

REPORT ON TROPICAL STORM ERNESTO AND SUBSEQUENT HIGH RAINFALL EVENTS

August -September 2006



Big Cypress Basin

Prepared October 2006

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1. INTRODUCTION:

Tropical Storm Ernesto passed through southwest Florida on August 30, 2006. Although the storm did not bring any damaging wind, the amount of rainfall associated with and following the storm was very severe in parts of Collier County. In west central Collier County, the area lying east of County Road (CR) 951, west of State Road (SR) 29 and south of CR 846 received the brunt of rainfall. Nuisance flooding in low lying areas and inundation of roads in several parts of Northern Golden Gate Estates (NGGE) brought inconvenience to the residents of those areas. This report provides an analysis of the characteristics of the storm, identifies flood impacted areas and summarizes lessons learned from this rainfall event. Based on the observation and problem assessment, an array of mitigation measures are recommended to reduce the recurrence of such inconveniences and safeguard public health, safety and welfare.

2. CHARACTERISTICS OF THE STORM AND AREA HYDROLOGIC CONDITIONS:

The magnitude of rainfall from Ernesto far exceeded the prediction of local meteorologists. The residual tropical moisture of Ernesto persisted for several days after the storm and enhanced the frequency of mid-summer convective sea-breeze thunderstorms with incessant rainfall activity for over two weeks. The intensity and duration of the series of storms and the total rainfall during the two week period varied spatially. The total amount of rainfall measured at four rainfall stations in the area east of CR 951 and south of CR 846 are summarized in Table 1 and located on Figure 1. Figures 2 - 5 illustrate the magnitude of rainfall during the period prior to Tropical Storm Ernesto, during Ernesto and subsequent to the storm at each of the four rainfall stations. In terms of recurrence interval of this series of storms, the 1-day duration rainfall in the area ranged from a 2-year to 25-year frequency event.

Table 1

Rainfall at Four Stations

Station	Rainfall in Inches Aug 1- Sept 25, 2006	Rainfall in Inches Aug 29- Sept 4, 2006	Rainfall in Inches August 30, 2006
CR 951 Ext	22.62	8.48	4.01
Coco #3	32.43	8.17	3.52
Golden Gate Fire St#2	26.49	7.43	3.94
SGGEWX (52 nd Ave SE)	29.05	12.79	8.41
ColSem	24.93		
FakaStrn	26.72		

