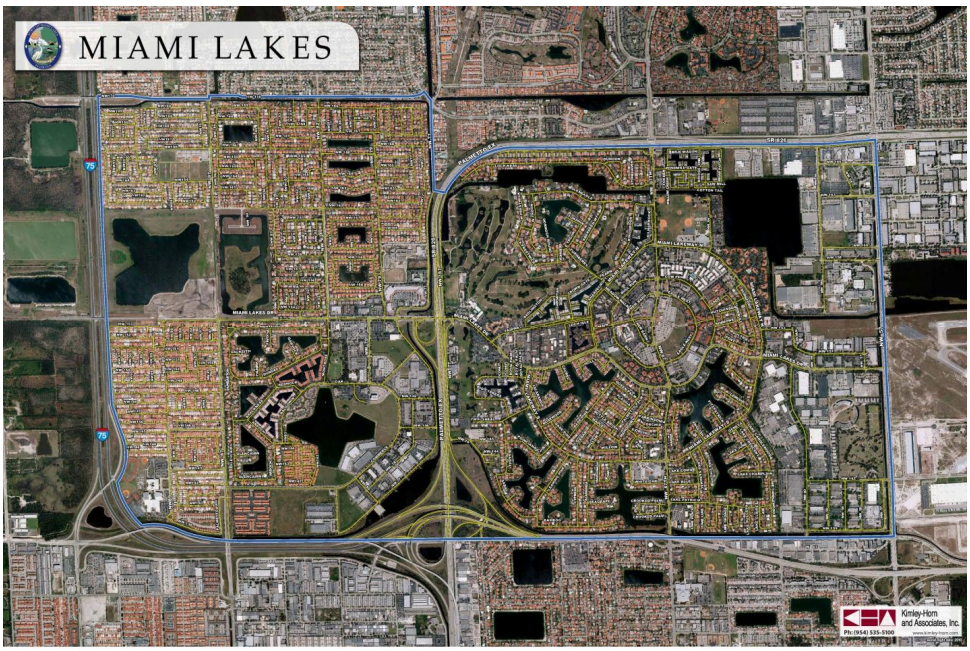
STORMWATER MASTER PLAN

UPDATE #2



Prepared for
Town of Miami Lakes, Florida

Prepared by
Kimley-Horn and Associates, Inc.

Kimley-Horn
and Associates, Inc.

April 2012
044533166

Executive Summary

The Town of Miami Lakes is located in northwestern Miami-Dade County, Florida and was incorporated in December 2000. In January 2003, Kimley-Horn and Associates, Inc. (KHA) completed a Stormwater Master Plan for the Town in preparation for the Town assuming responsibility for stormwater management within its boundaries. In March 2003, the Town adopted Ordinance 03-31 which established the Town's Storm Water Utility and assumed maintenance responsibility from Miami-Dade County for drainage facilities located within the Town boundary. In April 2006, KHA completed Stormwater Master Plan Update #1 in order to enable the Town to examine the effectiveness of the ongoing Stormwater Operation and Maintenance and Capital Improvement Programs.

In the six years since Stormwater Master Plan Update #1 was completed, the Town of Miami Lakes has implemented the recommended Operations and Maintenance Program and constructed several of the drainage projects included in the Capital Improvement Program utilizing grant funding and revenue from the Stormwater Utility. This Stormwater Master Plan Update #2 will enable the Town to examine the effectiveness of the ongoing Operation and Maintenance Program, to evaluate progress in implementing the Capital Improvement Program, and to identify additional Capital Improvement Projects for future reduction of flooding and improvement of water quality within the Town of Miami Lakes.

In order to measure the performance of each drainage sub-basin, performance goals were identified in the Town's original Stormwater Master Plan. This report summarizes the performance against goal for ten priority sub-basins (two sub-basins from the previous Stormwater Master Plan Update and eight new priority sub-basins identified as a part of this report). The report also recommends drainage improvements that will improve stormwater management in the priority sub-basins. The recommended improvements are the basis for the Capital Improvement Program contained at the end of the report.

The Capital Improvement Program contains approximately $900,000 in annual expenses related to ongoing Operation and Maintenance of the existing system in conformance with the mandates of Federal and State government agencies and the Town's desire to improve drainage conditions. The Capital Improvement Program also contains approximately $9,500,000 worth of major Capital Improvement Projects recommended to be implemented over the next ten years.

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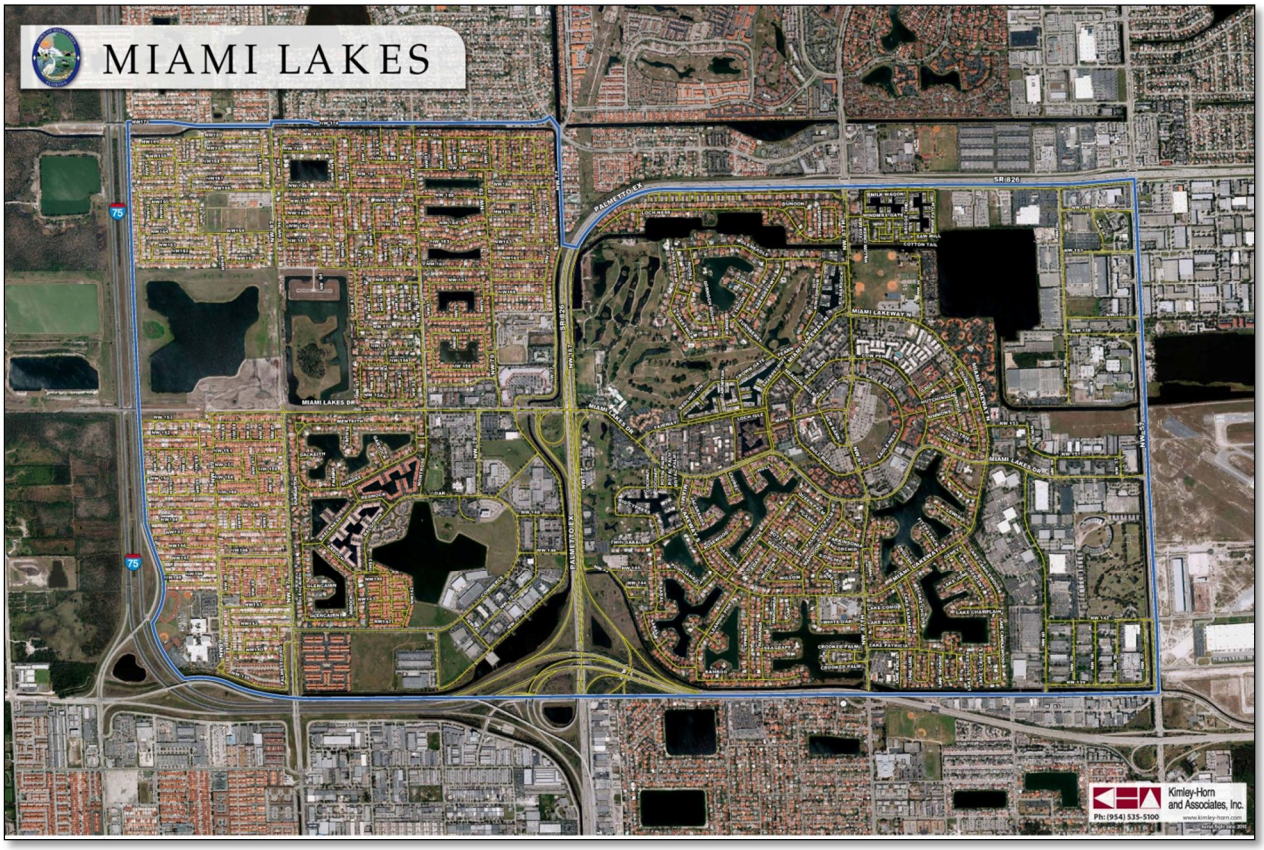
INTRODUCTION

The Town of Miami Lakes is located in northwestern Miami-Dade County, Florida and was incorporated in December 2000. Figure 1 illustrates the location of the Town of Miami Lakes.

Figure 1: Town of Miami Lakes Location Map



In January 2003, Kimley-Horn and Associates, Inc. (KHA) completed a Stormwater Master Plan for the Town in preparation for the Town assuming responsibility for stormwater management within its boundaries. In March 2003, the Town adopted Ordinance 03-31 which established the Town's Storm Water Utility and assumed maintenance responsibility from Miami-Dade County for drainage facilities located within the Town boundary. In April 2006, KHA completed Stormwater Master Plan Update #1 in order to enable the Town to examine the effectiveness of the ongoing Operation and Maintenance Program, to evaluate progress in implementing the Capital Improvement Program, and to identify additional Capital Improvement Projects for future reduction of flooding and improvement of water quality within the Town of Miami Lakes.

The first section of Stormwater Master Plan Update #1 described existing conditions within the Town of Miami Lakes. Existing information on stormwater management available from various sources including the Miami-Dade County Department of Environmental Resource Management (DERM), the Miami-Dade County Department of Public Works, the South Florida Water Management District (SFWMD), the Federal Emergency Management Agency (FEMA), the Florida Department of Environmental Protection (FDEP), and Town of Miami Lakes records was compiled in this section. In addition, the section included field information on the existing condition of Town drainage infrastructure and locations where street flooding was occurring.

The second section of Stormwater Master Plan Update #1 contained drainage analysis of eighteen (18) sub-basins that were selected as priority areas for improvement by the Town. Drainage improvements for the priority sub-basins were recommended to meet performance goals associated with both reducing flooding and improving water quality. The third section of the Stormwater Master Plan Update #1 outlined a Capital Improvement/ Operations and Maintenance Program for the Town's Stormwater Utility.

In the six years since Stormwater Master Plan Update #1 was completed, the Town of Miami Lakes has implemented the recommended Operations and Maintenance Program and constructed several of the drainage projects included in the Capital Improvement Program utilizing grant funding and revenue from the Storm Water Utility. This Stormwater Master Plan Update #2 will enable the Town to examine the effectiveness of the ongoing Operation and Maintenance Program, to evaluate progress in implementing the Capital Improvement Program, and to identify additional Capital Improvement Projects for future reduction of flooding and improvement of water quality within the Town of Miami Lakes.

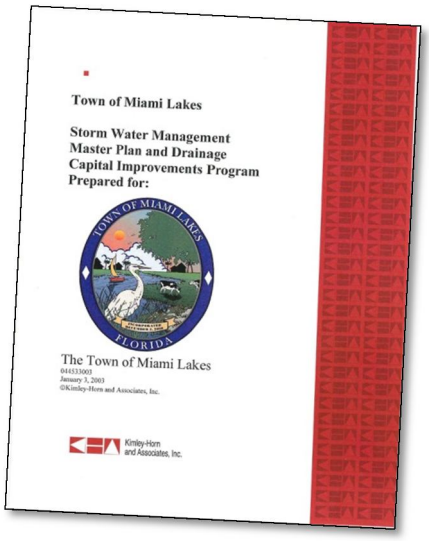
DATA COLLECTION AND EXISTING CONDITIONS

Available stormwater management information for the Town of Miami Lakes was reviewed to provide a baseline for this Stormwater Master Plan Update. The information reviewed included the following:

1. Town of Miami Lakes Stormwater Master Plan and Stormwater Master Plan Update #1.
2. Town permits, ordinances, regulations and guidance for stormwater management.
3. Stormwater management GIS coverage.
4. Design and record drawings of completed and proposed drainage projects.
5. Field inventory of existing storm water structures and facilities throughout the Town.
6. Review of citizen complaints and field review during storm events to identify existing drainage deficiency areas.

Town of Miami Lakes Stormwater Master Plan and Update #1

The Town's original Stormwater Master Plan was issued in January 2003 and the first update was issued in April 2006.



Stormwater Master Plan:

The first section described existing conditions within the Town at the time that the Town assumed responsibility for the drainage system from Miami-Dade County. Figure 2 shows the location of stormwater problems identified in the 2003 Stormwater Master Plan. The problem areas are indicated by blue dots and in some cases associated photos. The second section analyzed sixteen (16) sub-basins that were selected as priority areas for improvement by the Town. Drainage improvements for the priority sub-basins (highlighted in yellow) were recommended to meet performance goals for reducing flooding and improving water quality. The location of the priority sub-basins identified in the original Storm Water Master Plan can be seen in Figure 3.

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Figure 2: Drainage Deficiencies Identified in 2003 Stormwater Master Plan

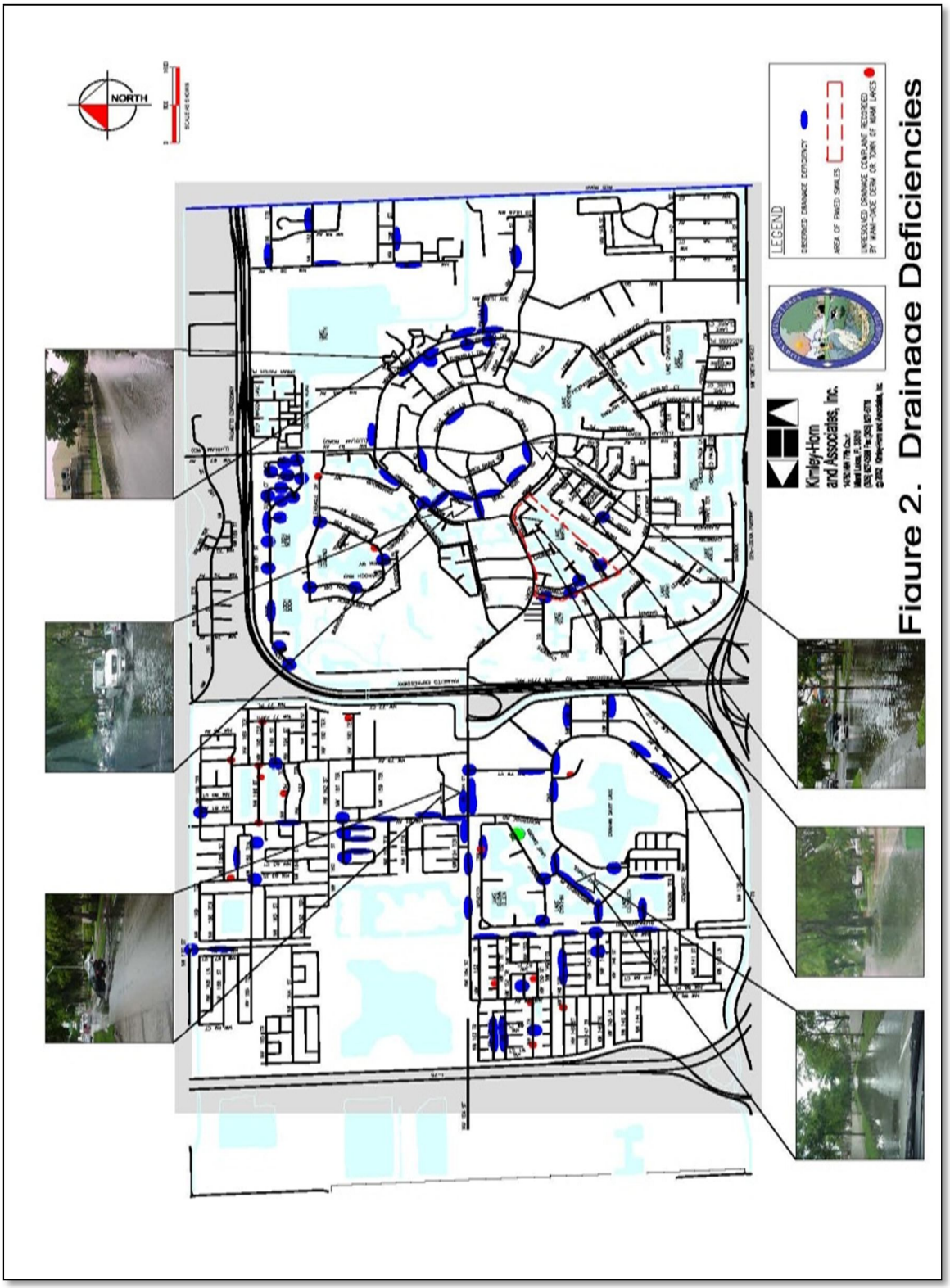
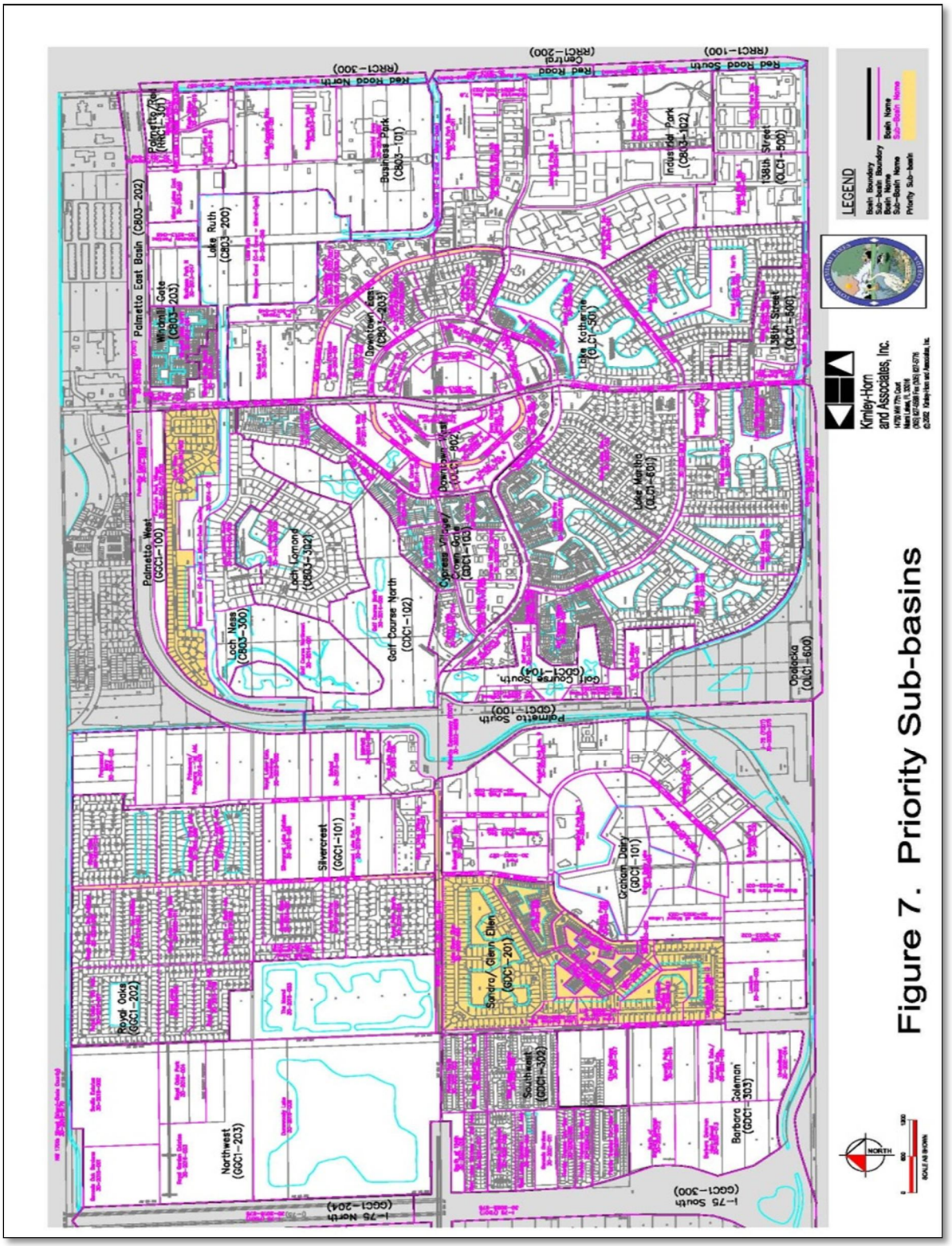
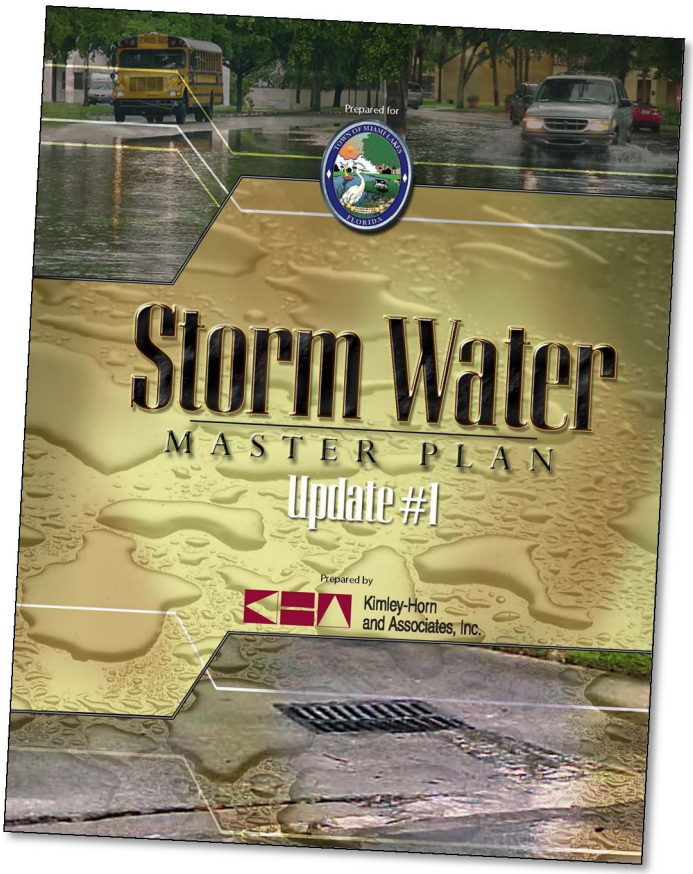


Figure 3: Priority Sub-basins Identified in 2003 Stormwater Master Plan



The third section of the original Storm Water Master Plan outlined a Capital Improvement/ Operations and Maintenance Program for the Town's Storm Water Utility. Many of the projects included in the original Stormwater Master Plan Capital Improvement Program have been implemented.

Stormwater Master Plan Update #1: Stormwater Master Plan Update #1 was issued in April 2006. The update enabled the Town to examine the effectiveness of the ongoing Operation and Maintenance Program, to evaluate progress in implementing the Capital Improvement Program, and to identify additional Capital Improvement Projects for future reduction of flooding and improvement of water quality within the Town of Miami Lakes.



The first section noted improved drainage conditions within the Town following the Town assuming responsibility for the drainage system from Miami-Dade County. The second section contained drainage analysis of eighteen (18) priority sub-basins. Drainage improvements for the priority sub-basins were recommended to meet performance goals for reducing flooding and improving water quality. The location of the priority sub-basins identified in Storm Water Master Plan Update #1 can be seen in Figure 4. The third section outlined an updated Capital Improvement/ Operations and Maintenance Program for the Town's Storm Water Utility. Again, many of the projects identified in the 2006 Stormwater Master Plan Update #1 Capital Improvement Program have been implemented utilizing grant funding and the proceeds of the Town's Stormwater Utility. Therefore, it is time to identify additional priority sub-basins and update the Capital Improvement Program.

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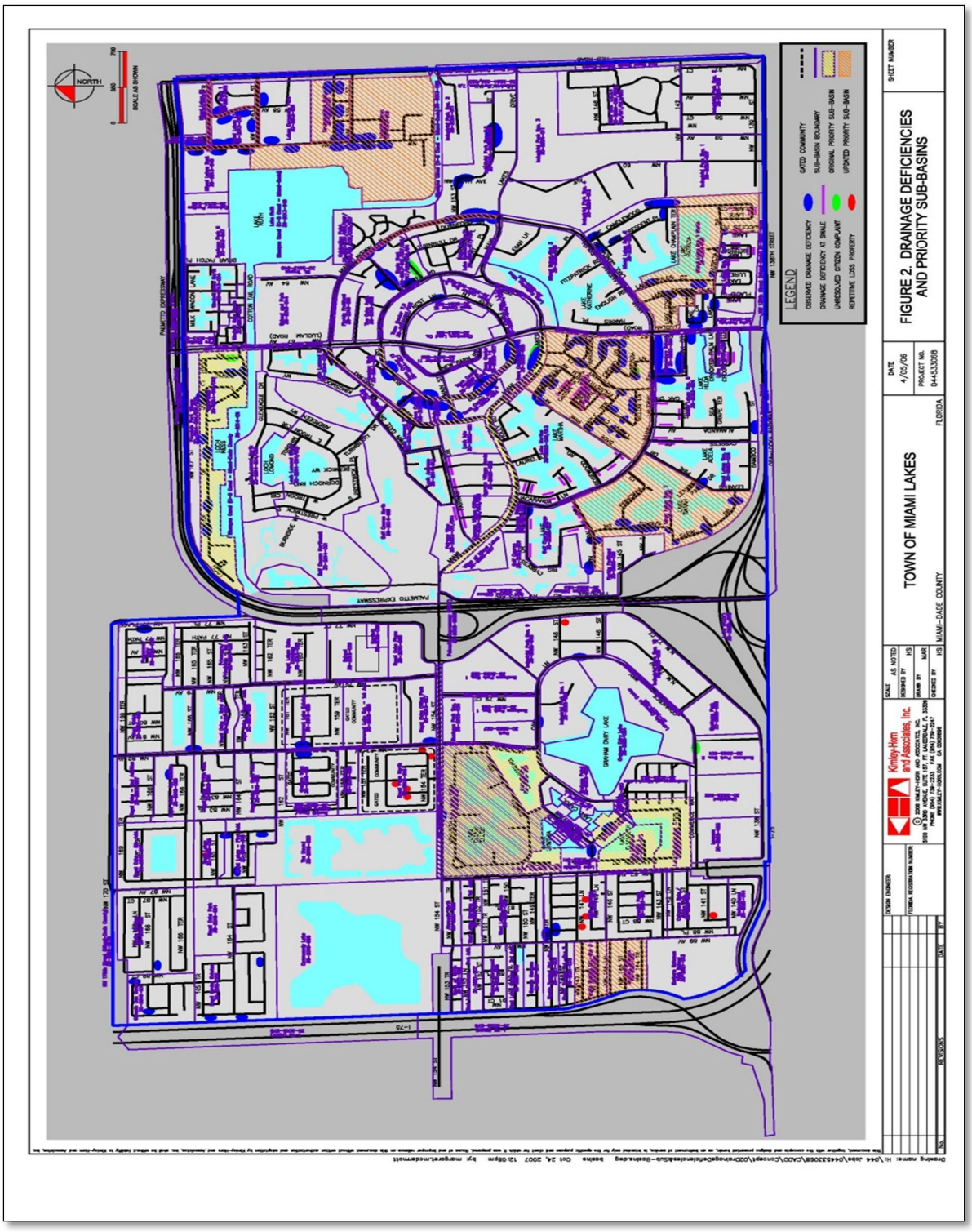
Figure 4: Priority Sub-basins Identified in 2006 Stormwater Master Plan Update #1



Town Permits, Ordinances, Regulations and Guidance

Stormwater management in the Town must consider the requirements associated with multiple permits, ordinances, regulations and guidelines.

