DRAINAGE
Table of Contents

List of Figures

List of Tables

11.0 DRAINAGE ELEMENT

The Drainage Element of the Monroe County (County) Comprehensive Plan addresses the data inventory requirements of Rule 9J-5.005(2) and Rule 9J-5.011 of the Florida Administrative Code (F.A.C.). The data inventory requirements will support the development of goals, objectives, policies, and implementation programs for the Drainage Element.

The purpose of the Drainage Element of the Comprehensive Plan is to describe the issues, needs and general facilities providing for existing and future drainage conditions.

11.1 Introduction

Development and urbanization affect hydrologic cycles, natural systems and drainage patterns. The natural biologic and geologic systems are adapted to, and altered by, the climatic and hydrogeologic regimes of a locale. As human activity disturbs this balance by removing vegetation, altering topography and increasing imperviousness, the intensity and frequency of damaging storm water runoff increases, as does the resulting erosion and flooding. Urbanization also alters the chemical composition of runoff. As rainfall washes over buildings, lawns, roadways, and parking lots, it carries away the detritus of human activity and absorbs anthropogenic compounds from pesticides, fertilizers, metals and petrochemicals.

These consequences of human habitation and activity require that stormwater be controlled and managed to mitigate the adverse effects on the natural environment and to safeguard life and property. This element provides an analysis of stormwater management system practices in the County. Based upon this analysis, the subsequent Goals, Objectives and Policies contained within the Comprehensive Plan policy document outline the growth management strategies necessary to correct existing deficiencies and accommodate future development.

11.2 Terms and Concepts

11.2.1 Stormwater Runoff

A certain amount of rainfall is converted to water flowing over land during and immediately following a storm event. Under the effects of gravity, the runoff flows toward sea level through depressions and channels which comprise the drainage system of an area. The drainage system may consist of natural features, artificial features or a combination of both. The occurrence of stormwater runoff is highly variable, depending upon the amount of rain falling during each storm event and on the conditions within the drainage basin. Since most storm events are relatively moderate, natural drainage features typically evolve to accommodate moderate quantities of stormwater runoff. Severe storm events create runoff volumes in excess of what these features can handle, resulting in temporary flooding of adjacent land.

11.2.2 Infiltration

As rain falls to the ground it is initially absorbed by the topsoil and percolates downward through the soil matrix until the ground is saturated and runoff begins at the surface. This process is referred to as infiltration.

11.2.3 Impervious Surface

Urbanization increases the imperviousness of a watershed by covering the ground with hard surfaces such as buildings, roads and parking lots, and thereby increases the quantity and frequency of runoff, also degrading the water quality.

The existing definition of "impervious surface" in Section 1.7.20 of the South Florida Water Management District (SFWMD) Environmental Resource Permitting Information Manual is,

> "Land surfaces which do not allow, or minimally allow, the penetration of water; examples are buildings, non-porous concrete and asphalt pavements, and some fine grained soils such as clays."

Natural topography varies in its ability to absorb rainfall through infiltration; the greater the degree of imperviousness, the greater the percentage of rainfall that will appear as runoff.

11.2.4 Stormwater Management System

A stormwater management system is the collection of facilities, improvements or natural systems whereby stormwater runoff is collected, controlled, conveyed, impounded or obstructed. Stormwater management facilities are designed to ensure that the volume, rate, timing and pollutant load of runoff after development is similar to that which occurred under natural conditions.

11.2.5 Best Management Practices

Best Management Practices (BMPs) are the techniques applied to manage stormwater runoff. These are selected to be the most effective and economical combination of structural, operational and regulatory practices for local conditions. Stormwater Management practices are regulated in the County by the SFWMD.

11.2.6 Design Storm

A design storm is a rainfall event of a particular duration and frequency which a stormwater management system must be designed to accommodate (See section 11.9.1, Water Quality Level of Service Standards.)

11.3 Climate and Rainfall

[Rule 9J-5.011(1)(f), F.A.C]

The Florida Keys (the Keys) experience a subtropical savanna-type climate characterized by warm humid summers and mild dry winters. The mean annual sunshine is 3,300 hours, 10 percent more than the Florida peninsula to the north.

The average temperature in the Keys ranges from a summer high of 89 degrees in July to a winter low of 63 degrees in February. Temperatures below freezing have not been recorded in the Keys, primarily due to the moderating effects of the warm marine waters in the area and the presence of the warm Gulf Stream along the coast.

The typical annual total precipitation in the Keys is 40 inches. Most of the rainfall comes in the wet season during the months of May through October. Winter rainfall accounts for less than one-third of the annual precipitation. Thunderstorms are the primary source of water during the wet season. During hot summer days, moist oceanic air heats up over the land, becoming unstable as it rises. As the moisture condenses, thunderstorms form. During the dry winter season, most of the rainfall is due to cold fronts, which pass over the area on the average of once a week. Day-long dry-season storms are rare.

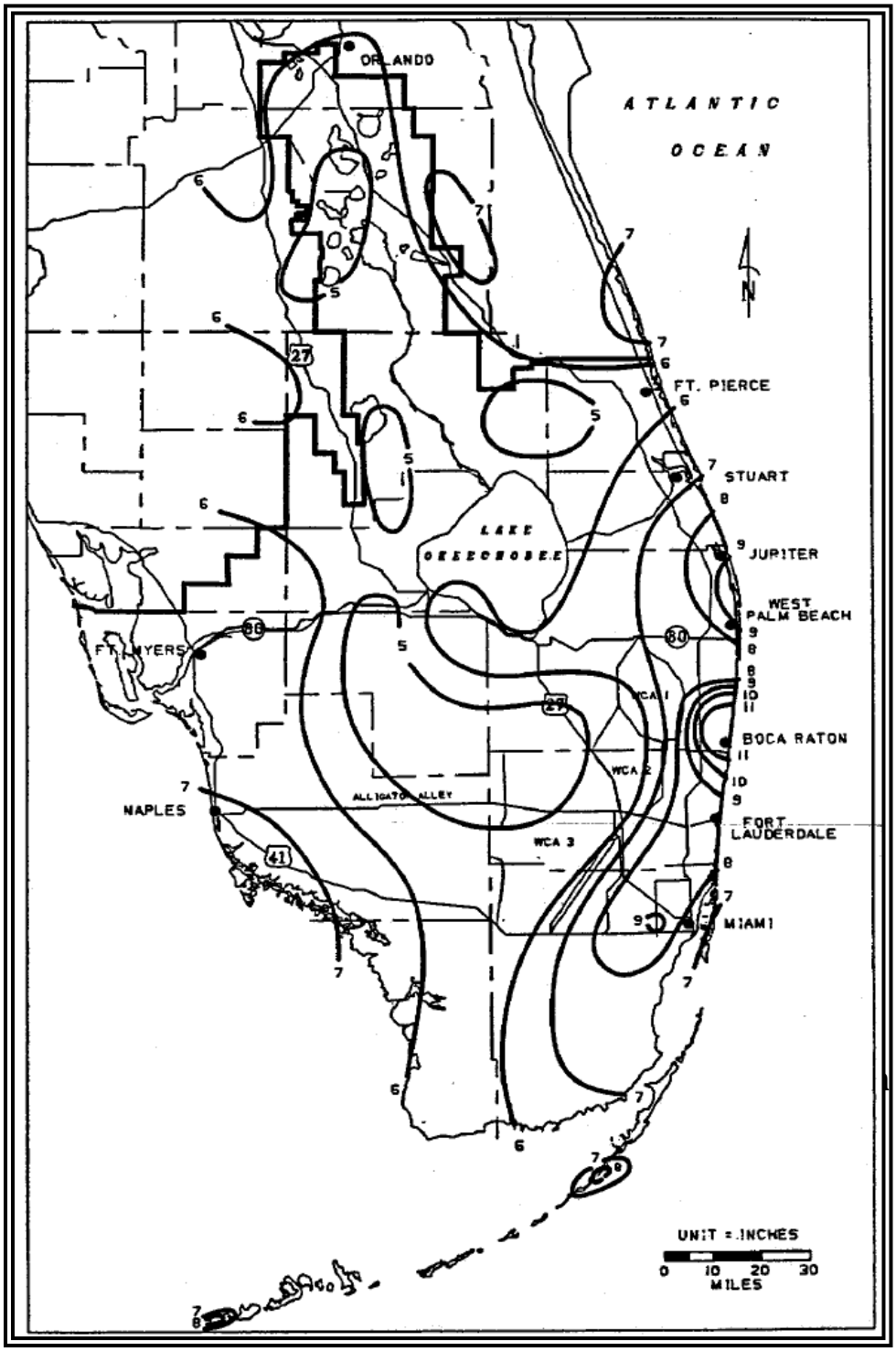
There is a decrease in precipitation and seasonal differences in precipitation southward from the Upper Keys to the Lower Keys. This is due to two factors. Winter cold fronts do not pass into the Lower Keys as often as they pass into the Upper Keys. Further, convective thunderstorms do not develop as readily over small islands as they do over the mainland.

