Nassau County Vulnerability Assessment: Phase II

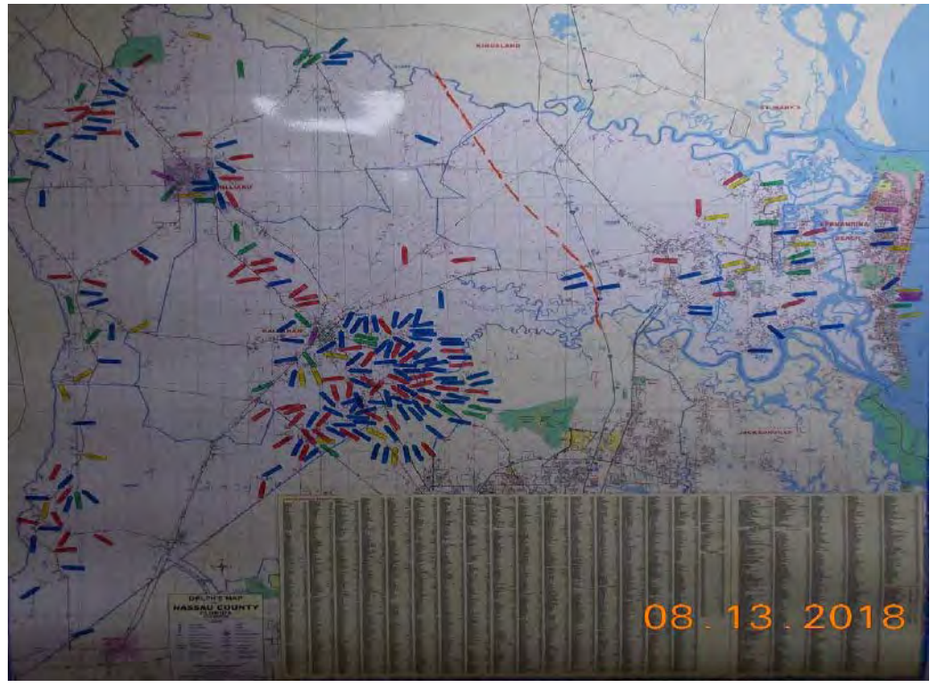
REPORT OF VULNERABILITY ASSESSMENT

APRIL 3, 2020

Executive Summary:
Vulnerability Assessment & Public Outreach

Nassau County applied for a Resiliency Planning Grant (RPG) through the Florida Department of Environmental Protection to assess vulnerabilities in two areas of the County: 1) Amelia Island (including the City of Fernandina Beach), and 2) west of I-95 and north and west of SR 200/US 301. This is the second of two phases, and completes the county-wide assessment.

Flooding, stormwater, and drainage are top of mind with elected officials and their communities based on recent storm events like Hurricanes Matthew and Irma, but also because of everyday flooding after typical summer thunderstorms. It is not uncommon for the County to hear on a weekly basis from citizens regarding road flooding issues or that they have been dropped from their flood insurance. An example of this is illustrated by the County Road and Bridge Department's open work orders map. In the picture at right, blue flags indicate open work orders related to drainage and flooding; while present throughout the County, this map describes a concentration around Callahan and demonstrates existing vulnerabilities.



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The community has indicated it is ready for action. This Vulnerability Assessment for the County's rapidly growing areas and areas with demonstrated flooding issues helps better prepare Nassau County and dovetails well with existing long-range planning projects that are underway. Further, based on this Assessment, the County should be prepared to address the impacts of sea level rise: tidally-influenced water bodies extend well into western Nassau County. In addition to losses of tidal wetlands; changes to the landforms of estuaries, tidal wetlands, and tidal rivers; destabilization of beach-dune systems, barrier islands, and inlets; and threats to coastal fresh water supplies, increasing sea level in Nassau County is anticipated to impact the functionality of stormwater systems (exacerbating flooding) and the safe operations of septic tanks and drainfields as well as sewer mains. Sea level rise will have a disproportionate impact on areas with higher concentrations of the disabled, major employers (including tourism), and historical resources. As a community with a geography dominated by floodplains and wetlands, the County must take sea level rise seriously. A rise in sea level will have impacts on infrastructure, development, community health, and the economy.

Nassau County Planning and Economic Opportunity (PEO) Department staff are working on numerous long-range planning initiatives in the two project areas. The timeline for these projects is roughly the next 18-24 months. Having a Vulnerability Assessment conducted now is an opportune time to make sure the County is adequately addressing future impacts of flooding and SLR as the County progresses on these planning projects. This not only helps the County plan for its citizens, it will also help the County plan internally in terms of siting future infrastructure projects.

These planning initiatives are directly related to projected growth trends for Nassau County. In Spring 2018, the PEO Department released a Growth Trends report with projections relative to population and potential future land areas expected to be impacted as a result of this growth. The proposed areas for this Vulnerability Assessment, which include areas of existing population concentration and growth, are projected to be the areas continuing to grow over the next ten years. These areas include, for example, Amelia Island and the City of Fernandina Beach, which continue to be economic focal points for the County. The city of Hilliard and portions of Callahan are also addressed in this phase of the Vulnerability Assessment, as are a number of approved subdivisions. Incorporating resiliency into planning efforts for these regions represents the holistic planning approach the County wishes to see implemented.

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Vulnerability Assessment & Public Outreach

In early 2019, Nassau County adopted the state statutory requirements regarding "Peril of Flood" into the County's Comprehensive Plan. This was an important step forward in resilience and adaptation planning for the County. Having a Vulnerability Assessment completed will move the County further along the Adaptation Planning process suggested by the State of Florida in the *Florida Adaptation Planning Guidebook*, as depicted to the right.

The Balmoral Group was contracted to perform the vulnerability assessment. Data were collected from a variety of sources and compiled to evaluate two areas: "Amelia Island" (including the City of Fernandina Beach), and "West", meaning west of I-95 and north of SR 200/US 301. Maps were prepared to provide relevant data, and public outreach events were conducted on February 5, 2020 in American Beach (for the Amelia Island study area) and on February 19, 2020 in Hilliard (for the West study area).