NPDES Permit: The Town is a co-permittee on the Miami-Dade County Multiple Separate Storm Sewer System (MS4) Permit through the EPA's National Pollutant Discharge Elimination System (NPDES). The permit is administered by the Florida Department of Environmental Protection (DEP). Each year, the co-permittees are required to submit an annual report to DEP detailing progress on permit mandated activities. These activities range from inspecting storm water treatment facilities to conducting public awareness events to publicize the environmental consequences of illegal dumping. The permit is now entering Year 10 which covers the time period between October 8, 2011 and October 7, 2012. The deadline for submitting the annual report for Year 9 is April 7, 2012. MS4 permit mandated activities should be included in the Town's Storm Water Utility Operation and Maintenance Budget. DEP has been working on a new permit for Miami-Dade County for several years, but it has not yet been released. The Town should continue to monitor the permitting process and comply with the requirements of the new permit when it is released.

CRS Application: The Town of Miami Lakes was the first of the recently incorporated Miami-Dade municipalities to join the National Flood Insurance Program (NFIP) Community Rating System (CRS) program with an initial rating of Class 6. This rating entitled residents in the Special Flood Hazard Area (SFHA) to a 20% flood insurance premium discount. Effective October 1, 2011, the Town has improved its CRS rating to a Class 5 which entitles residents in the SFHA to a 25% flood insurance premium discount. Maintaining the Town's CRS rating requires inter-departmental teamwork because it includes activities implemented by the Building Department, the Planning Department, the Parks Department and the Public Works Department. CRS activities such as Public Outreach, Flood Map Reading Service, Flood Information Website, Flood Protection Assistance, Flood Data Maintenance, and Drainage System Maintenance should be included in the Town's Stormwater Utility Operation and Maintenance Budget.

Floodplain Management Ordinance and Regulations: Upon incorporation, the Town of Miami Lakes adopted the Miami-Dade County Code. Since that time, the Town has passed a few additional ordinances pertaining to storm water management. In March of 2003, the Town passed Ordinances 03-31 and 03-32 which established the Town's Stormwater Utility and set the Stormwater Utility rate at $4.50 per Equivalent Residential Unit. These ordinances established the Town's Stormwater Utility as a source of funding for storm water related projects and maintenance activities within the Town. In April 2003, the Town adopted

Ordinance 03-34-B which revised the Town's Floodplain Management Regulations. This Ordinance was subsequently revised by Ordinance 05-67 in March 2005 and Ordinance 10-122 in May 2010. The Floodplain Management Ordinance sets flood protection minimum standards for new and substantially improved properties within the Town. In December 2003, the Town adopted the Comprehensive Plan for the Town of Miami Lakes under Ordinance 03-46. The Comprehensive Plan contains a section on Storm Water Management which sets stormwater management Level of Service standards for development within the Town. These standards and modifications to date will be applied to the stormwater improvement recommendation included in this master plan update.

Stormwater Management GIS Coverage

As part of the original Town of Miami Lakes Storm Water Master Plan, KHA obtained Geographic Information System (GIS) information on existing storm water systems from Miami-Dade County Department of Environmental Resource Management (DERM). This information was in the form of an AutoCAD file showing the location of drainage infrastructure and several hard copy data sheets showing additional information on each drainage structure. As part of the Town's Storm Water Master Plan Update #1, KHA converted this information to ArcGIS format. To date the Town has not updated the database with infrastructure information from completed drainage improvement projects. The Town has recently added the requirement to provide as-built information in GIS as part of new Capital Improvement Projects (CIPs). It is recommended that the database be updated for all projects completed to date for an improved Operations and Maintenance program.

Summary of Completed Stormwater Projects

The previous Storm Water Master Plan Update #1 identified fourteen (14) priority sub-basins for Capital Improvement Projects as shown in Figure 4. Capital Improvement Projects for nine (9) of these priority sub-basins have been constructed:

- Loch Ness
- Miami Lakeway North
- Lake Elizabeth
- Lake Cynthia
- Lake Carol Section 2
- Lake Carol Section 3
- Business Park East
- NE Industrial Area
- Industrial Area

In addition, improvements for the following two (2) priority sub-basins are currently in the design phase:

- Lake Patricia
- Downtown Improvement Phase 1 and 2 (Bull Run)

The following three (3) priority sub-basins from Storm Water Master Plan Update #1 have not yet been addressed:

- Lake Sarah
- Lake Martha Single Family Homes
- West Lakes B (Olivia Gardens)

Field Inventory of Existing Stormwater Structures

Fifty (50) existing drainage structures were inventoried. The field inventory log sheets associated with this inventory can be found in Appendix A. In general, the condition of the existing drainage structures appears to be better than the conditions observed under the Town's first Storm Water Master Plan. The majority of the catch basins were clean and in good condition as a result of the Town's on-going maintenance efforts. However, some catch basins were full of sediment or covered with debris. Catch basin cleaning and pipe flushing is recommended in the areas where these catch basins are located.

Identification of Drainage Deficiency Areas

Citizen Complaint Records: KHA obtained copies of unresolved citizen stormwater related complaints from Town staff. The areas represented by these complaints are shown in Figure 5. Many of these areas correspond to drainage deficiencies observed during the field review of stormwater problem areas.

Field Review of Stormwater Problem Areas: KHA staff conducted drive-thru review of drainage conditions during the more significant storm events taking place during the summer of 2011. It should be noted that the 2011 wet season was drier than usual and additional drainage deficiencies may exist within the Town which could not be identified by observation during this time period. The results of the field review can be seen in Figure 5. Based on this field review, many of the drainage deficiencies identified in the Town's original Storm Water Master Plan have been corrected by either improved maintenance by the Town or capital improvements projects completed by the Town as part of the Storm Water Utility. However, there are still areas within the Town where drainage deficiencies can be observed. In particular, a few drainage deficiencies were observed in the area around Lake Glenn Ellen where capital Improvements were completed in 2004. Due to the heavy tree canopy, it is recommended that more frequent inspection and cleaning of drainage inlets and pipe be conducted in the area.

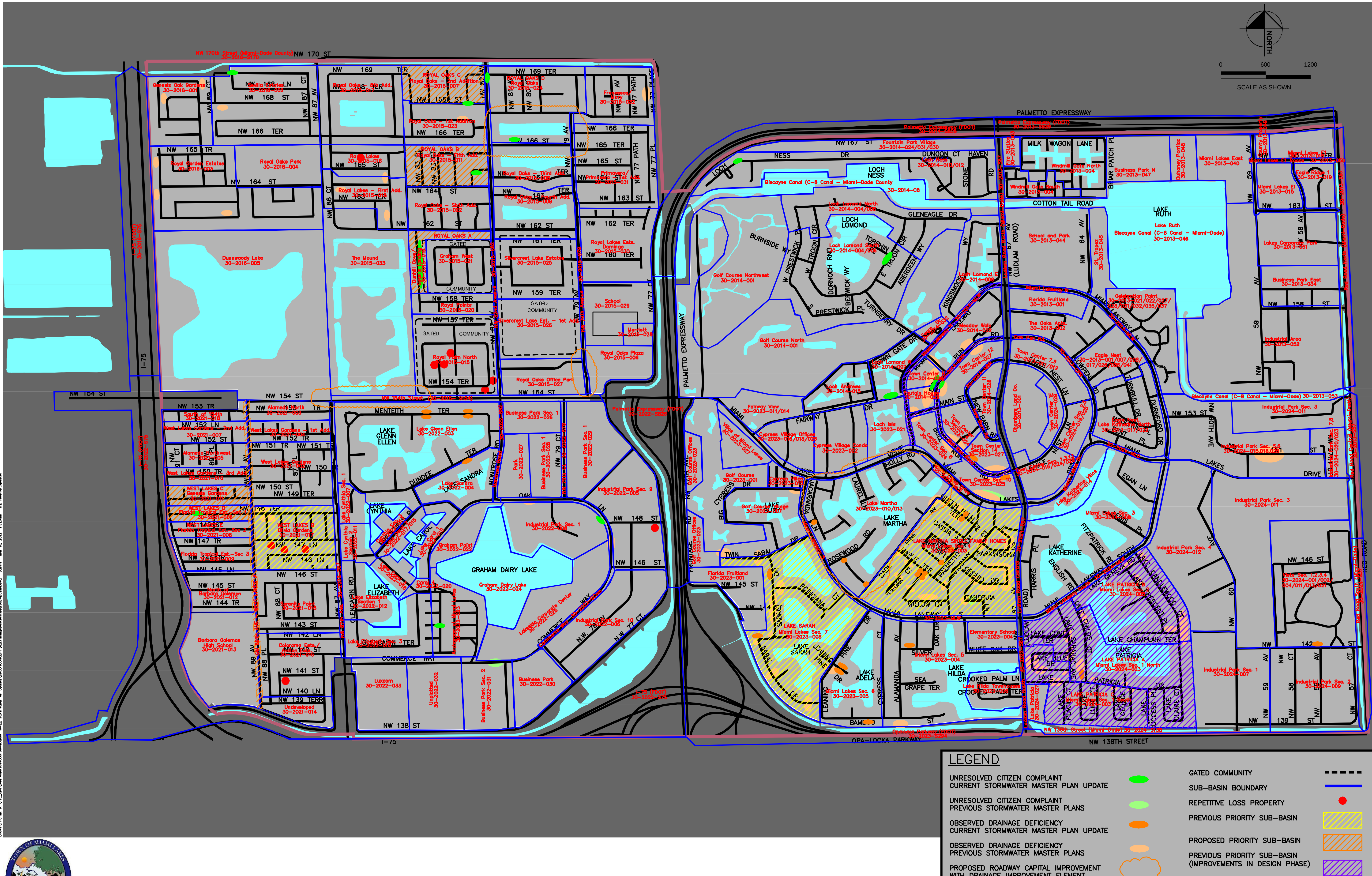


FIGURE 5. DRAINAGE DEFICIENCIES AND PRIORITY SUB-BASINS

Updated Sub-basin Prioritization

Based on observed flooding, complaints, road conditions and the other parameters noted above, the Town selected priority sub-basins for more in depth study under the original Storm Water Master Plan and Stormwater Master Plan Update #1. Only three of those priority sub-basins remain to be addressed through capital improvement projects. Therefore, the Town has identified seven new priority sub-basins for review as part of this Stormwater Master Plan Update #2. These priority sub-basins are the subject of hydraulic and hydrologic analysis as part of this report. The locations of the new priority sub-basins are depicted in Figure 5. They include:

- West Lakes A (NW 89th Avenue)
- West Lakes C
- West Lakes D
- West Lakes E
- Royal Oaks A
- Royal Oaks B
- Royal Oaks C

The West Lakes B (Olivia Gardens) priority sub-basin from Stormwater Master Plan Update #1 will also be re-evaluated in order to allow for its consideration as part of a master drainage system to serve the entire West Lakes area of the Town located west of NW 87th Avenue and south of NW 154th Street. Hydraulic and hydrologic analysis of these new priority sub-basins will result in Capital Improvement Project recommendations for these sub-basins which will be incorporated into an updated Stormwater Capital Improvement Program (CIP). Updated budget information associated with the two remaining Capital Improvement Projects from Stormwater Master Plan Update #1 (Lake Sarah and Lake Martha) will also be incorporated into the new Stormwater CIP.

DRAINAGE SUB-BASIN ANALYSIS

Methodology

In order to measure the performance of each drainage sub-basin, performance goals were identified in the Town's original Stormwater Master Plan.

Water Quality Treatment Performance Goal: Drainage sub-basins discharging into lakes should have minimum water quality pre-treatment equal to the volume of the first one-half inch of runoff. Drainage sub-basins discharging into canals should have minimum water quality pre-treatment equal to the greater of the volume of the first one-inch of runoff or 2.5-inches over the impervious area contained within the sub-basin. This goal ensures that the drainage improvements meet South Florida Water Management District (SFWMD) and Miami-Dade County Department of Environmental Resource Management (DERM) requirements for water quality pre-treatment.

Water Quantity Treatment Performance Goals: The Town has adopted several water quantity treatment performance goals designed to reduce the potential for flooding within the Town.

- During the 5-year, 24-hour design storm event, flooding should not exceed the crown of the local roadways located within the sub-basin.
- During the 10-year, 24-hour design storm event, flooding should not exceed the crown of the arterial or collector roadways located within the sub-basin.
- During the 25-year, 72-hour design storm event, flood depth should be less than 12-inches above the crown of the road.
- During the 100-year, 72-hour design storm event, flooding should not exceed building finish floor elevations.

Existing conditions in each of the priority sub-basins were modeled to determine the extent to which the performance goals are currently being met. When a performance goal was not being met within a sub-basin, stormwater management improvements were proposed for the sub-basin to bring it into compliance with the performance goal.

For each priority sub-basin, the amount of existing paved area, building area and pervious area was determined utilizing existing aerial photographs and Geographic Information System (GIS) data. Elevation information contained in the GIS data was utilized to estimate the average high and low elevation of the paved area, building area and pervious area associated with the sub-basin. This information along with information on existing drainage infrastructure located within the sub-basin was incorporated into a computer model. Existing flood routing and maximum flood stage produced by four different design storm events for each sub-basin was

analyzed within the computer model. In addition to flood routing analysis, each sub-basin was analyzed for water quality pre-treatment capacity. SFWMD and DERM require storm water runoff to be pretreated to minimize pollution prior to discharging into any water body. Typically, water quality pre-treatment in the Town of Miami Lakes is provided by exfiltration trench (underground perforated pipes in a gravel bed, also known as French drain) or by retention in roadside grass swale areas. The pre-treatment capacity of existing infrastructure within each sub-basin was estimated based on available data and compared with required pre-treatment volumes.

The following is a summary of the findings for each of the ten priority sub-basins (three sub-basins from Stormwater Master Plan Update #1 and seven new priority sub-basins).

Lake Martha Single Family Residential

The Lake Martha Single Family (SF) Residential Sub-basin was analyzed as part of Stormwater Master Plan #1. This report includes a summary of the Stormwater Master Plan #1 findings and an updated budget for the proposed improvements.

Location: The Lake Martha Single Family Residential sub-basin is generally located west of Ludlam Road and north of Miami Lakeway South, in the southeastern residential section of the Town. The Lake Martha Single Family Residential sub-basin is part of the Lake Martha (OLC1-601) Drainage Basin.

Existing and Future Conditions: Figure 6 shows existing conditions for the Lake Martha Sub-basin. The sub-basin consists of approximately 78.2 acres of existing detached single family development with approximately 11,000 linear feet of roadway including Dade Pine Avenue, Palmetto Palm Avenue, Mahogany Court, Maple Terrace, Cedar Court, Willow Lane, Bottle Brush Lane, Cassia Place, Queen Palm Terrace, Parkinsonia Drive, Orchid Drive and Tabuia Lane. The existing drainage system in this sub-basin consists of catch basins discharging either to Lake Martha or isolated sections of underground exfiltration trench. Roadside swales also provide some water quality pre-treatment and storage of roadway run-off. KHA observed several areas of flooding extending to the centerline of road within this sub-basin. The location of these deficiencies can be seen in Figure 6.

Based on available GIS and as-built information, the elevation of existing roads ranges from a low of approximately 6.3 feet to a high of approximately 8.0 feet NGVD. It was assumed that building finish elevations are 1.5 feet above crown of road elevations. Pervious area elevations were assumed to range from 0.5 feet below the minimum roadway elevation in the roadside swales to 0.5 feet below the finish floor elevations. Since the area is already developed, it is anticipated that future development conditions will not vary significantly from the existing conditions.

Performance Goal Analysis: Based on the detailed hydrologic and hydraulic calculations for this sub-basin, included in Stormwater Master Plan Update #1, the majority of the modeled drainage areas within the sub-basin do not currently meet the Town's performance goals. Table 1 shows the performance of the basin versus performance goals. "Yes" means the given drainage area within the sub-basin meets the performance goal, and "No" means that the given drainage area within the sub-basin does not meet the performance goal.

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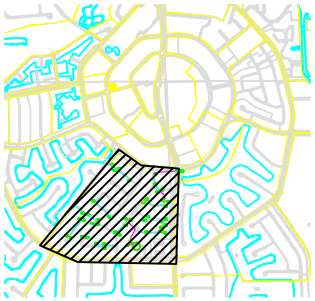


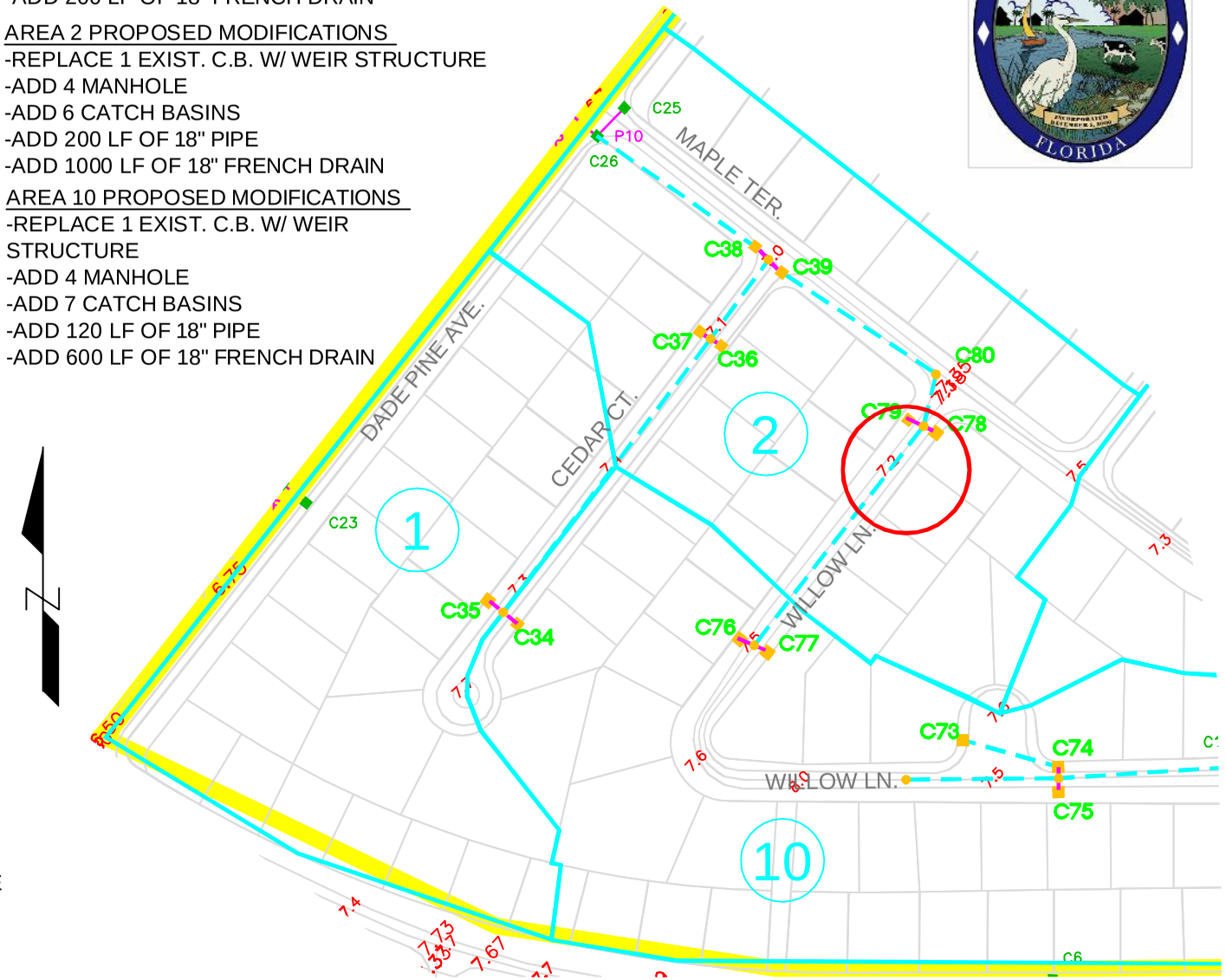
LEGEND

- EXIST./PROP. OUTFALL PIPE
- EXIST./PROP. DRAINAGE PIPE
- EXIST./PROP. FRENCH DRAIN
- AREA DELINEATION
- SUB-BASIN GROUP
- EXIST./PROP. CATCH BASIN
- EXIST./PROP. MANHOLE
- PROP. REGRADING
- # AREA NUMBER
- KHA OBSERVED FLOODING
- TOWN COMPLAINT LOCATIONS
- UNRESOLVED CITIZEN COMPLAINT (PREVIOUS SWMP)

AREA 1 PROPOSED MODIFICATIONS
-ADD 1 MANHOLE
-ADD 2 CATCH BASINS
-ADD 40 LF OF 18" PIPE
-ADD 200 LF OF 18" FRENCH DRAIN

AREA 2 PROPOSED MODIFICATIONS
-REPLACE 1 EXIST. C.B. W/ WEIR STRUCTURE
-ADD 4 MANHOLE
-ADD 6 CATCH BASINS
-ADD 200 LF OF 18" PIPE
-ADD 1000 LF OF 18" FRENCH DRAIN

AREA 10 PROPOSED MODIFICATIONS
-REPLACE 1 EXIST. C.B. W/ WEIR STRUCTURE
-ADD 4 MANHOLE
-ADD 7 CATCH BASINS
-ADD 120 LF OF 18" PIPE
-ADD 600 LF OF 18" FRENCH DRAIN



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SUMMARY OF PROPOSED MODIFICATIONS

-REPLACE 2 EXIST. C.B. W/ WEIR STRUCTURE
-ADD 9 MANHOLE
-ADD 15 CATCH BASINS
-ADD 360 LF OF 18" PIPE
-ADD 1800 LF OF 18" FRENCH DRAIN

0 200 400
SCALE FEET

TOWN OF MIAMI LAKES
STORMWATER MASTER PLAN
LAKE MARTHA SUB-BASIN

FIGURE 6
1 of 5

Kimley-Horn and Associates, Inc.

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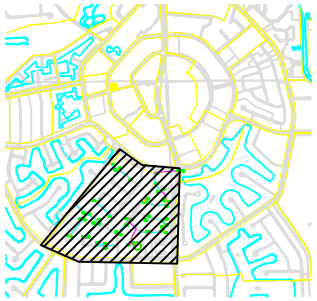


LEGEND

- EXIST./PROP. OUTFALL PIPE
- EXIST./PROP. DRAINAGE PIPE
- EXIST./PROP. FRENCH DRAIN
- AREA DELINEATION
- SUB-BASIN GROUP
- EXIST./PROP. CATCH BASIN
- EXIST./PROP. MANHOLE
- PROP. REGRADING
- # AREA NUMBER
- KHA OBSERVED FLOODING
- TOWN COMPLAINT LOCATIONS
- UNRESOLVED CITIZEN COMPLAINT (PREVIOUS SWMP)

AREA 3 PROPOSED MODIFICATIONS

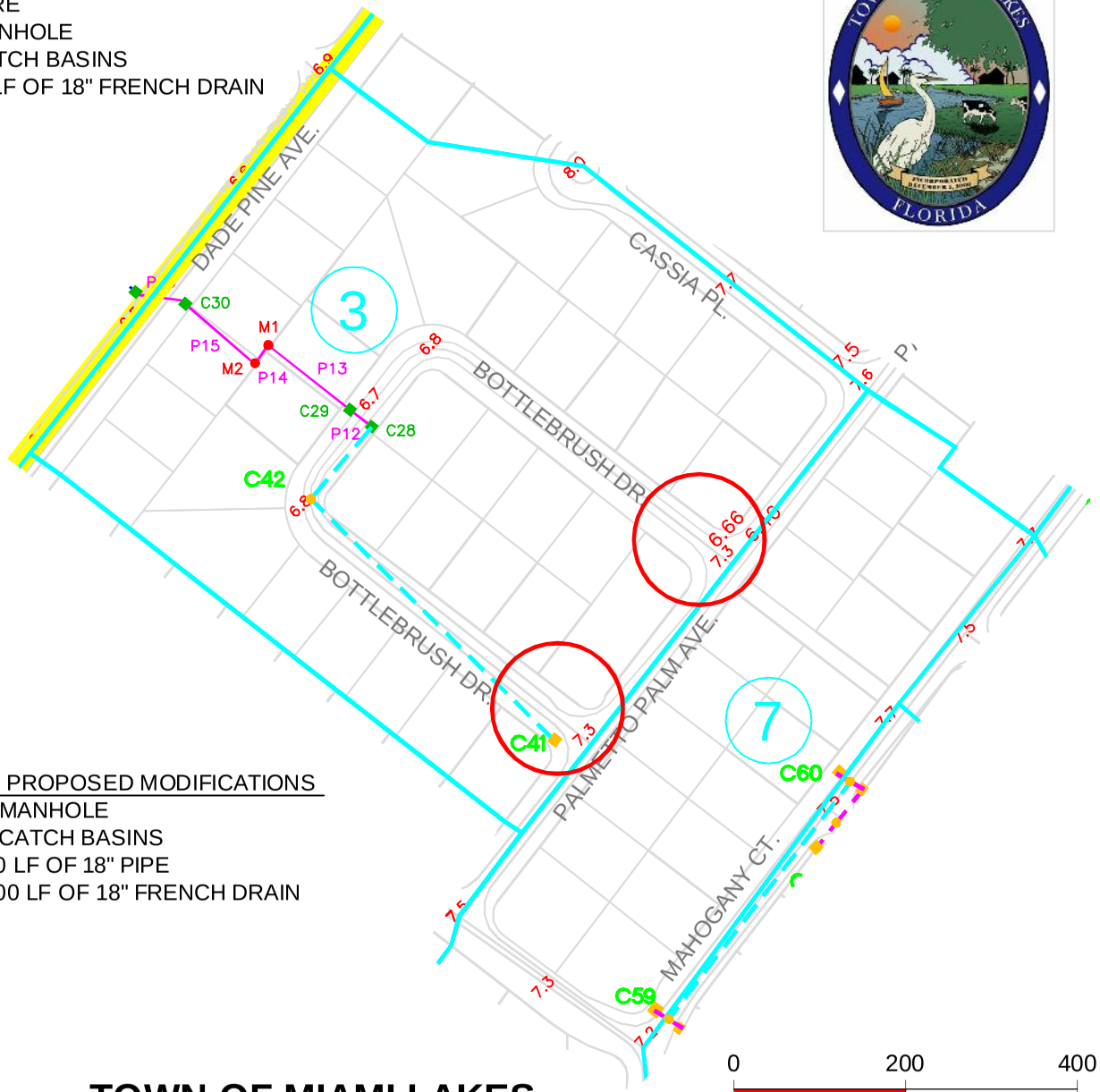
-REPLACE 1 EXIST. C.B. W/ WEIR STRUCTURE
-ADD 1 MANHOLE
-ADD 1 CATCH BASINS
-ADD 500 LF OF 18" FRENCH DRAIN

AREA 7 PROPOSED MODIFICATIONS

-ADD 2 MANHOLE
-ADD 4 CATCH BASINS
-ADD 40 LF OF 18" PIPE
-ADD 300 LF OF 18" FRENCH DRAIN

SUMMARY OF PROPOSED MODIFICATIONS

-REPLACE 1 EXIST. C.B. W/ WEIR STRUCTURE
-ADD 3 MANHOLE
-ADD 5 CATCH BASINS
-ADD 40 LF OF 18" PIPE
-ADD 800 LF OF 18" FRENCH DRAIN



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0 200 400
SCALE FEET

TOWN OF MIAMI LAKES
STORMWATER MASTER PLAN
LAKE MARTHA SUB-BASIN

FIGURE 6
2 of 5

Kimley-Horn and Associates, Inc.

