

February 4, 2011

**NORTH BEACH  
STORMWATER STUDY  
DRAFT**

**DEVELOPMENTSERVICES  
DEPARTMENT CHRISTI AND THE  
NORTH BEACH TASK FORCE**

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December 27, 2010

## North Beach Streets, Water, Wastewater Study

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### **Summary of Recommendations and Costs**

- Summary
- Estimated Costs

**Prepared by: Development Services Department, City of Corpus Christi and the North Beach Taskforce**

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## Existing Conditions

### Topography

North Beach is part of what is known as the Rincon Peninsula that was created in the mid 1920s when the Corpus Christi Ship Channel was dredged. Prior to construction of the ship channel, the area was connected to the mainland and the downtown area. The topography of the area is flat with an elevation of only 1 to 6 feet above sea level.

### Soils and Water Table

Area soils are composed of sand and silt with an under layer of clay. The Nueces County Soil Survey describes the soils as the Lomalta Association with a water table of less than six feet. Because of the relatively soft surface soil of sand, for any building to survive even a modest hurricane construction must be built on suspended foundations or pile supported foundations.

A deep pile supported foundation can withstand the undermining and washing away of the sandy soils during a storm surge as opposed to a slab on grade which will sink or float away.

The high water table and low elevation of the area makes draining the area very difficult since there is very little opportunity to create a slope for drainage structures or pipes. Just as important is that the “force” to create stormwaters to flow is difficult to create when the drainage pipe is already partially full of water due to the high water table. For these reasons the standard drainage systems generally only have modest success at draining storm waters.

### Flooding / Erosion

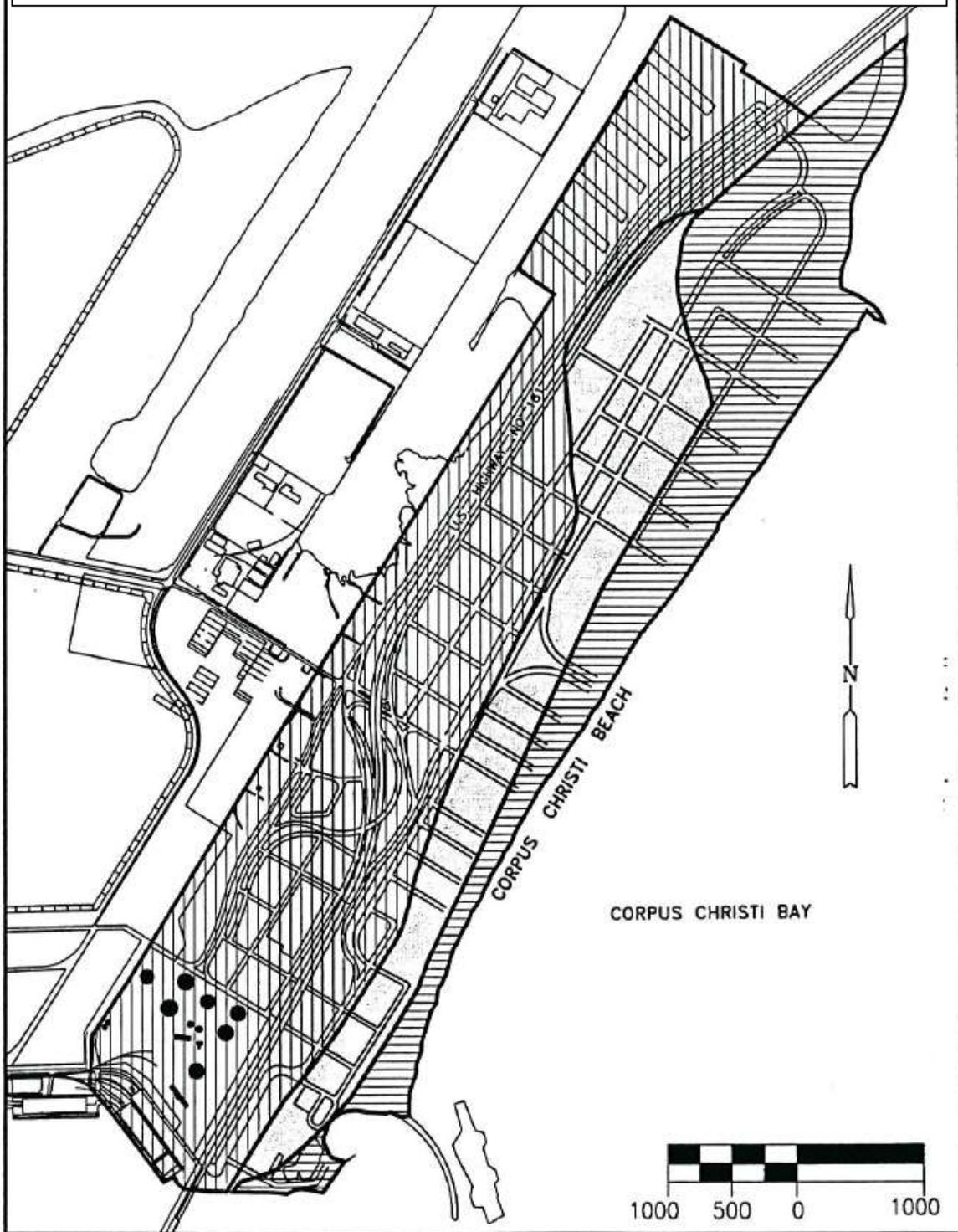
With the low elevation, bay location at the mouth of the Nueces River and with water on three sides, North Beach is subject to three natural flood water threats. These three flooding threats are: storm surge due to hurricanes; bay flooding from non-tropical events; and rainfall flooding.

