Eastern North Carolina Coastal Flood Climatology

What is Coastal Flooding/Storm Surge?

- **Coastal Flooding** is the inundation of people, buildings, and coastal structures on land at locations that, under normal conditions, are above the level of high tide. This flooding may impact the immediate oceanfront, bays, sounds, tidal portions of river mouths and inland tidal waterways.

- **Storm Surge** is an abnormal rise of water generated by a storm, over and above the predicted astronomical tide.

- **Storm Tide** is the water level produced during a storm due to the combination of storm surge and the astronomical tide.

- **Astronomical Tide** is the twice daily alternating rise and fall of sea level produced by gravitational attraction of the moon and sun.

- **Inundation** is water covering normally dry land.

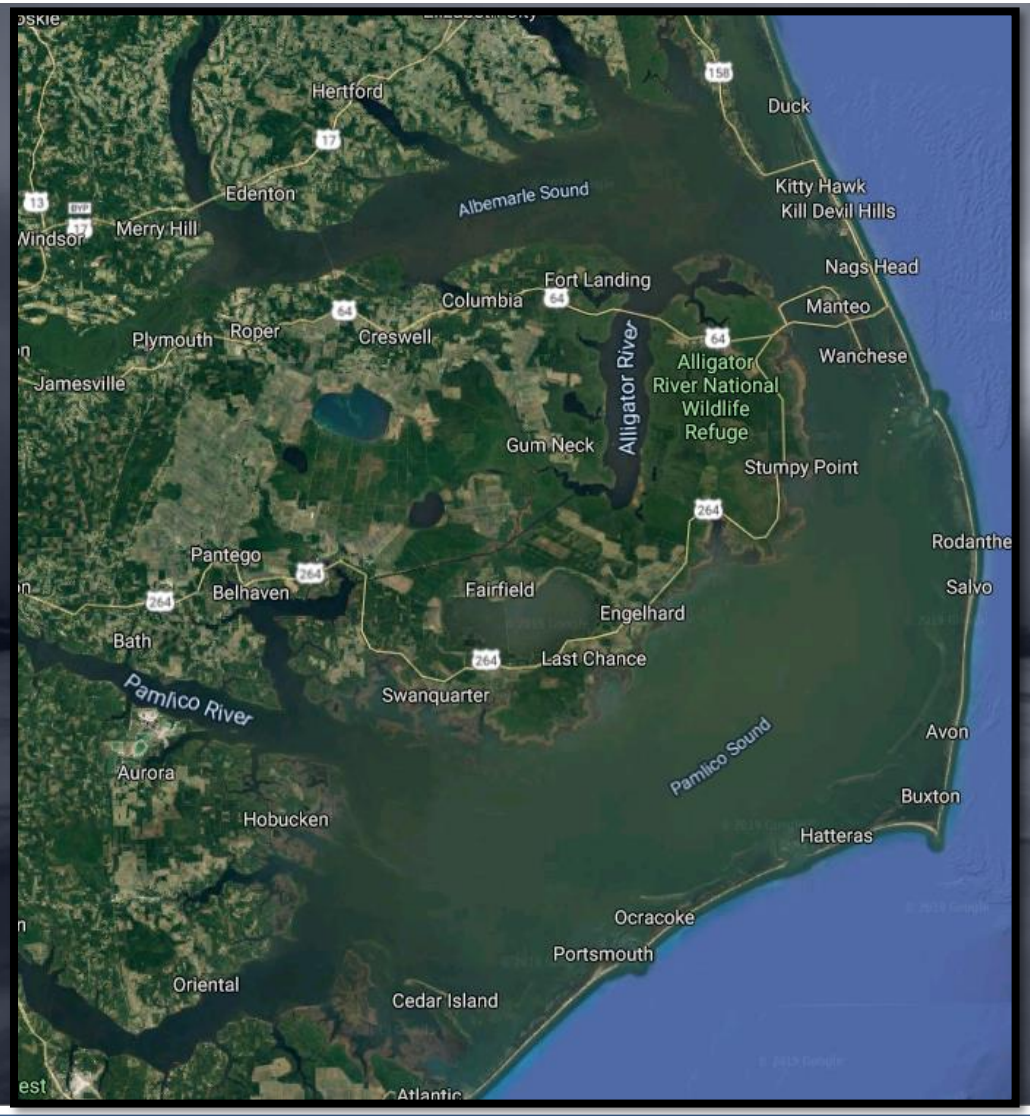
The North Carolina coastline is very complex with numerous bodies of water (sounds, rivers, creeks) and barrier islands.

Many areas along the coast are vulnerable to flooding from both the ocean and the sounds. It is important to keep in mind that not only tropical cyclones produce coastal flooding or storm surge. Several factors contribute:

- Severe weather events can create meteorological conditions that drive up the water level, creating a storm surge. These conditions include strong winds and low atmospheric pressure that can be caused by tropical cyclones (such as hurricanes), by mid-latitude extratropical storms (such as Nor'easters), or by other severe weather conditions.
- Large waves, whether driven by local winds or swell from distant storms, raise average coastal water levels and can cause large and damaging waves to reach land.
- High tide levels are caused by normal variations in the astronomical tide cycle. High astronomical tides (King Tides) can result in minor flooding for low lying areas.

Coastal floods and storm surge are extremely dangerous and the combination of surge, tides, and waves can cause significant damage.

