AGENDA MEMORANDUM ***Streets and Stormwater Department***

Workshop Meeting Date: September 14, 2020

To: City Council

Through: Charles T. Chapman IV, City Manager

From: Gregg Strakaluse, Director

Date: August 25, 2020

SUBJECT:
Discussion regarding Gulf Shore Boulevard construction and restoration as part of the Naples Beach Restoration & Water Quality Project.

BACKGROUND:
At the June 3, 2020 City Council meeting, staff provided a summary of over 18 years of information related to the City's 9 stormwater beach outfalls to the Gulf of Mexico. The 13-page agenda memorandum, along with the 44 attachments to the item can be found at the following link:

https://granicus_production_attachments.s3.amazonaws.com/naples/b8ab903a4f574980f14842e19fa6e0660.pdf

At the conclusion of the meeting, City Council approved the following motions (as recorded in the meeting minutes by the City Clerk):

DIRECTION #1
MOTION by Hutchison to DIRECT staff to not consider bike lanes as part of the Naples Beach Restoration & Water Quality Improvement Project other than sharrow design that currently exists. Motion seconded by Perry and carried 6-1.

DIRECTION #2
MOTION by Hutchison to DIRECT staff to provide Council with, and clearly demonstrate, measurable water quality improvements which include baseline measuring of existing water quality and the cost benefit of using different technologies to enhance water quality as part of the Naples Beach Restoration and Water Quality Improvement Project; and direct staff to report back to Council at its September 14, 2020 Workshop Meeting on the design of the project as well as provide a presentation on the cost and benefits of the technologies that have been evaluated, and schedule the item for approval at the September 16, 2020 Regular Meeting. This motion was seconded by Price and unanimously carried, all members present and voting

DIRECTION #3
MOTION by Hutchison to DIRECT staff to evaluate an alternative pump station along with an alternative primary horizontal water dispersion location into the Gulf of Mexico and contiguous to the location of the Naples Beach Hotel, which would accommodate stormwater from areas currently

identified under Phases One and Two of the Naples Beach Restoration and Water Quality Improvement Project, and provide to Council at its September 14, 2020 Workshop Meeting. This motion was seconded by Price and unanimously carried, all members present and voting

DIRECTION #4

MOTION by Christman to DIRECT staff to return with a proposed updated Bicycle and Pedestrian Master Plan for the next fiscal year with an appropriate budget, and also include recommendations for short-term safety related improvements such as stop signs, speed limits, or other traffic control methods along Gulf Shore Boulevard, particularly within the proposed Naples Beach Restoration and Water Quality Improvement Project area. This motion was seconded by Blankenship and unanimously carried, all members present and voting

DIRECTION #5

MOTION by Christman to DIRECT staff to prepare an evaluation of key elements, staff recommendations, and expenditures associated with roadway design, including the location of the water main, stormwater infrastructure, selection of appropriate gutters, as well as elevation of the road, and return to Council that fall with recommendations that would minimize the impact to existing sidewalks, adjacent properties, the roadway, and right-of-way. This motion was seconded by Hutchison and unanimously carried, all members present and voting.

By setting the September 14th Workshop date for follow-up to these directives, City Council required staff to work expeditiously. At the June 17, 2020 City Council meeting, Amendment No. 3 was approved with Erickson Consulting Engineers, Inc. for $159,800 so that the engineer of record (Karyn Erickson, P.E.) and staff could thoroughly respond to the directives. In the 75 calendar days that have passed between June 17, 2020 and the deadline to submit materials for the September 14th Workshop, much work has been accomplished. City Council's direction to report back on specific items required a tremendous amount of research, data collection, analysis, engineering, collaboration, and reporting. This agenda package is voluminous, and staff has attempted categorize the entire work effort into the following categories:

1. Project Structure Alternatives (Direction #3)
2. Water Quality Components (Direction #2)
3. Minimizing Key Component Impacts (Direction #5)
4. Interim Transportation Safety Improvements on Gulf Shore Blvd. (Direction #4)

It is important to note that Direction #1 is a clear design change that will remove the on-street bicycle lanes from the project and will be made when incorporating other potential design changes resulting from discussion of this item.

PROJECT STRUCTURE ALTERNATIVES

It is important to point out that recommendations within the Key Components Evaluation and the Water Quality Review can be applied to each of the Project Structure Alternatives below; further reducing construction impacts and improving stormwater quality prior to discharge. The following project structure alternatives have been developed and assessed:

1. TWO PUMP STATION ALTERNATIVE (Original Design Approach)

North PS: Located at 5,000 sf Naples Beach Club (NBC) Drainage Easement
South PS: 3RD Avenue North ROW

	North PS	***South PS***	***TOTAL***
Flow	***78 CFS***	***98 CFS***	***176 CFS***
Drainage Area	***164 acres***	***256 acres***	***420 acres***
Est. Construction Cost	***$10.4M***	***$12.9M***	***$23.3M***
Permit-ability	***Probable***	***Permitted***	
Construction Impacts	***Low***	***Moderate-High***	
Water Quality	***TBD***	***High***	

2. SINGLE PUMP STATION ALTERNATIVE (Highest Risk, Most Impacts)

Located at 5,000 sf NBC Drainage Easement Plus 13,000 sf of Oleander ROW

	North PS
Flow	***176 CFS***
Drainage Area	***420 acres***
Est. Cost	***Not Priced due to Design & Constructability Impacts & Permit Issues***
Permit-ability	***Improbable***
Construction Impacts	***High & Very Impactful***
Water Quality	***TBD***