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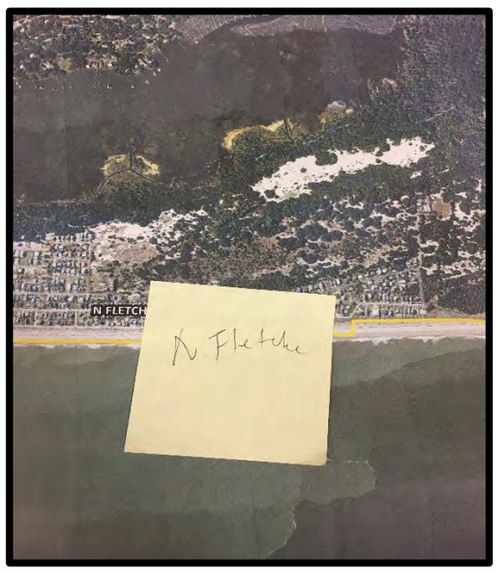
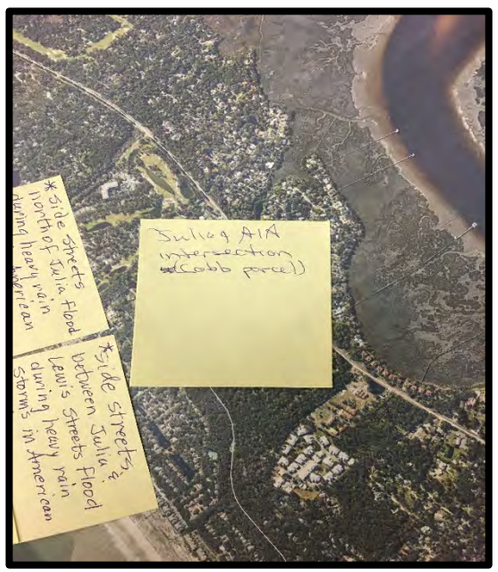




Citizen Comments

At the two publicly noticed outreach events, citizens were provided the opportunity to mark up maps; verify, validate, and correct indicated areas of flood risk and occurrence; and to ask questions to clarify the methodology and findings. Images and notes compiled by TBG staff.

American Beach (2/5/20):

File Image	Comment
IMG_1301	“N Fletcher”
IMG_1302	“Hurricane surge waves washing over Atlantic Ave @ Egans Creek”
IMG_1303	“Flooding from Alligator Creek to Calhoun Street; Broom (saltwater marsh behind port) east of port:
IMG_1304a	Julia @ A1A intersection (Cobb parcel)”
IMG_1304b	“side streets north of Julia flood during heavy rain storm in American Beach”
IMG_1304c	“side streets between Julia & Lewis Streets flood during heavy rain storm in American Beach”
IMG_1304d	“Heavy Rains; from Julie left to end of Ervin floods; Water remains in street; Drain needed”
IMG_1304e	“During major storms Gregg Street floods houses near the pumping station, gets at least 4’ of water in their garages. American Beach”

Hilliard (2/19/20):

Note Reference	Comment
A	“During Irma, Kame Creek 1A lot, 1 foot under”
B	“Alligator Creek; Brandy’s Ave (early Feb) water in ditches at all times; (Oak Trail), Irma 6””
C	”US 1 property across from Cedar Dr has filled in Callahan”
D	“SJRWMD looks at property not context”

Introduction & Background to Data Collection

The following maps describe data relevant to the evaluation of two study areas within Nassau County: Amelia Island and the "West", meaning west of I-95, north (and west) of SR 200/US 301. A number of vulnerabilities were assessed in this study. As planning efforts may need to respond differently to episodic flooding versus long-term changes in flooding conditions, the maps are organized by type of inundation for each new data theme introduced, as follows:

1. The first map in each sequence provides data regarding seasonal, episodic flooding or inundation, based on satellite data reflecting the presence or absence of surface water (described in more detail in the next section).

2. The second map in each sequence provides data in the context of storm surge inundation, based on NOAA-modeled impacts associated with each hurricane category (1 thorough 5).

3. The third map relates data to several sea level rise projections for the area (1', 3' and 6').

Three figures also have been included that relate existing land uses and development patterns to the County's Future Land Use Map and zoning, followed by a series of slides describing the three types of flooding or inundation data used throughout the assessment, described here as Episodic (water frequency), Event-driven (storm surge) and Persistent (sea level rise).

Common to all inundation maps in this study is the direct relationship between level of risk and land elevation as shown in the Figure on the right. Areas of low elevation (dark shading) are typically at the highest level of risk, whereas areas of high elevation are less likely to be inundated by episodic, storm surge or sea level rise flooding events.