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Rainfall 8/1/06 - 9/25/06

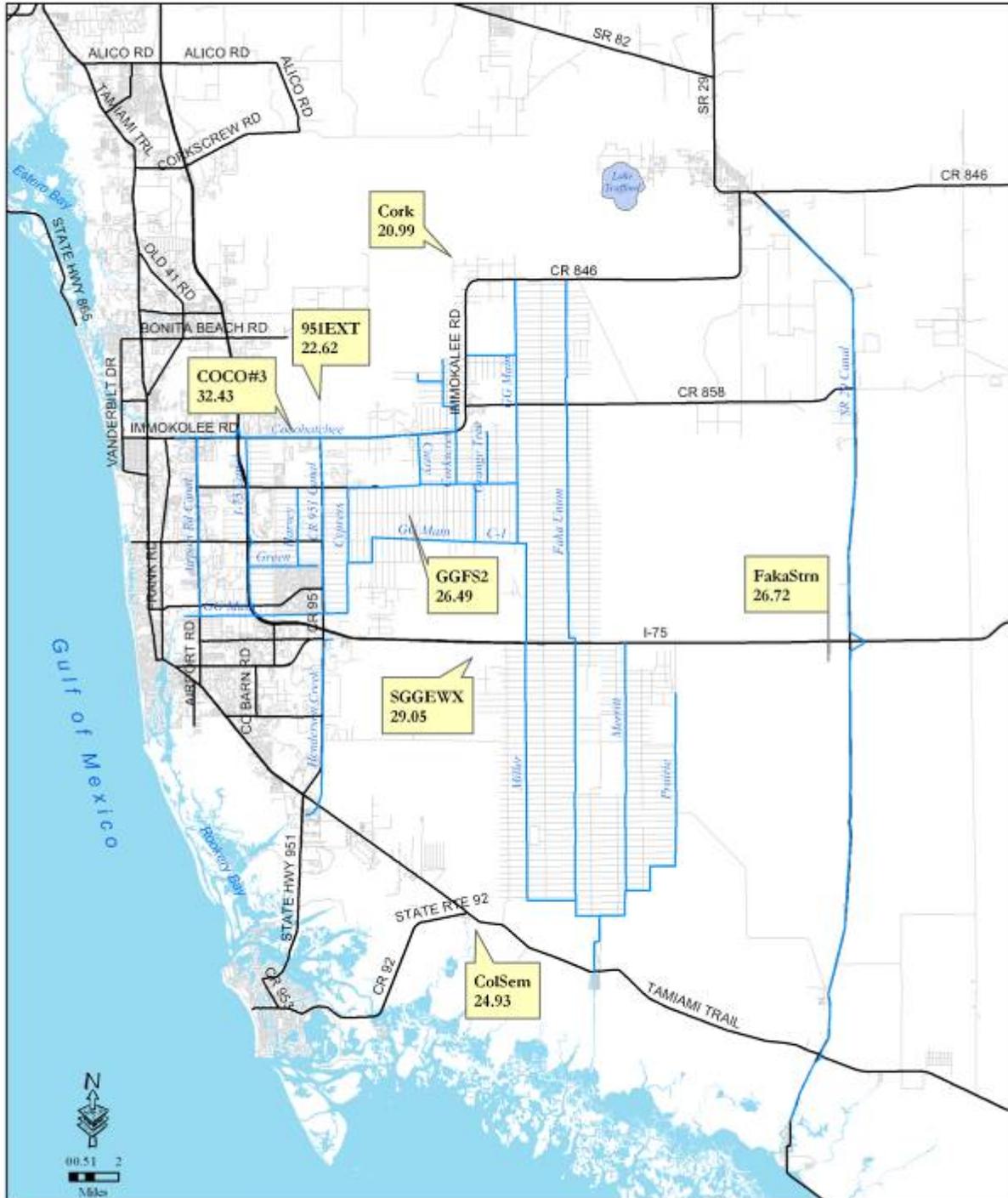
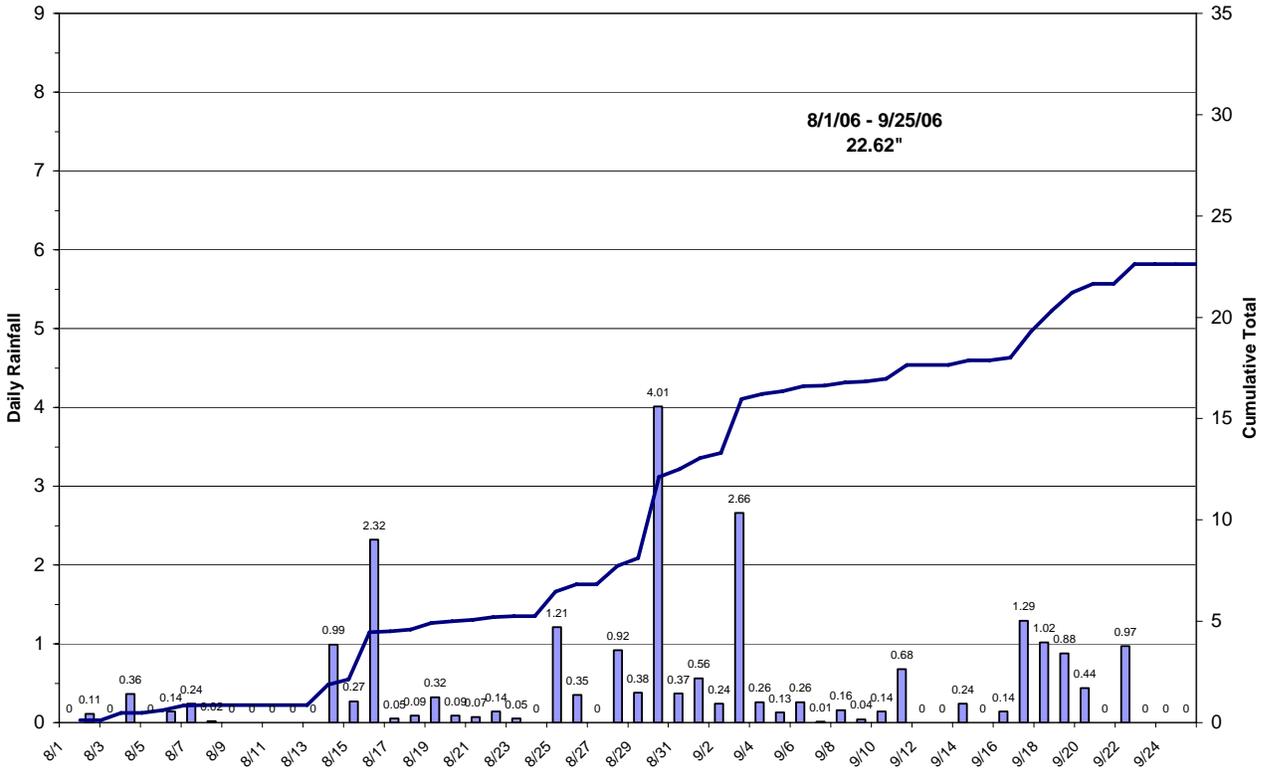