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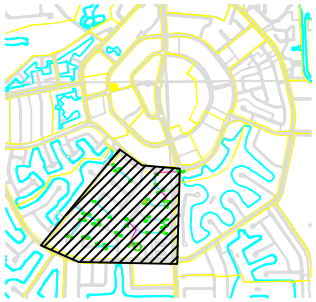

AREA 4 PROPOSED MODIFICATIONS
-REPLACE 1 EXIST. C.B. W/ WEIR STRUCTURE
-ADD 3 MANHOLE
-ADD 2 CATCH BASINS
-ADD 40 LF OF 18" PIPE
-ADD 500 LF OF 18" FRENCH DRAIN

LEGEND

- EXIST./PROP. OUTFALL PIPE
- EXIST./PROP. DRAINAGE PIPE
- EXIST./PROP. FRENCH DRAIN
- AREA DELINEATION
- SUB-BASIN GROUP
- EXIST./PROP. CATCH BASIN
- EXIST./PROP. MANHOLE
- PROP. REGRADING
- # AREA NUMBER
- KHA OBSERVED FLOODING
- TOWN COMPLAINT LOCATIONS
- UNRESOLVED CITIZEN COMPLAINT (PREVIOUS SWMP)

SUMMARY OF PROPOSED MODIFICATIONS

-REPLACE 1 EXIST. C.B. W/ WEIR STRUCTURE
-ADD 3 MANHOLE
-ADD 2 CATCH BASINS
-ADD 40 LF OF 18" PIPE
-ADD 500 LF OF 18" FRENCH DRAIN

0 200 400
SCALE FEET

TOWN OF MIAMI LAKES
STORMWATER MASTER PLAN
LAKE MARTHA SUB-BASIN

FIGURE 6
3 of 5

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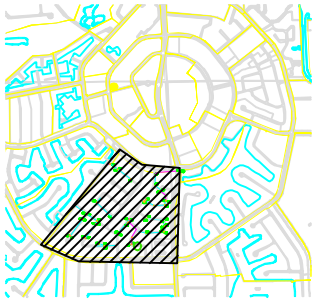


LEGEND

- EXIST./PROP. OUTFALL PIPE
- EXIST./PROP. DRAINAGE PIPE
- EXIST./PROP. FRENCH DRAIN
- AREA DELINEATION
- SUB-BASIN GROUP
- EXIST./PROP. CATCH BASIN
- EXIST./PROP. MANHOLE
- PROP. REGRADING
- # AREA NUMBER
- KHA OBSERVED FLOODING
- TOWN COMPLAINT LOCATIONS
- UNRESOLVED CITIZEN COMPLAINT (PREVIOUS SWMP)

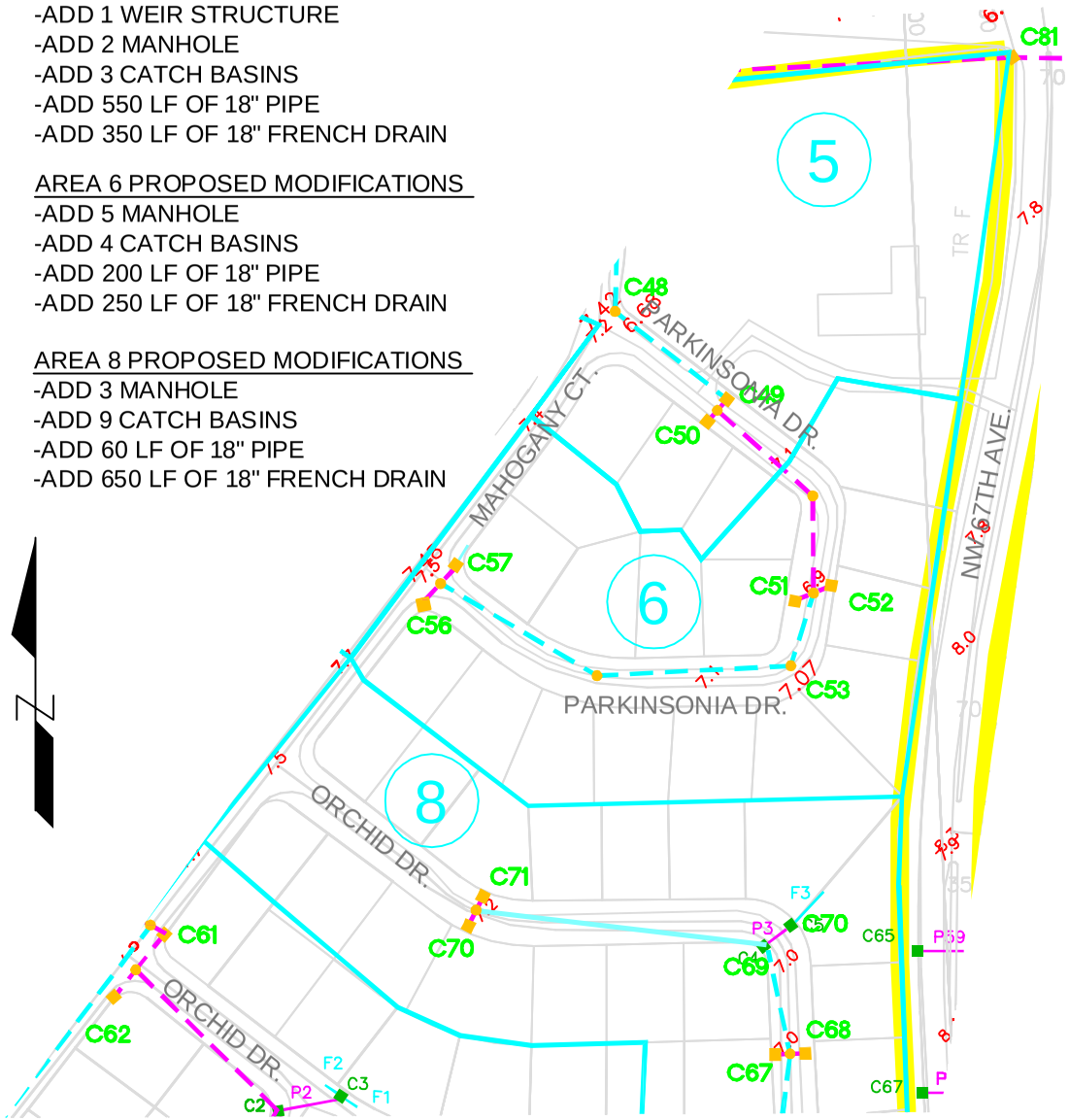
AREA 5 PROPOSED MODIFICATIONS
-ADD 1 WEIR STRUCTURE
-ADD 2 MANHOLE
-ADD 3 CATCH BASINS
-ADD 550 LF OF 18" PIPE
-ADD 350 LF OF 18" FRENCH DRAIN

AREA 6 PROPOSED MODIFICATIONS
-ADD 5 MANHOLE
-ADD 4 CATCH BASINS
-ADD 200 LF OF 18" PIPE
-ADD 250 LF OF 18" FRENCH DRAIN

AREA 8 PROPOSED MODIFICATIONS
-ADD 3 MANHOLE
-ADD 9 CATCH BASINS
-ADD 60 LF OF 18" PIPE
-ADD 650 LF OF 18" FRENCH DRAIN

SUMMARY OF PROPOSED MODIFICATIONS

-ADD 1 WEIR STRUCTURE
-ADD 10 MANHOLE
-ADD 16 CATCH BASINS
-ADD 810 LF OF 18" PIPE
-ADD 1250 LF OF 18" FRENCH DRAIN



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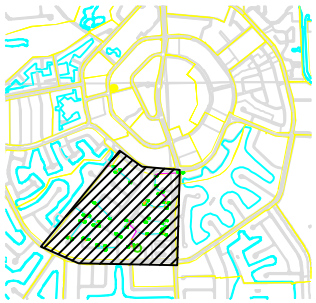
TOWN OF MIAMI LAKES
STORMWATER MASTER PLAN
LAKE MARTHA SUB-BASIN

0 200 400
SCALE FEET

FIGURE 6
4 of 5



LEGEND

- EXIST./PROP. OUTFALL PIPE
- EXIST./PROP. DRAINAGE PIPE
- EXIST./PROP. FRENCH DRAIN
- AREA DELINEATION
- SUB-BASIN GROUP
- EXIST./PROP. CATCH BASIN
- EXIST./PROP. MANHOLE
- PROP. REGRADING
- # AREA NUMBER
- KHA OBSERVED FLOODING
- TOWN COMPLAINT LOCATIONS
- UNRESOLVED CITIZEN COMPLAINT (PREVIOUS SWMP)

SUMMARY OF PROPOSED MODIFICATIONS

-ADD 1 MANHOLE
-ADD 2 CATCH BASINS
-ADD 450 LF OF 18" PIPE
-ADD 350 LF OF 18" FRENCH DRAIN

AREA 9 PROPOSED MODIFICATIONS

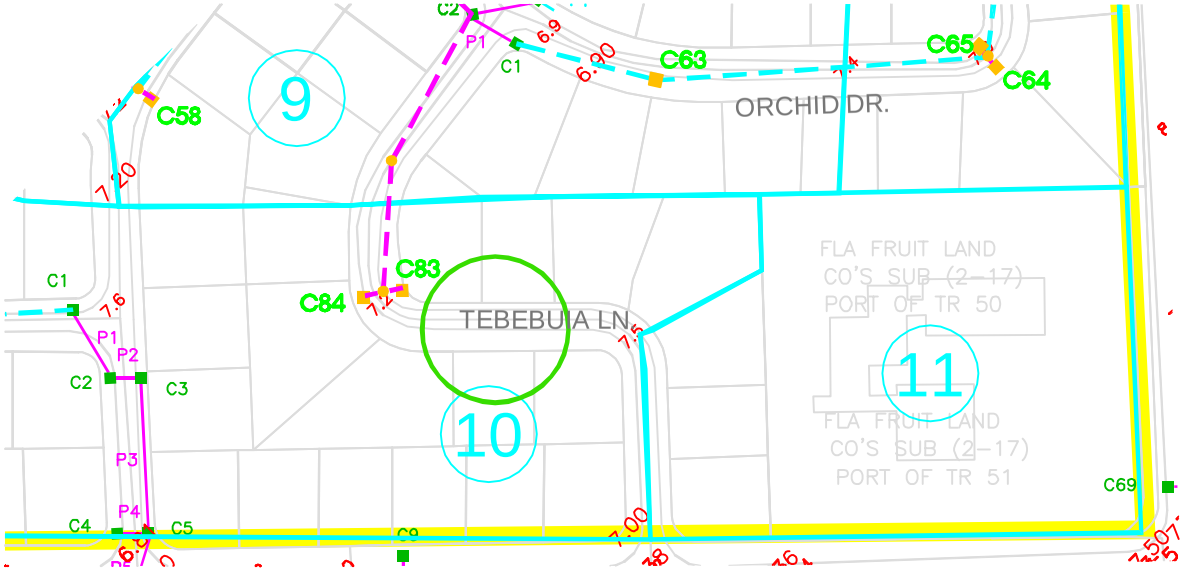
-ADD 1 MANHOLE
-ADD 2 CATCH BASINS
-ADD 450 LF OF 18" PIPE
-ADD 350 LF OF 18" FRENCH DRAIN

AREA 10 PROPOSED MODIFICATIONS

-SEE SHEET 1 OF 5 FOR IMPROVEMENTS

AREA 11 PROPOSED MODIFICATIONS

-NO IMPROVEMENTS PROPOSED



0 200 400
SCALE FEET

TOWN OF MIAMI LAKES STORMWATER MASTER PLAN

LAKE MARTHA SUB-BASIN

FIGURE 6
5 of 5

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Table 1: Lake Martha Single Family Residential Sub-basin – Performance Goal Analysis

Sub-basin Area	Water Quality	5-Year Storm	10-Year Storm	25-Year Storm	100-Year Storm	No Observed Flooding or Complaints
1	No	Yes	Yes	Yes	Yes	Yes
2	No	Yes	Yes	Yes	Yes	No
3	No	Yes	Yes	Yes	Yes	Yes
4	No	Yes	Yes	Yes	Yes	No
5	No	No	No	No	No	Yes
6	No	No	No	No	No	Yes
7	No	No	No	No	No	Yes
8	No	No	No	No	No	Yes
9	No	No	No	No	No	Yes
10	No	Yes	Yes	Yes	Yes	Yes
11	No	Yes	Yes	Yes	Yes	Yes

Storm Drainage Deficiencies: Some catch basins in this sub-basin were observed to be filled with debris and sediment blocking or highly restricting flow. Based on the hydrologic and hydraulic calculations for this sub-basin, the existing drainage infrastructure does not discharge adequate runoff to meet the desired performance criteria. The capacity of the existing swales and French drains is not sufficient to discharge the volume of runoff outlined in the performance criteria during the modeled storm events. Roadway settlement at intersections was also observed as a result of inadequate drainage conditions. Improvements to drainage infrastructure will be needed to address these inadequacies. Only the northwestern areas within this drainage sub-basin currently connect to an outfall to Lake Martha.

Recommended Drainage Improvements: Clean and flush all sediment and debris from existing catch basins and pipes and adjust catch basin elevations and locations to minimize accumulation of sediment and debris. Install the additional infrastructure depicted in Figure 6. Existing catch basins should be modified or reconstructed as required to provide sediment traps (sumps). Additional catch basins/ manholes, culverts and exfiltration trench are recommended to be constructed to interconnect the catch basins. Exfiltration trench and a new outfall to Lake Hilda are recommended to provide positive drainage. The outfall can be constructed in road right-of-way and cross through the park at the southeast corner of Ludlam Road and Miami Lakes Drive. The final catch basin prior to the outfall should be a control structure catch basin with a weir, pollution retardant baffle and a sedimentation sump.

Environmental Impact of Proposed Improvements: A full analysis of the estimated pollutant loading for existing, future and proposed conditions was prepared for the priority sub-basins utilizing a spreadsheet developed for this purpose which can be found in Appendix C. The table below shows how the proposed improvements will result in a significant reduction in the

pollutant load contribution from this sub-basin to the Biscayne Aquifer and Lake Martha for three major pollutants.

Table 2: Lake Martha Single Family Residential Sub-basin – Pollutant Loading Analysis

Pollutant	Existing Load (kg/yr)	Reduction (kg/yr)	Proposed Load (kg/yr)
Total Phosphorous	46.45	43.04	3.41
Total Nitrogen	365.98	327.55	38.43
Total Suspended Solids	4387.02	3972.45	414.57

Capital Improvement Budget: A budget was developed for the proposed stormwater capital improvements.

Table 3: Lake Martha Single Family Residential Sub-basin – Capital Improvement Budget

Item	Description	Qty.	Units	Unit Price	Sub-total
1	Mobilization/ MOT/ Clearing & Grubbing	1	L.S.	$77,600	**$78,000**
2	Remove Existing Structure	5	Ea.	$500	**$3,000**
3	Inlet Pavement (5' x 5')	40	Ea.	$500	**$20,000**
4	Swale Inlet (Miami-Dade SD 2.2)	40	Ea.	$2,200	**$88,000**
5	Manhole (FDOT Type P-7)	26	Ea.	$2,200	**$58,000**
6	Core Drill Existing Inlets	4	Ea.	$500	**$2,000**
7	18" HDPE Pipe	1,700	L.F.	$40	**$68,000**
8	French Drain (18" HDPE Pipe)	4,700	L.F.	$110	**$517,000**
9	Weir Structure	5	Ea.	$4,000	**$20,000**
10	Stormwater Pollution Prevention	1	L.S.	$8,540	**$9,000**
11	Utility Adjustments	1	L.S.	$42,700	**$43,000**
12	Swale Restoration	1	L.S.	$42,700	**$43,000**
13	Professional Services	1	L.S.	$142,350	**$143,000**
14	Contingency	1	L.S.	$189,800	**$190,000**
TOTAL					**$1,290,000**

Notes:

1. The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

Lake Martha Townhomes

Location and Existing Conditions: The Lake Martha Townhomes (TH) sub-basin is generally located immediately surrounding Lake Martha south of Miami Lakes Drive, in the southeastern residential section of the Town. The Lake Martha Townhomes sub-basin is part of the Lake Martha (OLC1-601) Drainage Basin. The Lake Martha Townhomes sub-basin is not one of the priority sub-basins included in the hydraulic/ hydrologic modeling, but it is an area that receives consistent citizen complaints that require more than maintenance actions to resolve. The stormwater GIS for the Lake Martha Townhomes sub-basin indicates that the drainage system consists of single catch basins located at the end of each cul-de-sac with direct outfall piping to Lake Martha. Because of the close proximity of the driveway aprons serving the townhomes, much of the swale area in this sub-basin is paved. As a result, stormwater management is impacted because the swales do not function as designed allowing stormwater runoff to percolate into the soil and/ or be conveyed to the catch basins and outfalls.

Recommended Drainage Improvements and Budget: One of the primary causes of flooding within the Lake Martha Townhomes sub-basin appears to be the lack of pervious swale area. Therefore, it is recommended that the existing stormwater system be upgraded to incorporate additional pervious area by replacing existing driveway aprons with pervious concrete aprons over filter fabric wrapped gravel reservoirs. Valley gutter is also proposed to improve conveyance of runoff to the existing catch basins. See the proposed budget below.

Table 4: Lake Martha Townhomes Sub-basin – Capital Improvement Budget

Item	Description	Qty.	Units	Unit Price	Sub-total
1	Mobilization/ MOT/ Clearing & Grubbing	1	L.S.	$67,100	**$68,000**
2	Remove Existing Driveway Aprons	10,000	S.Y.	$2	**$20,000**
3	Construct 6" Pervious Concrete Aprons	10,000	S.Y.	$30	**$300,000**
4	Fabric Wrapped (10'x2') Gravel Reservoir	9,000	L.F.	$24	**$216,000**
5	Install Valley Gutter	9,000	L.F.	$15	**$135,000**
6	Stormwater Pollution Prevention	1	L.S.	$7,390	**$8,000**
7	Utility Sleeves and Adjustments	1	L.S.	$36,950	**$37,000**
8	Swale Restoration	1	L.S.	$36,950	**$37,000**
9	Professional Services	1	L.S.	$123,150	**$124,000**
10	Contingency	1	L.S.	$164,200	**$165,000**
TOTAL					**$1,110,000**

Notes:

1. The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

Lake Sarah

The Lake Sarah Sub-basin was analyzed as part of Stormwater Master Plan #1. This report includes a summary of the Stormwater Master Plan #1 findings and an updated budget for the proposed improvements.

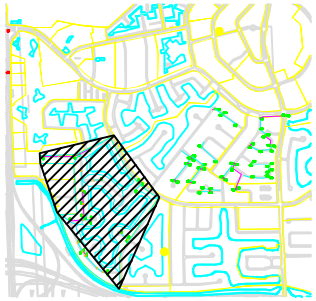
Location: The Lake Sarah sub-basin is generally located between Miami Lakeway South and the Palmetto Expressway right-of-way and between Twin Sabal Drive and Leaning Pine Drive, in the southeast residential area of the Town. The Lake Sarah sub-basin is part of the Lake Martha (OLC1 – 601) Drainage Basin.

Existing and Future Conditions: Figure 7 shows existing conditions for the Lake Martha Sub-basin. The sub-basin consists of approximately 69.1 acres of existing detached single family development with approximately 6,300 linear feet of roadway including Twin Sabal Drive, Sabal Drive, Poinciana Court and Leaning Pine Drive. The existing drainage system in this sub-basin consists of catch basins discharging either to Lake Sarah or to the smaller lake located northwest of Lake Sarah. Roadside swales and exfiltration trenches provide some water quality pre-treatment and storage of roadway run-off. KHA observed several areas of flooding extending to the centerline of road within this sub-basin. The location of these deficiencies can be seen in Figure 7.

Based on available GIS and as-built information, the elevation of existing roads ranges from a low of approximately 6.4 feet to a high of approximately 7.9 feet NGVD. It was assumed that building finish elevations are 1.5 feet above crown of road elevations. Pervious area elevations were assumed to range from 0.5 feet below the minimum roadway elevation in the roadside swales to 0.5 feet below the finish floor elevations. Since the area is already developed, it is anticipated that future development conditions will not vary significantly from the existing conditions.

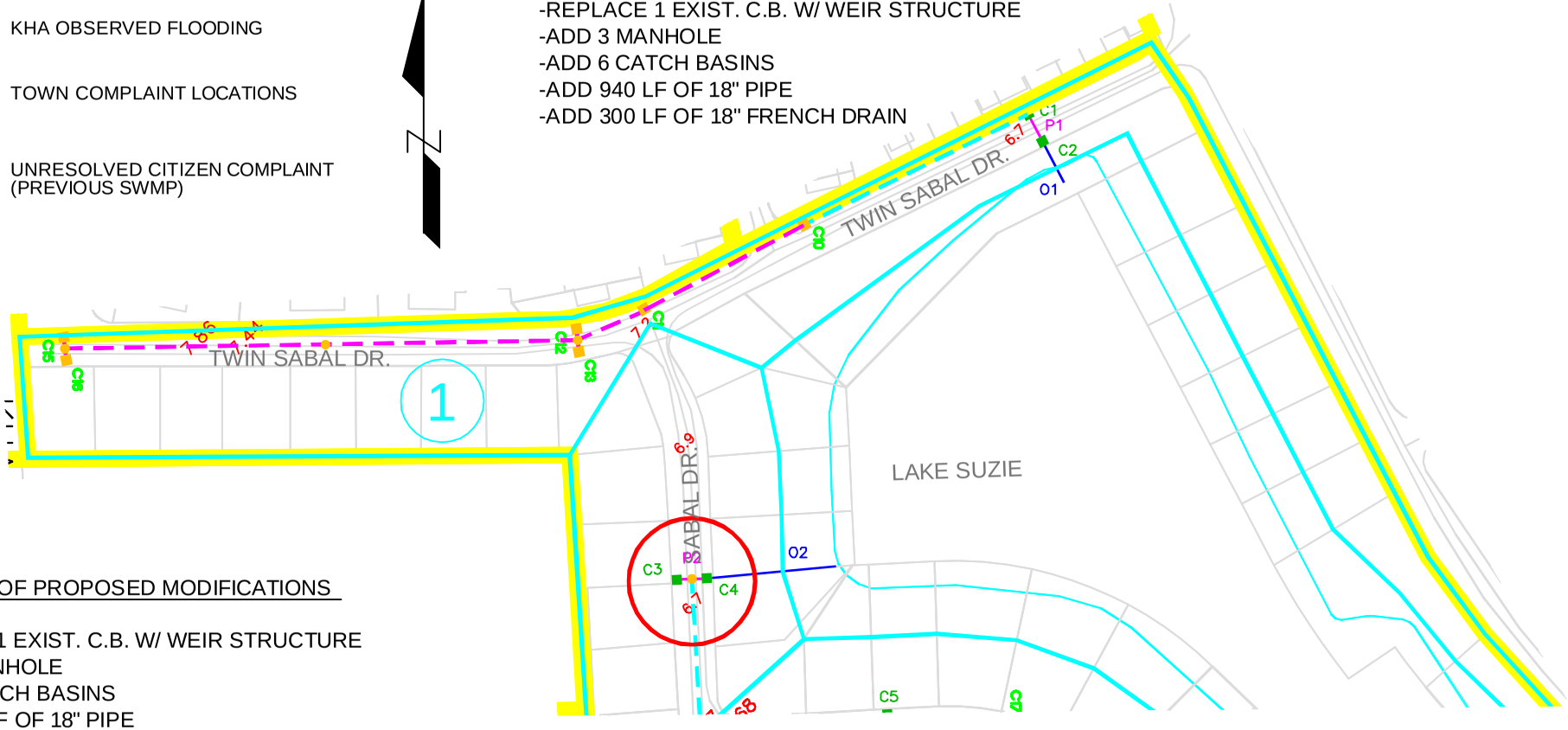
LEGEND

- EXIST./PROP. OUTFALL PIPE
- EXIST./PROP. DRAINAGE PIPE
- EXIST./PROP. FRENCH DRAIN
- AREA DELINEATION
- SUB-BASIN GROUP
- EXIST./PROP. CATCH BASIN
- EXIST./PROP. MANHOLE
- PROP. REGRADING
- # AREA NUMBER
- KHA OBSERVED FLOODING
- TOWN COMPLAINT LOCATIONS
- UNRESOLVED CITIZEN COMPLAINT (PREVIOUS SWMP)



AREA 1 PROPOSED MODIFICATIONS

-REPLACE 1 EXIST. C.B. W/ WEIR STRUCTURE
-ADD 3 MANHOLE
-ADD 6 CATCH BASINS
-ADD 940 LF OF 18" PIPE
-ADD 300 LF OF 18" FRENCH DRAIN



SUMMARY OF PROPOSED MODIFICATIONS

-REPLACE 1 EXIST. C.B. W/ WEIR STRUCTURE
-ADD 3 MANHOLE
-ADD 6 CATCH BASINS
-ADD 940 LF OF 18" PIPE
-ADD 300 LF OF 18" FRENCH DRAIN

0 200 400
SCALE FEET

TOWN OF MIAMI LAKES STORMWATER MASTER PLAN

LAKE SARAH SUB-BASIN

FIGURE 7
1 of 4

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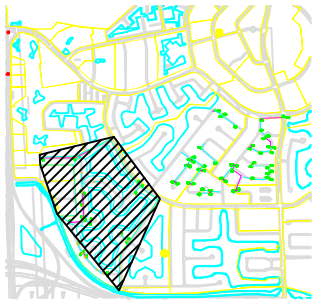