The SFWMD uses rainfall maps for 24-hour duration storms of various return frequencies. These maps are used to determine the depth of rainfall in inches for use in the design and analysis of stormwater management systems. **Figures 11.1** and **11.2** present the maps for the 10-year and 25-year return frequency storms.

The Florida Department of Transportation (FDOT) also uses rainfall data to design and permit storm drainage along the agency's facilities. **Figure 11.3** presents the FDOT Intensity Duration Frequency (IDF) curves for Zone 11, which includes the Florida Keys.

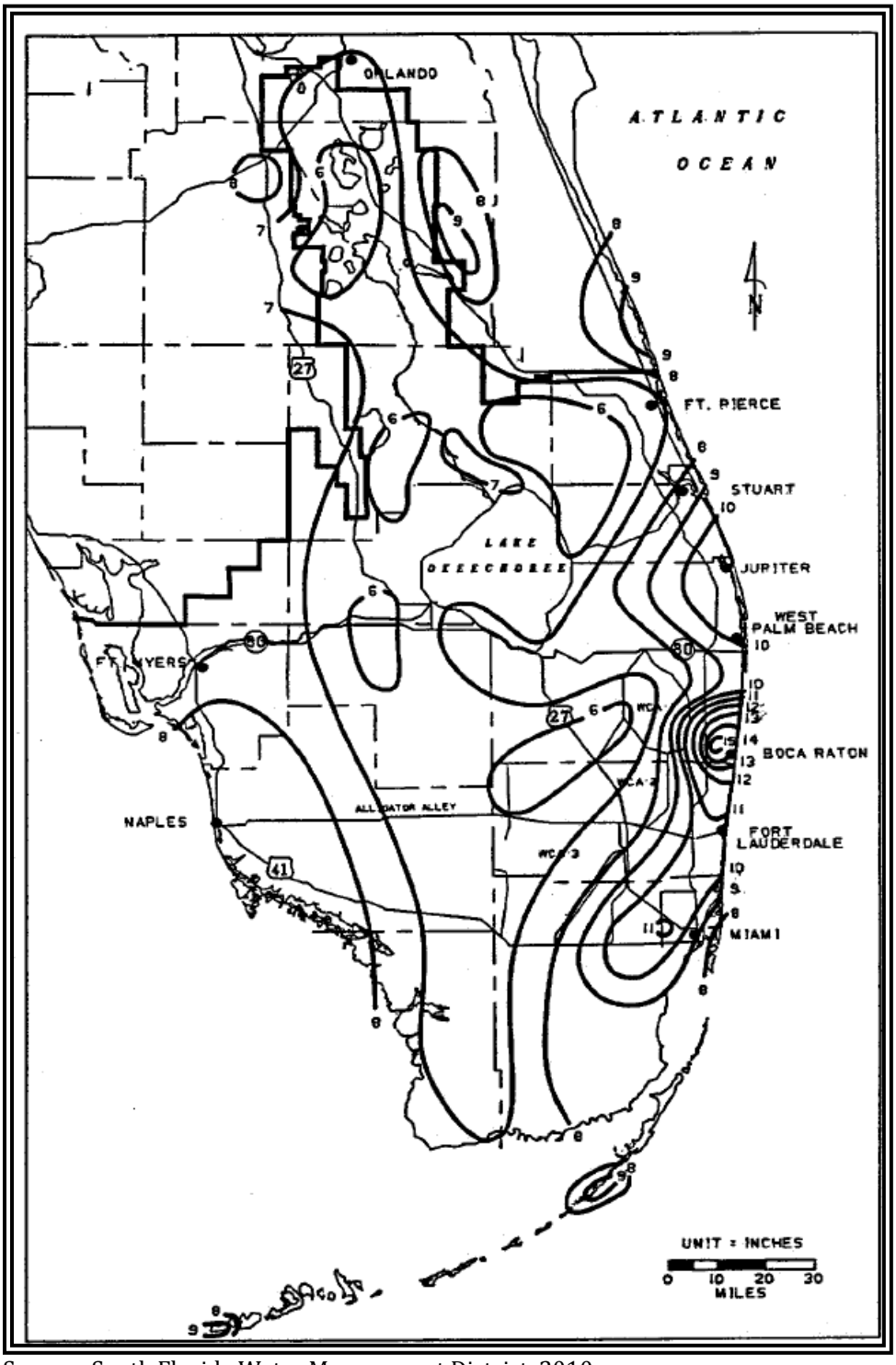
Prevailing tradewinds from the east and southeast in the Keys are relatively mild, averaging 11 to 12 knots throughout the year. The strongest winds occur during the winter months from December through March, when cold fronts move over the area from the north.

The Keys lie in an area which is susceptible to tropical cyclones and hurricanes. These low pressure systems vary in intensity and orientation. Tropical depressions or disturbances are cyclones with winds of less than 38 miles per hour (mph). By comparison, tropical storms exhibit distinct circulation patterns, with winds exceeding 38 mph. When the maximum winds exceed 74 mph, the storm is categorized as a hurricane.



