TERTIARY STORMWATER SYSTEM IMPROVEMENT PLAN

FOR

BAYSHORE MSTU AREA

GradyMinor

Civil Engineers • Land Surveyors • Planners • Landscape Architects

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September, 2011

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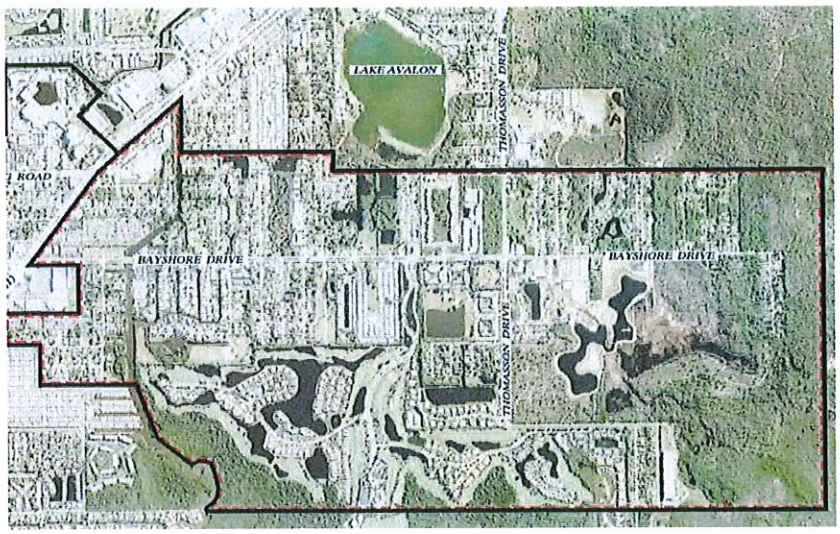
Section 1 – Executive Summary

This Tertiary System Improvement Plan (Plan) for the Bayshore area has been prepared by Q. Grady Minor & Associates, P.A. (GradyMinor). The purpose of this Plan was to evaluate the existing drainage within the Study area, recommend improvements to the system to alleviate flooding in the area, develop a tertiary stormwater system improvement plan and provide budget cost estimates.

The Study area is limited to the Bayshore Beautification Municipal Services Taxing Unit (MSTU) area that is not part of a permitted master water management system or mobile home complex or apartment complexes. The Bayshore MSTU is located in Sections 11, 13, 14 and 23, Township 50S, Range 25E and is bounded by Naples Bay to the west, US 41 on the North and about one-half mile to the east of Bayshore Drive to the east. This area is approximately 1,133 acres of the total 1,391 acres in the MSTU area.



As a part of previously authorized work an aerial survey was completed to obtain physical features such as roads, buildings, general elevations and contours. In conjunction with this aerial survey, field reconnaissance has been completed in the Study area. This field reconnaissance allowed for review of the general condition of the existing drainage patterns and system. An initial Neighborhood Meeting was held with residents of the area to receive input from them concerning flooding in the Study area. These actions have allowed this Plan to be developed.

Portions of the Study area are without an effective drainage system. In several locations, swales have been filled either intentionally or by long term sedimentation. Driveway culverts are a mix of materials and size. Many culverts have deteriorated and reached the end of their useful life. As a result, these portions of the Study area experiences localized flooding during small storm events and overall area flooding during larger storm events. Dependent on rainfall and duration, the severity of localized flooding can be extreme and long in duration. Other portions of the Study area are hydraulically connected to significant outfall systems (e.g., tidal canals, Lake Avalon outfall ditch to Haldeman Creek and the North-South outfall ditch south of Thomasson Drive). The areas connected to the canals tend to be less susceptible to rainfall-induced flooding.

Becca Avenue Street Flooding

In order to address the flooding in the Study area, this Plan has identified a series of recommended improvements. These recommendations are generally not listed by priority, however, to minimize disruption to areas a priority list has been developed also. These projects may combine certain Level One system improvements with Level Two and Level Three improvements. The first set of recommendations addresses those to the Level One system which consists of stormwater facilities which convey stormwater to a major outfall. Improvements are recommended at the following areas:

- North-South Outfall Ditch south of Thomasson Drive
- North-South Ditch north of Lake Avalon to Haldeman Creek
- Thomasson Drive drainage from North-South ditch crossing Bayshore Drive to approximately 100 feet east of entrance to Botanical Garden

The estimated cost for these improvements is approximately $1,700,000 to $2,000,000.

Additionally the Windstar Outfall Swale (internal to Windstar PUD) for offsite properties should be completed. This project would be the responsibility of the Windstar community as it is a condition of their water management permit.

The next level of priorities addresses the Level Two system consisting of those stormwater facilities which convey stormwater from Level Three facilities to the Level One system. Considering the limited number of Level Two systems, they have been included in the Level Three facility improvements.

Improvements are recommended at the following areas:

- Area 1 (streets within the Weeks and Becca Avenues area)
- Area 2 (streets within the Bayview and Lakeview Avenues area)
- Area 3 (streets within the Coco and Areca Avenues area)
- Area 4 (streets within the Van Buren Avenue (West) and Linda Drive area)
- Area 5 (streets within the Van Buren Avenue (East), Lunar Street and Jeepers Drive area)
- Area 6 (streets within the Cottage Grove, Republic Avenue, Woodside Avenue area)
- Area 7 (streets within the Pine Street and Bay Street area)
- Area 8 (streets within the Peters Avenue area)

The estimated cost for these improvements is approximately $4,000,000. Given that some of these Areas are not hydraulically connected to tidal canals (Areas 1, 4, 5, 6 and 8), it is recommended that priority be given to these areas for system improvements. In addition, the areas that have not historically been subject to repeated flooding events

should be given a lower priority (Areas 6 and 8). Thus, it is recommended that Areas 1, 4 and 5 be given greater priority.

Many of the proposed tertiary improvements can be completed as part of an on-going maintenance program not requiring any special permitting with exception of a Collier County Right-of-Way Permit. These improvements would include swale regrading and re-establishment and replacement of driveway culverts up to and including 15" diameter (or equivalent). These would include projects that are tertiary or secondary in nature. Additionally, if street landscaping or sidewalk improvements are made, drainage improvements can be and usually are by necessity part of those improvements.

Other improvements dependent on their scope may require No-Noticed and Noticed General Permits from SFWMD. These would include those generally associated with the tertiary system.

The Level One system projects will generally require a Modification to the existing Environmental Resource Permit issued for public projects in the area (Sugden Park or Bayshore Drive).

Potentially there are several sources of funding that could be utilized for these projects. It may be possible for minor swale regrading to be completed by Collier County Transportation as part of the on-going maintenance program. However, County policy generally does not fund projects that have limited benefit. These could apply to the identified projects in this Plan.

Possible other sources of funds include grants directly from the SFWMD for stormwater improvements. SFWMD generally requires an element of water quality

improvements to be included. There are also grants available from the State and Federal agencies for flood related projects.

Collier County grant funding is often tied to the local agency providing matching funds. Matching funds can come from limited Community Redevelopment Agency funds, the Municipal Services Taxing Unit (MSTU) or through other special assessment means. All sources of possible funding should be pursued. Additionally, Community Development Block Grant funding may become available from time to time to allow portions of the projects to be completed.

Once grant funding is secured or assured, construction plan preparation should occur for the portion of the system that is funded. Prior to completion of the plans, permit application shall be made to SFWMD for a construction permit.

Once these stormwater improvements are completed it is equally important that they be maintained. This would include regular visual inspection of stormwater facilities, culverts and ditches for obstruction and regular cleaning and regrading of drainage swales and structures.

The completion of these recommendations will go far in alleviating flooding within the Study area. During unusual or long duration storm events there may still be some flooding, but these improvements will reduce rain induced flooding levels and their duration.

Section 2 – Introduction

A. Authorization

Q. Grady Minor & Associates, P.A. (GradyMinor) was authorized by the Bayshore Beautification Municipal Services Taxing Unit (MSTU) on February 15, 2011, to provide a Tertiary System Stormwater Master Plan (Plan) for the MSTU Area that is not part of a master stormwater system or a system not previously permitted by SFWMD. Previously in November, 2008, the MSTU authorized aerial mapping (photogrametry). An overall map had been developed, then a series of larger scale maps (refer to Appendix B) were completed to assist in this Study and future drainage work in the area.

B. Purpose

The purpose of this Plan is to evaluate the conditions of the drainage system within the Study area, recommend improvements to the system to alleviate flooding within the Study area and develop a Tertiary Stormwater System Improvement Plan. These improvements will be prioritized to identify those most critical to the overall system. Budget cost estimates for the recommended improvements are to be prepared to facilitate funding for the improvements. A list of potential projects will be developed.

C. Scope of Services

The scope of services included the following:

- Conduct spot field surveying to obtain physical locations of culverts, drainage inlets and general drainage patters. This was supplemented by spot field topography.

- Conduct field reconnaissance to review general conditions of existing drainage and drainage structures. Pictures have been taken in various areas of the Study area.
- Participate in Neighborhood Meeting to obtain anecdotal information on flood prone areas and to gauge residents' reaction to the proposed improvements.
- Review SFWMD for permitted development in area.
- Review County DOT Kelly Road/Bayshore construction plans in regards to drainage.
- Prepare a Tertiary Stormwater System Improvement Plan outlining findings of the above tasks and engineering analysis.
- Preparation of budget cost estimate with recommended improvements.

Jeepers Drive Street Flooding

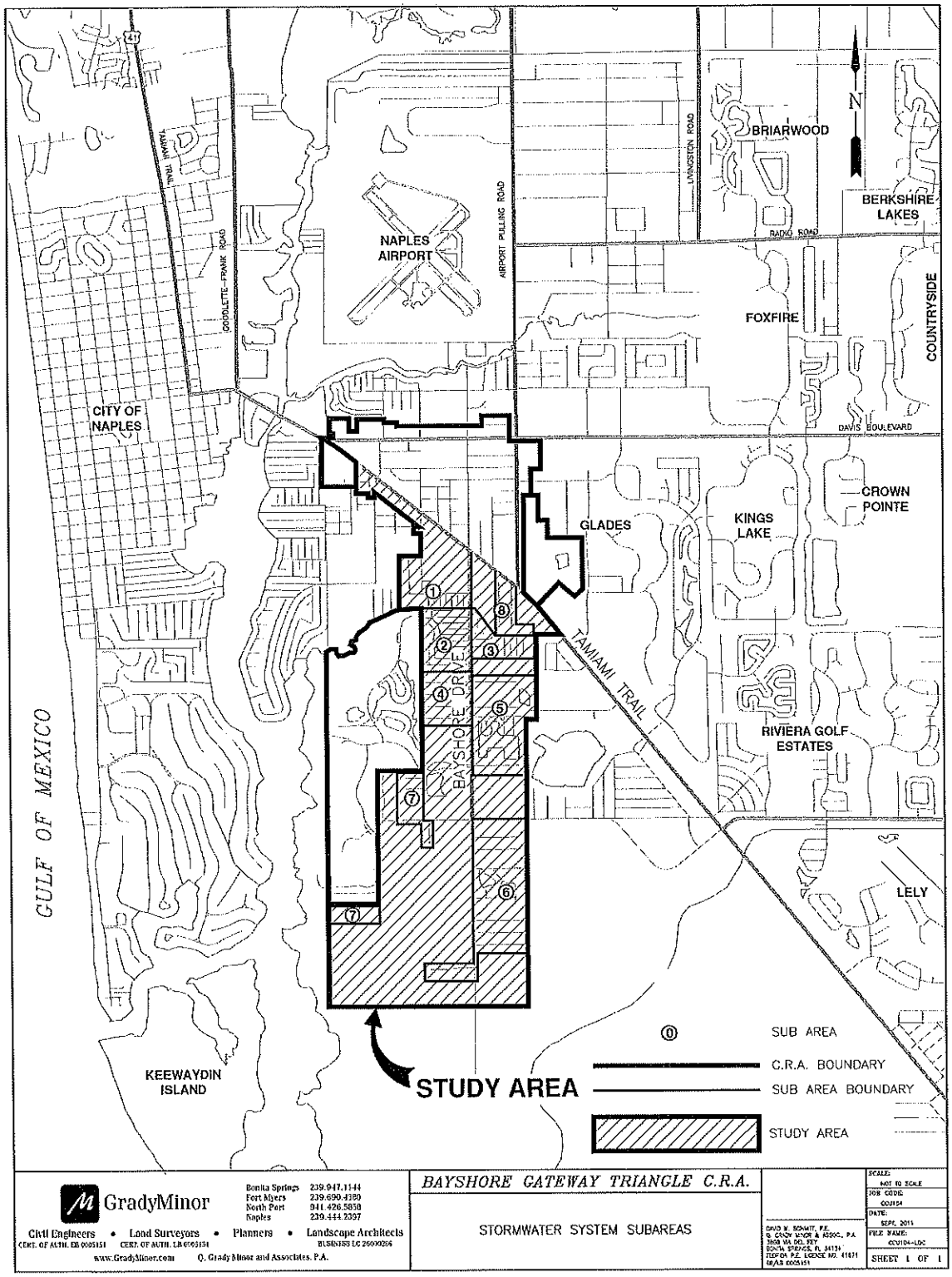
Section 3 – Description of Area

A. Bayshore Beautification Municipal Services Taxing Unit (MSTU)

The MSTU generally incorporates that portion of the CRA south of US 41 with exception of that immediately adjacent to US 41 to the west. A general location map (Map 1) with the boundary of the CRA and MSTU follows (Map 2). The MSTU is a funding mechanism for community members to create a special taxing district to make improvements to their neighborhood and/or community area through approval of the Board of County Commissioners.