(a) Must convey and receive stormwater from 420 acres;
(b) Requires at least one 'booster pump station' to convey flows from distant locations to the North PS;
(c) Flow during a 25-year, 3-day storm is approximately 175 CFS or 81,000 GPM {For perspective, the Cove and Public Works Stormwater Pump Stations are currently the City's largest and permitted for 50K GPM flows};
(d) Land required to build pump station of this size is between 15,000 – 18,000 sf. There is approximately 7,500 sf available in the Oleander ROW and a 5,000-sf commitment by NBC, totaling 12,500 sf. Insufficient land area exists.
(e) Four 30-inch discharge pipes are required to be placed approximately 1,600- 1,700 feet out into the Gulf. Discharge diffusers in the Gulf would need to be staggered over significant distances to achieve an acceptable mixing zone for the marine environment;
(f) Significant permitting hurdles through FDEP, US-ACE are probable and would likely drive up costs. Potential concerns from environmental advocates are possible.
(g) Significantly larger trunk lines (pipes or box culverts) are required to be placed within the right-of-way to convey stormwater. This is especially true as flows combine and

near the pump station. Such a trunkline is expected to run into significant conflicts with existing utilities within the ROW, requiring relocation at high cost.

(h) No opportunities to divide coverage areas to reduce risk to the watershed. Emphasis is on one single system and failure of a single system impacts a greater area.

3. TWO PUMP STATION ALTERNATIVE 'A'

North PS: Located at 5,000 sf NBC Drainage Easement and some Oleander ROW
South PS: 3RD Avenue North ROW (3rd St. North into Alligator Lake)

	North PS	***South PS***	***TOTAL***
Flow	***105 CFS***	***65 CFS***	***170 CFS***
Drainage Area	***181 acres***	***239 acres***	***420 acres***
Est. Cost	***$11.9M***	***$12.1M***	***$24M***
Permit-ability	***Probable***	***Permit Modification***	
Construction Impacts	***Low***	***Low-Moderate – but larger impact area***	
Water Quality	***TBD***	***High***	

(a) Redirects all of South Golf Drive stormwater flow (27 CFS) from the south system to the north system. South Golf Drive has an FDOT funded streetscape project that includes stormwater improvements and the redirection of flow could be address at that time.

(b) According to the 2020 Naples Bay Water Quality & Biological Analysis Report, there is an increase in suspended solids, total Nitrogen, fecal coliform, and enterococci in lakes draining to the Gulf of Mexico. North Lake is a 2.3-acre stormwater pond that drains to the Gulf of Mexico through South and Alligator Lakes. It currently receives stormwater from approximately 55-acres of developed land. The design capacity of North Lake is approximately 27-acres; therefore, the lake is receiving substantially more stormwater than its size is able to accommodate. By redirecting South Golf Drive flows to the North Pump Station system, the drainage area for North Lake is reduced by approximately 9-acres, giving the lake a better opportunity to remove pollutants in conjunction with South and Alligator Lakes. Pollutants within the diverted flow could be removed through bioswales and other BMP's designed as part of the South Golf Drive Project.

(c) Reduces pipe sizes and construction impacts along Gulf Shore Blvd between 2nd Avenue South to 3rd Avenue North by capturing and conveying stormwater along 3rd Street and 3rd Avenue North and redirecting flows to Alligator Lake. While this broadens the construction area of the project to 3rd Street, it reduces construction impacts to Gulf Shore Boulevard and provides opportunity to integrate additional water quality measures and recapture swales east of Gulf Shore Blvd.

(d) A larger pump station for the north system maximizes the use of the 5,000-sf drainage easement commitment from the Naples Beach Hotel and Golf Course and will likely require some encroachment into the Oleander ROW;

(e) The south pump station has three pumps instead of four pumps and a slightly smaller footprint within the 3rd Avenue North right-of-way.

(f) The size of the two discharge pipes into the Gulf for the south pump station decrease from 32" to 24" (inside diameter). This also reduces directional drilling costs at this location. Larger or an additional discharge pipe is probably at the discharge location for the north system.

(g) Acquiring permits for this option is highly probably.

(h) Overlapping coverage areas is possible and operation of two separate systems reduces risk of failure when compared to a single treatment system.

4. TWO PUMP STATION ALTERNATIVE 'B'

North PS: Located at 5,000 sf NBC Drainage Easement
South PS: 3RD Avenue North ROW (3rd St. North into Alligator Lake)

	North PS	***South PS***	***TOTAL***
Flow	***78 CFS***	***98 CFS***	***170 CFS***
Drainage Area	***164 acres***	***256 acres***	***420 acres***
Est. Cost	***$10.4M***	***$13.2M***	***$23.6M***
Permit-ability	***Probable***	***Permit Modification***	
Construction Impacts	***Low***	***Moderate with slightly larger impact area***	
Water Quality	***TBD***	***High***	

(a) This option remains generally consistent with the original design for both north and south systems with the exception of a reduction of pipe sizes and construction impacts along Gulf Shore Blvd between 2nd Avenue South to 3rd Avenue North. This is done by capturing and conveying stormwater along 3rd Street and 3rd Avenue North via new pipes and inlets and directly tying into the pump station at 3rd Avenue North.
(b) Continues to direct a portion of South Golf Drive stormwater flow to North Lake rather than redirecting flows to the north system. North Lake continues to receive stormwater from a larger area than its present dimensions allow for.
(c) Discharge pipe sizes at both pump stations remain consistent with the original design.
(d) The south system currently has a permit for 98 CFS. A permit modification for a lesser flow rate is highly probable. Previous discussions with permitting agencies in 2015 indicated two discharge locations are permittable, pending application review.
(e) Overlapping coverage areas is possible and operation of two separate systems reallocates risk.