Federal Emergency Management Agency (FEMA) designates all of the area east of U.S. 181 as a flood zone. These flood zones contain three different designations as illustrated on Figure 1<sup>1</sup>: V-22 with an elevation 15 feet; V-22 with an elevation of 13 feet and A-18 with an elevation of 12 feet. The impact of these zones is significant as the City Building Code requires that all new structures' finished floors be built at least one foot above the designated elevation contained in each of the FEMA flood zones.

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<sup>1</sup> Corpus Christi Beach Strategic Action Plan, Prepared by Shiner, Moseley and Associates, Inc., 1999.

Figure 1: Federal Emergency Management Agency (FEMA) Flood Zones



All of Corpus Christi Beach is within Coastal Flood Hazard Areas, with potential flood heights of 12-15 ft. The portions near the bay are in the V-Zone and are subject to violent wave action.

- ZONE V-22 (EL=15 FT)
- ZONE V-22 (EL=13 FT)
- ZONE A-18 (EL=12 FT)

Above based on applicable Federal Flood Insurance Rate Map. Consult map for precise boundaries.

### **Recent Heavy Rainfall**

During the summer of 2010 there were several periods of heavy rainfall. Hurricane Alex impacted the area with 2.2 inches of rain and high tides from June 29 thru July 1. Staff visited the North Beach area to observe drainage problem areas on July 2, 2010. Figure 2 - 4 are photos taken of some of the areas that contained large pools of rainwater from 12 to 24 hours following the storm events. Based on the pictures and staff observations Figure 5 is a map of storm water problem areas.