B. Study area

The Study area generally incorporates the boundaries of the MSTU with several excluded areas which either already have SFWMD Water Management permits and Stormwater systems or will have them as a result of the future development. The total area of the MSTU is approximately 1,391 acres and the Study area is approximately 1,133 acres. There are several permitted developments with existing water management systems that are not included in the Study area. They include Windstar, Sugden Park, Botanical Place and the Botanical Gardens. There are also a few mobile home parks and apartment complexes that have existing water management features that have not been included in the Study area (Map 3). These projects however, have been evaluated as to their affect on the Study area. A significant portion of the Study area is comprised of single family residential dwellings. There are several businesses and commercial properties along Bayshore Drive.


GULF OF MEXICO
CITY OF NAPLES
KEEWAYDIN ISLAND
NAPLES AIRPORT
AIRPORT PULLING ROAD
GOODLETTE-FRANK ROAD
TAMIAMI TRAIL
LIVINGSTON ROAD
RADIO ROAD
BRIARWOOD
BERKSHIRE LAKES
FOXFIRE
COUNTRYSIDE
DAVIS BOULEVARD
CROWN POINTE
KINGS LAKE
GLADES
BAYSHORE DRIVE
RIVIERA GOLF ESTATES
LELY
N
STUDY AREA
SUB AREA
C.R.A. BOUNDARY
SUB AREA BOUNDARY
STUDY AREA
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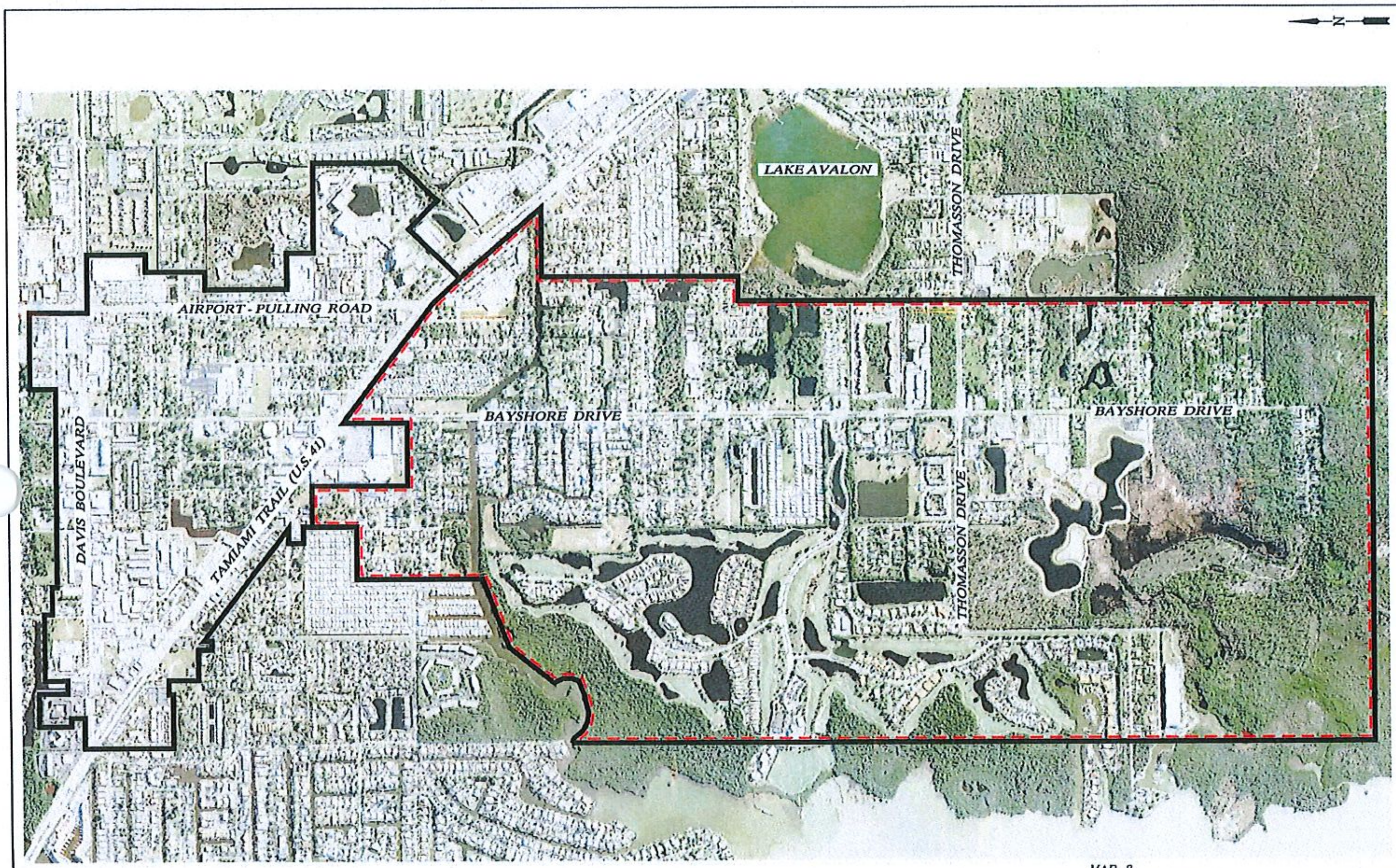
BAYSHORE GATEWAY TRIANGLE C.R.A.
STORMWATER SYSTEM SUBAREAS
SCALE: NOT TO SCALE
JOB CODE: CCU104
DATE: SEPT. 2011
FILE NAME: CCU104-LOC
SHEET 1 OF 1



MAP 2

LEGEND

- C.R.A. BOUNDARY
- M.S.T.U. BOUNDARY

Revision	Date	Description	By

DESIGNED BY: D.W.S.
DRAWN BY: D.W.S.
APPROVED: D.W.S.
JOB CODE: CCU104
SCALE: NOT TO SCALE

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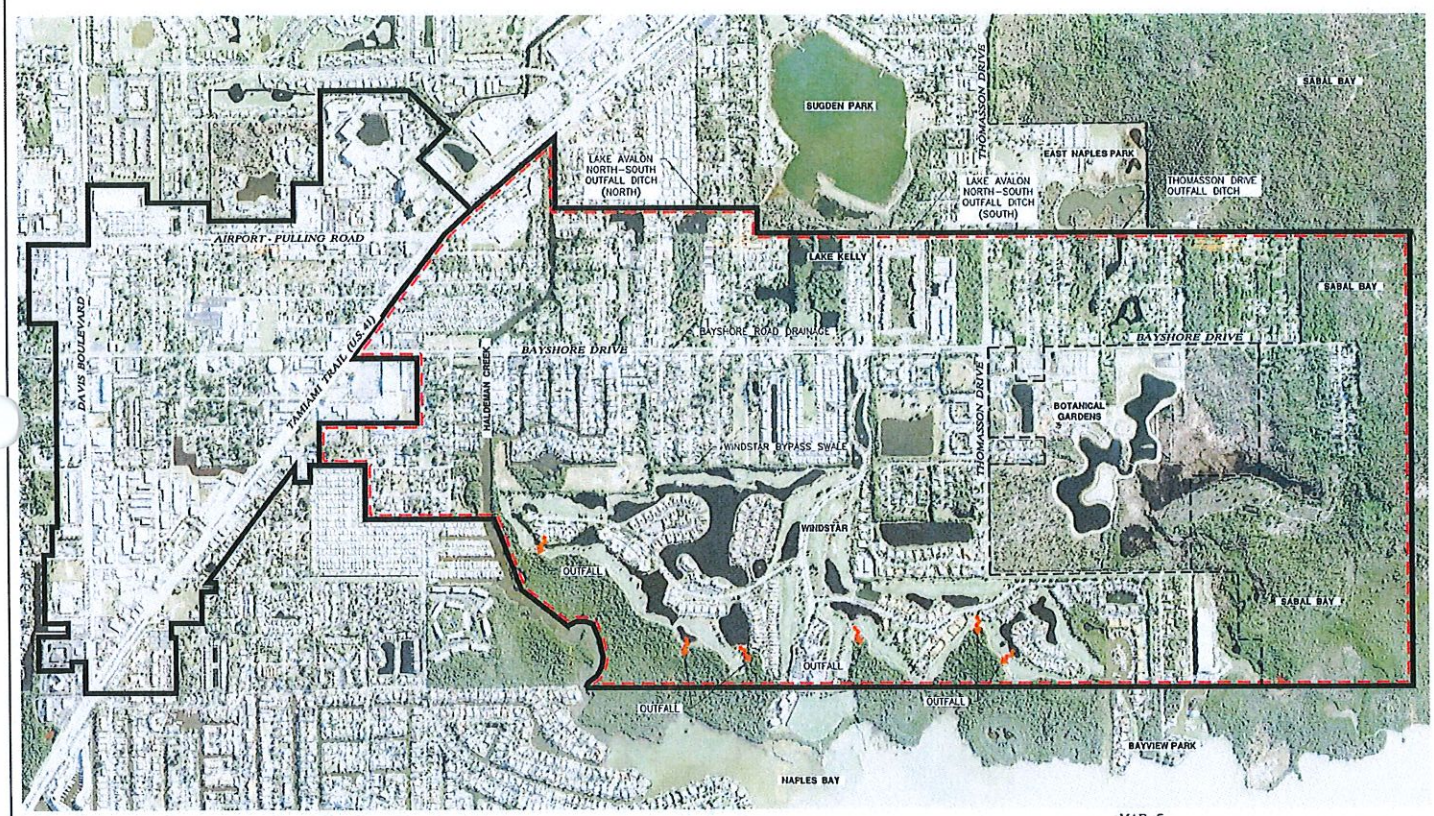
BAYSHORE M.S.T.U. AREA

TERTIARY STORMWATER SYSTEM IMPROVEMENT PLAN
COMMUNITY REDEVELOPMENT AGENCY and
M.S.T.U. BOUNDARIES

MUNICIPALITY: COLLIER COUNTY
DATE: JUNE, 2011
FILE NAME: CCU104-LOCATION
SHEET 1 OF 1



MAP 5

LEGEND

C.R.A. BOUNDARY

M.S.T.U. BOUNDARY

Revision	Date	Description	By

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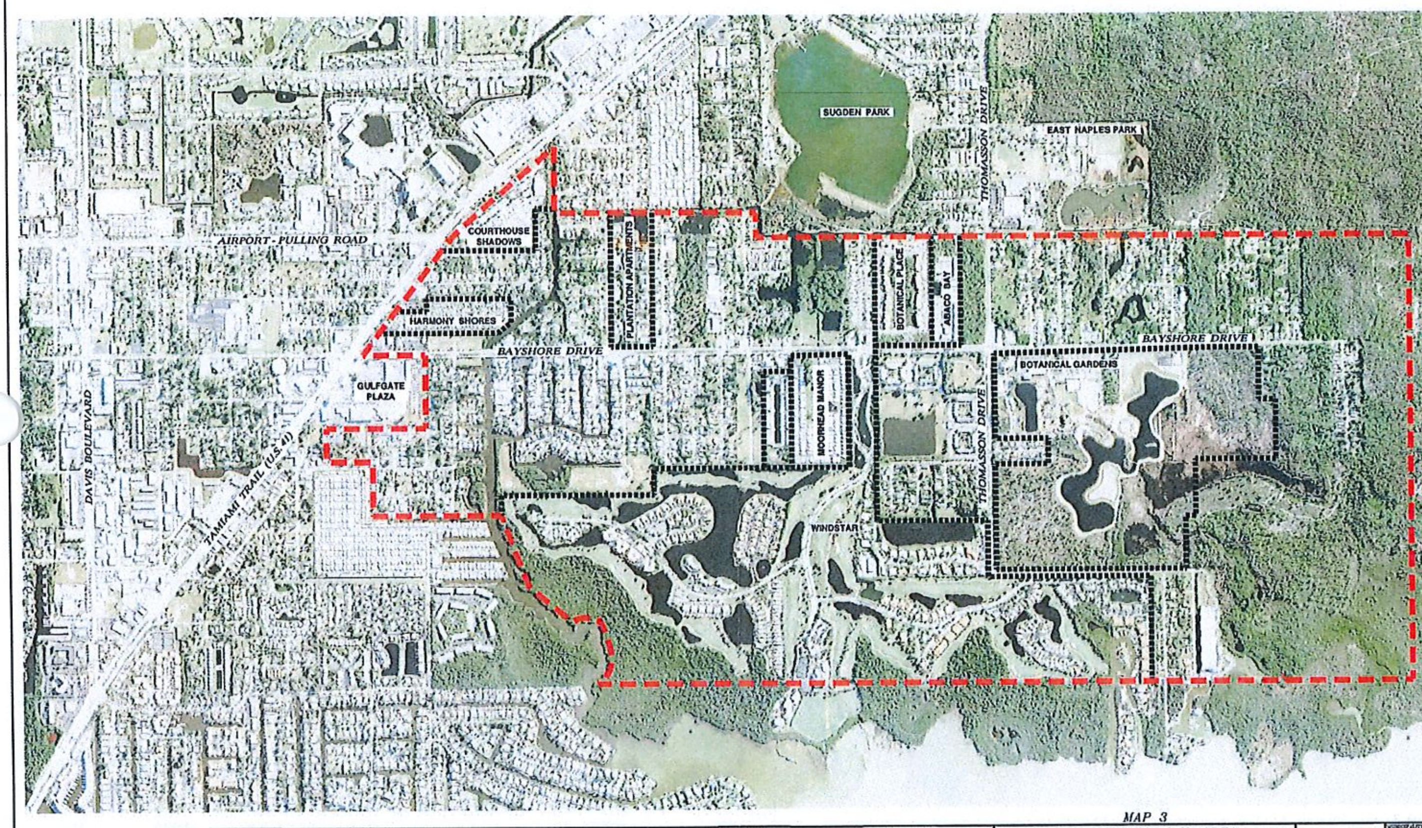
BAYSHORE M.S.T.U. AREA