Figure 1. Rainfall Station Locations

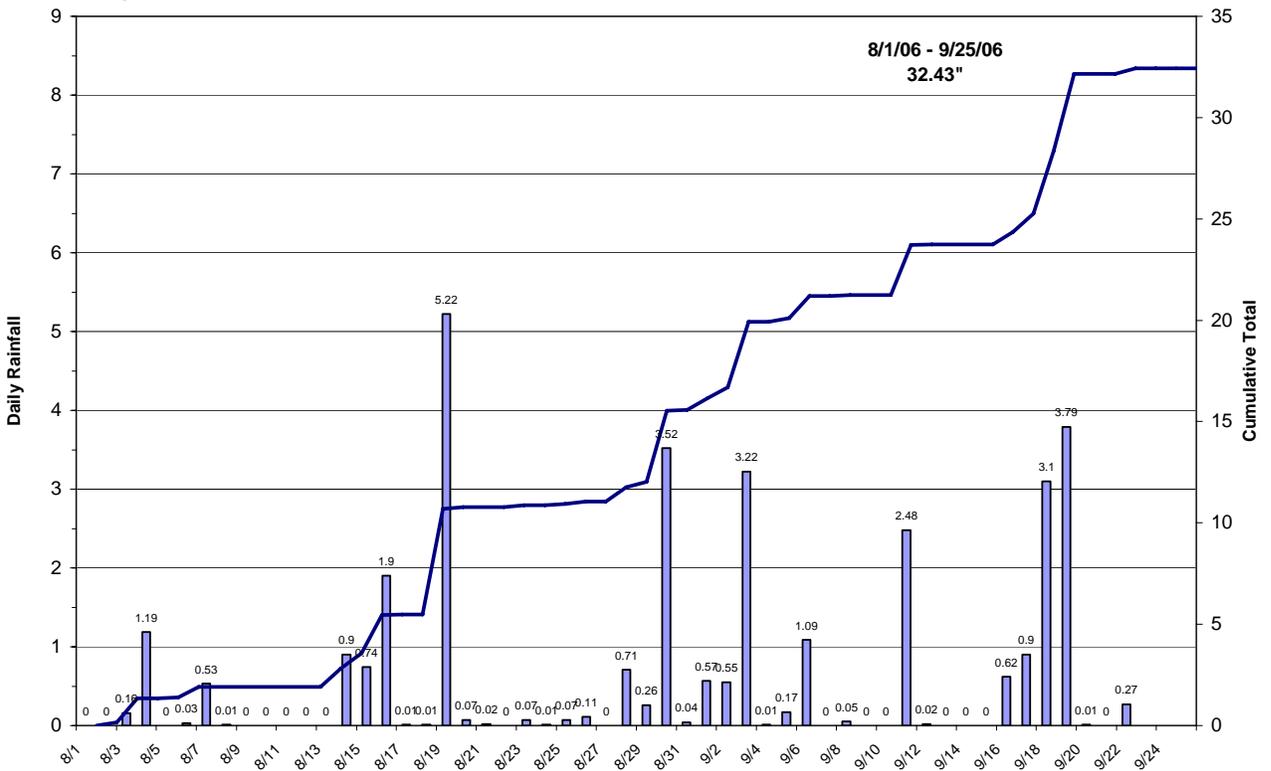
CR951 EXT

Figure 2



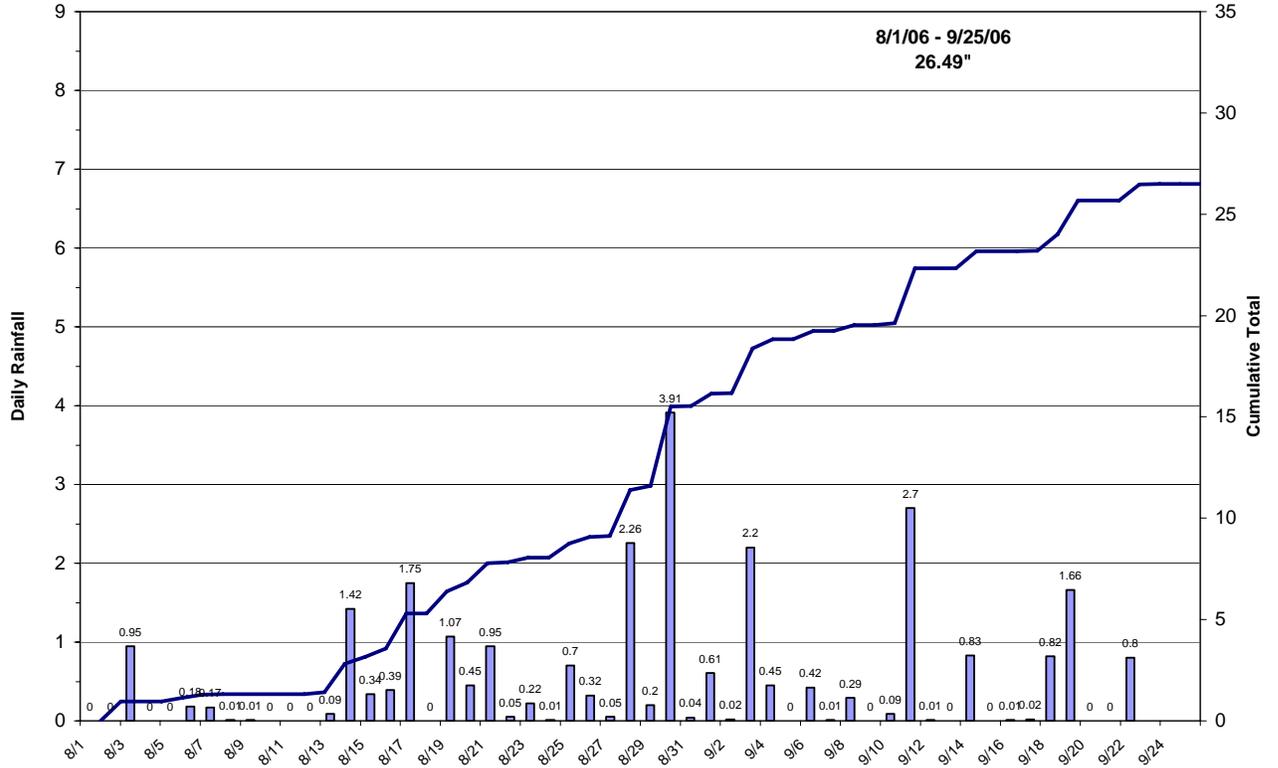
Coco #3

Figure 3



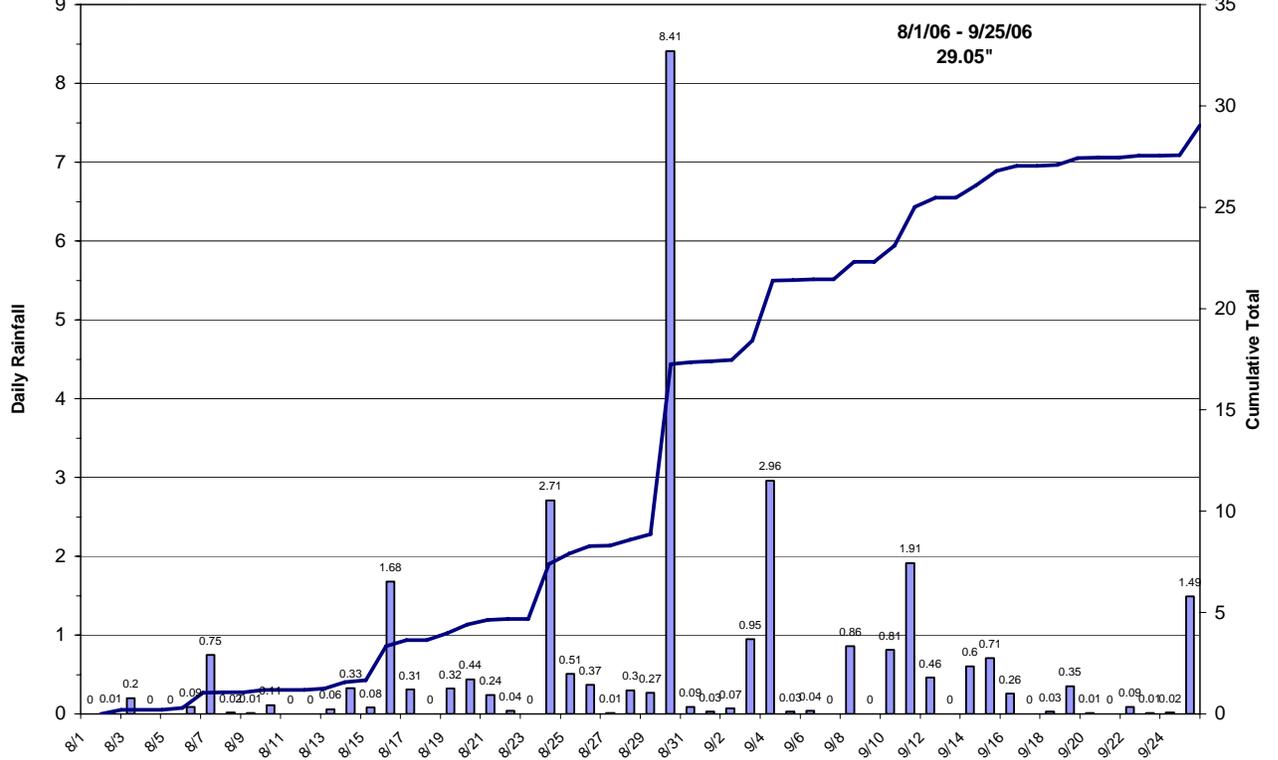
Golden Gate Fire Station #2

Figure 4



SGGEWX

Figure 5



Hydrologic conditions of the central Collier County region had been wetter than normal prior to the storm. Beginning from July, the regional groundwater level started to rise above the long term average levels (Figure 6), and this trend continued to the end of the August. The dotted line is the historical average of the groundwater well. The solid line reflects the groundwater levels for 2006. Such soggy antecedent moisture and saturated groundwater conditions could not absorb the high intensity rainfall and generated significant runoff with flash flooding and street inundation in several low lying areas of NGGE and adjacent outlying areas. Of particular note is the Rock Road – Acremaker Road area between Richards Road and Moulder Drive, south of CR 846, where the residents were inconvenienced for several days due to inundation of roads and yards. Figure 7 illustrates the stretches of observed roadway flooding across central Collier County.

Figure 6.
GROUND WATER LEVELS AT WELL C-1063

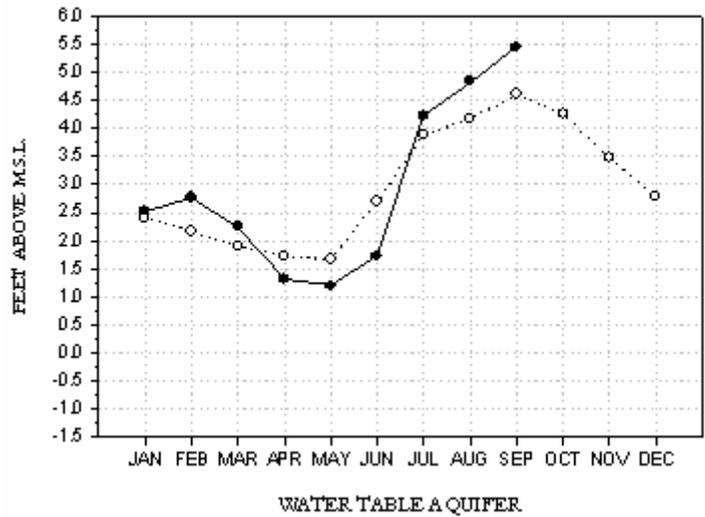


Figure 7. Observed Roadway Flooding in Western Collier County after Ernesto



3. PROBLEM ASSESSMENT AND PRELIMINARY RECOMMENDATIONS:

The salient components of the NGGE region's overall stormwater management system, the factors contributing to occurrence of nuisance flooding and proposed measures to alleviate the problem are summarized below:

A. The Stormwater Conveyance System:

The localized flooding and inconveniences that occurred were due to the limited conveyance capacity of the existing primary, secondary and tertiary drainage system, low-lying wetlands, natural topography with no defined stormwater outlets in several neighborhoods and loss of traditional flood storage areas as a result of explosive urban/residential growth in NGGE. In the majority of NGGE, there is not a comprehensive secondary stormwater management system. The roadside swales direct flows into the secondary and primary canal systems. However, as evidenced in many instances, inadequate functioning of one unit to convey stormwater to the next outlet or conveyance unit can render the entire system a failure. Development of a plan to improve the existing secondary canal and tertiary drainage systems should be a high priority, given the future projected growth for this area. The Plan would include improvements to the existing tertiary system, but would also likely involve improvements to the existing and construction of new secondary canals and stormwater impoundment areas. In spite of the limited capacity of the primary canal system, a large-scale channel modification of the Golden Gate Canal is not feasible due to the adverse impact on Naples Bay.