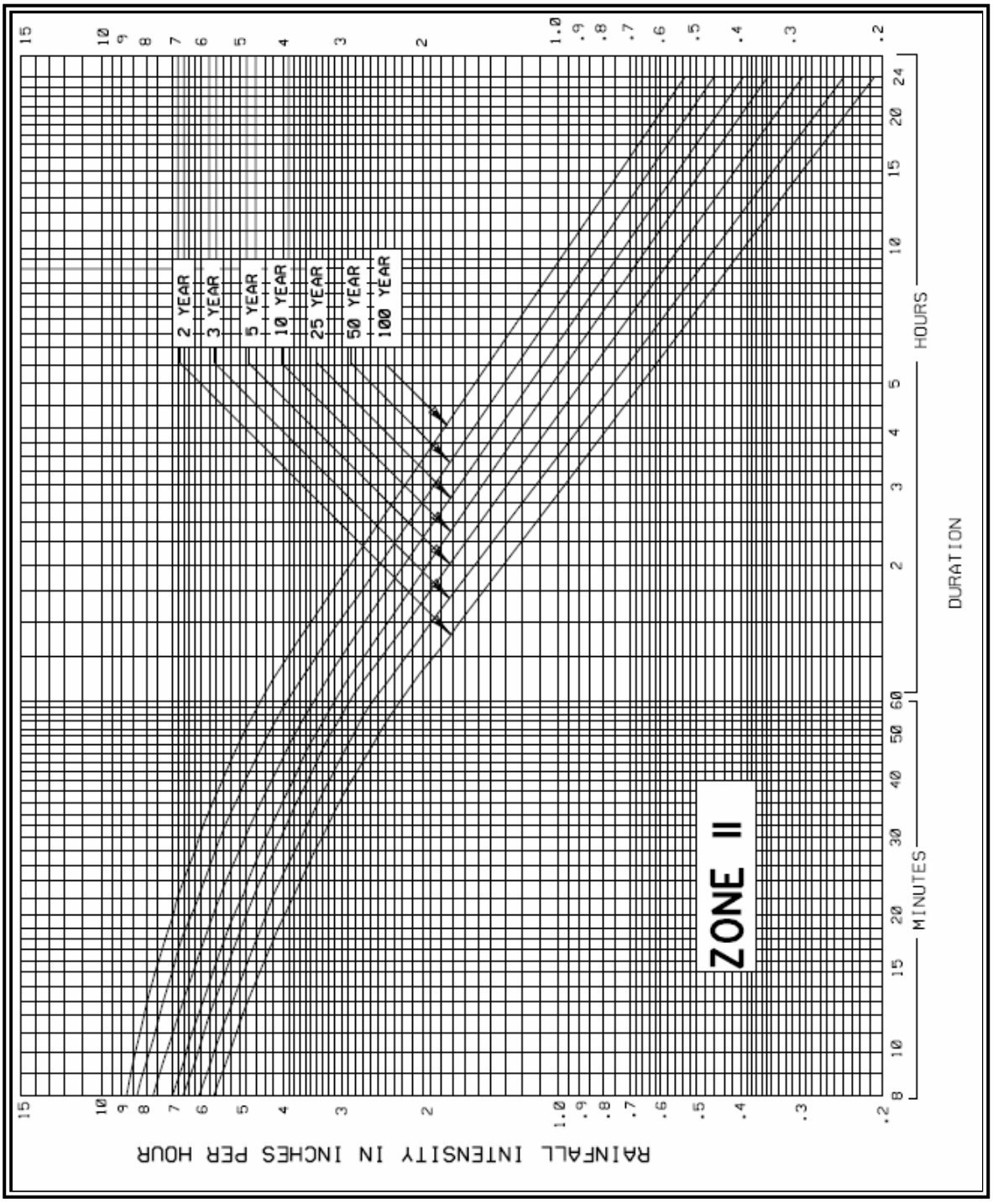
Source: South Florida Water Management District, 2010

Figure 11.1 – 10 Year, 24 Hour Return Frequency Storm



Source: South Florida Water Management District, 2010

Figure 11.2 – 25 Year, 24 Hour Return Frequency Storm



Source: FDOT Drainage Manual, 2010

Figure 11.3 - IDF Curves

11.4 Regulatory Framework

[Rule 9J-5.011(1)(h), F.A.C.]

11.4.1 Federal Regulations

In 1987 Congress re-authorized the Federal Water Pollution Control Act (the "Clean Water Act") (CWA) 33 United States Code (U.S.C.) §1251 et seq. (1972). Section 208 of the CWA had been the traditional means of addressing pollution abatement and water quality since 1972. In 1987 Congress also enacted the Water Quality Act (WQA). (Public Law 100-4), Titles IV & V. The WQA contains three provisions which specifically address stormwater discharges and sets forth the permitting criteria for municipal and industrial stormwater discharges. The central provision governing stormwater is Section 405 of the WQA which adds Section 402(p) to the CWA and establishes the general role and exceptions for municipal and industrial stormwater discharges. The Environmental Protection Agency (EPA) has promulgated rules for the application of National Pollution Discharge Elimination System (NPDES) permit programs for stormwater discharges.

The NPDES is a program under the CWA that regulates the quality of discharges into the "waters of the United States." The NPDES program initially focused on discrete point source discharges (e.g., pipe outfalls) and now also has regulatory programs that deal with potential discharges that might also have been considered non-point sources, such as industrial and municipal stormwater. Under the NPDES program, the EPA issues permits for operators of large and small municipal separate storm sewer systems, known as MS4s, and for runoff associated with industrial operations and construction.

Stormwater NPDES permits issued to industry and construction permit operations require implementation of stormwater controls to meet narrative and/or numeric effluent limits as well as documentation of the controls used on-site in a stormwater pollution prevention plan. Permit recipients must develop and implement a stormwater management plan. At this writing, based on the EPA's new focus on measurable compliance, the EPA is in the process of promulgating Water Quality Standards for the State of Florida's Lakes and Flowing Waters and Marine Systems, 40 Code of Federal Regulations (CFR), part 131, which regulate discharges that impact surface and groundwater resources.

11.4.2 State Regulations

While the EPA generally regulates water quality, water quality standards are developed by Florida Department of Environmental Protection (FDEP) and adopted by the Environmental Regulatory Commission. FDEP is charged with enforcing the standards, although it may delegate some of its authority to the regional water management district or other governmental units. Other regulatory authority, such as the land use/zoning powers of local government, directly impact water quality, and the SFWMD has established a program to address water resource concerns related to land use and other comprehensive plan issues. Currently, FDEP is working with the EPA to establish Water Quality Standards for the State of Florida's Lakes and Flowing Waters and Marine Systems, 40 CFR, part 131, for Florida.

The SFWMD regulates surface waters within the district that includes the entire County. Under Part IV of Chapter 373, F.S., and Rules Chapter 40E-4, F.A.C., and 40E-40, F.A.C., the SFWMD is responsible for permitting the construction and operation of surface water management systems. Additionally, the SFWMD has been delegated stormwater quality and quantity responsibility by the FDEP under Chapter 62-25, F.A.C.

The SFWMD is comprised of 16 counties and has a nine member Governing Board which sets policy for the agency. The SFWMD is divided into two separate watershed basins: the Big Cypress Basin and the Okeechobee Basin. The Big Cypress Basin has a Basin Board which sets policy for the Big Cypress Basin. A portion of mainland Monroe County lies within the Big Cypress Basin, but the majority of the County is in the Okeechobee Basin.

The FDEP is the primary environmental regulatory agency in the State of Florida and has the authority under Chapter 403, F.S. to classify water bodies and to regulate discharges to ensure that they are appropriate to the water body's designation. The FDEP has classified much of Florida Bay and the reef track as "Outstanding Florida Waters" (OFW) affording these areas State protection. Rule amendments adopted by the FDEP provide a new water quality classification: "Outstanding National Resource Waters." The proposed rules impose an anti-degradation standard for designated water bodies. The Everglades National Park (including a large portion of Florida Bay) is among those water bodies included in the rule's designations of Outstanding National Resource Waters.

In addition to the above regulations, the FDOT independently permits stormwater discharges and connections to FDOT rights-of-way under Chapter 14-86, F.A.C.

11.4.3 Local Regulations

In the past, the only controls on stormwater imposed by the County were those involving flood protection and floodplain encroachment in Section 122 of the Monroe County Land Development Code (MCLDC). Subsequently, the MCLDC has been revised, based on recommendations provided in the County's Stormwater Management Master Plan (SMMP), 2001, to not only provide stormwater controls for flood protection and floodplain encroachment, but also to include water quality controls in Section 114-3 of the MCLDC. This new MCLDC also includes water quality controls for existing and proposed residential development and addresses retrofitting of existing facilities and redevelopment activities. This meets the intent of Section 114-3(a) of the MCLDC, to protect the vital water resources of the County.

In conjunction with Section 114-3 of the MCLDC, the County has prepared a Manual of Stormwater Management Practices which provides information on acceptable forms of BMPs. This document was prepared with the assistance of the South Florida Regional Planning Council (SFRPC) and the SFWMD and includes BMPs consisting of rate control structures, catch basins with skimmers and baffles, and wet and dry detention/retention facilities.