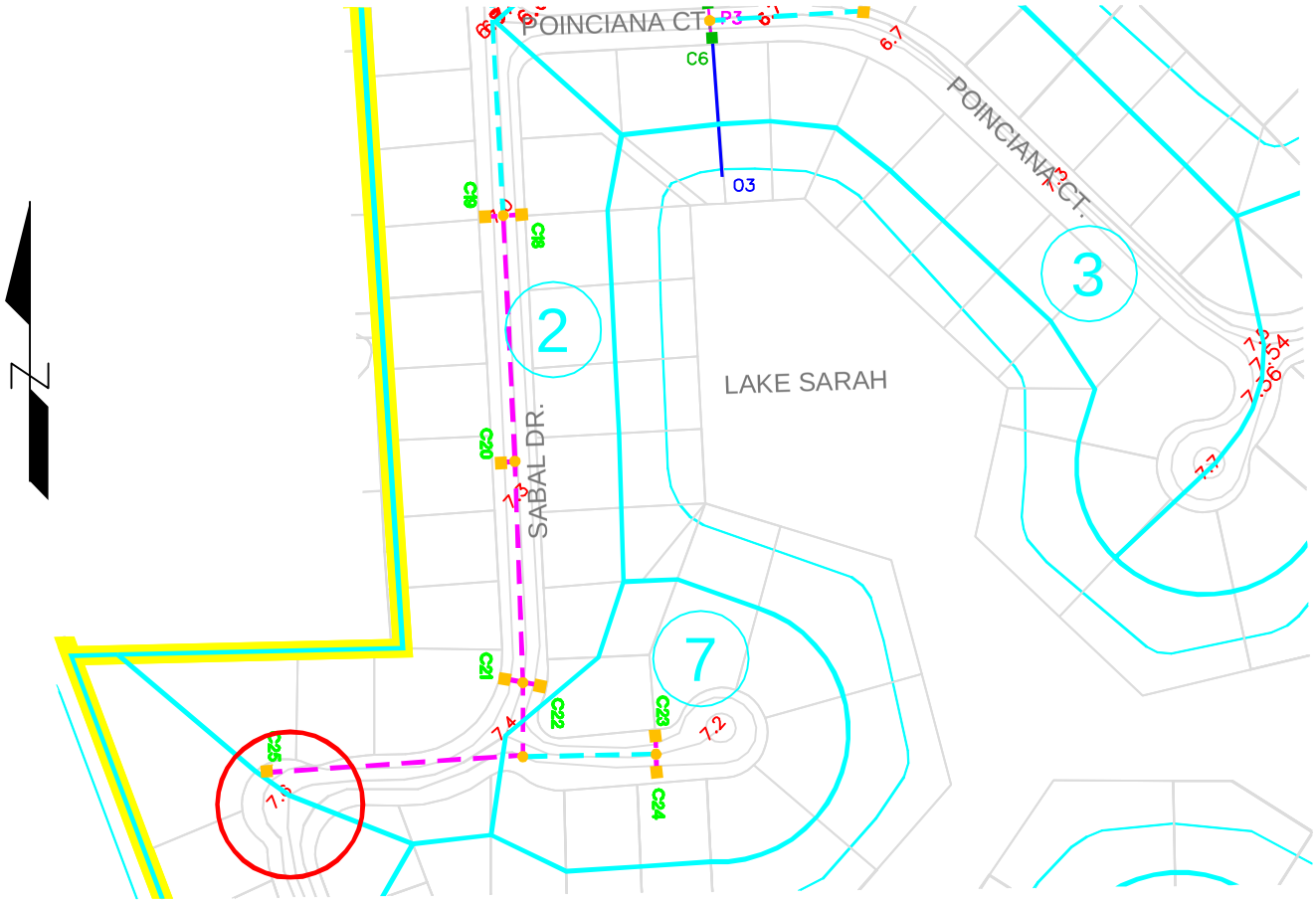
AREA 2 PROPOSED MODIFICATIONS
-REPLACE 1 EXIST. C.B. W/ WEIR STRUCTURE
-ADD 4 MANHOLE
-ADD 5 CATCH BASINS
-ADD 900 LF OF 18" PIPE
-ADD 380 LF OF 18" FRENCH DRAIN

AREA 3 PROPOSED MODIFICATIONS
-REPLACE 1 EXIST. C.B. W/ WEIR STRUCTURE
-ADD 1 MANHOLE
-ADD 1 CATCH BASINS
-ADD 150 LF OF 18" FRENCH DRAIN

AREA 7 PROPOSED MODIFICATIONS
-ADD 2 MANHOLE
-ADD 2 CATCH BASINS
-ADD 30 LF OF 18" PIPE
-ADD 110 LF OF 18" FRENCH DRAIN

LEGEND

- EXIST./PROP. OUTFALL PIPE
- EXIST./PROP. DRAINAGE PIPE
- EXIST./PROP. FRENCH DRAIN
- AREA DELINEATION
- SUB-BASIN GROUP
- EXIST./PROP. CATCH BASIN
- EXIST./PROP. MANHOLE
- PROP. REGRADING
- # AREA NUMBER
- KHA OBSERVED FLOODING
- TOWN COMPLAINT LOCATIONS
- UNRESOLVED CITIZEN COMPLAINT (PREVIOUS SWMP)



SUMMARY OF PROPOSED MODIFICATIONS

-REPLACE 2 EXIST. C.B. W/ WEIR STRUCTURE
-ADD 7 MANHOLE
-ADD 8 CATCH BASINS
-ADD 930 LF OF 18" PIPE
-ADD 640 LF OF 18" FRENCH DRAIN

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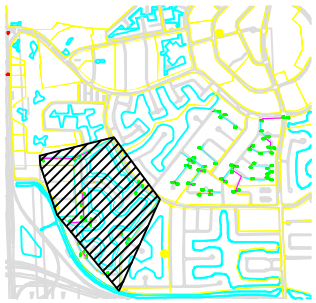
TOWN OF MIAMI LAKES
STORMWATER MASTER PLAN
LAKE SARAH SUB-BASIN

0 200 400
SCALE FEET

FIGURE 7
2 of 4



LEGEND

- EXIST./PROP. OUTFALL PIPE
- EXIST./PROP. DRAINAGE PIPE
- EXIST./PROP. FRENCH DRAIN
- AREA DELINEATION
- SUB-BASIN GROUP
- EXIST./PROP. CATCH BASIN
- EXIST./PROP. MANHOLE
- PROP. REGRADING
- # AREA NUMBER
- KHA OBSERVED FLOODING
- TOWN COMPLAINT LOCATIONS
- UNRESOLVED CITIZEN COMPLAINT (PREVIOUS SWMP)

AREA 6 PROPOSED MODIFICATIONS
-ADD 1 MANHOLE
-ADD 3 CATCH BASINS
-ADD 30 LF OF 18" PIPE
-ADD 180 LF OF 18" FRENCH DRAIN

AREA 8 PROPOSED MODIFICATIONS
-ADD 6 MANHOLE
-REPLACE 1 EXIST. C.B. W/ WEIR STRUCTURE
-ADD 7 CATCH BASINS
-ADD 140 LF OF 18" PIPE
-ADD 740 LF OF 18" FRENCH DRAIN

SUMMARY OF PROPOSED MODIFICATIONS

-REPLACE 1 EXIST. C.B. W/ WEIR STRUCTURE
-ADD 7 MANHOLE
-ADD 10 CATCH BASINS
-ADD 170 LF OF 18" PIPE
-ADD 920 LF OF 18" FRENCH DRAIN

0 200 400
SCALE FEET

TOWN OF MIAMI LAKES
STORMWATER MASTER PLAN
LAKE SARAH SUB-BASIN

FIGURE 7
3 of 4

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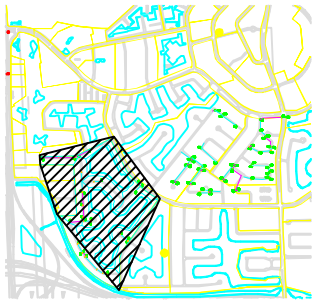


LEGEND

- EXIST./PROP. OUTFALL PIPE
- EXIST./PROP. DRAINAGE PIPE
- EXIST./PROP. FRENCH DRAIN
- AREA DELINEATION
- SUB-BASIN GROUP
- EXIST./PROP. CATCH BASIN
- EXIST./PROP. MANHOLE
- PROP. REGRADING
- # AREA NUMBER
- KHA OBSERVED FLOODING
- TOWN COMPLAINT LOCATIONS
- UNRESOLVED CITIZEN COMPLAINT (PREVIOUS SWMP)

SUMMARY OF PROPOSED MODIFICATIONS

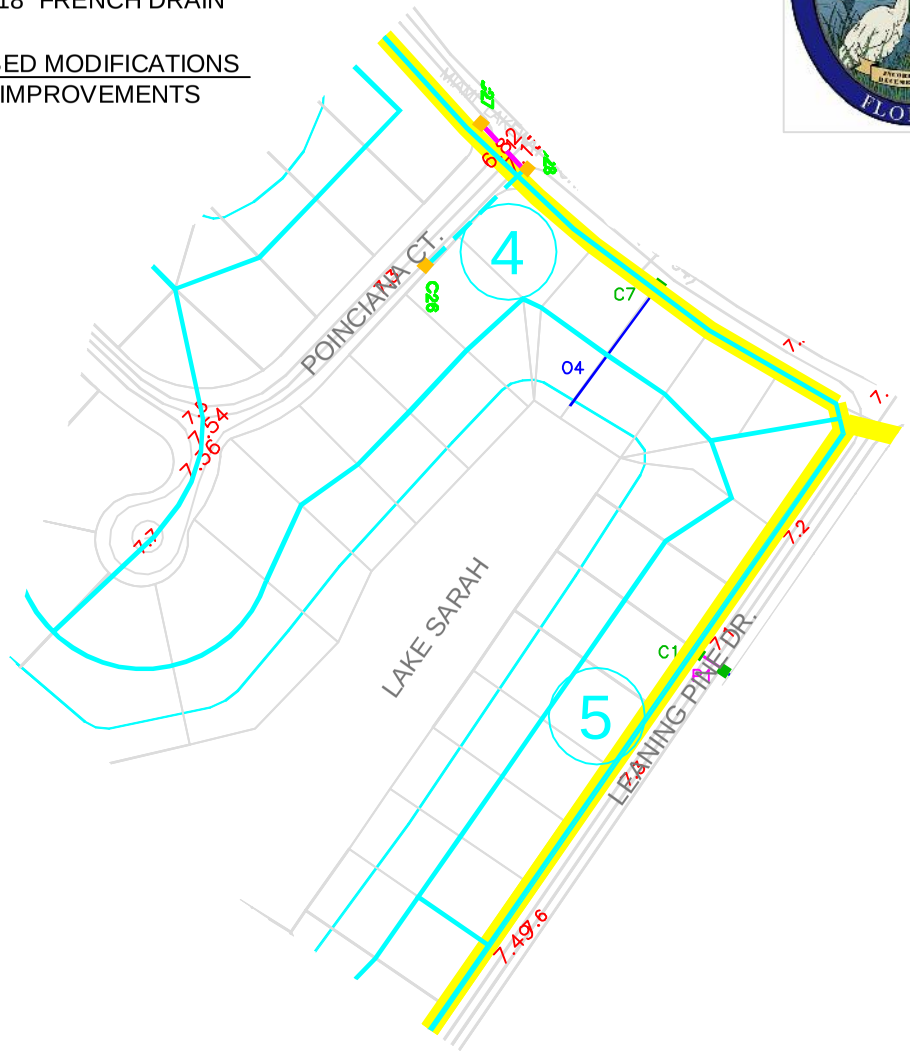
-ADD 3 CATCH BASINS
-ADD 60 LF OF 18" PIPE
-ADD 150 LF OF 18" FRENCH DRAIN

AREA 4 PROPOSED MODIFICATIONS

-ADD 3 CATCH BASINS
-ADD 60 LF OF 18" PIPE
-ADD 150 LF OF 18" FRENCH DRAIN

AREA 5 PROPOSED MODIFICATIONS

-NO PROPOSED IMPROVEMENTS



0 200 400
SCALE FEET

TOWN OF MIAMI LAKES STORMWATER MASTER PLAN

LAKE SARAH SUB-BASIN

FIGURE 7
4 of 4

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Performance Goal Analysis: Based on the detailed hydrologic and hydraulic calculations for this sub-basin, included in Stormwater Master Plan Update #1, the majority of the modeled drainage areas within the sub-basin do not currently meet the Town's performance goals. The table below shows the performance of the basin versus performance goals. "Yes" means the given drainage area within the sub-basin meets the performance goal, and "No" means that the given drainage area within the sub-basin does not meet the performance goal.

Table 5: Lake Sarah Sub-basin – Performance Goal Analysis

Sub-basin Area	Water Quality	5-Year Storm	10-Year Storm	25-Year Storm	100-Year Storm	No Observed Flooding or Complaints
1	No	Yes	Yes	Yes	Yes	No
2	No	Yes	Yes	Yes	Yes	No
3	No	Yes	Yes	Yes	Yes	Yes
4	No	Yes	Yes	Yes	Yes	Yes
5	No	No	No	No	No	Yes
6	No	No	No	No	No	No
7	No	No	No	No	No	Yes
8	No	No	No	No	Yes	No

Storm Drainage Deficiencies: Some catch basins in this sub-basin were observed to be filled with debris and sediment blocking or highly restricting flow. Based on the hydrologic and hydraulic calculations for this sub-basin, the existing drainage infrastructure does not discharge adequate runoff to meet the desired performance criteria. The capacity of the existing swales and French drains is not sufficient to discharge the volume of runoff outlined in the performance criteria during the modeled storm events. Roadway settlement at intersections was also observed as a result of inadequate drainage conditions. Improvements to drainage infrastructure will be needed to address these inadequacies.

Recommended Drainage Improvements: Clean and flush all sediment and debris from existing catch basins and pipes and adjust catch basin elevations and locations to minimize accumulation of sediment and debris. Install the additional infrastructure depicted in Figure 7. Existing catch basins should be modified or reconstructed as required to provide sediment traps (sumps). Based on the observed ponding, the existing drainage system appears to be under sized and does not appear to have sufficient capacity to meet the performance goals. Additional exfiltration trench is recommended to provide additional storage prior to positive drainage. The final catch basin prior to each outfall should be a control structure catch basin with a weir, pollution retardant baffle and a sedimentation sump.

Environmental Impact of Proposed Improvements: A full analysis of the estimated pollutant loading for existing, future and proposed conditions was prepared for the priority sub-basins utilizing a spreadsheet developed for this purpose which can be found in Appendix C. The table below shows how the proposed improvements will result in a significant reduction in the

pollutant load contribution from this sub-basin to the Biscayne Aquifer and Lake Sarah for three major pollutants.

Table 6: Lake Sarah Sub-basin – Pollutant Loading Analysis

Pollutant	Existing Load (kg/yr)	Reduction (kg/yr)	Proposed Load (kg/yr)
Total Phosphorous	41.05	38.03	3.02
Total Nitrogen	323.39	289.43	33.96
Total Suspended Solids	3876.51	3510.18	366.33

Capital Improvement Budget: A budget was developed for the proposed stormwater capital improvements.

Table 7: Lake Sarah Sub-basin – Capital Improvement Budget

Item	Description	Qty.	Units	Unit Price	Sub-total
1	Mobilization/ MOT/ Clearing & Grubbing	1	L.S.	$43,600	**$44,000**
2	Remove Existing Structure	4	Ea.	$500	**$2,000**
3	Inlet Pavement (5' x 5')	27	Ea.	$500	**$14,000**
4	Swale Inlet (Miami-Dade SD 2.2)	27	Ea.	$2,200	**$60,000**
5	Manhole (FDOT Type P-7)	17	Ea.	$2,200	**$38,000**
6	Core Drill Existing Inlets	0	Ea.	$500	**$0**
7	18" HDPE Pipe	2,100	L.F.	$40	**$84,000**
8	French Drain (18" HDPE Pipe)	2,010	L.F.	$110	**$222,000**
9	Weir Structure	4	Ea.	$4,000	**$16,000**
10	Stormwater Pollution Prevention	1	L.S.	$4,800	**$5,000**
11	Utility Adjustments	1	L.S.	$24,000	**$24,000**
12	Swale Restoration	1	L.S.	$24,000	**$24,000**
13	Professional Services	1	L.S.	$79,950	**$80,000**
14	Contingency	1	L.S.	$106,600	**$107,000**
TOTAL					**$720,000**

Notes:

1. The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

West Lakes A (NW 89th Avenue)

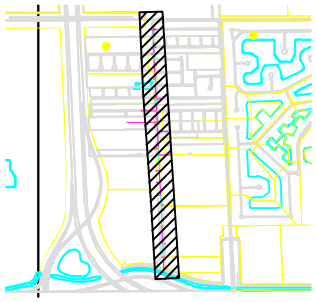
Location: The West Lakes A Sub-basin includes the right-of-way of NW 89th Avenue between NW 154th Street and the Graham Dairy Canal. It is part of the Southwest (GDCI-302) Basin.

Existing and Future Conditions: Figure 8 shows existing conditions for West Lakes A. The sub-basin consists of approximately 10.60 acres of four-lane road right-of-way with approximately 4,800 linear feet of roadway. The drainage system in this sub-basin consists of isolated catch basins connected to exfiltration trenches.

Although there are no unresolved resident complaints or observed drainage deficiencies within this sub-basin, it is surrounded by sub-basins which do have complaints and observed drainage deficiencies. Therefore, it is proposed that the NW 89th Avenue right-of-way will be utilized to provide a drainage trunk-line connecting sub-basins on either side of NW 89th Avenue to the Graham Dairy Canal. The sub-basin area was modeled together with the other sub-basins within the West Lakes area of the Town based on data collected as part of the stormwater master plan process.

Based on available GIS and as-built information, the elevation of NW 89th Avenue ranges from a low of approximately 6.1 feet to a high of approximately 8.3 feet NGVD. It was assumed that building finish elevations are 1.5 feet above crown of road elevations. Pervious area elevations were assumed to range from 0.1 feet above the minimum roadway elevation to flush with the finish floor elevations. Since the area is already developed, it is anticipated that future development conditions will not vary significantly from the existing conditions.

Performance Goal Analysis: Based on the detailed hydrologic and hydraulic calculations for this sub-basin, which can be found in Appendix B, the majority of the modeled drainage areas within the sub-basin do not currently meet the Town of Miami Lakes performance goals. Table 7 shows the performance of the basin versus performance goals. "Yes" means the given drainage area within the sub-basin meets the performance goal, and "No" means that the given drainage area within the sub-basin does not meet the performance goal.



LEGEND

- EXIST./PROP. OUTFALL PIPE
- EXIST./PROP. DRAINAGE PIPE
- EXIST./PROP. FRENCH DRAIN
- AREA DELINEATION
- SUB-BASIN GROUP
- EXIST./PROP. CATCH BASIN
- EXIST./PROP. MANHOLE
- PROP. REGRADING
- # AREA NUMBER
- KHA OBSERVED FLOODING
- TOWN COMPLAINT LOCATIONS

SUMMARY OF PROPOSED MODIFICATIONS

-REPLACE 8 EXIST. C.B.
-ADD 10 MANHOLES
-ADD 1 CONTROL STRUCTURE
-ADD 525 LF OF 15" PIPE
-ADD 625 LF OF 48" PIPE
-ADD 465 LF OF 48" FRENCH DRAIN
-ADD 685 LF OF 54" PIPE
-ADD 560 LF OF 54" FRENCH DRAIN

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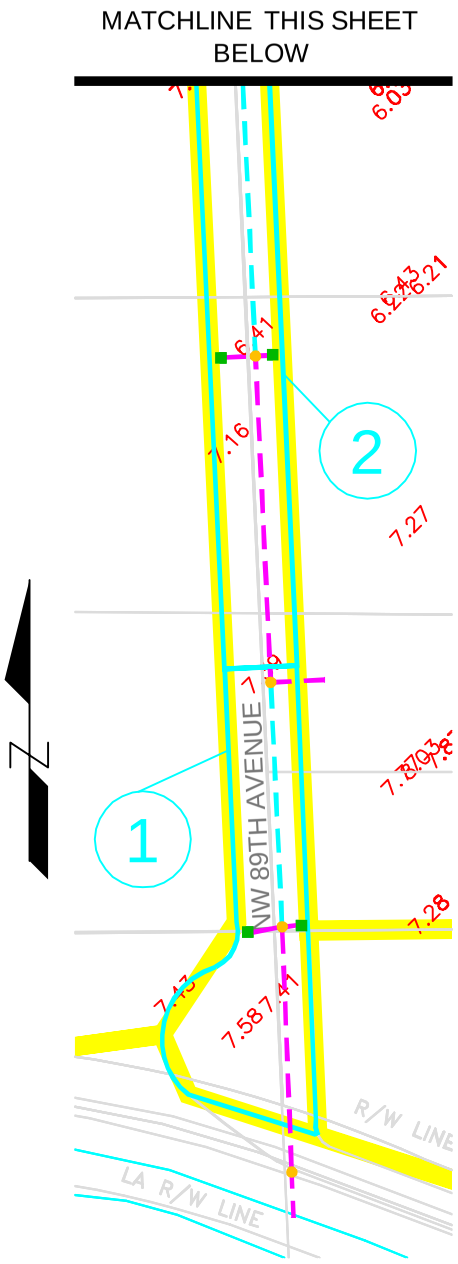
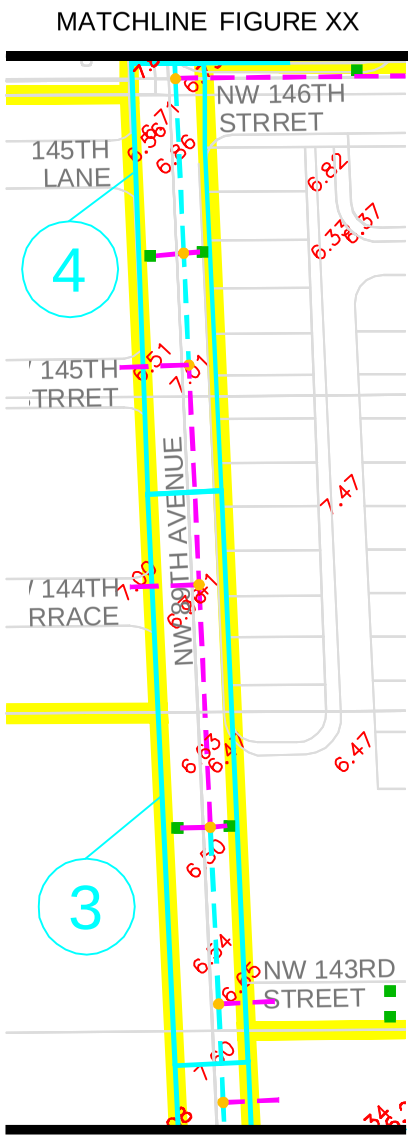




AREA 1 PROPOSED MODIFICATIONS
-REPLACE 2 EXIST. C.B.
-ADD 2 MANHOLES
-ADD 1 CONTROL STRUCTURE
-ADD 100 LF OF 15" PIPE
-ADD 300 LF OF 54" PIPE
-ADD 255 LF OF 54" FRENCH DRAIN

AREA 2 PROPOSED MODIFICATIONS
-REPLACE 2 EXIST. C.B.
-ADD 2 MANHOLES
-ADD 100 LF OF 15" PIPE
-ADD 385 LF OF 54" PIPE
-ADD 305 LF OF 54" FRENCH DRAIN

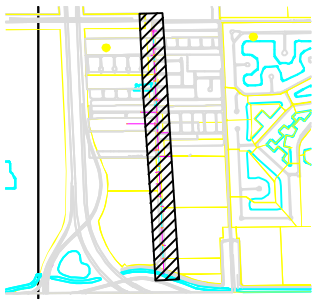
AREA 3 PROPOSED MODIFICATIONS
-REPLACE 2 EXIST. C.B.
-ADD 3 MANHOLES
-ADD 150 LF OF 15" PIPE
-ADD 375 LF OF 48" PIPE
-ADD 270 LF OF 48" FRENCH DRAIN

AREA 4 PROPOSED MODIFICATIONS
-REPLACE 2 EXIST. C.B.
-ADD 3 MANHOLES
-ADD 175 LF OF 15" PIPE
-ADD 250 LF OF 48" PIPE
-ADD 195 LF OF 48" FRENCH DRAIN

0 200 400
SCALE FEET

TOWN OF MIAMI LAKES
STORMWATER MASTER PLAN
WEST LAKES A SUB-BASIN

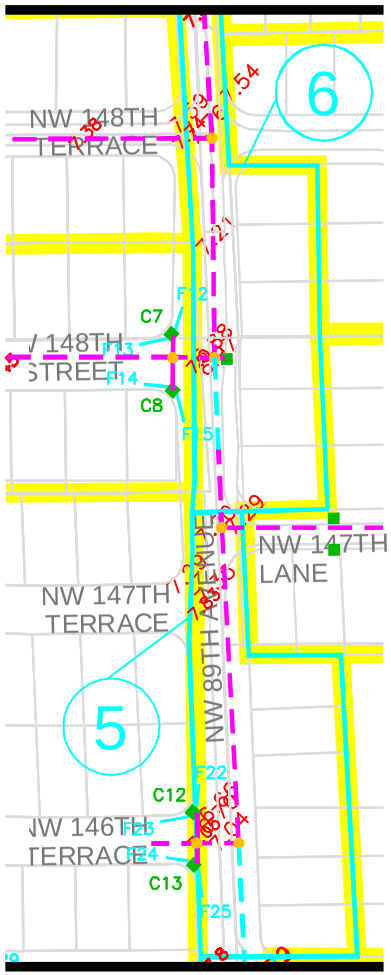
FIGURE 8
1 of 3



LEGEND

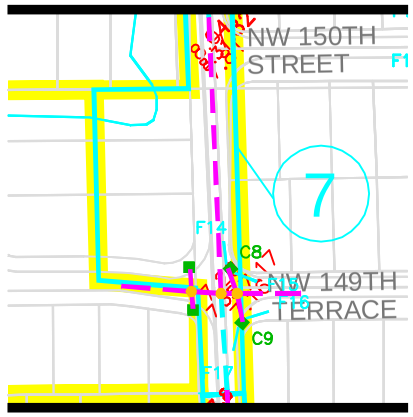
- EXIST./PROP. OUTFALL PIPE
- EXIST./PROP. DRAINAGE PIPE
- EXIST./PROP. FRENCH DRAIN
- AREA DELINEATION
- SUB-BASIN GROUP
- EXIST./PROP. CATCH BASIN
- EXIST./PROP. MANHOLE
- PROP. REGRADING
- # AREA NUMBER
- KHA OBSERVED FLOODING
- TOWN COMPLAINT LOCATIONS

MATCHLINE THIS SHEET BELOW



MATCHLINE FIGURE XX

MATCHLINE FIGURE XX



MATCHLINE THIS SHEET ABOVE

AREA 5 PROPOSED MODIFICATIONS
-REPLACE 2 EXIST. C.B.
-ADD 3 MANHOLES
-ADD 150 LF OF 15" PIPE
-ADD 350 LF OF 48" PIPE
-ADD 95 LF OF 48" FRENCH DRAIN

AREA 6 PROPOSED MODIFICATIONS
-REPLACE 3 EXIST. C.B.
-ADD 3 MANHOLES
-ADD 75 LF OF 15" PIPE
-ADD 50 LF OF 42" PIPE
-ADD 450 LF OF 48" PIPE
-ADD 85 LF OF 48" FRENCH DRAIN

AREA 7 PROPOSED MODIFICATIONS
-REPLACE 4 EXIST. C.B.
-ADD 3 MANHOLES
-ADD 250 LF OF 15" PIPE
-ADD 300 LF OF 48" PIPE
-ADD 100 LF OF 48" FRENCH DRAIN

SUMMARY OF PROPOSED MODIFICATIONS

-REPLACE 9 EXIST. C.B.
-ADD 9 MANHOLES
-ADD 475 LF OF 15" PIPE
-ADD 50 LF OF 42" PIPE
-ADD 1100 LF OF 48" PIPE
-ADD 280 LF OF 48" FRENCH DRAIN