Staff Recommendation: Alternative 'A'

North PS: Located at 5,000 sf NBC Drainage Easement
South PS: 3RD Avenue North ROW (3rd St. North into Alligator Lake)

	North PS	***South PS***	***TOTAL***
Flow	***105 CFS***	***65 CFS***	***170 CFS***
Drainage Area	***181 acres***	***239 acres***	***420 acres***
Est. Cost	***$11.9M***	***$12.1M***	***$24M***

WATER QUALITY BASELINE, GOALS & STANDARDS, & BMP COST-BENEFIT

Measurable Project Water Quality Data: Baseline

Many rounds of very specific water quality sampling have been conducted for this project over the past 4 years. In 2017 a water quality sampling protocol was completed with the following objectives:

1. Siting the sampling locations for overall geographic location to estimate and quantify the sub-basin contribution and concentrations for outfalls characterized by high discharge rates;
2. Timing the sampling to capture the "worst case conditions" for an approximate 0.5 inch or greater rainfall event;
3. Following established standard methods for sampling and testing to measure pollutants of concern and gather related key baseline and physical information;
4. Utilizing adaptive management to assess the sampling and testing results to incorporate feedback loops that may result in siting and protocol changes; and
5. Gaining an understanding of variability and levels of water quality impacts to the Gulf associated with stormwater at these outfalls and opportunities to reduce levels of pollutants.

Sampling events occurred on the following dates:

- May 4, 2016
- June 7, 2016
- July 21, 2016
- June 6, 2017

This data collected during this sampling protocol was used as the basis for the design efforts between the 30% Design and the 90% Design. Reference the "Water Quality Report in Appendix of 30%" for the details of this sampling protocol as well as the testing results.

Bacteria

Sampling results indicate that bacteria, specifically enterococcus is a pollutant of concern. Several items of note are:

- First flush at the outset of the rainy season discharges high bacteria counts as sampled in the Gulf by the outfall pipes (19,000 cfu/100 mL);
- Subsequent rainfall event show significantly lower bacteria counts as sampled in the Gulf by the outfall pipes (under 400 cfu/100 mL);
- Bacteria result at the Alligator Lake weir site is relatively very low, which indicates that the lake system may be functioning to reduce bacteria (300 cfu/100 mL);
- Bacteria counts rapidly decrease in Gulf samples around the outfalls as samples were taken farther from the pipe discharge point. In certain conditions sunlight and salt water are known to inactivate fecal indicator bacteria (e.g. E. coli and enterococcus).

Based on feedback gathered from various stakeholders including residents and the City Council, additional water quality sampling occurred on June 4, 2020 and July 17th, 2020. These events focused on fecal coliform and enterococcus bacteria in the stormwater flowing from upland areas prior to entering into the stormwater pipe system. The results, which are

included in Attachment #1 to this item show that the bacterial levels are also high in the stormwater flowing over land from the east and west of Gulf Shore Blvd.

Total Suspended Solids, Total Phosphorus, Total Nitrogen, Bacteria

Measurable Project Baseline Standards from Multiple Sampling Events

Pre-Project Annual Loading	Catchment Area (Ac)	Runoff (Ac-Ft/Yr)	TSS	TP	TN	Enterococci
			lbs/yr	lbs/yr	lbs/yr	Billion Colonies
EMC (mg/l)			37.5	0.327	2.07	300*
Sub-Basins 2-4	148	221	22495	196	1242	820
Sub-Basins 5-6	156	233	23733	207	1310	865
Sub-Basins 7-10	100	149	15197	133	839	554
Total (Sub-Basins 2-10)	405	604	61425	536	3391	2240

*300 cfu/100 ml (base flow)

Guidance for Water Quality Goals and Standards

Gulf of Mexico FDEP Water Quality Standards:

Turbidity ≤ 29 NTU's
Total Suspended Solids ≤ 25 mg/L
Total Nitrogen (TN) ≤ 0.29 mg/L (EPA Ecoregion XIII ≤ 1.27 mg/L)
Total Phosphorus (TP) ≤ 0.018 mg/L (EPA Ecoregion XIII ≤ 0.018 mg/L)
Bacteria (FL Department of Health):

Florida Healthy Beaches Program Categories are:

Good = 0-35 Enterococci per 100 milliliters of marine water
Moderate = 36-70 Enterococci per 100 milliliters of marine water
Poor = 71 or greater Enterococci per 100 milliliters of marine water

WATER QUALITY COMPONENTS

Water Quality Component Listing

- Lakes
  - By modifying the existing lake control structure, Alligator Lake can be better utilized to attenuate stormwater runoff for both water quality purposes as well as water quantity.
  - Alum treatment system – based on feedback from Council and members of the public, an alum treatment system is being investigated for Alligator Lake. This would disperse alum into the lake with the intent to bind nutrients and allow to settle to the bottom for collection (dredge).
  - Use of this product increases lake dredge maintenance requirements.

Staff Recommendation: Employ upland BMP's, such as increased street sweeping and inlet filters and baskets, exfiltration and bioswales. Avoid the use of alum for flocculation sludge in lakes and toxicity.

- Inlet drain baskets and filters
  - The current plans include inlet filter baskets which capture debris and sediment prior to entering the pipes. When maintained properly, these devices are highly effective at preventing pollution (nutrients and bacteria).

Staff Recommendation: *Integrate the use of approximately 130 units on the north and south treatment systems. NBC to fund installation of @ 30 units when GSB is rebuilt from S.Golf Dr. to Oleander.*

- Swales and bioswale treatment
  - Many of the Avenues in the project limits currently have swale drainage systems. However, some swales have been filled in either by redevelopment or naturally over time. By re-establishing swales, stormwater runoff from smaller storm events will be captured in the swale where water will be able to percolate into the soils. The current plans include installing several bio-swales near Gulf Shore Blvd which will have specifically designed filtering media that allow nutrients to adhere to and prevent from flowing downstream – similar technology that was recently incorporated in the City of Bonita Springs Bioreactor project under a municipal (gravel) parking lot.

