Town of Cutler Bay

Watershed Master Plan

September 2018

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Executive Summary

The purpose of this Watershed Master Plan is to provide the Town with a tool it can use to regulate future development in a way that does not increase runoff or flooding from future conditions. This plan examines and provides a comparison of pre- and post-development peak flows on the watershed level as well as the individual sub-basin level for those parcels within the Town that are currently undeveloped.

Also included in this plan is an examination of related studies and relevant data into one combined source. The following components have been included:

- A profile of the Town including land use, topography, wetlands and drainage features
- Evaluation of climate adaptation including sea level rise
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- Recommendations for the Town's regulatory and development codes as they relate to stormwater management

The Town of Cutler Bay is composed of three watersheds: C-100, C-1 and D-4A. Within these watersheds, 18 sub-basins were identified for detailed stormwater analysis. These 18 sub-basins comprise the vacant parcels over 1 acre in area in the Town that will likely be impacted by future development. An analysis was completed for the three watersheds and for each of the 18 sub-basins. For the watershed level analysis, pre- and post-development peak flows were computed for a 3-day duration/25-year return frequency and a 100-year return frequency. For each of the 18 sub-basins, a detailed analysis of pre- and post-development peak flows was computed over a 3-day duration for the 10-, 25-, 50- and 100-year return frequencies. Additionally, for the 25- and 100-year return frequencies, the post-development hydrographs were routed through a detention basin in order to size an overflow structure to control post-development discharges at or below pre-development rates.

This plan also complies with the Federal Emergency Management Agency's Community Rating System (CRS) Program which provides credit for a community that implements stormwater management regulations through an adopted watershed master plan.

1 Introduction

Stormwater is created when rain that falls to the ground does not infiltrate into the soil. The volume of stormwater runoff varies based on a number of factors; including: the amount of rain that falls and how quickly or intensely it falls, the moisture condition of the soil prior to rainfall, and the land cover in the area where the rain falls. Stormwater runoff is important to manage from both a water quantity and a water quality standpoint in order to protect public health and safety. Localized stormwater flooding may occur when heavy rainfall and an accumulation of runoff overburden the stormwater drainage system within the community.

Cutler Bay is located along the Atlantic Ocean and Biscayne Bay, and the topography of the area is very flat with low elevations. Flooding problems are presented by ponding in the very flat, poorly drained areas and by overflow from the drainage canals that traverse the Town. Stormwater drainage has been an on-going challenge in the Town for the following reasons:

- Low topography
- Flat, poorly drained areas
- Substantial build out
- Heavy rainfall patterns
- Coastal environment/tidal activity

Stormwater flooding may be caused by the following maintenance related issues:

Clogged Inlets – debris covering the asphalt apron and the top of grate at catch basin inlets may contribute to an inadequate flow of stormwater into the system which may cause flooding near the structure. Debris within the basin itself may also reduce the efficiency of the system by reducing the carrying capacity.

Blocked Drainage Outfalls – debris blockage or structural damage at drainage outfalls may prevent the system from discharging runoff which may lead to a back-up of stormwater within the system.

Improper Grade – poorly graded asphalt around catch basin inlets may prevent stormwater from entering the catch basin as designed. Areas of settled asphalt may create low spots within the roadway that allow for areas of ponded water.

1.1 BACKGROUND

With the assistance of the South Florida Water Management District (SFWMD), the Town of Cutler Bay developed its first Stormwater Master Plan adopted in March 2008. The 2008 plan, prepared by Kimley-Horn and Associates, Inc., included a review of existing drainage data, an inventory of drainage structures, delineation of 17 drainage sub-basins, hydrologic and hydraulic modeling of the existing drainage systems, and identification of needs for drainage improvements. The purpose of that plan was "to identify opportunities to protect surface water quality and to reduce flooding within the limits of the Town of Cutler Bay, Florida."

The 2008 plan also identified Capital Improvements Program project recommendations to improve drainage performance. Since the development of the 2008 plan, the Town has completed several stormwater drainage improvement projects, detailed as follows:

- Eliminated drainage issues at the intersection of SW 85th Avenue and AW 208th Street. Project was funded by Town's Stormwater Utility Fund and a State grant from the Florida Department of Environmental Protection (FDEP).
- Upgrades completed in the Bel-Aire and Sage Bay neighborhoods. Funding provided by the Stormwater Utility Fund and grants from the South Florida Water Management District (SFWMD) and FDEP.
- SW 97th Avenue Roadway and Drainage Improvement Project: overall upgrades made to the Lakes by the Bay neighborhood. Funding was provided via agreement with a private developer.
- Old Cutler Road Roadway and Drainage Improvement Project: drainage improvements made between SW 87th Avenue and SW 97th Avenue. Funding was provided through a Joint Participation Agreement (JPA) with Miami-Dade County using both the County's People's Transportation Plan (PTP) Fund and the Town's own PTP Fund. These projects addressed areas identified as the top priorities for improvements in the 2008 Stormwater Master Plan.
- Caribbean Boulevard Drainage Improvement Project: drainage improvements funded through a JPA with Miami-Dade County. A secondary component of this project includes bridge improvements to expand the existing bridge crossing the C-1N Canal, which will improve the conveyance capacity of the canal.

In 2014, the Town of Cutler Bay developed a Floodplain Mitigation Plan (FMP) with the objective to identify sources of flooding within the Town and to develop mitigation strategies that will reduce the Town's vulnerability to flooding. The FMP, prepared by the Wood Group (formerly Amec), identified areas of repetitive stormwater flooding in the Town. These areas, listed below, are shown on the following page in Figure 1.1.

- Sterling Dr and SW 93 St
- Parcels between SW 195 St and SW 196 St
- The parcels bordered by Caribbean Blvd, Anchor Rd, Pan American Dr and Blue Water Rd
- Manta Drive at Old Cutler Rd
- Old Cutler Rd southwest of the intersection of Franjo Rd
- The intersection of SW 89 Ct, Franjo Rd and SW 200 St
- SW 186 St at SW 97th Avenue
- SW 77 Ave and SW 188 St through the intersection of SW 78 Ave
- SW 79 Ave at SW 79 Ct
- SW 197 Terrace at SW 196 Terrace
- SW 84 Ave at SW 199 Terrace
- SW 212 St between SW 85 Ave and SW 87 Ave
- SW 92 Ave between Old Cutler Road and SW 208 St
- SW 24 Terrace between SW 97 Ct and SW 97 Pl
- SW 216 St between SW 97 Ave and SW 98 Ct
- SW 97 Ave between SW 219 St and SW 224 St
- The quadrant of parcels bordered by SW 97 Ave, SW 221 Street/Terrace, SW 99 Pl and SW 224 St
- The intersection of SW 92 Ave/SW 93 Path and SW 216 St
- Parcels between SW 216 St and the eastern portion of SW 215 Terrace
- SW 216 St between SW 87 Pl and SW 88 Pl

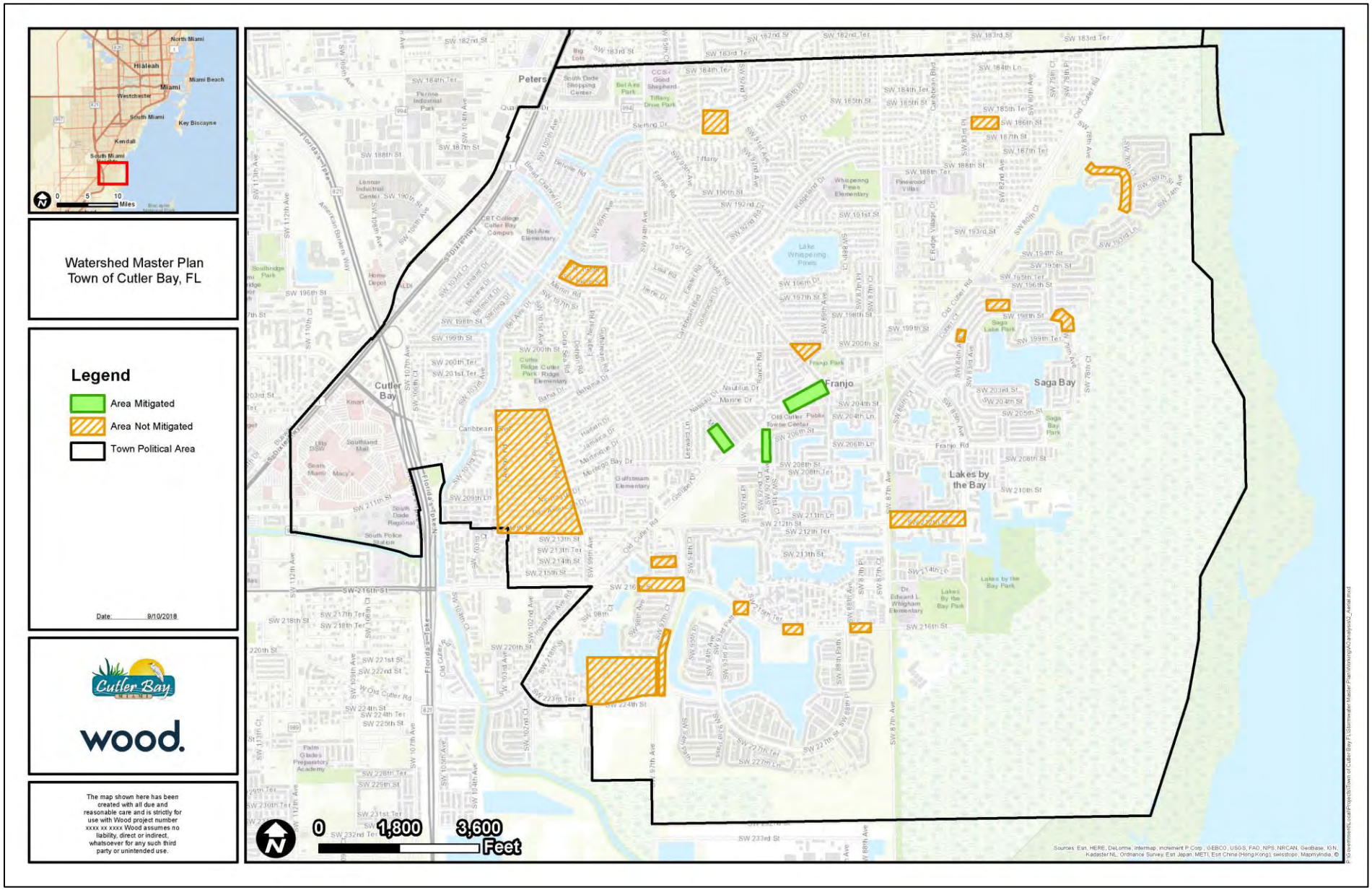

Figure 1.1 – Areas of Repetitive Stormwater Flooding

1.2 OBJECTIVE

Looking ahead to future development and re-development, the Town is working to manage its stormwater infrastructure, minimize flooding, and maintain or improve water quality.

The purpose of this Watershed Master Plan is to provide the Town with a tool it can use to regulate future development in a way that does not increase runoff or flooding from future conditions. This plan examines and provides a comparison of pre- and post-development peak flows on the watershed level as well as the individual sub-basin level for those parcels within the Town that are currently undeveloped (parcels of 1 acre in size or larger).

This plan also complies with the Federal Emergency Management Agency's Community Rating System (CRS) Program which provides credit for a community that implements stormwater management regulations through an adopted watershed master plan.

1.3 COMPONENTS OF THE WATERSHED MASTER PLAN

This plan includes an examination of related studies and relevant data into one combined source. The following components have been included in this plan:

- A profile of the Town including land use, topography, wetlands and drainage features
- Evaluation of climate adaptation including sea level rise
- A review of existing drainage data, reports and plans available through FEMA, SFWMD, Miami-Dade County, and the Town of Cutler Bay
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- A review of the Town's regulatory and development codes and recommendations as they relate to stormwater management

2 Community Profile

The Town of Cutler Bay is located in Miami-Dade County along the Biscayne Bay and has a total area of approximately 9.7 square miles. The Town was incorporated in November 2005 and is currently home to over 44,000 residents. The Town was incorporated on November 8, 2005 and was substantially built-out at the time of its incorporation.

The boundaries of the Town are approximately as follows: on the North by SW 184 Street (Eureka Drive) from the Florida Turnpike to Biscayne Bay; on the West from SW 184 Street following US 1 to SW 112 (Allapattah Road) and then along SW 126 (Hanlin Mills Drive); on the South by SW 216 Avenue and along historic Old Cutler Road, taking a right on SW 224 Street (up to SW 47th Avenue heading south and left of SW 232 Street) going east to Biscayne Bay. The Eastern Border follows the coastline of Biscayne Bay from SW 184 Street to SW 224 Street. A base map for the Town of Cutler Bay is shown in Figure 2.1 on the following page.

2.1 LAND USE

A map of the Town of Cutler Bay's existing land use, as adapted from the existing uses depicted in the Town's Future Land Use 2020 plan, is shown in Figure 2.2. As can be seen from this map, the Town is almost entirely built out; therefore, changes to land use will primarily be limited to redevelopment. However, there are a small number of vacant parcels, which comprise primarily privately-owned conservation land in the eastern and southern portions of the Town as well as a cluster of unprotected and government owned parcels in the south, sections along Old Cutler Rd, and a few other parcels scattered throughout the Town.

Table 2.1 summarizes the Future Land Use designations for the Town of Cutler Bay by acreage per the Town's Land Use 2020 Map.

Table 2.1 – Town of Cutler Bay Future Land Use

Land Use	Acres	Percent of Total
Estate Density	601.01	9.18%
Low Density	2,085.23	31.85%
Medium Density	365.27	5.58%
Mixed Use	221.54	3.38%
Town Center	185.15	2.83%
Institutional	206.67	3.16%
Parks and Recreation	154.64	2.36%
Conservation	1,266.46	19.34%
Roadway	1,023.35	15.63%
Transportation	18.11	0.28%
Water	419.99	6.41%

Source: Town of Cutler Bay

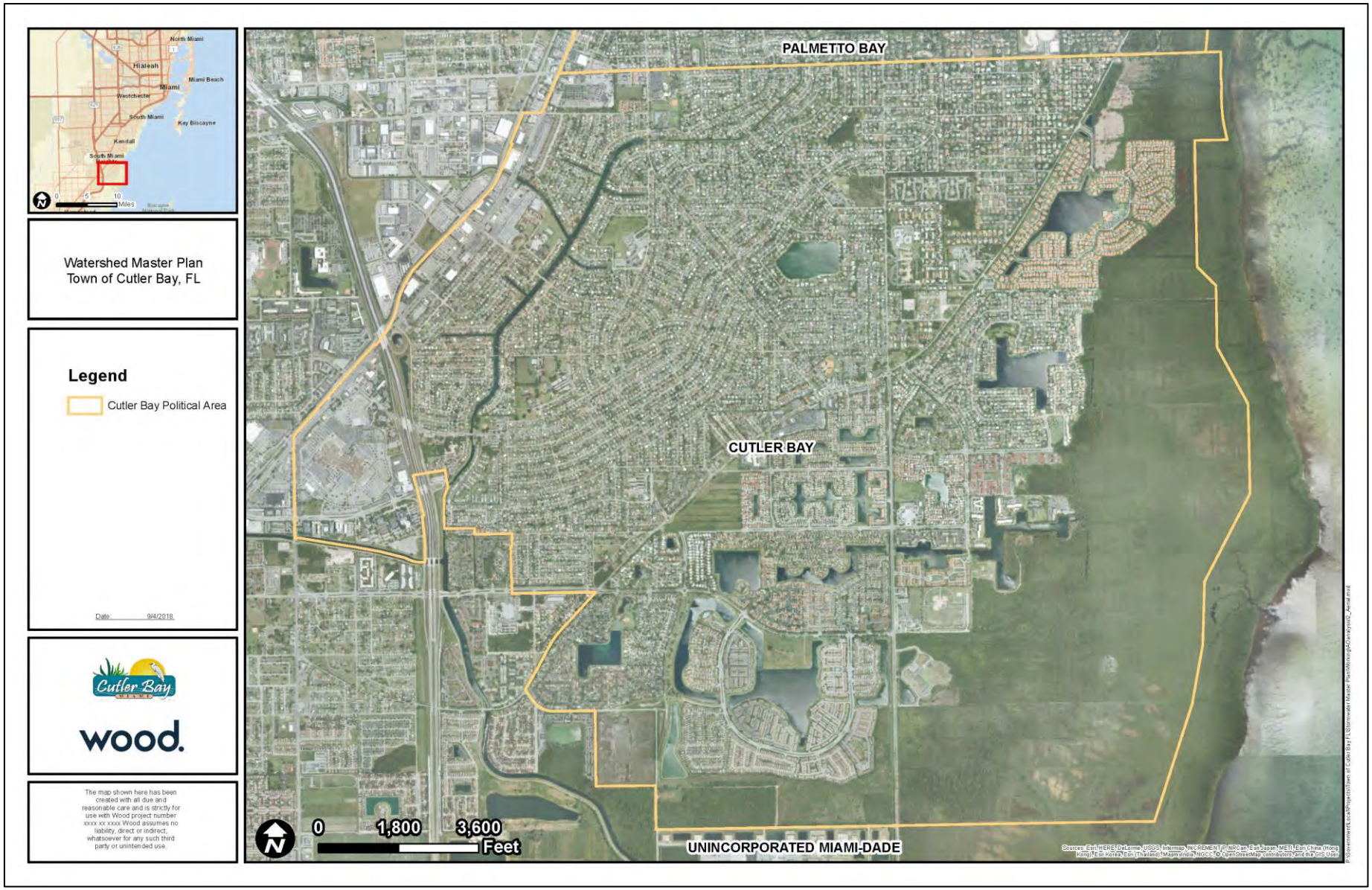


Figure 2.1 – Cutler Bay Base Map

Low density residential land use makes up the largest category of future land use, accounting for over 31 percent of the Town's area. The next largest land use category is conservation, which is intended to preserve and protect environmentally sensitive areas.

There have been minimal changes to the Future Land Use since its adoption. Several parcels have been re-designated for lower densities, including 11.50 acres changed from low density to parks and recreation, 4.51 acres changed from mixed use to low density, and 8.20 acres changed from mixed use to medium density. Conversely, 16.39 acres have been changed from low density to medium density, and 2.04 acres have been changed from low density to mixed use.

A comparison of current and future land use shows that much of the vacant land in the town, including some lands bordering wetlands and conservation areas, is slated for residential or mixed use development.

Table 2.2 lists the maximum impervious surface coverage standards for each zoning district as defined in the Town's Land Development Code. Based on these standards, maximum possible impervious surface coverage for the town based on the future land use categories and coverage detailed above is calculated. According to this analysis, if the Town is completely built out according to the Future Land Use Map, of the Town's 6,547.42 acres, 3,274.11, or 50%, could be covered in impervious surface.

Table 2.2 – Town of Cutler Bay Zoning District Standards and Impervious Surface Coverage Potential

Zoning District	Applicable Land Use	Max. Impervious Surface Coverage	Potential Impervious Surface Acreage
Estate Residential	Estate Density	50%	300.51
Single Family Residential	Low Density	60%	1,251.14
Multi-Family Residential	Medium Density	65%	237.43
Neighborhood Center/Neighborhood Residential	Mixed Use	70%	155.08
Town Center	Town Center	100%	185.15
Institutional	Institutional[1]	50%	103.34
Park	Parks and Recreation[2]	0%	0.00
Conservation	Conservation[2]	0%	0.00
Undefined	Roadway[3]	100%	1,023.35
Transit Corridor	Transportation	100%	18.11
Water Use	Water[2]	0%	0.00
		Total	**3,274.11**

Source: Town of Cutler Bay

[1]No impervious surface coverage standard identified. Assumed maximum impervious surface coverage of 50% based on maximum building coverage standard.

[2]No impervious surface coverage standard identified. Assumed maximum impervious surface coverage of 0%.

[3]No correlated zoning district. Assumed maximum impervious surface coverage of 100%.