Albemarle-Pamlico Sounds

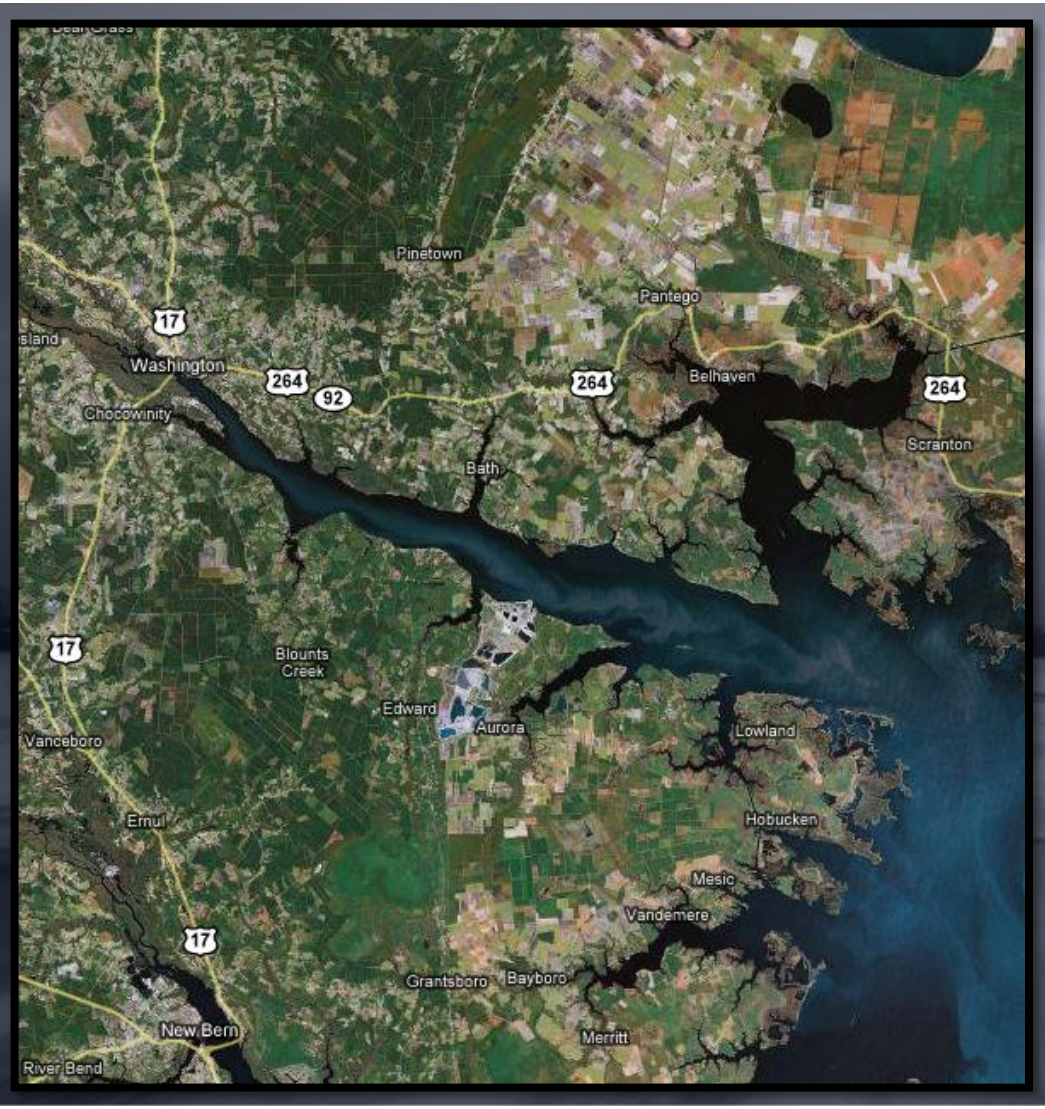


- Second largest estuary in the US
- Average depth ~6 ft
- Wind blowing across the sound pushes water from one side to another
- Extreme wind events will blow one side of the sound dry with extreme flooding downwind side

The Slosh Effect

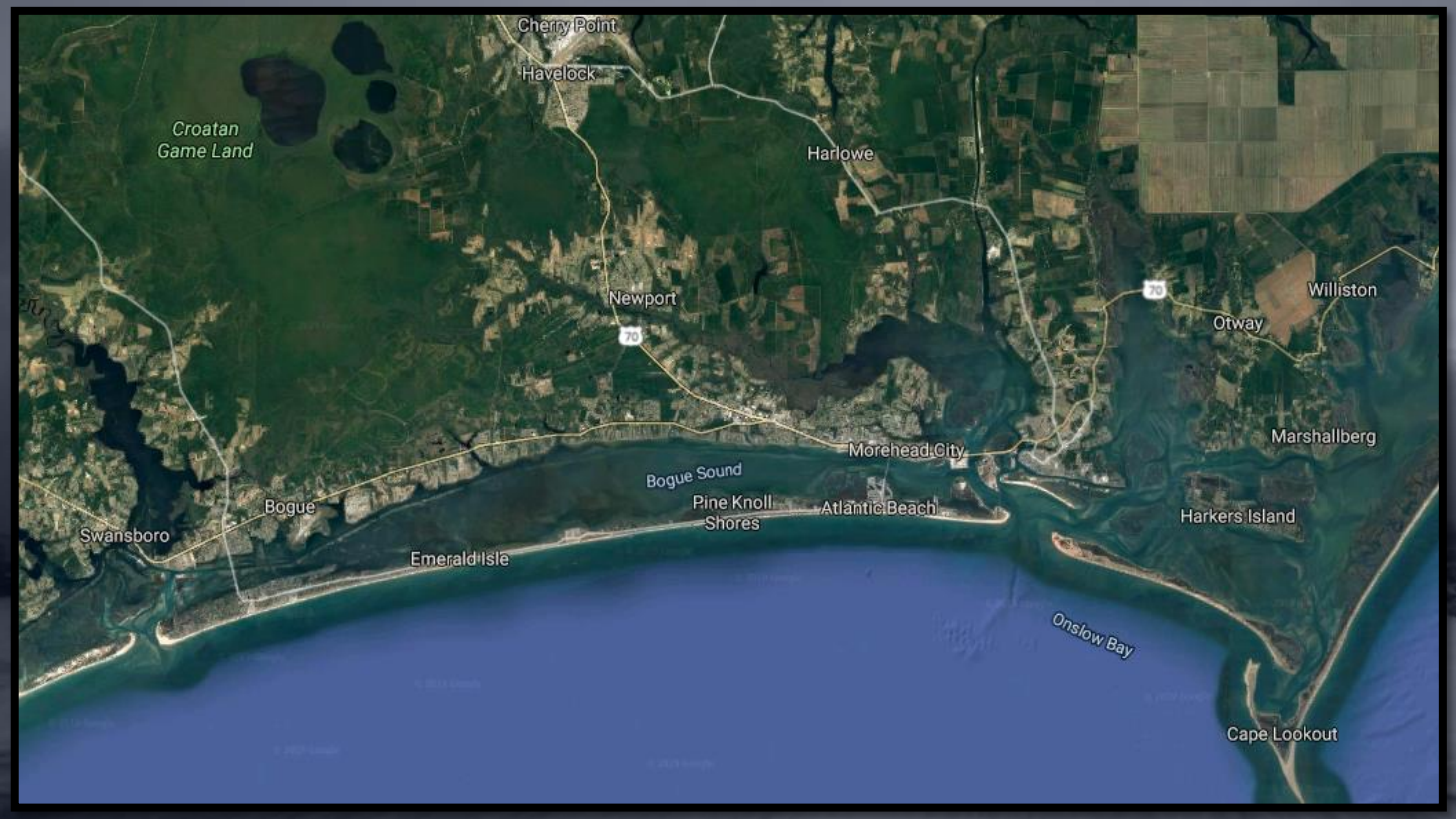
- Occurs when strong winds rapidly shift direction.
- Typically occurs with tight compact circulations associated with tropical storms.
- Eg: Strong easterly winds water initially produces very high water rises on the western side of sound with flooding of mainland counties.
- With a rapid wind shift to west, water will quickly slosh to eastern side of sound and flood sound-side Outer Banks.
- Sound-side Outer Banks flooding usually occurs 1-2 hrs after wind shift.
- Hurricane Emily (1993) produced water levels 9 ft above normal on sound-side of the Outer Banks as it hooked out to sea near Hatteras.
- Hurricane Matthew (2016) behaved similar in nature and produced water levels 4 to 6 feet above ground level on the sound-side of Hatteras Island.