11.4.4 Work Program and Florida Keys Carrying Capacity Study

In December 12, 1995, the State of Florida Administrative Commission found the 2010 Monroe County Comprehensive Plan not in compliance and it noticed a proposed rule (Rule 28-20.100, F.A.C.) and ordered facilitated rulemaking/mediation to address outstanding issues. The disputed provisions of the Rule required further action. Mediation was conducted resulting in subsequent rule changes and challenges. The Administration Commission eventually adopted Rule 28-20.100, F.A.C. in July 1997. This rule introduced the concept of the "Five Year Work Program" (Work Program). The Work Program required, among other things, the implementation of several stormwater improvement projects and the Florida Keys Carrying Capacity Study (FKCCS).

Reports began to be issued to the Governor and Cabinet in March 1998. In January 1999, the second report to the Governor and Cabinet was issued stating a lack of substantial compliance. Subsequent rule amendments extended the program's deadline to accommodate the tasks that had not been completed and today tasks remain incomplete beyond the extended horizon of the Work Program. No Work Program task has been ignored or not acted upon and all tasks may be considered either complete or in progress. While the number of remaining tasks is limited, these tasks are costly and time consuming to complete.

The Final Order in 1995 also initiated the FKCCS. In 1996 the Work Program required the development of a carrying capacity analysis study which was completed in July 2002. The US Army Corps of Engineers and the Florida Department of Community Affairs (DCA) formed a partnership to jointly fund and complete the study and the Carrying Capacity Impact Analysis Model (CCIAM). The goal of the FKCCS, excerpted from Rule 28-20.100, F.A.C. was as follows:

> "The carrying capacity analysis shall be designed to determine the ability of the Florida Keys ecosystem and the various segments thereof, to withstand all impacts of additional land development activities."

In 2001, the FKCCS was peer reviewed by the National Research Council (NRC). The NRC found that the CCIAM was not ready to determine the ability of the Florida Keys ecosystem to withstand all impacts of additional development activities as required by Rule 28-20.100, F.A.C. Based on subsequent FKCCS revisions, it was later concluded that the CCIAM may be a useful tool in some circumstances, but it had limitations, particularly the inability to determine the impact to near shore water quality. The NRC did agree with several recommendations of the study including the implementation of the Stormwater Management Master Plan (SMMP) (See Section 11.6.2.1, Stormwater Management Master Plan.)

In November 2010, DCA proposed amendments to Rule 28-20 F.A.C. which includes specific stormwater tasks and their associated timelines:

- By July 1, 2011, Monroe County shall evaluate and allocate funding for stormwater implementation. Monroe County shall identify any funding in the annual update to the Capital Improvements Element of the Comprehensive Plan;

- By July 1, 2011, Monroe County shall apply for stormwater grants from the South Florida Water Management District; and

- By July 1, 2011, Monroe County shall complete Card Sound Road stormwater improvements.

11.5 Existing Facilities

[Rule 9J-5.011(1)(f), F.A.C.]

11.5.1 The Keys

Over the last 50 years, the County has witnessed rapid growth as development has spread beyond the confines of Key West and Key Largo. Over this period, the unincorporated sections of the County have been transformed from very isolated and rural to increasingly urbanized.

Because of the combination of the proximity of the ocean, dense vegetation and permeable soil, many citizens of the County have traditionally given little concern to stormwater runoff. Most rainfall readily infiltrates the undifferentiated sands that comprise the soil of the Florida Keys. (See *Chapter 12.0, Natural Ground Water and Aquifer Recharge Element.*)

Historically, drainage works in the County primarily consisted of improvements addressing low areas, mosquito ditches cut to drain native wetlands, and boat canals used as primary drainage facilities with building sites draining directly into them by sheet flow, minor ditches or through percolation. On a number of projects, the County has also included the installation of stormwater seepage trenches as part of many of the County Road resurfacing projects. Further, a number of injection wells have been installed as part of drainage improvements within County Roads when possible and funding allowed.

The dredging of navigable canals and borrow pits has also had an effect on the hydrologic regime of the Florida Keys. Besides the obvious impact to the landscape, such activities can have widespread off-site effects. Because canal cuts open new interfaces between the ocean and groundwater, they can have dramatic hydrogeologic consequences.

Ditches along U.S. 1 have served as primary drainage systems on several Keys, transporting stormwater along the axis of the highway to the ocean. The highway was originally constructed on an old railroad with little improvement other than pavement installation. Key Largo, Islamorada and other urbanized segments of U.S. 1 have limited storm drainage systems. As part of a major roadway projects, the FDOT installs storm sewer and retention basins adjacent to U.S. 1 as required to meet current attenuation and water quality requirements.

The overriding stormwater concern for residents of the County has always been the low-lying topography with the threat of inundation by hurricane-driven storm surges. In some areas, particularly in Key West and Marathon, significant localized flooding occurs from longer duration storms which occur almost annually. Virtually the entire landmass of the Florida Keys lies within the 100-year flood plain designated by the Federal Emergency Management Agency (FEMA) and is classified as an area of special flood hazard. (See *Chapter 3.0, Conservation and Coastal Management Element.*)

11.5.2 The Mainland

The mainland segment of the County has been largely ignored by development interests because it consists solely of the vast system of marshes, sloughs, tree islands and cypress forests known as the Everglades. This indifference has not, however, protected this wilderness from the effects of human activity. Much of mainland Monroe County was incorporated into the Everglades National Park which was created in 1947. Also in 1947, the U.S. Army Corps of Engineers undertook the Central and Southern Florida Flood Control Project (C&SFP). This extensive network of canals and control structures was intended to meet the needs of flood protection, drainage and irrigation of farmland, and water supply to the urban areas along the coast. Although none of the C&SFP improvements are within Monroe County, the project modified the hydrology of the Shark River Slough, Rocky Glades, Taylor Slough and Broad River which serve as headwaters to the Everglades National Park.

Completed in the 1960s, the C&SFP had unfortunate consequences for the Everglades, including Everglades National Park. This management system altered the hydro period of the Everglades, exacerbating droughts and extending inundations. The C&SFP also altered the quantity of fresh water and transported an increased quantity of nutrients and agrichemicals from the Everglades Agricultural Area through the Everglades National Park and into Florida Bay.

Currently planned improvements to restore the Everglades are underway under the Comprehensive Everglades Restoration Plan (CERP). This plan is one of the largest ecosystem restoration programs in United States. CERP was authorized by the Water Resources Development Act of 2000. The goal of CERP is to restore the South Florida ecosystem, including the Everglades, while providing for other water supply and flood protection needs of South Florida.

The restoration focuses on several major problems affecting Florida Bay and the Florida Keys. These issues include water quantity, flow, increased salinity, water quality, fish and wildlife resource management, water supply and public access. Examples of projects designed to improve the water resources of Monroe County include:

- Water Conservation Areas: Protect and improve the natural resources of the Water Conservation Areas (WCA) as an integral part of the Everglades system while maintaining the multiple functions of the WCA.

- Everglades National Park: Provide adequate timing, distribution and flow of rainfall-quality water (phosphorus concentrations equal to or less than 0.03 milligrams per liter (mg/l)) to the Everglades National Park (ENP) which will maintain and perpetuate natural southern Everglades habitats and functional ecosystems.

- C-111 Basin: Manage the C-111 Basin to protect environmental resources and maintain existing public uses, and to provide more natural hydroperiod and flow conditions and adequate water quality to the basin's wetlands, coastal estuaries and the ENP.

- Florida Bay: Protect and improve natural surface water quality, quantity, distribution and timing of water flowing into Florida Bay through the ENP, the C-111 and the Florida Keys so as to maintain the ecosystem integrity and habitat diversity of the receiving waters.