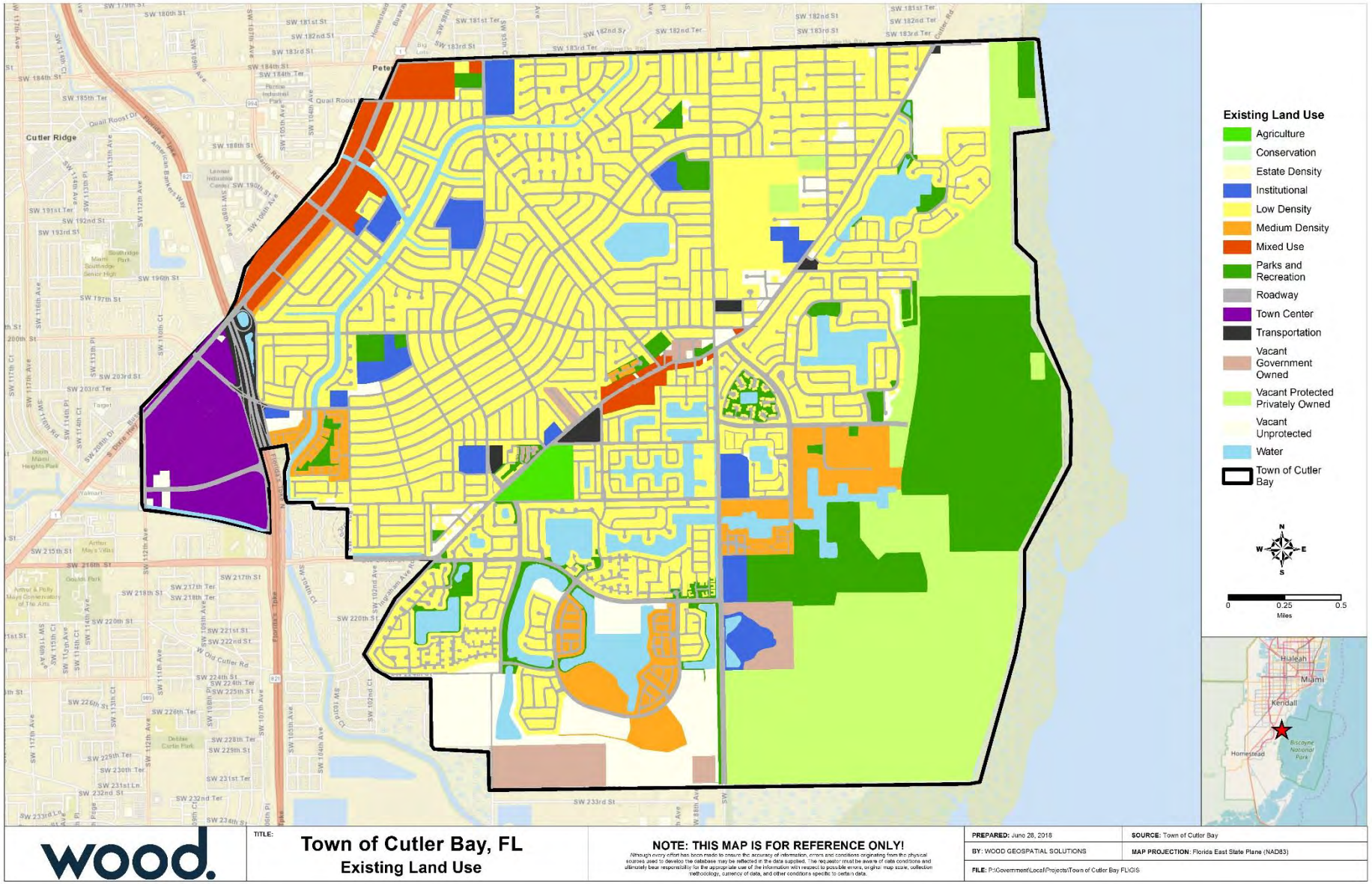


Figure 2.2 – Town of Cutler Bay Existing Land Use

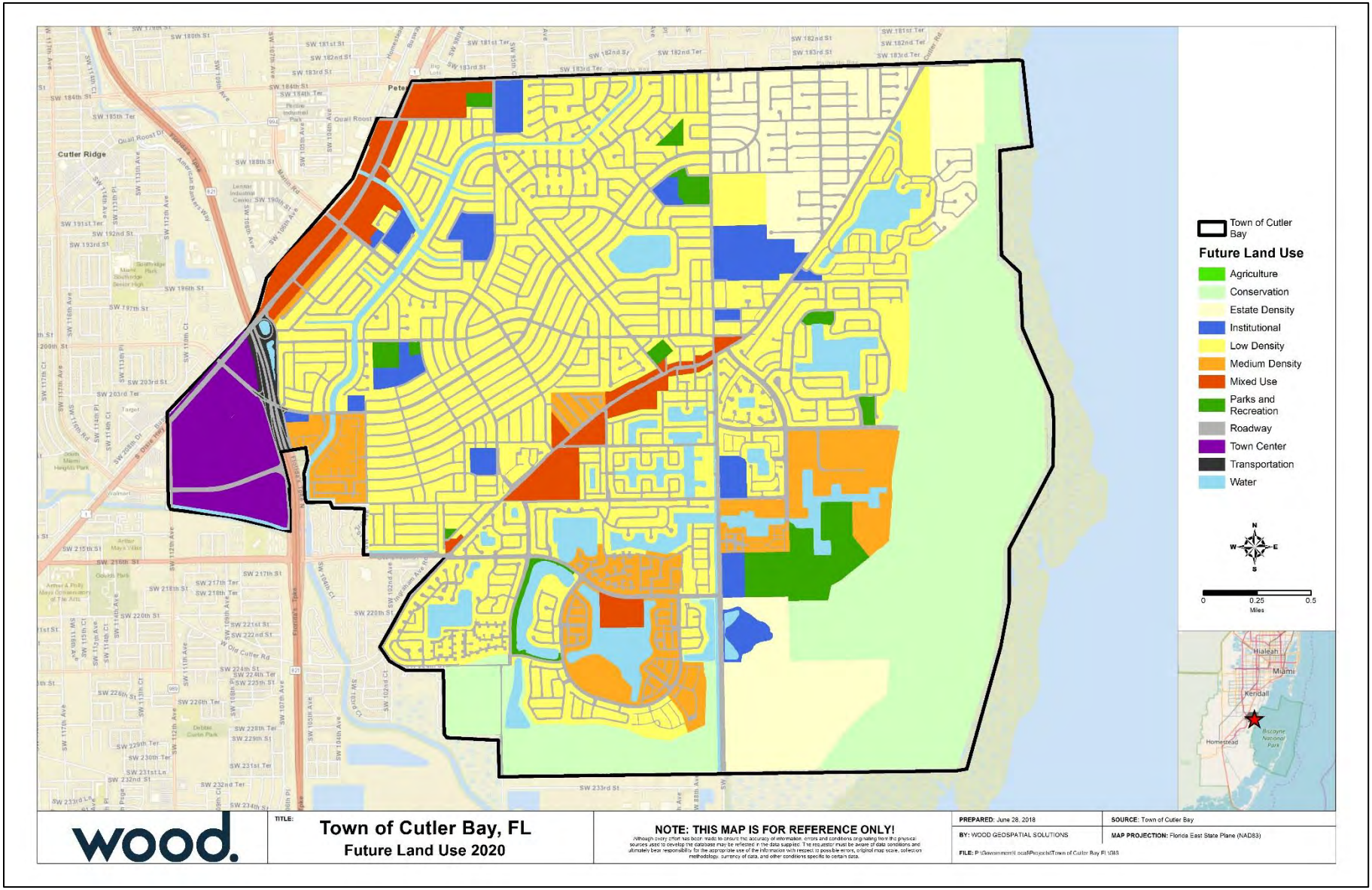


Figure 2.3 – Town of Cutler Bay Future Land Use

2.2 TOPOGRAPHY

Cutler Bay is low and flat with elevations generally below 10 feet NGVD 1929. The topography of the Town is shown in five-foot elevation contours in Figure 2.4 on the following page. Cutler Ridge, a limestone formation that runs along the coast from Miami to Homestead, passes through the Town of Cutler Bay where it reaches elevations of 10 feet and higher. Land along the ridge sits outside the 1%-annual-chance floodplain, and the ridge acts as a protective barrier from storm surge for areas further inland. To the east of the ridge, land slopes down to sea level.

Localized stormwater flooding occurs when heavy rainfall and an accumulation of runoff overburden the stormwater drainage system within the community. Flooding problems are presented by ponding in the very flat, poorly drained areas and by overflow from the drainage canals that traverse the Town. Stormwater drainage has been an on-going challenge in the Town, particularly the areas of marl and muck soils east of Old Cutler Road.

2.3 WETLANDS

The eastern and southern portions of the Town are covered by marsh and wetlands. Figure 2.5 depicts the location and type of these wetlands. Table 2.3 details the types and acreage of wetlands in the Town.

Table 2.3 – Wetlands Area by Type

Wetland Type	Acres
Estuarine and Marine Deepwater	4.72
Estuarine and Marine Wetland	948.62
Freshwater Emergent Wetland	140.89
Freshwater Forested/Shrub Wetland	582.93
Freshwater Pond	109.50
Lake	201.97
Riverine	51.62
Total	**2,040.25**

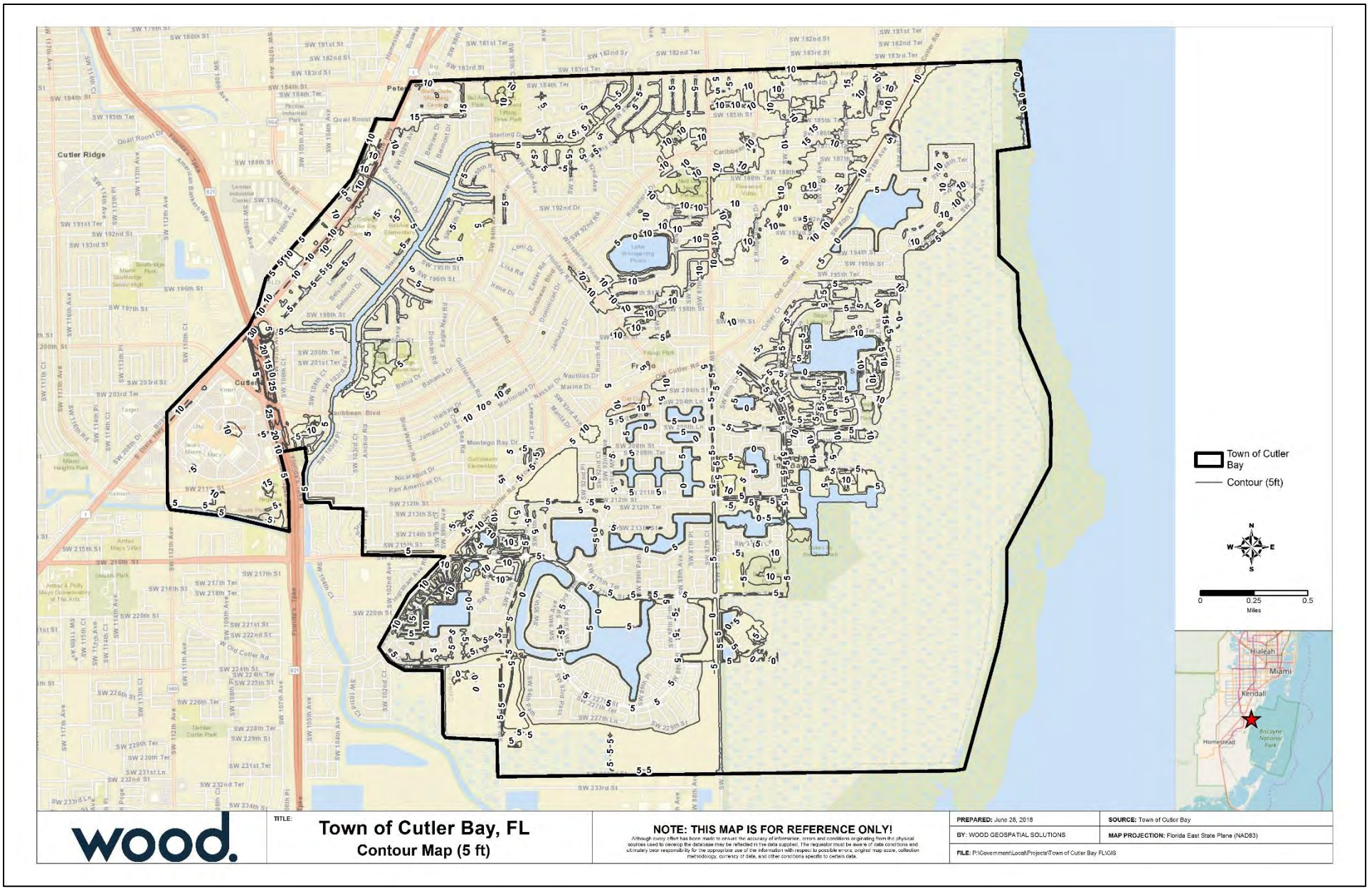


Figure 2.4 – Town of Cutler Bay Topography

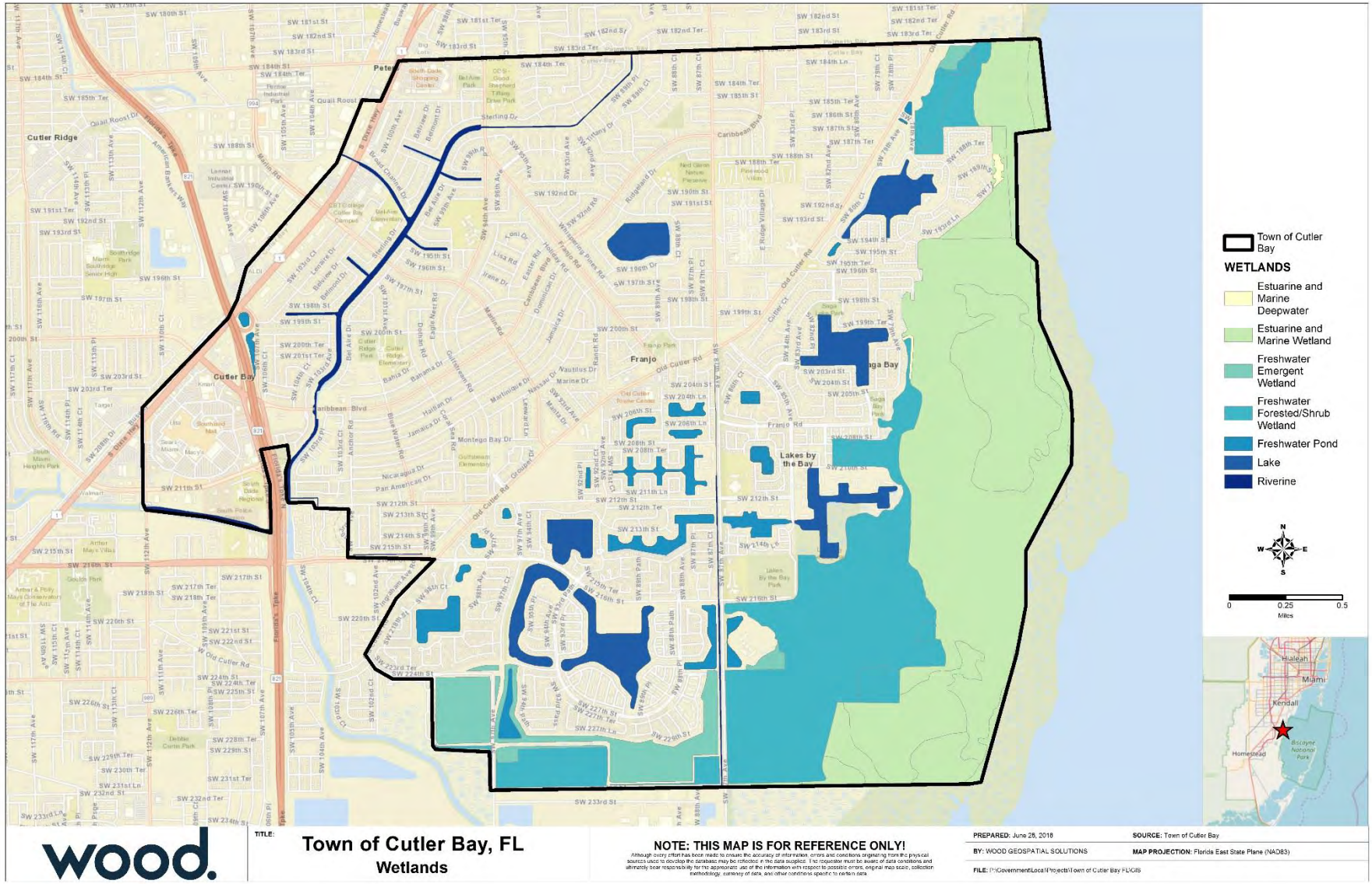


Figure 2.5 – Town of Cutler Bay Wetlands

2.4 DRAINAGE BASINS AND CANALS

As shown in Figure 2.7, the Town is comprised of three Miami-Dade County canal basins: C-100, C-1 and D-4A.

The C-100 basin has a triangular boundary and comprises approximately 40 square miles in the northern portion of the Town (see Figure 2.6). The C-100 basin includes the area north of SW 97th Avenue (Franjo Road) and Old Cutler Road. Upstream in this watershed is governed by the following requirements from the South Florida Water Management District. This basin is also known as the Cutler Drainage Basin. This system of conveyances (i.e. C-100, C-100A, C-100B, C-100C) is designed to provide flood protection from the 10-year storm. The allowable discharge rate at any point is 56.6 CSM. The allowable discharge rates are described in cubic feet per second per square mile (CSM).

The C-1 basin comprises approximately 58 square miles and covers the western portion of the Town (see Figure 2.6). The C-1 basin includes land west of Franjo Road and SW 87th Avenue (Galloway Road). This basin is over 50 square miles and is larger than the minimum requirement for showing upstream discharge.

The D-4A basin comprises approximately four square miles in the eastern portion of the Town. The D-4A basin includes land east of Old Cutler Road and Galloway Road.

There are also six major canals that lie within and/or border the Town of Cutler Bay: C-100, C100B, C-1, C-1N, C-1W and L31E. These canals provide three main functions:

- To provide drainage and flood protection.
- To supply water for irrigation.
- To maintain a groundwater table elevation that is adequate to prevent saltwater intrusion into local groundwater.

