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Modeling Sea Level Rise with Tidal Floods in Shore Acres Neighborhood of St. Petersburg, Florida

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Planning for Sea Level Rise (SLR) is essential as stakeholders need to identify potential risks to homes, commercial and industrial structures, infrastructure, and public assets. Tidal flooding is an issue for many communities here in Tampa Bay and sea level rise is going to contribute to higher tide levels and therefore, more regularly flooded areas. This analysis focuses on Shore Acres Neighborhood of St. Petersburg, FL. Shore Acres experiences its worst tidal flooding during the fall months, primarily due to the end of the rainy season.

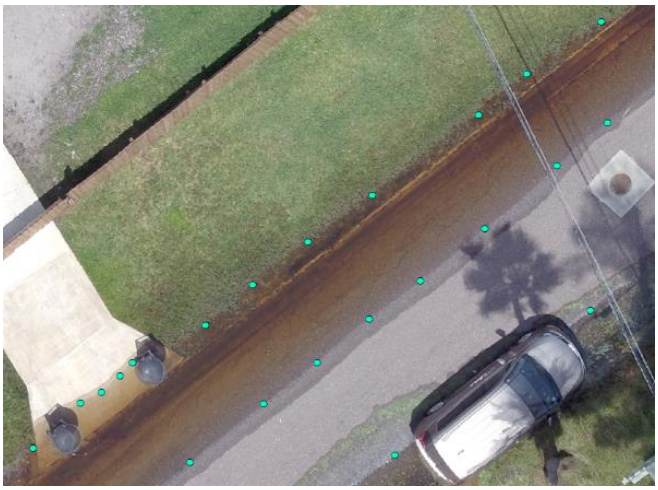

Figure 1: Drone Aerial Ortho Photo with Digitized Flood Points

To document the tidal flooding, a drone flight was conducted during high tide on September 16, 2020. There was a new moon on this day, which caused the high tide to be at the highest level of the month (2.25 ft NAVD). Photos were taken from 1pm to 2:45pm, when the tide levels went from 2.25 ft to 1.88 ft. There was zero precipitation on this day. The photos were taken using a technique to create Georeferenced Mosaic Orthophotos. The orthophotos were then used to map points where the flooding water edge could easily be seen. 813 points were digitized across four areas of Shore Acres (see Figure 1).

To calculate actual flood levels for the 813 points, aerial lidar data was utilized. A digital elevation model (DEM) was generated for the area at 1-foot horizontal resolution (NAVD). The points were then overlaid, and elevations were applied to all 813 of them. The elevations ranged between 1.62 and 2.41, with an average of 1.99. The range exceeds the tidal range, but factors such as topography, model interpolation, and hydraulic infrastructure can cause some outliers.

Shore Acres coastline is mostly seawall that is built up to approximately 3-5 feet (NAVD). So, the source of the tidal flood is the storm drain system. The DEM map (see Figure 2) displays the built-up shoreline/seawall areas and the lower lying inland areas. Flooding can be substantially worse if there is rainfall because the water does not have many locations to drain, it just continues to fill up the "bowl." Figure 3 maps the current potential sunny day flooding based on elevations of 1.99 and below. These areas match up well with the observed and recorded flood extents from the drone orthophotos. At this water level, no structures are impacted by flooding.

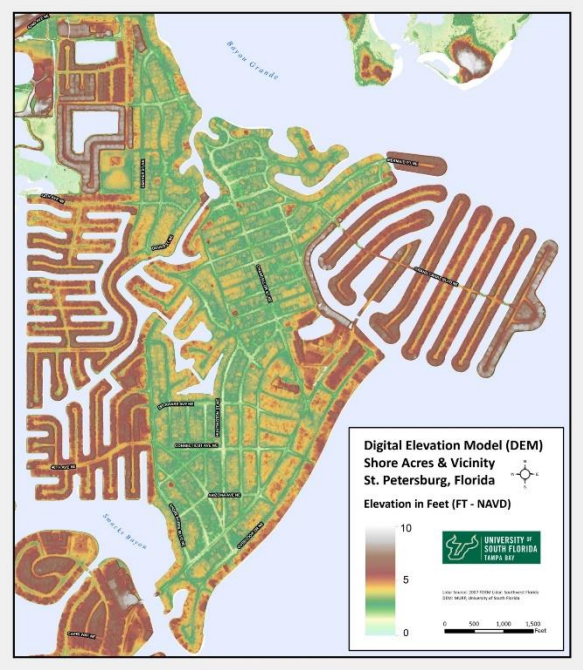

Figure 2: Digital Elevation Model (DEM)