TERTIARY STORMWATER SYSTEM IMPROVEMENT PLAN
MAJOR DRAINAGE FEATURES

SCALE: NOT TO SCALE

DATE: JUNE, 2011

SHEET 1 OF 1



MAP 3

LEGEND

M.S.T.U. BOUNDARY

DRAINAGE BOUNDARY

Revision	Date	Description	By

DESIGNED BY: D.H.S.
DRAWN BY: E.N.N.
APPROVED: D.H.S.
JOB CODE: CCV104
SCALE: NOT TO SCALE

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BAYSHORE M.S.T.U. AREA

TERTIARY STORMWATER SYSTEM IMPROVEMENT PLAN
AREAS WITH EXISTING WATER MANAGEMENT PERMITS/SYSTEM

MUNICIPALITY: COLLIER COUNTY
DATE: JUNE, 2011
FILE NAME: CCV104-LOCATION
SHEET 1 OF 1

Stormwater drainage within the Study area is generally limited in conveyance to roadside swales and culverts. The general flow of stormwater is from north and east towards the west. However, localized drainage patterns differ. When Bayshore Drive was improved in the 1980s, allowance was made to collect limited runoff from adjacent roadways to be conveyed through its drainage system. Drainage east of Bayshore Drive generally flows eastward to collector swales and canals that flows north from Thomasson to Haldeman Creek and south from Thomasson to Sabal Bay.

For a significant portion of the streets in the Study area, generally stormwater drainage from homesite and roadside areas is limited in conveyance.

C. Utility Service Providers

Utility service within the Study area is provided by the following:

Potable Water: City of Naples Utilities

Wastewater: Collier County Utilities

Stormwater: Collier County Growth Management

Electric: Florida Power and Light Co.

Telephone: Century Link

Cable TV: Comcast

Given the age of the neighborhood, the electric, telephone and cable TV utilities are generally located overhead on poles within the right of way or rear yard easements. Some underground utilities do exist.

The potable water mains within the Study area vary in size from 2-in to 16-in. The City's records on location, sizes and pipe material types are limited. Generally, the

mains are located within the street rights of way and are located 2-3 feet from edge of pavement. These mains are generally buried 30 to 36" below the ground surface. The City has indicated that many of the mains are constructed of asbestos cement material, a commonly used pipe material at the time of development of this area. Though this material is generally considered safe to transmit potable water, it is very fragile when handled and requires due care when working in its vicinity. It is anticipated that future stormwater improvements will have conflicts with these mains.

Wastewater facilities include gravity sewer main with services extended to each lot. The gravity sewer mains flow to several wastewater pump stations in the area. The wastewater from these wastewater pump stations is then pumped through force mains to master pump stations located along Bayshore Drive and Thomasson.

The gravity sewer mains are located within the rights of way and generally in the middle of the road pavement. However, there are locations where the main is located off the edge of pavement and could be in conflict with any open swale system. The force mains generally paralleled the gravity sewer mains. Some conflicts with these force mains can be anticipated.

All side street rights of way within the Study area are 60 ft in width. The 60-ft width allows room for roadside drainage swales, road pavement and other utilities to

share the right of way. Additionally, some of the subdivisions have platted drainage easements that would allow for additional drainage connections to outfall facilities.

Storter Ave. (water main (flagged blue) locations in close proximity to culverts and swales)

Section 4 – Major Drainage Features and Previous Water Management Permitting

A. Major Drainage Features

Development within the Study area occurred primarily in the 1950s and 1960s prior to regulation on stormwater management and prior to advancements in the understanding of hydrology in this region. The resulting development within the Study area consisted of platted rights of way with lots on either side with minimal street drainage for conveyance, but with no storm water quality or attenuation being provided. In spite of these limitations on hydraulic design, the development that did occur did rely on general knowledge of providing conveyance for large rain events. Over the years this resulted in the construction of several conveyance ditches and the use of existing field ditches. Listed below are the significant drainage features in the Study area and a description of their function:

- **Sugden Lake (aka Lake Avalon) North-South Outfall Ditch**

This ditch provides the major outfall conveyance for the streets located on the east side of Bayshore Drive from Thomasson Drive north to Areca Ave. This ditch is generally located in a 30-ft platted drainage easement. The ditch ranges from about 15 ft wide on its north and middle segments to up to 30 ft wide in the lower segments. In 2008, Collier County Stormwater Management improved the southern end of the ditch from Botanical Place to Thomasson Drive by cleaning and restoring it to its original design. This improved hydraulic capacity and allowed the ability for the ditch to flow both south and north depending on flow stage conditions.

North-South Ditch

- **Thomasson Drive Outfall Ditch**

The Sugden Lake outfall ditch continues south under Thomasson Drive via a 30-in culvert. At that point, the ditch is enclosed by twin 30-in culvert pipes and conveyed south along the west side of Avalon Elementary School. At the southern school property line, it becomes on open ditch and continues south along the west side of the East Naples Community Park. The Park discharges into the ditch as well as the lake in the Republic Avenue residential area via a long overflow weir. The ditch continues south along the east end of Pine Tree, Andrews and Woodside Avenues. South of Woodside, the ditch becomes undefined and flows overland to the south.

Thomasson Drive Outfall Ditch adjacent to East Naples Community Park

Overflow weir at Republic Ave area lake

- **Windstar Bypass (Offsite Flow Conveyance) Swale**

This swale, more thoroughly described in the next section, acts as the major outfall conveyance for the streets located west of Bayshore Drive from Moorehead Manor north to Barrett Ave.

- **Haldeman Creek and Contributory Canals**

Haldeman Creek was formerly a naturally meandering waterway. As development occurred in this area, the Creek banks have been re-shaped and hardened. Its function as a drainageway has remained intact. Haldeman Creek has a drainage area that extends well north of US 41, and it accepts runoff via ditches, swales and overland flow from about two-thirds of the Study area. This includes flows from the northern portion of the Sugden Lake outfall ditch. The Creek outfalls near the center of Naples Bay through tidal areas on the east side of Royal Harbor.

Haldeman Creek has been subject to sedimentation and Collier County has been regularly monitoring and maintaining the drainage way by dredging. This dredging also assists with maintaining boating access.

Haldeman Creek, because of its proximity to Naples Bay, is subject to tidal conditions within the bay. Naples Bay normally has two high and two low tides per day with a tidal fluctuation of about 2 feet. These tidal conditions are reflected by daily fluctuation of Haldeman Creek within the Study area. Because the Creek meanders in its run to the bay, the tidal fluctuations on the upper reaches of the Creek are not as significant as those in the lower reaches. These fluctuations, however, do play a role in the drainage capacity of the Study area.

The mean high tide of Haldeman Creek in the Study area range front elevation 2.5 to 3.0 ft NAVD (with elevation 0.0 NAVD being approximately mean sea level). In addition, abnormally high tides (from full moon or persistent onshore winds) can also elevate the tide levels significantly. These high tides can also be influenced by storm events discharging into the Creek. As indicated elsewhere in this Study, there is anecdotal information that indicates that many flood events in the Study area occur during high tide events and specially those occurring during tropical storm events.

- **Lake Kelly**

This lake abuts the north-south ditch on its western side and is hydraulically connected to the ditch. The lake serves to drain parts of the adjacent neighborhood off Lunar St. In 1999, Collier County obtained a permit (Application No. 990219-5) to modify the ditch in that area and to connect the ditch and lake. Lake Kelly provides

additional stormwater storage capacity for the surrounding area and discharge conveyance.

B. South Florida Water Management District Permits

There are several water management systems that have been permitted by the South Florida Water Management District (SFWMD) both within the Study area and in the vicinity of the Study area that affect drainage within the area. These systems include the following:

- Windstar (SFWMD Permit No. 11-0210-S)
- Bayshore Drive (fka Kelly Road) 4-lane Improvements (SFWMD Permit No. 84-00055-S)
- Sabal Bay (SFWMD Permit No. 11-02003-P-06)
- Sugden Park (SFWMD Permit No. 11-00638-S)
- East Naples Community Park (SFWMD Permit No. 11-00398-S)
- Naples Botanical Gardens (SFWMD Permit No. 11-02285-P)

Windstar: This project was originally permitted in 1980 by SFWMD. It had also been reviewed by Collier County and it's Water Management Board at the time. The 320-ac golf course and marina community was developed between Naples Bay and the existing residential streets west of Bayshore Drive and north of Thomasson Drive. The areas east and south of Windstar were originally developed in the 1950's and 1960's. The streets west of Bayshore Drive (Van Buren, Barrett, Storter and Linda) generally drain to the west through the Windstar property by way of ditch networks to Naples Bay. As well, the streets north of Thomasson Drive in the Sunset Homes subdivision (Sunset, Lake and

Florida Avenues) generally drain to the north and west through Windstar property. The Windstar water management plans accounted for this offsite flow contribution and identified a conveyance way.

For those streets west of Bayshore Drive, a collector swale was constructed at the west end of the streets within a 40-ft drainage easement in the Windstar project. This swale is separate from the overall system that serves the Windstar property. It was designed to drain to the north along the west ends of the streets to a series of small ponds before final discharge to tidal waters. The plan's ditch cross section indicates a 5-ft bottom width with 4:1 sideslopes to grade with a total ditch top width of 20± ft.

For those streets north of Thomasson Drive in the Sunset Homes subdivision, the plans showed drainage from the existing Lake Spencer (Sunset Homes storage lake) to be collected and conveyed directly through the Windstar project's water management system. That particular part of the system serving this area discharges to Naples Bay.

Windstar Bypass Swale

Bayshore Drive 4-lane Improvements: The four-laning of Kelly Road (now Bayshore Drive) was permitted by SFWMD in 1984. The roadway improvements (including stormwater management) were from US 41 south to Thomasson Drive. The design included exfiltration treatment of road stormwater runoff. This treatment system was designed to be in-line with the use of trenches at many of the curb inlet structures along the road. The stormwater discharge from the system is not limited by control structures but allows for direct discharge to Haldeman Creek on both the north and south banks at the bridge crossing. The conveyance system was designed with 36-in through 54-in equivalent sized pipes from the north and south, respectively.

Bayshore Drive does provide for portions of several side streets to drain into the roadway system as it had before the improvements were made. These connections typically consist of one or two inlets on the side street connecting to the roadway drainage system with a 15" or greater culvert. The contributory area was identified on the drainage maps included in the roadway improvement plan. Generally the contributory areas were limited to 25 to 35% of the overall street. Streets provided with these connections included: Storter Avenue, Barrett Avenue (East and West), Lakeview Drive, Areca Avenue, Coco Avenue, Linda Drive and Van Buren Avenue.

Sabal Bay: This large project is approximately 2200 acres in size is located generally south of Thomasson Drive and east of Bayshore Drive (with a small portion on the west side of Bayshore Drive at the south end of Hamilton Avenue) and extending east to US 41.