B. Permitting and Construction of Single-Family Residences

In NGGE, the construction of Single-Family Residences (SFRs) are permitted through Collier County (for zoning and building) and through the Florida Department of Environmental Protection (FDEP) for wetland encroachment impacts. If on-site mitigation is not feasible, currently, owners are assessed a fee for impacts to wetlands based on the acreage impacted. Fees are then directed to wetland enhancement and restoration projects sponsored by organizations like Rookery Bay National Estuarine Research Reserve (RBNERR). While mitigation of wetland impacts in RBNERR contributes to the maintenance of regional ecosystem health, the Rookery Bay area does not directly improve hydrology or wetland functions in NGGE. Measures to compensate the storage from lost wetlands through structural and non-structural means should be the primary focus for controlling runoff and flooding problems in NGGE (Figure 8).



Figure 8. Residential Yard Flooding

Big Cypress Basin does not have any direct control over Single-Family Residence permits. The Basin does coordinate with those agencies that do have authorization and will participate in joint endeavors toward updating the policies of SFR permitting in NGGE, as well as provide technical assistance in formulating system-wide improvements for the cumulative impacts of these incremental projects.

Collier County has the ability to require certain elements for Single-Family Residence construction. Engineering solutions that could be implemented to incrementally improve the functioning of the system include: proper sizing, grading and inverts correctly set for culverts installed along the tertiary system, as well as assuring that proper flow line elevations are achieved.

These individual elements need to be considered holistically at several levels. For example, the roadside swales (tertiary system) along streets may consist of multiple property owners with culverted driveways. If the flow line elevations of each culverted driveway are not placed at the appropriate elevation for the culvert location along the previously determined and prorated grades (slopes) for the roadside swales, stormwater will not be appropriately conveyed through the tertiary system to the secondary and primary systems, causing water to pool or back-up within the tertiary system, thereby increasing the potential for and effects of flooding. In many areas of Collier County, maintenance to the numerous existing roadside swales (the major component of the tertiary system) has not been performed with any systematic approach to maintain optimum conditions. Additionally, as parcels are developed or improved at different times along the numerous streets utilizing roadside swales to provide initial stormwater drainage and water quality treatment, those owners improving their property sooner will experience water pooling in their areas due to the lack of conveyance arising from the improperly maintained and non-connectivity of the roadside swales of the tertiary system. To assure that individual improvements to the tertiary and secondary systems are coordinated, Collier County should have a comprehensive Stormwater System Plan that includes:

- Improvement of conveyance in both the secondary and tertiary systems
- Consideration of cumulative impacts from fill and impervious surfaces created by construction of not only Single-Family Residences, but also commercial property development and infrastructure within the watershed
- Assistance to property owners in improving and maintaining their properties to compliment the system

Steps:

- The County must develop effective plans for operating and maintaining the secondary and tertiary stormwater systems. While the County's Road Maintenance Department possesses practical knowledge and presently performs random repairs to problem sites, it does not have technical staff to assist in engineered solutions.
- While the use of stem wall and/or piling construction for Single-Family Residence's cannot be mandatory, implementation of a homeowner incentive program to encourage this construction method will minimize the amount of fill needed and wetlands impacted.
- Mandate on-site retention for Single-Family Residences, including retention replacement based upon amount of fill and impervious surface for homesites.
- Properly grade and vegetate swales to convey flows and reduce sedimentation in the primary canals.
- Develop neighborhood-based retention sites (compensated storage) to handle incremental impacts of new developments in NGGE.
- Identify restrictions in the current road drainage system infrastructure and properly place culverts to maximize equalization of surface flows during major rain events.
- Examine areas where cross flows, instead of only roadside swales, can be utilized to accommodate additional flow across both roadways and driveways.
- Establishment of a special flood taxing district for NGGE to fund the construction of a secondary stormwater management system. Currently, the system drains from the tertiary roadside swale system into the primary system. A secondary component would add storage and better conveyance.

- Assess a stormwater impact fee for new development, in lieu of taxing current owners.
- Communicate the limitations of the stormwater systems to the general public and generate support for the County to obtain easements for the establishment of a secondary system for incremental impacts and maintenance in their areas.
- Develop recommended construction methods and list of materials to reduce impacts of impervious surfaces created by the construction of driveways and parking areas, with incentives for use of those methods and materials.

C. Private Developments

Several private Planned Unit Developments (PUDs) are located within and adjacent to the flood affected areas in NGGE. These developments are responsible for maintaining flows through and maintenance of their stormwater systems.

A review of the recorded stages and flow patterns entering the Cocohatchee Canal during the two-week period indicates that the stages and flows appeared to be higher than observations from previous storm events in 1991 and 1995 near certain locations. A berm along the north side of Twin Eagles had in the past diverted water to the west through interconnected wetlands and finally reached the Cocohatchee Canal west of CR 951. This 1000' berm (an estimated 30% of the total berm) was removed and a collector swale was created as a permit requirement to allow water to bypass between the Bonita Bay East Golf Course and Twin Eagles development. This caused stormwater to enter the system east of where it had traditionally entered, where it was then directed off-site. This bypass reduced the amount of water that was able to reach the Cocohatchee Canal near the proposed Mirasol development via historic sheetflow. Surface water changes need to be evaluated to ensure proper hydroperiod of wetlands east of Olde Cypress and to minimize peak surface flows on the west drainage ditch of Twin Eagles. While one of the stormwater outlets from Twin Eagles appeared to be clogged at the discharge point, it did not appear to impact the overall stormwater flows from this development. This raises a question of the functionality of the development's stormwater system, prompting a need for review.

In an attempt to provide relief to the flooded residents in the Rock Road / Acremaker Road area (Figure 9), the Basin installed, ran and maintained a pump at the Olde Florida Golf Course outfall to Cypress Canal to assist with abnormal drainage. Olde Florida Golf Course also ran a second pump at their own cost for the benefit of themselves and the neighboring areas. While water levels receded after installation of the pumps, it is to be noted that the topography and drainage characteristics of the Rock Road neighborhood is typical of wetlands. The area is dominated by dense cypress, pop ash and red maple, indicative of wetland systems and has no defined outlet to the near by primary canals. If proper stormwater drainage infrastructure is not implemented through a Municipal Serving Taxing Unit (MSTU), the only solution to relieve flooding in this area is through installation of emergency pumps during each major rainfall event.