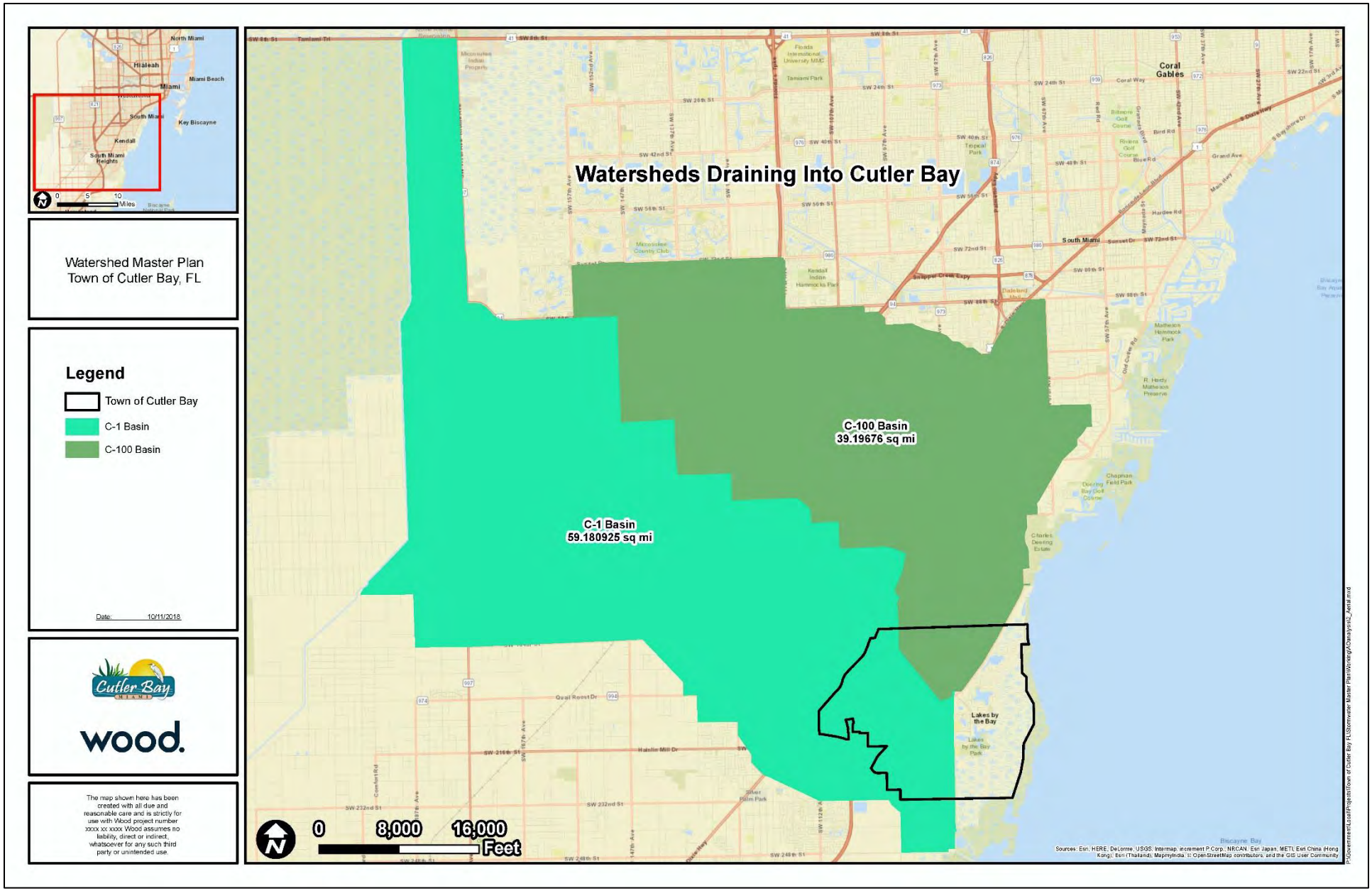


Figure 2.6 – Watersheds Draining into Cutler Bay

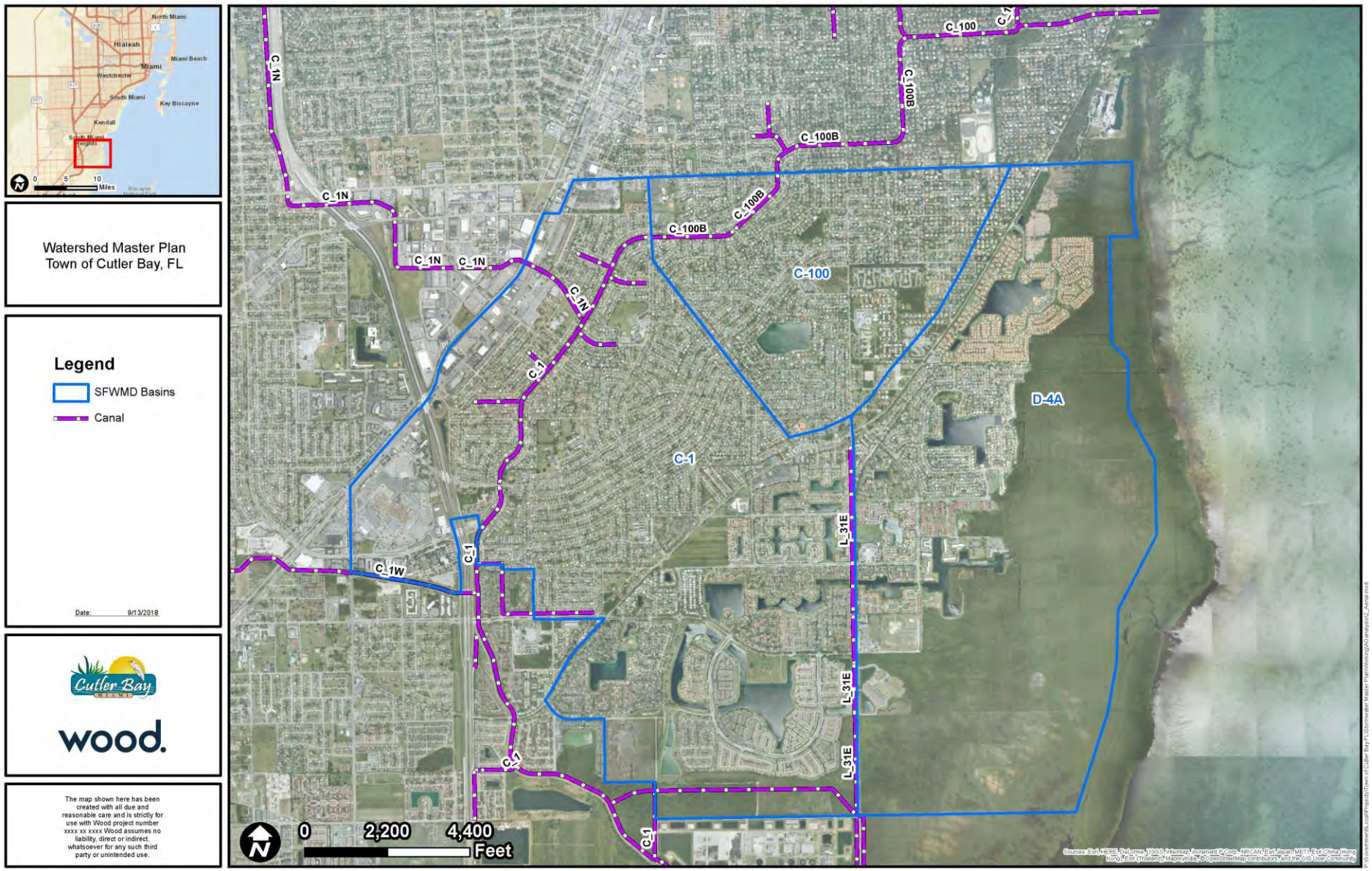


Figure 2.7 – Drainage Basins

3 Climate Adaptation

As the Town of Cutler Bay seeks to plan for current and future stormwater management, it must consider the potential impacts of climate change, including the effects of sea level rise and saltwater intrusion.

3.1 SEA LEVEL RISE

Historical trends in sea level rise according to NOAA tide gage records from 1931 to 1981 indicate that the relative sea level near Cutler Bay has risen at an average rate of 2.39 mm/year. This is equivalent to a rise of 0.78 feet in 100 years. This linear trend is shown below in Figure 3.1.

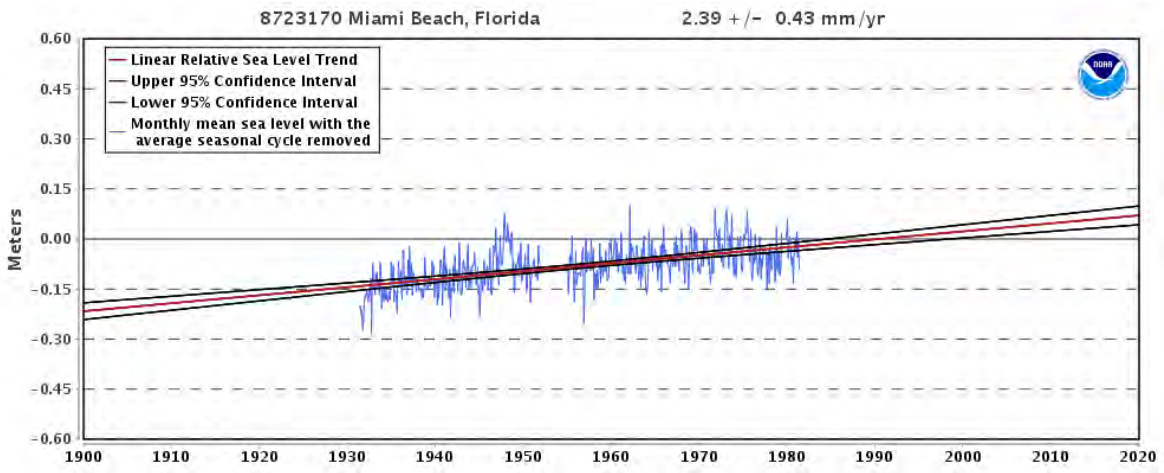


Figure 3.1 – Relative Sea Level Trend, Miami Beach Tide Station

According to the Fifth Assessment Report of the International Panel on Climate Change (IPCC), with accelerating ice melt and thermal expansion resulting from climate change, it is very likely that the future rate of sea level rise will exceed the historical rate.

The Union of Concerned Scientists reported in 2016 that the Miami-Dade County area can expect 15 inches of sea level rise above current levels by the year 2045, according to US Army Corps of Engineers data. Based on this projection, coastal communities in the county would face up to 80 tidal flooding events annually by 2030 and up to 380 high-tide flood events annually by 2045. These tidal floods are also expected to be much more extensive and reach farther inland.

Climate Central's 2014 report, "Florida and the Surging Sea," projects sea level rise of 1.7 to 4.7 feet along the Florida coast by 2100 using sea level in 2012 as a baseline. This range reflects variation in low, intermediate, and high emissions scenarios developed by the National Research Council and adapted by the U.S. Army Corps of Engineers and the Southeast Florida Regional Climate Change Compact.

In 2015, the Southeast Florida Regional Climate Change Compact released an updated sea level rise projection with a long-term projection that sea level will rise 31 to 81 inches above 1992 mean sea level by 2100.

Figure 3.2 on the following page shows the potential inundation area with 2 feet of sea level rise, which is roughly what is expected under the intermediate low scenario by 2100, according to NOAA's Sea Level Rise Viewer.

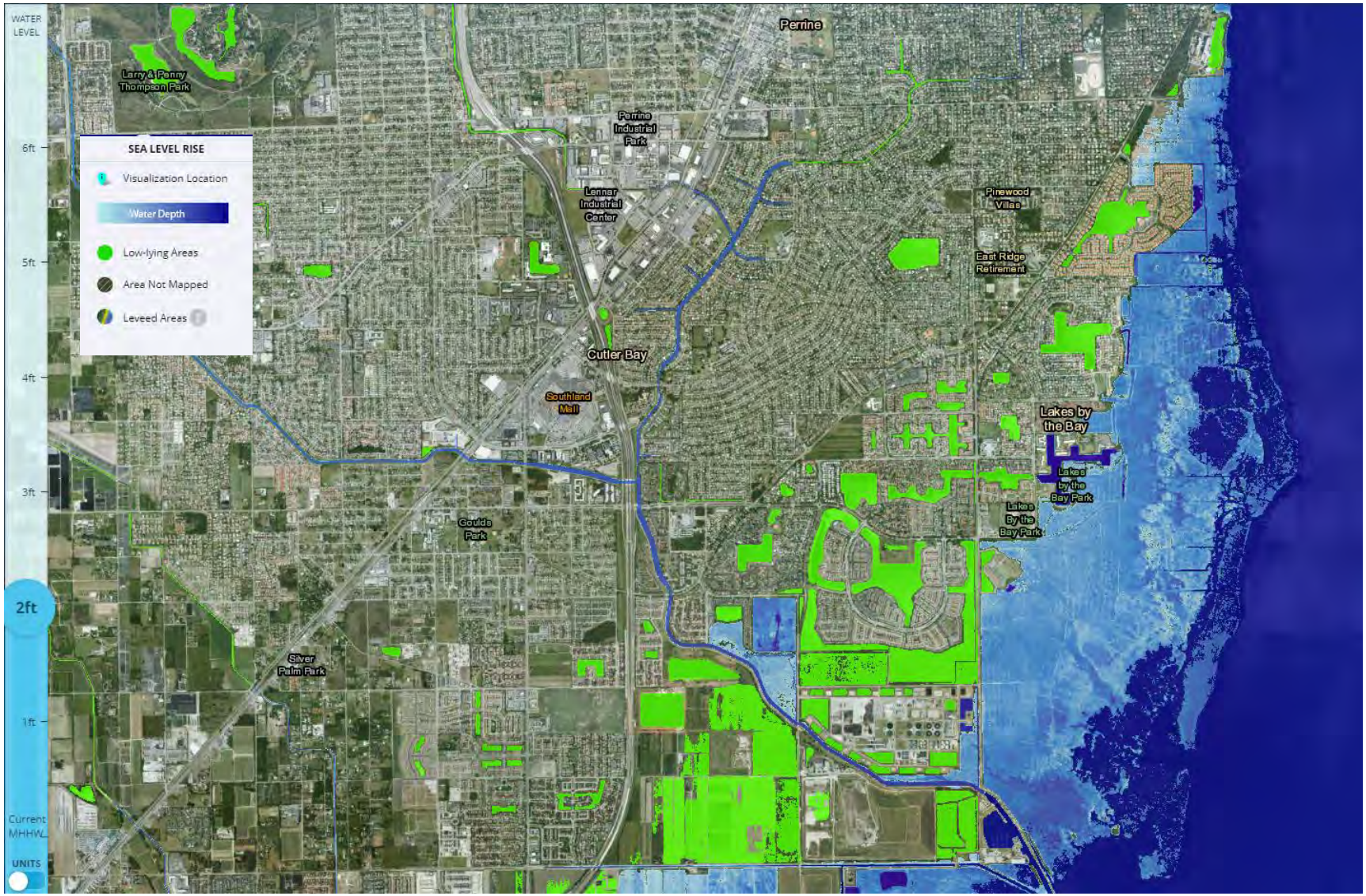


Figure 3.2 – Potential Inundation with 2 Feet Sea Level Rise

3.2 ELEVATED GROUNDWATER LEVELS

The U.S. Geological Survey (USGS) developed a surface water and groundwater model of Miami-Dade County, detailed in the 2016 report, "Hydrologic Conditions in Urban Miami-Dade County, Florida, and the Effect of Groundwater Pumpage and Increased Sea Level on Canal Leakage and Regional Groundwater Flow." The model was developed using USGS's MODFLOW-INT and uses a sea level rise scenario based on the National Research Council curve III (NRC III).

The USGS report finds that during the 30th year of the sea level rise scenario, the water table was less than 0.5 feet below land surface in 5,672 of the 19,089 total model cells (29.7% of the study area). Additionally, the model finds a 10.32 square mile increase in flood-prone areas and a 4 percent increase in the percentage of time flood prone areas have a water table depth less than 0.5 feet below land surface. Compared to the current sea level scenario, the study also found that sea level rise reduces the hydraulic gradient, which reduces canal flows through salinity control structures and groundwater outflow and reduced the rate at which the canal system can recharge the groundwater system. In other words, sea level rise slows canal drainage and reduces canal capacity for managing the hydrologic system.

3.3 SALT WATER INTRUSION

As sea levels rise, the "salt front" (location of the freshwater-saltwater line) may progress further upstream. This progression may be further exacerbated by drought, reduced rainfall or changes in water demand. During periods of drought there is not enough rainfall to replenish fresh water aquifers. When fresh water levels decrease, the transition zone where freshwater meets salt water rises and saltwater intrusion becomes a threat to the quality of ground water.

Beyond the threat to the quality of ground water and drinking water supply, saltwater intrusion is a threat to the Everglades due to habitat migration and ecological shifts, such as freshwater marshes giving way to saline mangroves. Saline mangroves are typically coastal but are now found further inland due to saltwater intrusion. As a result of saltwater intrusion, certain habitats have become inhospitable to supporting historically indigenous wildlife and new wildlife has encroached.

Saltwater intrusion into the stormwater system can also corrode pipes and other components, increasing infrastructure maintenance costs for the Town.

4 Data Collection

This section summarizes data sources and the data collected to compile the Community Profile as well as to inform the modeling and analysis for this Watershed Master Plan.

4.1 TOWN OF CUTLER BAY

The Town of Cutler Bay provided spatial data of the Town's Future Land Use 2020 map as well as an image of the Town's existing land use which was digitized and reproduced, incorporating known changes in land use that occurred since the production of the source map.

The 2008 Stormwater Master Plan and 2014 Floodplain Mitigation Plan were reviewed for relevancy and to understand the stormwater issues facing the Town and the Town's approach to stormwater management to date.

The Town also provided a July 1, 2013 update of the Town of Cutler Bay Capital Improvement Element (CIE), which includes a description of projects completed since the development of the 2008 Stormwater Master Plan. Annual updates to the CIE from August 15, 2012 and December 10, 2014 were also retrieved and reviewed.

4.2 MIAMI-DADE COUNTY

Miami-Dade County maintains an open data GIS portal with a variety of spatial data on the environment, hydrology, infrastructure, planning, and other categories. The following data was retrieved from the GIS portal:

- Municipal boundaries: this dataset represents municipal boundaries within Miami-Dade County, including the Town of Cutler Bay.
- Canals: this dataset is a line feature class representing all canals across Miami-Dade County.
- Contours: the dataset is a line feature class representing topography in five feet contour lines, provided by the Florida Water Management District.
- Stormwater Lines: this dataset represents all drainage features for the Unincorporated Miami-Dade County Service Area (UMSA), which can be represented by lines in a map, such as outfalls, culverts, infiltration trenches, and ditches in the drainage network. The data was collected through permit files, surveys and "as-builts", representing the best available information for each location at the time the layer was published. The dataset is updated monthly and was retrieved in June 2018.
- Stormwater Points: this dataset represents all drainage features in the Unincorporated Miami-Dade County Service Area (UMSA), which can be represented by points in a map, such as manholes, catch basins, drainage wells, inlets, valves, weirs and canal cross sections in the drainage network. The data was collected through permit files, surveys and "as-builts", representing the best available information for each location at the time the layer was published. The dataset is updated monthly and was retrieved in June 2018.

Miami-Dade County GIS data is located here: https://gis-mdc.opendata.arcgis.com/

The Miami-Dade Office of Resilience's Report on Flooding and Salt Water Intrusion, prepared in conjunction with the USGS, South Florida Water Management District, and the Army Corps of Engineers, was also acquired and reviewed. Findings in this report supplemented the background information on sea level rise and its expected impacts on the county.

4.3 DATA FROM OTHER SOURCES

4.3.1 National Wetlands Inventory

The National Wetlands Inventory (NWI) is a resource provided by the U.S. Fish & Wildlife Service (FWS) to detail the abundance, characteristics, and distribution of U.S. wetlands. The NWI Wetlands Mapper tool provides this data spatially, detailing the status, extent, and functions of wetlands. NWI data was downloaded through the Wetlands Mapper tool for analysis. The data was retrieved in June 2018 at which time it was last updated on May 1, 2018.

NWI data is located here: https://www.fws.gov/wetlands/

4.3.2 South Florida Water Management District (SFWMD)

The South Florida Water Management District *Environmental Resource Permit Applicant's Handbook Volume II* is applicable to the water quality and water quality design and performance criteria of stormwater management systems. According to the SFWMD requirement, a storm event of 3 day duration and 25 year return frequency shall be used in computing off-site discharge rates unless otherwise specified by previous Agency permits or criteria. In this analysis, the 10, 25, 50 and 100-year return frequency storm event of 3-day duration were selected as design storms. The rainfall depth for each storm event was extracted from the South Florida Water Management District *Environmental Resource Permit Applicant's Handbook Volume II* and is shown in Table 4.1 in the following Section.

The rainfall distribution was obtained from Isohyetal Maps from SFWMD Technical Memorandum, *Frequency Analysis of One and Three Day Rainfall Maxima for Central and Southern Florida*, October 1990.

4.3.3 Union of Concerned Scientists

The Union of Concerned Scientists (UCS) reviews and compiles research on climate change and sea level rise across the country. The UCS Fact Sheet "Encroaching Tides in Miami-Dade County, Florida" was reviewed for a summary of the estimated amount of sea level rise the County will experience and the anticipated consequences of this sea level rise for the County.

4.3.4 U.S. Geological Survey

The U.S. Geological Survey (USGS) developed a model for surface water and groundwater in Miami-Dade County to evaluate the effect of groundwater pumping and sea level rise on canal leakage and groundwater flow. The report on the findings of this study, "Hydrologic Conditions in Urban Miami-Dade County, Florida, and the Effect of Groundwater Pumpage and Increased Sea Level on Canal Leakage and Regional Groundwater Flow" was reviewed for information on the consequences of sea level rise on the County's stormwater system.

The USGS report can be found here: https://pubs.usgs.gov/sir/2014/5162/

4.3.5 U.S. Army Corps of Engineers

The Comprehensive Everglades Restoration Plan (CERP), implement by the U.S. Army Corps of Engineers, is intended to maintain and improve the environmental quality of the Everglades and surrounding South Florida ecosystems by balancing and improving water quality, flood control, natural systems and water supply. The CERP initiated the construction of many of the canals and control structures that serve as stormwater infrastructure collection in the Town.

Included in the CERP is a Biscayne Bay Coastal Wetlands component. Historically, the natural landscape distributed flow from the Everglades evenly across the coastal marshes into Biscayne Bay. Water management systems have reduced the freshwater flow to the bay causing salinity concentrations to exceed natural conditions. The ultimate goal of the Biscayne Bay Coastal Wetlands project is to improve the spatial distribution of freshwater into the bay.

4.3.6 Federal Emergency Management Agency

The Town of Cutler Bay has been a participant in the National Flood Insurance Program (NFIP) since August 31, 2006. Cutler Bay has achieved a Class 5 flood insurance rating through participation in the NFIP's Community Rating System which rewards all policyholders in the Town with a 25 percent reduction in their flood insurance premiums.

In its common usage, the floodplain most often refers to that area that is inundated by the 100-year flood, the flood that has a 1% chance in any given year of being equaled or exceeded. The 100-year flood is the national minimum standard to which communities regulate their floodplains through the NFIP. The 500-year flood is the flood that has a 0.2 percent chance of being equaled or exceeded in any given year. The potential for flooding can change and increase through various land use changes and changes to land surface, which result in a change to the floodplain. A change in environment can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity.

Regulated floodplains are illustrated on inundation maps called Digital Flood Insurance Rate Maps (DFIRMs). It is the official map for a community on which FEMA has delineated both the special flood hazard areas (SFHAs) and the risk premium zones applicable to the community. SFHAs represent the areas subject to inundation by the 1-percent-annual chance flood event. Structures located within the SFHA have a 26-percent chance of flooding during the life of a standard 30-year mortgage. Flood zones are geographic areas that FEMA has defined according to varying levels of flood risk and type of flooding. Flood prone areas were identified within the Town of Cutler Bay using the most current Flood Insurance Study (FIS) and associated DFIRMs developed by FEMA and adopted by ordinance on September 11, 2009. Table 4.1 summarizes the flood insurance zones identified by the DFIRMs. Figure 4.1 reflects the mapped flood insurance zones for the Town of Cutler Bay.

