



TECHNICAL MEMORANDUM

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TO: Jessica Beach, P.E., Dept. of Public Works, Engineering Division
FROM: Tim Mason, P.E.
CC: Phil Clancy
DATE: October 25, 2018
RE: Post-Irma Assessment – Inlet Drive Shoreline Stabilization, Davis Shores

The following summarizes the results of an evaluation of pre- and post-Hurricane Irma survey data along Inlet Drive in Davis Shores, in accordance with Task 1 of ATM's scope of services approved via Work Order 4, PW2016-15Y, Encumbrance #20181113.

After the passing of Hurricane Irma in September of 2017, the City of St. Augustine asked ATM to examine available survey data at the Inlet Drive site, to determine if additional damage was done following damage which occurred due to Hurricane Matthew in October 2016. ATM was asked to assess the amount of damage by Hurricane Irma, and modify the stabilization design if necessary. The costs of any necessary modifications due to additional Irma damage were to be calculated, so the City can apply to be reimbursed by FEMA, if eligible.

The survey data collected consisted of two topographic surveys both performed by Geomatics Corp. as well as two sets of LiDAR data collected by the U.S. Army Corps of Engineers. The dates of the data sets reviewed are as follows:

| | |
|--------------|---|
| Geomatics: | May 4, 2017 and August 25, 2018 |
| USACE LiDAR: | October to December 2016 and September 18 to October 25, 2017 |

Upon review of the data sets, it was determined that the Geomatics survey data does not align vertically as well as expected with the LiDAR data. The vertical accuracy of the 2017 LiDAR data is reported in the metadata to be 19.6 cm or 0.64 ft. This is significantly less accurate than would be anticipated from the Geomatics field ground survey. Therefore, the two survey sources were not directly compared. ATM only compared the two Geomatics surveys with each other, and the two LiDAR surveys with each other.

Based on the raw elevation data from the Geomatics surveys, it appears that the two surveys had relatively little change between them, indicating a limited amount of damage done by Hurricane Irma. To best show differences between the two surveys, a surface was generated in AutoCAD for each survey, and a color isopach map of elevation changes was developed. Figures 1 and 2 are the color isopach maps for the Geomatics and LiDAR data, respectively. It is noted that the LiDAR data does not cover the entire site, and terminates approximately 100 ft south of the north limit of the site, and thus does not represent the entire site. It can be seen in Figures 1 and 2 that most of the elevation changes appear random in the area that would reasonably have been affected by Hurricane Irma (the area between the mangrove edge and the upland grassed shoulder area) and is in the +0.5 to -0.5 ft range.

In addition, four cross-section profiles were generated using the survey data. The profile locations are shown on Figure 3, and are labeled A, B, C, and D. Figures 4 and 5 present the profile sections for the

Geomatics and LiDAR data, respectively. It is apparent from the profile plots that the elevation changes are relatively minor.

As discussed above, the LiDAR data was not compared with the Geomatics data. The LiDAR data can however be compared with itself. It is noted that the areas of increase and decrease in elevation do not agree between the LiDAR and Geomatics data, but this may be due to several factors:

-) Poorer vertical accuracy of the LiDAR survey compared to that expected for the ground survey
-) Density difference (LiDAR much denser data coverage than ground survey, ground survey primarily cross sections at approximately 25 ft intervals)
-) Computer interpolation and surface generation from available data point density in the original data sets utilized.

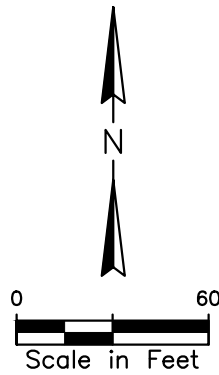
Based on the volumetric comparison of the survey sets, the net changes are 10.5 cy for the Geomatics data and 57 cy for the LiDAR data. It is noted that these values are positive, or accretion and not erosion as would be expected if a significant loss due to Irma's effects had occurred.

Over the approximately 443 ft project length, the unit net volume changes were 0.02 cy/ft and 0.13 cy/ft, based on the Geomatics and LiDAR surveys, respectively. Over the surface area of the data compared, the corresponding net average elevation changes were computed as 0.15 inches and 1.1 inches.