Staff Recommendation: *Reclaim swales, consider filtering media, and identify areas of ROW for bioswales.*

- Stormwater pollutant removal vaults
  - Designed to separate out grit, trash, and other debris for collection prior to flowing downstream.

Staff Recommendation: *Integrate one vault into each treatment system (north and south).*

- Nutrient Separating Baffle Box
  - A Nutrient Separating Baffle Box is being planned for immediately upstream of the pump station as another filtering mechanism to remove grit, trash, and debris prior to discharge.

- This device removes debris, trash and solids that are carried by stormwater flows.
- Some devices can also remove finer suspended solids (silts and sands) and hydrocarbons.
- Product efficiency: TSS 50-80%; TP 15%; TN 19%

Staff Recommendation: Integrate nutrient separating baffle boxes in both the north and south treatment systems.

- Ultraviolet light treatment
  - UV Treatment can reduce between 75-99% of bacteria and viruses in the stormwater exposed to UV light. Large flows from intense storm events would not receive 100% exposure.
  - Estimated cost: $750,000-$850,000
  - An ultraviolet light treatment (UV) system has been considered as water quality treatment devices for this project from the beginning. Staff's prior recommendation was to bid construction of the south system with the UV treatment component as an 'alternate bid item'. This approach would reveal the competitive construction costs to install the UV system and allow staff and City Council to weigh the actual cost to the proposed benefit for bacteria and virus removal. Staff's opinion to defer the installation of a UV system until one to two full years' worth of data is obtained after construction of the south system is based on staff's review of recent bacteria data for upstream and downstream flows. While the first full flush of stormwater through the existing outfall pipes at the shoreline is high in bacteria, subsequent rainfall events are lower than the standards for recreation set by the FDEP/DOH. Recent sampling of upstream flows prior to entering the stormwater conveyance system show high bacteria levels; however, levels of bacteria at the discharge locations along the shoreline remain lower than the FDEP/DOH standards for recreation (not including first flush). This may indicate that something is happening during the movement of stormwater to bring the bacteria levels down prior to discharge at the outfall after the first flush.

Staff Recommendation: *Continue to bid a UV treatment system as an alternate bid item, reveal a competitive bid cost to construct, and assess the cost/benefit of constructing a UV treatment system at the time of constructing the south system. Reassess cost benefit after receipt of actual bid. Additional bacteria data may be collected for one to two years near the offshore discharge location to better assess the performance of the new discharge system and actual bacteria counts. The cost estimates for a UV system that could treat 15 CFS is approximately $700,000-$800,000, at the time of constructing the entire south system.*

- Exfiltration & Bioreactor Systems
  - Exfiltration systems and Bioreactor systems require unaffected open space. Linear exfiltration systems can integrate nutrient removal materials within the design and can more easily be constructed along the greenspaces of public ROW. However, finding sufficient open space in the project area for a more significant bioreactor project is challenging. While there is a vacant parcel of

land at 680 Gulf Shore Boulevard, this parcel was purchased for $1.9 million in 2013. This would appear to be an ideal location to create a bioreactor; but the cost to acquire land is unlikely to provide an acceptable cost-benefit scenario. City beach end ROW at 8th Avenue North may be an alternative to purchasing an expensive vacant parcel of land; however, public and private utilities are entitled to access public ROW for their infrastructure through a ROW Permit. New installation and maintenance of utilities would put a bioreactor system at constant risk of damage unless specific controls and restoration requirements were put in place by the City.

Staff Recommendation: *Integrate linear exfiltration systems where there is sufficient elevation above the wet season water table and consider the use of filtering media to maximize nutrient removal effectiveness. Consider ROW controls that may assist with bioreactor installation and protection within beach end ROW's. Further explore bioreactors with Collier County and the BCB, particularly where rural agricultural runoff exists.*

MINIMIZING KEY COMPONENT IMPACTS

The following key components of the south system have been identified for evaluation:

(a) ***Stormwater Trunk Line Size & Location***: This component is greatly influenced by the selection of a project structure. As described above, Alternative Structure A and B both can reduce pipe size, thereby reducing construction impacts resulting from excavating and trenching withing the ROW. Both Alternative Structure options, do however, broaden the project construction area since additional swale reclamation and pipe installation is necessary along 3rd Street and 3rd Avenue North.

Along GSB between 2nd Avenue South to Central Avenue, there is no reuse main under the northbound travel lane; therefore, the stormwater trunk line can be placed under the travel lane, recognizing that manhole covers will also be located in the travel lane and any maintenance of the stormwater trunk line in this location will require a travel lane to be temporarily closed and detour provided.

North of Central Avenue along GSB, there is a large reuse main currently located under the northbound travel lane; therefore, a new stormwater trunk line is required within the ROW just to the east of the existing curb location. By selecting an Alternative Structure Option A or B, the trunkline size can be reduced and construction impacts also minimized.