Beaufort County



- **Northeast**, **East** and **Southeast** winds will increase water levels for areas adjacent to the Pamlico and Pungo Rivers.
- Biggest impact at upper ends of rivers/creeks
  - Belhaven
  - Washington
  - Whichard's Beach
  - Aurora
  - River Road

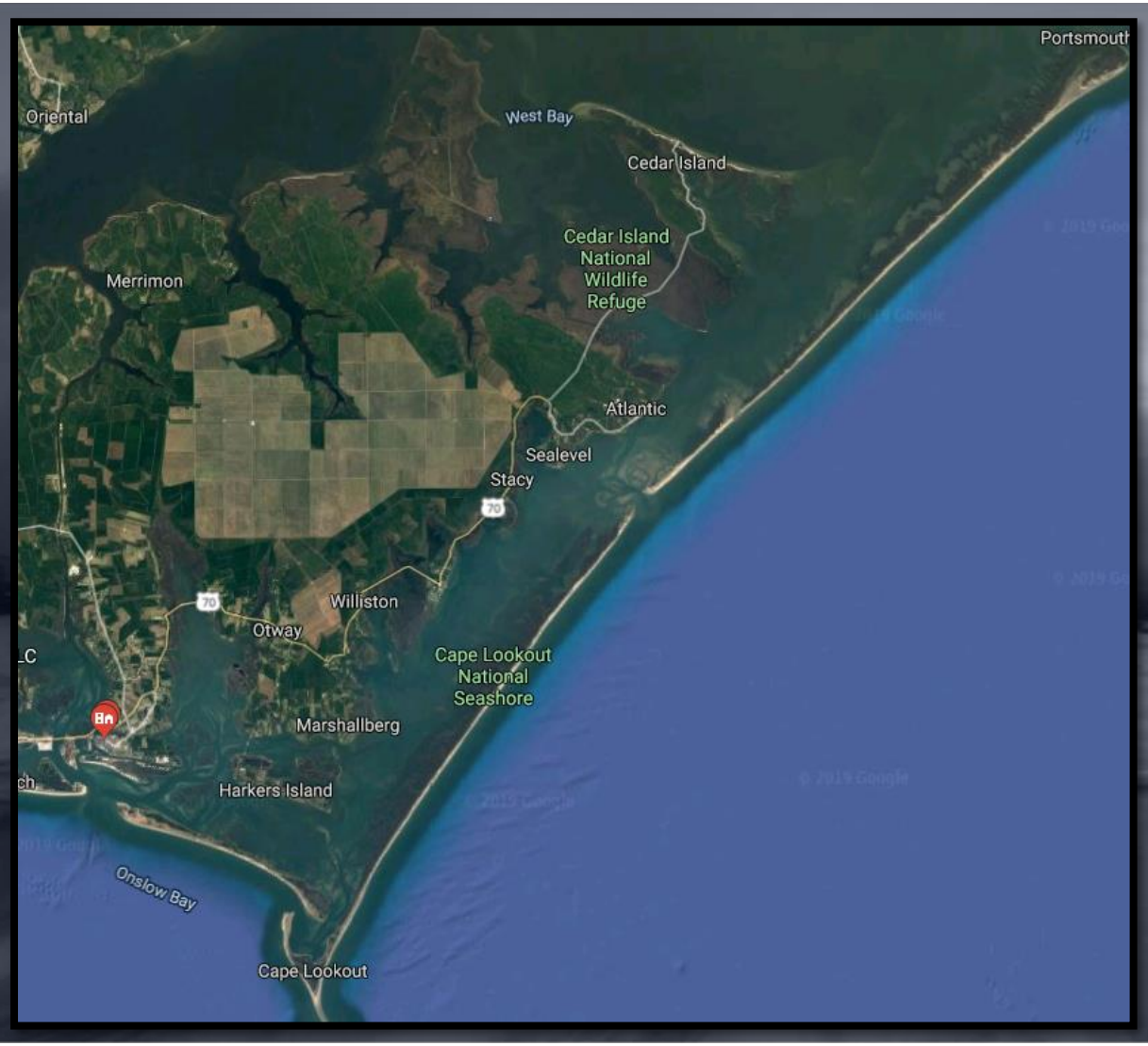
Carteret County



Carteret County is vulnerable to both sound-side and ocean-side flooding.