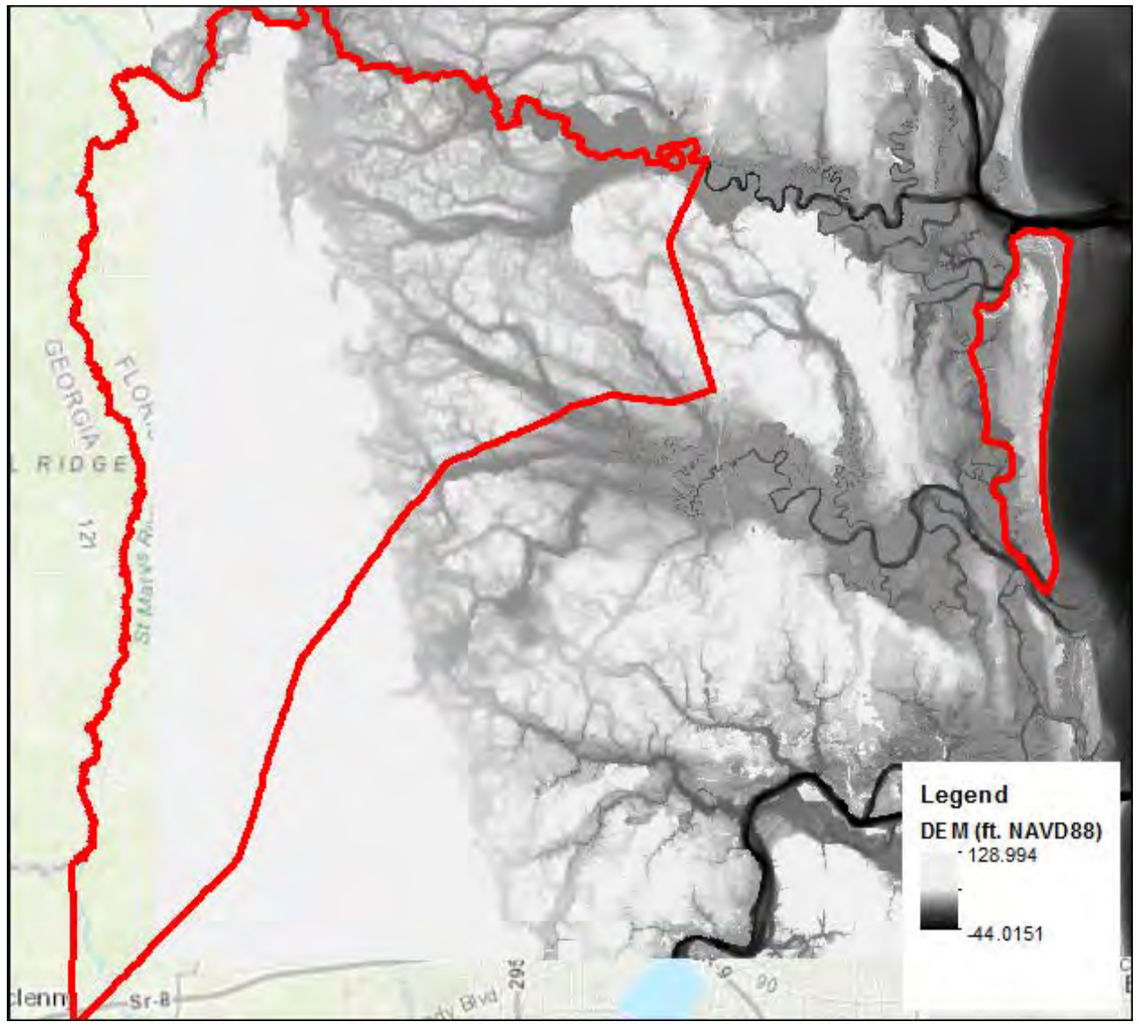
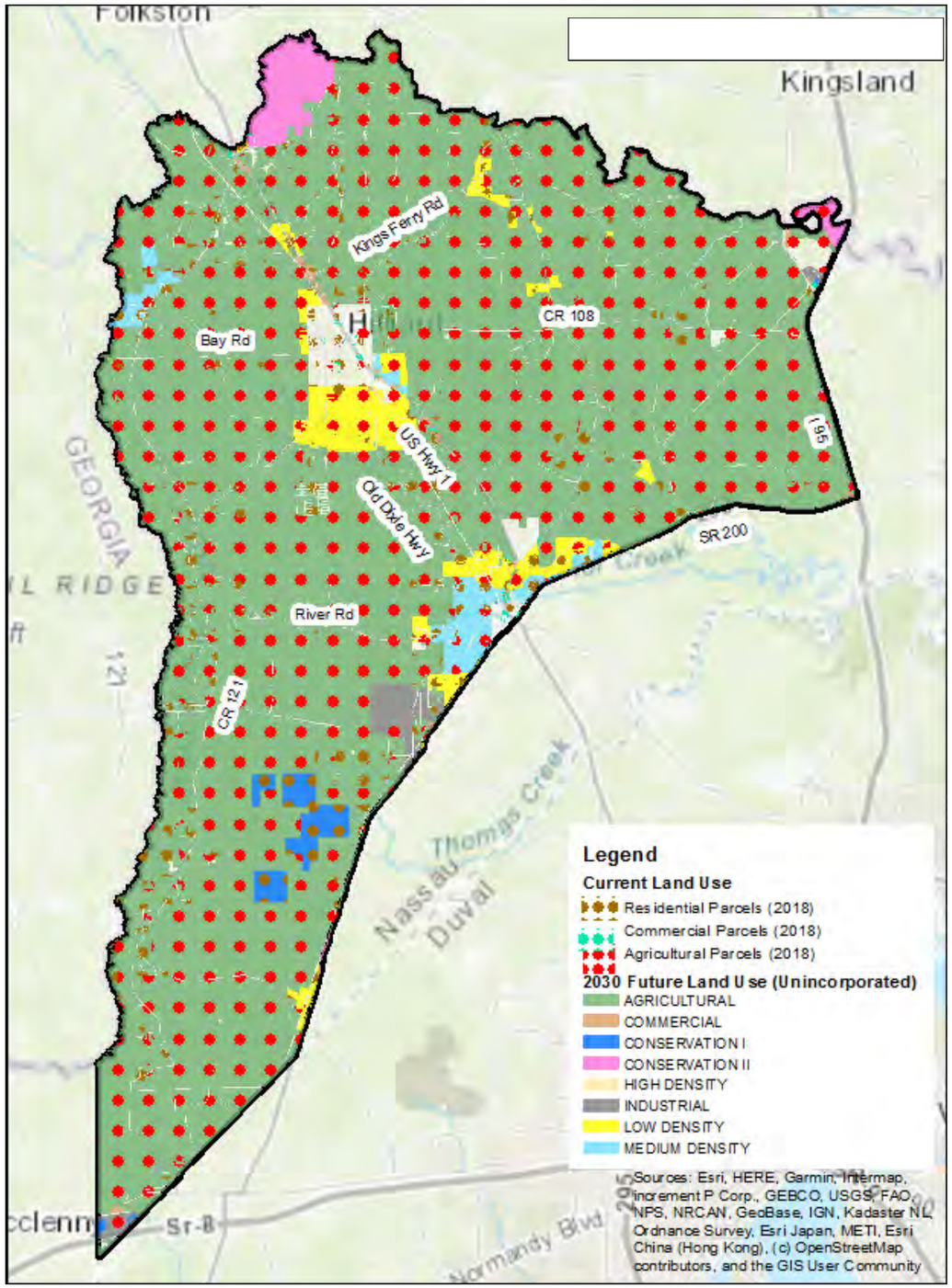