11.5.3 Performance Assessment [Rule 9J-5.011(1)(f), F.A.C.]

11.5.3.1 Water Quantity

Little documentation about the design or implementation of drainage improvements in the County existed prior to the creation of the County SMMP. The presence of flooding problems and inference of inadequate capacity was based upon the personal knowledge of local residents. This information was collected during the development of the SMMP through public involvement activities. In the past, the FDOT has used a 3-year frequency event of critical duration for the design of its facilities within Monroe County. More recently the FDOT has been using a 25-year frequency for U.S. 1 highway improvements.

The Natural Resources Conservation Service (NRCS) completed a comprehensive soil survey of the County in 1995. The delineation of soil types compiled in this survey provides an important tool in the analysis and design of stormwater systems and assists in the assessment of potential problem areas. Existing soil types in the Florida Keys are illustrated on the Soils Map series of the Map Atlas.

11.5.3.2 Water Quality

In 1988 the FDEP prepared an assessment of nonpoint source pollution for the entire State in conjunction with the Federal Clean Water Act, Section 205(j) water quality assessment program. The data collected in the Florida Keys was extremely limited and insufficient to distinguish potential stormwater problems. The assessment, however, did show degradation of water quality in urbanized areas.

The County participated in research projects through the Florida Department of Environmental Protection, and published the document Reasonable Assurance Documentation (FKRAD -May 2008), which "provides reasonable assurance that the

stakeholders in the Keys have provided or will implement sufficient control mechanisms to return the area's near shore waters to the water quality targets". The following elements were implemented to provide the reasonable assurance: Description of the Impaired Water, Description of the Water Quality and Aquatic Ecological Goals, Description of the Proposed Management Actions to Be Undertaken, Description of Procedures for Monitoring and Reporting Results, and Description of Proposed Corrective Actions. Further the report introduces the following stormwater program rules. Current stormwater management programs will limit any significant increase in annual nutrient loading in anthropogenic stormwater discharged to the Halo Zone waters through the following provisions: Current authority of FDEP under the delegated Stormwater NPDES program to enforce permit conditions against communities that are not in compliance with their MS4 Permits; Existing on-site stormwater management requirements of SFWMD related to new development activities; Authority for FDEP and SFWMD to undertake enforcement actions for non-complying stormwater management practices; Local Monroe County land development regulations governing the development of raw land and the redevelopment of properties that establish on-site stormwater attenuation and treatment requirements prior to discharge; and ability of Monroe County to undertake authorized enforcement actions for non-complying stormwater management practices.

11.6 Surface Water Management

[Rule 9J-5.011(1)(g), F.A.C.]

The major impact of inadequate draining facilities upon surrounding natural resources is that associated with flooding and stormwater runoff. Rapid runoff of stormwater results in the loss of valuable freshwater resources, and may have other ecological impacts as well. Further, potential recharge capabilities of natural water systems have been lost or greatly diminished, due to the lack of stormwater drainage practices throughout the County.

Development associated with urbanization increases runoff by increasing flow velocity and flow volume due to the characteristics of impervious surfaces. 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. The creation of large expanses of impervious surfaces also prohibits water storage in the soils they cover. In this manner the problem is compounded since natural water storage capacity is lost while stormwater runoff is increased.

Urban development covers large areas of land with impervious surfaces which inhibit the ground's ability to absorb rainfall and increases stormwater runoff. This increased amount of runoff places greater stress on the natural drainage system, which results in increased probability of flooding during periods of heavy rainfall.

11.6.1 SFWMD Permitting Practices

The permitting of surface water management systems by the SFWMD is specified in Chapter 373, Part IV, F.S. This section regulates the construction, alteration, maintenance and

operation of most real property improvements designed to control surface waters. An applicant for a surface water permit must show that the proposed project is consistent with the goals and policies expressed in Section 373.016, F.S. (Declaration of Policy) and Section 373.016, F.S. (State Water Use Plan), and must demonstrate that construction or alteration of the surface water management systems will not be harmful to the water resources of the SFWMD. In addition, the operation and maintenance of the systems cannot be inconsistent with the overall objectives of the District or be harmful to the water resources of the District.

Documentation of existing conditions is limited to General and Individual Surface Water Management Permits issued by the SFWMD. A general SFWMD surface water management permit is applicable to development which is less than 40 acres in size and has limited site activities such as upland clearing, earthwork and lake construction. An individual SFWMD surface water management permit is generally applied to sites greater than 40 acres. An individual surface water management permit must be approved by the SFWMD Governing Board. SFWMD issues exemptions from obtaining a general permit for projects less than 10 acres of total land area and less than two acres of impervious surface. Projects within the County that have been issued permits by the SFWMD are listed in **Appendix A**.

Chapter 40E-4, F.A.C. describes the permit requirements for construction, alteration or operation of surface water management systems. To satisfy the permit requirements an applicant must either receive an individual permit or qualify for a general permit. Individual permits are issued by the Governing Board upon application and compliance with Part IV of Chapter 363, F.S. and Chapter 40E, F.A.C. with the specific permitting criteria found in Rule 40E-4.091, F.A.C. General permits are issued by Rule for most small projects and certain types of highway construction. To qualify for a general permit, an applicant needs to file the notice specified in the rules, a copy of the project construction plans and basic technical data about the project such as proposed minimum road and floor elevations, proposed discharge rate, and retention/detention volume and facilities.

Upon receipt of this information, the District determines whether the project qualifies for a general permit and/or if any additional information is needed. Once the District has indicated that the general permit is in effect for the project, no further application is required. Both individual and general permits are subject to revocation, suspension or modification in accordance with the provision of Chapter 40E, F.A.C. and Chapter 373, F.S. SFWMD regulates stormwater discharge and water treatment quality through the provisions contained in Chapter 62-25, F.A.C. which are the State stormwater discharge regulations.

In 2005, the SFWMD initiated the implementation of their “ePermitting” program, making it possible to apply for a permit online, in addition to providing the public with convenient access to its existing permit files. In 2009, the online public access to existing permit portion of the project was completed, providing online access to more than 9.1 million records. **Table 11.1** is a sampling of the permits issued by the SFWMD within the County. (See **Appendix A** for the complete list.)