Table 4.1 – Cutler Bay Flood Insurance Zones

Flood Zone	Description
VE	Also known as the coastal high hazard areas. They are areas subject to high velocity water including waves; they are defined by the 1% annual chance (base) flood limits (also known as the 100-year flood) and wave effects 3 feet or greater. The hazard zone is mapped with base flood elevations (BFEs) that reflect the combined influence of stillwater flood elevations, primary frontal dunes, and wave effects 3 feet or greater.

Flood Zone	Description
AE	AE Zones, also within the 100-year flood limits, are defined with BFEs that reflect the combined influence of stillwater flood elevations and wave effects less than 3 feet. The AE Zone generally extends from the landward VE zone limit to the limits of the 100-year flood from coastal sources, or until it reaches the confluence with riverine flood sources. The AE Zones also depict the SFHA due to riverine flood sources, but instead of being subdivided into separate zones of differing BFEs with possible wave effects added, they represent the flood profile determined by hydrologic and hydraulic investigations and have no wave effects.
AH	Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are 1–3 feet. BFEs derived from detailed hydraulic analyses are shown in this zone.
0.2% Annual Chance (shaded Zone X)	Moderate risk areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent-annual-chance flood by a levee. No BFEs or base flood depths are shown within these zones. (Zone X (shaded) is used on new and revised maps in place of Zone B.)
Zone X (unshaded)	Minimal risk areas outside the 1-percent and .2-percent-annual-chance floodplains. No BFEs or base flood depths are shown within these zones. (Zone X (unshaded) is used on new and revised maps in place of Zone C.)

4.3.7 Environmental Protection Agency

Recognizing that stormwater is a major source of pollution, the United States Environmental Protection Agency (EPA) initiated the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit program for local governments, under authorization by the United States Clean Water Act (33 U.S.C. §1251 et seq. (1972)). NPDES-MS4 permitting in Florida has two phases. Phase I addresses discharges of stormwater runoff from "medium" and "large" MS4s (i.e., those MS4s located in incorporated areas with populations of 100,000 or greater). Phase II of the program includes additional MS4s that are urbanized but meet lower population thresholds. Cutler Bay, along with more than thirty other communities in the Biscayne Bay watershed, was permitted by the Florida Department of Environmental Protection (FDEP) under Phase I as co-permittees under Miami-Dade County's MS4 NPDES permit. The co-permittees are regulated under one NPDES permit, but each co-permittee is required to develop and employ their own stormwater management program. On October 1, 2017, the Town of Cutler Bay entered into a five-year agreement for shared stormwater management between Cutler Bay and the County. The County provides maintenance of the municipal stormwater system and is reimbursed on an agreed-upon basis by Cutler Bay.

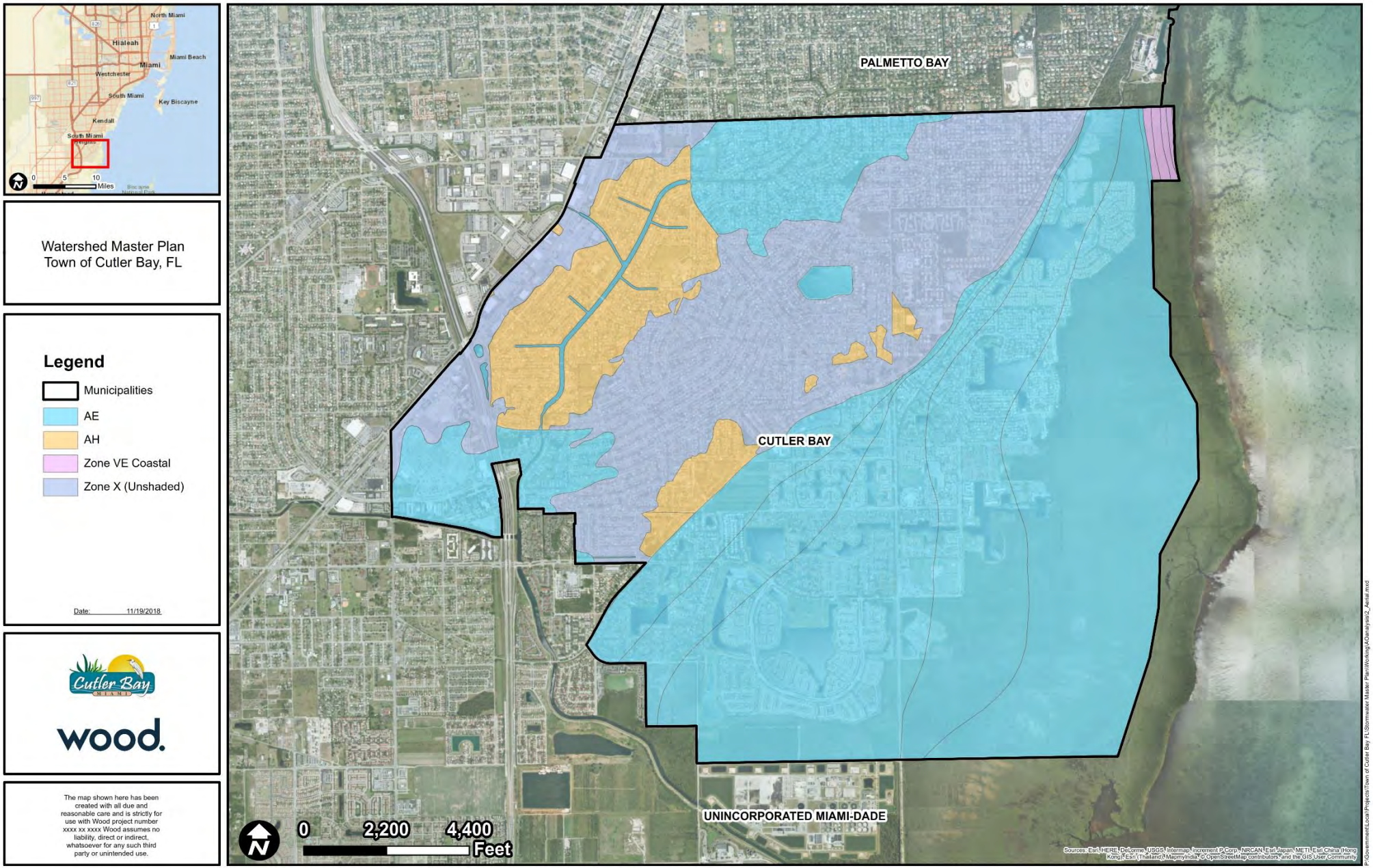


Figure 4.1 – Cutler Bay Mapped Flood Insurance Zones

5 Water Quantity Methodology

In order to address future development (new development and/or redevelopment), a detailed study of runoff under both present and future (fully developed) conditions was prepared. This section provides a comparison of pre- and post-development peak flows on the watershed level as well as the individual sub-basin level for those parcels within the Town that are currently undeveloped.

PCSWMM-2D Professional was selected as the modeling software to perform this study. Hydrologic models were used to simulate various storm events, based on the nature of the watershed's current impervious area, future land use and future impervious area, to determine the timing and total volume of peak flows. These hydrologic studies were then used to determine the appropriate amount of detention necessary to ensure that post-development runoff is less than or equal to pre-development runoff.

5.1 STORM EVENT

A storm event of a 3-day (72-hr) duration was used to compute discharge rates for the 10-, 25-, 50- and 100-year return frequencies. This storm event was chosen based on the South Florida Water Management District (SFWMD) *Environmental Resource Permit Applicant's Handbook Volume II* and the rainfall depth for each storm event was also extracted from this document. The rainfall distribution was obtained from Isohyetal Maps from SFWMD Technical Memorandum, *Frequency Analysis of One and Three Day Rainfall Maxima for Central and Southern Florida*, October 1990. Table 5.1 below displays total rainfall depth for each return frequency. Additional rainfall data is provided in Appendix A.

Table 5.1 – Rainfall Depth

Storm Event	3 Days Rainfall Depth (in)
10	10
25	11
50	12.2
100	14

5.2 AREAS STUDIED AND MODEL APPROACH

The Town of Cutler Bay is comprised of three watersheds: C-100, C-1 and D-4A, shown in Figure 5.1. For the watershed level analysis of C-100, C-1 and D-4A, pre- and post-development peak flows were computed for a 3-day duration/25-year return frequency and a 3-day duration 100-year return frequency.

As mentioned in Section 2.1, the Town is almost entirely built out; therefore, changes to land use will primarily be limited to redevelopment. However, there are a small number of vacant parcels throughout the Town that may be subject to future development. Using a LiDAR based terrain, orthographic imagery and land use provided by the Town of Cutler Bay, 18 sub-basins were identified for vacant parcels greater than 1 acre (shown in Figure 5.2). Pre- and post-development peak flows were computed over a 3-day duration for the 10-, 25-, 50- and 100-year return frequencies for the 18 sub-basins. For the 25- and 100-year return frequencies, the post-development hydrographs were routed through a detention basin in

order to size an overflow structure to control post-development discharges at or below pre-development rates. The approximate storage required to mitigate increases in peak flow of post-development was calculated for each sub-basin.

The SCS Curve Number infiltration method was selected to compute the runoff for each sub-basin. The Curve Number is based on soils data from the National Resources Conservation Service (NRCS) SSURGO data, and land use data from the National Land Cover Database (NLCD) supplemented by orthographic imagery and data from the Town. The slope of each sub-basin was calculated based on a 5-ft digital elevation model (DEM) derived from LiDAR data provided by Miami-Dade County. The impervious area for existing and future conditions was estimated based on land cover data, the Town's zoning map and orthographic imagery. The width of the overland flow path for sheet flow runoff for each sub-basin was developed by delineating and averaging the maximum length of overland sheet flow.

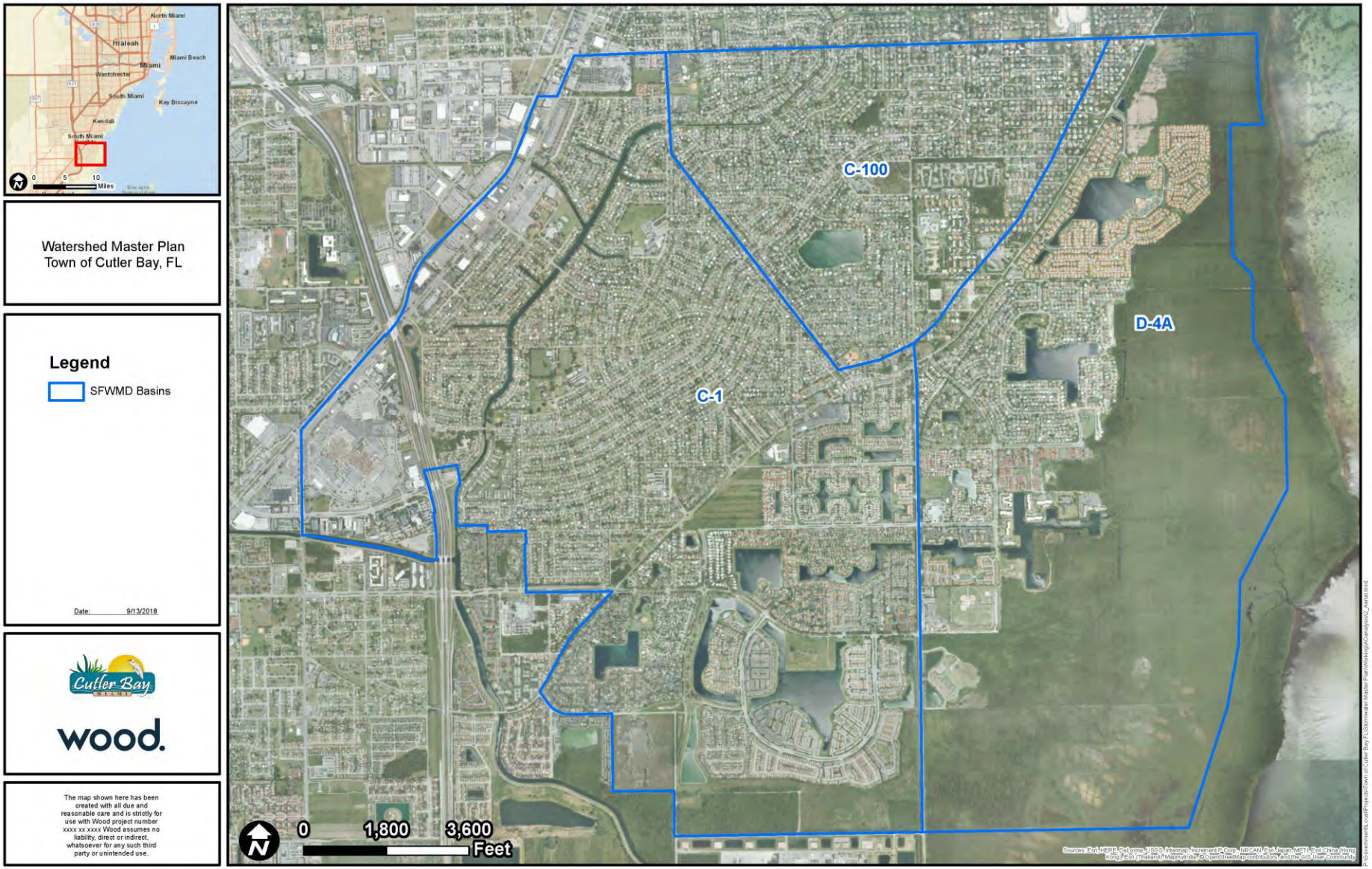


Figure 5.1 – Canal Basins

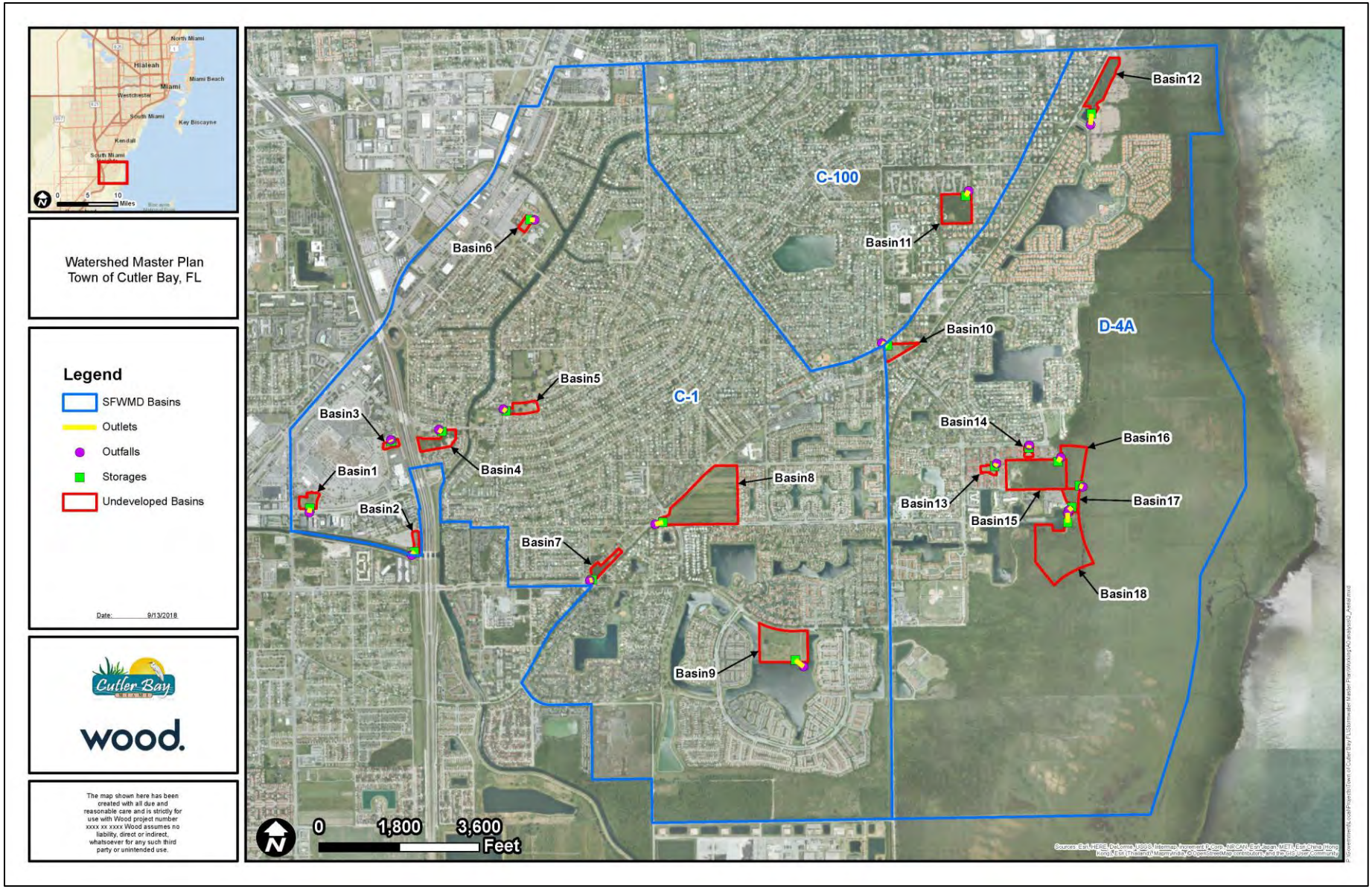


Figure 5.2 – Detailed Study Sub-basins

6 Water Quantity Results

6.1 WATERSHED LEVEL ANALYSIS

For the watershed level analysis, pre- and post-development peak flows were computed for a 3-day duration/25-year return frequency and a 3-day duration/100-year return frequency. Pre- and Post-peak flow hydrographs for each watershed follow Table 6.1 below. Tabular hydrograph results are provided in Appendices B-D.

Table 6.1 – Watershed Level Pre and Post Peak Comparison

Watershed	Area (Acre)	Exist. Imperv. %	Future Imperv. %	Pre Peak 25 Yr (CFS)	Post Peak 25 Yr (CFS)	Pre Peak 100 Yr (CFS)	Post Peak 100 Yr (CFS)	Pre Total Runoff 25 Yr (Ac-Ft)	Post Total Runoff 25 Yr (Ac-Ft)	Pre Total Runoff 100 Yr (Ac-Ft)	Post Total Runoff 100 Yr (Ac-Ft)
C-1	3,070	70	90	13,480	15,540	17,690	20,200	2,562	2,725	3,320	3,490
C-100	1,012	80	90	4,840	5,123	6,314	6,657	884	905	1,136	1,157
D-4A	2,465	40	60	6,565	8,896	8,667	11,670	1,879	2,016	2,481	2,624