Table of Figures

Figure 1a. Future Land Use and Existing Parcels

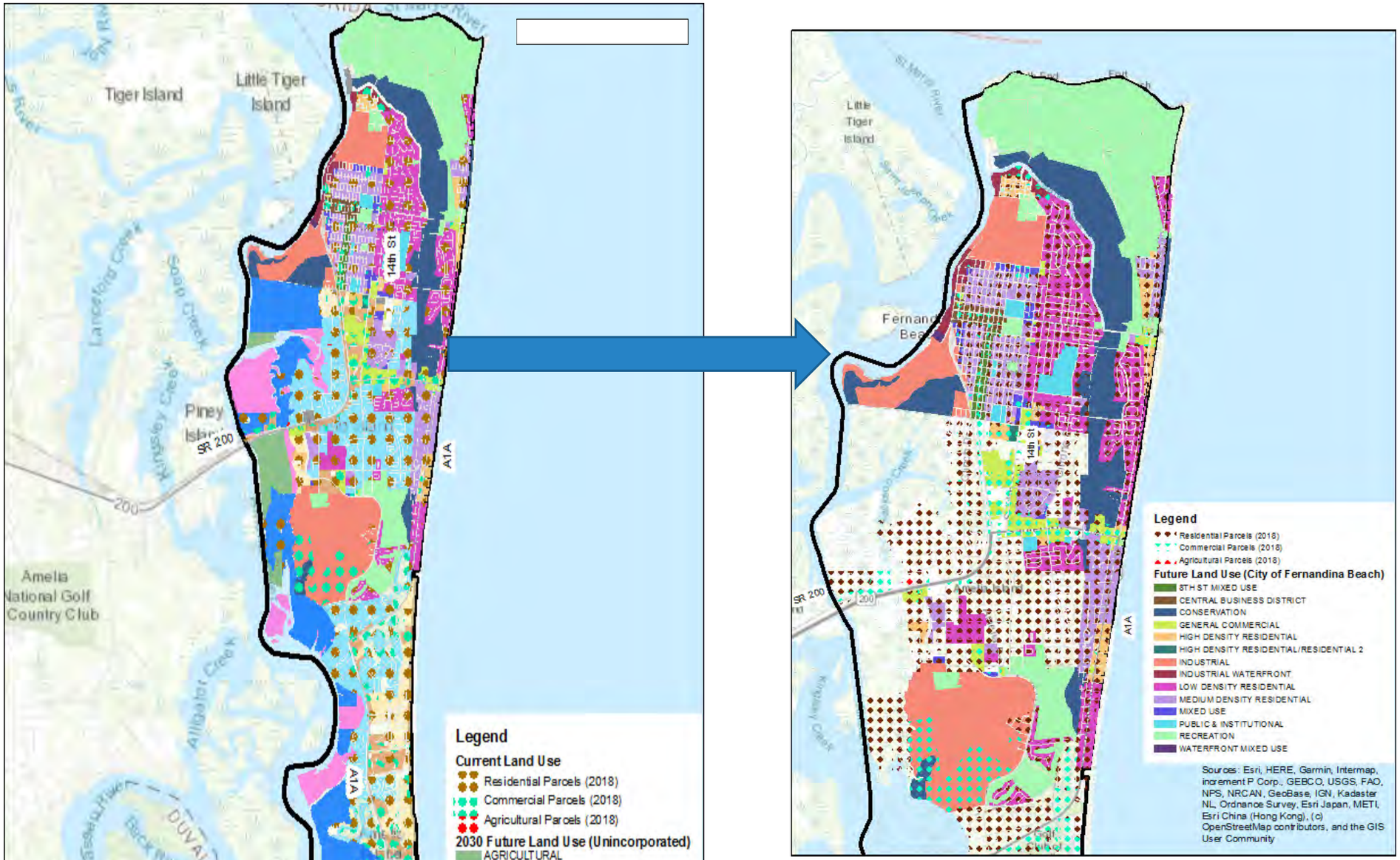
Figure 1a compares the Future Land Use Map (FLUM) categories (presented in solid colors) with the current land use (2019 parcel data, shown by dotted colors) to identify areas where the planned future use has been superseded by existing uses. For example, there are places in the West area where future land use is labeled for conservation (Conservation II), but is currently in agriculture or residential.



Sources: TBG Work Product; Nassau County FLUM; DOR

Figure 1b. Future Land Use and Existing Parcels, Amelia Island

Figure 1b presents the Future Land Use Map (FLUM) categories and existing uses for both the unincorporated and incorporated areas of Amelia Island.