The above calculated unit volume and elevation changes are basically immaterial when designing a bank stabilization solution for the damage initially occurring from Hurricane Matthew. Since the ground survey would be expected to have a tighter accuracy than the reported LiDAR data, volume changes estimated with the LiDAR data are likely conservative. Thus, ATM's opinion based on our review of the available survey data is that the damage due to Hurricane Irma is immaterial relative to initial damage which occurred due to Hurricane Matthew.

Please contact me or Phil Clancy at our office if you have questions or need additional information.

C:\Users\jpcand\Documents\COSA Inlet Drive\geomatrics elev comparison (2).dwg Layout1 10/25/18
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APPLIED TECHNOLOGY & MANAGEMENT.



NOTES:

- 1.) NEW SURVEY COMPLETED BY GEOMATICS CORP. AUGUST 25 2018.
HORIZONTAL DATUM FL STATE PLANE NAD83, VERTICAL DATUM NAVD88
- 2.) ORIGINAL SURVEY COMPLETED BY GEOMATICS CORP. MAY 4 2017.
HORIZONTAL DATUM FL STATE PLAN NAD83, VERTICAL DATUM NAVD88.
- 3.) CONTOURS SHOWN IS THE NEW AUGUST 25 2018 SURVEY
- 4.) NEGATIVE DIFFERENCE (RED) AREAS SHOW WHERE 2018 SURVEY IS LOWER THAN 2017 SURVEY. POSITIVE DIFFERENCE (GREEN) AREAS SHOW WHERE 2018 SURVEY IS HIGHER THAN 2017.
- 5.) TOTAL LOSS VOLUME ACROSS SITE IS 76 CUBIC YARDS. TOTAL FILL VOLUME ACROSS SITE IS 86.5 CUBIC YARDS.

LEGEND (FEET NAVD88):

| | |
|--------------|------------|
| ■ -1.5 TO -1 | ■ 2.5 TO 2 |
| ■ -1 TO -.5 | ■ 2 TO 1.5 |
| ■ -.5 TO -.1 | ■ 1.5 TO 1 |
| | ■ 1 TO .5 |
| | ■ .5 TO .1 |

FIGURE 1
COSA INLET DRIVE
GEOMATICS CORP. HURRICANE IRMA SURVEY COMPARISON
OCTOBER 25 2018



NOTES:

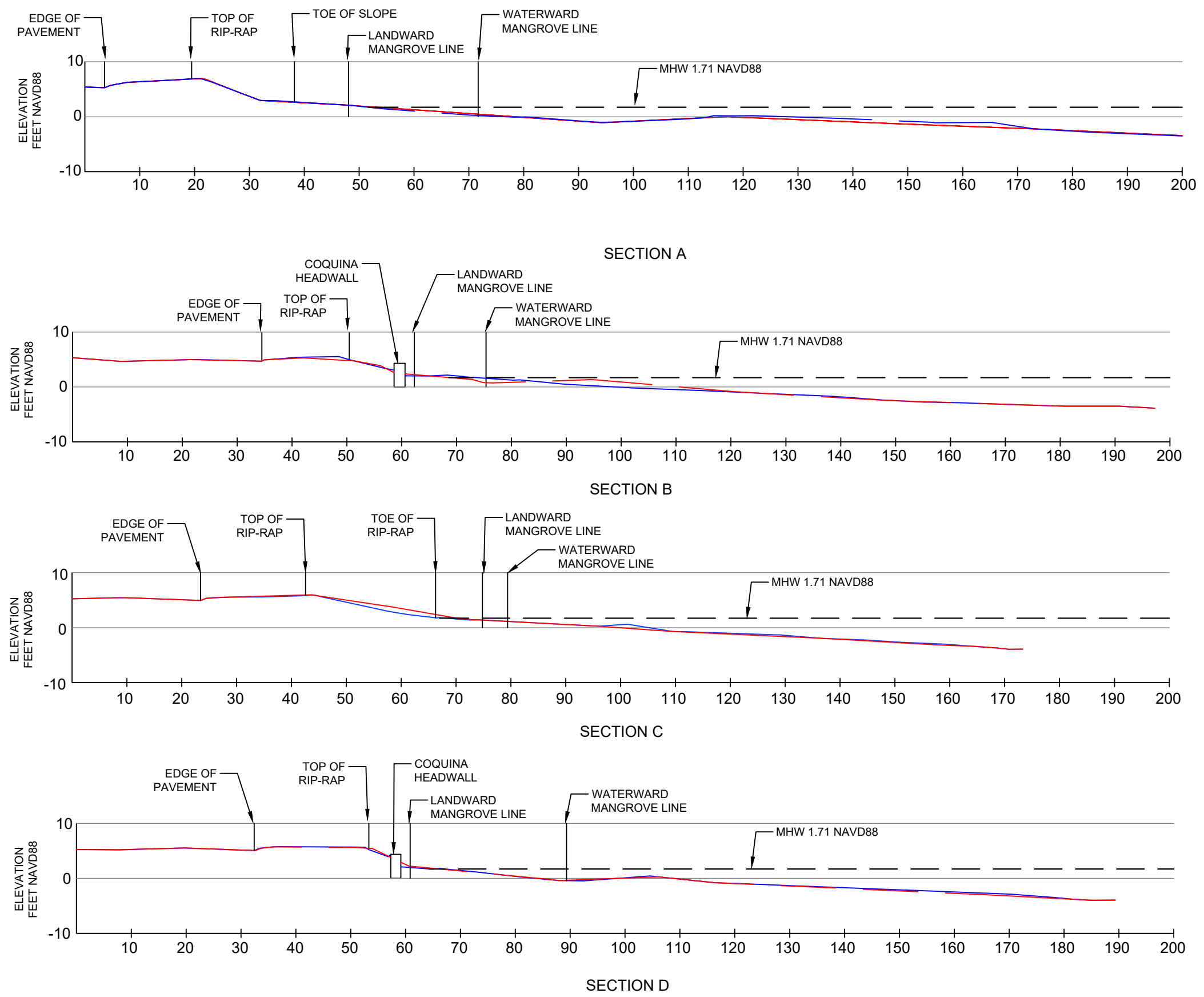
- 1.) POST MATTHEW LIDAR DATA COLLECTED 10/2016 - 12/2016. HORIZONTAL DATUM FL STATE PLANE NAD83, VERTICAL DATUM NAVD88
- 2.) POST IRMA LIDAR DATA COLLECTED 9/18/17 - 10/25/17. HORIZONTAL DATUM FL STATE PLAN NAD83, VERTICAL DATUM NAVD88.
- 3.) CONTOURS SHOWN REPRESENT POST IRMA DATA.
- 4.) NEGATIVE DIFFERENCE (RED) AREAS SHOW WHERE 2018 SURVEY IS LOWER THAN 2017 SURVEY. POSITIVE DIFFERENCE (GREEN) AREAS SHOW WHERE 2018 SURVEY IS HIGHER THAN 2017.
- 5.) TOTAL LOSS VOLUME ACROSS SITE IS 38 CUBIC YARDS. TOTAL FILL VOLUME ACROSS SITE IS 95 CUBIC YARDS.

LEGEND (FEET NAVD88):

| | |
|--------------|------------|
| ■ -1.5 TO -1 | ■ 2.5 TO 2 |
| ■ -1 TO -.5 | ■ 2 TO 1.5 |
| ■ -.5 TO -.1 | ■ 1.5 TO 1 |
| | ■ 1 TO .5 |
| | ■ .5 TO .1 |