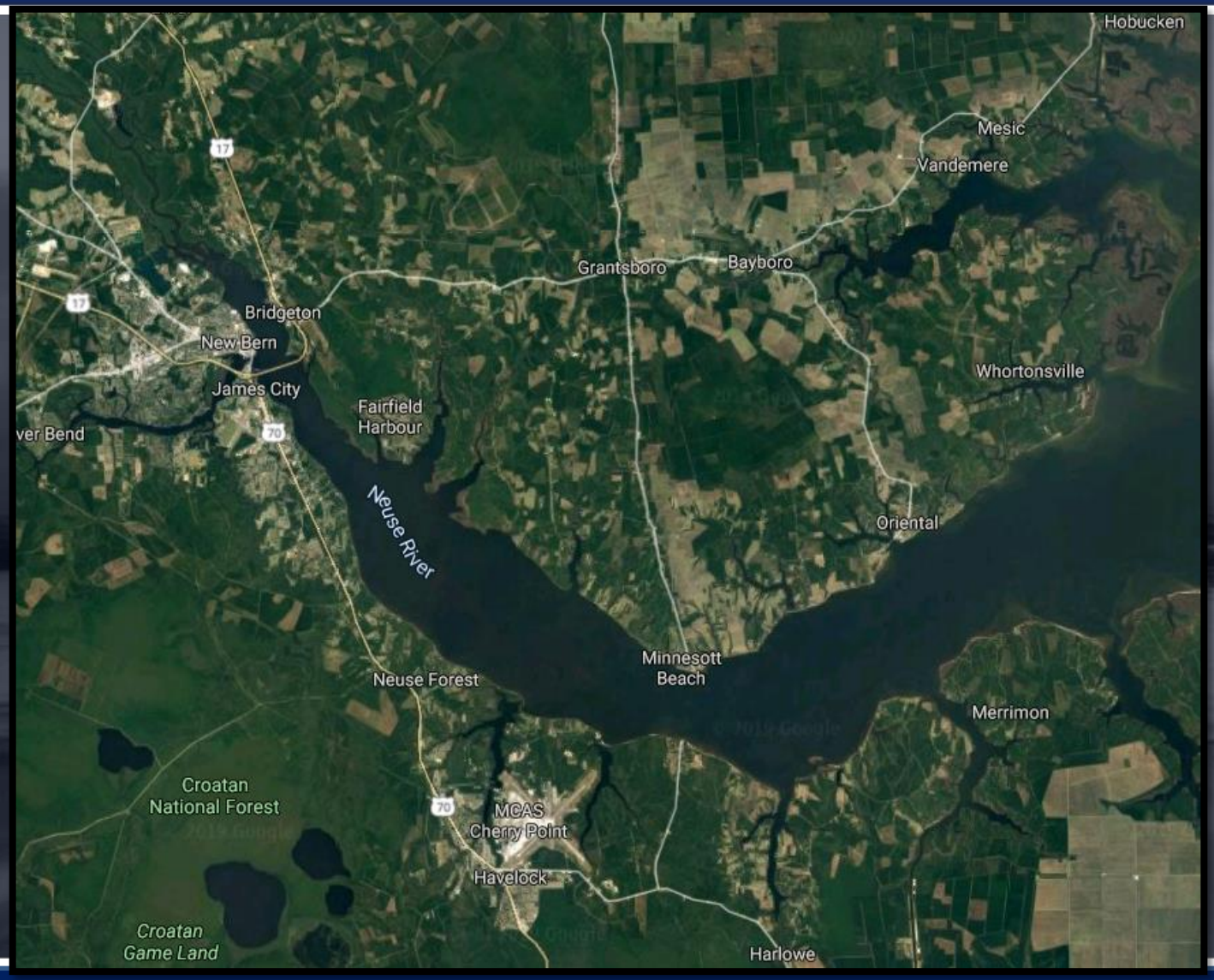
- Areas adjacent to the Bogue Sound (including Morehead City) may see minor flooding in low lying areas during high astronomical tide events coupled with persistent moderate to strong onshore winds.
- Tropical cyclones that approach from the south or southeast and make landfall between Wilmington and Cape Hatteras bring the greatest danger of flooding.

Carteret County - Downeast



- **North** and **Northeast** winds will increase water levels across Downeast Carteret County. Most of the county east of the Intracoastal Waterway, from the Beaufort area north and east, has an elevation of less than 10 feet.
- Areas of most impact extend from Cedar Island to Merrimon including South River. Water levels will also rise in Core Sound with a north wind which will impact Marshallberg to Atlantic. Roads impacted include Highway 12 around Cedar Island and Highway 70 near Core Sound. Many of the small roads between Merrimon and South River will become flooded. Flooding of the Beaufort business district occurs above with surges above the seawall which is 3 ft above the normal high tide.
- Core Banks between Cape Lookout and Ocracoke Inlet – At 5 ft above MSL minor flooding will occur, and at 10 ft the water will wash from the ocean-side to the sound-side.

Craven County

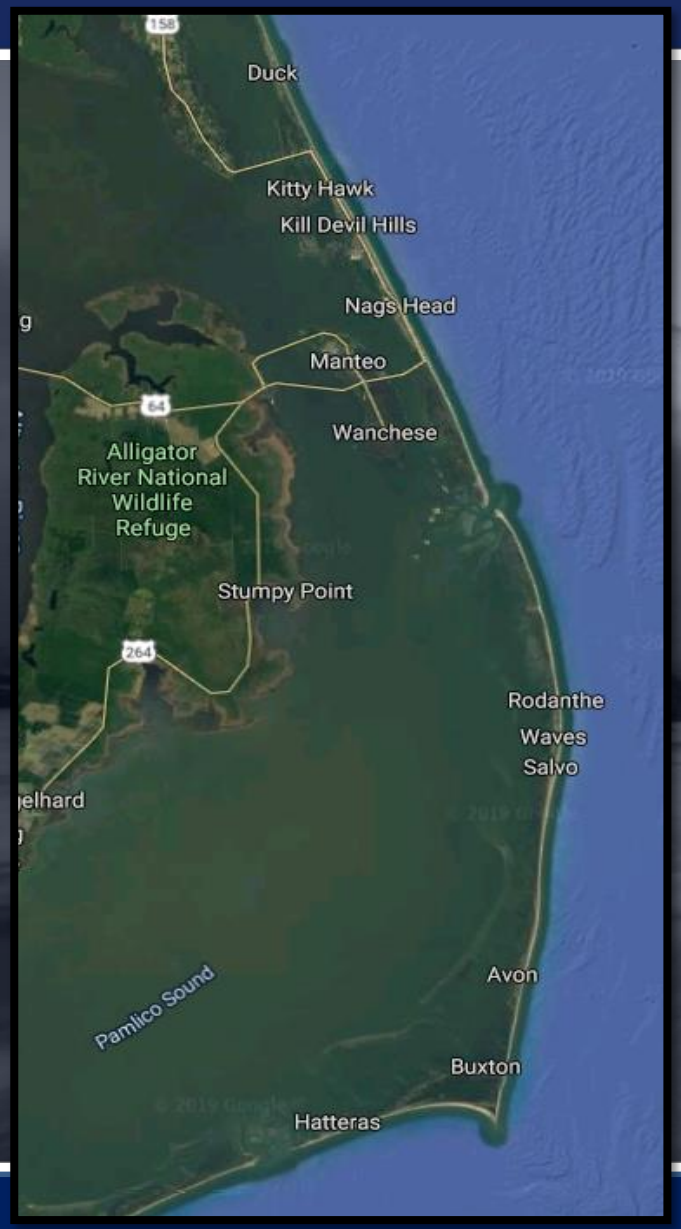


- **North, Northeast** and **East** winds will increase water levels across the southern portions of the county, for areas adjacent to the Pamlico Sound, Neuse River, and Trent Rivers.