Table 11.1 – Sampling of Monroe County SFWMD Permits

NO.	APPROVED DATE	APPLICATION NO	PERMIT NO	LANDUSES	WATERSOURCE/RECEIVING BODY	PROJECT ACRES	LOCATION	OPERATOR
1	25-Jun-10	100520-10	44-00191-S	Institutional	Existing System	14.42	S26/T67/R25	Florida Keys Community College
2	15-Aug-08	080116-6	44-00411-P	Government; Residential	Gulf Of Mexico	31.74	S32/T67/R25	Southeast Housing LLC
3	11-Jan-07	060109-8	44-00357-P	Residential; Commercial	Groundwater Table And Adjacent Surface Waters	55.13	S25 26/T67/R25	Landings at Key Haven Property Owners Association
4	3-Feb-06	051227-20	44-00204-S	Residential; Commercial	Atlantic Ocean And Groundwater Table	20.58	S6/T68/R25	Sunset Island Homeowner's Association
5	2-Sep-05	050525-18	44-00345-P	Residential	Adjacent Bay And Groundwater Table	23	S35/T67/R25	Islander Village Master Property Owners Association Inc.
6	3-Mar-05	040617-11	44-00334-P	Residential	Groundwater Table	12.86	S31/T65/R33	Indigo Reef Marina Homes Property Owners Assoc. Inc.
7	14-Aug-03	030226-5	44-00149-S	Airport Related Facilities	N/A	33.45	S3/T68/R25	Monroe County
8	26-Sep-01	010919-4	44-00283-P	Recreational	Florida Bay	48.23	S18/T63/R38	Village of Islamorada
9	7-Sep-00	000619-9	44-00274-P	Institutional	Atlantic Ocean	20.96	S4 5 6/T63/R38	Monroe County School District
10	3-Feb-00	991011-15	44-00262-P	Government	Atlantic Ocean	97.8	S6/T64/R37	Florida Department of Environmental Protection Division of Recreation & Parks
11	14-Jan-98	971121-5	44-00051-S	Residential	Toms Harbor	18.43	S21/T65/R34	Village At Hawk's Cay Property Owners Assoc Inc
12	14-Aug-97	970716-6	44-00178-S	Residential	On-Site Drainage Wells And Garrison Bite	25.9	S31/T67/R25	Department of the Navy
13	14-Nov-96	960819-10	44-00211-P	Institutional	On Site Freshwater Wetland Via Outfall Swale	37.87	S36/T66/R27	Monroe County School Board
14	15-Jul-96	960612-7	86-00066-S	Commercial	Total On-Site Retention	24.21	S32 33/T63/R37	Hawthorne Realty Group
15	2-Oct-95	950829-4	44-00202-S	Commercial	Sisters Creek	14.6	S15/T66/R32	Office of Cuba Broadcasting
16	16-Mar-94	940222-10	44-00041-S	Commercial	Tidal Canal	21.81	S22/T61/R39	K-Mart Corporation
17	21-Apr-92	911204-3	44-00096-S	Commercial	Existing Basin	16.8	S32/T67/R25	Lewis Property Investors Inc.
18	9-May-91	910208-9	44-00156-S	Highway	Atlantic Ocean	28.2	S00/T63/R37	Florida Department of Transportation
19	3-Oct-90	900913-14	44-00050-S	Sanitary Landfill	Florida Bay	20	S19/T66/R28	Monroe County
20	22-Jun-90	900418-4	44-00122-S	Institutional	Total Onsite Retention	16.46	S1/T61/R39	Mccarthy Edward A Archbishop Of Archdiocese Of M
21	15-Nov-89	891013-9	44-00104-S	Highway	Existing Ditch And Swales	83.66	S1 11 12 14 15 22/T61/R39;S6/T61/R40	Florida Department of Transportation
22	19-Jul-89	890301-3	44-00091-S	Residential	Atlantic Ocean Via Fla Straits	14	S14/T66/R32	Sunrise Isle Homeowners Association
23	13-Jul-89	890315-6	44-00090-S	Residential	Atlantic Ocean & Card Sound	134.09	S13 24/T59/R40;S18/T59/R41	Ocean Reef Improvement Association
24	31-May-89	12148-B	44-00087-S	Residential	Total Onsite Retention	22.3	S35/T65/R33	Little Crawl Key Homeowners Association
25	17-May-89	10278-6	44-00054-S	Residential; Commercial	Atlantic Ocean	13.32	S6/T68/R25	Truman Annex Property Owners Association

Source: SFWMD ePermitting

Prior to the 1990's, given the location and configuration of the Keys and the unlimited outfall capacity of the surrounding water bodies, relatively little consideration had been given to stormwater runoff. There is concern that this history of unregulated stormwater runoff contributes to a portion of the nearshore water nutrient and sediment loading. Subsequent regulatory developments have increased focus on stormwater management practices related to water quality and quantity. Designation of the Keys as an Area of Critical State Concern (ACSC) (Section 380.0552 F.S.) in 1974 and designation of the surrounding waters as Outstanding Florida Waters (OFW) (Chapter 62-3, F.A.C.) in 1985 required that a county-wide comprehensive water quality monitoring program be established. In 2001, the County Stormwater Management Master Plan was created, and a portion of its recommendations have been implemented, though not yet complete.

11.6.2 Needs Assessment
[Rule 9J-5.011(1)(f), F.A.C.]

11.6.2.1 Stormwater Management Master Plan

At the present time, only project specific surface water management systems exist in the County that are capable of servicing existing land use or mitigating associated impacts. A facility-specific land use inventory has not been completed to ascertain the drainage system needed to serve a combination of residential, commercial, industrial, extractive, institutional and agricultural land uses as well as public facilities, conservation/preservation areas and vacant lands.

Similarly, a comprehensive analysis of current demand and projected needs for stormwater management facilities, which would include future facility capacity analysis based on development permitted by the County, projected population, and land use distributions based on the "Future Land Use Map," has not been completed. Recognizing the inadequacy regarding surface water management in the County, a SMMP was completed in 2001 to assess the need for design of drainage systems in the developed portions of the County. The objectives of the SMMP included:

- assessing the adequacy of existing stormwater conveyance systems in developed or developing basins;

- prioritizing stormwater management needs of each island within a framework of the needs of the entire County; and

- developing a plan of identifying options available to the County on how to finance the cost of construction, operation, and maintenance of required stormwater management facilities.

Monroe County's present stormwater management practices have been revised, partially as a result of information and recommendations provided in the SMMP. However, these revised practices have not been adequate to solve all of the problems associated with stormwater management. The SMMP did identify a significant number of stand alone improvements, some of which have been implemented, that have had positive water quantity and quality impacts in localized areas. A number of SMMP referenced projects are in various stages of completion with yet other needing funding Projects identified that have been completed or are in process include: El Prado Circle on Big Coppitt Key, Card Sound Road (SR905A), Marathon Government Center, Burton Drive at U.S. 1 in Tavernier, Jo-Jean Way in Tavernier and Veterans Park in Little Duck Key. It should be further noted, projects associated with U.S. 1 right-of-way are the responsibility of FDOT. The County has partnered with the FDOT on numerous occasions and look forward to maintain this partnership.

Additionally, the focus of the SMMP was on public facilities, and did not address the needs of many of the private stormwater management systems throughout the County.

To this end, in an effort to provide increased control of water quantity, enhance water quality, and effectively manage stormwater, the feasibility of creating a county-wide Stormwater Utility entity can be examined. Under the Utility, developed parcels of property could be assessed a fair and equitable user fee based upon that property's amount of impervious surface or other criteria. This user fee could then be used by the utility to correct existing deficiencies and provide for future facilities in the stormwater management system. The utility fee could also provide ongoing revenues for operation and maintenance of the public system.

11.6.2.2 Other Needs

11.6.2.2.1 Revise as Necessary, Section 114-3 of the Monroe County Land Development Code Which Regulates Stormwater Management

Section 114-3 of the MCLDC provides stormwater management criteria compliant with existing federal and State criteria, and Section 114-4 provides for revisions to 114-3 to maintain compliance. Revisions to the MCLDC may soon be necessitated by impending EPA and FDEP establishment of quantitative nutrient criteria for surface water, anticipated sea level rise due to global warming and possible deviations from historically observed storm frequencies, intensities and durations. Additionally, revisions may also be necessitated to insure compliance and inspectability for residential permits.

11.6.2.2.2 Continue and Expand the Assessment of Ground Water and Surface water Quality

As mentioned above, the County participated in the development of the FKRAD documents that provided control mechanisms in the quest to return near shore waters to the water quality targets. The results of recent studies clearly demonstrate that development is adversely affecting water quality in the County. (See *Chapter 12.0, Natural Ground Water and Aquifer Recharge Element.*)

11.6.2.2.3 Prepare an Inventory of Drainage Systems and Performance Data for All Public and Private Systems Within the County

The Monroe County Department of Public Works should undertake the inventory and evaluation of existing drainage structures and facilities within county rights-of-way, identifying flooding issues; and, obtain data from the FDOT and municipalities for their facilities, collaborating efforts to resolve common issues.