Figure 9. Rock Road Flooding

Steps:

- Examination of the removal of parts of Twin Eagles north berm and subsequent downstream effects.
- Examination of water levels in proposed development areas, like Mirasol, may reveal lower levels, given the bypass at Twin Eagles.

- Meet with Homeowner’s Associations to explain the importance of system maintenance and their responsibilities.
- Assess the feasibility of implementing an MSTU for the Rock Road – Acremaker Road area for road and stormwater system improvements. A stormwater outlet from the area may provide relief through use of a pump through the Cypress or CR 951 Canals. Culverts should be installed under the provisionally upgraded Rock Road to facilitate drainage east and west of the road.
- The access road across the Cocohatchee Canal between the Quarry development and Bonita Bay East Golf Course has undersized culverts. This access road needs to be removed or the culverts need to be properly sized to better accommodate flows.
- Place sand bags or sluice gates at the entrance to the wildlife crossing on Immokalee Road to prevent peak surface flows from entering the Rock Road area.
- The Massey Road drainage ditch needs to be examined. Culverts properly installed with proper grades and connections to Cypress Canal may provide some flood relief.
- Review and enforcement of current standards for low member elevations for bridges and culvert inverts crossing primary and secondary canals to assure adequate clearance for conveyance during storm events.

D. Road Construction and Drainage:

Big Cypress Basin/SFWMD regulatory and enforcement staff need to be vigilant for compliance of the drainage features of road construction projects with permit conditions.

Collier County experienced several areas of road washouts and private areas that had flood impacts. Due to ongoing construction to widen Immokalee Road, many of the previously existing flow conveyance structures under Immokalee Road were observed by Basin staff to be at least partially blocked (Figure 10). Some conveyances were completely blocked, thus reducing the potential for flood relief by conveying flows north into the Cocohatchee Canal, as had previously occurred during the storm events of 1991 and 1995. The resident engineers/inspectors of road construction projects should be vigilant that such outfall pipes are not blocked.

Steps:

- Culverts could be installed in certain areas to equalize flow levels and move water toward a pump station used for emergency purposes only.
- Incorporate high elevations in road designs to prevent sections of road from becoming submerged during storm events for public health and safety.
- Incorporate Action Plans and responses to address flooding issues from potential storm events into road construction permits/plans to ensure adequate conveyance of stormwater during these events and to minimize any increase in flooding from construction activities.



E. Water Control Structure Upgrades

Most of the water control structures in the primary and secondary system were installed decades ago when development in Collier County was minimal and development pressure was

low. These older structures primarily used a fixed crest weir design with limited outflow



Figure 11. Golden Gate Weir #5
Submerged

capability through mechanisms like v-notch. The explosive urban growth in the region and the resulting increase in stormwater runoff decrease time to peak, has rendered those structures ineffective in providing the desired levels of flood water conveyance (Figure 11).

Since the early eighties, the **Big Cypress Basin** has upgraded most of the old structures in the Golden Gate, Cocohatchee, Corkscrew, Faka Union and CR 951 Canals in NGGE, including major canal improvements in the Cocohatchee, Corkscrew and CR 951 Canals.

The renovation of these water control structures from fixed crest weirs to gated structures and the associated channel improvements have increased the flow capacity within the primary drainage system prior to, during and after storm events. If these upgrades, specifically those to Golden Gate Weir #1 and the Cocohatchee Canal improvements, had not been completed the system would have been overwhelmed much sooner and flooding would have been more prolonged, pronounced and widespread.

Upcoming upgrades: Currently, Golden Gate Weirs #2 and #3 are scheduled to be upgraded in 2007 and 2008, respectively.

- Improvements to Golden Gate Weir #2 will allow for an additional 300-500 cfs of water to be released during storm events.
- The relocation and upgrade of Golden Gate Weir #3 includes a diversion of 100 cfs from the Golden Gate Main Canal to Henderson Creek Canal. While this is a minor amount of water, relatively, it is a step toward reestablishing historic flows to their original watersheds. The major challenge for this relocation will be to obtain the easements from the property owners for the relocation of Golden Gate Weir #3.
- The Miller Canal Weir #1 and Faka Union Canal Weir #2 structures, located in South Golden Gate Estates have a series of steel gate supports that collect an enormous amount of debris and require frequent maintenance during and after storm events. Modification of the steel gates and gate support features would enhance flows and reduce maintenance during and after storm events. Since these gates help enhance groundwater storage, impacts to groundwater should be assessed prior to their removal. During periods of below average rainfall or drought conditions the additional groundwater storage provided from the steel gates and supports may be critical to the potable water supply for the citizens using private wells to the north of these areas.
- Reduction of freshwater flows to Naples Bay can also be achieved by the diversion of ~400 cfs of peak flows to the historic flowways in North Belle Meade, as outlined in the Belle Meade Stormwater Management Plan.

Collier County should review their stormwater infrastructure for needed upgrades and maintenance, and work with the Basin to secure necessary funding. Many of the County's conveyance canals are of inadequate size and overgrown with vegetation. The water control structures are in various states of disrepair and need proper attention for upgrades.