The Sabal Bay project itself is outside of the Study area, but portions immediately abut the area. The Sabal Bay project has been in the permitting process for numerous years and there is currently no development occurring. Collier County has issued a PUD approval for the project (Ordinance 2005-0059), and in 2006 the SFWMD issued their stromwater permit for the project. The conceptual water management plans identify a proposed "Avalon Canal Extension". This is the extension of the North-South ditch referenced elsewhere in the report. The design of the outfall ditch depicts a 87-ft drainage easement with a 24-ft wide ditch bottom. This proposed easement runs from approximately Colonial Drive south to Woodside Avenue.

Sugden Park: This project was permitted by SFWMD in 1990. It consists of a 60-acre manmade lake and about 60 acres of developed park area. Collier County Parks and Recreation manages the park. The lake historically receives runoff from about 140 acres of adjoining area. Discharge from the project is at the northwest corner of the site to the North-South ditch (Lake Avalon) at the east end of Lunar St. This ditch conveys stormwater to the north to Haldeman Creek. Although the park is located in close proximity to the Study area, the Study area does not contribute flow to the lake and discharge to the north-south ditch from the park is controlled at a pre-development rate, as determined through SFWMD permitting.

North-South Ditch Adjacent to Sugden Park

East Naples Community Park: This project was permitted by SFWMD in 1987 and has subsequently been modified through the years. It consists of a 5-acre lake and about 49 acres of developed park area. Collier County Parks and Recreation manages the park. Discharge from the project is at the west side of the lake to the north-south (Lake Avalon) ditch. This ditch conveys stormwater south to the Sabal Bay area. Although the park is located in close proximity to the Study area, the Study area does not contribute flow to the park and discharge to the north-south ditch is controlled at a pre-development rate, as determined through SFWMD permitting.

Naples Botanical Garden: This project was permitted by SFWMD in 2004 and modified in 2008. It consists of a series of lakes over a 171-acre site. The site is within the overall drainage Study area boundaries. Generally the project does not affect the Study area as all outside flow bypasses the site. Water management improvements

associated with the bypassing of flows included enhancing the swales along Thomasson Drive and Bayshore Drive along the project's frontage. These improvements provide the hydraulic capacity for the bypass conveyance of stormwater around the Botanical Garden.

This project does directly affect one street within the Study area. Palmetto Court is surrounded by the project on 3 sides. The water management plans depict a perimeter berm around this subdivision which allows for rear yard lot drainage to drain to the swales and then to Thomasson Dr.

Other Drainage Systems: There are also other drainage systems that have been constructed to serve specific areas that do not significantly affect drainage within the Study area and have been excluded from review:

- Moorehead Manor (It discharges directly to Bayshore Drive Stormwater system and the Windstar bypass swale. It is reported that localized flooding occurs in this development).
- Harmony Shores MHP (discharges directly to Haldeman Creek)
- Gulfgate Plaza (discharges to Bayshore Drive system)
- Plantation Apartments (discharges to onsite lake then controlled discharge to north-south swale on east side of project)
- Botanical Place (discharges to North-South ditch at pre-development discharge rates)
- Abaco Bay Apartments (discharges to North-South ditch at pre-development discharge rates.

C. County LIDAR

In 2002, Collier County obtained advanced Light Detection and Ranging (LIDAR) imaging for the County. LIDAR is a remote sensing system used to collect general topographic data. This data has been compiled for the entire County. The data for the Study area indicated general conformance with the drainage basin divisions indicated above and also the recent photogrametric survey completed. This LIDAR data, though useful in providing general trends, is not detailed enough for design of improvements. A copy of this map can be found in Appendix H.

D. Federal Emergency Management Agency

The Federal Emergency Management Agency (FEMA) publishes Maps identifying predicted 100 year flood levels for coastal storm events (tropical systems with tidal flooding only, it does not account for rainfall induced flooding). These Maps were last updated in November 2005. The Map for the Study area (Map 12021C0582G) shows mostly a Base Flood (100 Year) elevation of 7.0 NAVD (8.3 NGVD) on the north end of the Study area and up to elevation 9.0 NAVD (10.3 NGVD) on the south end of the Study area. A copy of these maps can be found in Appendix F.

E. Storm Surge Mapping

The National Hurricane Center publishes a Storm Surge Map. This mapping identifies potential storm surge of up to 7 feet in the Study area for a Category 2 storm. A copy of this map can be found in Appendix G.

Section 5 – Existing Conditions

A. Mapping of Area

To assist in determining existing conditions in the Study area, aerial mapping was completed in January 2009 in conjunction with overflights for the Gateway Triangle Area. This mapping provided a high resolution color photograph of the Study area along with topographic information. This topographic information included spot elevations along with elevation contours that identifies low elevation areas and general drainage patterns.

These aerial maps are included in Appendix B of this Plan. These maps will assist in development of proposed recommendations contained in this Plan and in further design. All elevation data on these maps is presented in National American Vertical Datum (NAVD) 1988. (To convert to National Geodetic Vertical Datum (NGVD) add 1.3 (±) feet to the NAVD Elevation).

This aerial information indicated that generally the terrain for each individual street is relatively flat. For many streets there are only a few inches in elevation difference from one end to the other. There are discontinuities in the slope on individual streets with pockets of lower areas. This mapping confirmed reports from the residents concerning areas of localized flooding due to these pockets of low areas. The mapping also confirms that Bayshore Drive had been constructed higher than adjoining streets, thereby creating a man-made drainage divide. Additional information on the specific findings is present in subsequent sections of this Study.

B. Site Investigation

A street by street field reconnaissance of the Study area has been performed. The intent of reconnaissance was to visually review the observations made from the photogrametry, review the conditions of the existing drainage system, to observe the interaction of the major stormwater outfalls with the street drainage, to review potential stormwater conveyance routes and to understand the existing condition limitations of possible improvements to the system.

The site investigation generally found the following deficiencies:

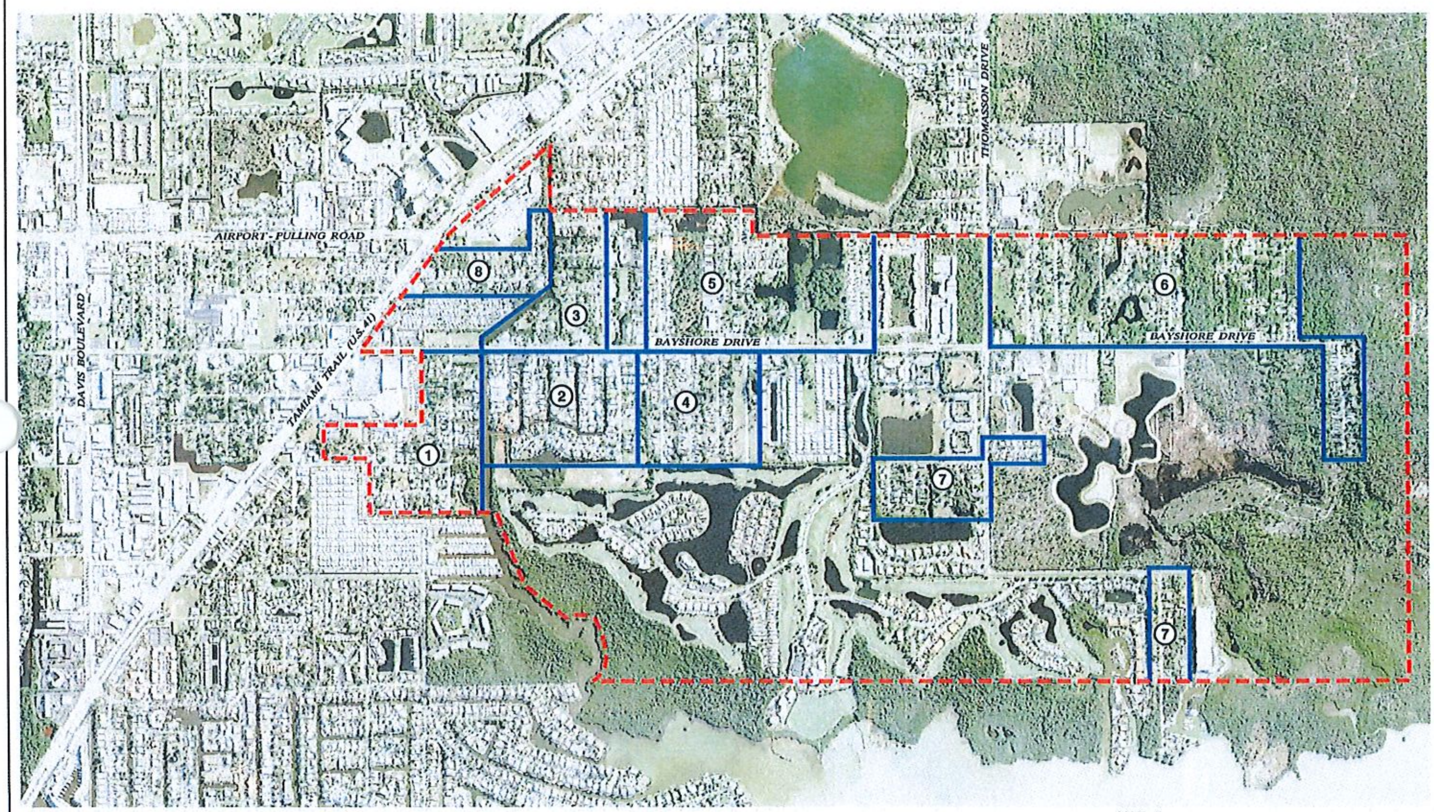
(Specifics are given in subsequent sections)

- There is a lack of a side street swale system for the majority of the streets. Over roadway flow is required to move stormwater.
- Where there is a drainage system, it is generally in poor condition lacking maintenance. Swale regrading has been completed in some areas but connection to outfall conveyance routes is only partially established.
- Many culvert pipes are undersized, filled or absent.
- Many swales have been filled either intentionally or over time due to sediment build up. In some areas drainage pipes were installed in swales to assist in moving stormwater, however no provisions have been made for continuity of drainage.
- Portions of the overall stormwater system have been hydraulically isolated due to Bayshore Drive widening and filling of drainage culverts overtime, and creation of high spots, intentionally or by nature.

- Many drainage systems have reduced capacity due to partial or complete failure/deterioration of culvert and improper invert elevation.

Table 1 contains the findings on a street by street basis. A more detailed synopsis of observations along with photographs for each street may be found in Appendix A. The drainage areas have been categorized by their geographical area and/or to which conveyance outfall they drain to. Additionally the drainage facilities within the Study area have been placed in three categories for their ability to convey stormwater: Level One facilities are described as those that serve as major stormwater facilities serving a large area and many land owners. Level Two facilities are similar to Level One but with a more limited geographical impact. Level Three facilities are those that are local and do receive flow from other Level Three facilities. The Study area contains mostly Level Three facilities.

Van Buren Avenue (typical conditions for area include inadequate swales and small diameter or no culverts)