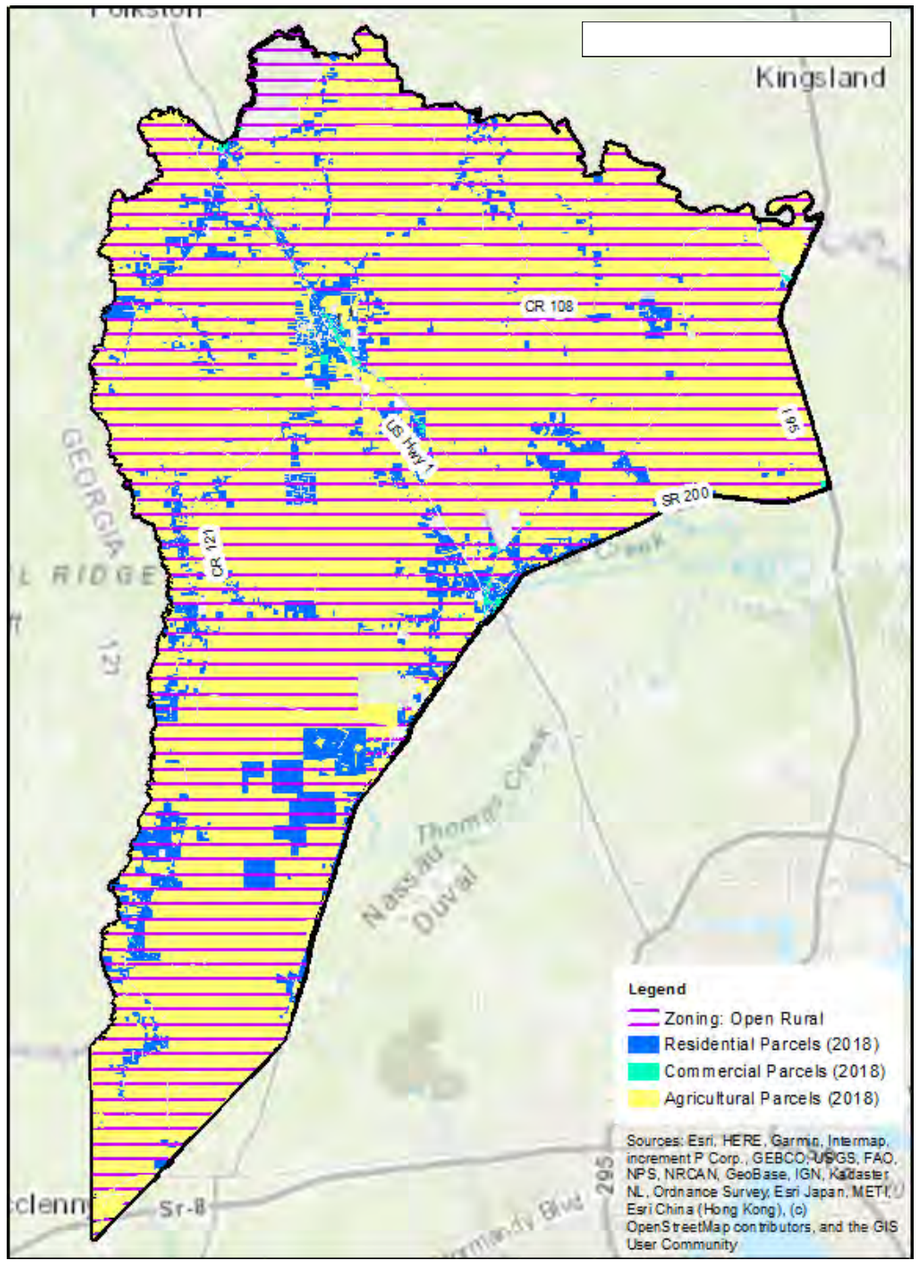


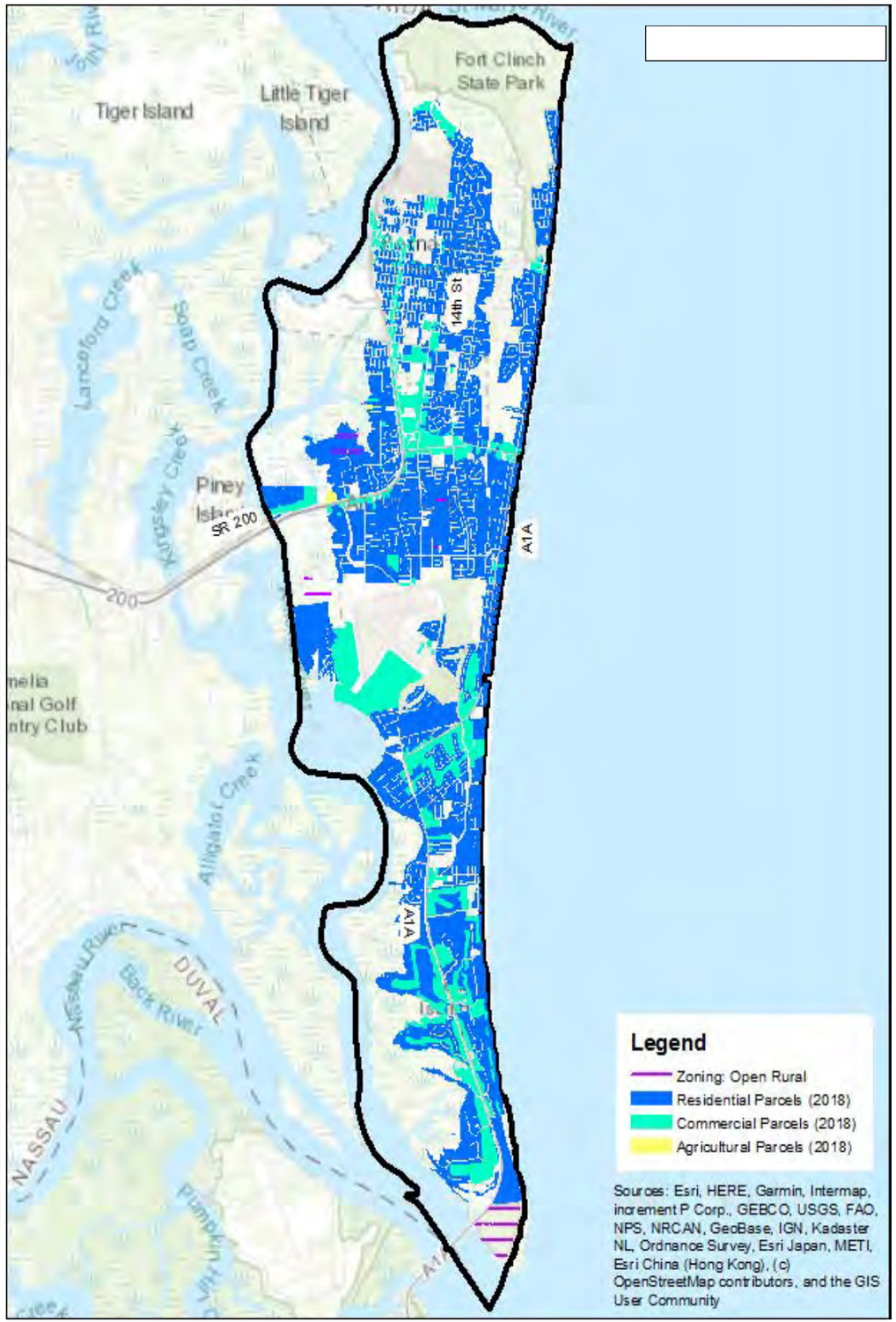
Sources: TBG Work Product; Nassau County FLUM; DOR

Figure 2. Zoning and Existing Parcels

Zoning information was also reviewed, to understand current land uses in the context of the vulnerability assessment.
Figure 2 compares land zoned as open rural (purple hashed line), 2018 agricultural (yellow), commercial/industrial (green),and residential parcels (blue). Similarly to what occurs with future land use designations, there are sections in the West area zoned open rural, but which have undergone some residential development. In unincorporated Amelia Island there are few sections zoned as open rural.