Figure 2: North Shoreline Blvd./Breakwater Ave. – East



Figure 3: Dolphin Park – Looking Northwest – 7/2/2010



Figure 4: Tourist Avenue – Looking East from US 181 – 7/2/2010

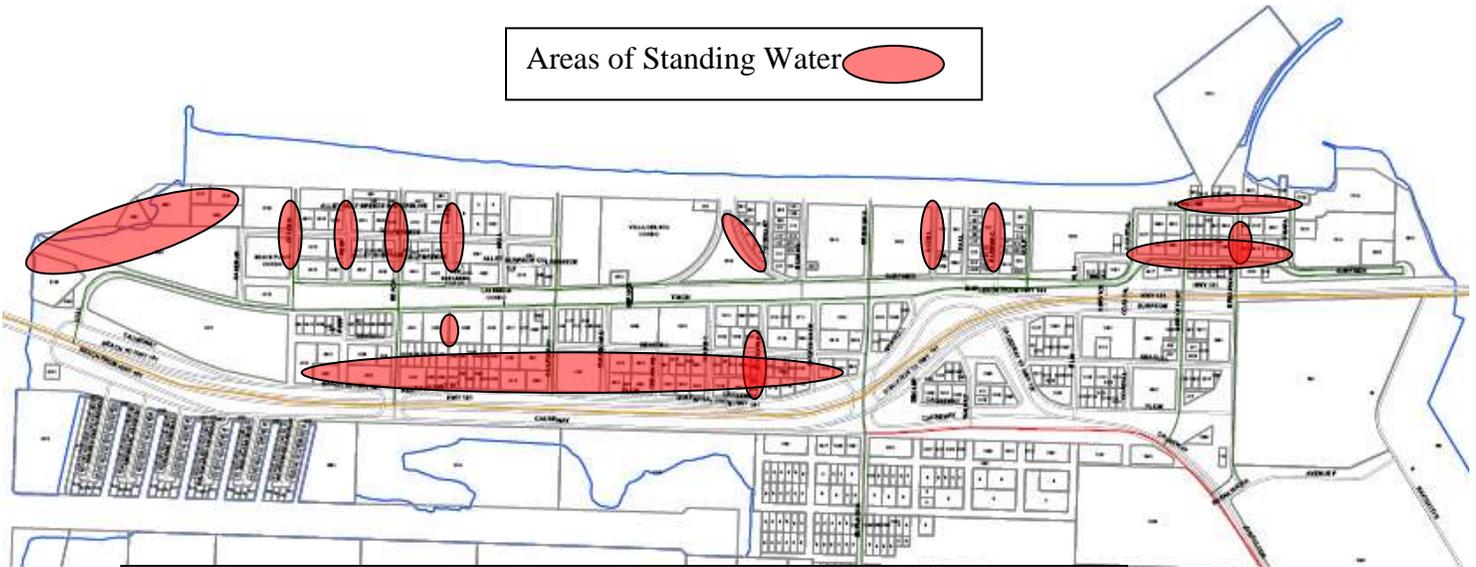


Figure 5: Storm Flooding July 2, 2010

## **Existing Street, Water and Wastewater System**

### **History**

The Brooklyn Subdivision, which encompassed all of North Beach, was filed in the Nueces County Court House November 8, 1890. The city blocks and associated street system layout can be traced back to the Brooklyn Subdivision.

Prior to 1977, the storm water drainage system was designed to drain much of the area across the beach to Corpus Christi Bay. The practice of draining storm water across the beach is known to cause erosion of a sandy beach and is not considered a good storm water management technique. Based on information from city employee accounts of the project, as a condition of participation in the 1977 beach renourishment project, the Corp of Engineers required the City to redesign the drainage system so that the drainage outfalls would not cross the beach. Drainage across the beach was replaced by two outfalls, one at the north and one at the south end of North Beach. Areas west of Timon Boulevard would continue to drain westward out to Rincon Channel A and B.