Craven County

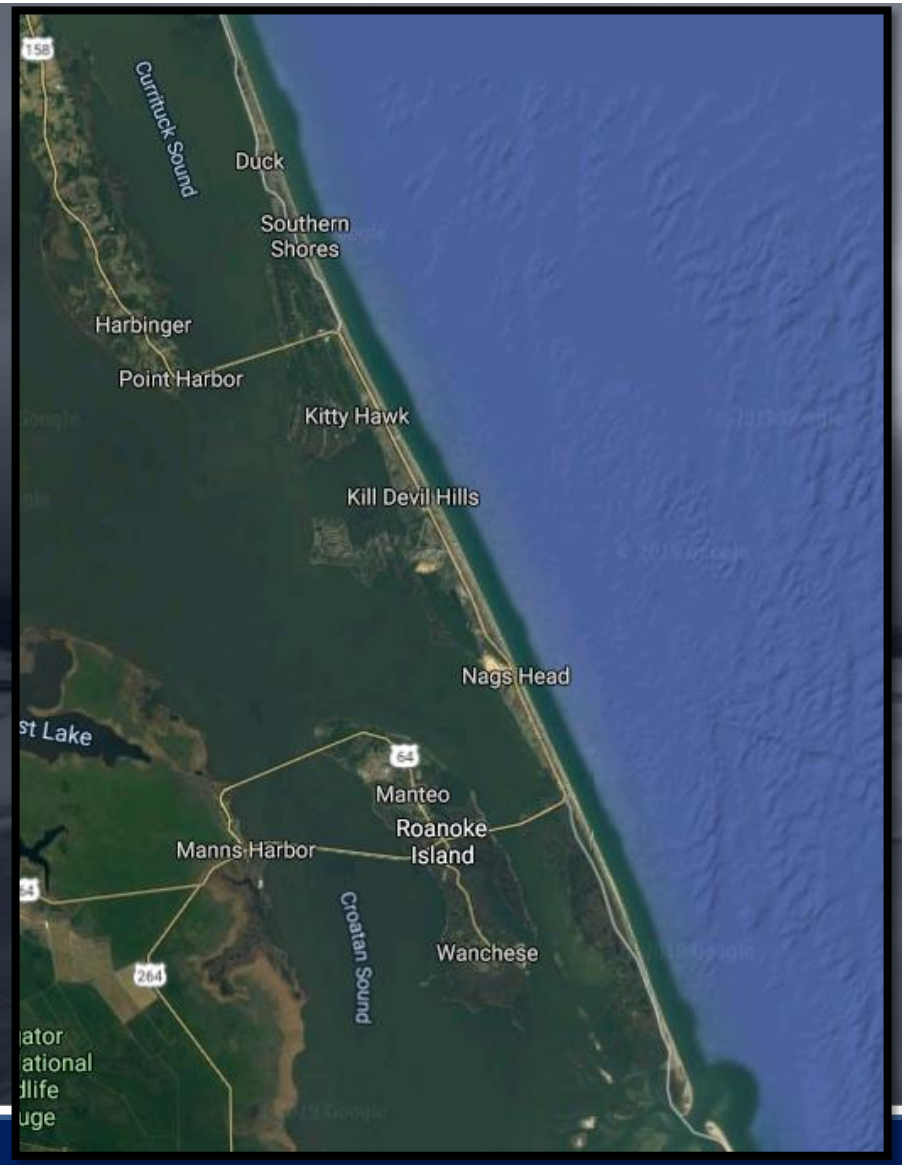
- North, Northeast (greatest impact), and East winds will raise water levels across the southern parts of the county adjacent to Pamlico Sound and the Neuse River. Areas impacted extend from New Bern south to Pine Cliff, then east to Clubfoot Creek and Adams Creek. Many small roads will be flooded east of Cherry Point as water levels rise. Roads adjacent to the Neuse and Trent Rivers in New Bern will also be impacted.
- Most effective wind pattern for water buildup is veering Northeast to Southeast winds in phase with the buildup period. Southeast winds have less influence since they act over much shorter fetch.
- New Bern - minor flooding at 3.5 ft with significant flooding at 5 ft. 8 ft flood approaches to bridges (Just over half of the city is subject to tidal flooding).
- Cherry Point – minor flooding at 1.5 ft with significant flooding at 3 ft. The boat docks are about the only thing affected. NE winds of 3 hrs duration can produce 2-3 ft of water.

Dare County – Outer Banks



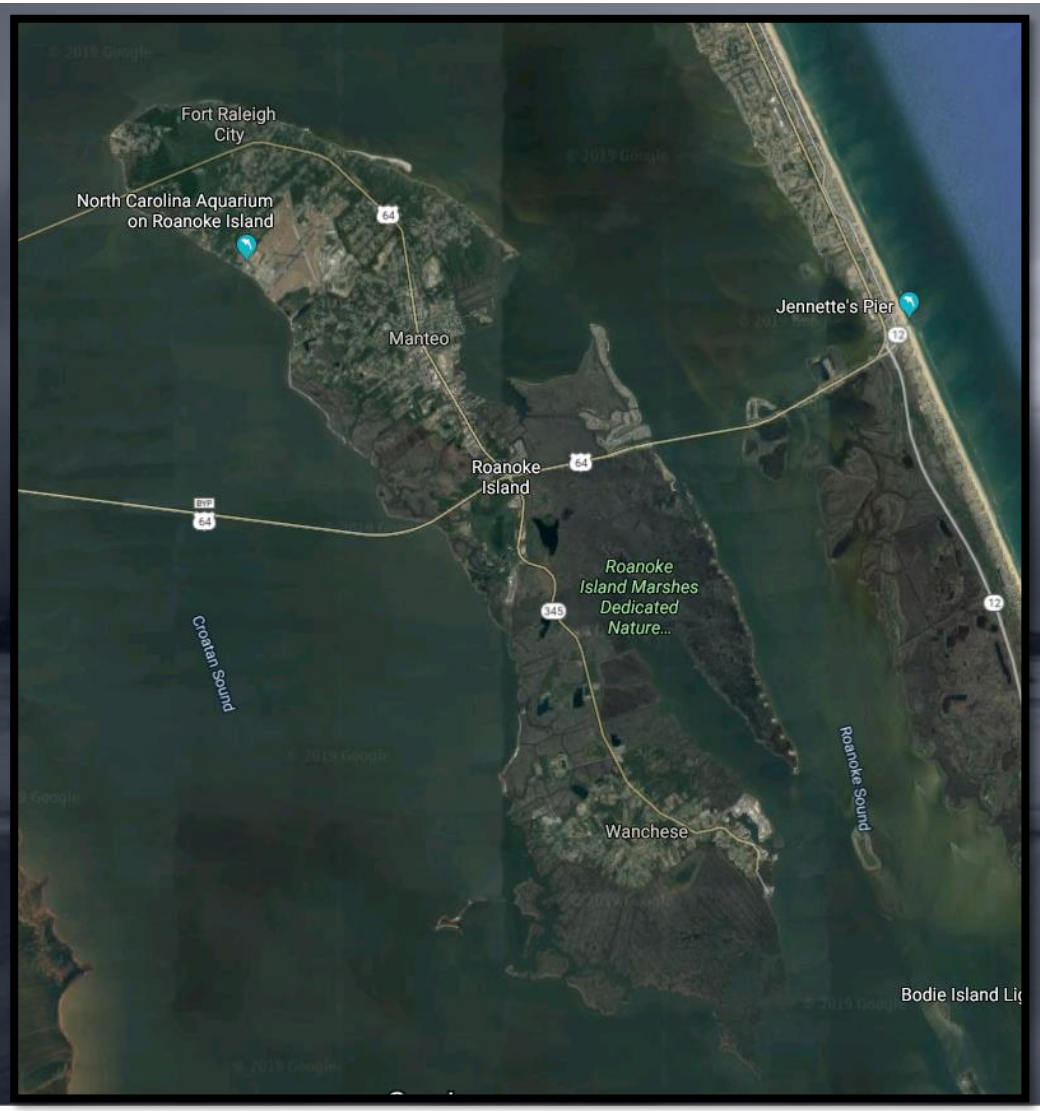
- The Outer Banks is very vulnerable to both sound-side and ocean-side flooding.
- Ocean overwash and beach erosion can have significant impacts along the Outer Banks, especially in certain spots between Kitty Hawk and Cape Hatteras where dune structure has been compromised over the years.