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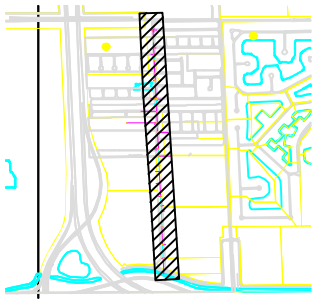
TOWN OF MIAMI LAKES
STORMWATER MASTER PLAN
WEST LAKES A SUB-BASIN

0 200 400
SCALE FEET

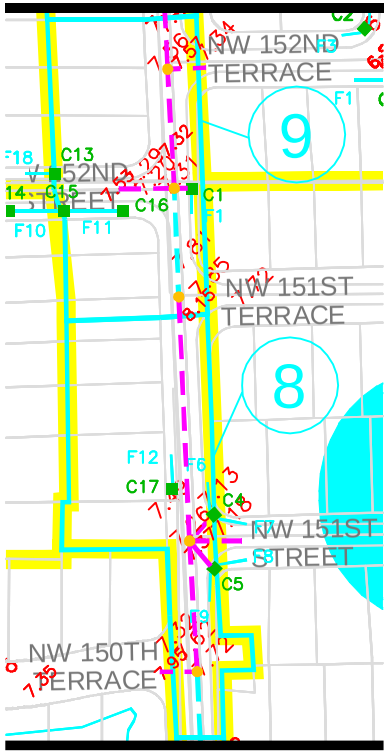
FIGURE 8
2 of 3



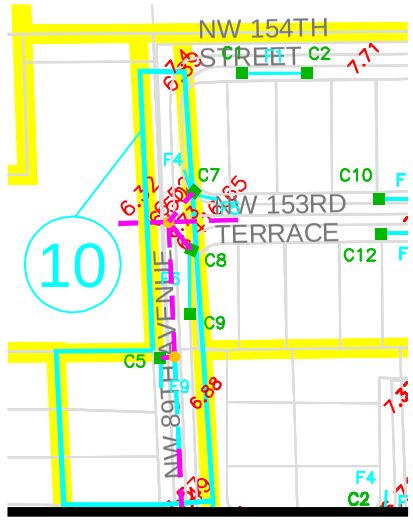
LEGEND

- EXIST./PROP. OUTFALL PIPE
- EXIST./PROP. DRAINAGE PIPE
- EXIST./PROP. FRENCH DRAIN
- AREA DELINEATION
- SUB-BASIN GROUP
- EXIST./PROP. CATCH BASIN
- EXIST./PROP. MANHOLE
- PROP. REGRADING
- # AREA NUMBER
- KHA OBSERVED FLOODING
- TOWN COMPLAINT LOCATIONS

MATCHLINE THIS SHEET BELOW



MATCHLINE FIGURE XX



MATCHLINE THIS SHEET ABOVE

AREA 8 PROPOSED MODIFICATIONS
-REPLACE 2 EXIST. C.B.
-ADD 2 MANHOLES
-ADD 175 LF OF 15" PIPE
-ADD 400 LF OF 48" PIPE
-ADD 75 LF OF 48" FRENCH DRAIN

AREA 9 PROPOSED MODIFICATIONS
-REPLACE 3 EXIST. C.B.
-ADD 3 MANHOLES
-ADD 125 LF OF 15" PIPE
-ADD 200 LF OF 48" PIPE
-ADD 85 LF OF 48" FRENCH DRAIN

AREA 10 PROPOSED MODIFICATIONS
-REPLACE 3 EXIST. C.B.
-ADD 2 MANHOLES
-ADD 100 LF OF 15" PIPE
-ADD 100 LF OF 42" PIPE
-ADD 225 LF OF 48" PIPE
-ADD 95 LF OF 48" FRENCH DRAIN

SUMMARY OF PROPOSED MODIFICATIONS

-REPLACE 7 EXIST. C.B.
-ADD 7 MANHOLES
-ADD 400 LF OF 15" PIPE
-ADD 100 LF OF 42" PIPE
-ADD 825 LF OF 48" PIPE
-ADD 255 LF OF 48" FRENCH DRAIN

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TOWN OF MIAMI LAKES
STORMWATER MASTER PLAN
WEST LAKES A SUB-BASIN

0 200 400
SCALE FEET

FIGURE 8
3 of 3

Table 8: West Lakes A Sub-basin – Performance Goal Analysis

Sub-basin Area	Water Quality	5-Year Storm	10-Year Storm	25-Year Storm	100-Year Storm	No Observed Flooding or Complaints
1	No	N/A	No	No	No	Yes
2	No	N/A	No	No	No	Yes
3	No	N/A	No	No	No	Yes
4	No	N/A	No	No	No	Yes
5	No	N/A	No	No	No	Yes
6	No	N/A	No	No	No	Yes
7	No	N/A	No	No	No	Yes
8	No	N/A	No	No	No	Yes
9	No	N/A	No	No	No	Yes
10	No	N/A	No	No	No	Yes

Storm Drainage Deficiencies: Some catch basins in this sub-basin were observed to be filled with debris and sediment blocking or highly restricting flow. Based on the hydrologic and hydraulic calculations for this sub-basin, the existing drainage infrastructure does not discharge adequate runoff to meet the desired performance criteria. The capacity of the existing French drains is not sufficient to discharge the volume of runoff outlined in the performance criteria during the modeled storm events. Improvements to drainage infrastructure will be needed to address these inadequacies. None of the areas within this drainage sub-basin connect to an outfall to a lake or canal.

Recommended Drainage Improvements: Clean and flush all sediment and debris from existing catch basins and pipes and adjust catch basin elevations and locations to minimize accumulation of sediment and debris. Install the additional infrastructure depicted in Figure 8. Existing catch basins should be modified or reconstructed as required to provide sediment traps (sumps). In addition, additional French drain, catch basins, and/or manholes are proposed to provide water quality and water quantity treatment. The West Lakes A, B, C, D and E sub-basins are proposed be connected to the Graham Dairy Canal located south of West Lakes A. It is recommended that design phase for West Lakes A, B, C, D and E improvements be completed simultaneously so that the potential for a joint outfall can be explored as one of the key design alternatives for this area. Coordination with and approval from Miami-Dade County will be required for connection to the Graham Dairy Canal. The outfall and related control structure should be sized to accommodate flow from the entire area of the Town located south of NW 154th Street and west of NW 87th Avenue.

Environmental Impact of Proposed Improvements: A full analysis of the estimated pollutant loading for existing, future and proposed conditions was prepared for the priority sub-basins utilizing a spreadsheet developed for this purpose which can be found in Appendix C. The table below shows how the proposed improvements will result in a significant reduction in the pollutant load contribution from this sub-basin to the Biscayne Aquifer for three major pollutants.

Table 9: West Lakes A Sub-basin – Pollutant Loading Analysis

Pollutant	Existing Load (kg/yr)	Reduction (kg/yr)	Proposed Load (kg/yr)
Total Phosphorous	6.29	5.83	0.46
Total Nitrogen	49.56	44.36	5.20
Total Suspended Solids	594.10	537.96	56.14

Capital Improvement Budget: A budget was developed for the proposed stormwater capital improvements.

Table 10: West Lakes A Sub-basin – Capital Improvement Budget

Item	Description	Qty.	Units	Unit Price	Sub-total
1	Mobilization/ MOT/ Clearing & Grubbing	1	L.S.	$87,800	**$88,000**
2	Remove and Replace Existing Catch Basin	24	Ea.	$3,500	**$84,000**
3	Inlet Pavement (5' x 5')	24	Ea.	$500	**$12,000**
4	Catch Basin	0	Ea.	$3,000	**$0**
5	Manhole (FDOT Type P-7)	26	Ea.	$2,200	**$58,000**
6	Core Drill Existing Inlets	0	Ea.	$500	**$0**
7	15" HDPE Pipe	1,400	L.F.	$35	**$49,000**
8	42" HDPE Pipe	1,401	L.F.	$50	**$71,000**
9	48" HDPE Pipe	2,550	L.F.	$60	**$153,000**
10	54" HDPE Pipe	150	L.F.	$75	**$12,000**
11	French Drain (15" HDPE Pipe)	1,345	L.F.	$110	**$148,000**
12	French Drain (48" HDPE Pipe)	1,000	L.F.	$175	**$175,000**
13	French Drain (54" HDPE Pipe)	560	L.F.	$200	**$112,000**
14	Weir Structure	1	Ea.	$4,000	**$4,000**
15	Stormwater Pollution Prevention	1	L.S.	$9,660	**$10,000**
16	Utility Adjustments	1	L.S.	$48,300	**$49,000**
17	Swale Restoration	1	L.S.	$48,300	**$49,000**
18	Conceptual Drainage Modeling, Grant Application Assistance and Coordination	1	L.S.	$55,000	**$55,000**
19	Professional Services	1	L.S.	$161,100	**$162,000**
20	Contingency	1	L.S.	$214,800	**$215,000**
TOTAL					**$1,510,000**

Notes:

1. The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

West Lakes B (Olivia Gardens)

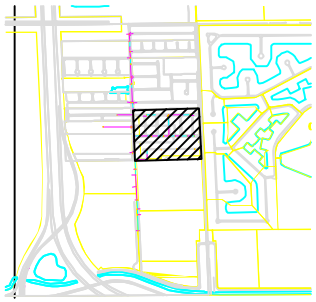
Location: The West Lakes B Sub-basin includes the Olivia Gardens sub-division and is located between NW 89th Avenue and NW 87th Avenue and between NW 146th Street and NW 148th Terrace in the southwestern residential area of the Town known as West Lakes. It is part of the Southwest (GDCI-302) Basin.

Existing and Future Conditions: Figure 9 shows existing conditions for West Lakes B. The sub-basin consists of approximately 27.9 acres of single family residential development with approximately 7,600 linear feet of roadway. The drainage system in this sub-basin consists of isolated catch basins connected to exfiltration trenches.

Several resident complaints have been described within this sub-basin and other sub-basins in the West Lakes area of the Town. In addition, several repetitive loss properties are located within this sub-basin. Therefore, it is proposed that the NW 89th Avenue right-of-way will be utilized to provide a drainage trunk-line connecting sub-basins on either side of NW 89th Avenue to the Graham Dairy Canal. The sub-basin area was modeled together with the other sub-basins within the West Lakes area of the Town based on data collected as part of the stormwater master plan process.

Based on available GIS and as-built information, the roadway centerline elevations within West Lakes B range from a low of approximately 6.6 feet to a high of approximately 8.0 feet NGVD. It was assumed that building finish elevations are 1.5 feet above crown of road elevations. Pervious area elevations were assumed to range from 0.1 feet above the minimum roadway elevation to flush with the finish floor elevations. Since the area is already developed, it is anticipated that future development conditions will not vary significantly from the existing conditions.

Performance Goal Analysis: Based on the detailed hydrologic and hydraulic calculations for this sub-basin, which can be found in Appendix B, the majority of the modeled drainage areas within the sub-basin do not currently meet the Town of Miami Lakes performance goals. Table 10 shows the performance of the basin versus performance goals. “Yes” means the given drainage area within the sub-basin meets the performance goal, and “No” means that the given drainage area within the sub-basin does not meet the performance goal.



LEGEND

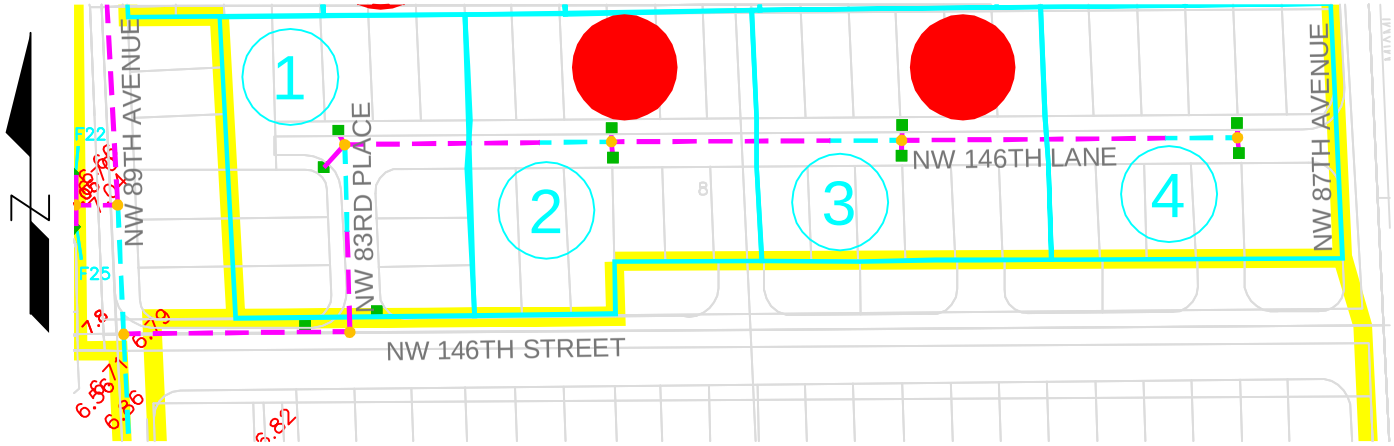
- EXIST./PROP. OUTFALL PIPE
- EXIST./PROP. DRAINAGE PIPE
- EXIST./PROP. FRENCH DRAIN
- AREA DELINEATION
- SUB-BASIN GROUP
- EXIST./PROP. CATCH BASIN
- EXIST./PROP. MANHOLE
- PROP. REGRADING
- # AREA NUMBER
- KHA OBSERVED FLOODING
- TOWN COMPLAINT LOCATIONS
- REPETITIVE LOSS PROPERTY

AREA 1 PROPOSED MODIFICATIONS
-REPLACE 2 EXIST. C.B.
-ADD 2 MANHOLES
-ADD 180 LF OF 15" PIPE
-ADD 340 LF OF 30" PIPE
-ADD 90 LF OF 30" FRENCH DRAIN

AREA 2 PROPOSED MODIFICATIONS
-REPLACE 2 EXIST. C.B.
-ADD 1 MANHOLES
-ADD 275 LF OF 15" PIPE
-ADD 75 LF OF 15" FRENCH DRAIN

AREA 3 PROPOSED MODIFICATIONS
-REPLACE 2 EXIST. C.B.
-ADD 1 MANHOLES
-ADD 275 LF OF 15" PIPE
-ADD 75 LF OF 15" FRENCH DRAIN

AREA 4 PROPOSED MODIFICATIONS
-REPLACE 2 EXIST. C.B.
-ADD 1 MANHOLES
-ADD 160 LF OF 15" PIPE
-ADD 75 LF OF 15" FRENCH DRAIN



SUMMARY OF PROPOSED MODIFICATIONS

-REPLACE 8 EXIST. C.B.
-ADD 5 MANHOLES
-ADD 890 LF OF 15" PIPE
-ADD 225 LF OF 15" FRENCH DRAIN
-ADD 340 LF OF 30" PIPE
-ADD 90 LF OF 30" FRENCH DRAIN

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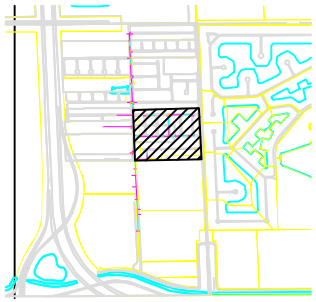
TOWN OF MIAMI LAKES
STORMWATER MASTER PLAN
WEST LAKES B
SUB-BASIN

0 200 400
SCALE FEET

FIGURE 9
1 of 3



LEGEND

- EXIST./PROP. OUTFALL PIPE
- EXIST./PROP. DRAINAGE PIPE
- EXIST./PROP. FRENCH DRAIN
- AREA DELINEATION
- SUB-BASIN GROUP
- EXIST./PROP. CATCH BASIN
- EXIST./PROP. MANHOLE
- PROP. REGRADING
- # AREA NUMBER
- KHA OBSERVED FLOODING
- TOWN COMPLAINT LOCATIONS
- REPETITIVE LOSS PROPERTY

AREA 5 PROPOSED MODIFICATIONS
-REPLACE 2 EXIST. C.B.
-ADD 1 MANHOLES
-ADD 30 LF OF 15" PIPE
-ADD 115 LF OF 42" PIPE
-ADD 75 LF OF 42" FRENCH DRAIN

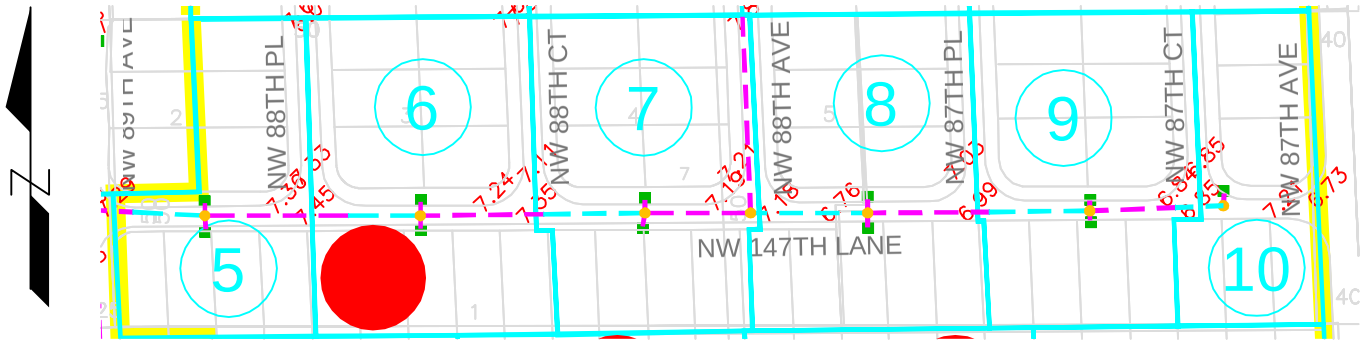
AREA 6 PROPOSED MODIFICATIONS
-REPLACE 2 EXIST. C.B.
-ADD 1 MANHOLES
-ADD 30 LF OF 15" PIPE
-ADD 170 LF OF 42" PIPE
-ADD 75 LF OF 42" FRENCH DRAIN

AREA 7 PROPOSED MODIFICATIONS
-REPLACE 2 EXIST. C.B.
-ADD 2 MANHOLES
-ADD 30 LF OF 15" PIPE
-ADD 275 LF OF 42" PIPE
-ADD 105 LF OF 42" FRENCH DRAIN

AREA 8 PROPOSED MODIFICATIONS
-REPLACE 2 EXIST. C.B.
-ADD 1 MANHOLES
-ADD 160 LF OF 15" PIPE
-ADD 105 LF OF 15" FRENCH DRAIN

AREA 9 PROPOSED MODIFICATIONS
-REPLACE 2 EXIST. C.B.
-ADD 1 MANHOLES
-ADD 125 LF OF 15" PIPE
-ADD 105 LF OF 15" FRENCH DRAIN

AREA 10 PROPOSED MODIFICATIONS
-REPLACE 2 EXIST. C.B.
-ADD 1 MANHOLES
-ADD 15 LF OF 15" PIPE
-ADD 50 LF OF 15" FRENCH DRAIN



SUMMARY OF PROPOSED MODIFICATIONS

-REPLACE 12 EXIST. C.B.
-ADD 7 MANHOLES
-ADD 390 LF OF 15" PIPE
-ADD 260 LF OF 15" FRENCH DRAIN
-ADD 560 LF OF 42" PIPE
-ADD 255 LF OF 42" FRENCH DRAIN

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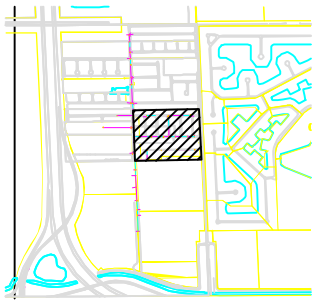
TOWN OF MIAMI LAKES
STORMWATER MASTER PLAN
WEST LAKES B
SUB-BASIN

0 200 400
SCALE FEET

FIGURE 9
2 of 3



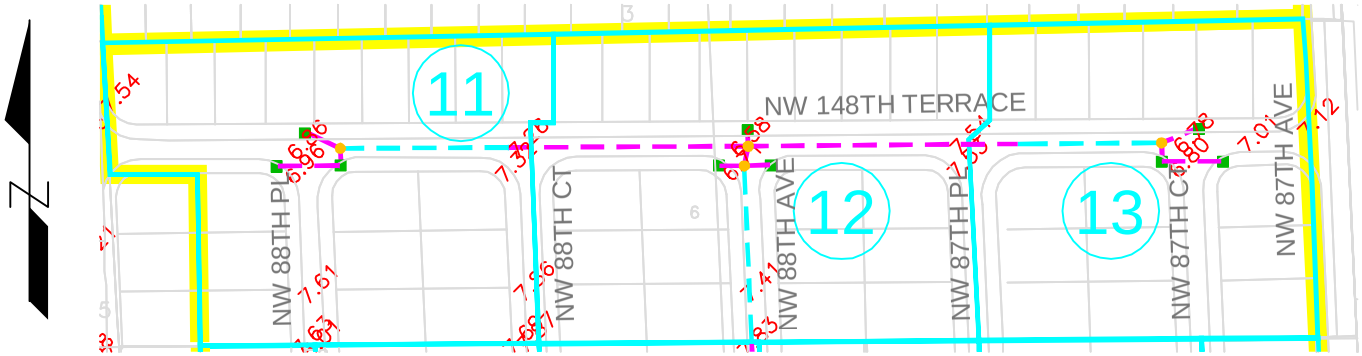
LEGEND

- EXIST./PROP. OUTFALL PIPE
- EXIST./PROP. DRAINAGE PIPE
- EXIST./PROP. FRENCH DRAIN
- AREA DELINEATION
- SUB-BASIN GROUP
- EXIST./PROP. CATCH BASIN
- EXIST./PROP. MANHOLE
- PROP. REGRADING
- # AREA NUMBER
- KHA OBSERVED FLOODING
- TOWN COMPLAINT LOCATIONS
- REPETITIVE LOSS PROPERTY

AREA 11 PROPOSED MODIFICATIONS
-REPLACE 3 EXIST. C.B.
-ADD 1 MANHOLES
-ADD 130 LF OF 15" PIPE
-ADD 25 LF OF 42" PIPE
-ADD 175 LF OF 42" FRENCH DRAIN

AREA 12 PROPOSED MODIFICATIONS
-REPLACE 3 EXIST. C.B.
-ADD 2 MANHOLES
-ADD 75 LF OF 15" PIPE
-ADD 500 LF OF 42" PIPE
-ADD 185 LF OF 42" FRENCH DRAIN

AREA 13 PROPOSED MODIFICATIONS
-REPLACE 3 EXIST. C.B.
-ADD 1 MANHOLES
-ADD 130 LF OF 15" PIPE
-ADD 50 LF OF 42" PIPE
-ADD 150 LF OF 42" FRENCH DRAIN



SUMMARY OF PROPOSED MODIFICATIONS

-REPLACE 9 EXIST. C.B.
-ADD 4 MANHOLES
-ADD 335 LF OF 15" PIPE
-ADD 575 LF OF 42" PIPE
-ADD 510 LF OF 42" FRENCH DRAIN

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TOWN OF MIAMI LAKES
STORMWATER MASTER PLAN
WEST LAKES B
SUB-BASIN

0 200 400
SCALE FEET

FIGURE 9
3 of 3

Table 11: West Lakes B Sub-basin – Performance Goal Analysis

Sub-basin Area	Water Quality	5-Year Storm	10-Year Storm	25-Year Storm	100-Year Storm	No Observed Flooding or Complaints
1	No	No	N/A	No	No	Yes
2	No	No	N/A	No	No	Yes
3	No	No	N/A	No	No	Yes
4	No	No	N/A	No	No	Yes
5	No	No	N/A	No	No	Yes
6	No	No	N/A	No	No	Yes
7	No	No	N/A	No	No	Yes
8	No	No	N/A	No	No	Yes
9	No	No	N/A	No	No	Yes
10	N0	No	N/A	No	No	Yes
11	No	No	N/A	No	No	Yes
12	No	No	N/A	No	No	Yes
13	No	No	N/A	No	No	Yes

Storm Drainage Deficiencies: Some catch basins in this sub-basin were observed to be filled with debris and sediment blocking or highly restricting flow. Based on the hydrologic and hydraulic calculations for this sub-basin, the existing drainage infrastructure does not discharge adequate runoff to meet the desired performance criteria. The capacity of the existing French drains is not sufficient to discharge the volume of runoff outlined in the performance criteria during the modeled storm events. Improvements to drainage infrastructure will be needed to address these inadequacies. This drainage sub-basin does not currently have a positive outfall.

Recommended Drainage Improvements: Clean and flush all sediment and debris from existing catch basins and pipes and adjust catch basin elevations and locations to minimize accumulation of sediment and debris. Install the additional infrastructure depicted in Figure 9. Existing catch basins should be modified or reconstructed as required to provide sediment traps (sumps). In addition, additional French drain, catch basins, and/or manholes are proposed to provide water quality and water quantity treatment. The West Lakes A, B, C, D and E sub-basins are proposed be connected to the Graham Dairy Canal located south of West Lakes A. It is recommended that design phase for West Lakes A, B, C, D and E improvements be completed simultaneously so that the potential for a joint outfall can be explored as one of the design alternatives. The outfall and related control structure should be sized to accommodate flow from the entire West Lakes area.

Environmental Impact of Proposed Improvements: A full analysis of the estimated pollutant loading for existing, future and proposed conditions was prepared for the priority sub-basins utilizing a spreadsheet developed for this purpose which can be found in Appendix C. The table below shows how the proposed improvements will result in a significant reduction in the

pollutant load contribution from this sub-basin to the Biscayne Aquifer for three major pollutants.

Table 12: West Lakes B Sub-basin – Pollutant Loading Analysis

Pollutant	Existing Load (kg/yr)	Reduction (kg/yr)	Proposed Load (kg/yr)
Total Phosphorous	15.12	14.01	1.11
Total Nitrogen	119.15	106.64	12.51
Total Suspended Solids	1428.31	1293.33	134.97

Capital Improvement Budget: A budget was developed for the proposed stormwater capital improvements.