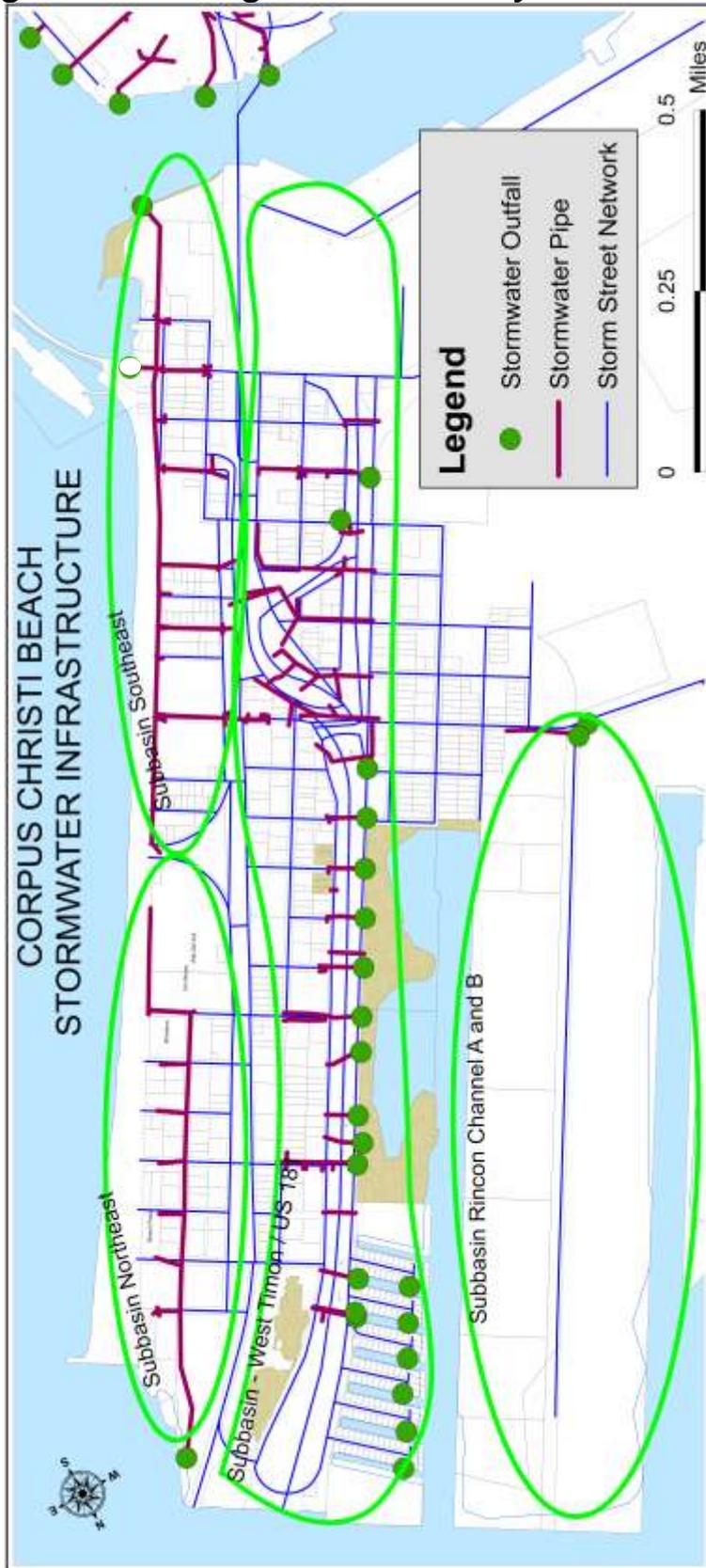
One of the questions that arise is whether the streets that formerly transported stormwater to the beach were re-graded with a slope that would funnel storm water to the new system required by the Corp of Engineers. Many of the streets which dead-end at the beach are currently problem areas after major rains or after seasonal high tides. The suspicion is that the streets were never fully evaluated since the priority at the time was to take the drainage off the beach and get the sand for the beach.

### **Existing Drainage System**

The existing storm drainage system is illustrated on Figure 6. The system is composed of a combination of underground storm water pipes and street system drainage. The outfalls indicated on the city layer for the storm water system incorrectly illustrates an outfall at Breakwater Avenue and the beach. Although this outfall was designed, it was never built since it would traverse the public beach in contradiction with the City agreement with the Corp of Engineers that the outfalls would cross the public beach.

Each drainage system basin in the city is designed based on a subbasin. There are essentially four subbasins in the study area as illustrated on Figure 6. The existing storm drainage infrastructure within each of the Subbasins is composed of a network of underground storm water pipes and surface street drainage.

Figure 6: Existing Storm Water System



## **Subbasin Southeast**

The Southeast Subbasin contains one storm water main that is within the North Shoreline right-of-way and which starts at Surfside Park and terminates at an outfall on the north shoreline of the Ship Channel next to the Texas State Aquarium. Various storm water pipes and surface street drainage inlets then tie into storm water main in the North Shoreline right-of-way.