Staff Recommendation: *Locate stormwater main on GSB between 2nd Avenue South and Central Avenue under the northbound travel lane and locating the downsized stormwater trunkline north of Central Avenue just east of the northbound valley gutter. Selection of Alternative Project Structure A will require new stormwater pipe and inlets along 3rd Street and 3rd Avenue. The design criteria for these streets would place the new pipe as close to the inlet drains and the roadway as possible.*

(b) ***Curb and Gutter Type***: The original design called for a raised curb to better receive stormwater into inlets, particularly at the intersections, and more easily accommodate the difference in elevation between the roadway and the ROW, particularly in those areas where homes have redeveloped to much higher FEMA flood elevations. The F-type curb can transition more easily to steep grade changes. The existing valley gutter is 18-inches and does not meet current roadway standards. Today's standard for valley gutter is 24-inches, which allows for improved stormwater conveyance and a more subtle transition over the gutter for driveways and intersections. Selecting the valley gutter options will require additional grading further into the ROW in order to properly transition from the gutter's edge towards the property line, particularly where steep grades exist.

Bicyclist have expressed that valley gutters would allow for a safer transition to the green portion of the ROW in cases of emergency or accidental maneuvers.

Staff Recommendation: *Redesign with 24-iinch valley gutter with elevated curbing only at open-throat drain inlets.*

(c) ***Curb Radii at Intersections & Alleys***: Existing curb/asphalt radii along GSB is approximately 25-feet at the intersections. While the smaller radii allows for shorter pedestrian crossing distances and more greenspace within the ROW, large trucks and trailer haulers tend to rut the greenspace and damage drain inlets as their rear wheels cross cannot stay on the pavement, sometimes causing wheel rutting in the soft ground and damage to drain inlets. Line of sight at some of the existing intersections is also impaired when vegetation grows into the ROW.

The original design called for a curb radii of 35-feet at all the intersections with the avenues and alleys along the east side of GSB, and 25-feet at all the intersections along the west side of GSB (alleys and avenues). Most large vehicle traffic tends to enter and exit from the east onto and off of GSB.

Further analysis was done to review vehicle count data and truck traffic movements observations from the east onto GSB. Additionally, a detailed analysis of truck and trailer turning movements using the software program Autoturn was performed. It was determined that curb radii dimensions could be refined and adjusted in key locations to better reflect the transportation usage and better preserve pervious greenspace and pedestrian connectivity.

Staff Recommendation: *Continue to design the curb radii at S. Golf Drive, 7th Avenue North, 4th Avenue North, and Central Avenue at 35-feet. This better reflects truck/trailer usage. Reduce the curb radii at intersections along the remaining east side avenues to 28-feet (rather than the proposed 35-feet), reduce the curb radii at all alleyways to 25-feet (rather than the proposed 35-feet) and maintain the curb radii along the west side at 25-feet.*

(d) ***Water Main Upgrade:*** The existing 6-inch water main is a very old asbestos concrete main. With the most conservative construction approach possible, the stormwater pipe and catch basins on the west side of Gulf Shore Boulevard will be in conflict with the old main at 27 locations. It is possible to deflect the main in those 27 locations, however flow and pressure of the main will be affected with the offset configuration. Also, multiple water service interruptions to customers will be required for the 27-deflections.

Additionally, other construction work near the old, brittle water main may subject it to additional breaks, particularly at its current shallow depth and location under the existing curb. To reduce the inconvenience of water service interruptions to the residents, and to ensure the highest level of long-term, service reliability, it is the Utilities Department recommendation to upgraded and replace the water main in a location that will minimize impacts to property owners along the GSB ROW. This criteria would guide the designers of the new water main to first consider constructing a new main within the travel lanes of GSB.

Staff Recommendation: *Upgrade and replace the water main in a location that will minimize impacts to property owners along the GSB ROW. Establish criteria that guides*

the design of the new water main first within the travel lanes of GSB, with exceptions for allowing placement outside the curb lines when significant conflicts arise.

(e) ***Roadway elevation:*** An elevated roadway has been proposed to improve drainage through better grading, without adverse impacts to existing low lying properties. As evident by puddles and slow drainage, the existing roadway grades are sloped at less than 0.5% longitudinally. Proper longitudinal grading ranges between 1-3%. Also, portions of GSB are below 4-feet elevation (NGVD-29). From time to time, sea levels and tides can exceed 4-feet, causing upland impacts to low lying lands. The original design proposes to raise the roadway elevation by 6-inches to help improve drainage and coastal resiliency. The drainage basin is generally protected by a 7-foot dune along the beach and will be served by a new pump station. Therefore, drainage within the basin will be greatly improved; however, if storms cause sea levels to rise above the 7-foot beach dune, flooding is likely to occur. Recovery from those instances will be greatly improved with a pump station.

Staff Recommendation: Maintain the design criteria for a 6-inch roadway elevation increase for improved drainage through grading and improved resiliency to climate change and rising sea levels (particularly during storm events).

INTERIM TRANSPORTATION SAFETY IMPROVEMENTS

Gulf Shore Boulevard between South Golf Drive and 20th Avenue South is a two-lane undivided road with valley gutter. It is currently identified in the City's code under Section 36-32 as a collector street with a 30-MPH speed limit. It's bound by the Gulf side properties to the west and single family residential properties to the east. There is significant bike and pedestrian traffic along the corridor as well as vehicular traffic. Two-way traffic counts for Gulf Shore Blvd. South near 5th Ave. South ranges from about 3,000 vehicles per day (VPD) in the off-season to a maximum of 7,775 VPD during season. A sidewalk exists primarily on the west side of the road from 18th Ave. South to Mooring Line Drive. There are no sidewalk facilities between 18th Ave. South to 20th Ave. South. A sidewalk connection exists along 18th Ave. South between Gulf Shore Blvd. South and 3rd St. South. There are currently no bike lanes on Gulf Shore Blvd. S. between South Golf Drive and 20th Ave. South but there are marked sharrows to designate a share the road condition with vehicular traffic.