11.6.2.2.4 Evaluate the Performance of Systems Constructed Under Monroe County Stormwater Management Regulation.

The County should periodically sample the discharge from stormwater management systems to determine compliance with the water quality requirements of the MCLDC and modify BMP recommendations as appropriate to improve the performance of future systems.

11.7 Adoption and Implementation of a Stormwater Management Ordinance

[Rule 9J-5.011(1)(h), F.A.C.]

Section 114-4 of the MCLDC, revises the Surface Water Management Criteria of the adopted Monroe County Land Development Codes and sets forth the following Monroe County responsibilities related to updating surface water management criteria:

The County Planning Commission shall consult with the Florida Department of Environmental Protection and the South Florida Water Management District, and shall recommend a stormwater management ordinance for adoption by the Board of County Commissioners that is consistent with Chapter 62-25, F.A.C. The recommendation shall be provided to the Board of County Commissioners pursuant to Section 102-158 of the MCLDC within 12 months of its effective date.

The following tasks are recommended for implementing stormwater management ordinance revisions aimed at controlling the quality and quantity of stormwater discharges from new and existing duplex and single family home development in the

County, and to provide information for distribution to the general public explaining the County's proposed stormwater management ordinance revisions:

Task 1: Review and assess the stormwater management techniques used in the development of typical duplex and single family homes in the County in the past to determine compliance with existing code and to determine the need for code revision or enforcement.

Task 2: Prioritization of project areas (residential subdivisions) most in need of implementation of stormwater management criteria.

Task 3: Refine criteria, procedures, and techniques used in the development of new and the retrofitting of existing duplex and single-family homes using the information developed in Tasks 1 and 2, and provided in the SMMP to a) eliminate or alleviate discharge into the public right-of-way from new duplex and single-family homes and b) retrofitting of existing duplex and single family homes to accomplish the same. The criteria must demonstrate the ability to be implemented through effective, practical, and cost-effective stormwater management improvements and BMP implementation. Procedures and techniques to control stormwater are to be implementable within the site planning, construction, and retrofitting stages of single family and duplex home sites. The code shall also require that the building official verify the implementation of required stormwater controls for new and updated construction. The intent of these procedures is to improve localized flooding conditions and improve the quality of the nearshore waters of Monroe County.

Task 4: Alternative analysis of all criteria, procedures, and techniques identified in Task 3.

Task 5: Development of a layman's brochure for distribution to the general public explaining the implementation of the criteria developed in Task 3 above, in addition to the refinement of the County's Stormwater Management Ordinance.

The current surface water management criteria for new development, and the retrofitting of existing duplexes and single family home sites, is contained in the MCLDC, Section 114-3.

11.8 Stormwater Management Master Plan

[Rule 9J-5.011(1)(f), F.A.C.]

Currently, no comprehensive study of drainage systems and stormwater management systems has been conducted in the County. Many research efforts have been directed at identifying specific impact areas of flooding or biotic communities in the nearshore

waters of the County while not being designed specifically to identify the causative stormwater discharge points which, in most cases, were beyond the scope of these studies. Although these studies have been reviewed and when applicable have been incorporated in the SMMP as design and improvement recommendations, it is now recognized that, in order to properly address the issue of preventing environmental degradation resulting from stormwater runoff, a comprehensive effort beyond the magnitude of anything yet undertaken will be required. Implementation of the SMMP has affected the fiscal, regulatory, and public and private operational characteristics presently in place related to stormwater systems utilized in the County. Successful implementation of the SMMP has and continues to require fiscal and political commitments and coordination at varying levels governmental and regulatory agencies.

The end result of the SMMP was to provide adequate and equitable means for the construction of a comprehensive, long-term, surface water management system which addresses existing as well as new development.

11.9 Level of Service Standards

[Rule 9J-5.011(1)(e) and (f), F.A.C.]

The level of service (LOS) standards for drainage meets or exceeds the requirements set forth in Chapter 62-25 F.A.C. The levels of service standards can only be applied to development having drainage systems permitted after the adoption of Section 9.5-293 of the MCLDC and, subsequently Section 114-3 of the MCLDC, and cannot be immediately applied to the vast number of unpermitted drainage systems or developments not having drainage systems. Stormwater quality and quantity infractions can only be addressed through vigilance and enforcement of the County's criteria. The level of service standards are described in Sections 11.9.1, 11.9.2 and 11.9.3 of the MCLDC.

11.9.1 Water Quantity Level of Service Standards

The following protection levels for development are based upon design storm frequency and duration:

- Residential and commercial building floors - 100 year, 3 day;
- Emergency shelters/service building floors - 100 year, 3 day;
- Evacuation routes and emergency service road - 100 year, 3 day;
- Arterial roads - 100 year, 3 day;
- Collector roads - 25 year, 3 day;
- Neighborhood roads - 5 year, 1 day;
- Urban sites - 5 year, 1 day;
- Rural sites - 3 year, 1 day; and
- Off-site discharge rates are limited to historic, predevelopment conditions or as previously determined by the SFWMD or the County.

11.9.2 Water Quality Level of Service Standards

Projects shall be designed and operated so that off-site discharges meet State water quality standards, as set forth in Chapter 62-302, F.A.C.

11.9.3 Retention/Detention Criteria (SFWMD Water Quality Criteria, 5.0 and Monroe County Criteria, Section 114-3 of the MCLDC)

- Retention, detention, or both retention and detention in the overall system, including swales, lakes, canals, greenways, etc., shall be provided for one of the three following criteria or equivalent combinations thereof (SFWMD Water Quality Criteria):

  - Wet detention volume shall be provided for the first inch of runoff from the developed project, or the total runoff of 2.5 inches times the percentage of imperviousness, whichever is greater.

  - Dry detention volume shall be provided equal to 75 percent of the above amounts computed for wet detention. (Note: This reduction is not allowed per MCLDC, Section 114-3.)

  - Retention volume shall be provided equal to 50 percent of the above amounts computed for wet detention. Retention volume included in flood protection calculations requires a guarantee of long term operation and maintenance of system bleed-down ability. (Note: This reduction is not allowed per MCLDC, Section 114-3.)

- Projects that discharge directly to sensitive receiving waters shall provide the dry retention or detention volume according to the following formula:

  Treatment volume = C x Disturbed area (acres) x 3.2 (inches)/12 (inches/foot)

  Where treatment volume (acre feet) is the amount of stormwater treatment necessary, the disturbed area is the total lot area and C is the rational method runoff coefficient. The rational method coefficient for the water quality treatment volume calculations shall be 0.1 for pervious areas and 0.95 for impervious areas.

- Commercial or industrial projects shall provide at least one-half-inch of dry detention or retention pretreatment prior to discharge to a disposal structure such as a well, subsurface drainage basin, or trench, as part of the required retention/detention.

11.9.4 Present and Projected Future Ability to Meet Level of Service Standards

The established SFWMD water quantity and quality drainage criteria and related Florida Administrative Code water quality requirements in conjunction with the implementation of the revisions to the Surface Water Management Criteria in Section 114-3 of the MCLDC, allows for drainage requirement criteria to be imposed on a site specific basis. Section 114-3 of the MCLDC allows for imposition of stormwater management criteria on development exempted from SFWMD requirements because of site characteristic such as size and impervious area, such as residential lots. Additionally, Section 114-3 of the MCLDC allows for more stringent requirements than those imposed by SFWMD, not allowing water quality credits for providing retention or dry detention.

The Remainder of This Page Intentionally Left Blank

Bibliography

Monroe County, 2010 Comprehensive Plan, 1990.

U.S. Environmental Protection Agency, "Overview of Climate Change Adaptation in the Southeastern United States with a Focus on Water and Coastal Resources Draft Discussion Paper," Prepared by Stratus Consulting Inc., January 26, 2010.

Florida Stormwater Association, "General Comments Concerning EPA's Proposed Numeric Nutrient Criteria (40 CFR Part 131.43)," 2010.