### **Subbasin Southeast Drainage Issues**

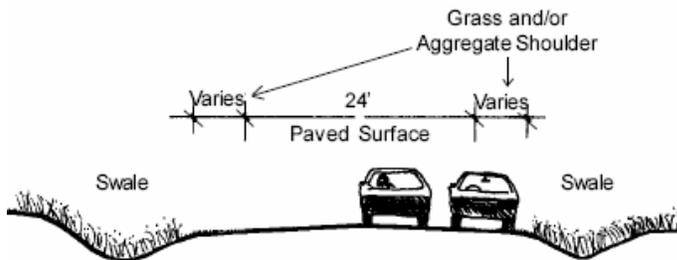
- Has the system silted in? This question was raised with the original North Central Area Development Plan but the adopted policy recommending an evaluation was never completed.
- The system is over 30 years old, are there major blockages and or cave-ins, particularly where development over the line or very near the line has occurred (Aquarium area)?
- Is the street system funneling storm water toward the storm water main? In some areas such as at the dead-end at Breakwater Avenue there is ponding after almost any rain even. Part of the problem might be that the standing water appears to be draining toward the east to the beach instead of draining toward the west toward the storm drainage main.
- There may be a lack of stormwater inlets at some locations.
- During high tides the storm water system contributes to flooding by transporting water into the area.
- The area is located in a FEMA Velocity Zone, therefore new development will have to be elevated on pilings.
- What alternatives to street reconstruction and regrading might exist?

### **Subbasin Southeast Drainage Solutions / Alternatives**

1. Continue staff monitoring and identification of drainage problem areas following storm events.
2. Determine if solids and siltation clogs the storm water collection system and identify any locations requiring structural repairs.
3. Prepare a plan for the removal and proper mode of disposal of any solids and siltation from the storm water mains.
4. Determine modifications to the outfall which would improve the flowrate and diminish the rate of solids deposition.
5. Determine whether a storm water pump station in lieu of or in combination with the storm water outfall would significantly improve the performance of the system.
6. Determine if a “gate” or “flapper valve” is necessary to prevent inflow from high tides. (Consider manually operated valves where water pressure is insufficient to operate an automatic flapper system.)
7. Target street ponding problem areas and regrade the street or move inlets to the low points.
8. Consider alternative designs to the standard street improvement with curbs and gutters and underground drainage. Alternative designs might

include a valley surface drainage system, a grated semi-submersed drainage system or a rural road side ditch system. (See Figure 7)

### Figure 8: Swale and Valley Gutter Storm Drainage



*Crowned, curbless road drains to roadside swales. Grass shoulders function as occasional parking lanes. Dimension Source: Afton, Minn.*



#### Recommended Action

1. Fund a contract for an engineering assessment of the drainage system. The assessment should include the following:
  - a. The assessment should include: cleaning pipes and inlets; and visual inspection of the storm water piping to look for blockages, leaking joints and cave-ins. Costs estimates should also be provided for design and construction of any repairs.
  - b. Design street improvements and estimate costs to address street flooding.
  - c. Determine feasibility for design improvements to increase storm water capacity and flow rates (such as slip lining, pump station, etc.)
  - d. Address any other issues found during the assessment with recommended solutions and preliminary cost estimates.

### Subbasin Northeast Drainage System

The Northeast Subbasin is similar in design to the Southeast Basin as one large storm water main flows from Surfside Park to outfall at the north end of North Beach. The main is then fed by a series of drainage pipes and street surface drainage which intersect the main at regular intervals.

#### Subbasin Northeast Drainage Issues

- The same issues as the Southeast basin.

### Subbasin Northeast Drainage Solutions / Alternatives

1. Same Solutions / Alternative as the Southeast Area
2. Determine the feasibility of using detention facilities as attractive wet ponds in the Timon-Surfside Boulevard. (See Figure 8)
  - Quantify capacity improvements
  - Assess regulatory feasibility with FEMA (V-Zone Area) and other environmental regulations and the potential use of excavated material as fill for development on North Beach.
  - Estimate costs.

**Figure 8: Storm Water Detention / Water Features**



## **Recommended Action**

1. Fund a contract for an engineering assessment of the drainage system. The assessment should include the following:
  - a. The assessment should include an on-site visual inspection of the storm water mains to look for blockages and cave-ins. Costs estimates should also be provided for design and construction of any repairs.
  - b. Design street improvements and estimate costs to address street flooding.
  - c. Determine feasibility for design improvements to increase storm water capacity, flow rates, etc.
  - d. Identify detention facility sites for wet ponds for overflow capacity and estimate costs.
  - e. Address any other issues found during the assessment with recommended solutions and preliminary cost estimates.