Options to increase the safety of the roadway without adjustments to roadway geometry include:

i. a public education campaign designed for the Gulf Shore Boulevard corridor;

ii. periodic law enforcement traffic programs;

iii. a reduction in speed limit;

iv. the installation of signs at key locations;

v. installation of informative pavement markings;

Public Education

There are many templates for public education campaigns specifically aimed at safety and awareness of proper roadway use by vehicles, bicyclists and pedestrians. Coordinating with the Florida Department of Transportation and Collier County on public service announcements on radio and television can be an effective way to educate a large number of roadway users. Additionally, coordination with local organizations such as the Naples Pathways Coalition and Naples VELO provide great opportunities to reach a more localized population of bicyclist and pedestrians.

Periodic Law Enforcement Traffic Programs

Generally, periodic law enforcement traffic programs can focus on specific safety issues of concern. For example, speeding, stop sign running (autos and bicycles), 3-foot separation rule between bicycles and automobiles, and aggressive driving or riding. The Streets & Traffic Division can collect traffic data that can help law enforcement identify the time of day speeding occurs so that an enforcement program can be fitted to the specifics of the safety issue.

Speed Limit

The City has the option to determine and make modifications to set the optimal speed limit based

on state statutes. According to Section 316.006(2), (3), F.S. municipalities and counties shall have original jurisdiction over all streets and highways located within their respective boundaries, except for state roads. A municipality may set a maximum speed limit of 20 or 25 miles per hour on local streets and highways after an investigation determines that such a limit is reasonable. A municipality may have a speed limit set no greater than 30-mph according to 316.189 F.S.

Another notable publication relating to the speed limit considerations is *The Manual on Speed Zoning for Highways, Roads, and Streets in Florida* also known as the *Speed Zone Manual* prepared by the Florida Department of Transportation (FDOT) in compliance with Chapter 316 F.S. This manual was created in order to promote uniformity in the establishment of state, municipal, and county speed zones throughout the State of Florida.

The Manual of Uniform Minimum Standards (MUMS) for Design, Construction and Maintenance (aka *Florida Greenbook*) provides standards, unless a municipality or county has otherwise adopted other criteria, for public streets, roads, highways, bridges, sidewalks, curbs and curb ramps, crosswalks, bicycle facilities, underpasses, and overpasses used by the public for vehicular and pedestrian travel. The Florida Greenbook is established by Chapters 20.23(3)(a), 334.044(10)(a), and 336.045, Florida Statutes, and Rule 14-15.002, Florida Administrative Code. The Florida Greenbook states the design speed should be set according to the anticipated operating speed, adjacent land uses including existing and future, functional classification, and the topography. Consideration is also to be given to bicycle and pedestrian usage.

As traffic volumes decrease, vehicle speeds have a greater potential for increasing, particularly when a driver is seldom influenced by other vehicles. Out of season, there is clearly a lower volume of traffic on Gulf Shore Boulevard. Variations in vehicle speeds on a road can lead to increased safety concerns. Too low of a speed limit can produce a mixture of reactions by a variety of drivers, some frustrated.

A speed study was completed on Gulf Shore Boulevard North near 4th Avenue North between July 18th through July 20th, 2008. Results are:

- 85th Percentile Speed: 32.9 MPH

A speed study was completed on Gulf Shore Boulevard North near 4th Avenue North between February 25th through March 3rd, 2020. Results are:

- 85th Percentile Speed: 30.0 MPH

The 85th percentile speed is the speed at or below which 85 percent of the motorists drive on a given road unaffected by slower traffic or poor weather. This speed indicates that under ideal conditions most drivers feel that speed is safe and reasonable for that particular stretch of road. The 85th percentile helps transportation planners determine the most effective speed at which traffic moves with the least amount of congestion, speed differentials, and driver frustration. It also reduces unsafe passing of slower vehicles and reduced rear end collisions.

The 85th percentile speed identified for Gulf Shore Boulevard is in acceptable range. The average speed is actually lower at 25.9 MPH. Looking closer at the data, high vehicle speeds were in the 12am to 2am time frame where there are somewhat unconstrained conditions.

Studies have shown that a speed limit set near the 85th percentile speed is the most favorable in terms of safety, driving comfort, and driver's compliance to enforcement. According to the FDOT Speed Zone Manual guidance, a speed limit should not differ from the 85th percentile speed or upper limit of the 10-mph pace by more than 3 mph, and it shall not be greater than 8 mph. A speed limit of 4 to 8 mph less than 85th percentile speed shall be supported by a supplemental investigation, which provides the following guidelines: there are road or roadside features not readily obvious to the normally prudent driver, such as length of section, alignment, roadway width, surface condition, sight distance, traffic volume, crash experience, maximum comfortable speed in curves, side friction (roadside development), signal progression, etc.

The existing land uses are residential through this area with a significant amount of driveway connections and cross-streets and alleyways. The only section in this span with any curvature in the road is at 20th Ave. S. Curvature does promote slower speeds.

Based on the Florida Greenbook, the minimum stopping sight distance shall be no less than 200 ft. at 30 mph and 155 ft. at 25-mph. Specific conditions for Gulf Shore Boulevard include numerous driveway and cross-street conflict points and that the street is a local collector with high levels of bike and pedestrian traffic. Both factors are used to establish the appropriate speed limit.

Vehicular accident data was reviewed for the span between 20th Ave. S. to S. Golf Dr. Over the past five years there was not a significant amount of accidents along the corridor or at any one intersection. A significant amount is defined as more than five crashes per calendar year.

The total road width is decreased in this area from the northern section of Gulf Shore Boulevard where there are bike lanes on both the northbound and southbound directions impacting the feel of the road and traffic conditions. The total width of the road is 24 ft. plus two 18-inch valley gutters on either side. Twelve-foot travel lanes accommodate north and southbound traffic. The width at 12 ft. wide does support higher speeds, which is a concern.