Table 13: West Lakes B Sub-basin – Capital Improvement Budget

Item	Description	Qty.	Units	Unit Price	Sub-total
1	Mobilization/ MOT/ Clearing & Grubbing	1	L.S.	$46,300	**$47,000**
2	Remove and Replace Existing Catch Basin	29	Ea.	$3,500	**$102,000**
3	Inlet Pavement (5' x 5')	29	Ea.	$500	**$15,000**
4	Catch Basin	0	Ea.	$3,000	**$0**
5	Manhole (FDOT Type P-7)	16	Ea.	$2,200	**$36,000**
6	Core Drill Existing Inlets	0	Ea.	$500	**$0**
7	15" HDPE Pipe	1,615	L.F.	$35	**$57,000**
8	30" HDPE Pipe	340	L.F.	$42	**$15,000**
9	42" HDPE Pipe	1,135	L.F.	$50	**$57,000**
10	48" HDPE Pipe	0	L.F.	$60	**$0**
11	French Drain (15" HDPE Pipe)	485	L.F.	$110	**$54,000**
12	French Drain (30" HDPE Pipe)	90	L.F.	$130	**$12,000**
13	French Drain (42" HDPE Pipe)	765	L.F.	$150	**$115,000**
14	Weir Structure	0	Ea.	$4,000	**$0**
15	Stormwater Pollution Prevention	1	L.S.	$5,100	**$6,000**
16	Utility Adjustments	1	L.S.	$25,500	**$26,000**
17	Swale Restoration	1	L.S.	$25,500	**$26,000**
18	Professional Services	1	L.S.	$85,200	**$86,000**
19	Contingency	1	L.S.	$113,600	**$114,000**
TOTAL					**$770,000**

Notes:

1. The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

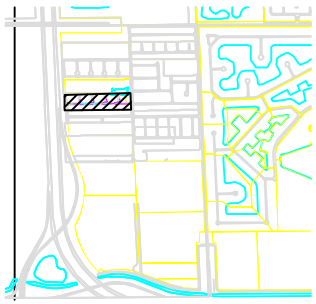
West Lakes C (Genesis Gardens)

Location: The West Lakes C Sub-basin includes the Genesis Gardens sub-division and is located between NW 89th Avenue and NW 92nd Avenue and between NW 150th Terrace and NW 148th Terrace in the southwestern residential area of the Town known as West Lakes. It is part of the Southwest (GDCI-302) Basin.

Existing and Future Conditions: Figure 10 shows existing conditions for West Lakes C. The sub-basin consists of approximately 9.2 acres of single family residential with approximately 2,200 linear feet of roadway. The drainage system in this sub-basin consists of isolated catch basins connected to exfiltration trenches.

Although there are no unresolved resident complaints or observed drainage deficiencies within this sub-basin, it is adjacent to sub-basins which do have complaints and observed drainage deficiencies. Therefore, it is proposed that the NW 89th Avenue right-of-way will be utilized to provide a drainage trunk-line connecting sub-basins on either side of NW 89th Avenue to the Graham Dairy Canal. The sub-basin area was modeled together with the other sub-basins within the West Lakes area of the Town based on data collected as part of the stormwater master plan process.

Based on available GIS and as-built information, the roadway centerline elevations within West Lakes C range from a low of approximately 6.8 feet to a high of approximately 7.7 feet NGVD. It was assumed that building finish elevations are 1.5 feet above crown of road elevations. Pervious area elevations were assumed to range from 0.1 feet above the minimum roadway elevation to flush with the finish floor elevations. Since the area is already developed, it is anticipated that future development conditions will not vary significantly from the existing conditions.



LEGEND

- EXIST./PROP. OUTFALL PIPE
- EXIST./PROP. DRAINAGE PIPE
- EXIST./PROP. FRENCH DRAIN
- AREA DELINEATION
- SUB-BASIN GROUP
- EXIST./PROP. CATCH BASIN
- EXIST./PROP. MANHOLE
- PROP. REGRADING
- # AREA NUMBER
- KHA OBSERVED FLOODING
- TOWN COMPLAINT LOCATIONS

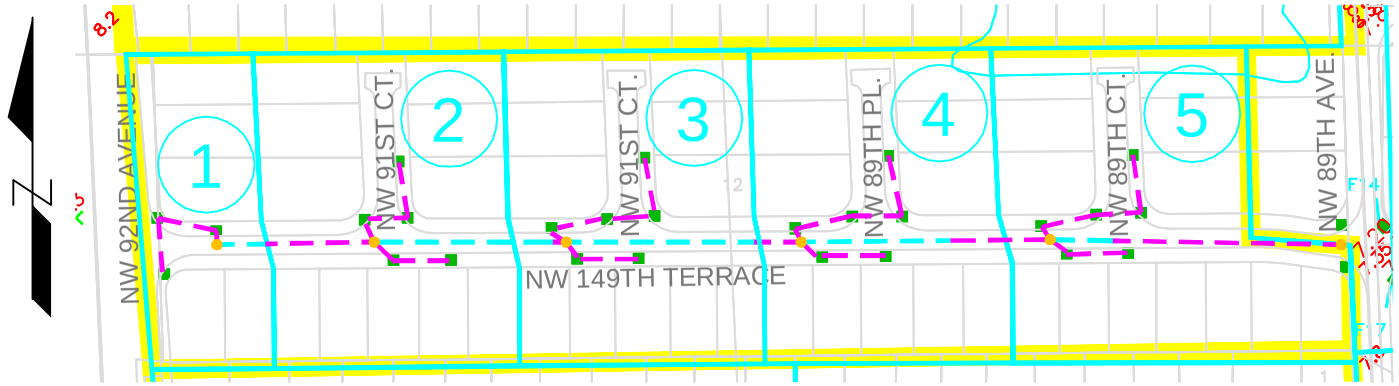
AREA 1 PROPOSED MODIFICATIONS
-REPLACE 3 EXIST. C.B.
-ADD 1 MANHOLES
-ADD 120 LF OF 15" PIPE
-ADD 50 LF OF 15" FRENCH DRAIN

AREA 2 PROPOSED MODIFICATIONS
-REPLACE 5 EXIST. C.B.
-ADD 1 MANHOLES
-ADD 340 LF OF 15" PIPE
-ADD 185 LF OF 15" FRENCH DRAIN

AREA 3 PROPOSED MODIFICATIONS
-REPLACE 6 EXIST. C.B.
-ADD 1 MANHOLES
-ADD 275 LF OF 15" PIPE
-ADD 195 LF OF 15" FRENCH DRAIN

AREA 4 PROPOSED MODIFICATIONS
-REPLACE 6 EXIST. C.B.
-ADD 1 MANHOLES
-ADD 400 LF OF 15" PIPE
-ADD 155 LF OF 15" FRENCH DRAIN

AREA 5 PROPOSED MODIFICATIONS
-REPLACE 6 EXIST. C.B.
-ADD 1 MANHOLES
-ADD 575 LF OF 15" PIPE
-ADD 65 LF OF 15" FRENCH DRAIN



SUMMARY OF PROPOSED MODIFICATIONS

-REPLACE 26 EXIST. C.B.
-ADD 5 MANHOLES
-ADD 1710 LF OF 15" PIPE
-ADD 650 LF OF 15" FRENCH DRAIN

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TOWN OF MIAMI LAKES
STORMWATER MASTER PLAN
WEST LAKES C SUB-BASIN

0 200 400
SCALE FEET

FIGURE 10

Performance Goal Analysis: Based on the detailed hydrologic and hydraulic calculations for this sub-basin, which can be found in Appendix B, the majority of the modeled drainage areas within the sub-basin do not currently meet the Town of Miami Lakes performance goals. The table below shows the performance of the basin versus performance goals. "Yes" means the given drainage area within the sub-basin meets the performance goal, and "No" means that the given drainage area within the sub-basin does not meet the performance goal.

Table 14: West Lakes C Sub-basin – Performance Goal Analysis

Sub-basin Area	Water Quality	5-Year Storm	10-Year Storm	25-Year Storm	100-Year Storm	No Observed Flooding or Complaints
1	No	No	N/A	No	No	Yes
2	No	No	N/A	No	No	Yes
3	No	No	N/A	No	No	Yes
4	No	No	N/A	No	No	Yes
5	No	No	N/A	No	No	Yes

Storm Drainage Deficiencies: Some catch basins in this sub-basin were observed to be filled with debris and sediment blocking or highly restricting flow. Based on the hydrologic and hydraulic calculations for this sub-basin, the existing drainage infrastructure does not discharge adequate runoff to meet the desired performance criteria. The capacity of the existing French drains is not sufficient to discharge the volume of runoff outlined in the performance criteria during the modeled storm events. Improvements to drainage infrastructure will be needed to address these inadequacies. None of the areas within this drainage sub-basin connect to an outfall to a lake or canal.

Recommended Drainage Improvements: Clean and flush all sediment and debris from existing catch basins and pipes and adjust catch basin elevations and locations to minimize accumulation of sediment and debris. Install the additional infrastructure depicted in Figure 10. Existing catch basins should be modified or reconstructed as required to provide sediment traps (sumps). In addition, additional French drain, catch basins, and/or manholes are proposed to provide water quality and water quantity treatment. The West Lakes A, B, C, D and E sub-basins are proposed be connected to the Graham Dairy Canal located south of West Lakes A. It is recommended that design phase for West Lakes A, B, C, D and E improvements be completed simultaneously so that the potential for a joint outfall can be explored as one of the design alternatives. The outfall and related control structure should be sized to accommodate flow from the entire area of the Town located south of NW 154th Street and west of NW 87th Avenue.

Environmental Impact of Proposed Improvements: A full analysis of the estimated pollutant loading for existing, future and proposed conditions was prepared for the priority sub-basins utilizing a spreadsheet developed for this purpose which can be found in Appendix C. The table below shows how the proposed improvements will result in a significant reduction in the

pollutant load contribution from this sub-basin to the Biscayne Aquifer for three major pollutants.

Table 15: West Lakes C Sub-basin – Pollutant Loading Analysis

Pollutant	Existing Load (kg/yr)	Reduction (kg/yr)	Proposed Load (kg/yr)
Total Phosphorous	5.35	4.95	0.39
Total Nitrogen	42.12	37.70	4.42
Total Suspended Solids	504.90	457.19	47.71

Capital Improvement Budget: A budget was developed for the proposed stormwater capital improvements.

Table 16: West Lakes C Sub-basin – Capital Improvement Budget

Item	Description	Qty.	Units	Unit Price	Sub-total
1	Mobilization/ MOT/ Clearing & Grubbing	1	L.S.	$24,700	**$25,000**
2	Remove and Replace Existing Catch Basin	26	Ea.	$3,500	**$91,000**
3	Inlet Pavement (5' x 5')	26	Ea.	$500	**$13,000**
4	Catch Basin	0	Ea.	$3,000	**$0**
5	Manhole (FDOT Type P-7)	5	Ea.	$2,200	**$11,000**
6	Core Drill Existing Inlets	0	Ea.	$500	**$0**
7	15" HDPE Pipe	1,710	L.F.	$35	**$60,000**
8	48" HDPE Pipe	0	L.F.	$60	**$0**
9	French Drain (15" HDPE Pipe)	650	L.F.	$110	**$72,000**
10	Weir Structure	0	Ea.	$4,000	**$0**
11	Stormwater Pollution Prevention	1	L.S.	$2,720	**$3,000**
12	Utility Adjustments	1	L.S.	$13,600	**$14,000**
13	Swale Restoration	1	L.S.	$13,600	**$14,000**
14	Professional Services	1	L.S.	$50,000	**$50,000**
15	Contingency	1	L.S.	$60,600	**$61,000**
TOTAL					**$420,000**

Notes:

1. The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

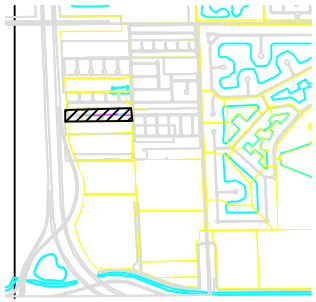
West Lakes D (Florida Tropical Estates Section 1)

Location: The West Lakes D Sub-basin includes the Florida Tropical Estates Section 1 sub-division and is located between NW 89th Avenue and NW 92nd Avenue and between NW 148th Terrace and NW 148th Street in the southwestern residential area of the Town known as West Lakes. It is part of the Southwest (GDCI-302) Basin.

Existing and Future Conditions: Figure 11 shows existing conditions for West Lakes D. The sub-basin consists of approximately 7.5 acres of single family residential with approximately 1,600 linear feet of roadway. The drainage system in this sub-basin consists of isolated catch basins connected to exfiltration trenches.

There is one unresolved citizen complaint reported within this sub-basin, and it is adjacent to other sub-basins with complaints and observed drainage deficiencies. Therefore, it is proposed that the NW 89th Avenue right-of-way will be utilized to provide a drainage trunk-line connecting sub-basins on either side of NW 89th Avenue to the Graham Dairy Canal. The sub-basin area was modeled together with the other sub-basins within the West Lakes area of the Town based on data collected as part of the stormwater master plan process.

Based on available GIS and as-built information, the roadway centerline elevations within West Lakes C range from a low of approximately 6.5 feet to a high of approximately 8.0 feet NGVD. It was assumed that building finish elevations are 1.5 feet above crown of road elevations. Pervious area elevations were assumed to range from 0.1 feet above the minimum roadway elevation to flush with the finish floor elevations. Since the area is already developed, it is anticipated that future development conditions will not vary significantly from the existing conditions.

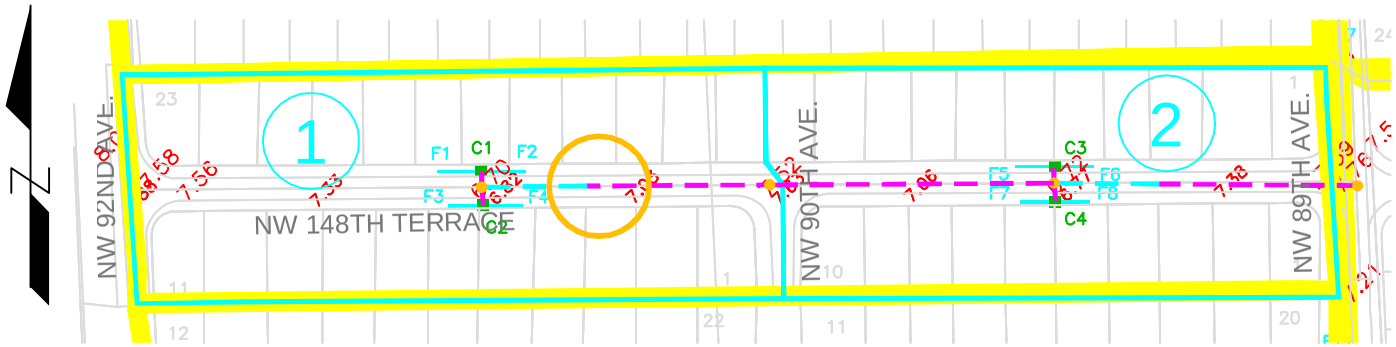


LEGEND

- EXIST./PROP. OUTFALL PIPE
- EXIST./PROP. DRAINAGE PIPE
- EXIST./PROP. FRENCH DRAIN
- AREA DELINEATION
- SUB-BASIN GROUP
- EXIST./PROP. CATCH BASIN
- EXIST./PROP. MANHOLE
- PROP. REGRADING
- # AREA NUMBER
- KHA OBSERVED FLOODING
- TOWN COMPLAINT LOCATIONS

AREA 1 PROPOSED MODIFICATIONS
-REPLACE 2 EXIST. C.B.
-ADD 2 MANHOLES
-ADD 230 LF OF 15" PIPE
-ADD 100 LF OF 15" FRENCH DRAIN

AREA 2 PROPOSED MODIFICATIONS
-REPLACE 2 EXIST. C.B.
-ADD 1 MANHOLES
-ADD 540 LF OF 15" PIPE
-ADD 100 LF OF 15" FRENCH DRAIN



SUMMARY OF PROPOSED MODIFICATIONS

-REPLACE 4 EXIST. C.B.
-ADD 3 MANHOLES
-ADD 770 LF OF 15" PIPE
-ADD 200 LF OF 15" FRENCH DRAIN

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TOWN OF MIAMI LAKES
STORMWATER MASTER PLAN
WEST LAKES D
SUB-BASIN

0 200 400
SCALE FEET

FIGURE 11

Performance Goal Analysis: Based on the detailed hydrologic and hydraulic calculations for this sub-basin, which can be found in Appendix B, the majority of the modeled drainage areas within the sub-basin do not currently meet the Town of Miami Lakes performance goals. The table below shows the performance of the basin versus performance goals. "Yes" means the given drainage area within the sub-basin meets the performance goal, and "No" means that the given drainage area within the sub-basin does not meet the performance goal.

Table 17: West Lakes D Sub-basin – Performance Goal Analysis

Sub-basin Area	Water Quality	5-Year Storm	10-Year Storm	25-Year Storm	100-Year Storm	No Observed Flooding or Complaints
1	No	No	N/A	No	No	No
2	No	No	N/A	No	No	Yes

Storm Drainage Deficiencies: Some catch basins in this sub-basin were observed to be filled with debris and sediment blocking or highly restricting flow. Based on the hydrologic and hydraulic calculations for this sub-basin, the existing drainage infrastructure does not discharge adequate runoff to meet the desired performance criteria. The capacity of the existing French drains is not sufficient to discharge the volume of runoff outlined in the performance criteria during the modeled storm events. Improvements to drainage infrastructure will be needed to address these inadequacies. None of the areas within this drainage sub-basin connect to an outfall to a lake or canal.

Recommended Drainage Improvements: Clean and flush all sediment and debris from existing catch basins and pipes and adjust catch basin elevations and locations to minimize accumulation of sediment and debris. Install the additional infrastructure depicted in Figure 11. Existing catch basins should be modified or reconstructed as required to provide sediment traps (sumps). In addition, additional French drain, catch basins, and/or manholes are proposed to provide water quality and water quantity treatment. The West Lakes A, B, C, D and E sub-basins are proposed be connected to the Graham Dairy Canal located south of West Lakes A. It is recommended that design phase for West Lakes A, B, C, D and E improvements be completed simultaneously so that the potential for a joint outfall can be explored as one of the design alternatives. The outfall and related control structure should be sized to accommodate flow from the entire area of the Town located south of NW 154th Street and west of NW 87th Avenue.

Environmental Impact of Proposed Improvements: A full analysis of the estimated pollutant loading for existing, future and proposed conditions was prepared for the priority sub-basins utilizing a spreadsheet developed for this purpose which can be found in Appendix C. The table below shows how the proposed improvements will result in a significant reduction in the pollutant load contribution from this sub-basin to the Biscayne Aquifer for three major pollutants.

Table 18: West Lakes D Sub-basin – Pollutant Loading Analysis

Pollutant	Existing Load (kg/yr)	Reduction (kg/yr)	Proposed Load (kg/yr)
Total Phosphorous	4.07	3.78	0.30
Total Nitrogen	32.10	28.73	3.37
Total Suspended Solids	384.85	348.48	36.37

Capital Improvement Budget: A budget was developed for the proposed stormwater capital improvements.

Table 19: West Lakes D Sub-basin – Capital Improvement Budget

Item	Description	Qty.	Units	Unit Price	Sub-total
1	Mobilization/ MOT/ Clearing & Grubbing	1	L.S.	$7,200	**$8,000**
2	Remove and Replace Existing Catch Basin	4	Ea.	$3,500	**$14,000**
3	Inlet Pavement (5' x 5')	4	Ea.	$500	**$2,000**
4	Catch Basin	0	Ea.	$3,000	**$0**
5	Manhole (FDOT Type P-7)	3	Ea.	$2,200	**$7,000**
6	Core Drill Existing Inlets	0	Ea.	$500	**$0**
7	15" HDPE Pipe	770	L.F.	$35	**$27,000**
8	48" HDPE Pipe	0	L.F.	$60	**$0**
9	French Drain (15" HDPE Pipe)	200	L.F.	$110	**$22,000**
10	Weir Structure	0	Ea.	$4,000	**$0**
11	Stormwater Pollution Prevention	1	L.S.	$800	**$1,000**
12	Utility Adjustments	1	L.S.	$4,000	**$4,000**
13	Swale Restoration	1	L.S.	$4,000	**$4,000**
14	Professional Services	1	L.S.	$50,000	**$50,000**
15	Contingency	1	L.S.	$17,800	**$18,000**
TOTAL					**$160,000**

Notes:

1. The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

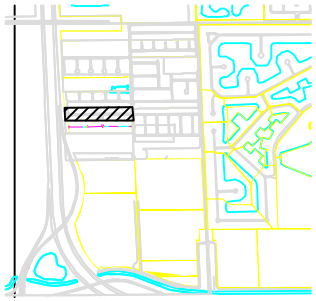
West Lakes E (Florida Tropical Estates Section 2)

Location: The West Lakes E Sub-basin includes the Florida Tropical Estates Section 2 sub-division and is located between NW 89th Avenue and NW 92nd Avenue and between NW 148th Street and NW 147th Terrace in the southwestern residential area of the Town known as West Lakes. It is part of the Southwest (GDCI-302) Basin.

Existing and Future Conditions: Figure 12 shows existing conditions for West Lakes E. The sub-basin consists of approximately 7.5 acres of single family residential with approximately 1,700 linear feet of roadway. The drainage system in this sub-basin consists of isolated catch basins connected to exfiltration trenches.

Although there are no citizen complaints or observed drainage deficiencies in this sub-basin, it is adjacent to other sub-basins with complaints and observed drainage deficiencies. Therefore, it is proposed that the NW 89th Avenue right-of-way will be utilized to provide a drainage trunk-line connecting sub-basins on either side of NW 89th Avenue to the Graham Dairy Canal. The sub-basin area was modeled together with the other sub-basins within the West Lakes area of the Town based on data collected as part of the stormwater master plan process.

Based on available GIS and as-built information, the roadway centerline elevations within West Lakes C range from a low of approximately 6.4 feet to a high of approximately 7.7 feet NGVD. It was assumed that building finish elevations are 1.5 feet above crown of road elevations. Pervious area elevations were assumed to range from 0.1 feet above the minimum roadway elevation to flush with the finish floor elevations. Since the area is already developed, it is anticipated that future development conditions will not vary significantly from the existing conditions.



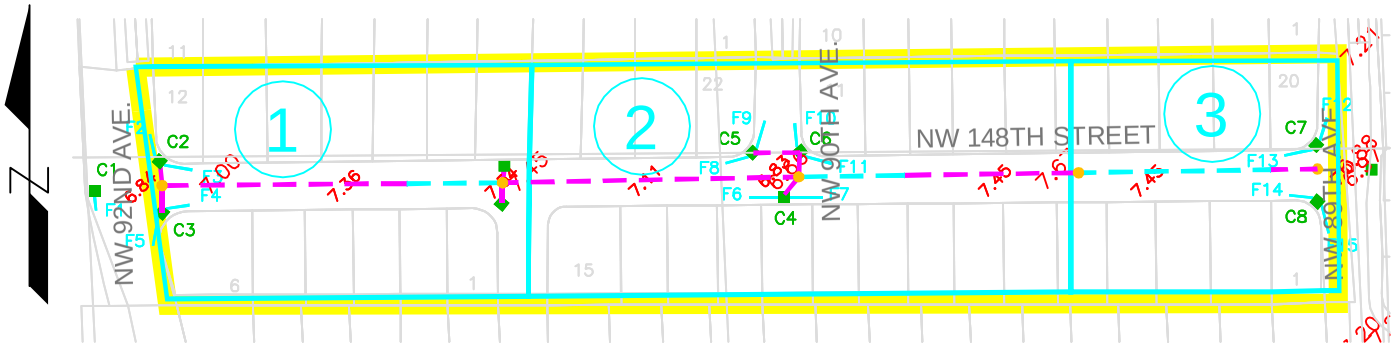
LEGEND

- EXIST./PROP. OUTFALL PIPE
- EXIST./PROP. DRAINAGE PIPE
- EXIST./PROP. FRENCH DRAIN
- AREA DELINEATION
- SUB-BASIN GROUP
- EXIST./PROP. CATCH BASIN
- EXIST./PROP. MANHOLE
- PROP. REGRADING
- # AREA NUMBER
- KHA OBSERVED FLOODING
- TOWN COMPLAINT LOCATIONS

AREA 1 PROPOSED MODIFICATIONS
-REPLACE 4 EXIST. C.B.
-ADD 2 MANHOLES
-ADD 100 LF OF 15" PIPE
-ADD 290 LF OF 42" PIPE
-ADD 100 LF OF 42" FRENCH DRAIN

AREA 2 PROPOSED MODIFICATIONS
-REPLACE 3 EXIST. C.B.
-ADD 1 MANHOLES
-ADD 100 LF OF 15" PIPE
-ADD 470 LF OF 42" PIPE
-ADD 110 LF OF 42" FRENCH DRAIN

AREA 3 PROPOSED MODIFICATIONS
-ADD 1 MANHOLES
-ADD 50 LF OF 42" PIPE
-ADD 200 LF OF 42" FRENCH DRAIN



SUMMARY OF PROPOSED MODIFICATIONS

-REPLACE 7 EXIST. C.B.
-ADD 4 MANHOLES
-ADD 200 LF OF 15" PIPE
-ADD 810 LF OF 42" PIPE
-ADD 410 LF OF 42" FRENCH DRAIN

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TOWN OF MIAMI LAKES
STORMWATER MASTER PLAN
WEST LAKES E
SUB-BASIN

0 200 400
SCALE FEET

FIGURE 12

Performance Goal Analysis: Based on the detailed hydrologic and hydraulic calculations for this sub-basin, which can be found in Appendix B, the majority of the modeled drainage areas within the sub-basin do not currently meet the Town of Miami Lakes performance goals. The table below shows the performance of the basin versus performance goals. "Yes" means the given drainage area within the sub-basin meets the performance goal, and "No" means that the given drainage area within the sub-basin does not meet the performance goal.

Table 20: West Lakes E Sub-basin – Performance Goal Analysis

Sub-basin Area	Water Quality	5-Year Storm	10-Year Storm	25-Year Storm	100-Year Storm	No Observed Flooding or Complaints
1	No	No	N/A	No	No	Yes
2	No	No	N/A	No	No	Yes
3	No	No	N/A	No	No	Yes

Storm Drainage Deficiencies: Some catch basins in this sub-basin were observed to be filled with debris and sediment blocking or highly restricting flow. Based on the hydrologic and hydraulic calculations for this sub-basin, the existing drainage infrastructure does not discharge adequate runoff to meet the desired performance criteria. The capacity of the existing French drains is not sufficient to discharge the volume of runoff outlined in the performance criteria during the modeled storm events. Improvements to drainage infrastructure will be needed to address these inadequacies. None of the areas within this drainage sub-basin connect to an outfall to a lake or canal.

Recommended Drainage Improvements: Clean and flush all sediment and debris from existing catch basins and pipes and adjust catch basin elevations and locations to minimize accumulation of sediment and debris. Install the additional infrastructure depicted in Figure 12. Existing catch basins should be modified or reconstructed as required to provide sediment traps (sumps). In addition, additional French drain, catch basins, and/or manholes are proposed to provide water quality and water quantity treatment. The West Lakes A, B, C, D and E sub-basins are proposed be connected to the Graham Dairy Canal located south of West Lakes A. It is recommended that design phase for West Lakes A, B, C, D and E improvements be completed simultaneously so that the potential for a joint outfall can be explored as one of the design alternatives. The outfall and related control structure should be sized to accommodate flow from the entire area of the Town located south of NW 154th Street and west of NW 87th Avenue.

Environmental Impact of Proposed Improvements: A full analysis of the estimated pollutant loading for existing, future and proposed conditions was prepared for the priority sub-basins utilizing a spreadsheet developed for this purpose which can be found in Appendix C. The table below shows how the proposed improvements will result in a significant reduction in the pollutant load contribution from this sub-basin to the Biscayne Aquifer for three major pollutants.