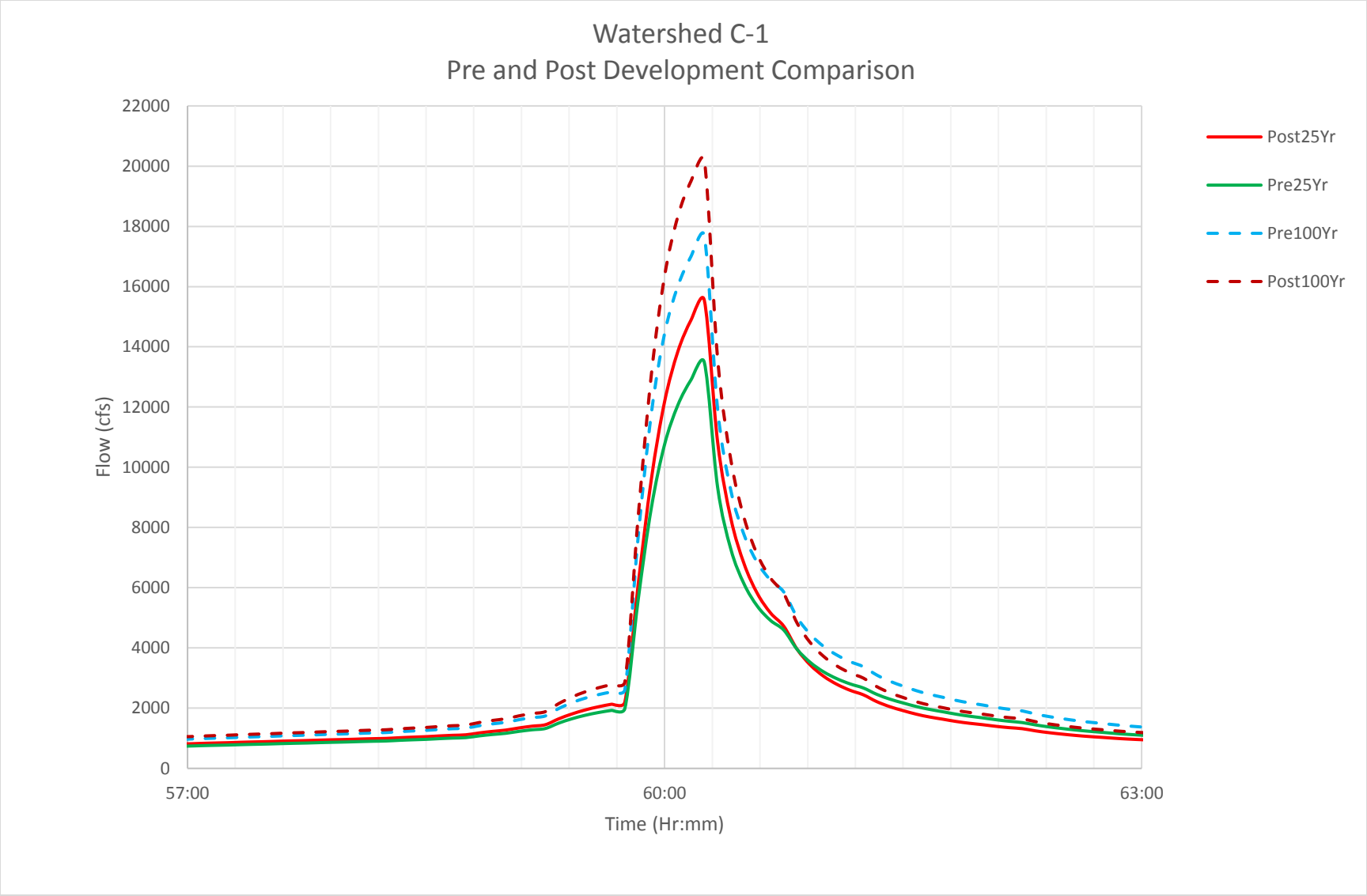


Figure 6.1 – Watershed C-1 Hydrograph

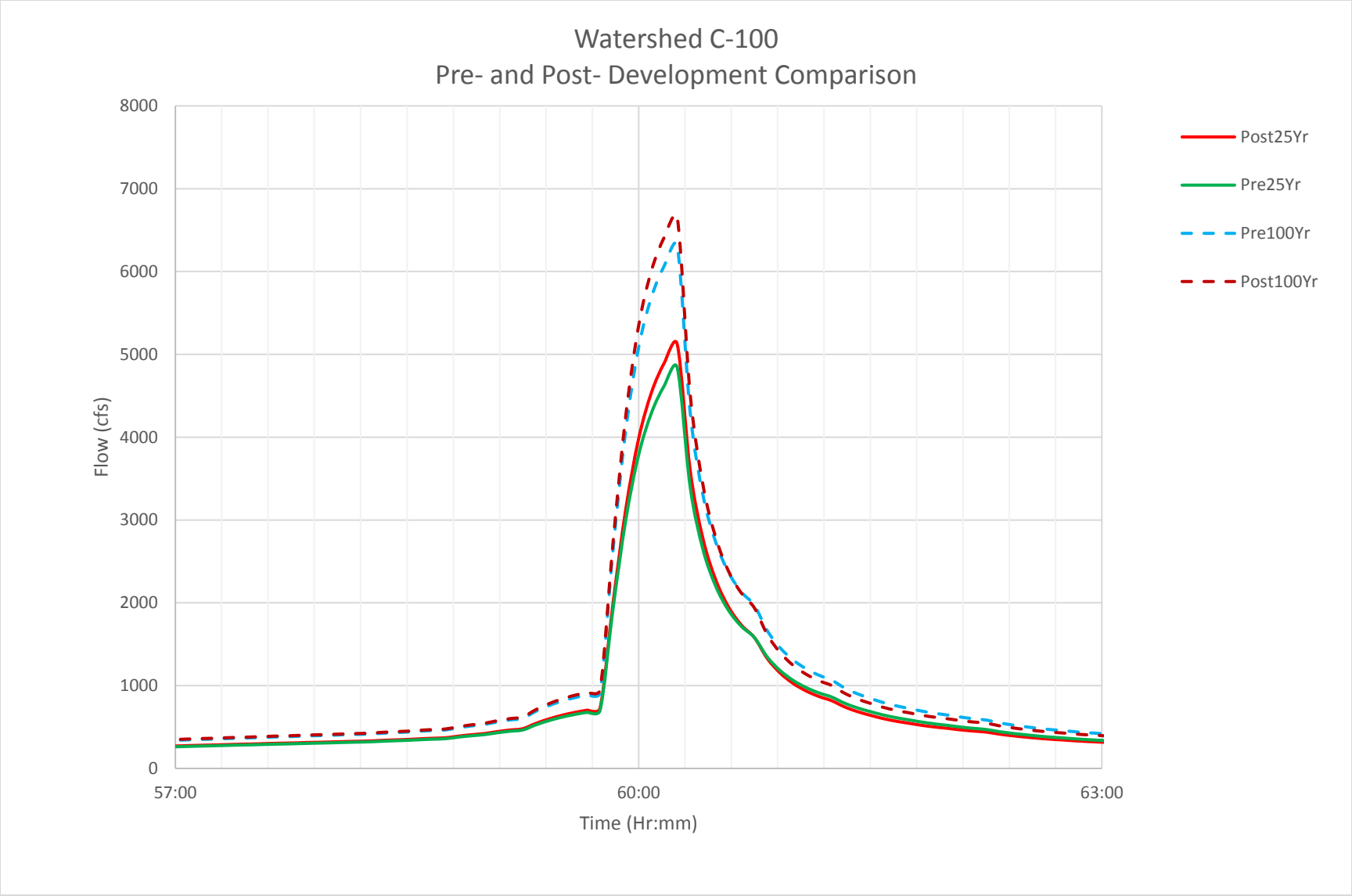


Figure 6.2 – Watershed C-100 Hydrograph

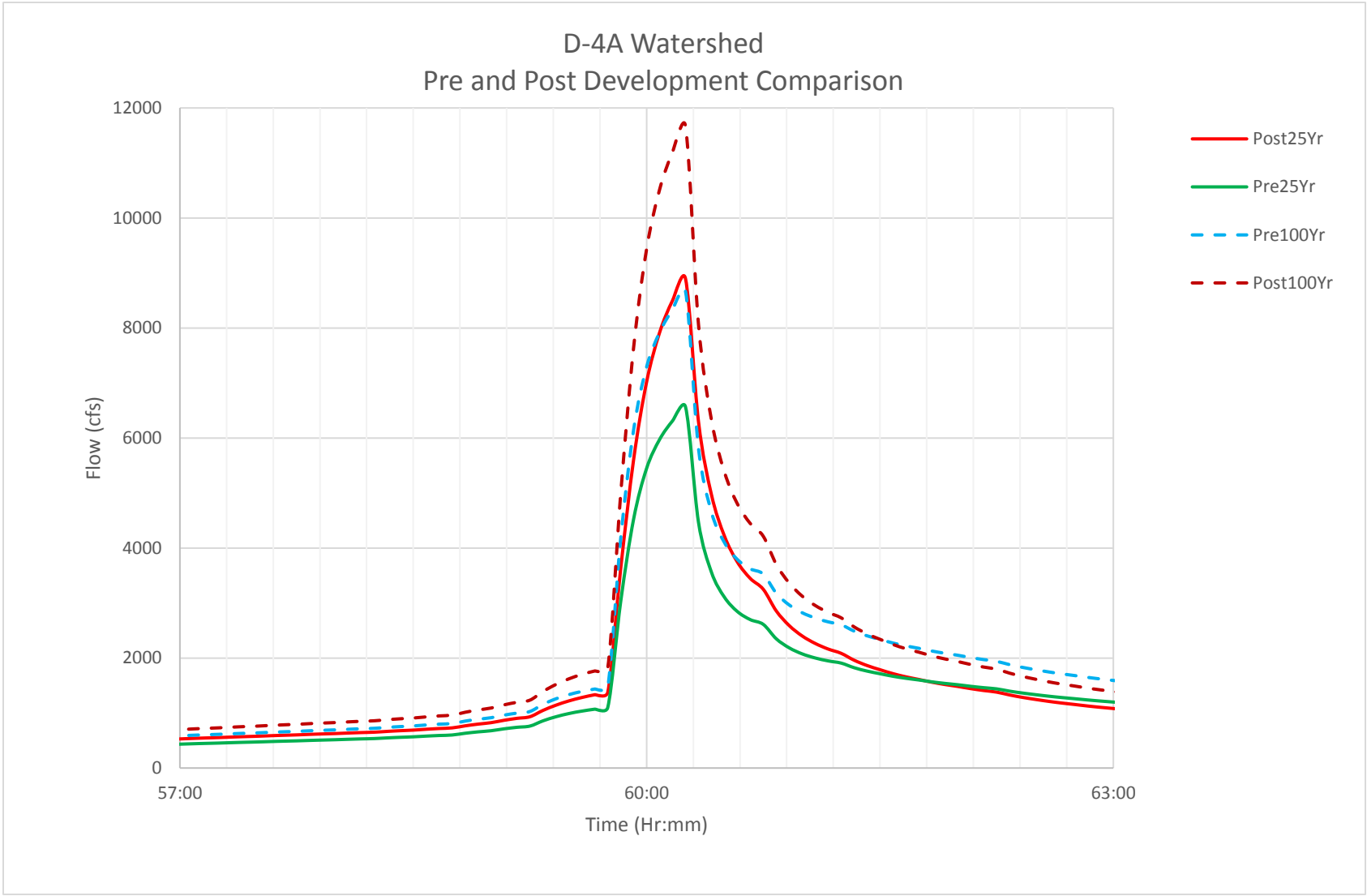


Figure 6.3 – Watershed D-4A Hydrograph

6.2 SUB-BASIN LEVEL ANALYSIS

For the sub-basin detailed analysis, pre- and post-development peak flows were computed over a 3-day duration for the 10-, 25-, 50- and 100-year return frequencies. For the 25- and 100-year return frequencies, the post-development hydrographs were routed through a detention basin in order to size an overflow structure that will control post-development discharges at or below pre-development rates. Pre- and Post-peak flow data as well as storage requirements for the 25- and 100-year return frequencies are shown in Tables 6.2 and 6.3 below. Hydrographs and tabular hydrograph results are provided in Appendices E-V for each sub-basin and return frequency.

Table 6.2 – Summary of Sub-basin Pre and Post Peak Comparison for 10- and 25-yr Storm Events

Basin	Area (Acre)	Exist. Imperv. %	Future Zone	Future Imperv. %	10-year Pre Peak (CFS)	10-year Post Peak (CFS)	25-year Pre Peak (CFS)	25-year Post Peak (CFS)	25-year Post w/ Pond Peak (CFS)	25-year Designed Storage Volume (1000 CF)	25-year Maximum Volume (1000 CF)
1	3.0	<5	TC	95	13.06	14.9	14.63	16.41	13.4	15	14.4
2	1.5	<5	TC	95	6.75	7.68	7.56	8.46	7.35	7	6.4
3	1.2	<5	TC	95	5.02	5.9	5.64	6.5	4.95	6.5	6.4
4	5.7	<5	MR9	75	18.56	26.47	21.44	29.31	19.96	34	32.3
5	3.6	<5	SR	80	9.55	16.6	11.22	18.37	10.53	25	23.9
6	1.3	<5	SR	80	5.56	6.48	6.27	7.15	5.81	6.5	6.3
7	3.2	<5	NC1	90	4.8	15.17	5.86	16.73	4.93	33.5	33.0
8	35.8	<5	NC1	90	131.01	177.12	148.98	195.05	138.53	210	200.6
9	18.3	<5	NC2	90	68.02	90.36	77.56	99.61	71.71	110	105.2
10	3.9	<5	NC1	90	16.59	19.42	18.67	21.39	17.51	19	18.5
11	10.2	<5	ER	70	35.12	48.93	40.03	54.08	37.35	60	56.0
12	8.4	<5	SR	80	24.14	40.68	27.73	44.89	25.71	60	57.1
13	1.5	<5	MR9	75	6.16	7.1	6.94	7.84	6.68	6.5	6.2
14	1.0	<5	MR9	75	3.14	4.54	3.62	5.03	3.58	6	5.4
15	20.6	<5	NR	65	37.34	88.58	43.72	98.59	39.16	160	156.7
16	9.3	<5	MR13	85	19.92	44.94	23.24	49.6	21.51	80	78.2
17	3.0	<5	MR13	85	9.97	14.6	11.44	16.1	9.87	20.5	20.2
18	29.7	<5	MR13	85	60.31	143.52	70.43	158.44	67.64	260	251.3

Table 6.3 – Summary of Sub-basin Pre and Post Peak Comparison for 50- and 100-yr Storm Events

Basin	Area (Acre)	Exist. Imperv. %	Future Zone	Future Imperv. %	50-year Pre Peak (CFS)	50-year Post Peak (CFS)	100-year Pre Peak (CFS)	100-year Post Peak (CFS)	100-year Post w/ Pond Peak (CFS)	100-year Designed Storage Volume (1000 CF)	100-year Maximum Volume (1000 CF)
1	3.0	<5	TC	95	16.51	18.21	19.32	20.92	18.46	16.5	15.2
2	1.5	<5	TC	95	8.53	9.39	9.97	10.78	9.45	8.5	8.0
3	1.2	<5	TC	95	6.38	7.21	7.49	8.29	7.08	7	6.6
4	5.7	<5	MR9	75	24.94	32.71	30.26	37.83	27.99	40.5	37.8
5	3.6	<5	SR	80	13.29	20.5	16.49	23.72	15.32	30	27.9
6	1.3	<5	SR	80	7.11	7.96	8.37	9.17	7.81	8	7.3
7	3.2	<5	NC1	90	7.22	18.62	9.44	21.46	9.1	37	35.4
8	35.8	<5	NC1	90	170.72	216.56	203.58	248.8	185.98	260	241.8
9	18.3	<5	NC2	90	89.09	110.7	106.46	127.34	95.07	135	128.3
10	3.9	<5	NC1	90	21.16	23.77	24.88	27.33	23.97	21	20.1
11	10.2	<5	ER	70	46	60.25	55.05	69.5	50.27	75	68.5
12	8.4	<5	SR	80	32.12	49.94	38.86	57.52	36.16	75	67.8
13	1.5	<5	MR9	75	7.87	8.74	9.26	10.07	8.96	8	7.2
14	1.0	<5	MR9	75	4.2	5.62	5.1	6.52	4.64	7.5	7.0
15	20.6	<5	NR	65	51.68	110.68	64.15	128.94	60.7	195	182.1
16	9.3	<5	MR13	85	27.35	55.2	33.75	63.59	32.02	100	91.5
17	3.0	<5	MR13	85	13.22	17.89	15.93	20.58	14.01	25	23.4
18	29.7	<5	MR13	85	83.02	176.35	102.66	203.21	97.27	310	301.5

6.3 DETAILED BASIN DESCRIPTION AND RESULTS

6.3.1 Basin 1

Basin 1 is a sub-basin within the C-1 watershed. The parcel is 3.0 acres and is located near the northeastern corner of the intersection of SW 211th Street and SW 112th Avenue. The parcel is bordered to the north, east, and west by the Southland Mall. Figure 6.4 shows the location of the basin.

Topography of the parcel ranges from 5.3 feet to 9.8 feet, with a peak of 9.8 feet in the northeastern portion of the parcel, an elevation of 7 feet around the northern, eastern, and western boundaries of the parcel, and a sink in the southern and central portions of the parcel.

The current land use of the parcel is open space. The future land use and zoning designation for the parcel is Town Center. As it is currently zoned, the parcel has the potential to be developed with up to 100 percent impervious surface coverage. However, for the purpose of assessing future stormwater runoff potential, the parcel was modeled with a future impervious surface coverage of 95 percent because this slightly lower impervious surface threshold reflects the Town's desire to encourage the implementation of Best Management Practices such as shallow bioretention and permeable pavers that would reduce impervious surface area on this parcel.

Soils in the basin are categorized as hydrologic soil group D: clay loam, silty clay loam, sandy clay, silty clay, or clay.

The following tables summarize the pre- and post- peak runoff for the 10-, 25-, 50-, and 100-year return frequencies.

Basin	10-year Pre Peak (CFS)	10-year Post Peak (CFS)	25-year Pre Peak (CFS)	25-year Post Peak (CFS)	25-year Post w/ Pond Peak (CFS)	25-year Designed Storage Volume (1000 CF)	25-year Maximum Volume (1000 CF)
1	13.06	14.9	14.63	16.41	13.4	15	14.4

Basin	50-year Pre Peak (CFS)	50-year Post Peak (CFS)	100-year Pre Peak (CFS)	100-year Post Peak (CFS)	100-year Post w/ Pond Peak (CFS)	100-year Designed Storage Volume (1000 CF)	100-year Maximum Volume (1000 CF)
1	16.51	18.21	19.32	20.92	18.46	16.5	15.2

Figure 6.4 – Basin 1 Location Map

6.3.2 Basin 2

Basin 2 is a sub-basin within the C-1 watershed. The parcel is 1.5 acres and is located along the western side of Florida's Turnpike South where it crosses the Black Creek Canal. Figure 6.5 shows the location of the basin.

Topography of the parcel ranges from 0.4 feet to 10.2 feet, sloping down gradually from east to west with a drainage ditch running north-south along the western side of the parcel. There is a slight peak in elevation of 10.2 feet in the southeastern portion of the parcel.

The current land use of the parcel is open space. The future land use and zoning designation for the parcel is Town Center. As it is currently zoned, the parcel has the potential to be developed with up to 100 percent impervious surface coverage. However, for the purpose of assessing future stormwater runoff potential, the parcel was modeled with a future impervious surface coverage of 95 percent because this slightly lower impervious surface threshold reflects the Town's desire to encourage the implementation of Best Management Practices such as shallow bioretention and permeable pavers that would reduce impervious surface area on this parcel.

Soils in the basin are categorized as hydrologic soil group D: clay loam, silty clay loam, sandy clay, silty clay, or clay.

The following tables summarize the pre- and post- peak runoff for the 10-, 25-, 50-, and 100-year return frequencies.

Basin	10-year Pre Peak (CFS)	10-year Post Peak (CFS)	25-year Pre Peak (CFS)	25-year Post Peak (CFS)	25-year Post w/ Pond Peak (CFS)	25-year Designed Storage Volume (1000 CF)	25-year Maximum Volume (1000 CF)
2	6.75	7.68	7.56	8.46	7.35	7	6.4

Basin	50-year Pre Peak (CFS)	50-year Post Peak (CFS)	100-year Pre Peak (CFS)	100-year Post Peak (CFS)	100-year Post w/ Pond Peak (CFS)	100-year Designed Storage Volume (1000 CF)	100-year Maximum Volume (1000 CF)
2	8.53	9.39	9.97	10.78	9.45	8.5	8.0

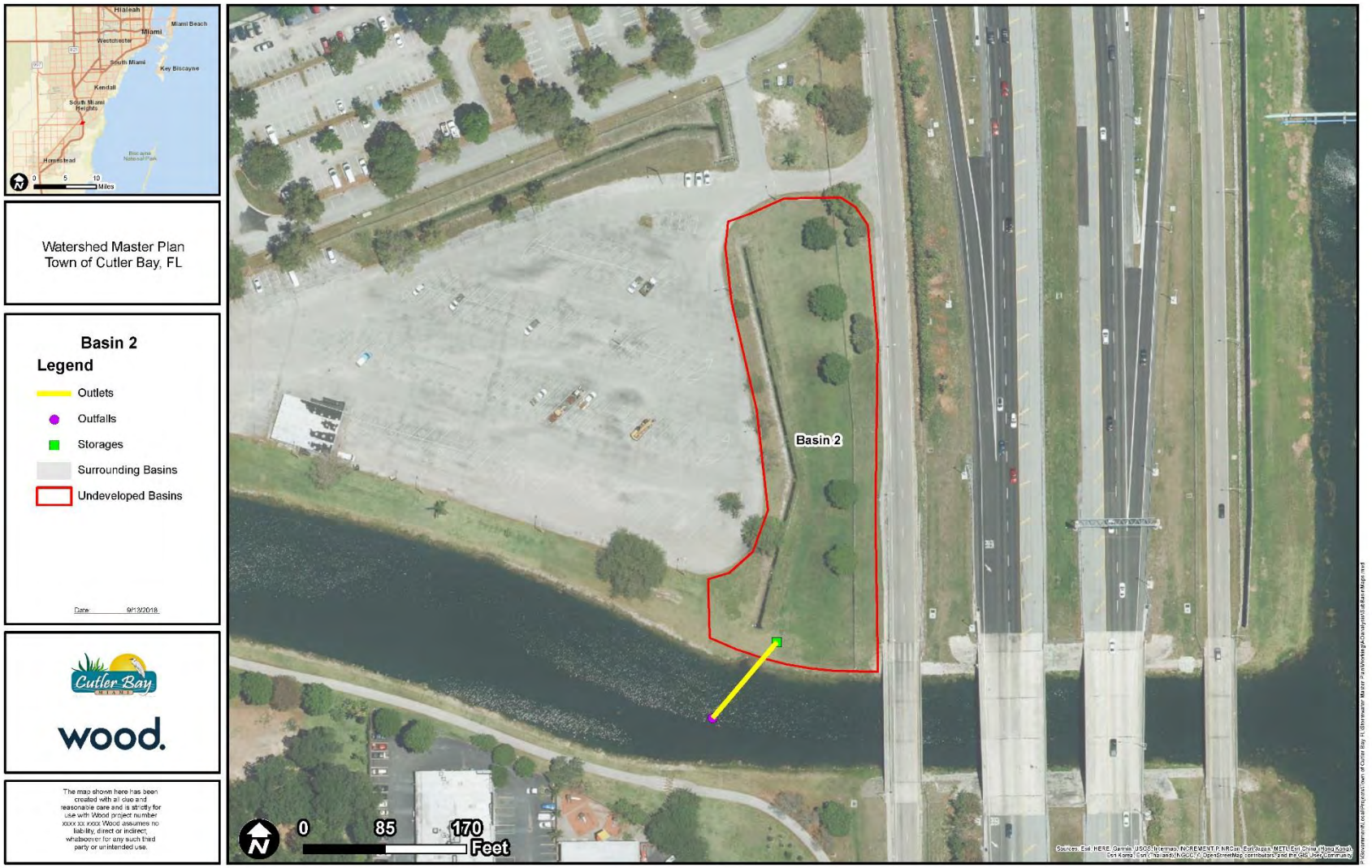


Figure 6.5 – Basin 2 Location Map

6.3.3 Basin 3

Basin 3 is a sub-basin within the C-1 watershed. The parcel is 1.2 acres and is located along the western side of Florida's Turnpike South between the intersections with Caribbean Boulevard and SW 211th Street. The parcel is bordered to the north, west, and south by the Southland Mall. Figure 6.6 shows the location of the basin.