Considering all data and guidance, it appears that a speed reduction is not warranted. Police enforcement opportunities may be best assigned between 12:00 a.m. and 2:00 a.m.

SIGNAGE

Historically, the City has preserved its aesthetic appeal by controlling the amount of regulatory, warning, and informative signs, as well as the size, placement and decorative-type mountings of signs along roadways. The required minimum signage suggested by the Manual for Uniform Traffic Control (MUTCD) is in place.

Along the corridor, particularly at Central Ave. and Gulf Shore Blvd. S. where marked crossings have been implemented, the City has increased warnings with signage. In-street Pedestrian Crossing Signs are placed along the street to notify drivers of their legal obligation to stop if a pedestrian is waiting to cross or in the process of crossing the roadway at the crosswalk.

The following list contains all existing signage on Gulf Shore Boulevard between South Golf Dr. and 20th Ave. S.:

- 10 Share the Road signs, 5 northbound and 5 southbound;
- 7 speed limit signs (1 for 25mph for speed zone approaching Naples Beach Hotel and 6 set at 30 mph) 4 southbound and 3 northbound;
- 6 pedestrian crosswalk signs (2 at Central Ave, 2 at 3rd Ave S & 2 at Broad Ave S);

Options such as enhanced crossings, particularly where there are no all-way stop conditions can be effective. One option that could be applied are the Pedestrian-activated Flashing LEDs in the border of a warning Sign. To make them more conspicuous and effective, the flashing LED's can be set-up to be pedestrian activated when needed to cross the roadway.

Another alternative would be Pedestrian-activated Warning Beacons. Section 4L.03 of the MUTCD provides details on a flashing yellow warning beacon to supplement a pedestrian crossing warning sign. The warning beacon may be pedestrian activated to increase its effectiveness in making the crossing sign stand out to drivers when a pedestrian wishes to cross the roadway. This would be a recommended option.

Frequency of warning signage:

The location of speed limit signs shall be in accordance with Section 2B.13 of the MUTCD which states, "Speed limit (R2-1) signs, indicating speed limits for which posting is required by law, shall be located at the points of change from one speed limit to another. At the downstream end of the section to which a speed limit applies, a Speed Limit sign showing the next speed limit shall be installed. Additional Speed Limit signs shall be installed beyond major intersections and at other locations where it is necessary to remind road users of the speed limit that is applicable. Speed Limit signs indicating the statutory speed limits shall be installed at entrances to the State and, where appropriate, at jurisdictional boundaries in urban areas." General studies have indicated that 5 miles is the optimum distance between signage beyond the initial placement requirements.

Staff discussed opportunities to improve pedestrian and bicycle safety along Gulf Shore Blvd with the Naples Pathway Coalition (NPC). NPC recommended additional stop signs and crosswalks on Gulf Shore Boulevard between South Golf Dr. and 5th Ave S. The top priority and critical location for this application is at Central Ave and Gulf Shore Blvd. S.

There is a misconception that stop signs should be utilized for traffic calming purposes. For this condition at Central Avenue, it would, however, provide an option for a crossing at a designated stop over a mid-block crossing option. Stop signs must meet standard criteria identified in the MUTCD or they can be more problematic and lead to an unsafe condition.

Below are the warrant requirements that must be met for a 4-way stop per MUTCD:

Section 2B.07 Multi-Way Stop Applications

Support:

1. *Multi-way stop control can be useful as a safety measure at intersections if certain traffic conditions exist. Safety concerns associated with multi-way stops include pedestrians, bicyclists, and all road users expecting other road users to stop. Multi-way stop control is used where the volume of traffic on the intersecting roads is approximately equal.*

2. *The restrictions on the use of STOP signs described in Section 2B.04 also apply to multi-way stop applications.*

Guidance:

3. *The decision to install multi-way stop control should be based on an engineering study.*

4. *The following criteria should be considered in the engineering study for a multi-way STOP sign installation:*

   A. Where traffic control signals are justified, the multi-way stop is an interim measure that can be installed quickly to control traffic while arrangements are being made for the installation of the traffic control signal.

   B. Five or more reported crashes in a 12-month period that are susceptible to correction by a multi-way stop installation. Such crashes include right-turn and left-turn collisions as well as right-angle collisions.

   C. Minimum volumes:

      1. The vehicular volume entering the intersection from the major street approaches (total of both approaches) averages at least 300 vehicles per hour for any 8 hours of an average day; and

      2. The combined vehicular, pedestrian, and bicycle volume entering the intersection from the minor street approaches (total of both approaches) averages at least 200 units per hour for the same 8 hours, with an average delay to minor-street vehicular traffic of at least 30 seconds per vehicle during the highest hour; but

      3. If the 85th-percentile approach speed of the major-street traffic exceeds 40 mph, the minimum vehicular volume warrants are 70 percent of the values provided in Items 1 and 2.

   D. Where no single criterion is satisfied, but where Criteria B, C.1, and C.2 are all satisfied to 80 percent of the minimum values. Criterion C.3 is excluded from this condition.

The two-way seasonal peak volume on Central Avenue between Goodlette-Frank Rd. has ranged between 7,600 vpd to 7,900 vpd over the last couple of years during season. Based on the numbers and considering traffic turning westbound from US41, the traffic flows may meet warrants for a multi-way stop at Central Avenue and Gulf Shore Boulevard but additional data is necessary. Traffic count data should be collected on Central Avenue during peak season conditions near Gulf Shore Boulevard for final determination. If warranted, this condition could provide a safer crossing for pedestrians.