Table 21: West Lakes E Sub-basin – Pollutant Loading Analysis

Pollutant	Existing Load (kg/yr)	Reduction (kg/yr)	Proposed Load (kg/yr)
Total Phosphorous	4.06	3.76	0.30
Total Nitrogen	32.01	28.65	3.36
Total Suspended Solids	383.72	347.46	36.26

Capital Improvement Budget: A budget was developed for the proposed stormwater capital improvements.

Table 22: West Lakes E Sub-basin – Capital Improvement Budget

Item	Description	Qty.	Units	Unit Price	Sub-total
1	Mobilization/ MOT/ Clearing & Grubbing	1	L.S.	$14,800	**$15,000**
2	Remove and Replace Existing Catch Basin	7	Ea.	$3,500	**$25,000**
3	Inlet Pavement (5' x 5')	7	Ea.	$500	**$4,000**
4	Catch Basin	0	Ea.	$3,000	**$0**
5	Manhole (FDOT Type P-7)	4	Ea.	$2,200	**$9,000**
6	Core Drill Existing Inlets	0	Ea.	$500	**$0**
7	15" HDPE Pipe	200	L.F.	$35	**$7,000**
8	42" HDPE Pipe	810	L.F.	$50	**$41,000**
9	French Drain (42" HDPE Pipe)	410	L.F.	$150	**$62,000**
10	Weir Structure	0	Ea.	$4,000	**$0**
11	Stormwater Pollution Prevention	1	L.S.	$1,630	**$2,000**
12	Utility Adjustments	1	L.S.	$8,150	**$9,000**
13	Swale Restoration	1	L.S.	$8,150	**$9,000**
14	Professional Services	1	L.S.	$50,000	**$50,000**
15	Contingency	1	L.S.	$36,600	**$37,000**
TOTAL					**$270,000**

Notes:

1. The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

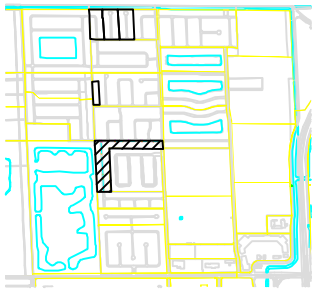
Royal Oaks A

Location: The Royal Oaks A Sub-basin includes the Dunhill Cove and Swan's Landing Sub-divisions and is located north of NW 158th Terrace, south of NW 162nd Street, east of NW 84th Court and west of NW 82nd Avenue. It is part of the Royal Oaks (GGCI-202) Basin.

Existing and Future Conditions: Figure 13 shows existing conditions for Royal Oaks A. The sub-basin consists of approximately 9.80 acres of existing detached single family development with approximately 2,200 linear feet of roadway. The drainage system in this sub-basin consists of isolated catch basins. Roadside swales also provide some water quality pre-treatment and storage of roadway run-off.

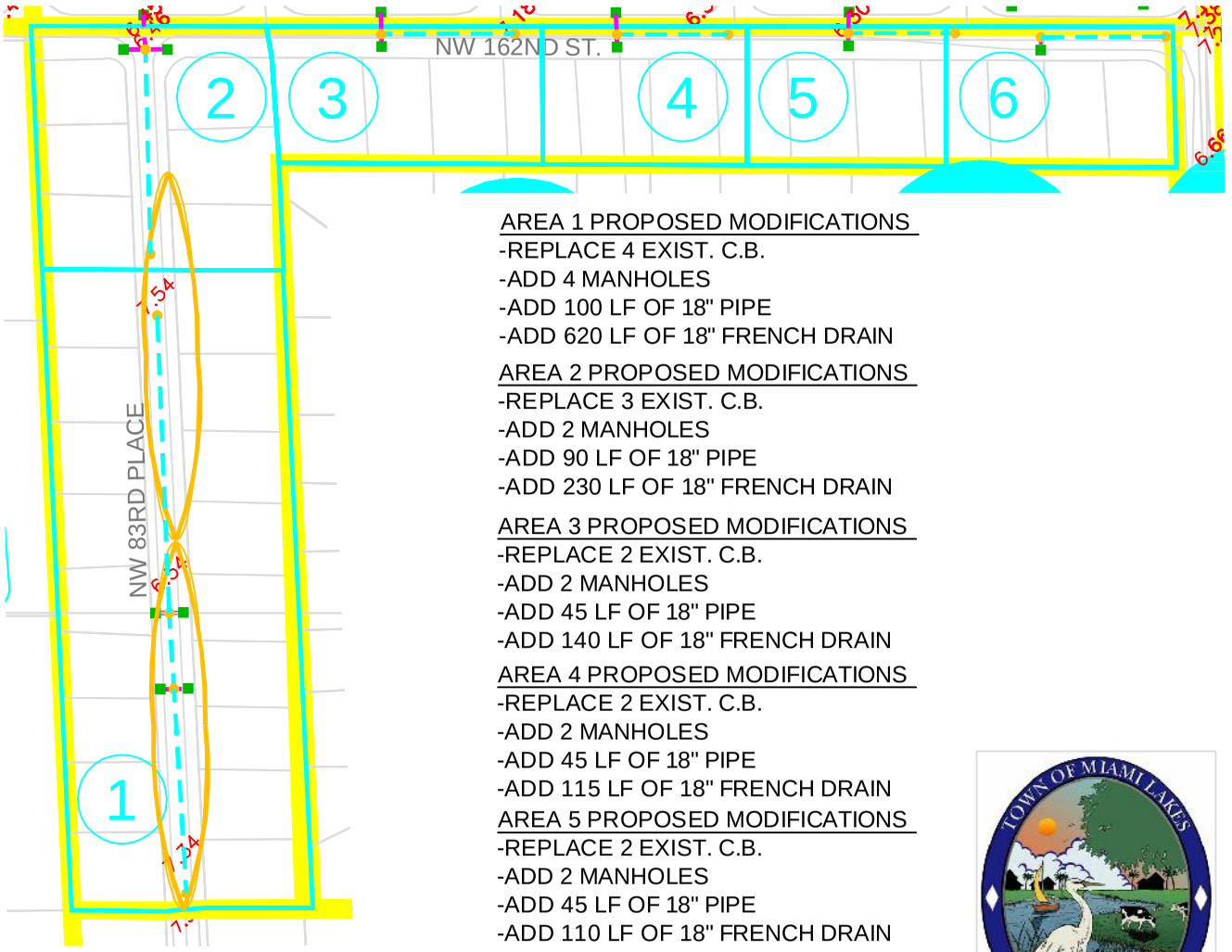
There are several unresolved resident complaints within this sub-basin. The location of these deficiencies can be seen in Figure 13. The sub-basin area was modeled together with the other sub-basins within the Royal Oaks area of the Town based on data collected as part of the stormwater master plan process.

Based on available GIS and as-built information, the elevation of existing roads ranges from a low of approximately 6.3 feet to a high of approximately 7.5 feet NGVD. It was assumed that building finish elevations are 1.5 feet above crown of road elevations. Pervious area elevations were assumed to range from 0.5 feet below the minimum roadway elevation in the roadside swales to 0.5 feet below the finish floor elevations. Since the area is already developed, it is anticipated that future development conditions will not vary significantly from the existing conditions.



LEGEND

- EXIST./PROP. OUTFALL PIPE
- EXIST./PROP. DRAINAGE PIPE
- EXIST./PROP. FRENCH DRAIN
- AREA DELINEATION
- SUB-BASIN GROUP
- EXIST./PROP. CATCH BASIN
- EXIST./PROP. MANHOLE
- PROP. REGRADING
- # AREA NUMBER
- KHA OBSERVED FLOODING
- TOWN COMPLAINT LOCATIONS



AREA 1 PROPOSED MODIFICATIONS
-REPLACE 4 EXIST. C.B.
-ADD 4 MANHOLES
-ADD 100 LF OF 18" PIPE
-ADD 620 LF OF 18" FRENCH DRAIN

AREA 2 PROPOSED MODIFICATIONS
-REPLACE 3 EXIST. C.B.
-ADD 2 MANHOLES
-ADD 90 LF OF 18" PIPE
-ADD 230 LF OF 18" FRENCH DRAIN

AREA 3 PROPOSED MODIFICATIONS
-REPLACE 2 EXIST. C.B.
-ADD 2 MANHOLES
-ADD 45 LF OF 18" PIPE
-ADD 140 LF OF 18" FRENCH DRAIN

AREA 4 PROPOSED MODIFICATIONS
-REPLACE 2 EXIST. C.B.
-ADD 2 MANHOLES
-ADD 45 LF OF 18" PIPE
-ADD 115 LF OF 18" FRENCH DRAIN

AREA 5 PROPOSED MODIFICATIONS
-REPLACE 2 EXIST. C.B.
-ADD 2 MANHOLES
-ADD 45 LF OF 18" PIPE
-ADD 110 LF OF 18" FRENCH DRAIN

AREA 6 PROPOSED MODIFICATIONS
-REPLACE 1 EXIST. C.B.
-ADD 2 MANHOLES
-ADD 20 LF OF 18" PIPE
-ADD 130 LF OF 18" FRENCH DRAIN

SUMMARY OF PROPOSED MODIFICATIONS

-REPLACE 14 EXIST. C.B.
-ADD 14 MANHOLES
-ADD 345 LF OF 18" PIPE
-ADD 1345 LF OF 18" FRENCH DRAIN

0 200 400
SCALE FEET

TOWN OF MIAMI LAKES
STORMWATER MASTER PLAN
ROYAL OAKS A
SUB-BASIN

FIGURE 13

Kimley-Horn and Associates, Inc.

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Performance Goal Analysis: Based on the detailed hydrologic and hydraulic calculations for this sub-basin, which can be found in Appendix B, the majority of the modeled drainage areas within the sub-basin do not currently meet the Town of Miami Lakes performance goals. The table below shows the performance of the basin versus performance goals. "Yes" means the given drainage area within the sub-basin meets the performance goal, and "No" means that the given drainage area within the sub-basin does not meet the performance goal.

Table 23: Royal Oaks A Sub-basin – Performance Goal Analysis

Sub-basin Area	Water Quality	5-Year Storm	10-Year Storm	25-Year Storm	100-Year Storm	No Observed Flooding or Complaints
1	No	No	N/A	No	No	No
2	No	No	N/A	No	No	No
3	No	No	N/A	No	No	Yes
4	No	No	N/A	No	No	Yes
5	No	No	N/A	No	No	Yes
6	No	No	N/A	No	No	Yes

Storm Drainage Deficiencies: Several catch basins in this sub-basin were observed to be filled with debris and sediment blocking or highly restricting flow. Based on the hydrologic and hydraulic calculations for this sub-basin, the existing drainage infrastructure does not discharge adequate runoff to meet the desired performance criteria. The capacity of the existing swales and French drains is not sufficient to discharge the volume of runoff outlined in the performance criteria during the modeled storm events. Improvements to drainage infrastructure will be needed to address these inadequacies. None of the areas within this drainage sub-basin connect to an outfall to a lake or canal.

Recommended Drainage Improvements: Clean and flush all sediment and debris from existing catch basins and pipes and adjust catch basin elevations and locations to minimize accumulation of sediment and debris. Install the additional infrastructure depicted in Figure 13. Existing catch basins should be modified or reconstructed as required to provide sediment traps (sumps). In addition, additional French drain, catch basins, and/or manholes are proposed to provide water quality and water quantity treatment. The Royal Oaks A, B, and C sub-basins could be connected to the NW 170th Street Canal located north of Royal Oaks C. For the purposes of this master plan, an outfall is not proposed. However, it is recommended that design phase for Royal Oaks A, B and C improvements be completed simultaneously so that the potential for a joint outfall can be explored as one of the design alternatives.

Environmental Impact of Proposed Improvements: A full analysis of the estimated pollutant loading for existing, future and proposed conditions was prepared for the priority sub-basins utilizing a spreadsheet developed for this purpose which can be found in Appendix C. The table below shows how the proposed improvements will result in a significant reduction in the pollutant load contribution from this sub-basin to the Biscayne Aquifer for three major pollutants.

Table 24: Royal Oaks A Sub-basin – Pollutant Loading Analysis

Pollutant	Existing Load (kg/yr)	Reduction (kg/yr)	Proposed Load (kg/yr)
Total Phosphorous	5.82	5.39	0.43
Total Nitrogen	45.86	41.05	4.82
Total Suspended Solids	549.78	497.83	51.95

Capital Improvement Budget: A budget was developed for the proposed stormwater capital improvements.

Table 25: Royal Oaks A Sub-basin – Capital Improvement Budget

Item	Description	Qty.	Units	Unit Price	Sub-total
1	Mobilization/ MOT/ Clearing & Grubbing	1	L.S.	$24,900	**$25,000**
2	Remove and Replace Existing Catch Basin	14	Ea.	$3,500	**$49,000**
3	Inlet Pavement (5' x 5')	14	Ea.	$500	**$7,000**
4	Catch Basin	0	Ea.	$3,000	**$0**
5	Manhole (FDOT Type P-7)	14	Ea.	$2,200	**$31,000**
6	Core Drill Existing Inlets	0	Ea.	$500	**$0**
7	18" HDPE Pipe	345	L.F.	$40	**$14,000**
8	French Drain (18" HDPE Pipe)	1,345	L.F.	$110	**$148,000**
9	Weir Structure	0	Ea.	$4,000	**$0**
10	Stormwater Pollution Prevention	1	L.S.	$2,740	**$3,000**
11	Utility Adjustments	1	L.S.	$13,700	**$14,000**
12	Swale Restoration	1	L.S.	$13,700	**$14,000**
13	Professional Services	1	L.S.	$50,000	**$50,000**
14	Contingency	1	L.S.	$61,000	**$61,000**
TOTAL					**$420,000**

Notes:

1. The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

Royal Oaks B

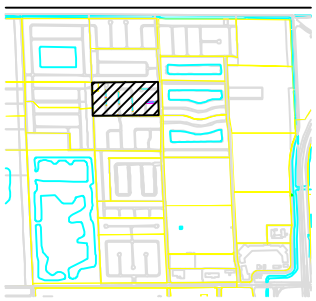
Location: The Royal Oaks B Sub-basin includes the Royal Oaks Fifth Addition Sub-division and is located north of NW 164th Street, south of NW 166th Terrace, east of NW 84th Court and west of NW 82nd Avenue. It is a part of the Royal Oaks (GGCI-202) Basin.

Existing and Future Conditions: Figure 14 shows existing conditions for Royal Oaks B. The sub-basin consists of approximately 18.7 acres of existing detached single family development with approximately 4,500 linear feet of roadway. The drainage system in this sub-basin consists of isolated catch basins. Roadside swales also provide some water quality pre-treatment and storage of roadway run-off.

There is one unresolved resident complaint within this sub-basin. The location of the deficiencies can be seen in Figure 14. The sub-basin area was modeled together with the other sub-basins within the Royal Oaks area of the Town based on data collected as part of the stormwater master plan process.

Based on available GIS and as-built information, the elevation of existing roads ranges from a low of approximately 6.4 feet to a high of approximately 8.0 feet NGVD. It was assumed that building finish elevations are 1.5 feet above crown of road elevations. Pervious area elevations were assumed to range from 0.5 feet below the minimum roadway elevation in the roadside swales to 0.5 feet below the finish floor elevations. Since the area is already developed, it is anticipated that future development conditions will not vary significantly from the existing conditions.

Performance Goal Analysis: Based on the detailed hydrologic and hydraulic calculations for this sub-basin, which can be found in Appendix B, the majority of the modeled drainage areas within the sub-basin do not currently meet the Town of Miami Lakes performance goals. Table 25 shows the performance of the basin versus performance goals. “Yes” means the given drainage area within the sub-basin meets the performance goal, and “No” means that the given drainage area within the sub-basin does not meet the performance goal.



LEGEND

- EXIST./PROP. OUTFALL PIPE
- EXIST./PROP. DRAINAGE PIPE
- EXIST./PROP. FRENCH DRAIN
- AREA DELINEATION
- SUB-BASIN GROUP
- EXIST./PROP. CATCH BASIN
- EXIST./PROP. MANHOLE
- PROP. REGRADING

AREA NUMBER

KHA OBSERVED FLOODING

TOWN COMPLAINT LOCATIONS

SUMMARY OF PROPOSED MODIFICATIONS

-REPLACE 12 EXIST. C.B.
-350 SY OF ASPHALT
-ADD 17 MANHOLES
-ADD 1 CATCH BASIN
-ADD 325 LF 18" HDPE PIPE
-ADD 1265 LF 18" FRENCH DRAIN

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AREA 1 PROPOSED MODIFICATIONS

-REPLACE 1 EXIST. C.B.
-ADD 2 MANHOLES
-ADD 25 LF OF 18" PIPE
-ADD 80 LF OF 18" FRENCH DRAIN

AREA 2 PROPOSED MODIFICATIONS

-REPLACE 2 EXIST. C.B.
-ADD 3 MANHOLES
-ADD 50 LF OF 18" PIPE
-ADD 285 LF OF 18" FRENCH DRAIN

AREA 3 PROPOSED MODIFICATIONS

-REPLACE 2 EXIST. C.B.
-ADD 2 MANHOLES
-ADD 50 LF OF 18" PIPE
-ADD 215 LF OF 18" FRENCH DRAIN

AREA 4 PROPOSED MODIFICATIONS

-REPLACE 2 EXIST. C.B.
-ADD 3 MANHOLES
-ADD 50 LF OF 18" PIPE
-ADD 300 LF OF 18" FRENCH DRAIN

AREA 5 PROPOSED MODIFICATIONS

-REPLACE 2 EXIST. C.B.
-ADD 2 MANHOLES
-ADD 50 LF OF 18" PIPE
-ADD 155 LF OF 18" FRENCH DRAIN

AREA 6 PROPOSED MODIFICATIONS

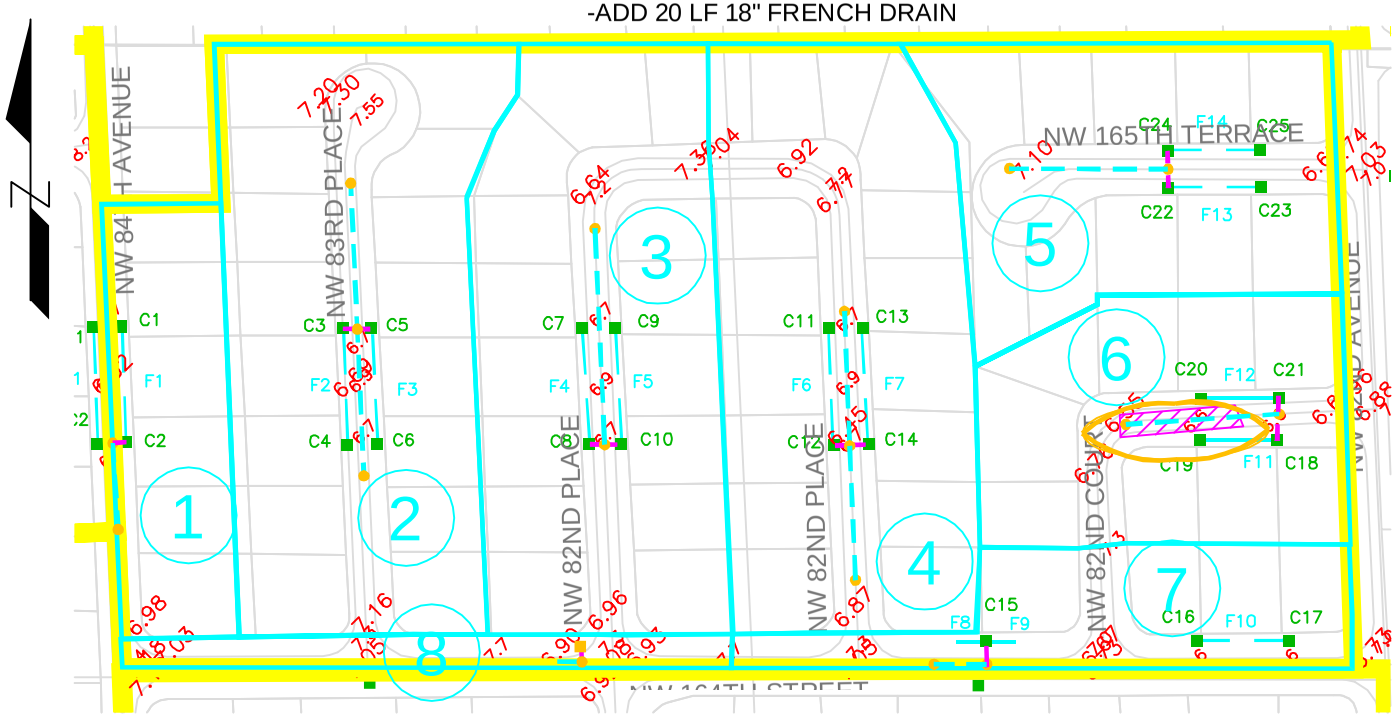
-REPLACE 2 EXIST. C.B.
-ADD 2 MANHOLES
-ADD 55 LF OF 18" PIPE
-ADD 150 LF OF 18" FRENCH DRAIN
-350 SY OF ASPHALT

AREA 7 PROPOSED MODIFICATIONS

-REPLACE 1 EXIST. C.B.
-ADD 2 MANHOLES
-ADD 30 LF OF 18" PIPE
-ADD 45 LF OF 18" FRENCH DRAIN

AREA 8 PROPOSED MODIFICATIONS

-ADD 1 MANHOLE
-ADD 1 CATCH BASIN
-ADD 15 LF 18" HDPE PIPE
-ADD 20 LF 18" FRENCH DRAIN



TOWN OF MIAMI LAKES
STORMWATER MASTER PLAN
ROYAL OAKS B
SUB-BASIN

0 200 400
SCALE FEET

FIGURE 14

Table 26: Royal Oaks B Sub-basin – Performance Goal Analysis

Sub-basin Area	Water Quality	5-Year Storm	10-Year Storm	25-Year Storm	100-Year Storm	No Observed Flooding or Complaints
1	Yes	No	N/A	No	No	Yes
2	Yes	No	N/A	No	No	Yes
3	Yes	No	N/A	No	No	Yes
4	Yes	No	N/A	No	No	Yes
5	Yes	No	N/A	No	No	Yes
6	Yes	No	N/A	No	No	No
7	Yes	Yes	N/A	Yes	No	Yes
8	No	No	N/A	No	No	Yes

Storm Drainage Deficiencies: Several catch basins in this sub-basin were observed to be filled with debris and sediment blocking or highly restricting flow. Based on the hydrologic and hydraulic calculations for this sub-basin, the existing drainage infrastructure does not discharge adequate runoff to meet the desired performance criteria. The capacity of the existing swales and French drains is not sufficient to discharge the volume of runoff outlined in the performance criteria during the modeled storm events. Improvements to drainage infrastructure will be needed to address these inadequacies. None of the areas within this drainage sub-basin connect to an outfall to a lake or canal.

Recommended Drainage Improvements: Clean and flush all sediment and debris from existing catch basins and pipes and adjust catch basin elevations and locations to minimize accumulation of sediment and debris. Install the additional infrastructure depicted in Figure 14. Existing catch basins should be modified or reconstructed as required to provide sediment traps (sumps). In addition, additional French drain, catch basins, and/or manholes are proposed to provide water quality and water quantity treatment. The Royal Oaks A, B, and C sub-basins could be connected to the NW 170th Street Canal located north of Royal Oaks C. For the purposes of this master plan, an outfall is not proposed. However, it is recommended that design phase for Royal Oaks A, B and C improvements be completed simultaneously so that the potential for a joint outfall can be explored as one of the design alternatives.

Environmental Impact of Proposed Improvements: A full analysis of the estimated pollutant loading for existing, future and proposed conditions was prepared for the priority sub-basins utilizing a spreadsheet developed for this purpose which can be found in Appendix C. The table below shows how the proposed improvements will result in a significant reduction in the pollutant load contribution from this sub-basin to the Biscayne Aquifer for three major pollutants.

Table 27: Royal Oaks B Sub-basin – Pollutant Loading Analysis

Pollutant	Existing Load (kg/yr)	Reduction (kg/yr)	Proposed Load (kg/yr)
Total Phosphorous	11.11	10.29	0.82
Total Nitrogen	87.52	78.33	9.19
Total Suspended Solids	1049.07	949.93	99.14

Capital Improvement Budget: A budget was developed for the proposed stormwater capital improvements.

Table 28: Royal Oaks B Sub-basin – Capital Improvement Budget

Item	Description	Qty.	Units	Unit Price	Sub-total
1	Mobilization/ MOT/ Clearing & Grubbing	1	L.S.	$25,000	**$25,000**
2	Remove and Replace Existing Catch Basin	12	Ea.	$3,500	**$42,000**
3	Inlet Pavement (5' x 5')	13	Ea.	$500	**$7,000**
4	Catch Basin	1	Ea.	$3,000	**$3,000**
5	Manhole (FDOT Type P-7)	17	Ea.	$2,200	**$38,000**
6	Core Drill Existing Inlets	0	Ea.	$500	**$0**
7	18" HDPE Pipe	325	L.F.	$40	**$13,000**
8	French Drain (18" HDPE Pipe)	1,265	L.F.	$110	**$140,000**
9	Weir Structure	0	Ea.	$4,000	**$0**
10	Asphalt regrading	350	S.Y.	$20	**$7,000**
11	Stormwater Pollution Prevention	1	L.S.	$2,750	**$3,000**
12	Utility Adjustments	1	L.S.	$13,750	**$14,000**
13	Swale Restoration	1	L.S.	$13,750	**$14,000**
14	Professional Services	1	L.S.	$50,000	**$50,000**
15	Contingency	1	L.S.	$61,200	**$62,000**
TOTAL					**$420,000**

Notes:

1. The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

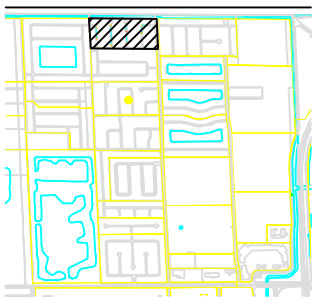
Royal Oaks C

Location: The Royal Oaks C Sub-basin includes the Royal Oaks Second Addition Sub-division and is located north of NW 168th Street, south of NW 170th Street, east of NW 84th Court and west of NW 82nd Avenue. It is a part of the Royal Oaks (GGCI-202) Basin.

Existing and Future Conditions: Figure 15 shows existing conditions for Royal Oaks C. The sub-basin consists of approximately 17.3 acres of existing detached single family development with approximately 3,600 linear feet of roadway. The drainage system in this sub-basin consists of isolated catch basins. Roadside swales also provide some water quality pre-treatment and storage of roadway run-off.

There is one unresolved resident complaint within this sub-basin. The location of the deficiencies can be seen in Figure 15. The sub-basin area was modeled together with the other sub-basins within the Royal Oaks area of the Town based on data collected as part of the stormwater master plan process.