Topography of the parcel ranges from 5.8 feet to 8.6 feet. There are two slight sinks in the parcel; one in the north central portion and another in the southwestern corner.

The current land use of the parcel is open space. The future land use and zoning designation for the parcel is Town Center. As it is currently zoned, the parcel has the potential to be developed with up to 100 percent impervious surface coverage. However, for the purpose of assessing future stormwater runoff potential, the parcel was modeled with a future impervious surface coverage of 95 percent because this slightly lower impervious surface threshold reflects the Town's desire to encourage the implementation of Best Management Practices such as shallow bioretention and permeable pavers that would reduce impervious surface area on this parcel.

Soils in the basin are categorized as hydrologic soil group B: silt loam or loam.

The following tables summarize the pre- and post- peak runoff for the 10-, 25-, 50-, and 100-year return frequencies.

Basin	10-year Pre Peak (CFS)	10-year Post Peak (CFS)	25-year Pre Peak (CFS)	25-year Post Peak (CFS)	25-year Post w/ Pond Peak (CFS)	25-year Designed Storage Volume (1000 CF)	25-year Maximum Volume (1000 CF)
3	5.02	5.9	5.64	6.5	4.95	6.5	6.4

Basin	50-year Pre Peak (CFS)	50-year Post Peak (CFS)	100-year Pre Peak (CFS)	100-year Post Peak (CFS)	100-year Post w/ Pond Peak (CFS)	100-year Designed Storage Volume (1000 CF)	100-year Maximum Volume (1000 CF)
3	6.38	7.21	7.49	8.29	7.08	7	6.6

Figure 6.6 – Basin 3 Location Map

6.3.4 Basin 4

Basin 4 is a sub-basin within the C-1 watershed. The parcel is 5.7 acres and is located along the eastern side of Florida's Turnpike North and the south side of Caribbean Boulevard. The parcel is surrounded by residential uses to the east and south and by a religious use to the northwest. Figure 6.7 shows the location of the basin.

Topography of the parcel ranges from 3.0 feet to 24.8 feet. Most of the parcel is relatively flat with an elevation of approximately 4 feet. However, the ground slopes up to a peak of 11.2 feet along the western edge of the parcel, and there are several steep hills reaching a peak of 24.8 feet in the southeastern corner of the parcel.

The current land use of the parcel is woodland. The future land use in Medium Density, and the zoning designation for the parcel is Multi-Family Residential (MR-9). As it is currently zoned, the parcel has the potential to be developed with up to 65 percent impervious surface coverage. However, for the purpose of assessing future stormwater runoff potential, the parcel was modeled with a future impervious surface coverage of 75 percent to ensure that the modeled post-development conditions remain valid should the parcel be given a variance to exceed the impervious surface requirements.

Soils in the basin are categorized as hydrologic soil group B: silt loam or loam.

The following tables summarize the pre- and post- peak runoff for the 10-, 25-, 50-, and 100-year return frequencies.

Basin	10-year Pre Peak (CFS)	10-year Post Peak (CFS)	25-year Pre Peak (CFS)	25-year Post Peak (CFS)	25-year Post w/ Pond Peak (CFS)	25-year Designed Storage Volume (1000 CF)	25-year Maximum Volume (1000 CF)
4	18.56	26.47	21.44	29.31	19.96	34	32.3

Basin	50-year Pre Peak (CFS)	50-year Post Peak (CFS)	100-year Pre Peak (CFS)	100-year Post Peak (CFS)	100-year Post w/ Pond Peak (CFS)	100-year Designed Storage Volume (1000 CF)	100-year Maximum Volume (1000 CF)
4	24.94	32.71	30.26	37.83	27.99	40.5	37.8

Figure 6.7 – Basin 4 Location Map

6.3.5 Basin 5

Basin 5 is a sub-basin within the C-1 watershed. The parcel is 3.6 acres and is located along Blue Water Road between Bahia Drive and Bahama Drive. The parcel is surrounded by residential uses to the east, south, and west, as well as religious use to the north and educational use to the east. Figure 6.8 shows the location of the basin.

Topography of the parcel ranges from 3.7 feet to 9.3 feet. The ground generally slopes down from east to west, with a sink in the northwest corner of the parcel. There are three small hills in the east and central portions of the parcel.

The current land use of the parcel is open space. The future land use is Low Density, and the zoning designation for the parcel is Single Family Residential. As it is currently zoned, the parcel has the potential to be developed with up to 60 percent impervious surface coverage. However, for the purpose of assessing future stormwater runoff potential, the parcel was modeled with a future impervious surface coverage of 80 percent to ensure that the modeled post-development conditions remain valid should the parcel be given a variance to exceed the impervious surface requirements.

Soils in the basin are categorized as hydrologic soil group A: sand, loamy sand, or sandy loam.

The following tables summarize the pre- and post- peak runoff for the 10-, 25-, 50-, and 100-year return frequencies.

Basin	10-year Pre Peak (CFS)	10-year Post Peak (CFS)	25-year Pre Peak (CFS)	25-year Post Peak (CFS)	25-year Post w/ Pond Peak (CFS)	25-year Designed Storage Volume (1000 CF)	25-year Maximum Volume (1000 CF)
5	9.55	16.6	11.22	18.37	10.53	25	23.9

Basin	50-year Pre Peak (CFS)	50-year Post Peak (CFS)	100-year Pre Peak (CFS)	100-year Post Peak (CFS)	100-year Post w/ Pond Peak (CFS)	100-year Designed Storage Volume (1000 CF)	100-year Maximum Volume (1000 CF)
5	13.29	20.5	16.49	23.72	15.32	30	27.9

Figure 6.8 – Basin 5 Location Map

6.3.6 Basin 6

Basin 6 is a sub-basin within the C-1 watershed. The parcel is 1.3 acres and is located along Belview Drive between SW 191st Street and SW 194th Street. The parcel is bordered by educational use to the southeast and southwest and residential use to the northeast and northwest. Figure 6.9 shows the location of the basin.

Topography of the parcel ranges from 5.4 feet to 9.3 feet. The elevation is highest along the northeastern and northwestern edges of the parcel. There is a slight sink in the southwestern edge of the parcel.

The current land use of the parcel is open space. The future land use is Low Density, and the zoning designation for the parcel is Single Family Residential. As it is currently zoned, the parcel has the potential to be developed with up to 60 percent impervious surface coverage. However, for the purpose of assessing future stormwater runoff potential, the parcel was modeled with a future impervious surface coverage of 80 percent to ensure that the modeled post-development conditions remain valid should the parcel be given a variance to exceed the impervious surface requirements.

Soils in the basin are categorized as hydrologic soil group B: silt loam or loam.

The following tables summarize the pre- and post- peak runoff for the 10-, 25-, 50-, and 100-year return frequencies.

Basin	10-year Pre Peak (CFS)	10-year Post Peak (CFS)	25-year Pre Peak (CFS)	25-year Post Peak (CFS)	25-year Post w/ Pond Peak (CFS)	25-year Designed Storage Volume (1000 CF)	25-year Maximum Volume (1000 CF)
6	5.56	6.48	6.27	7.15	5.81	6.5	6.3

Basin	50-year Pre Peak (CFS)	50-year Post Peak (CFS)	100-year Pre Peak (CFS)	100-year Post Peak (CFS)	100-year Post w/ Pond Peak (CFS)	100-year Designed Storage Volume (1000 CF)	100-year Maximum Volume (1000 CF)
6	7.11	7.96	8.37	9.17	7.81	8	7.3

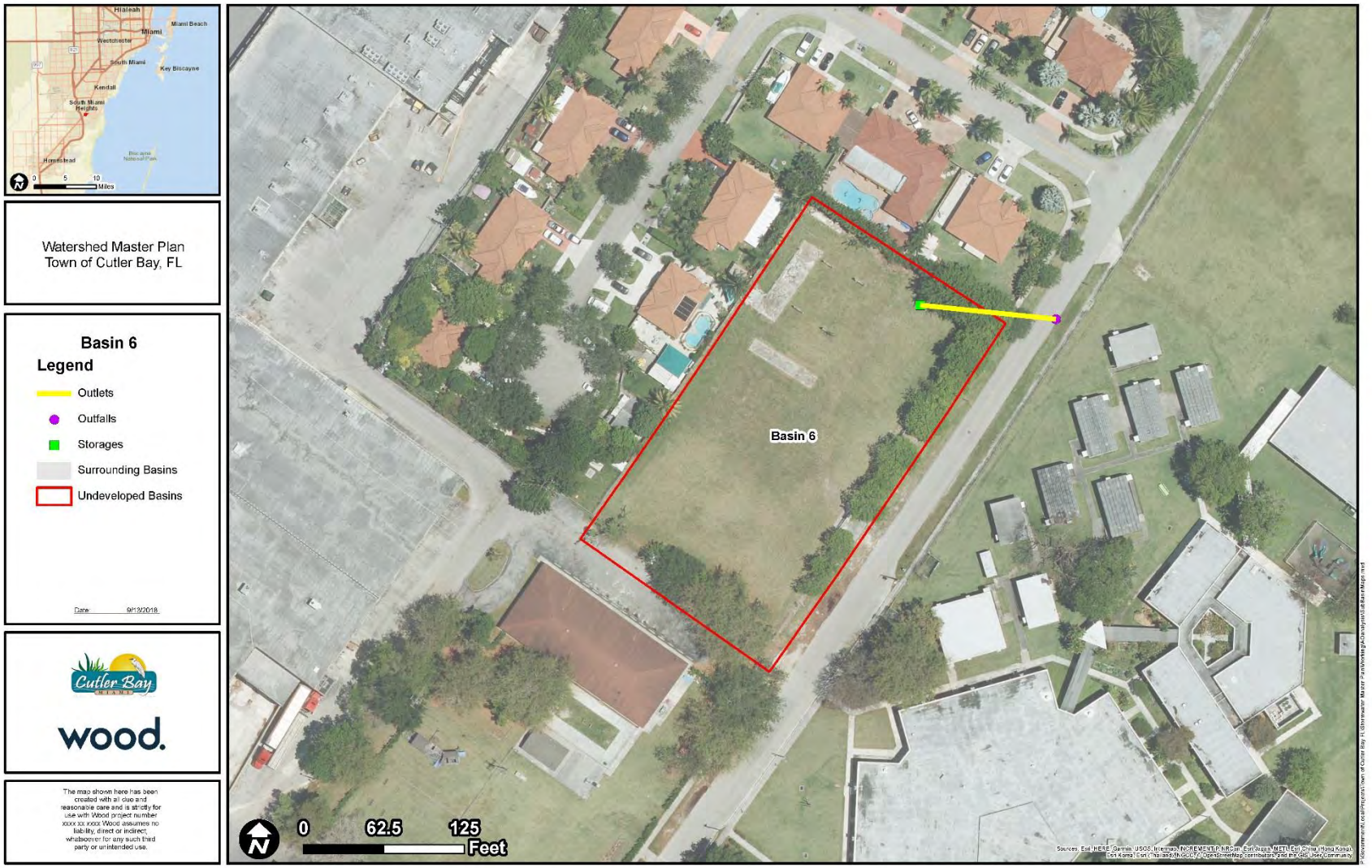


Figure 6.9 – Basin 6 Location Map

6.3.7 Basin 7

Basin 7 is a sub-basin within the C-1 watershed. The parcel is 3.2 acres and is located on the northwestern corner of SW 216th Street and Old Cutler Road, extending from the corner along Old Cutler Road. The parcel is at the edge of the Town limits, with unincorporated Miami-Dade County across SW 216th Street to the southwest. The parcel is surrounded by residential development on all sides. Figure 6.10 shows the location of the basin.

Topography of the parcel ranges from 3.4 feet to 10.0 feet. Both the lowest and highest points are found in the northeastern corner of the parcel, with a peak in the northwest and a sink in the southeast of the corner.

The current land use of the parcel is woodland. The future land use for the parcel includes Mixed Use and Low Density, and the zoning designation is Neighborhood Center. As it is currently zoned, the parcel has the potential to be developed with up to 70 percent impervious surface coverage. However, for the purpose of assessing future stormwater runoff potential, the parcel was modeled with a future impervious surface coverage of 90 percent to ensure that the modeled post-development conditions remain valid should the parcel be given a variance to exceed the impervious surface requirements.

Soils in the basin are categorized as hydrologic soil group A: sand, loamy sand, or sandy loam.

The following tables summarize the pre- and post- peak runoff for the 10-, 25-, 50-, and 100-year return frequencies.

Basin	10-year Pre Peak (CFS)	10-year Post Peak (CFS)	25-year Pre Peak (CFS)	25-year Post Peak (CFS)	25-year Post w/ Pond Peak (CFS)	25-year Designed Storage Volume (1000 CF)	25-year Maximum Volume (1000 CF)
7	4.8	15.17	5.86	16.73	4.93	33.5	33.0

Basin	50-year Pre Peak (CFS)	50-year Post Peak (CFS)	100-year Pre Peak (CFS)	100-year Post Peak (CFS)	100-year Post w/ Pond Peak (CFS)	100-year Designed Storage Volume (1000 CF)	100-year Maximum Volume (1000 CF)
7	7.22	18.62	9.44	21.46	9.1	37	35.4

Figure 6.10 – Basin 7 Location Map

6.3.8 Basin 8

Basin 8 is a sub-basin within the C-1 watershed. The parcel is 35.8 acres and is located along the eastern side of Old Cutler Road between SW 208th Street and SW 212th Street. The parcel is surrounded by residential uses to the east and south and the HealthSouth Rehabilitation Hospital to the north. Figure 6.11 shows the location of the basin.

Topography of the parcel ranges from 2.5 feet to 11.1 feet. The parcel is predominantly flat, but has a high ridge along Old Cutler Road and a low drainage ditch along SW 212th Street at the southern edge of the parcel.

The current land use of the parcel is cultivated crops. The future land use is Mixed Use, and the zoning designation for the parcel is Neighborhood Center. As it is currently zoned, the parcel has the potential to be developed with up to 70 percent impervious surface coverage. However, for the purpose of assessing future stormwater runoff potential, the parcel was modeled with a future impervious surface coverage of 90 percent to ensure that the modeled post-development conditions remain valid should the parcel be given a variance to exceed the impervious surface requirements.

Soils in the basin are categorized as hydrologic soil group C: sandy clay loam.

The following tables summarize the pre- and post- peak runoff for the 10-, 25-, 50-, and 100-year return frequencies.

Basin	10-year Pre Peak (CFS)	10-year Post Peak (CFS)	25-year Pre Peak (CFS)	25-year Post Peak (CFS)	25-year Post w/ Pond Peak (CFS)	25-year Designed Storage Volume (1000 CF)	25-year Maximum Volume (1000 CF)
8	131.01	177.12	148.98	195.05	138.53	210	200.6

Basin	50-year Pre Peak (CFS)	50-year Post Peak (CFS)	100-year Pre Peak (CFS)	100-year Post Peak (CFS)	100-year Post w/ Pond Peak (CFS)	100-year Designed Storage Volume (1000 CF)	100-year Maximum Volume (1000 CF)
8	170.72	216.56	203.58	248.8	185.98	260	241.8

Figure 6.11 – Basin 8 Location Map

6.3.9 Basin 9

Basin 9 is a sub-basin within the C-1 watershed. The parcel is 18.3 acres and is located south of SW 216th Street east of SW 93rd Path. The parcel is surrounded by American White Pelican Lake to the south, east, and west. Figure 6.12 shows the location of the basin.

Topography of the parcel ranges from 1.3 feet to 6.2 feet. A ridge of higher elevation rings the parcel boundaries. There are slight hills within the parcel and a slight sink in the north central portion of the parcel.

The current land use of the parcel is meadow. The future land use is Mixed Use, and the zoning designation for the parcel is Neighborhood Center. As it is currently zoned, the parcel has the potential to be developed with up to 70 percent impervious surface coverage. However, for the purpose of assessing future stormwater runoff potential, the parcel was modeled with a future impervious surface coverage of 90 percent to ensure that the modeled post-development conditions remain valid should the parcel be given a variance to exceed the impervious surface requirements.

Soils in the basin are categorized as hydrologic soil group C: sandy clay loam.

The following tables summarize the pre- and post- peak runoff for the 10-, 25-, 50-, and 100-year return frequencies.

Basin	10-year Pre Peak (CFS)	10-year Post Peak (CFS)	25-year Pre Peak (CFS)	25-year Post Peak (CFS)	25-year Post w/ Pond Peak (CFS)	25-year Designed Storage Volume (1000 CF)	25-year Maximum Volume (1000 CF)
9	68.02	90.36	77.56	99.61	71.71	110	105.2

Basin	50-year Pre Peak (CFS)	50-year Post Peak (CFS)	100-year Pre Peak (CFS)	100-year Post Peak (CFS)	100-year Post w/ Pond Peak (CFS)	100-year Designed Storage Volume (1000 CF)	100-year Maximum Volume (1000 CF)
9	89.09	110.7	106.46	127.34	95.07	135	128.3

Figure 6.12 – Basin 9 Location Map

6.3.10 Basin 10

Basin 10 is a sub-basin within the South Biscayne Bay watershed. The parcel is 3.9 acres and is located at the northeast corner of the intersection of Old Cutler Road and SW 87th Avenue. It is surrounded completely by residential uses with the exception of a religious use to the west. Figure 6.13 shows the location of the basin.

Topography of the parcel ranges from 5.3 feet to 11.3 feet. There are high points of elevation in the eastern corner and along the northern edge of the parcel; low points are located in the northwest and southwest corners of the parcel.

The current land use of the parcel is open space. The future land use is Mixed Use, and the zoning designation for the parcel is Neighborhood Center. As it is currently zoned, the parcel has the potential to be developed with up to 70 percent impervious surface coverage. However, for the purpose of assessing future stormwater runoff potential, the parcel was modeled with a future impervious surface coverage of 90 percent to ensure that the modeled post-development conditions remain valid should the parcel be given a variance to exceed the impervious surface requirements.

Soils in the basin are categorized as hydrologic soil group D: clay loam, silty clay loam, sandy clay, silty clay, or clay.

The following tables summarize the pre- and post- peak runoff for the 10-, 25-, 50-, and 100-year return frequencies.

Basin	10-year Pre Peak (CFS)	10-year Post Peak (CFS)	25-year Pre Peak (CFS)	25-year Post Peak (CFS)	25-year Post w/ Pond Peak (CFS)	25-year Designed Storage Volume (1000 CF)	25-year Maximum Volume (1000 CF)
10	16.59	19.42	18.67	21.39	17.51	19	18.5

Basin	50-year Pre Peak (CFS)	50-year Post Peak (CFS)	100-year Pre Peak (CFS)	100-year Post Peak (CFS)	100-year Post w/ Pond Peak (CFS)	100-year Designed Storage Volume (1000 CF)	100-year Maximum Volume (1000 CF)
10	21.16	23.77	24.88	27.33	23.97	21	20.1

Figure 6.13 – Basin 10 Location Map

6.3.11 Basin 11

Basin 11 is a sub-basin within the C-100 watershed. The parcel is 10.2 acres and is located on the eastern side of East Ridge Village Drive to the north of SW 193rd Street. The parcel sits south of Pinewood Villas and is surrounded by residential uses. Figure 6.14 shows the location of the basin.

Topography of the parcel ranges from 5.4 feet to 13.3 feet. The northwest corner of the parcel has the highest elevation, and another ridge of higher elevation runs along the southern edge of the parcel. There is a slight sink in the northcentral portion of the parcel.

The current land use of the parcel is woodland. The future land use is Estate Density, and the zoning designation for the parcel is Estate Residential. As it is currently zoned, the parcel has the potential to be developed with up to 50 percent impervious surface coverage. However, for the purpose of assessing future stormwater runoff potential, the parcel was modeled with a future impervious surface coverage of 70 percent to ensure that the modeled post-development conditions remain valid should the parcel be given a variance to exceed the impervious surface requirements.