MAP 4

LEGEND

- SUBAREAS
- M.S.T.U. BOUNDARY
- ① SUB AREAS

Revision	Date	Description	By

SCALE: NOT TO SCALE

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BAYSHORE M.S.T.U. AREA

TERTIARY STORMWATER SYSTEM IMPROVEMENT PLAN SUBAREAS

MUNICIPALITY: COLLIER COUNTY

DATE: JUNE, 2011

SHEET 1 OF 1

STREET OBSERVATIONS SUMMAY

Table 1

AREA	STREET	PROJECTED CONVEYANCE CAPACITY (LEVEL)	CULVERT CONDITION	SWALE CONDITION	DRIVEWAY CONDITION	CONFLICTS*	NOTES
1	WEEKS AVE	THREE	FAIR	FAIR TO POOR	GOOD	NARROW ROW	POTENTIAL CONNECTION TO BAYSHORE DRAINAGE
	BECCA AVE	THREE	POOR	POOR	POOR	MINIMAL	
	PINE ST (N)	TWO	FAIR TO POOR	POOR	FAIR	MINIMAL	LIMITED BY TIDAL EVENTS
	ARBUTUS ST	THREE	FAIR TO POOR	FAIR TO POOR	FAIR TO GOOD	NARROW ROW	LIMITED BY TIDAL EVENTS
	MANGROVE ST	THREE	FAIR TO POOR	FAIR TO POOR	FAIR TO GOOD	MINIMAL	
2	BAYVIEW DR	THREE	NONE	NONE	FAIR	MINIMAL	
	SHOREVIEW DR	THREE	NONE	NONE	FAIR	MINIMAL	
	GULFVIEW DR	THREE	NONE	NONE	FAIR	MINIMAL	
	RIVERVIEW DR	THREE	NONE	NONE	FAIR	MINIMAL	
	LAKEVIEW DR	THREE	FAIR TO POOR	FAIR TO POOR	FAIR TO GOOD	MINIMAL TO NARROW ROW	POSSIBLE ADDITIONAL OUTFALL TO CANAL
3	COCO AVE	THREE	FAIR TO POOR	FAIR TO POOR	FAIR TO POOR	MINIMAL	DRAINAGE CONNECTION TO NORTH-SOUTH DITCH NEEDED
	ARECA AVE	THREE	POOR	FAIR TO POOR	FAIR TO POOR	MINIMAL	
	CAPTAINS CV	THREE	NONE	FAIR	FAIR	MINIMAL	
	CANAL ST	THREE	NONE	FAIR	POOR	MINIMAL	NO DRAINAGE SYSTEM
	BASIN ST	THREE	NONE	FAIR	POOR	MINIMAL	NO DRAINAGE SYSTEM
	SABAL CT	THREE	NONE	FAIR	POOR	MINIMAL	NO DRAINAGE SYSTEM
4	VAN BUREN AVE (WEST)	THREE	POOR	POOR	FAIR TO POOR	MINIMAL	DRAINAGE TO BAYSHORE HINDERED
	BARRETT AVE (WEST)	THREE	FAIR	FAIR	FAIR	MINIMAL	DRAINAGE CONNECTION TO WINDSTAR NEEDED
	STORTER AVE	THREE	FAIR TO POOR	FAIR TO POOR	FAIR	MINIMAL	DRAINAGE CONNECTION TO WEST NEEDED
	LINDA DR	THREE	GOOD	FAIR	FAIR	MINIMAL	OUTFALL TO BAYSHORE
5	BARRETT AVE (EAST)	THREE	FAIR TO POOR	FAIR TO POOR	FAIR	TIGHT ROW	DRAINAGE CONNECTION TO EAST NEEDED
	VAN BUREN (EAST)	THREE	FAIR	FAIR TO P	GOOD	MINIMAL	LIMITED OUTFALL TO NORTH-SOUTH
	LUNAR ST	THREE	POOR	POOR	POOR	SOME TREES	DRAINAGE CONNECTION TO BAYSHORE AND EASTNORTH/SOUTH
	FULL MOON CT	THREE	NONE	POOR	FAIR	SOME TREES	NO DEFINED OUTFALL
	NEW MOON CT	THREE	NONE	POOR	FAIR	MINIMAL	
	HARVEST CT	THREE	NONE	POOR	FAIR	MINIMAL	
	JEEPERS DR	THREE	FAIR TO POOR	FAIR TO POOR	FAIR TO POOR	MINIMAL	NEED CONNECTION TO THE NORTH-SOUTH

*Apparent conflicts (i.e., above ground pipes, trees, etc). Does not include any water main or sewer main conflicts.
Culvert condition also includes inadequate size and elevation.

DRAIN CANAL

STREET OBSERVATIONS SUMMAY

AREA	STREET	PROJECTED CONVEYANCE CAPACITY	CULVERT CONDITION	SWALE CONDITION	DRIVEWAY CONDITION	CONFLICTS*	NOTES
	COTTAGE GROVE AVE	THREE	FAIR	FAIR	GOOD	SIDEWALK ON NORTH SIDE	NEEDS CONNECTIONS TO NORTH-SOUTH DITCH
	KAREN DR	THREE	N/A	N/A	N/A	N/A	STREET PROVIDED WITH VALLEY GUTTERED. NEEDS BETTER CONNECTION TO NORTH-SOUTH DITCH
	REPUBLIC DR	THREE	NONE	POOR	GOOD	MINIMAL	
	LIBERTY LN	THREE	FAIR	POOR	FAIR	SOME TREES	
6	CONSTITUTION DR	THREE	FAIR	POOR	FAIR	MINIMAL	NEED CONNECTION TO LAKE
	COLONIAL DR	THREE	FAIR	POOR	FAIR	MINIMAL	NEED CONNECTION TO LAKE
	PINE TREE DR	THREE	FAIR	FAIR/POOR	FAIR/GOOD	MINIMAL	NEED CONNECTION TO NORTH -SOUTH SWALE
	ANDREWS AVE	THREE	FAIR	FAIR/POOR	FAIR/GOOD	MINIMAL	NEED CONNECTION TO NORTH -SOUTH SWALE
	WOODSIDE AVE	THREE	FAIR	FAIR/POOR	FAIR/GOOD	MINIMAL	NEED CONNECTION TO NORTH -SOUTH SWALE
	HOLLY AVE	THREE	NONE	NONE	POOR	NUMEROUS	FLAT AND LOW
	PALMETTO CT	THREE	NONE	NONE	FAIR	MINIMAL	APPEARS TO BE WELL DRAINED
7	PINE ST (S)	TWO	FAIR	POOR	FAIR/POOR	MINIMAL	NEEDS CONTINUOUS SWALE
	FLORIDA AVE	THREE	FAIR/POOR	FAIR/POOR	FAIR/POOR	MINIMAL	NEEDS CONTINOUS SWALE EAST TO TIE TO PINE STREET
	LAKE AVE	THREE	FAIR/POOR	FAIR/POOR	FAIR/POOR	MINIMAL	NEEDS CONTINOUS SWALE EAST TO TIE TO PINE STREET
	SUNSET AVE	THREE	FAIR/POOR	FAIR/POOR	FAIR/POOR	MINIMAL	NEEDS CONTINOUS SWALE EAST TO TIE TO PINE STREET
7	BAY ST	THREE	GOOD	EXCELLENT	GOOD	MINIMAL	NO NEED OF IMPROVEMENT
	DANFORD ST	THREE	FAIR	FAIR	FAIR	NUMEROUS	TIGHT RIGHT OF WAY
	GORDON ST	THREE	POOR	FAIR	POOR	NUMEROUS	CULVERT REPLACEMENT NEEDED
8	PETERS AVE	THREE	FAIR	GOOD	FAIR	MINIMAL	CULVERT REPLACEMENT NEEDED
	COLLEE CT	THREE	POOR	FAIR	FAIR	NUMEROUS	CULVERT REPLACEMENT NEEDED

*Apparent conflicts (i.e., above ground pipes, trees, etc). Does not include any water main or sewer main conflicts.
Culvert condition also includes inadequate size and elevation.

STREET OBSERVATIONS SUMMAY

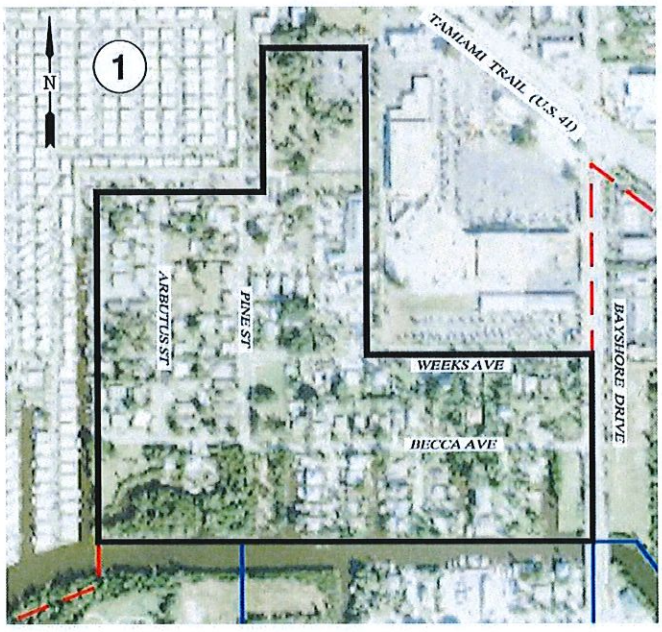
ADDITIONAL OBSERVATIONS

AREA	CONVEYANCE	PROJECTED CONVEYANCE CAPACITY	CULVERT CONDITION	SWALE CONDITION	DRIVEWAY CONDITION	CONFLICTS*	NOTES
A	NORTH-SOUTH DITCH (north of Sugden to Haldeman Creek)	ONE	N/A	GOOD. NARROWS ON NORTH END WITH STEEP SLOPES	N/A	LIMITED EASEMENT AREA	THE DITCH IS IN GOOD CONDITION BUT NARROWS SIGNFICANTLY ON THE NORTH END.
B	NORTH-SOUTH DITCH (south of Sugden to Thomasson)	ONE	N/A	EXCELLENT.	N/A	NONE	RECENTLY RECONSTRCUTED FROM SUGDEN SOUTH TO THOMASSON IN PAST 10 YEARS
C	NORTH-SOUTH Ditch (south of Thomasson)	ONE	EXCELLENT AT SCOOL PROPERTY	POOR.	N/A	NONE	SWALE TERMINATES TO GRADE SOUTH OF WOODSIDE AVE
D	THOMASSON DRIVE	TWO	GOOD	GOOD	GOOD	SOME UNDERGROUND UTILITIES PRESENT	RECENT IMPROVEMENTS AS PART OF THE BOTANICAL GARDENS PROVIDED ADDTL CAPACITY. MISSING CONNECTION FROM N-SORTH-SSOUTH DITCH. AT EAST SIDE
E	WINDSTAR BYPASS SWALE	TWO	NONE OBSERVED	POOR	N/A	GOLF COURSE	SWALE HAS NOT BEEN MAINTAINED AND CONNECTION TO OUTFALL DOES NOT APPEAR TO EXIST

*Apparent conflicts (i.e., above ground pipes, trees, etc). Does not include any water main or sewer main conflicts.
Culvert condition also includes inadequate size and elevation.

The Study area has been separated into eight (8) sub-areas based on geography, the drainage area they are located in and the level of drainage improvements existing (see Map 4). Each of these are not mutually exclusive (i.e., certain adjacent streets were constructed in similar periods with similar attention to drainage provided). The areas consisted of the following:

- **Area 1**: This area consists of the streets connecting to Becca and Weeks Avenues. This area drains to the tidal canals connected to Haldeman Creek with a portion of the area draining to the Bayshore Drive drainage system by way of inlets located near the intersections. This area is low in elevation, especially at the west end of Becca Avenue where the outfall for a significant portion of the area is located. The northern end of Pine Street nearer to US 41 is higher and does not appear to have significant drainage problems. The area is lacking swales and culverts and those present are in poor condition. The outfall is tidally influenced and has limited conveyance because of its size.



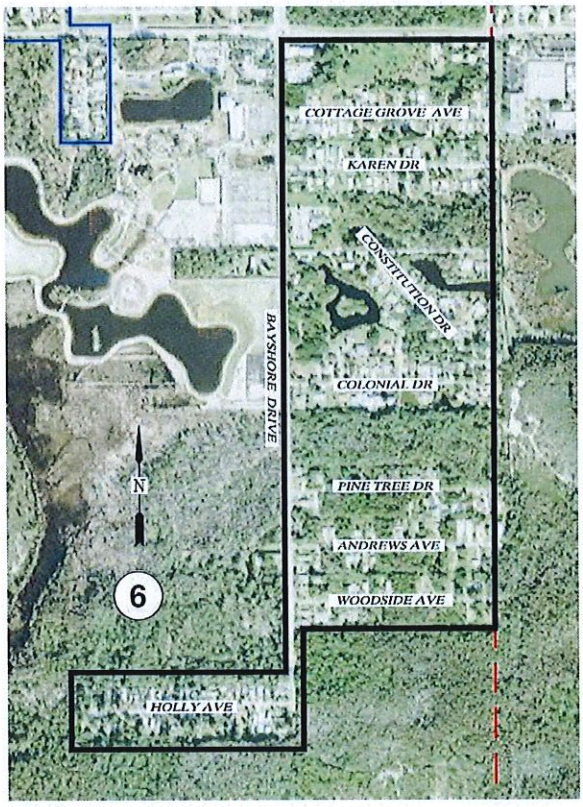
- **Area 2**: This area consists of the streets connecting to the west side of Bayshore Drive from Bayview Drive south to Lakeview Drive in the Gulf Shores subdivision. These streets ultimately drain to Haldeman Creek either through the tidally influenced canals or through the Bayshore Drive drainage system by way of inlets located near the intersections. Some of the streets have additional inlets that allow drainage to the canals. Generally, most of the area lacks an overall local drainage system. Riverview Avenue has no defined outfall to either the canals or Bayshore Drive. Minor street flooding is evident with small rain events. Significant rain-induced flooding is reduced because of the connection to tidally influenced canals allowing quicker discharge and the relatively higher lot elevations compared to high tide elevations.

- **Area 3**: This area consists of Coco and Areca Avenues on the east side of Bayshore Dive. and the streets connecting to these two avenues. This area is part of the Sabal Shores subdivision. This area ultimately drains to Haldeman Creek either through the tidally influenced canals or to the Bayshore Drive drainage system by way of inlets located near the intersection of Areca Avenue. There is not a defined drainage swale system in the area and the drainage is generally by overland flow. The adjoining streets of Captains Cove, Basin Street and Canal Street. are adjacent to tidal canals and the Lake Avalon outfall ditch, however there are no direct outfalls to provide for discharge to them. Minor street flooding is evident with smaller rain events. Significant rain-induced flooding is reduced because of the overland flow connection to tidally influenced canals allowing quicker discharge and the relatively higher lot elevations compared to high tide elevation.