F. Operation of Water Control Structures:

The Big Cypress Basin operates the water control gates of 46 structures in the primary canal system in accordance with the guidelines of a schedule to provide the desired levels of flood protection, reduction of overdrainage, prevention of salt water intrusion and protection of the downstream receiving water bodies, including Naples Bay, Wiggins Pass and the Ten Thousand Islands estuaries. The operating schedules are developed by detailed hydrologic-hydraulic assessment performed as a part of the design of the structures, and are duly permitted by the State and Federal regulatory agencies (FDEP and the Corps of Engineers). The gates of several of the water control structures constructed since the mid-1990s (namely Cocohatchee Canal Weirs #1, 2 and 3; Golden Gate Main Weir #1; Henderson Creek Canal Weir #1; and, Faka Union Canal Weir #4) operate automatically by induced electronic signals from a set of programmed opening and closing water levels. The operating parameters (headwater and tailwater levels, extent of gate opening, battery functions, etc.) of such structures are monitored by the BCB staff via a real-time radio transmission network called loggernet. Any observed malfunctioning or deviation from the programmed gate operation is immediately attended to.

Due to the limited conveyance capacity of many of the canals, the operating schedules and their associated permits call for opening the gates manually to wide-open positions in the event of any meteorologically predicted major rainfall or tropical storm activity. However, the operating schedule must have the flexibility to address the difficult balancing act of the transition from wet season to dry season and, likewise, from dry season to wet season, as well as anticipation and preparation for major storm or drought events.

To optimize the system, it is essential to constantly collect and analyze data on surface water and groundwater conditions, land development patterns, and the intensity and duration of rainfall. The response of runoff to rainfall in Collier County is dominated by seasonal groundwater levels. The groundwater levels and trends should be closely monitored real-time, and, if levels of the water table are unseasonably high during the mid-wet season, canal draw-downs should be performed to enhance conveyance performance during an unanticipated major storm event.

Due to the wide range of variables affecting the operation of the structures, such as the location of the structure, size of drainage area, adjacent land use, inflows from secondary drainage systems, and gate operating mechanism, a single set of criteria does not work for the entire Basin. The criteria and schedule developed for each structure should not be considered fixed, but rather a guide. As the performance of the gate operations are monitored, continued improvements should be made for more efficient water management.

G. Vegetation Management

Several invasive plant species are prevalent in the canal systems in Collier County, including floating hearts (*Nymphoides peltata*), hydrilla (*Hydrilla verticillata*), torpedo grass (*Panicum repens*) and East Indian hygrophila (*Hygrophila polysperma*). In addition to the invasive species, other existing grasses and vegetation are treated to maximize canal function and capacity.



Figure 12. Mechanical Removal of Vegetation

Big Cypress Basin controls these plants using both mechanical and chemical means. The Basin uses two (2) Aquamogs (Figure 12), a

Gradall and a Posi-Track with mower decks to mechanically maintain vegetation along canal slopes and banks. The amount and frequency of chemical applications for vegetation control is outlined on the herbicide label and regulated by the US Environmental Protection Agency. In addition to the continual mechanical and chemical treatments of aquatic weeds, Basin staff should inspect the canal system prior to the onset of the wet season to ascertain no impedance of flows by harvested or treated vegetation biomass.

Private developments, such as Twin Eagles and Grey Oaks, also maintain vegetation along portions of the primary canals. These developments are very high profile and tend to maintain their portions of the system frequently. New large-scale developments along primary canals should be required to develop maintenance agreements with the Basin and to control the aquatic vegetation in their portion of the canal as required in their maintenance agreements.

- Hyacinth barriers could be employed to force floating vegetation to the sides of the canal where it could then be mechanically removed and disposed of, based on a regular maintenance schedule. An example of this can be found at Airport Road South Amil Gate. These barriers may also be effective for floating trash and yard waste, reducing loads of organic debris to Naples Bay and other coastal receiving waters. These barriers would also prevent the build-up of debris at water control and other permitted structures, reducing the potential for impediments to flow within the drainage system (Figure 13).
- Another alternative would be to utilize a Tow Boat, as they do on the east coast, in the larger canals, such as Golden Gate Main Canal and Faka Union Canal.
- The Basin could proactively use the 'T-Bar' attachment for the Aquamogs for mechanical harvesting of weeds in high density or problem areas, specifically prior to storm events or the onset of the wet season. This attachment hangs below the Aquamog and scissor cuts vegetation at the bottom of the canal. A tow boat drags vegetation up from the bottom of the canal, where it is then pushed downstream to a collection point, mechanically removed from the canal and disposed of.



Figure 13. Vegetation Causing Flow Impediment

Collier County should take steps similar to the Basin and maximize vegetation control efforts. In some cases the side slopes of the tertiary swales in North Golden Gate Estates limit the ability to mechanically mow for weed control. Collier County may want to obtain additional width on the easements to allow for a more gradual slope to accommodate maintenance mowing.

H. Shoaling/Sedimentation

At many intersections between the primary and secondary/tertiary system of canals, sedimentation and shoaling have occurred at the roadside swale discharge points. Two identified problem areas are:

- 47th Ave NE at Golden Gate Main Canal
- 54th Ave NE, west of 40th St NE on Faka Union Canal

The use of hydroseeding and native cord grass (*Spartina* spp.) for revegetation should be encouraged as it provides for excellent soil and bank stabilization, is low maintenance and provides some wildlife habitat. Cost savings for canal bank maintenance activities could be significant with the widespread use of *Spartina* in the drainage system. In addition to vegetation, the use of gravel or rip-rap should be explored to stabilize some areas. Methodologies for canal and bank stabilization should be reviewed on a site-specific basis.

Big Cypress Basin has heavy equipment available to remove the sediment, provided that secondary system repairs are in place to limit the recurrence of shoals.

Collier County should grade these areas, using erosion control best management practices and turbidity screens to limit transport into the primary system. The areas should then be hydroseeded for soil stabilization. These discharge points tend to be in areas of ‘sugar’ sand and may prove problematic to revegetate. However, by establishing native cord grass (*Spartina* spp.), both maintenance costs and continued erosion would be reduced.

