREASE GROUNDWATER RECHARGE WHERE PRACTICABLE THROUGHOUT THE CITY.

Objective 4.C.3.1: The City will continue to assist SFWMD and USGS (United States Geological Survey) in implementing a comprehensive groundwater monitoring plan which includes monitoring wells, instrumentation devices, and database format to establish groundwater response to rainfall and artificial recharge systems.

Policy 4.C.3.1.1: The City will require that new developments with internal stormwater management system monitor rainfall, groundwater levels, and surface water levels within the new development as needed.

Policy 4.C.3.1.2: The City will continue to maintain monitoring stations at selected locations in the city to establish the baseline monitoring network.

Policy 4.C.3.1.3: The City and SFWMD will compile monitoring data.

Objective 4.C.3.2: The City will cooperate with the SFWMD, and participate in the monitoring plan to quantify groundwater recharge and discharge rates for natural and artificial recharge/discharge systems.

Policy 4.C.3.2.1: Analytical techniques shall be utilized with sub-basins as recharge boundaries.

Objective 4.C.3.3: The City provide for protection of groundwater recharge areas.

Policy 4.C.3.3.1: By the year 2000, the City will review and revise as needed land development regulations to include criteria for regulating land use and development to protect the functions of natural groundwater recharge areas.