Dare County – Northern Outer Banks



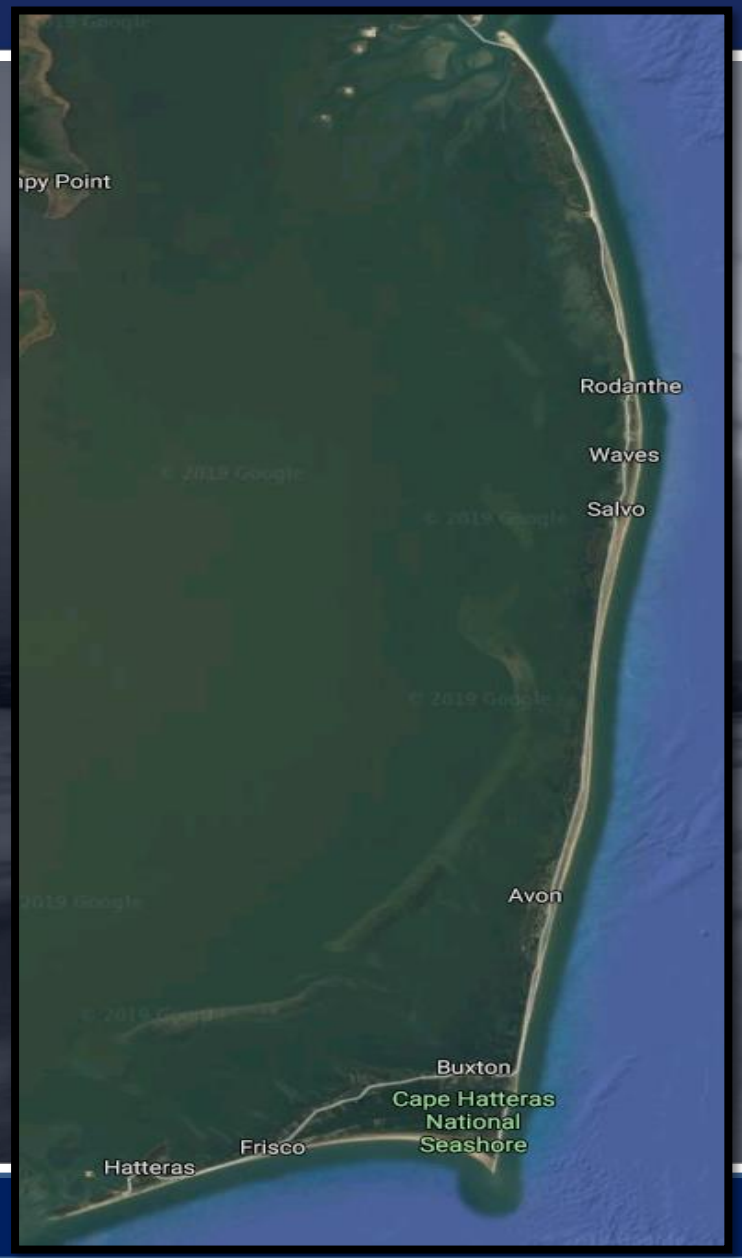
- **South**, **Southwest**, and **West** winds will increase water levels along the sound-side of the northern Outer Banks (north of Oregon Inlet), from Kitty Hawk to Nags Head, including Colington Island.

Dare County - Roanoke Island



- **Northwest** winds will impact the northern portion of the island, areas in and around Manteo.
- **South** winds will impact the southern portion of the island, including Wanchese.