Based on available GIS and as-built information, the elevation of existing roads ranges from a low of approximately 6.4 feet to a high of approximately 7.9 feet NGVD. It was assumed that building finish elevations are 1.5 feet above crown of road elevations. Pervious area elevations were assumed to range from 0.5 feet below the minimum roadway elevation in the roadside swales to 0.5 feet below the finish floor elevations. Since the area is already developed, it is anticipated that future development conditions will not vary significantly from the existing conditions.



LEGEND

- EXIST./PROP. OUTFALL PIPE
- EXIST./PROP. DRAINAGE PIPE
- EXIST./PROP. FRENCH DRAIN
- AREA DELINEATION
- SUB-BASIN GROUP
- EXIST./PROP. CATCH BASIN
- EXIST./PROP. MANHOLE
- PROP. REGRADING
- # AREA NUMBER
- KHA OBSERVED FLOODING
- TOWN COMPLAINT LOCATIONS

AREA 1 PROPOSED MODIFICATIONS

-REPLACE 2 EXIST. C.B.
-ADD 2 MANHOLES
-ADD 40 LF 18" HDPE PIPE
-ADD 200 LF 18" FRENCH DRAIN

AREA 2 PROPOSED MODIFICATIONS

-REPLACE 2 EXIST. C.B.
-REPLACE 2 EXIST. C.B.
-ADD 3 MANHOLES
-ADD 55 LF 18" HDPE PIPE
-ADD 360 LF FRENCH DRAIN

AREA 3 PROPOSED MODIFICATIONS

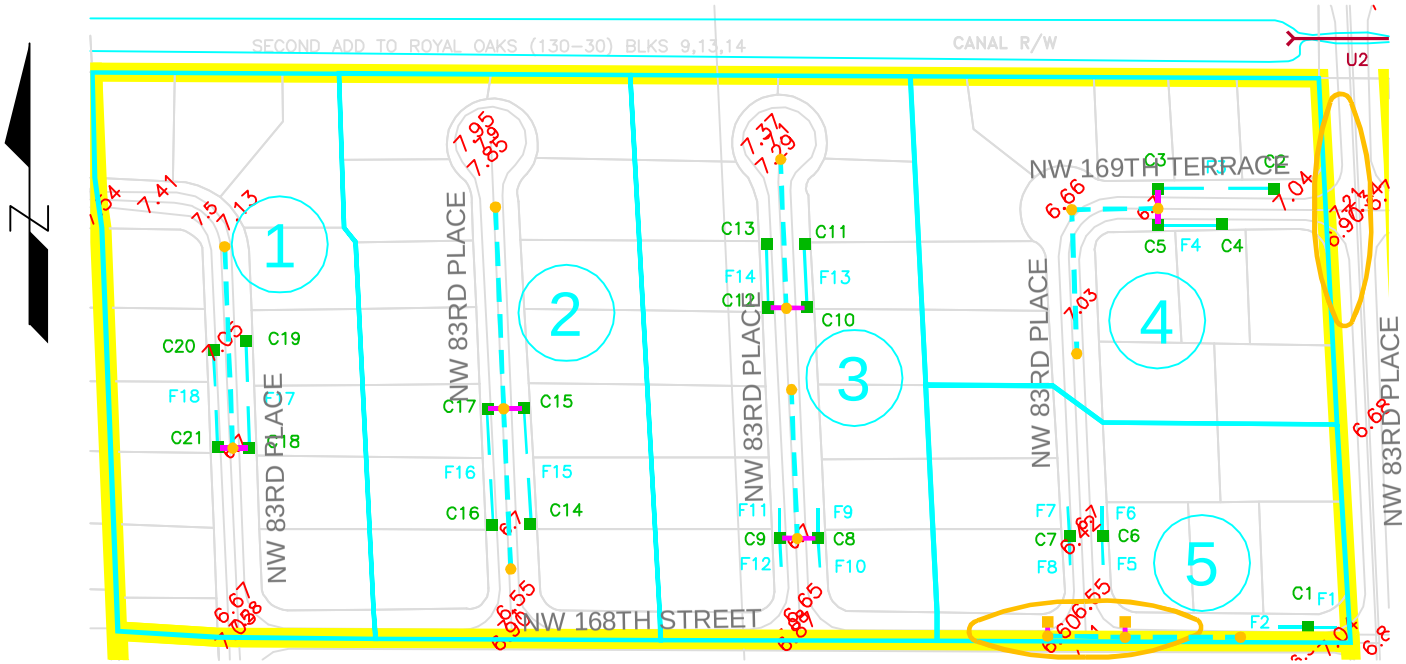
-REPLACE 4 EXIST. C.B.
-ADD 4 MANHOLES
-ADD 90 LF 18" HDPE PIPE
-ADD 290 LF 18" FRENCH DRAIN

AREA 4 PROPOSED MODIFICATIONS

-REPLACE 2 EXIST. C.B.
-ADD 3 MANHOLES
-ADD 55 LF 18" HDPE PIPE
-ADD 220 LF 18" FRENCH DRAIN

AREA 5 PROPOSED MODIFICATIONS

-ADD 3 MANHOLES
-ADD 2 CATCH BASINS
-ADD 60 LF OF 18" PIPE
-ADD 180 LF OF 18" FRENCH DRAIN



0 200 400
SCALE FEET

SUMMARY OF PROPOSED MODIFICATIONS

-REPLACE 10 EXIST. C.B.
-ADD 15 MANHOLES
-ADD 2 CATCH BASINS
-ADD 300 LF OF 18" PIPE
-ADD 1250 LF OF 18" FRENCH DRAIN

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TOWN OF MIAMI LAKES
STORMWATER MASTER PLAN
ROYAL OAKS C
SUB-BASIN

FIGURE 15

Performance Goal Analysis: Based on the detailed hydrologic and hydraulic calculations for this sub-basin, which can be found in Appendix B, the majority of the modeled drainage areas within the sub-basin do not currently meet the Town of Miami Lakes performance goals. The table below shows the performance of the basin versus performance goals. "Yes" means the given drainage area within the sub-basin meets the performance goal, and "No" means that the given drainage area within the sub-basin does not meet the performance goal.

Table 29: Royal Oaks C Sub-basin – Performance Goal Analysis

Sub-basin Area	Water Quality	5-Year Storm	10-Year Storm	25-Year Storm	100-Year Storm	No Observed Flooding or Complaints
1	Yes	No	N/A	No	No	Yes
2	Yes	No	N/A	No	No	Yes
3	Yes	No	N/A	No	No	Yes
4	Yes	No	N/A	No	No	No
5	Yes	No	N/A	No	No	No

Storm Drainage Deficiencies: Several catch basins in this sub-basin were observed to be filled with debris and sediment blocking or highly restricting flow. Based on the hydrologic and hydraulic calculations for this sub-basin, the existing drainage infrastructure does not discharge adequate runoff to meet the desired performance criteria. The capacity of the existing swales and French drains is not sufficient to discharge the volume of runoff outlined in the performance criteria during the modeled storm events. Improvements to drainage infrastructure will be needed to address these inadequacies. None of the areas within this drainage sub-basin connect to an outfall to a lake or canal.

Recommended Drainage Improvements: Clean and flush all sediment and debris from existing catch basins and pipes and adjust catch basin elevations and locations to minimize accumulation of sediment and debris. Install the additional infrastructure depicted in Figure 15. Existing catch basins should be modified or reconstructed as required to provide sediment traps (sumps). In addition, additional French drain, catch basins, and/or manholes are proposed to provide water quality and water quantity treatment. The Royal Oaks A, B, and C sub-basins could be connected to the NW 170th Street Canal located north of Royal Oaks C. For the purposes of this master plan, an outfall is not proposed. However, it is recommended that design phase for Royal Oaks A, B and C improvements be completed simultaneously so that the potential for a joint outfall can be explored as one of the design alternatives.

Environmental Impact of Proposed Improvements: A full analysis of the estimated pollutant loading for existing, future and proposed conditions was prepared for the priority sub-basins utilizing a spreadsheet developed for this purpose which can be found in Appendix C. The table below shows how the proposed improvements will result in a significant reduction in the

pollutant load contribution from this sub-basin to the Biscayne Aquifer for three major pollutants.

Table 30: Royal Oaks C Sub-basin – Pollutant Loading Analysis

Pollutant	Existing Load (kg/yr)	Reduction (kg/yr)	Proposed Load (kg/yr)
Total Phosphorous	11.11	10.29	0.82
Total Nitrogen	87.52	78.33	9.19
Total Suspended Solids	1049.07	949.93	99.14

Capital Improvement Budget: A budget was developed for the proposed stormwater capital improvements.

Table 31: Royal Oaks C Sub-basin – Capital Improvement Budget

Item	Description	Qty.	Units	Unit Price	Sub-total
1	Mobilization/ MOT/ Clearing & Grubbing	1	L.S.	$23,000	**$23,000**
2	Remove and Replace Existing Catch Basin	10	Ea.	$3,500	**$35,000**
3	Inlet Pavement (5' x 5')	12	Ea.	$500	**$6,000**
4	Catch Basin	2	Ea.	$3,000	**$6,000**
5	Manhole (FDOT Type P-7)	15	Ea.	$2,200	**$33,000**
6	Core Drill Existing Inlets	0	Ea.	$500	**$0**
7	18" HDPE Pipe	300	L.F.	$40	**$12,000**
8	French Drain (18" HDPE Pipe)	1,250	L.F.	$110	**$138,000**
9	Weir Structure	0	Ea.	$4,000	**$0**
10	Stormwater Pollution Prevention	1	L.S.	$2,530	**$3,000**
11	Utility Adjustments	1	L.S.	$12,650	**$13,000**
12	Swale Restoration	1	L.S.	$12,650	**$13,000**
13	Professional Services	1	L.S.	$50,000	**$50,000**
14	Contingency	1	L.S.	$56,400	**$57,000**
TOTAL					**$390,000**

Notes:

1. The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

Royal Oaks D

Location and Existing Conditions: The Royal Oaks D Sub-basin includes the Royal Oaks Sub-division and is located north of NW 166th Street, south of NW 170th Street, east of NW 82nd Avenue and west of NW 79th Avenue. It is a part of the Royal Oaks (GGCI-202) Basin. Royal Oaks D is not one of the priority sub-basins included in the hydraulic/ hydrologic modeling, but it is an area that receives consistent citizen complaints that require more than simple maintenance actions to resolve. The stormwater GIS for the Royal Oaks D sub-basin does not indicate any piped outfalls to the central wet retention lake. Instead the lots surrounding the lake appear to sheet flow to the lake while the remainder of the area is drained by roadside swales and small sections of exfiltration trenches within the NW 166th Street right-of-way.

Recommended Drainage Improvements and Budget: One cause of flooding within NW 166th Street right-of-way appears to be the lack of a positive outfall. Therefore, it is recommended that the existing stormwater system be upgraded to include an outfall connection to the existing stormwater retention lake. See the proposed budget below.

Table 32: Royal Oaks D Sub-basin – Capital Improvement Budget

Item	Description	Qty.	Units	Unit Price	Sub-total
1	Mobilization/ MOT/ Clearing & Grubbing	1	L.S.	$16,400	**$17,000**
2	Remove and Replace Existing Catch Basin	6	Ea.	$3,500	**$21,000**
3	Inlet Pavement (5' x 5')	6	Ea.	$500	**$3,000**
4	Catch Basin	2	Ea.	$3,000	**$6,000**
5	Manhole (FDOT Type P-7)	5	Ea.	$2,200	**$11,000**
6	18" HDPE Pipe	700	L.F.	$40	**$28,000**
7	French Drain (18" HDPE Pipe)	500	L.F.	$110	**$55,000**
8	Weir Structure	1	Ea.	$4,000	**$4,000**
9	Replace Valley Gutter	2,400	L.F.	$15	**$36,000**
10	Stormwater Pollution Prevention	1	L.S.	$1,810	**$2,000**
11	Utility Adjustments	1	L.S.	$9,050	**$10,000**
12	Swale Restoration	1	L.S.	$9,050	**$10,000**
13	Professional Services	1	L.S.	$30,450	**$31,000**
14	Contingency	1	L.S.	$40,600	**$41,000**
TOTAL					**$280,000**

Notes:

2. The Engineer has no control over the cost of labor, materials, equipment, or over the Contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to Engineer at this time and represent only the Engineer's judgment as a design professional familiar with the construction industry. The Engineer cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

CAPITAL IMPROVEMENT PROGRAM

Background

KHA prepared this Capital Improvement Program (CIP) for Stormwater improvements to prioritize and set budgets required to plan, construct, operate and maintain the Town's Stormwater Management Program. The CIP is a tool intended to provide an order of magnitude for the Town's yearly funding for the implementation of the Stormwater Utility.

The proposed CIP is based on the findings of the assessment of existing drainage conditions within the Town and the detailed analysis of the ten drainage sub-basins which were identified as priority basins. Two components of the CIP were identified. These are the operation and maintenance component and the capital improvements component.

The operation and maintenance component is based on the general assessment of the existing drainage conditions within the Town limits. Recommended operation and maintenance procedures were identified. The preliminary budget estimates are based on the implementation of these procedures over the next several years.

The Capital Improvement component is based on the findings of the analysis of the priority sub-basins. Recommended improvements to achieve the stated performance goals were identified for each sub-basin. The recommended improvements where quantified based on the available data and preliminary opinions of probable costs (preliminary budgets) where prepared for each sub-basin. Based on the preliminary budgets, the priority sub-basin improvements were grouped and phased to provide the proposed Capital Improvement Program. The following is a detailed explanation and summary of each component of the Capital Improvement Program.

Operation and Maintenance Plan

The intent of the operation and maintenance plan is to maintain the integrity of the storm water management system. This is accomplished by maintaining the existing storm water management system to provide the level of service that was originally designed. To achieve this goal, periodic observations, routine maintenance, and general improvements are required. This section of the overall report is not intended to provide a complete operation and maintenance manual, but to provide some of the key components and allow sufficient budget to implement these items. Unit costs associated with these items are taken from the Town's FY2011-2012 Stormwater Utility Budget and/ or existing contracts with service providers.

Street Sweeping: The Town should continue to invest resources in street sweeping. This activity cleans intake structures, reduces debris deposition within the pipe network, and contributes to the aesthetics of the Town. Generally, street sweeping is a positive maintenance activity that provides measurable benefits. Because pollutants such as hydrocarbons and metals adhere to dirt particles, removing this dirt from the street system will remove the pollutants before they are allowed to discharge into the Town's lakes.

Catch Basin Maintenance: Catch basin maintenance is a two-step process. This task includes cleaning the external grate to permit stormwater to enter the system and removing sand, silt and debris from the sedimentation chamber of the intake structure. The catch basins will be cleaned using mechanical and manual methods. In the majority of cases, catch basins will be cleaned/ maintained in response to observations following significant rain events. Upon making such observations, the Town should evaluate the general area and perform the required maintenance on the inlets and pipes within a sub-basin. Under normal conditions, catch basin maintenance is recommended every 12 months. However, because of foliage and other debris entering the system, the Town should consider conducting catch basin maintenance more frequently in some areas. By maintaining and updating the GIS database created as part of Stormwater Master Plan Update #1 on a regular basis, the Town will be able to track catch basin maintenance activities.

Pipe Flushing and Exfiltration Trench Cleaning: Pipe flushing and exfiltration trench cleaning are typically performed in conjunction with catch basin cleaning and are usually contracted out on an as-needed basis. During this activity, a high-pressure water hose is inserted into the pipe network. This process flushes debris into the catch basin where it can then be removed. Pipe flushing is required to be performed semi-annually by the Town's MS4 permit. By maintaining

and updating the GIS database created as part of Storm Water Master Plan Update #1 on a regular basis, the Town will be able to track pipe flushing and cleaning activities.

Swale Inspection, Maintenance and Restoration: Grassed swales and landscaped medians play an important role stormwater disposal. Consistent mowing, inspection and restoration of such features promote stormwater retention and efficient percolation. The Town maintains swales and medians within public roadways and parking lots. Individual business owners and residents are mandated through local codes to maintain their facilities. This activity should continue on a scheduled basis.

Canal Maintenance: Local canals play an important role stormwater disposal. The Town maintains the Golden Glades Canal on the south side of NW 170th Street, the Red Road Canal along the west side of NW 57th Avenue, the Graham Dairy Canal along the north side of I-75 and the Peter's Pike Canal along the west side of the southbound Palmetto Expressway while the South Florida Water Management District maintains the C-8 (Biscayne Canal).

Lake Inspection and Water Quality Monitoring: The Town is blessed with many lakes which give it its name. Consistent inspection and water quality monitoring procedures for the lakes should be established to ensure that they continue to provide both the flood protection and water quality treatment for which they were designed and to ensure the continued enjoyment of the lakes by Town residents.

Minor Repairs and Improvements: Maintaining the storm water collection system requires routine improvements and repairs. This task covers a significant spectrum of activities ranging from the repair of collapsed pipes and manholes to the replacements of catch basin grates. Maintenance activities are performed in response to an immediate problem using the best methods available. These tasks often cannot be foreseen or scheduled.

MS4 and CRS Program Activities: In order to remain in good standing in the National Flood Insurance Program's Community Rating System (CRS) and to comply with the Miami-Dade County Multiple Separate Storm Sewer System Permit (MS4) administered by the U.S. Environmental Protection Agency and Florida Department of Environmental Protection, the Town must perform certain activities on an annual basis. The preceding maintenance activities all qualify for credit under CRS and the MS4 Permit. In addition these maintenance activities, the Town is required to monitor water quality in the canals and prepare a pollutant loading study as part of the MS4 Permit. The Town pays an annual fee to the Miami-Dade County Department of Environmental Resource Management (DERM) for water quality monitoring in the canals. The Town will need to contract with an outside engineering firm to prepare the pollutant loading study. Both the MS4 Permit and the CRS Program require annual public outreach activities on water quality and the dangers associated with flooding such as mailings to residents and workshops for the general public, pesticide applicators and construction contractors.

WASD Utility Fee Collection: The Town has an agreement with the Miami-Dade County Water and Sewer Department (WASD) to include the Town's Storm Water Utility Fee on bills for water and sewer service within the Town. WASD bills customers on a quarterly basis and charges the Town a fee to collect the Town's Stormwater Utility Fee.

Administrative Expenses: There are two items noted in the budget to provide personnel to oversee the operation and maintenance of the stormwater system. These items are: "Professional Services" and "Stormwater Utility Administration". The Professional Services item will include the preparation and oversight of contracting services such as pipe and inlet cleaning and street sweeping. The Stormwater Utility Administration item includes general administration, clerical support, program planning and public awareness. Table 33 details the operations and maintenance budget.

Table 33: Stormwater Utility Operations and Maintenance Budget

Item	Description	Qty.	Units	Unit Price	Sub-total
1	Stormwater Utility Administration	1	L.S.	$179,000	**$179,000**
2	Clean Catch basins & Manholes - Annually	1,460	Ea.	$30	**$44,000**
3	Pipe Flushing - Every Two Years	12,000	L.F.	$1.50	**$18,000**
4	Exfiltration Trench Cleaning - Annually	60,000	L.F.	$1.50	**$90,000**
5	Street Sweeping and Litter Collection	1	L.S.	$71,000	**$71,000**
6	Canal Maintenance	1	L.S.	$170,000	**$170,000**
7	MS4 Permit Monitoring Fee to DERM	1	L.S.	$25,000	**$25,000**
8	NPDES - Computer Discharge Model	1	L.S.	$15,000	**$15,000**
9	Inspection Services	1	L.S.	$30,000	**$30,000**
10	WASD Utility Fee Collection	1	L.S.	$32,000	**$32,000**
11	Professional Services - Engineering and Legal	1	L.S.	$25,000	**$25,000**
12	Minor Repairs and Improvements	1	L.S.	$100,000	**$100,000**
13	Community Rating System - FEMA Program	1	L.S.	$20,000	**$20,000**
14	Public Outreach and Workshops for MS4 Permit	1	L.S.	$10,000	**$10,000**
15	QNIP Debt Service Payment	1	L.S.	$70,000	**$70,000**
TOTAL					**$900,000**

Stormwater Capital Projects

The Capital Improvement Program (CIP) is based on the findings of the analysis of the priority sub-basins. Recommended improvements to achieve the stated performance goals were identified for each sub-basin. The recommended improvements were quantified based on the available data and preliminary opinions of probable costs (preliminary budgets) were prepared for each basin. Prior to each individual project being implemented, professional services such as surveying, engineering, and permitting will be required and are included within the budgets. The budget figures were developed by reviewing recent costs from similar projects.

The following assumptions have been made in the formulation of the budgets for the drainage improvements:

- The budgets include the recommended improvements identified in the analysis of the ten priority sub-basins.
- Projects were grouped by sub-basin.
- The budgets include restoration of the roadway impacted by the proposed trenching, but do not include any additional roadway resurfacing.
- The budgets do not include any costs of obtaining drainage or construction easements.
- The budgets include a 10% allowance for mobilization and maintenance of traffic for each project.
- The budgets include a 20% contingency for each project.
- The budgets include a 15% allowance for surveying, engineering, permitting, and limited construction phase assistance (site observations).
- The budgets do not include any landscape costs for improvements or restoration.

The budgetary numbers are an opinion of probable construction costs in the current marketplace. Unit pricing for similar projects constructed by the Town of Miami Lakes within the last few years was used as the basis for the construction budgets. Based on the preliminary budgets, the priority sub-basin proposed improvements were grouped and phased to provide the capital improvement program.

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Table 34: Sub-Basin Prioritization Matrix

Priority Ranking	Sub-basin Name	Hydraulic Analysis	Observed Flooding	Repetitive Loss Prop.	Complaints	Roadway Condition	Traffic Volume	Total Score
1	West Lakes B	5	1	5	1	2	1	15
2	Lake Martha TH	1	4	1	4	4	1	15
3	West Lakes A	5	1	1	1	3	3	14
4	Lake Sarah	4	3	1	1	4	1	14
5	Royal Oaks C	5	1	1	3	3	1	14
6	Lake Martha SF	3	2	1	2	4	1	13
7	West Lakes D	5	1	1	3	2	1	13
8	Royal Oaks A	5	1	1	3	1	1	12
9	Royal Oaks B	4	1	1	2	3	1	12
10	West Lakes C	5	1	1	1	2	1	11
11	West Lakes E	5	1	1	1	2	1	11
12	Royal Oaks D	1	1	1	2	3	1	9

Table 34 shows the priority ranking for the capital improvement projects. Each project was given a score between 1 and 5 in each of the six categories: hydraulic analysis, observed flooding, repetitive loss properties, complaints, roadway condition and traffic volumes. The scores were then totaled and the projects were ranked from highest to lowest.

Hydraulic Analysis:

- All water quantity performance goals met by existing conditions = 1
- Water quantity performance goals failed in less than 1/3 of drainage areas in sub-basin = 2
- Water quantity performance goals failed in1/3 to 1/2 of drainage areas in sub-basin = 3
- Water quantity performance goals failed in 1/2 to all but one drainage area in sub-basin = 4
- Water quantity performance goals failed in all of the drainage areas in the sub-basin = 5

Observed Flooding:

- No flooding observed in sub-basin = 1
- Roadway flooding observed in less than 1/3 of drainage areas within sub-basin = 2
- Roadway flooding observed in 1/3 to 1/2 of drainage areas within sub-basin = 3
- Roadway flooding observed in 1/2 to all but one drainage area within sub-basin = 4
- Roadway flooding observed in all of the drainage areas within sub-basin = 5

Repetitive Loss Properties:

- No repetitive loss properties = 1
- One or two repetitive loss properties = 3
- Three or more repetitive loss properties = 5

Complaints:

- No complaints recorded = 1
- Complaints recorded for less than 1/3 of drainage areas within sub-basin = 2
- Complaints recorded for 1/3 to 1/2 of drainage areas within sub-basin = 3
- Complaints recorded for 1/2 to all but one drainage area within sub-basin = 4
- Complaints recorded for all drainage areas within the sub-basin = 5

Roadway Condition/ Traffic Volumes: The ratings for this category are based on the existing pavement condition as described in the Town's Road Assessment Report.

- Pavement conditions classified as Excellent in Roadway CIP = 1
- Pavement conditions classified as Excellent and Good in Roadway CIP = 2
- Pavement conditions classified rated as Good in Roadway CIP = 3
- Pavement conditions classified rated as Good and Fair in Roadway CIP = 4
- Pavement conditions classified rated as Fair in Roadway CIP = 5

Traffic Volumes: The ratings for this category are based on a percentage of roadway length classified as local, collector, or arterial roadways throughout the sub-basin according to the Town's Comprehensive Plan.

- The majority of roadways in sub-basin are local roadways = 1
- The majority of roadways in sub-basin are collector roadways = 3
- The majority of roadways in sub-basin are arterial roadways = 5

The proposed CIP summary and schedule of work is contained in Table 35. Further budget detail for each of the proposed CIP projects can be found in the Drainage Sub-Basin Analysis section of this report. Budget detail for the operations and maintenance component can be found in the preceding section. The projects are recommended to be coordinated with the roadway CIP project scheduling to insure that the drainage improvements are complete before or at the same time as the roadway improvements in the same area.

Table 35: Stormwater Capital Improvement Program Budget Summary

PROPOSED PROJECT	FY 11-12	FY 12-13	FY 13-14	FY 14-15	FY 15-16	FY 16-17	FY 17-18	FY 18-19	FY 19-20	FY 20-21	TOTAL
Downtown Improvement Project (Currently in Design)	$450,000	$452,500	$452,500								$1,355,000
Lake Patricia (Currently in Design)	$50,000	$550,000									$600,000
West Lakes A	$217,000		$518,000	$775,000							$1,510,000
West Lakes B	$86,000		$274,000	$410,000							$770,000
Lake Martha TH					$1,110,000						$1,110,000
Lake Sarah					$80,000	$640,000					$720,000
Royal Oaks C						$50,000	$340,000				$390,000
Lake Martha SF							$401,000	$889,000			$1,290,000
West Lakes D	$50,000						$110,000				$160,000
Royal Oaks A						$50,000			$370,000		$420,000
Royal Oaks B						$50,000			$370,000		$420,000
West Lakes C	$50,000									$370,000	$420,000
West Lakes E	$50,000									$220,000	$270,000
Royal Oaks D						$31,000				$249,000	$280,000
TOTAL	$953,000	$1,002,500	$1,244,500	$1,185,000	$1,190,000	$821,000	$851,000	$889,000	$740,000	$839,000	$9,715,000

The proposed CIP groups design for all West Lakes projects and schedules it to take place in FY11-12. This will allow the Town to meet Federal Emergency Management Agency (FEMA) grant application deadlines in early FY12-13. FEMA funding, if awarded would likely be available beginning FY13-14. The CIP distributes construction of the West Lakes projects as determined by the priority ranking, but the projects could be constructed simultaneously if grant funding is awarded. To date the Town has received grant funding and PTP funding for paving and drainage projects which has allowed implementation of the capital improvement program alongside the operation and maintenance program. However, if grant and/or PTP funding become less available in the future, the Town should consider assessing the current Stormwater Utility Rate for possible adjustments to allow the continued implementation of the Stormwater Capital Improvement Program as well as the operation and maintenance program.