Figure 3: Potentially Inundated Areas – 2020

Sea level rise estimates have been modeled by various U.S. agencies for multiple scenarios. These scenarios factor in multiple environmental factors and scientific observations. Using the National Oceanic and Atmospheric Association (NOAA) predictions (see Figure 4), two scenarios are mapped. The 2040 intermediate curve is shown in Figure 5. Flooding at this level can completely cut off access to over 1,000 structures and potentially flood over 170 homes. According to the Pinellas County Property Appraiser, the 170 plus homes have a just market value of $52,033,104. Even more dire, is the NOAA High 2040 scenario flood extent (see Figure 6), where approximately 1,000 homes would be impacted by tidal flooding. The just market value for these structures rises to $294,760,282. Flooding would occur 1-3 times a year and can impact home values, insurance rates, and in some cases require redevelopment.

Scenarios for ST. PETERSBURG
NOAA2017 VLM: 0.00285 feet/yr
All values are expressed in feet

Year	NOAA2017 VLM	NOAA2017 Low	NOAA2017 Int-Low	NOAA2017 Intermediate	NOAA2017 Int-High	NOAA2017 High	NOAA2017 Extreme
2000	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2010	0.03	0.13	0.16	0.23	0.30	0.36	0.36
2020	0.06	0.30	0.36	0.49	0.62	0.72	0.75
2030	0.09	0.46	0.56	0.79	1.02	1.25	1.35
2040	0.11	0.59	0.72	1.08	1.41	1.77	2.03
2050	0.14	0.79	0.95	1.44	1.97	2.56	2.95
2060	0.17	0.92	1.15	1.87	2.62	3.48	4.10
2070	0.20	1.08	1.35	2.33	3.38	4.56	5.41
2080	0.23	1.21	1.54	2.82	4.20	5.71	6.92
2090	0.26	1.31	1.71	3.38	5.15	7.05	8.66
2100	0.29	1.44	1.90	3.90	6.17	8.50	10.53

Figure 4: NOAA Sea Level Rise Scenario Levels

Figure 5: Potentially Inundated Areas – NOAA 2040 Sea Level Rise Intermediate Scenario

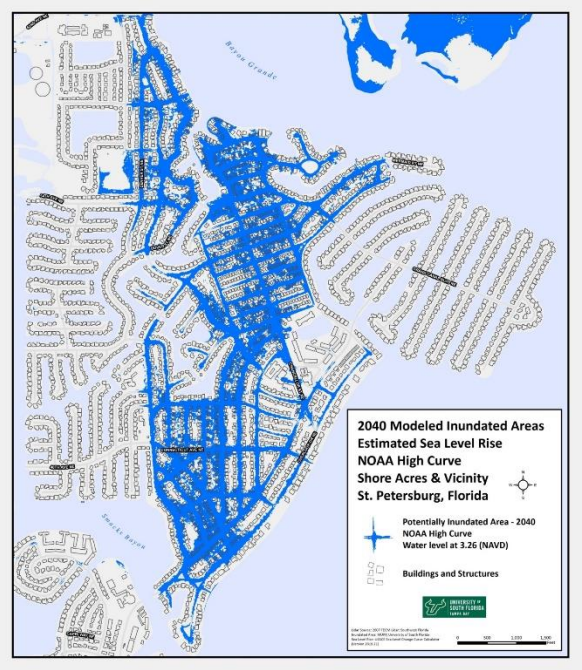

Figure 6: Potentially Inundated Areas – NOAA 2040 Sea Level Rise High Scenario

Planners have been using the high curves to write policy so that they are planning for a worst-case scenario. This analysis only looks at the next 20 years and the flooding predictions will create situations that would limit access, flood homes, and impact infrastructure. The 40-year predictions would make many areas of Shore Acres unsustainable. New rebuilt homes are taking mitigation steps, including bringing in fill to increase the elevation of the lot 3 or 4 feet and designing the buildings to handle first floor flooding. This will help on individual lots, but the existing homes and right-of-way corridors will still experience flooding. Land should be redeveloped into wetlands and retention ponds to handle the increasing waters. However, at the present time, over 99% of the parcels are developed. Solutions are being examined now, so hopefully a plan will be put in place soon.