FIGURE 3
COSA INLET DRIVE
PROFILE LOCATIONS
OCTOBER 25 2018

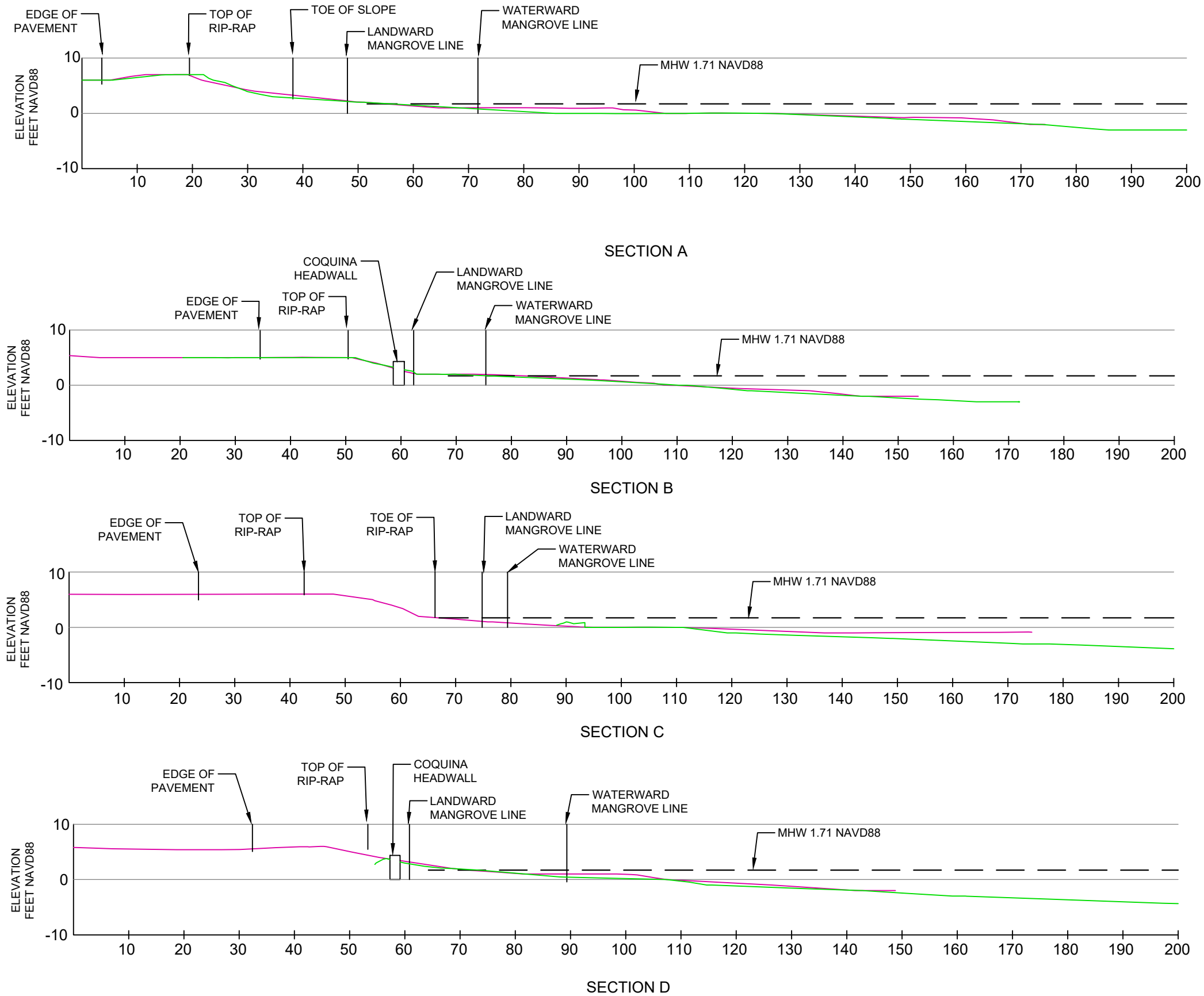


NOTES:
 1.) NEW SURVEY COMPLETED BY GEOMATICS SURVEYING AUGUST 25 2018.
 HORIZONTAL DATUM FL STATE PLANE NAD83, VERTICAL DATUM NAVD88
 2.) ORIGINAL SURVEY COMPLETED BY GEOMATICS SURVEYING MAY 4 2017.
 HORIZONTAL DATUM FL STATE PLAN NAD83, VERTICAL DATUM NAVD88.

— OLD SURVEY PROFILE, MAY 4TH 2017
 — NEW SURVEY PROFILE, AUGUST 25TH 2018

C:\Users\jpc\OneDrive\Documents\COSA Inlet Drive\post math\profiles.dwg survey profiles 10/25/18
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C:\Users\jpcandry\Documents\COSA Inlet Drive\post-matthew profiles.dwg Lidar profiles 10/25/18
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— POST-IRMA LIDAR PROFILE 09/18/2017 - 10/25/2017
— POST-MATTHEW LIDAR PROFILE 10/2016 - 12/2016