Dare County – Hatteras Island



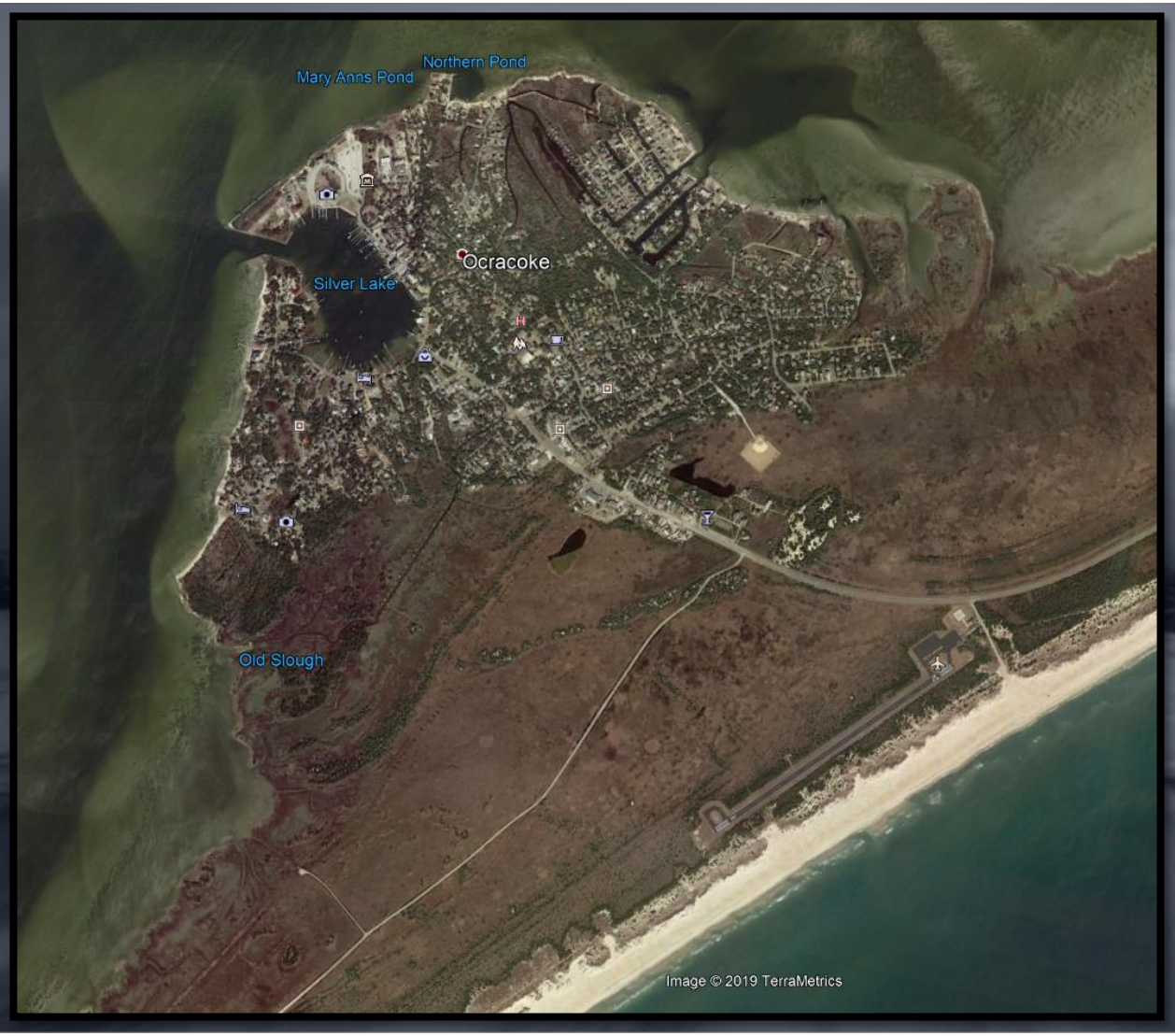
- **West** and **Northwest** winds will increase waters levels along the sound-side of Hatteras Island, impacting areas from Rodanthe down to Hatteras Village.

- Persistent strong **North** winds could also increase water levels for Buxton, Frisco, and Hatteras Village.

Dare County - Mainland

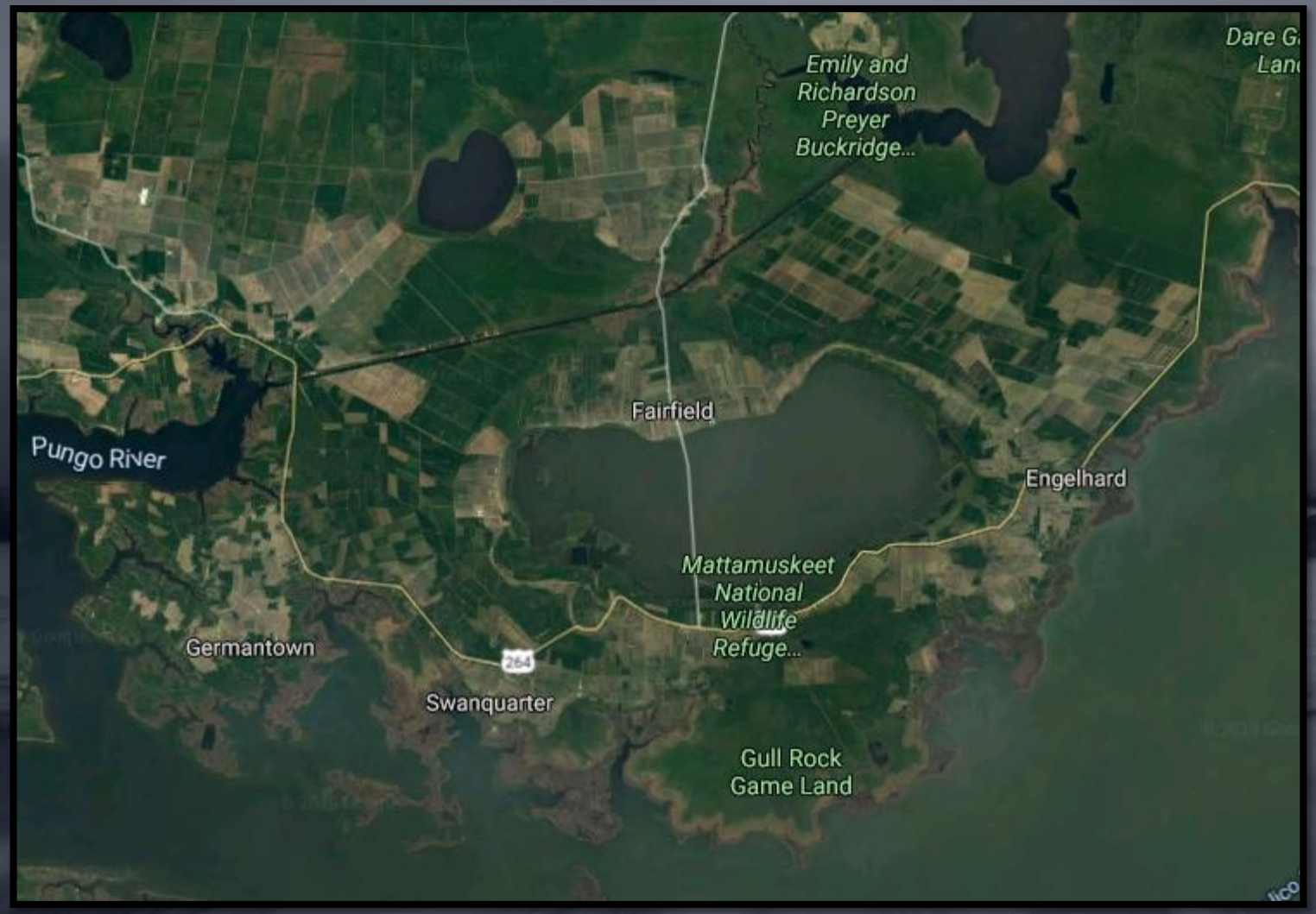
- **Southeast** and **South** winds will increase water levels over the eastern portions of the county, mainly impacting the towns of Manns Harbor and Stumpy Point.
- The lack of rivers and creeks limits the areas that flood as the water can spread out instead of being funneled.