- **Area 4**: This area consists of the streets connecting to the west side of Bayshore Drive from Barrett Avenue (West) south to Linda Drive. A portion of each street is intended to drain to the Bayshore Drive drainage system by way of inlets located near the intersection. The western portion of the streets drain to the Windstar by-pass swale. Ultimately this area drains to Haldeman Creek. Several of the streets have significant swale systems but overall the swale and culvert system is in poor condition. Connections to the Windstar bypass swale are deteriorated and need to be improved. An inspection of the bypass swale revealed it to be in a fair to poorly maintained condition. The by-pass swale was over grown with exotic vegetation and vegetative debris. In several locations especially at the north end, the swale cross-section has not been maintained. More significantly, the swale terminates prior to its connection at the north to tidal lakes and it's outfall to a tidal creek. (This is conveyance is identified in the water management permits.) This connection is not evident and appears to not have been constructed.

- **Area 5**: This area consists of Lunar Street and it's connecting streets (Lake Kelly Unit 2), Barrett Avenue (East), Van Buren Avenue (East) and Jeepers Drive on the east side of Bayshore Drive. This area ultimately drains to Haldeman Creek either through the north-south outfall ditch (Lake Avalon) or to the Bayshore Drive drainage system by way of inlets located near the intersections. There is not a defined drainage swale system within the Lunar Street area and drainage generally is by overland flow. Lake Kelly is adjacent to the Lunar Street area, however direct connections from the area to the lake are by overland flow. The existing swale culvert system on Jeepers Drive is filled and poorly maintained with varying culvert invert elevations. Additionally, connections to the North-South outfall are either overland or constricted and in need of improvement.

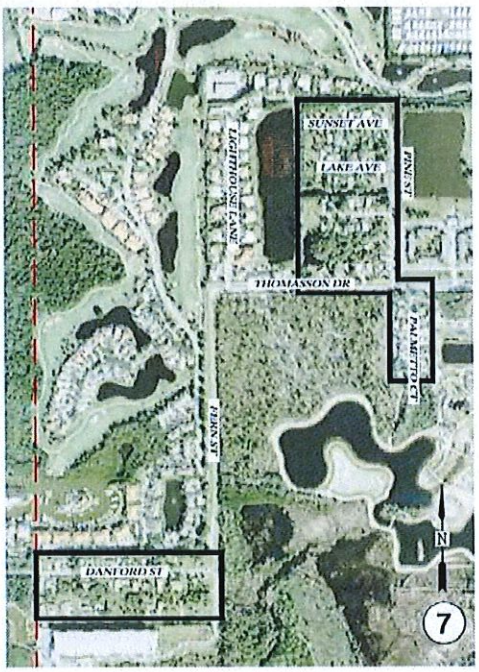
Area 6: This area consists of the streets south of Thomasson Drive along Bayshore Drive. These streets drain both east and west. Drainage to the west is to the Bayshore Drive roadside swale. Drainage to the east is to the North-South outfall ditch (Lake Avalon). Both of these conveyances flow south to low, undeveloped areas. The north-south ditch and Bayshore Drive roadside swale loses its identity south of Woodside Avenue. LIDAR imagery indicates that there may be remnants of a swale that connect to tidal areas to the south, but ground reconnaissance indicates that it is heavily choked with vegetation. Holly Avenue has neither swales nor an outfall, and the roadway is at a low elevation. The Colonial/Republic Drive area has lake area relative to the drainage area it serves; however, there are few direct drainage connections to the two lakes, and these two large lakes do not appear to be interconnected. The eastern lake has a hardened overflow weir that runs along its eastern lake bank that overflows to the north south outfall.



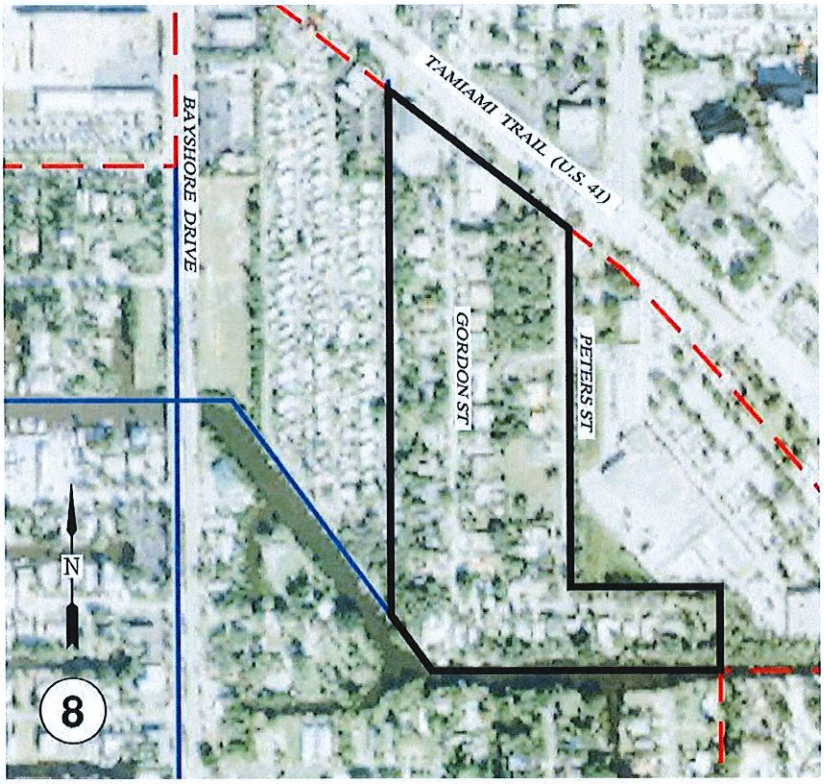
- **Area 7**: This area consists of the streets west of Bayshore Drive along Thomasson Drive and Hamilton Avenue. The streets north of Thomasson Drive, Pine Street, Sunset Avenue, Lake Avenue and Florida Avenue drain into finger canals within the area through the Windstar Stormwater system and into a lake within the Windstar development. This lake ultimately discharges to Naples Bay. The swale and culverts in this area are in poor condition and lacking direct connections to the finger canals.

  Palmetto Court is located south of Thomasson Drive and is relatively high in elevation. Although there are no swales and culverts on this street, its high elevation and the perimeter swale that was constructed as part of the Botanical Garden provides adequate flood protection.

  Bay Street and Danford Street are located at the west end of Hamilton Avenue. The drainage system along Bay Street is in excellent condition. The drainage system along Danford Street is in good condition. Both of these streets discharge directly to Naples Bay.



- **Area 8**: This area is located south of US 41, east of Bayshore Drive and west of Airport Road and consists of Peters Avenue, Collee Court and Gordon Street. This area is located north of Haldeman Creek and discharges to the Creek through one identifiable outfall. Gordon Street has limited right of way width. It does have a shallow swale and culvert system on both sides of the street, though it is in poor condition. This system is connected to a 24-in outfall pipe at the west end of Collee Court. Peters Avenue has a defined swale and culvert system that connects at the west end of Collee Court outfall. The Peters Avenue swales are generally maintained. The system in this area appears to function adequately.



C. Neighborhood Meeting

On March 21, 2011, a neighborhood meeting was held at East Naples Community Park to reach out to residents within the Study area to provide anecdotal information on flooding histories in the area. The meeting involved a short presentation on the proposed Study, an overview of the aerial exhibits and an invitation to complete a questionnaire on flooding and to point out flooding areas on aerial exhibits. The results of the questionnaire and discussion with residents generally confirmed the field observations and topographic data. The meeting also identified additional areas that required follow up site observations.

During the meeting, the residents were allowed to review aerial exhibits of the Study area that that they were familiar with. The residents then placed colored dots representing the severity of flooding they have experienced in the area. Red dots represented home flooding, orange dots for street flooding and blue dots for standing water. The information generally confirmed the results of the questionnaire, mapping and field observations. A copy of this map can be found in the Appendix.

Most of the attendees were long-time residents of the Study area and had intimate knowledge of both drainage issues within close proximity of their residences and generally of the area. Based upon these discussions, the flooding within the area appears to be in isolated areas and generally in those areas with no defined connection to an outfall. Those areas directly discharging to a tidal canal had experienced, according to

the attendees, only infrequent flooding of the streets during extreme tidal events and during tropical storm events. Occasional nuisance flooding did occur in those areas but was limited to localized areas. Residents reported that there was prolonged standing water on roads and lots in the area during Tropical Storm Fay in 2008. Tropical storm Fay was an unusual event and coupled prolonged heavy rains with of storm surge moving up Haldeman Creek from Naples Bay.

Other areas of flooding are the end of streets where outfall connections have filled in or were never constructed.

Bayview Drive localized flooding

Follow-up field surveying and observations confirmed that several streets had blocked or no outfall to the conveyance systems.

Standing water in Study area

The information supplied by the residents in the neighborhood meeting did warrant a follow up of the affected areas described above. Additional field observation confirmed the drainage patterns and facilities in the affected areas had potential for flooding. In particular, the inlets along Bayshore Drive at intersecting street appear to have been set too high to allow drainage to them.

Section 6 – Recommendations and Priorities

A. General

Generally improvements are needed to the stormwater facilities throughout the Study area. These improvements range from minor swale regrading with isolated culvert replacement to complete re-construction of swales with new culverts for the Phase Two and Three conveyance system. The improvements for the Phase One conveyances would range from improving connections to improvements to conveyance ways. The recommended improvements are presented based upon their importance to the overall system and generally represent their priority. This ranking however does not preclude certain system improvements being made in conjunction with other projects or improvements planned in the MSTU or CRA. This is especially true with Level Three improvement when the systems discharge directly into Level Two and Level One systems that require no additional improvement. The incorporation of drainage work in conjunction with other planned projects will help in reducing overall impacts in the Study area.

B. Level One System Improvements

The Level One system consists of improving the major outfall conveyance systems as practical within the confines of existing or potential easement areas. The proposed Level One system improvements include the following:

- North-South Ditch south of Thomasson Drive: This ditch has limited conveyance capacity south of Colonial Drive and turns to overland flow south of Woodside Avenue. Because the ditch acts as the primary conveyance for areas south of

Thomasson Drive and east of Bayshore Drive and also as a "pop-off" for the northern extent of the ditch, this ditch should be reconstructed and built to its southern terminus within Sabal Bay tidal areas. (A portion of flow from this area also goes to the Bayshore roadside drainage conveyance.) This ditch was proposed and permitted as part of the Sabal Bay project by the SFWMD and Corps of Engineers and is required to be constructed as part of Sabal Bay. However, there are no definitive plans as to when this project may be constructed. In order to allow the ditch to be constructed independently from the Sabal Bay project, it will be necessary to modify the Sabal Bay permit and permit it as its own project. As part of the project re-permitting, wetland impacts would have to be mitigated. This process has been successfully accomplished for portions of the Lely Area Stormwater Improvement Project within the Sabal Bay limits. The property owner has cooperated with Collier County in the past in this regard and is conceptually receptive to such an effort for this ditch conveyance, according to recent conversation with owner representatives.

Thomasson Drive Drainage and North/South Lake Avalon/Sugden Outfall Ditch Interconnect: There is the opportunity to provide an interconnect between the existing North/South Lake Avalon/Sugden Outfall Ditch and the existing outfall ditch on Thomasson Drive. The Thomasson ditch currently exists on the north side of Thomasson from Bayshore Drive west to Palmetto Court. At Palmetto Court it crosses to the south side of Thomasson and continues west to Hamilton Avenue. It then continues south along the east side of Hamilton Avenue where it

eventually discharges at Bay Street and the Sabal Bay project. An interconnection with this drainage way with the North/South ditch on Thomasson near the Avalon Elementary School is recommended. There are several underground utilities in the Thomasson Drive corridor, however, it appears that the north side would have sufficient width for an interconnect. This interconnection would need to be a culvert.

- North/South Lake Avalon/Sugden Outfall Ditch (from Lunar St north to Haldeman Creek): Currently from Lunar Street north to its discharge at Haldeman Creek this ditch is limited in its conveyance due to its current construction and limited easements of 30 foot width. It is recommended that additional drainage easements be obtained if possible to allow improved capacity. It would be possible to increase capacity with the existing easement by "hardening" the existing ditch by vertical side walls constructed of gabin or other similar materials. The ditch is limited in width by existing easements of record. However, the narrow width of the channel is not sufficient for the area it drains. Unless additional easement area can be obtained, which would be difficult given the existing development adjacent to the ditch, it is recommended that gabion stabilization be used to allow a more vertical side slope. This would allow the channel to be widened to it's maximum section within the existing easements.

- Windstar Bypass Swale: Currently portions of this swale are not maintained per permit plan requirements. There is overgrowth as well as eroded banks.

Additionally, the outfall has not been completed to tidal waters. It is recommended that the maintenance of the swale become more regular. The swale should be regraded per plan where erosion has occurred. Additionally, either the outfall be constructed per plan or an alternative outfall be constructed (such as through the Windstar stormwater system or through adjoining property through an easement).