FDEP, "Florida Keys Area Reasonable Assurance Documentation – North, Central, South-Central and Southern," May 2008

Monroe County, "Monroe County and Incorporated Municipalities Key West, Marathon, Key Colony Beach, Layton, and Islamorada Village of Islands Local Mitigation Strategy 2005 Revision," November 2005.

CERP Assessment Team, "Comprehensive Everglades Restoration Plan 2009 System Status Report Draft," April 2010.

SFWMD, SFWMD News Release "SFWMD Expands Online Public Access to Permitting Records," January 28, 2009.

Monroe County*, Stormwater Management Master Plan*, August 2001, Prepared by Camp Dresser & McKee, Inc.

SFWMD, "Basis of Review for Environmental Resource", November 11, 2009.

CHAPTER 11.0 - DRAINAGE SUMMARY – COMMENT RESPONSES

Commenter: Kevin Wilson
Date Received: 8/17/10

Location	County Comment	K&S Action
11.4 Regulatory Framework	The Manual of Stormwater Management Practices is out of date.	Comment noted. The "needs and opportunities" chapter of the drainage element will address the need to update the Manual of Stormwater Management Practices.
11.4 Regulatory Framework	Should this mention the plan to revamp 114-3?	The plan to revamp Section 114-3 of the MCLDR should be addressed in the "needs and opportunities" chapter of the drainage element. We intend to address changes to the MCDLR Section 114-3 in the "needs and opportunities" chapter.
11.4 Regulatory Framework	What new state wide stormwater rule?	Numeric Nutrient Criteria (NNC) is currently being promulgating by the EPA. No new state wide rules regarding NNC have been established to this point. Any new criteria, once established, can be addressed with revision(s) to Section 114-3 of the MCLDR if not covered by the FDEP or SFWMD. Any needs to be addressed once the EPA has established NNC, can be included in the "needs and opportunities" chapter of the drainage element.
11.4 Regulatory Framework	Most of the 114-3 revamp will be what is required for residential permits to insure compliance and inspectability.	Comment noted. We intend to address changes to the MCDLR Section 114-3 in the "needs and opportunities" chapter.
11.6.1 SFWMD Permitting Practices	Where is Appendix A? Is it necessary to list permitted projects in a 20 year document?	All Appendices, Maps and Attachments were submitted to the County on August 13, 2010. [Rule 9J-5.011(1)(e)] requires the permit information to be provided in the Comprehensive Plan.

Location	County Comment	K&S Action
11.6.2.1 Stormwater Management Master Plan	A BIG deal Stormwater Utility recommended in the previous Comp. Plan.	Comment Noted. This will be addressed in the "needs and opportunities" chapter of this element.
11.9.3(a)Retention/Detention Criteria	The MCLDR 114-3 uses more strict requirements and does not permit reductions of 50% or 75%.	Comment noted and address through revision to the drainage element. Please see revisions to 11.9.3(a) and 11.9.4.
11.9.3(b) Retention/Detention Criteria	The Disturbed area is defined as the "total lot area"	Comment noted and addressed through revision to drainage element. Please see revisions to 11.9.3(b).
Commenter: Judy Clarke **Date Received: 10/26/10**		
Location	**County Comment**	**K&S Action**
11.2.6 Design Storm	Is "typically, a 24-hour, 25-year return frequency storm is used" true? Section 11.9.1 lists different design storms than what is listed in section 11.2.6	Revised verbiage and referenced section 11.9.1 to address comment.
11.4.4 Work Program and Florida Key Carrying Capacity Study	This section is strange. Only refers to stormwater in last sentence. SMMP- hasn't been mentioned yet in report, but dropped in this section.	Comment noted. Addressed SMMP to reflect Stormwater Management Master Plan (SMMP) and referenced section 11.6.2.1(SMMP).
11.5.1 The Keys (Existing Facilities)	Was this section updated or is it the same as the previous comp plan? We have installed injection well and seepage trenches.	Comment noted. Injection wells and seepage trenches address localized flooding as mentioned in section 11.5.1
11.5.3 Water Quantity	-They need to spell out what SMMP is and when it was written before using abbreviation all through out the section. - When was the NRCS completed?	-SMMP Comment was spelled out in section 11.2.6 per previous comment. -Added date of NRCS.
11.5.3.2 Water Quality	- Nothing more recent on water quality than the noted1988? -All of this sounds like ancient text; is this current, or a complete history of water quality?	- Nothing more recent based on our review of the documents received by our office. -This is the history based on documents reviewed by our office.

Location	County Comment	K&S Action
11.6.1 SFWMD Permitting Practices	-Add the word "has" to second sentence in second paragraph. -Revise verbiage in second paragraph. -Revise verbiage in fifth paragraph - Again, this text sounds very old. The County re-did its stormwater codes in 1995 didn't it? They need to qualify "Historically" as "prior to 1990's…2001,… whatever. -Is 2001 the correct date?	- Revision made. - Revised verbiage. - Revised verbiage. - Revised verbiage. - Yes.
11.6.2.1 Stormwater Management Master Plan	- What is the first paragraph saying? - This text is old. Recognizing the "present" inadequacy. We wrote the master plan in 2001. - Is this (a significant number of SMMP proposed improvements have yet to be implemented) true? - When do we talk about County stormwater permitting requirements?	- There is no master drainage systems, only those associated with specific areas. - Revised verbiage. - Yes - In section 11.9
11.6.2.2.2 Continue and Expand the Assessment of Ground Water and Surface Water	-When do they consider recent?	- Please see chapter 12.0 for the specific dates, etc.
11.6.2.2.3 Prepare and Inventory of Drainage Systems and Performance Data for all Public and Private Systems Within the County	-FYI – This topic came up recently and I am working with public works to document our structures only, not DOT or Municipal. -	- Comment noted.
11.6.2.2.4 Evaluate the Performance of Systems Constructed Under Monroe County Stormwater Management Regulation	- Need a sampling location – i.e. injection wells don't discharge to surface or outfall, can't sample. Are they familiar with our stormwater structure or is this standard text?	- To determine the effectiveness of water quality measures, sampling is needed whether the runoff is conveyed to surface water or injection wells.
11.7 Adoption and Implementation of a Stormwater Management Ordinance	- is this stuff to do in the future or what we did in 1990's? This seems to address improving our codes, but I don't recall anything in the section about what our codes require. - This was done in the past; is this historical text or a "new" idea?	- Updating County code is ongoing to insure County code is consistent with FDEP and SFWMD. -This was done in the past and remains a need to be done procedure. Task 5: for instance, needs revision.

Location	County Comment	K&S Action
11.8 Stormwater Management Master Plan	-This text implies that the master plan is still being written and revised. It isn't as far as I know.	-Correct. Comment Noted and element revised
Note: Please provide information requested on the attached memo dated May 19, 2010.		
Commenter: Judy Clarke **Date Received: 2/18/11, Follow up 3/10/11**		
Location	**County Comment**	**K&S Action**
Section 11.4.3	Cite report dates	Updated as suggested
Section 11.4.4	Update rules – JPA cancelled	Rule updated as suggested
Section 11.5.1	Insert language regarding inspection and add language regarding seepage trenches within County roads	Updated as requested
Section 11.5.3.2	Add reference to FKRAD	References to FKRAD added as suggested.
Section 11.6.1	Add detail of completed stormwater projects	Details of Completed stormwater projects added.
Section 11.5.3.2 and Section 11.6.2.2.2	Provide detail of existing State/County cooperative studies	References to completed studies (FKRAD) have been added to 11.5.3.2 and referenced 11.6.2.2.2
Section 11.7	Reference to Regulation (FDER) change to Protection (FDEP)	Agreed. Changed