Hyde County - Ocracoke Island



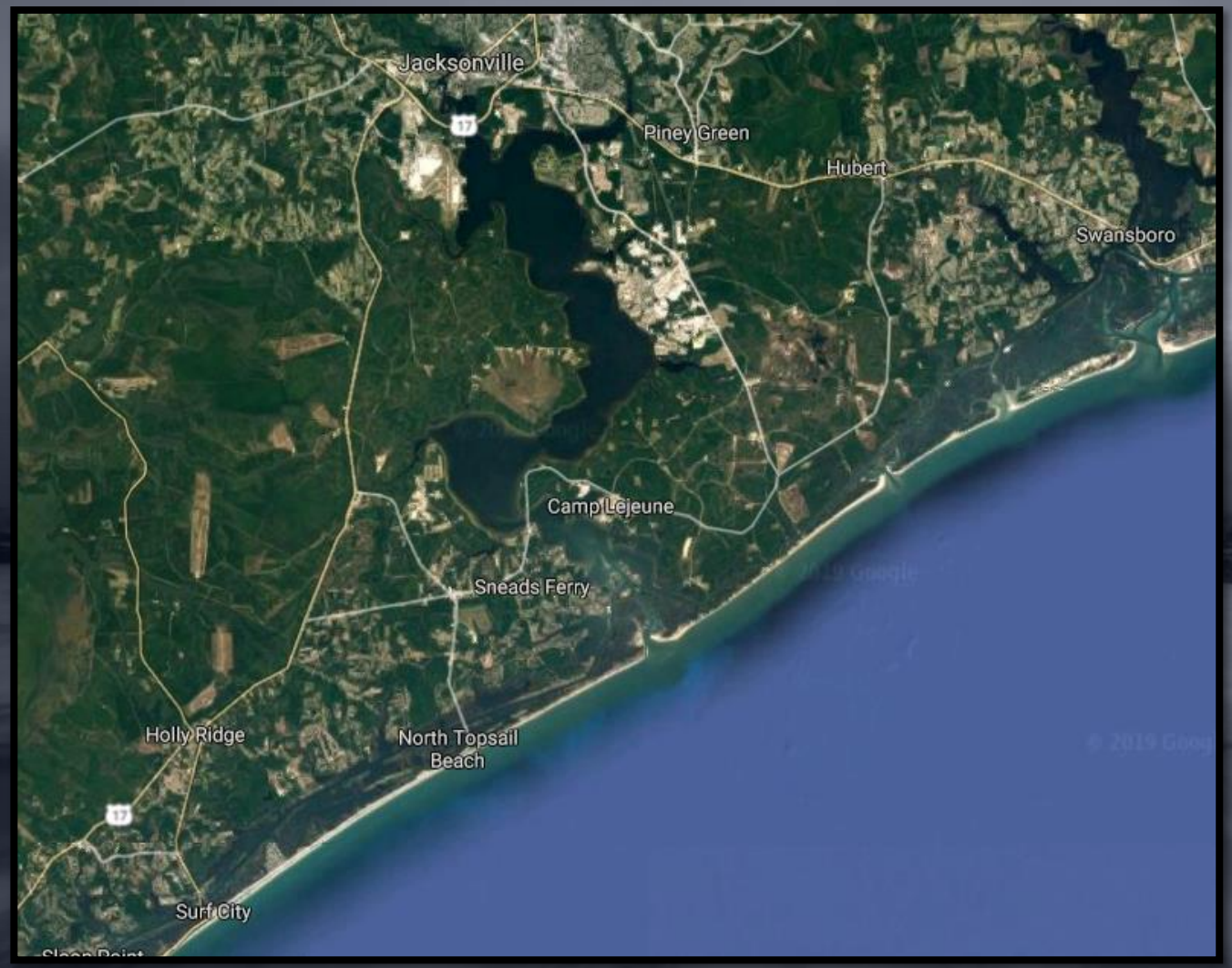
- **West** and **Northwest** winds will increase water levels on the sound-side of Ocracoke Island. Much of the island is undeveloped and sound-side flooding is not a major problem. Areas in and around Ocracoke are the concern. Much like Hatteras Island, significant slosh effect flooding is possible if strong winds rapidly shift from east to west.

Hyde County - Mainland



- **East** and **Southeast** winds will increase water levels over the eastern parts of the county, mainly impacting the towns of Swanquarter, Sladesville, and Englehard.

Onslow County



- **East, Southeast** and **South** winds will increase water levels across coastal Onslow County.
- Onslow County is vulnerable to both ocean-side flooding and minor sound-side/tidal flooding. Areas impacted include Swansboro down to Sneads Ferry and Topsail Island.
- Beach erosion along North Topsail Beach has become severe and several homes are threated by the ocean.

Pamlico County

- **Northeast, East** and **Southeast** winds will increase water levels for areas adjacent to the Pamlico Sound, Neuse, Pamlico, and Bay Rivers.
- The entire eastern half of county is vulnerable to flooding, including the towns of Oriental, Hobucken, Vandemere, and Whortonsville

Pamlico County

- Northeast and East winds result in the greatest impacts. Nearly the entire eastern section of the county and most roads flood as water levels begin to rise.
- All of the county east of a line from Oriental to Stonewall to Hollyville (Cash Corner) has an elevation of less than 10 ft MSL. Alliance, Bayboro, and Arapahoe have very little flooding problems.
- Oriental – Floods with Northeast to Southeast winds. Minor 3.5 ft, significant 5 ft.
- Hobucken – 4 ft surge cuts off road of escape across inland waterway and a 2 ft tide covers some sections of the road from Lowland.
- Vandemere – Begins flooding with 4 ft surge and east winds. Minor 3.5 ft, significant 5 ft.
- Stonewall – minor 5 ft, significant 8 ft.

New Bern – Hurricane Florence 2018

New Bern – Hurricane Florence (4 hrs later)