I. Gross Pollutants

A large amount of gross pollutants – the large debris in runoff consisting of everything from Styrofoam cups and cigarette butts to construction debris and yard waste – passes through the primary, secondary and tertiary canal systems during high water events. While the debris did not cause major system malfunctions during this storm event, it has the potential to cause impediments to flow and made its way to the major outfall points of the primary canal system, specifically Naples and Cocohatchee Bays (Figure 14).

The impacts from these gross pollutants can be system-wide. Debris can:

- accumulate at water control structures and other permitted structures within the primary canal system, such as docks, bridges and culverts, severely impeding flows
- cause boating hazards in navigational waterways
- have an effect on public recreational areas, including swimming areas
- damage environmental resources, such as seagrass beds and mangrove shorelines
- impact ambient wildlife
- create aesthetic impacts for residents and visitors



Figure 14. Gross Pollutants Near Corkscrew Canal

Big Cypress Basin currently removes gross pollutants from canals and structures during routine maintenance activities. The biggest problem area for gross pollutants in the primary system is the Airport Road Canal due to the high volume of traffic and flow of construction vehicles.

- Basin staff will continue to make removal of trash during maintenance activities a high priority.
- Companies contracted by the Basin for maintenance and construction activities along the primary system are now required to remove trash.
- The Basin and County should actively participate in Keep Collier Beautiful ‘Litter Bugs Me’ campaign
- The Basin continues to work with Keep Collier Beautiful and Collier County’s Stormwater Department to promote the Adopt-A-Canal Program where businesses, groups or

individuals volunteer to pick up trash from a specified stretch of canal on a quarterly basis.

- The Basin continues to host/sponsor the annual ‘Know the Flow’ seminars to inform local citizens, interested civic groups and Homeowner’s Associations of the necessity and methods that they can employ to maintain the drainage system.

Collier County should also remove gross pollutants from their systems during their routine maintenance activities, as well as encourage their contractors to pick up any gross debris encountered.

- Debris collectors could be added to the ends of swales in the tertiary system. This may prove costly and time-consuming to maintain.
- Through the single-family residence permit process, the County could require debris grates at the ends of each driveway culvert. This would allow homeowners to easily collect trash that could otherwise block culverts and impede flows within the tertiary system. As some residents are seasonal, citizen initiatives would have to be coordinated with the County to assure the grates do not collect debris and block flows.
- Citizens need to take responsibility for trash in their portion of the system. Keep Collier Beautiful is launching a campaign called ‘Litter Bugs Me’ to raise awareness of litter, as well as programs and regulations that address gross pollutants. The campaign will emphasize local, community-based involvement and looks to enhance and build projects that will be sustained longterm.
- Measures to address construction debris need to be established. The rapid growth in the County has increased the number of construction, contractor and service vehicles on Collier County roadways. Debris in the back of trucks, unsecured on job-sites and carelessly disposed of can make its way into the stormwater system and impede flows. Local enforcement of existing regulations for job sites would assist in this effort.
- The County needs to participate in the Basin sponsored ‘Know the Flow’ programs for citizens, civic groups and Homeowner’s Associations.

J. Land Use Regulations

The Collier County Transfer of Development Rights (TDR) Program within the Rural Fringe Mixed Use (RFMU) District establishes a method for protecting and conserving the most valuable environmental land, including large connected wetland systems and significant areas of habitat for listed species, while allowing property owners of such lands to recover lost value and residential development potential through an economically viable process of transferring such rights to other more suitable lands. Additionally, the TDR Program responds to the Collier County Growth Management Plan’s objectives in focusing growth towards areas where services such as sewer, water and transportation exist or can be readily provided.

Within the RFMU District, residential density may be transferred from lands designated as Sending Lands to lands designated as Receiving Lands, urban designated areas, and the urban residential fringe on the Collier County’s Future Land Use Map. Participation in the Collier County TDR Program is voluntary. However, land uses in the RFMU Sending Lands are restricted. As Sending Lands are acquired and managed by an appropriate entity, there may be opportunities for reestablishment of flowways that would also serve as water retention and aquifer recharge areas.

This is a multi-agency effort being spearheaded in conjunction with private development and landowners.

Conclusions:

This nuisance flooding event has proved to be an eye-opener for all involved (homeowners, developers and public agencies) to be assertive with renewed efforts for efficient stormwater management. The explosive growth in NGGE makes it imperative that highest priority for addressing stormwater problems effectively and efficiently begin in NGGE and the adjacent unplatted rural residential areas. A concerted effort to develop a comprehensive Watershed Management Plan for the area should be the first task. This plan should specifically include:

- Improvement of conveyance in both the secondary and tertiary systems
- Consideration for mitigation of cumulative impacts of filling of wetlands and resultant increase of impervious surfaces from development and infrastructure construction
- Streamlining Single-Family Residence permitting for compensated storage enhancement
- Technical assistance to property owners in improving and maintaining their properties to compliment the system through broader public outreach programs.
- Completion and implementation of the Flood Insurance Rate Maps

This will require a commitment by the agencies and organizations involved to complete this document in a timely manner.

In addition to this Plan, it is essential to have a unified County Stormwater Department that is independently able to plan, implement and maintain stormwater systems within Collier County. Currently maintenance of the County's stormwater system is handled through the County's Road and Bridges Department, which has no support staff to develop engineered solutions to stormwater problems, especially in times of crisis.

Several priority Interim Steps can be implemented during the development of the Watershed Plan, including:

- Operation and maintenance of the primary, secondary and tertiary systems
- Development of a MSTU for private residential areas, like the Rock Road area
- Incorporate PUD outfalls near private, rural residential communities to assure proper function
- Vigilant enforcement of road construction drainage plan maintenance for storm events

Again, it is imperative that involved agencies and organizations commit to implementation of priority steps to minimize future flooding impacts to the extent possible.