While in Amelia there are 283 acres of land zoned as open rural, there are almost 260,000 acres in the West area. In the West area, 5,735 residential (24,600 acres) and 73 commercial parcels (324) intersect with areas zoned as open rural. In Amelia Island, there are 82 residential (376 acres) and no commercial parcels within open rural zones.





Sources: TBG Work Product; Nassau County FLUM; DOR

Information about satellite data reflecting water frequency

Satellite data* representing water frequency provides information about how often an area was under water in 1984 1999 compared to conditions during 2000-2015. The results were mapped as follows:

- Red represents a percent loss of surface water occurrence between the two time periods (brighter red = higher loss)
- Black areas represent no change, and
- Green represents a percent increase of water occurrence (brighter green = higher increase).

For instance, between the two periods, Amelia Island had a net gain of almost 2,400 acres in surface water occurrence (losing approximately 494 acres, but gaining 2,860 acres). It is significant that the satellite data show increased flooding in locations near the Intracoastal Waterway and the historic district of Fernandina Beach.

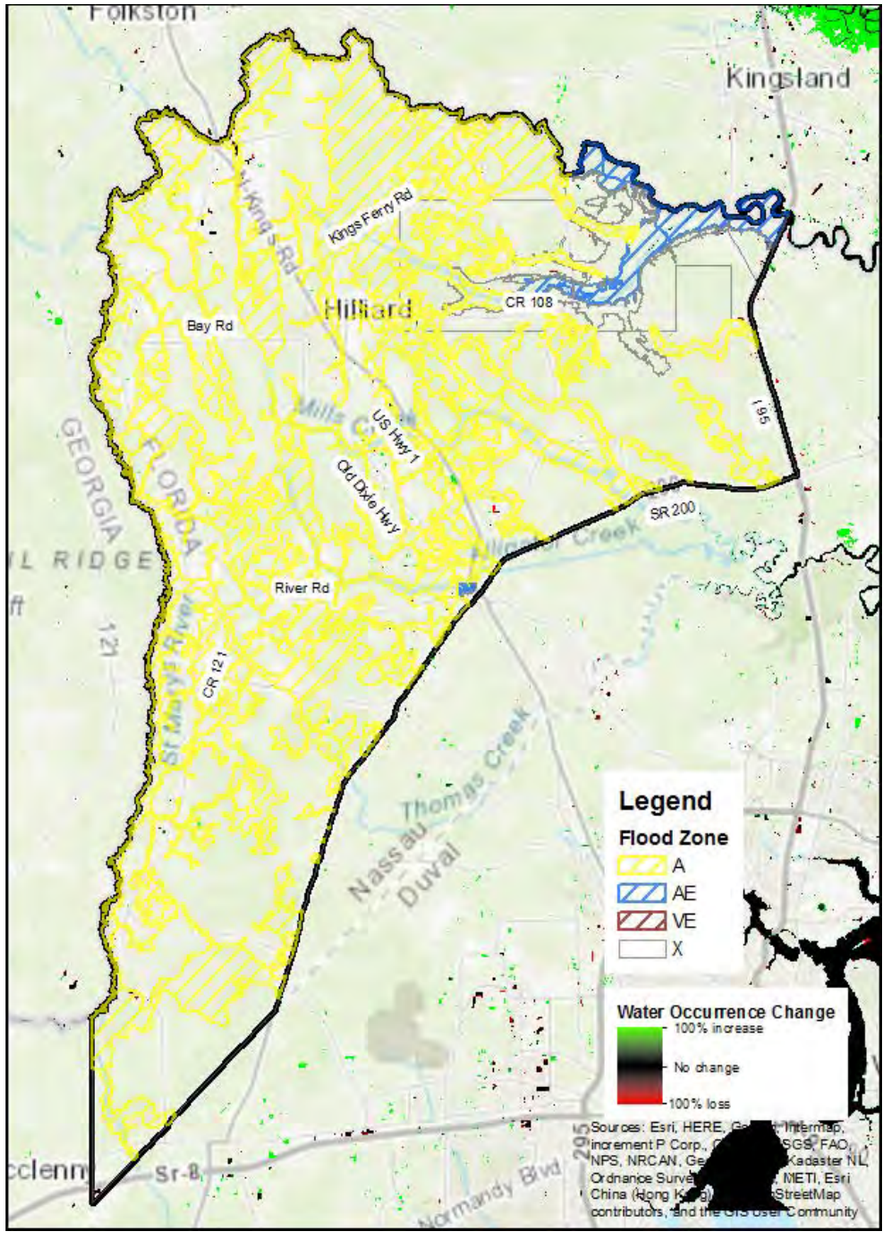
However, the data are limited in some locations. For instance, within the study boundaries, there are more data in Amelia Island than in the western area of the County. This is, in part, because the published data exclude imagery with factors such as cloud cover that could misidentify the presence of water in a given place. Areas just inland of coastal environments tend to have more cloud cover that can obscure observations.