Soils in the basin are categorized as hydrologic soil group D: clay loam, silty clay loam, sandy clay, silty clay, or clay.

The following tables summarize the pre- and post- peak runoff for the 10-, 25-, 50-, and 100-year return frequencies.

Basin	10-year Pre Peak (CFS)	10-year Post Peak (CFS)	25-year Pre Peak (CFS)	25-year Post Peak (CFS)	25-year Post w/ Pond Peak (CFS)	25-year Designed Storage Volume (1000 CF)	25-year Maximum Volume (1000 CF)
11	35.12	48.93	40.03	54.08	37.35	60	56.0

Basin	50-year Pre Peak (CFS)	50-year Post Peak (CFS)	100-year Pre Peak (CFS)	100-year Post Peak (CFS)	100-year Post w/ Pond Peak (CFS)	100-year Designed Storage Volume (1000 CF)	100-year Maximum Volume (1000 CF)
11	46	60.25	55.05	69.5	50.27	75	68.5

Figure 6.14 – Basin 11 Location Map

6.3.12 Basin 12

Basin 12 is a sub-basin within the South Biscayne Bay watershed. The parcel is 8.4 acres and is located along Old Cutler Road between SW 78th Avenue and SW 184th Street. The parcel is surrounding by residential uses to the west and woodland and marsh to the east. A drainage pond is located directly southwest of the parcel. Figure 6.15 shows the location of the basin.

Topography of the parcel ranges from 1.4 feet to 12.2 feet, with a steady slope down from Old Cutler Road to the southeast edge of the parcel.

The current land use of the parcel is woodland. The future land use is Low Density, and the zoning designation for the parcel is Single Family Residential. As it is currently zoned, the parcel has the potential to be developed with up to 60 percent impervious surface coverage. However, for the purpose of assessing future stormwater runoff potential, the parcel was modeled with a future impervious surface coverage of 80 percent to ensure that the modeled post-development conditions remain valid should the parcel be given a variance to exceed the impervious surface requirements.

Soils in the basin are categorized as hydrologic soil group D: clay loam, silty clay loam, sandy clay, silty clay, or clay.

The following tables summarize the pre- and post- peak runoff for the 10-, 25-, 50-, and 100-year return frequencies.

Basin	10-year Pre Peak (CFS)	10-year Post Peak (CFS)	25-year Pre Peak (CFS)	25-year Post Peak (CFS)	25-year Post w/ Pond Peak (CFS)	25-year Designed Storage Volume (1000 CF)	25-year Maximum Volume (1000 CF)
12	24.14	40.68	27.73	44.89	25.71	60	57.1

Basin	50-year Pre Peak (CFS)	50-year Post Peak (CFS)	100-year Pre Peak (CFS)	100-year Post Peak (CFS)	100-year Post w/ Pond Peak (CFS)	100-year Designed Storage Volume (1000 CF)	100-year Maximum Volume (1000 CF)
12	32.12	49.94	38.86	57.52	36.16	75	67.8

Figure 6.15 – Basin 12 Location Map

6.3.13 Basin 13

Basin 13 is a sub-basin within the South Biscayne Bay watershed. The parcel is 1.5 acres and is located along SW 82nd Avenue between SW 208th Terrace and SW 209th Street. The parcel is surrounded by residential uses. Figure 6.16 shows the location of the basin.

Topography of the parcel ranges from 4.5 feet to 9.6 feet. There is a peak in the center of the parcel and along the western edge. An area of lower elevation runs along the eastern edge of the parcel to the northeast corner.

The current land use of the parcel is open space. The future land use is Medium Density, and the zoning designation for the parcel is Mixed-Use Residential (MR-9). As it is currently zoned, the parcel has the potential to be developed with up to 65 percent impervious surface coverage. However, for the purpose of assessing future stormwater runoff potential, the parcel was modeled with a future impervious surface coverage of 75 percent to ensure that the modeled post-development conditions remain valid should the parcel be given a variance to exceed the impervious surface requirements.

Soils in the basin are categorized as hydrologic soil group B: silt loam or loam.

The following tables summarize the pre- and post- peak runoff for the 10-, 25-, 50-, and 100-year return frequencies.

Basin	10-year Pre Peak (CFS)	10-year Post Peak (CFS)	25-year Pre Peak (CFS)	25-year Post Peak (CFS)	25-year Post w/ Pond Peak (CFS)	25-year Designed Storage Volume (1000 CF)	25-year Maximum Volume (1000 CF)
13	6.16	7.1	6.94	7.84	6.68	6.5	6.2

Basin	50-year Pre Peak (CFS)	50-year Post Peak (CFS)	100-year Pre Peak (CFS)	100-year Post Peak (CFS)	100-year Post w/ Pond Peak (CFS)	100-year Designed Storage Volume (1000 CF)	100-year Maximum Volume (1000 CF)
13	7.87	8.74	9.26	10.07	8.96	8	7.2

Figure 6.16 – Basin 13 Location Map

6.3.14 Basin 14

Basin 14 is a sub-basin within the South Biscayne Bay watershed. The parcel is 1.0 acre and is located along SW 208th Street between SW 81st Avenue and SW 80th Place. The parcel is surrounded by residential uses to the north, east, and west, and another undeveloped basin to the south. Figure 6.17 shows the location of the basin.

Topography of the parcel ranges from 4.6 feet to 6.9 feet, with a ridge running east to west through the center of the parcel and low points along the northern and southern edges of the parcel.

The current land use of the parcel is open space. The future land use is Medium Density, and the zoning designation for the parcel is Mixed-Use Residential (MR-9). As it is currently zoned, the parcel has the potential to be developed with up to 65 percent impervious surface coverage. However, for the purpose of assessing future stormwater runoff potential, the parcel was modeled with a future impervious surface coverage of 75 percent to ensure that the modeled post-development conditions remain valid should the parcel be given a variance to exceed the impervious surface requirements.

Soils in the basin are categorized as hydrologic soil group A: sand, loamy sand, or sandy loam.

The following tables summarize the pre- and post- peak runoff for the 10-, 25-, 50-, and 100-year return frequencies.

Basin	10-year Pre Peak (CFS)	10-year Post Peak (CFS)	25-year Pre Peak (CFS)	25-year Post Peak (CFS)	25-year Post w/ Pond Peak (CFS)	25-year Designed Storage Volume (1000 CF)	25-year Maximum Volume (1000 CF)
14	3.14	4.54	3.62	5.03	3.58	6	5.4

Basin	50-year Pre Peak (CFS)	50-year Post Peak (CFS)	100-year Pre Peak (CFS)	100-year Post Peak (CFS)	100-year Post w/ Pond Peak (CFS)	100-year Designed Storage Volume (1000 CF)	100-year Maximum Volume (1000 CF)
14	4.2	5.62	5.1	6.52	4.64	7.5	7.0

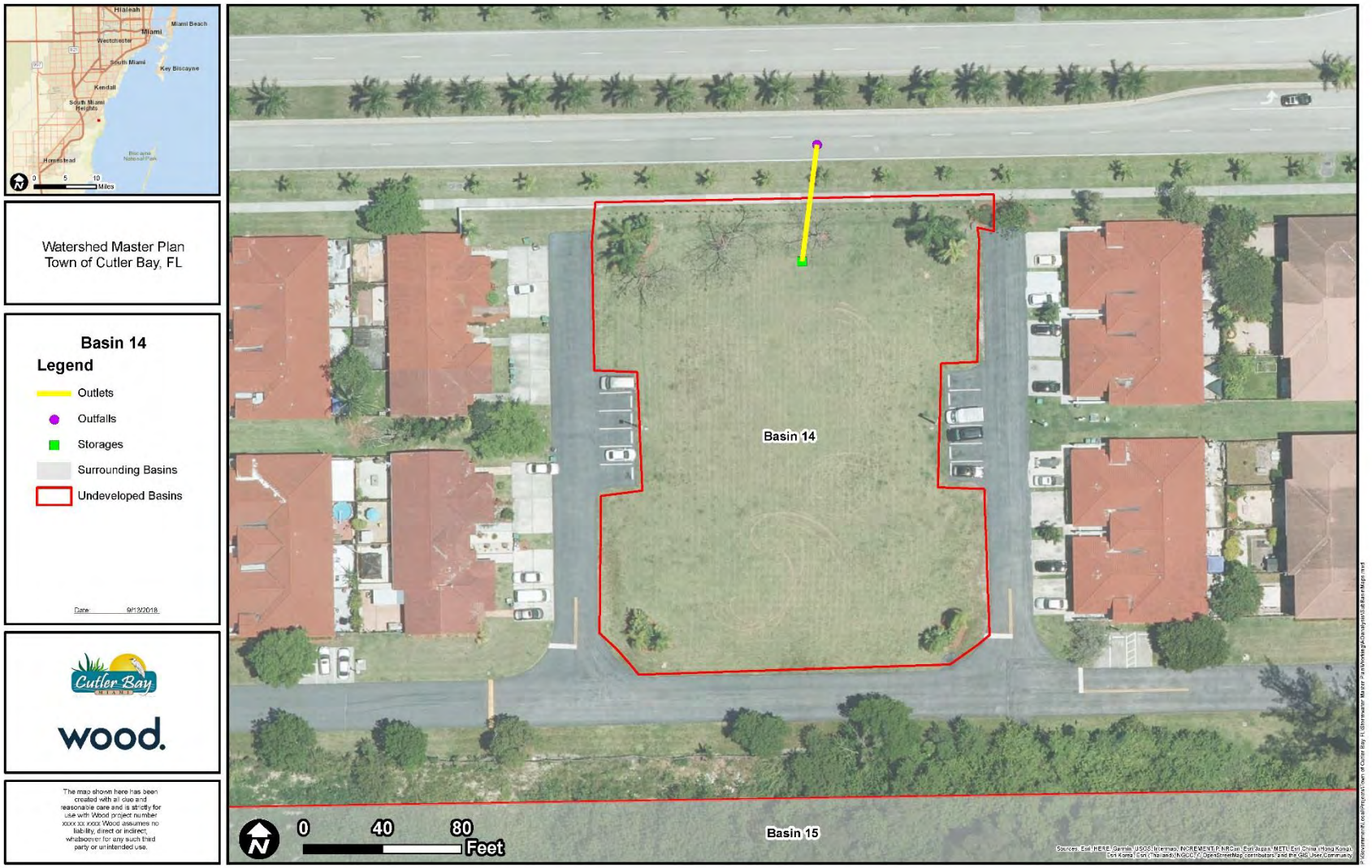


Figure 6.17 – Basin 14 Location Map

6.3.15 Basin 15

Basin 15 is a sub-basin within the South Biscayne Bay watershed. The parcel is 20.6 acres and is located south of SW 208th Street, east of SW 81st Place and north of SW 210th Street. It is bordered by residential uses to the north, south, and west and other undeveloped basins to the east. Figure 6.18 shows the location of the basin.

Topography of the parcel ranges from 0.1 feet to 12.0 feet. The majority of the parcel is relatively low and flat, with elevations of 0.3 to 1.5 feet. This topography covers roughly the eastern two thirds of the parcel. Land surrounding the parcel to the north, south, and east sits as higher elevations. There is a peak in the western third of the parcel and a ridge along the western edge.

The current land use of the parcel is wooded wetland. The future land use is Medium Density, and the zoning designation for the parcel is Neighborhood Residential. As it is currently zoned, the parcel has the potential to be developed with up to 70 percent impervious surface coverage. However, for the purpose of assessing future stormwater runoff potential, the parcel was modeled with a future impervious surface coverage of 65 percent because the future land use designation reflects a slightly lower impervious surface cap. This threshold makes the post-development conditions more accurate in the event that a rezoning occurs, as it would need to be consistent with the Future Land Use Map. Additionally, this slightly lower impervious surface threshold reflects the Town's desire to encourage the implementation of Best Management Practices such as shallow bioretention and permeable pavers that would reduce impervious surface area on this parcel.

Soils in the basin are categorized as hydrologic soil group C: sandy clay loam.

The following tables summarize the pre- and post- peak runoff for the 10-, 25-, 50-, and 100-year return frequencies.

Basin	10-year Pre Peak (CFS)	10-year Post Peak (CFS)	25-year Pre Peak (CFS)	25-year Post Peak (CFS)	25-year Post w/ Pond Peak (CFS)	25-year Designed Storage Volume (1000 CF)	25-year Maximum Volume (1000 CF)
15	37.34	88.58	43.72	98.59	39.16	160	156.7

Basin	50-year Pre Peak (CFS)	50-year Post Peak (CFS)	100-year Pre Peak (CFS)	100-year Post Peak (CFS)	100-year Post w/ Pond Peak (CFS)	100-year Designed Storage Volume (1000 CF)	100-year Maximum Volume (1000 CF)
15	51.68	110.68	64.15	128.94	60.7	195	182.1

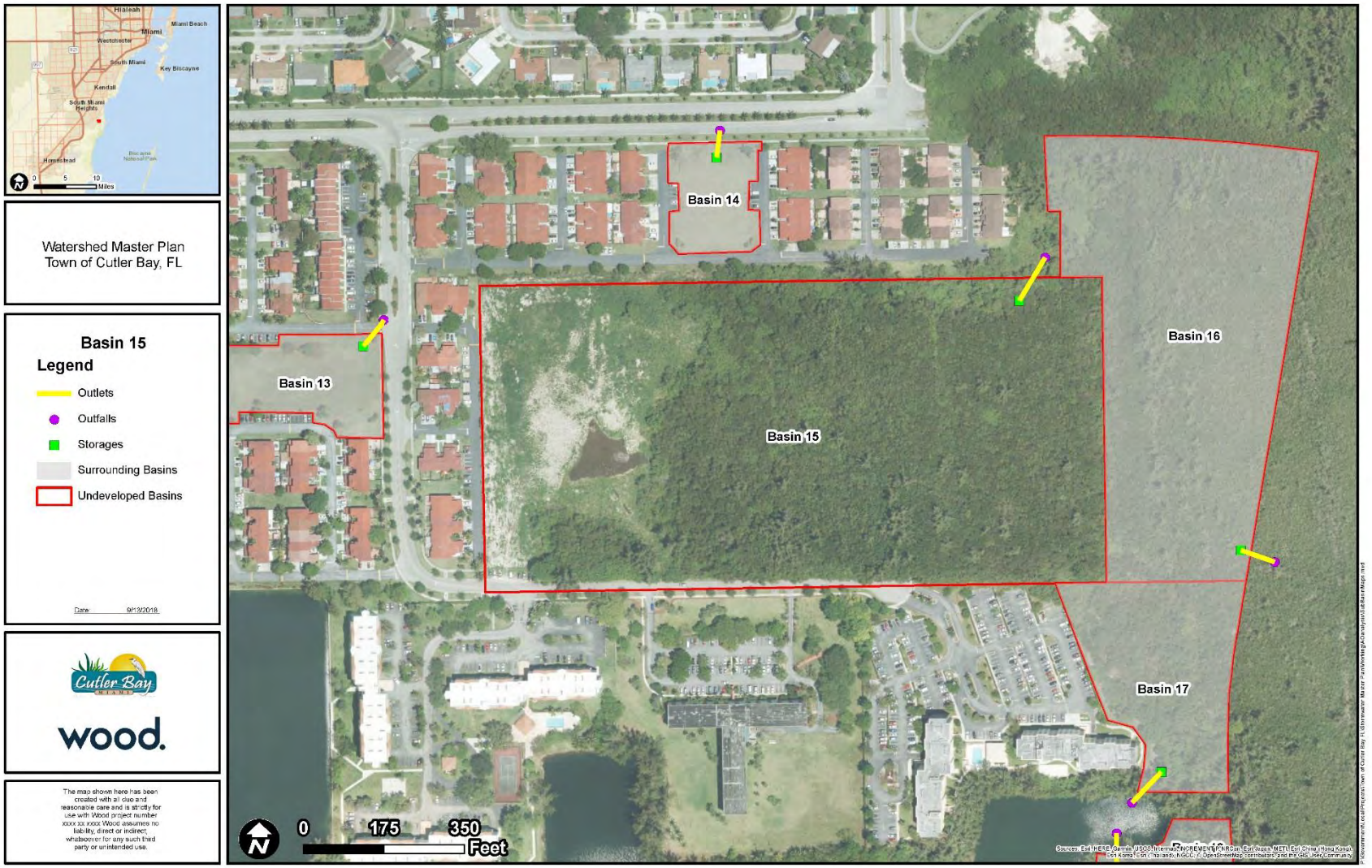


Figure 6.18 – Basin 15 Location Map

6.3.16 Basin 16

Basin 16 is a sub-basin within the South Biscayne Bay watershed. The parcel is 9.3 acres and is located east of SW 78th Place ear SW 208th Street. The parcel is bordered by conservation land to the north and east, other undeveloped basins to the west and south, and residential use to the northwest. Figure 6.19 shows the location of the basin.

Topography of the parcel ranges from -0.3 feet to 10.0 feet, with a peak in the northwest corner of the parcel and a low ditch running north-south along the western portion of the parcel surrounded by ridges of higher elevation. Most of the parcel sits below 2 feet in elevation.

The current land use of the parcel is wooded wetland. The future land use is Medium Density, and the zoning designation for the parcel is Mixed-Use Residential (MR-13). As it is currently zoned, the parcel has the potential to be developed with up to 65 percent impervious surface coverage. However, for the purpose of assessing future stormwater runoff potential, the parcel was modeled with a future impervious surface coverage of 85 percent to ensure that the modeled post-development conditions remain valid should the parcel be given a variance to exceed the impervious surface requirements.

Soils in the basin are categorized as hydrologic soil group C: sandy clay loam.

The following tables summarize the pre- and post- peak runoff for the 10-, 25-, 50-, and 100-year return frequencies.

Basin	10-year Pre Peak (CFS)	10-year Post Peak (CFS)	25-year Pre Peak (CFS)	25-year Post Peak (CFS)	25-year Post w/ Pond Peak (CFS)	25-year Designed Storage Volume (1000 CF)	25-year Maximum Volume (1000 CF)
16	19.92	44.94	23.24	49.6	21.51	80	78.2

Basin	50-year Pre Peak (CFS)	50-year Post Peak (CFS)	100-year Pre Peak (CFS)	100-year Post Peak (CFS)	100-year Post w/ Pond Peak (CFS)	100-year Designed Storage Volume (1000 CF)	100-year Maximum Volume (1000 CF)
16	27.35	55.2	33.75	63.59	32.02	100	91.5

Figure 6.19 – Basin 16 Location Map

6.3.17 Basin 17

Basin 17 is a sub-basin within the South Biscayne Bay watershed. The parcel is 3.0 acres and is located east and south of SW 210th Street, east of the Calusa Cover Apartments complex. The parcel is otherwise bordered by other undeveloped basins to the north and south and conservation land to the east. Figure 6.20 shows the location of the basin.

Topography of the parcel ranges from -0.5 feet to 6.6 feet, with a peak in the southwest corner of the parcel. Higher elevations run along the western edge of the parcel and north-south through the eastern side of the parcel. A sink sits below sea level near the southeastern corner of the parcel.

The current land use of the parcel is wooded wetland. The future land use is Medium Density, and the zoning designation for the parcel is Mixed-Use Residential (MR-13). As it is currently zoned, the parcel has the potential to be developed with up to 65 percent impervious surface coverage. However, for the purpose of assessing future stormwater runoff potential, the parcel was modeled with a future impervious surface coverage of 85 percent to ensure that the modeled post-development conditions remain valid should the parcel be given a variance to exceed the impervious surface requirements.

Soils in the basin are categorized as hydrologic soil group C: sandy clay loam.

The following tables summarize the pre- and post- peak runoff for the 10-, 25-, 50-, and 100-year return frequencies.