Volumes and comparisons for other intersecting roads with Gulf Shore Blvd were evaluated earlier this year looking at crash data, etc. and they did not appear to warrant multi-way stops.

Other Signage

In Florida, the bicycle is legally defined as a vehicle (F.S. 316.2065) and has all the privileges, rights, and responsibilities on public roads that a motor vehicle operator does. Bicyclists may ride out of the bike lane in the travel lane for their own safety on narrow roads to avoid obstacles or pavement hazards, or to prepare for a left turn. Bicyclists are permitted to utilize the full lane even while traveling substantially below the speed of traffic if the lane is too narrow for both a car and bicycle to share. Per Florida law, motorists must provide a minimum of three feet clearance and drive cautiously at low speeds when driving alongside or passing bicyclists.

The Bicycles May Use Full Lane (R4-11) sign is permitted to be used on roadways where no bike lanes or shoulders are in place and where travel lanes are too narrow for bicyclists and motor vehicles to operate side by side. To assist with the understanding of the rules of the road, signage where the bike lane ends and the sharrows begin heading southbound near 8th Ave. N., a “Bicycles May Use Full Lane” sign (R4-11) should be installed. It is an important location to inform road users that bicyclists might occupy the travel lane and provide awareness. This option is recommended.

Additional Share the Road and 3 Feet to Pass signage is recommended along the corridor to provide more awareness.

Bike route guide signs are typically green in color and indicate where a bike route is located and also provide directional changes. These can be included as options but are more likely to be implemented with the overall wayfinding project to provide a more extensive route.

Bike and Pedestrian Road Marking Considerations

There are several options that can be implemented for bike and pedestrians along the corridor. Without increasing the pavement width, options for road markings and signage are the top considerations. Other options may include increased police enforcement and education for all modes of travel. Road markings are effective ways to capture pedestrian, bicyclist and motorists along the corridor and should be a key consideration.

Sharrows

Sharrows are pavement markings that are intended to provide safety for cyclists on streets that are too narrow for traditional bike lanes. Shared Lane Markings are to be placed immediately after an intersection and spaced at intervals not greater than 250 feet thereafter. Bicycles May Use Full Lane signage may be used in addition to or instead of the Shared Lane Marking to inform road users that bicyclists might occupy the travel lane. Per the MUTCD, they “Assist bicyclists with lateral positioning in a shared lane with on-street parallel parking in order to reduce the chance of a bicyclist's impacting the open door of a parked vehicle, assist bicyclists

with lateral positioning in lanes that are too narrow for a motor vehicle and a bicycle to travel side by side within the same traffic lane, alert road users of the lateral location bicyclists are likely to occupy within the traveled way, encourage safe passing of bicyclists by motorists, and reduce the incidence of wrong-way bicycling". The Bicycles May Use Full Lane (R4-11) sign (MUTCD 9B.06) is an option that can be implemented. They may be used on roads where there are no bike lanes or adjacent shoulders and where travel lanes are too narrow for bicyclists and motor vehicles to operate side by side.

Pros: Shared lane markings help convey to the public that motorists and bicyclist must share the roads on which they operate. The markings helped to identify where bicyclists are expected to ride and provide the expectation for motorists that bicyclists are also sharing the road. Studies indicate that sharrows increase operating space for bicyclists.

Cons: More education is necessary for motorists as well as bicyclists to understand the rules associated with the markings. Motorists who do not understand the intent sometimes get aggravated and do not provide the proper space needed to pass. Some studies indicate that they may not be safer for cyclists due to a false sense of security while on the road.

Sharrows are already identified on this stretch of roadway. Additional sharrows are recommended where the spacing is extended. A recommended more effective option is to replace the white sharrow markings with bright green and white sharrows to provide more impact. Additional signage and education will also assist with the efforts.

High Visibility Crosswalks

For added visibility of crosswalks, the MUTCD permits marking white diagonal lines at a 45-degree angle to the crosswalk or with white longitudinal lines parallel to traffic flow. If diagonal or longitudinal lines are used, the transverse lines of the crosswalk are permitted to be omitted. This is typically applied where a significant amount of pedestrian's cross, the added visibility of the crosswalk is desired, or it is not anticipated. At Central Ave. and Gulf Shore Blvd. S., the crosswalk currently consists of transverse lines. There are options for utilizing a brick paver type of thermoplastic paint under the striping at the crosswalk to enhance the crossing making it more conspicuous. The brick paver could be the typical red brick color or a brighter fluorescent yellow-green color.

Recommendations of the Traffic Engineer

Several recommendations are noted to increase the pedestrian and bicycle safety along Gulf Shore Boulevard between South Golf Drive and 20th Ave. S. They include:

1. Consider a public education effort with FDOT, Collier County and interested community groups.
2. Coordinate with the Police Department for data-based enforcement programs.
3. Collect in-season traffic data to determine if warrants are met for a multi-way stop at Central Avenue and South Golf Blvd. with Gulf Shore Boulevard.
4. Place pedestrian-activated warning beacons at the crossing at Central Avenue.
5. Enhance pedestrian crossings with a thermoplastic brick paver pavement marking or a bright fluorescent yellow-green marking.

6. Replace the existing white sharrow markings with bright green and white sharrow pavement markings to provide more visual impact.
7. Install additional sharrows to meet MUTCD standards (placed immediately after an intersection and spaced a maximum of 250 ft. thereafter).
8. Install additional Share the Road and 3-ft. from Cyclist signage along the corridor.
9. Install a Bicycles May Use Full Lane (R4-11) sign for southbound traffic near South Golf Drive.

A combination of improvements will help to provide a reminder that all modes of travel are welcome and encouraged. The various improvements should provide a safer network while maintaining the existing paved right-of-way.