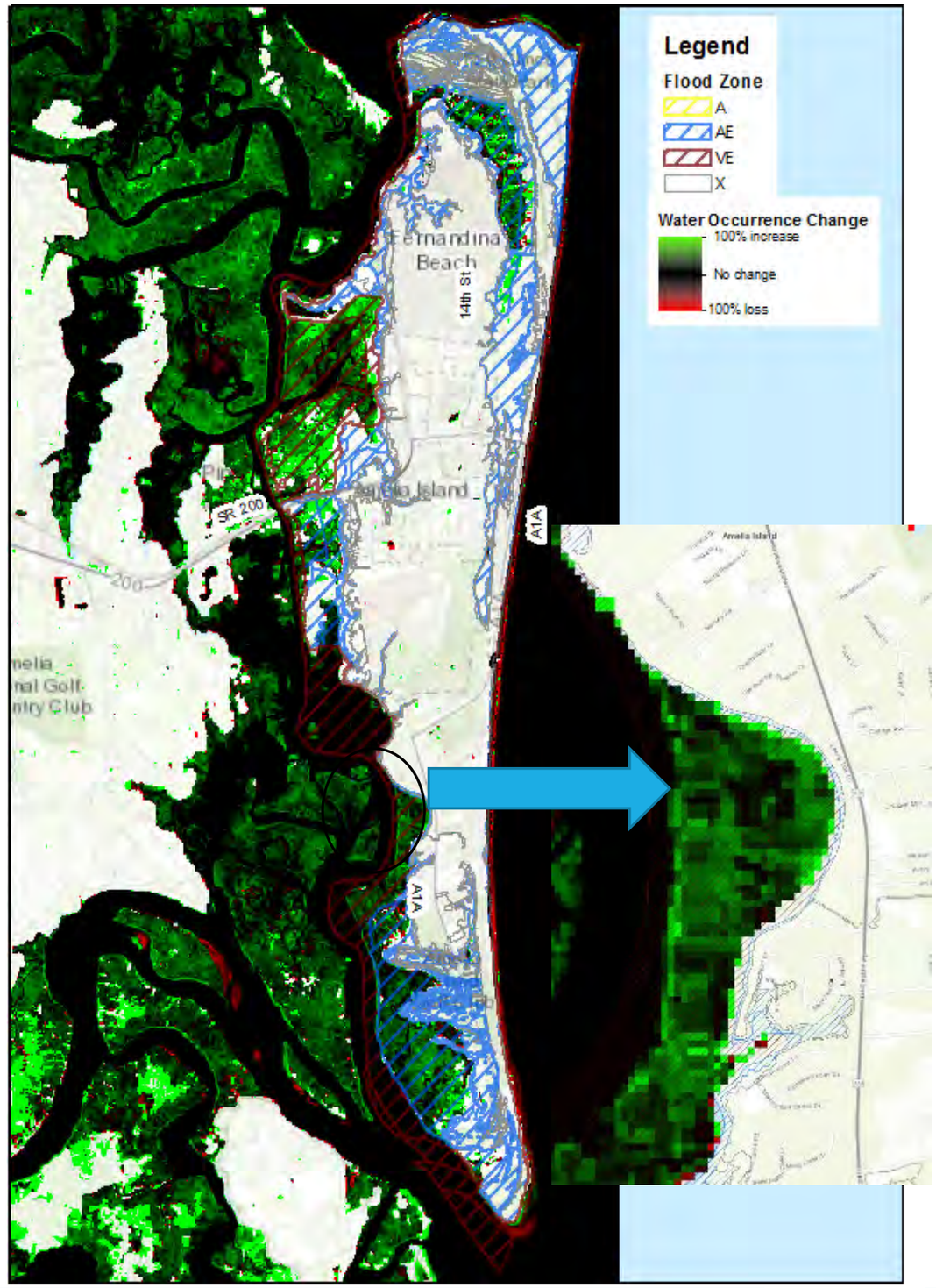
* Published by the European Commission Joint Research Centre (EC JRC).

Series 1 Map 1. Flood Zones and Water Occurrence Change

Data regarding flooding incidence were compiled from a variety of sources, including FEMA flood zone designations and satellite data showing water frequency changes between 1984 and 2015. The maps at right allow for comparisons between flood zone rating and the observed changes in surface water frequency. For example, the maps show Flood Zones rated A or AE, meaning they have a greater than 1% chance of flooding in a given year according to FEMA hydrologic mapping.

The bright green areas and red areas illustrate areas of increased or decreased water occurrence. Bright green areas show water present significantly more frequently in 2015 than in the 1984-1999 period, while red areas reflect areas where water was commonly present during the 1984-1999 period but not any longer, likely due to human alteration.