## **Subbasin West Timon Boulevard / SH 181 Drainage System**

The drainage subbasin generally runs the length of the North Beach area west of Timon Boulevard and drains into Rincon Channel A. There are 14 outfalls which serve the area and 10 of the outfalls are located at approximately one block intervals between the Porto Bello (canal) Subdivision and Burleson Street.

## **Subbasin West Timon Boulevard / SH 181 Drainage System Issues**

- Same issues as the Southeast Subbasin.
- Many city cross streets between Timon Boulevard and US 181 flooded and were closed during the June 28 and 29, 2010 rain and high tide event.
- The existing mobile home park was evacuated and a portion of the frontage road was closed during June 28 and 29, 2010 rain and high tide water event.
- Most of the area is served by a surface street drainage system of roadside ditches.
- Less than 50% of the area is developed and as development occurs more impervious surfaces will increase stormwater runoff.
- With so much vacant land would a detention pond system help to mitigate drainage problems after major storm events?

## **Subbasin West Timon Boulevard / SH 181 Solutions / Alternatives**

1. Same Solutions / Alternative as the Southeast Area
2. Determine the feasibility of using detention facilities as attractive wet ponds in the Timon-Surfside Boulevard.
  - Quantify capacity improvements
  - Assess regulatory feasibility with FEMA (V-Zone Area) and other environmental regulations and the potential use of excavated material as fill for development on North Beach.

- Estimate costs.

### **Recommended Action**

1. Fund a contract for an engineering assessment of the drainage system. The assessment should include the following:
  - a. The assessment should include an on-site visual inspection of the storm water mains to look for blockages and cave-ins. Costs estimates should also be provided for design and construction of any repairs.
  - b. Design street improvements and estimate costs to address street flooding.
  - c. Determine feasibility for design improvements to increase storm water capacity, flow rates, etc.
  - d. Identify detention facility sites for wet ponds for overflow capacity and estimate costs.
  - e. Address any other issues found during the assessment with recommended solutions and cost estimates.

### **Subbasin Rincon Road Drainage System**

The Rincon Road Drainage System is located outside city limits and encompasses property that abuts Rincon Channel A and B. While these properties will one day need a drainage master plan, all of the properties are in close proximity to one of the Rincon Channels which should be an aid to the functionality of the future drainage system. In addition, almost all of the shorelines contain bulkheading to eliminate the threat from tidal flooding.

### **Recommended action**

No action at this time. When a specific development is proposed, a master plan for drainage will be required.

## Recommendation Summary

### Southeast

- Fund a contract for an engineering assessment of the drainage system. The assessment should include the following:
  - The assessment should include an on-site visual inspection of the storm water mains to look for blockages and cave-ins. Costs estimates should also be provided for design and construction of any repairs.
  - Design street improvements and estimate costs to address street flooding.
  - Determine feasibility for design improvements to increase storm water capacity, flow rates, etc.
  - Address any other issues found during the assessment with recommended solutions and preliminary cost estimates.

### Subbasin Northeast and Subbasin Timon Boulevard / US 181 - Same recommendations as in the Subbasin Southeast area plus:

- Identify detention facility sites for wet ponds for overflow capacity and estimate costs.

**Rincon Channel A and B – no recommendations at this time.** Require a drainage plan when a specific plan for development is proposed.

<b>COST OF PROPOSED NORTH BEACH INFRASTRUCTURE IMPROVEMENTS</b>		
<u>Improvements</u>	<u>Total</u>	<u>Comments</u>
<b>Southeast</b>		
Phase 1		
Cleanout system	\$200,000+-	
Phase 2		
Repair Major Problems	\$200,000+-	Cave ins, etc.
Slip Lining, Cast in place Tech.	\$100,000+-	To improve flow characteristic
Phase 3		
Emergency Pump	Unknown	City Emergency Response Program – post storm