C. Level Two System Improvements

The Level Two system consists of the combined roadside swale/culvert conveyance that moves stormwater from the Level Three facilities to outfalls (Level One). The proposed Level Two system improvements include the following:

- Pine Street (north of Weeks Avenue): The swale and culvert system along Pine Street needs to be reconstructed between Weeks Avenue to Becca Avenue to provide for an effective outfall conveyance to the tidal canals south of Becca Avenue. A system of 18" culverts with an 18-24" depth swale is recommended on both sides of Pine Street.

- Pine Street (north of Thomasson Drive): The swale and culvert system along Pine Street north of Thomasson Drive needs to be reconstructed to connect the existing side street drainage to the finger channels for offsite conveyance through Windstar. A system consisting of 18-24" culverts and 18-24" depth swales is

recommended on the west side of the street. This work may be combined with the Level Three improvements to minimize impacts to the overall area.

D. Level Three System Improvements

The Level Three systems consist of the roadside swale/culvert combination that convey stormwater to Level Two facilities or directly to offsite conveyances. A significant portion of the facilities in the Level Three system need to be reconstructed and improved because of inadequate culvert sizes, inadequate connections to outfalls and missing or filled swales. These Level Three system improvements are identified by drainage area. The following stormwater improvements are recommended:

AREA 1

- **Weeks Avenue**: Existing swales on both sides are generally in fair to poor condition and should be regraded. The culverts generally vary in size and are undersized (do not meet County Right-of-Way standards of a minimum 15" equivalent pipe size) and should be replaced with 15-18" culverts. Limited right of way and existing utility facilities will provide design challenges at the west end at Pine Street. The south side needs to be graded to allow discharge to the Bayshore Drive drainage connection along with necessary backflow prevention to minimize tidal effects. Additional stormwater storage may be available on the north side of the street in the wide right of way in that area.

Weeks Avenue

- **Becca Avenue**: Existing swales in both sides are generally in poor condition and should be regraded. The culverts should be replaced with 15" culverts. Connection to the Bayshore Drive drainage should be made on the south side and maintained on the north side. Additional stormwater storage may be available at the vacant lots at the intersection of Pine and Becca. Additional connections to the tidal canals south of Becca would be beneficial but easements across the single family lots would be needed.

Improved swale and culvert example

- **Pine, Arbutus and Mangrove Streets**: Existing swales and culverts on all streets are generally in fair to poor condition and should be regraded and culverts replaced. The culverts should be replaced with 15" or equivalent culvert

  The estimated cost of the Area 1 improvements is $850,000 to $900,000.

AREA 2

- **Bayview, Shoreview and Gulfview Avenues**: Existing mid-block stormwater inlets provide outfall to tidal canals. The existing swales are effectively filled. Currently they are ineffective but with regrading these inlets will be more effective in low intensity rain events. There is an existing inlet at the terminus of Gulfview which would benefit from regrading of the swales. Connections to Bayshore Drive Stormwater system are recommended.

- **Riverview Drive**: Existing swales and culverts are on Riverview Drive, but discharge is limited to the Bayshore Drive stormwater system. Because of this limited discharge, it is recommended that additional drainage easements for a connection to Tidal Waters be obtained. Shallow swales should be graded and culverts provided at driveways to allow drainage to proposed outfalls.

- **Lakeview Drive**: Because there is no effective outfall on the north end of the street, the existing shallow swales shall be regraded and culverts replaced (15" minimum) to drain to the south. Swales should be graded and culverts provided at driveways to allow drainage on the east-west portion of the street. Because the tidal canal abuts the right of way at the end of the street, connection to the canal should be made there. The existing inlet at that location may be utilized for the connection.

  The estimated cost of the Area 2 improvements is $510,000 to $550,000.

AREA 3

- **Coco and Areca Avenues**: Existing swales and culverts on these streets are generally in fair to poor condition and swales should be regraded and culverts replaced. The culverts should be replaced with 15" or equal culverts and minimum18" depth swales. Because no direct outfall to tidal canals is provided on either street, connection should be made to the finger canals through existing drainage easements on Areca Avenue. Additionally, the existing overland flow

connection to the Bayshore Drive drainage system should be fully established by way of direct connection to existing inlet.

- **Basin Street, Canal Street and Captains Cove**: Existing swales and culverts on these streets are generally in fair to poor condition. The existing swales should be regraded and culverts replaced. The culverts should be replaced with 15" equivalent culverts and minimum 18" depth swales. Because no direct outfall to tidal canals is provided on these streets, the swales should be graded to Areca Avenue where connection should be made to allow discharge to the finger canals through the Areca system.

  The estimated cost of the Area 3 improvements is $310,000 to $360,000.

AREA 4

- **Barrett Avenue (West), Van Buren Avenue (West), Storter Avenue and Linda Drive**: Existing swales and culverts on these streets are generally in fair to poor condition and swales should be regraded and culverts replaced. The culverts should be replaced with 15" or equivalent culverts with minimum 18" depth swales. Connections to the Windstar bypass swale, located at the west end of each of these street, should be re-established. Additionally, connections to the Bayshore Drive drainage system should be made at the existing inlets near the intersections. Barrett Avenue does not currently have any connection to the Bayshore Drive System. Connection should be made at this location.

  The estimated cost of the Area 4 improvements is $500,000 to $580,000.

AREA 5

- **Barrett Avenue (East) and Van Buren Avenue (East)**: Existing swales and culverts on these streets are generally in poor condition and swales should be regraded and culverts replaced. The culverts should be replaced with 15" or equivalent culverts and minimum 18" depth swales. Connections to the North/South Sugden Lake outfall ditch, located at the east end of each of these streets, should be re-established with a positive outfall. Current outfalls are undefined and they have filled. Additionally, connections to the Bayshore Drive drainage system should be more fully established at the existing inlets near the intersections.
- **Lunar Street, Full Moon Court, Half Moon Court and Harvest Court**: Because there are no existing swales and culverts on these streets, they should be constructed along with connections to Lake Kelly and the North/South Lake Sugden outfall ditch. The swales, because of constricted rights of way in certain locations, should be 12-15" in depth.

  The estimated cost of the Area 5 improvements is $750,000 to $800,000.

AREA 6

- **Cottage Grove Avenue and Karen Drive**: Existing valley gutter on Cottage Grove Avenue and existing swales and culverts on Karen Drive are generally in good condition and do not need to be improved. However, connections to the

south of Thomossan Drive outfall ditch needs to be re-established for positive discharge.

- **Republic Drive, Constitution Drive, Liberty Lane, and Colonial Drive**: Existing swales and culverts on these streets are generally in poor condition or non-existent and swales should be regraded and culverts replaced. The culverts should be replaced with 15" or equivalent culverts and minimum 18" depth swales. Connections between the existing lakes within this area should be made to provide additional storage capacity and discharge from the lake. There are platted drainage easements that will allow the connections. Connection from the roadside drainage system should be made to east lake, which discharges by an overflow weir into the south of Thomossan Drive outfall ditch. These connection locations include the east end of Republic Dr, and through additional platted drainage easements along Constitution Drive.

- **Pine Tree Drive, Andrews Avenue and Woodside Avenue**: Generally the development of the lots on the Streets has been limited. The existing swales and culverts on the street are in fair condition. The proposed reconstruction of the Bayshore Drive drainage indicates that discharge from the Bayshore Drive will be directed east along these streets. It is recommended that the existing culverts be replaced as needed and swales be regraded. The outfalls at the east end of these streets to the existing and proposed improved south of Thomasson Drive outfall ditch should be improved to allow discharge.

- **Holly Avenue**: The existing Holly Avenue area is very low in elevation and currently drains by sheet flow. It appears to pick up sheet flow from the area north of Holly then crosses Holly Avenue to the south. To reduce flooding of the street it will be necessary to direct flow around the area by use of perimeter berms and swales. Then a roadside ditch system should be constructed.

  The estimated cost of the Area 6 improvements is $680,000 to $730,000.

AREA 7

- **Florida Avenue, Lake Avenue and Sunset Avenue**: Existing swales and culverts on these streets are generally in poor condition and swales should be regraded and culverts replaced. The culverts should be replaced with 15" or equivalent culverts and 18" depth swales. Connection of the street drainage to the improved drainage system on Pine Street will allow discharge to the existing finger canals and ultimately offsite through Windstar.

  The estimated cost of the Area 7 improvements is $230,000 to $260,000.

AREA 8

- **Peters Avenue, Gordon Street and Collee Court**: Existing swales and culverts on these streets are generally in fair to poor condition. Though they are functioning, they should be regraded and replaced. The culverts should be replaced with 15" culverts and the swales should be shaped to match available right of way.

  The estimated cost of the Area 8 improvements is $350,000 to $400,000.

F. Maintenance Program

Essential to the long term ability of Stormwater facilities to provide Stormwater attenuation and water quality treatment (as is often designed in systems) and to convey runoff, a regular maintenance program is required. Without a regular maintenance program, the system will fail to operate as intended when swales fill and culverts become blocked with debris and sediment. A hindrance to maintenance of existing Stormwater systems is often how they were constructed. Often Stormwater systems evolve with inconsistency during their construction. There are many cases in which a variety of culvert materials and sizes are utilized and pipe flow line inverts are set at non-uniform elevations. This in turn causes swales to vary in size and elevation. This can accelerate swales and culverts filling. Upon completion of the recommended improvements these inconsistencies will be eliminated and the ability to maintain these stormwater systems will be improved.

Also critical to maintenance of the stormwater systems is the ability to access the systems for maintenance. Those within rights-of-way are easily maintained from the roadway. However, those conveyances within the easements or drainage rights-of-way at back or sides of property lines can be more difficult to maintain. In these cases, where possible, the maintenance way should be incorporated into their design. In the Bayshore MSTU this is especially true of the Level One conveyance. Without proper maintenance of the Level One conveyance, the remaining systems relying on the conveyance will not operate properly.

The following maintenance schedule is recommended for the facilities as the recommended improvements are constructed.

Swales: Regular mowing by homeowners or County where lot is not developed. Visual inspection of swales on annual basis. Removal of debris and grading as necessary, but a frequency of once per ten (10) year cycle may be expected.

Culverts: Visual inspection of culverts on annual basis checking for obstructions and debris blockage. Replacement culvert life expectancy should be considered 35 years but actual life may be up to fifty (50) years.

Drainage Structures: Visual inspection of structures on a semi annual basis checking for obstructions and debris blockage. Drainage structures should be cleaned as needed. (Newer structures are typically provided with bottom sumps to allow sediment and debris to accumulate in lieu of being conveyed downstream). Generally this should be prior to the storm season in May and then following the storm season in October. Replacement structures life expectancy should be planned for thirty five (35) years. Actual life may be longer.

Outlets/Outfalls: Visual inspection of outlets/outfalls should be completed semi-annually checking for obstructions and debris blockage. Generally this should be prior to the storm season in May and then following the storm season in October. It should also be supplemented with inspection prior to and following major storm events.

Below is a schedule for system maintenance:

GATEWAY TRIANGLE RESIDENTIAL AREA STORMWATER SYSTEM MAINTENANCE PROGRAM			
ITEM	INSPECTION FREQUENCY	ANTICIPATED LIFE (YEARS)	REQUIRED ACTION
Swales	Annually	10	Debris Removal and Regrading as necessary
Culverts	Annually	35-50	Cleaning as required Replacement at end of life
Drainage System	Semi-Annually	35-50	Cleaning as required Replacement at end of life
Outlets/Outfalls	Semi-Annually	35-50	Cleaning as required Replacement at end of life

Note: Semi-annual inspection should be conducted in May and October.

G. Cost Estimates and Potential Projects

Costs for the proposed improvements have been prepared and are included in the following Table. The improvements have been presented by system. Generally improvements to the Level One system should be completed initially or in conjunction with other system improvements. These cost estimates have taken into account some incidental utility relocation. It can be anticipated that repairs will be needed to the existing City of Naples water services and adjustments made to the existing water mains at the roadway cross drains. Adjustment to Collier County sewer facilities should be minimal and generally limited to isolated roadway cross drains where force mains are present. (As designs proceed with individual projects it is recommended that additional utility coordination and locating (by potholing, etc) be completed.)

SUMMARY TABLE

COST ESTIMATES

AREA 1	$854,226.00
AREA 2	$15,025.00
AREA 3	$316,912.50
AREA 4	$506,925.00
AREA 5	$740.785.50
AREA 6	$680,076.00
AREA 7	$229,972.50
AREA 8	$349,407.00
ADDTL AREA A	$345,000.00
ADDTL AREA B	$0
ADDTL AREA C	$881,250.00
ADDTL AREA D	$488,700.00

For a detailed cost estimate matrix, refer to Appendix J.

Following is a summary of potential projects that could be completed based upon the drainage improvements previously identified. It is generally recommended that construction occur first in the Level One system followed by the Level Two and Level Three systems. However, to minimize local neighborhood disruption, it may be helpful to complete Level Two and Level Three improvements in conjunction with the Level One improvements.