Basin	10-year Pre Peak (CFS)	10-year Post Peak (CFS)	25-year Pre Peak (CFS)	25-year Post Peak (CFS)	25-year Post w/ Pond Peak (CFS)	25-year Designed Storage Volume (1000 CF)	25-year Maximum Volume (1000 CF)
17	9.97	14.6	11.44	16.1	9.87	20.5	20.2

Basin	50-year Pre Peak (CFS)	50-year Post Peak (CFS)	100-year Pre Peak (CFS)	100-year Post Peak (CFS)	100-year Post w/ Pond Peak (CFS)	100-year Designed Storage Volume (1000 CF)	100-year Maximum Volume (1000 CF)
17	13.22	17.89	15.93	20.58	14.01	25	23.4

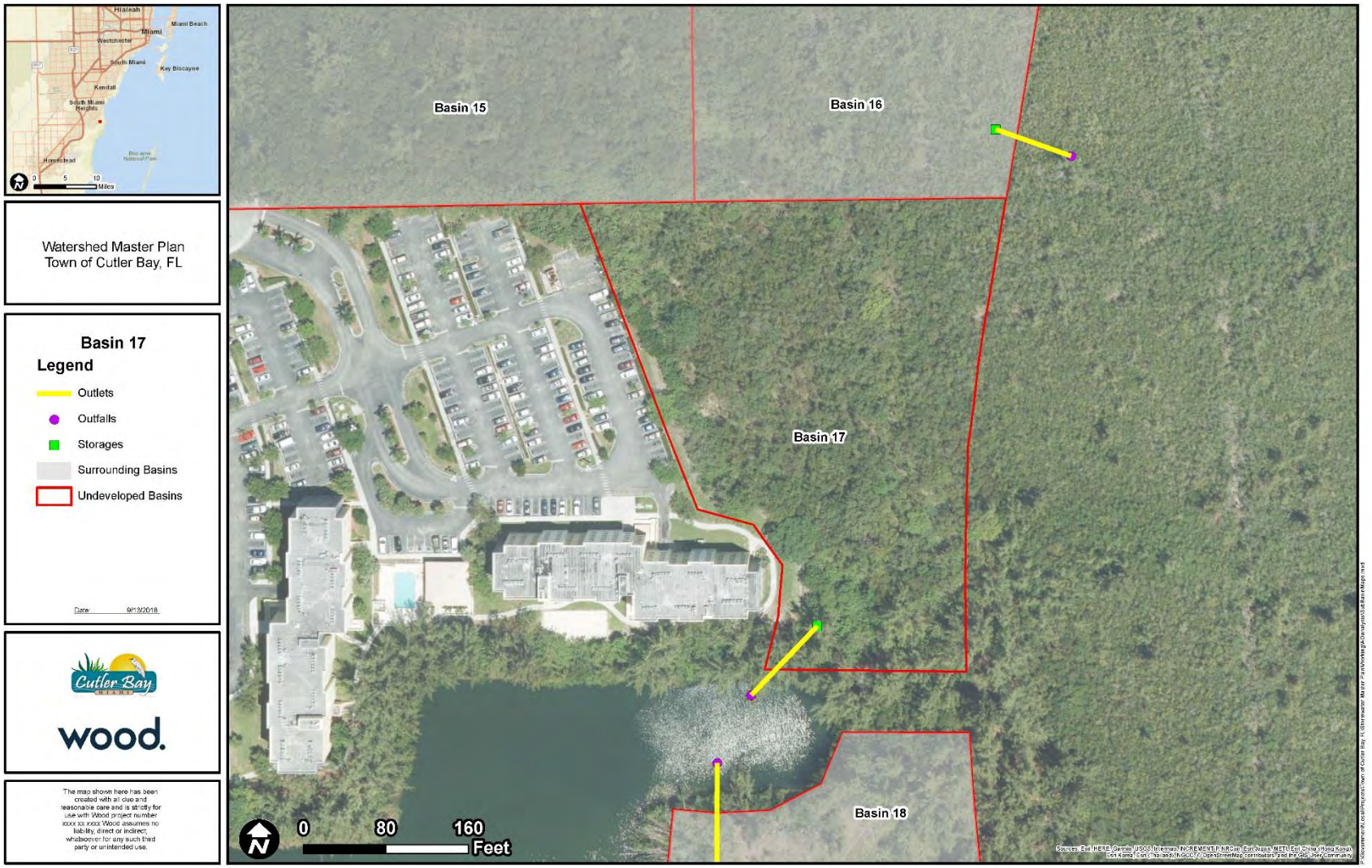


Figure 6.20 – Basin 17 Location Map

6.3.18 Basin 18

Basin 18 is a sub-basin within the South Biscayne Bay watershed. The parcel is 29.9 acres and is located south of SW 210th Street and Tricolored Heron Lake and east of Lakes by the Bay Park. It is also bordered by another undeveloped basin to the north and conservation land to the east and south. Figure 6.21 shows the location of the basin.

Topography of the parcel ranges from -0.4 feet to 6.9 feet, with higher elevations in the northern portion of the parcel and the lowest elevations running north-south through the southeastern portion of the parcel. Most of the land in this basin sits below 2 feet in elevation.

The current land use of the parcel is wooded wetland. The future land use is split between Medium Density and Conservation. The zoning designation for the parcel is Mixed-Use Residential (MR-13). As it is currently zoned, the parcel has the potential to be developed with up to 65 percent impervious surface coverage. However, for the purpose of assessing future stormwater runoff potential, the parcel was modeled with a future impervious surface coverage of 85 percent to ensure that the modeled post-development conditions remain valid should the parcel be given a variance to exceed the impervious surface requirements.

Soils in the basin are categorized as hydrologic soil group C: sandy clay loam.

The following tables summarize the pre- and post- peak runoff for the 10-, 25-, 50-, and 100-year return frequencies.

Basin	10-year Pre Peak (CFS)	10-year Post Peak (CFS)	25-year Pre Peak (CFS)	25-year Post Peak (CFS)	25-year Post w/ Pond Peak (CFS)	25-year Designed Storage Volume (1000 CF)	25-year Maximum Volume (1000 CF)
18	60.31	143.52	70.43	158.44	67.64	260	251.3

Basin	50-year Pre Peak (CFS)	50-year Post Peak (CFS)	100-year Pre Peak (CFS)	100-year Post Peak (CFS)	100-year Post w/ Pond Peak (CFS)	100-year Designed Storage Volume (1000 CF)	100-year Maximum Volume (1000 CF)
18	83.02	176.35	102.66	203.21	97.27	310	301.5

Figure 6.21 – Basin 18 Location Map

7 Water Quality Standards

The Town of Cutler Bay is required to adhere to the State of Florida's surface water quality standards published in 62-302 F.A.C (and 62-302.530 F.A.C.). These standards include classifications of waterbodies based on their designated use such as "supporting aquatic life" or "recreation"; water quality criteria necessary to protect the designated use; anti-degradation policies; and special requirements for the protection of Outstanding Florida Waters.

"Presumptive criteria," has been codified in the statewide Environmental Resource Permitting (ERP) rule, Chapter 62-330, F.A.C. BMPs shall be utilized for the retention or detention of stormwater runoff. The stormwater treatment target is removal of 80 percent of the annual average load of post development pollutants for Class III waters, and 95 percent removal for Outstanding Florida Waters. These minimum targets are codified in Chapter 62-40.432(2)(a), F.A.C. Further, Section 373.4131(3)(b), F.S., authorizes the presumptive BMP based approach.

The SFWMD *Environmental Resource Permit Applicant's Handbook Volume II* shall be followed to meet stormwater quantity and quality sizing criteria within the Town of Cutler Bay. The handbook defines the stormwater quality standard by the performance of the stormwater system assuming it is designed and operated according to the handbook. This method of "presumptive criteria" assumes that this design and operation will allow the project to meet State water quality standards.

8 Level of Service

Level of Service (LOS) for stormwater management refers to the degree of protection to be provided in terms of the storm event to be accommodated by the drainage feature or facility. LOS standards apply to both water quantity in order to provide flood protection and water quality in order to protect surface waters from erosion and degradation.

Water Quantity

For water quantity LOS, specifying the return period and duration of rainfall to be handled by a drainage facility establishes the degree of protection that facility is expected to provide. For the Town of Cutler Bay, all new development and re-development is regulated except for single family residential, parcels of 1 acre or less, or increases in impervious area of 10,000 square feet or less. In accordance with the SFWMD *Environmental Resource Permit Applicant's Handbook Volume II*, the water quantity LOS used for this Watershed Master Plan is as follows: post-development runoff should not exceed pre-development runoff for a 3-day duration/25-year storm event when computing off-site discharge rates. In addition, on-site treatment is required for the first inch of rainfall or the first half-inch of runoff, whichever is greater.

Note: The water quantity LOS stated in the Town's 2008 Comprehensive Growth Management Plan refers to a 25-year storm event, up to and including an event with 24-hour duration. This Watershed Master Plan intentionally used a more conservative rain event to support future planning purposes and the potential for regulation to a higher standard.

Water Quality

Water quality LOS standards establish water quality goals for specific water bodies and for stormwater runoff. Once again in accordance with the SFWMD *Environmental Resource Permit Applicant's Handbook Volume II,* the quality of stormwater discharged is presumed to meet the surface water standards in Chapters 62-4 and 62-302 F.A.C. if the system is permitted, constructed, operated and maintained in accordance with Chapter 62-330 F.A.C. and Part III, IV and V of the Handbook. The volume of runoff to be treated from a site will be determined by the type of treatment system. Retention/detention volumetric requirements are shown in Table 8.1 below.

Table 8.1 – Water Quality Volumetric Requirements

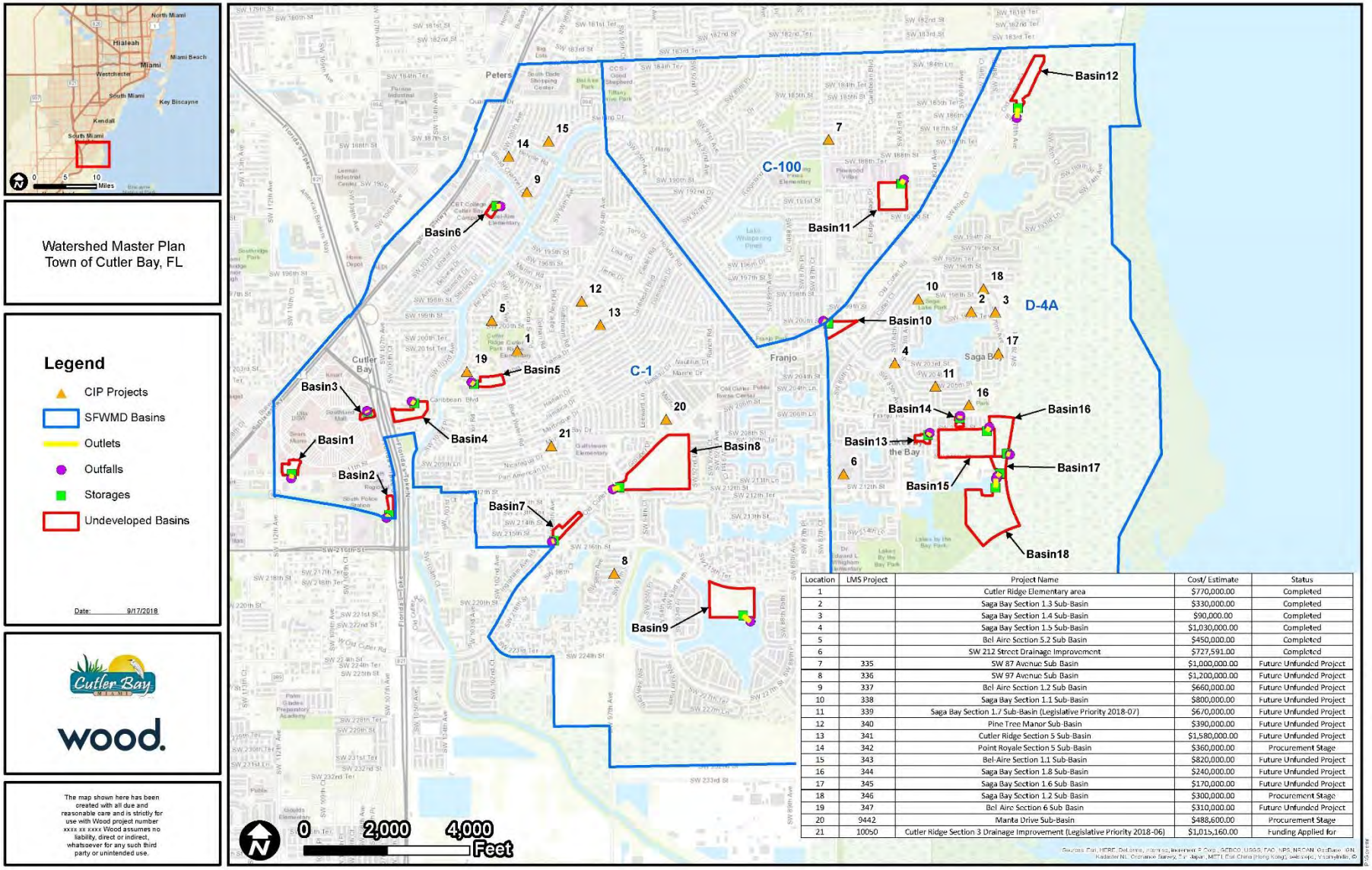
Treatment System	Volumetric Requirement
Wet Detention	Volume shall be provided for the first inch of runoff from the developed project or 2.5 inches times the percent of impervious area, whichever is greater.
Dry Detention	Volume shall be provided equal to 75 percent of the wet detention requirement, one inch minimum
Retention	Volume shall be provided equal to 50 percent of the wet detention requirement, one inch minimum

9 Capital Improvement Program

The Town of Cutler Bay Public Works Department is responsible for the improvement and maintenance of the Town's infrastructure including drainage improvements, system maintenance and stormwater management. As part of the 2008 Stormwater Master Plan, a Capital Improvement Program (CIP) was developed based on the results of the analysis of the priority sub-basins analyzed as part of that plan. Recommended improvements were made for each basin in order to improve performance goals for water quantity and quality. Table 9.1 below shows the status for the capital improvement projects identified as part of the 2008 Plan. Figure 9.1 on the following page shows the location for each project.

Table 9.1 – Capital Improvement Projects

Location	Project Name	Cost/Estimate	Status
1	Cutler Ridge Elementary Area	$770,000.00	Completed
2	Saga Bay Section 1.3 Sub-Basin	$330,000.00	Completed
3	Saga Bay Section 1.4 Sub-Basin	$90,000.00	Completed
4	Saga Bay Section 1.5 Sub-Basin	$1,030,000.00	Completed
5	Bel-Aire Section 5.2 Sub-Basin	$450,000.00	Completed
6	SW 212 Street Drainage Improvement	$727,591.00	Completed
7	SW 87 Avenue Sub-Basin	$1,000,000.00	Future Unfunded Project
8	SW 97 Avenue Sub-Basin	$1,200,000.00	Future Unfunded Project
9	Bel-Aire Section 1.2 Sub-Basin	$660,000.00	Future Unfunded Project
10	Saga Bay Section 1.1 Sub-Basin	$800,000.00	Future Unfunded Project
11	Saga Bay Section 1.7 Sub-Basin (Legislative Priority 2018-07)	$670,000.00	Future Unfunded Project
12	Pine Tree Manor Sub-Basin	$390,000.00	Future Unfunded Project
13	Cutler Ridge Section 5 Sub-Basin	$1,580,000.00	Future Unfunded Project
14	Point Royale Section 5 Sub-Basin	$360,000.00	Under Construction
15	Bel-Aire Section 1.1 Sub-Basin	$820,000.00	Future Unfunded Project
16	Saga Bay Section 1.8 Sub-Basin	$240,000.00	Future Unfunded Project
17	Saga Bay Section 1.6 Sub-Basin	$170,000.00	Future Unfunded Project
18	Saga Bay Section 1.2 Sub-Basin	$300,000.00	Under Construction
19	Bel-Aire Section 6 Sub-Basin	$310,000.00	Future Unfunded Project
20	Manta Drive Sub-Basin	$488,600.00	Completed
21	Cutler Ridge Section 3 Drainage Improvement (Legislative Priority 2018-06)	$1,015,160.00	Funding Applied for



Location	LMS Project	Project Name	Cost/ Estimate	Status
1		Cutler Ridge Elementary area	$770,000.00	Completed
2		Saga Bay Section 1.3 Sub-Basin	$330,000.00	Completed
3		Saga Bay Section 1.4 Sub-Basin	$90,000.00	Completed
4		Saga Bay Section 1.5 Sub-Basin	$1,030,000.00	Completed
5		Bel Aire Section 5.2 Sub Basin	$450,000.00	Completed
6		SW 212 Street Drainage Improvement	$727,591.00	Completed
7	335	SW 87 Avenue Sub Basin	$1,000,000.00	Future Unfunded Project
8	336	SW 97 Avenue Sub Basin	$1,200,000.00	Future Unfunded Project
9	337	Bel Aire Section 1.2 Sub Basin	$660,000.00	Future Unfunded Project
10	338	Saga Bay Section 1.1 Sub-Basin	$800,000.00	Future Unfunded Project
11	339	Saga Bay Section 1.7 Sub-Basin (Legislative Priority 2018-07)	$670,000.00	Future Unfunded Project
12	340	Pine Tree Manor Sub-Basin	$390,000.00	Future Unfunded Project
13	341	Cutler Ridge Section 5 Sub-Basin	$1,580,000.00	Future Unfunded Project
14	342	Point Royale Section 5 Sub-Basin	$360,000.00	Procurement Stage
15	343	Bel-Aire Section 1.1 Sub-Basin	$820,000.00	Future Unfunded Project
16	344	Saga Bay Section 1.8 Sub-Basin	$240,000.00	Future Unfunded Project
17	345	Saga Bay Section 1.6 Sub-Basin	$170,000.00	Future Unfunded Project
18	346	Saga Bay Section 1.2 Sub-Basin	$300,000.00	Procurement Stage
19	347	Bel Aire Section 6 Sub-Basin	$310,000.00	Future Unfunded Project
20	9442	Manta Drive Sub-Basin	$488,600.00	Procurement Stage
21	10050	Cutler Ridge Section 3 Drainage Improvement (Legislative Priority 2018-06)	$1,015,160.00	Funding Applied for

Figure 9.1 – Capital Improvement Projects

10 Development Code Review

It is important for the Town of Cutler Bay to adopt a stormwater management ordinance in order to enforce water quantity and quality regulations that meet the requirements of county and state regulations regarding the control of stormwater runoff and discharge.

The purpose of a stormwater management ordinance is to protect, maintain and enhance public health, safety, environment and general welfare by establishing minimum requirements and procedures to control adverse effects of post construction stormwater runoff, illicit discharges, flood damage and sediment and erosion control. Proper management of stormwater runoff will minimize damage to public and private property and infrastructure, safeguard the public health, safety and general welfare and protect water and aquatic life.

The Town of Cutler Bay's Stormwater Management Ordinance [number] adopted on [date] seeks to meet its general purpose through the following objectives:

1. Establishing decision-making processes for developments that protect the integrity of watersheds and preserve the health of water resources;
2. Requiring that new development and redevelopment maintain the predevelopment hydrologic response in their post-development state as nearly as practicable for the applicable design storm in order to reduce flooding, stream/canal bank erosion, and to maintain the integrity of stream channels and aquatic habitats;
3. Establishing minimum post-development stormwater management standards and design criteria for the regulation and control of stormwater runoff quantity and quality;
4. Establishing design and review criteria for the construction, function, and use of structural stormwater control facilities that may be used to meet the minimum post-development stormwater management standards;
5. Encouraging the use of better management and site design practices, such as the preservation of green space and other conservation areas, to the maximum extent practicable;
6. Establishing provisions for the long-term responsibility for and maintenance of structural and nonstructural stormwater best management practices (BMPs) to ensure that they continue to function as designed, are maintained appropriately, and pose no threat to public safety;
7. Establishing administrative procedures for the submission, review, approval and disapproval of stormwater management plans, for the inspection of approved projects, and to assure appropriate long-term maintenance; and
8. Coordinating site design plans that include open space and natural areas with the 2007 Comprehensive Plan.

Beginning with and subsequent to its effective date, Stormwater Management Ordinance [number] is applicable to all development and redevelopment, including, but not limited to, site plan applications and subdivision applications, unless exempt pursuant to the exemptions, below.

- Development and redevelopment that cumulatively disturbs less than one (1) acre and is not part of a larger common plan of development or sale is exempt from the provisions of this ordinance. However, development and redevelopment that disturb less than one (1) acre are not exempt if such activities are part of a larger common plan of development or sale, even though multiple, separate or distinct activities take place at different times on different schedules.
- Development and redevelopment that consist only of a single family residential lot.

Through the Stormwater Management Ordinance, the Town of Cutler Bay regulates all parcels 1 acre or greater in size or adding increase in impervious surface of 10,000 sq. ft. or more so that the post-development runoff does not exceed pre-development runoff conditions. These regulations apply to the 18 sub-basins detailed in Section 6.3 of this Plan; however, as redevelopment occurs these standards shall also apply. The regulation standards are as follows:

- The runoff discharge rates shall be limited to the pre-development conditions based on the 25-year design storm event.
- The process for implementation of these development standards are outlined in Section 3 of the 2018 Town of Cutler Bay Stormwater Manual.
- The Town of Cutler Bay will require before the installation of a structural Best Management Practice (BMP) to control peak runoff (10 year and 25-year design storm event) to the maximum extent possible on parcels one acre or greater in size in order to maintain or restore a basin's hydrologic cycle and to improve water quality.
- The Town of Cutler Bay will require before the installation of a structural Best Management Practice (BMP) to control peak runoff (10 year and 25-year design storm event) to the maximum extent possible on parcels one acre or greater in size in order to maintain or restore a basin's hydrologic cycle and to improve water quality.
- The process for implementation of these development standards are outlined in Section 4 of the 2018 Town of Cutler Bay Stormwater Manual.

11 Works Cited

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Appendices

For a copy of the Appendices, please contact the Public Works Department at 305-234-4262.