Where necessary to obtain easements or additional easements for projects, this work should be accelerated. This will allow the easements to be obtained early in the

process. Similarly, permitting involving SFWMD and USCOE should also be completed early in the process.

PROJECT	SYSTEM PORTION	ESTIMATED COSTS*
A. NORTH-SOUTH DITCH	LEVEL ONE (south of Thomasson Dr)	$880,000 - $980,000
B. NORTH-SOUTH DITCH	LEVEL ONE (north of Sugden Park)	$350,000 - $400,000
C. THOMASSON DR.	LEVEL ONE	$490,000 - $550,000
D. AREA 1	LEVEL ONE and LEVEL TWO	$850,000 - $900,000
E. AREA 2	LEVEL THREE	$510,000 - $550,000
F. AREA 3	LEVEL THREE	$310,000 - $360,000
G. AREA 4	LEVEL THREE	$500,000 - $580,000
H. AREA 5	LEVEL THREE	$750,000 - $800,000
I. AREA 6	LEVEL THREE	$680,000 - $730,000
J. AREA 7	LEVEL THREE	$230,000 - $260,000
K. AREA 8	LEVEL THREE	$350,000 - $400,000

*Includes Construction, Administrative, Engineering, Permitting and Contingency Costs

H. Methodology

As a part of the Stormwater Master Plan for the Bayshore MSTU Area the following recommendations are made. These recommendations are based upon the findings of this Plan.

1. A Neighborhood Meeting should be held to brief the residents and other stakeholders in the area of the findings of this Plan.
2. A meeting should be held with Collier County Transportation (Road and Bridge Maintenance and Stormwater groups) to review the Plan and to receive final input from them.
3. The Plan should be presented to the Bayshore MSTU for their adoption.
4. A presentation should be made to the Collier County Board of Commissioners to receive their concurrence (or adoption) of the Plan.
5. Funding sources for the various projects should be sought from various agencies to begin implementation of the stormwater improvements. As funding sources are secured, the detailed engineering design and permitting can be completed with Construction and Bidding Plans and Specifications prepared. As project funding is implemented, the projects can be bid and constructed. This recommendation can be anticipated to include several cycles of grant funding and construction.
6. Continued on-going inspection and maintenance of the system.

Section 7 – Potential Funding Sources

A. Community Redevelopment Agency

The CRA is limited in its financial capabilities to support extensive drainage improvements. The ability to fund a specific area for drainage improvements over other portions of the CRA would limit its involvement. It is feasible that the CRA could provide partial matching funds for grants and in providing in-house services when possible.

Also when the CRA is completing other infrastructure improvements such as landscaping, sidewalks and beautification, it may be possible to include drainage improvements in the overall project.

B. Board of Collier County Commissioners

The Study area consists of a road networks and rights of way that are maintained and owned by the Board. Over the years, attempts have been made to improve the swale drainage system within the area, but without a cohesive unified approach. In addition, there have been periods of maintenance neglect.

The Board has repeatedly expressed its desire to fund only primary and secondary drainage facility improvements. Tertiary facilities are recognized to be the responsibility of the residents directly receiving the improvements. Primary facilities are generally described as those that serve as major drainage improvements serving a large area and encompassing many land owners. Secondary facilities are similar to primary but with a more limited geographical impact. Tertiary facilities are generally those that do not provide flow through connection to other primary, secondary or tertiary facilities. The Study area contains what the County would designate as tertiary facilities.

Potentially, by working with the County's stormwater and road and bridge maintenance groups, it may be possible to work jointly on certain projects. This would be especially true where the County could provide swale maintenance and the CRA providing funding for culvert replacement.

C. MSTU or Special Assessment

A possible sustained funding source could be by the Municipal Services Taxing Unit (MSTU). The MSTU was established by the Board of County Commissioners after residents in an area vote to establish a new taxing authority for specific purposes (beautification, etc.). The MSTU tax is assessed based on appraised land value and can be a recurring source of revenue to fund proposed improvements and subsequent maintenance. As sidewalks and landscaping are constructed, drainage improvements will be needed to accommodate that and would necessarily be included in project design.

A special assessment can also be placed on the properties by Board motion. The assessment would be for a specific improvement such as culvert replacement and for a specific amount.

The MSTU or special assessment would be ideal for these recommended improvements, in that the recommended improvements can be budgeted.

D. SFWMD

Based on discussions with SFWMD, there are certain funds available to assist local governments with improvements to drainage systems. These funds are generally intended to improve water quality and attenuation and not for increasing drainage capacity. SFWMD has already provided funding to the CRA for the lake within the Gateway Triangle area and other improvements associated with that project.. Where

projects could provide improvement to water quality and attenuation, funding may be available. Other potential funding from SFWMD do not appear readily available. SFWMD staff is researching other possible means of funding and follow up with them is recommended as this Study is adopted.

The Big Cypress Basin Board of SFWMD currently does not have any funding programs available for these types of improvements.

E. FEMA/Federal Funding

Possible significant funding may be available through Federal Emergency Management Agency (FEMA) grants earmarked for the development of comprehensive mitigation planning for dealing with identified hazard and hazard management problems. There are three (3) review criteria deemed by FEMA as important: Cost effectiveness (represented by cost-benefit analysis), technical feasibility and environmental soundness. Funding by FEMA to reduce or eliminate the long-term risks of flood damage to buildings is regularly offered to areas that are part of the National Flood Insurance Program.

A first step in the application for such grants is presentation to the Local Mitigation Strategy Working Group (LMSWG). This group consists of a mix of governmental employees from all Collier County municipalities, private residents and businesses. The group evaluates the grant application based on the above criteria and scores it compared with other applications (attached is the Prioritization Matrix used by the LMSWG). The group meets on a regular basis to score submittals. After scoring by the group, application may then be made to the federal funding agency.

It is up to the applicant to bring the potential project and potential funding sources to the attention of the LMSWG. The submittal should include a brief summary of the project, estimated costs, benefit-cost analysis, identification of matching funds (if available), the potential sources of funds and a completed scoring sheet. The recommended improvements to the Study area should rank highly, based on a cursory review of ranking criteria. The improvements would score mostly in the High and Medium range for the scores with a higher weighting factor.

Pre-award costs, such as engineering design, permitting and other "soft" costs associated with improvements are allowed to be included in many grant applications. Many applications require some form of matching funds and quite possibly if no other funding is available, this engineering report could be considered the "match."

F. Florida Section 319 Grant Work Plans and Project Summaries

As indicated on the Florida Department of Environmental Protection website, "the Nonpoint Source Management Section administers grant money it receives from EPA through Section 319(h) of the Federal Clean Water Act. These grant funds can be used to implement projects or programs that will help to reduce nonpoint sources of pollution. Projects or programs must be conducted within the state's NPS priority watersheds, which are the state's SWIM watersheds and National Estuary Program waters. All projects must include at least a 40% nonfederal match." This Study area falls within those watersheds. Furthermore, the goal of the program is to support watershed projects that meet a minimum set of project planning, implementation, monitoring, and evaluation requirements designed to lead to successful documentation of project effectiveness with respect to water quality protection or improvement.

Provided examples of fundable projects include nonpoint pollution reduction in priority watersheds. Non-point source pollution is stormwater discharge that does not emanate from a defined point. All approved projects will be contracted with the Department of Environmental Protection (FDEP) and managed by the staff of the Nonpoint Source Management Section. Project proposals are due each year in late May with project selection completed by September.

Collier County Transportation recently attempted to obtain funding recently through FDEP for a stormwater project in south Naples. Similar projects to this south Naples project have been funded throughout the state. In order for the projects outlined in this Plan to obtain funding from this source, it is likely that some additional water quality measures (e.g., stepped detention of water in the swales) would need to be incorporated into the design. These measures could be added without negatively impacting the ability to drain the Study area.

G. Community Development Block Grants (CDBG)

Collier County annually receives block grants for improvements to areas with significant economically disadvantaged populations. These improvements are to better the living conditions of the populations. Sidewalks, housing improvements and drainage improvements are typical grant awards. The awards process is competitive and the allocation is based on available funds. The grants are Federal and are administered by the State of Florida Department of Community Affairs and locally by the Collier County HUD office.

Additionally, there are occasional CDBG grants provided for areas impacted by natural disasters such as flooding. The CRA was able to secure grant funding from

Tropical Storm Fay for the proposed improvements in the residential portion of the Gateway Triangle area.

APPENDICES

A. Street by Street Evaluation

B. Aerial Contour Maps

C. Plat Maps

D. SFWMD Permits

E. FEMA Flood Elevation Maps

F. Basin Boundary Map

G. City of Naples Water Main Locations

H. Storm Surge Map

I. LIDAR

J. Drainage Structure Information

K. Detailed Cost Estimate for Drainage Improvements

A. Street by Street Evaluation

Area	Street Name
1	Weeks Avenue
1	Becca Avenue
1	Pine Street North
1	Arbutus Street
1	Mangrove Street
Area	
2	Bayview Drive
2	Shoreview Drive
2	Gulfview Drive
2	Riverview Drive
2	Lakeview Drive
Area	
3	Coco Avenue
3	Areca Avenue
3	Captains Cove
3	Canal Street Basin
3	Basin Street
3	Sabal Court
Area	
4	VanBuren Avenue West
4	Barrett Avenue West
4	Storter Avenue
4	Linda Drive
Area	
5	Barrett Avenue East
5	VanBuren Avenue East
5	Lunar Street
5	Full Moon Court
5	New Moon Court
5	Harvest Court
5	Jeepers Drive
Area	
6	Cottage Grove Avenue
6	Karen Drive
6	Republic Drive
6	Liberty Lane
6	Constitution Drive
6	Colonial Drive
6	Pine Tree Drive
6	Andrews Avenue
6	Woodside Avenue
6	Holly Avenue

Area	Street Name
7	Palmetto Court
7	Pine Street South
7	Florida Avenue
7	Lake Avenue
7	Sunset Avenue
7	Bay Street
7	Danford Street
Area	
8	Gordon Street
8	Peters Avenue
8	Collee Court

B. Aerial Contour Maps

C. Plat Maps

D. SFWMD Permits

Many of the proposed tertiary improvements can be completed as part of an on-going maintenance program not requiring any special permitting with exception of a Collier County Right-of-Way Permit. These improvements would include swale regrading and re-establishment and replacement of driveway culverts up to and including 15" diameter (or equivalent). These would include projects that are tertiary or secondary in nature. Additionally, if street landscaping or sidewalk improvements are made, drainage improvements can be and usually are by necessity part of those improvements. Other improvements dependent on their scope may require No-Noticed and Noticed General Permits from SFWMD. These would include those generally associated with the tertiary system.

The Level One system projects will generally require a Modification to the existing Environmental Resource Permit issued for public projects in the area (Sugden Park or Bayshore Drive).

Listing of Permits:

- Windstar (SFWMD Permit No. 11-0210-S)
- Bayshore Drive (fka Kelly Road) 4-lane Improvements (SFWMD Permit No. 84-00055-S)
- Sabal Bay (SFWMD Permit No. 11-02003-P-06)
- Sugden Park (SFWMD Permit No. 11-00638-S)
- East Naples Community Park (SFWMD Permit No. 11-00398-S)
- Naples Botanical Gardens (SFWMD Permit No. 11-02285-P)

E. FEMA Flood Elevation Maps

F. City of Naples Water Main Locations

G. Storm Surge Map

H. LIDAR

I. Drainage Structure Information

Area	Street Name
1	Weeks Avenue
1	Becca Avenue
1	Pine Street North
1	Arbutus Street
1	Mangrove Street
Area	
2	Bayview Drive
2	Shoreview Drive
2	Gulfview Drive
2	Riverview Drive
2	Lakeview Drive
Area	
3	Coco Avenue
3	Areca Avenue
3	Captains Cove
3	Canal Street Basin
3	Basin Street
3	Sabal Court
Area	
4	VanBuren Avenue West
4	Barrett Avenue West
4	Storter Avenue
4	Linda Drive
Area	
5	Barrett Avenue East
5	VanBuren Avenue East
5	Lunar Street
5	Full Moon Court
5	New Moon Court
5	Harvest Court
5	Jeepers Drive
Area	
6	Cottage Grove Avenue
6	Karen Drive
6	Republic Drive
6	Liberty Lane
6	Constitution Drive
6	Colonial Drive
6	Pine Tree Drive
6	Andrews Avenue
6	Woodside Avenue

6	Holly Avenue
Area	**Street Name**
7	Palmetto Court
7	Pine Street South
7	Florida Avenue
7	Lake Avenue
7	Sunset Avenue
7	Bay Street
7	Danford Street
Area	
8	Gordon Street
8	Peters Avenue
8	Collee Court

J. Detailed Cost Estimate for Drainage Improvements

K. Neighborhood Meeting Map