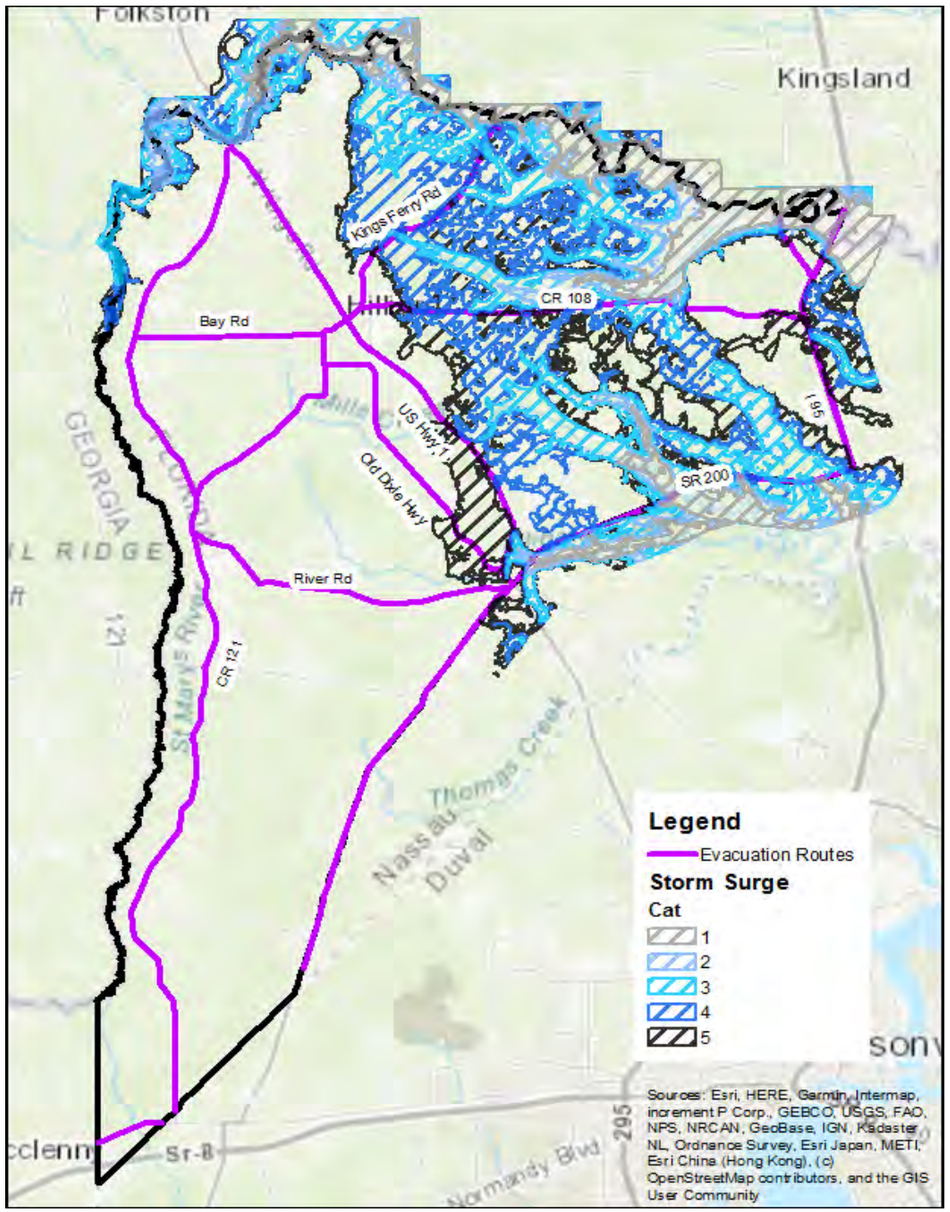


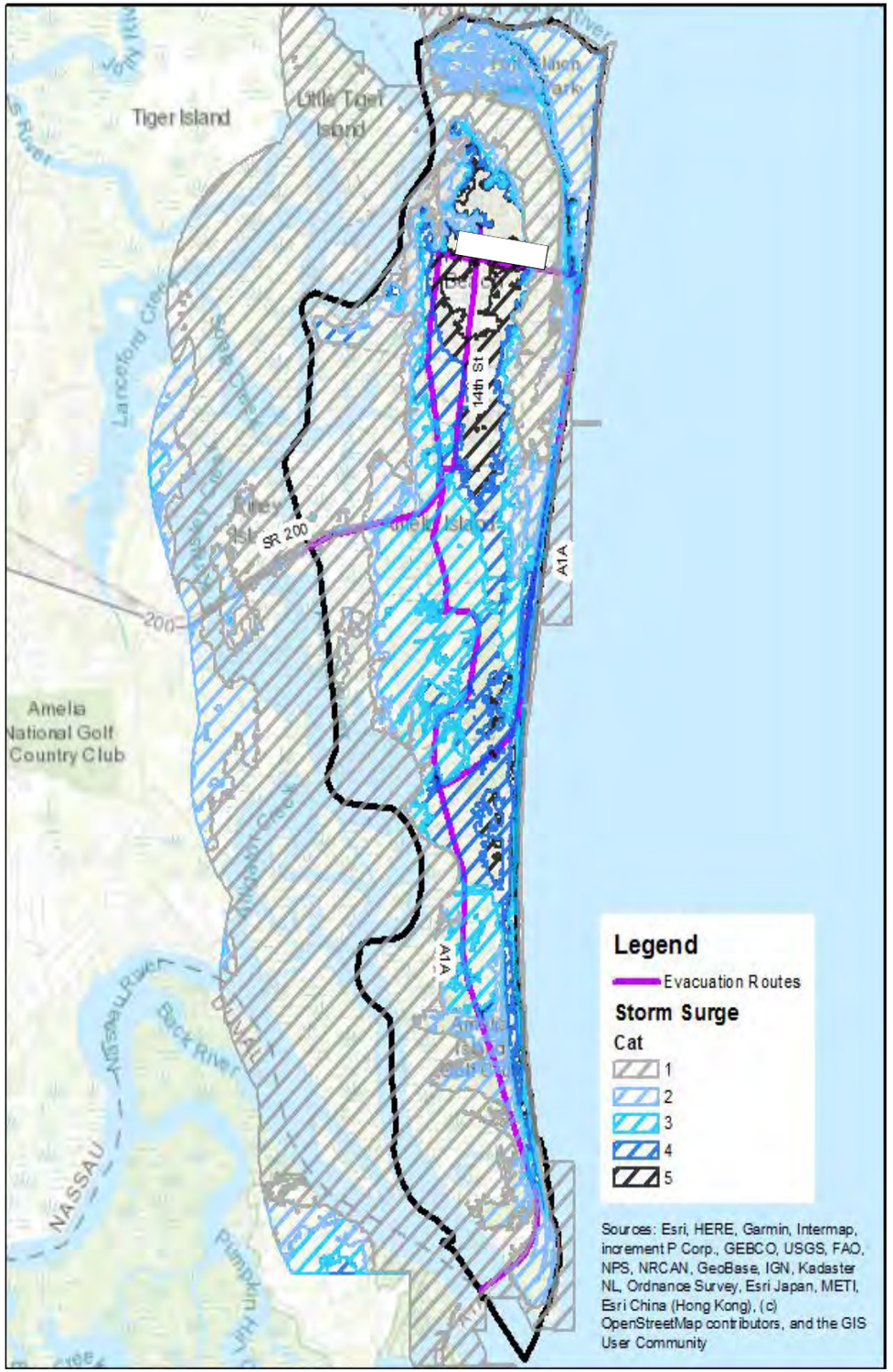


Series 1 Map 2. Storm Surge Projections

Storm surge data from the National Oceanic and Atmospheric Administration (NOAA) have been mapped for each category of storm and overlaid with Amelia Island and the West study area. Evacuation routes are included for reference. In the West area, sections north of SR 200 and lands adjoining St. Marys River. Areas southwest of Hilliard and US Highway I would not be impacted by storm surges. Most of Amelia Island is impacted by even the weakest and most frequent storm, Category I.

Importantly, NOAA maps do not incorporate sea level rise with the storm surge projections. Thus, a Category I storm combined with a 1 ft. sea level rise may be closer to a Category II storm in impact, but this combination is not shown in the storm surge maps.



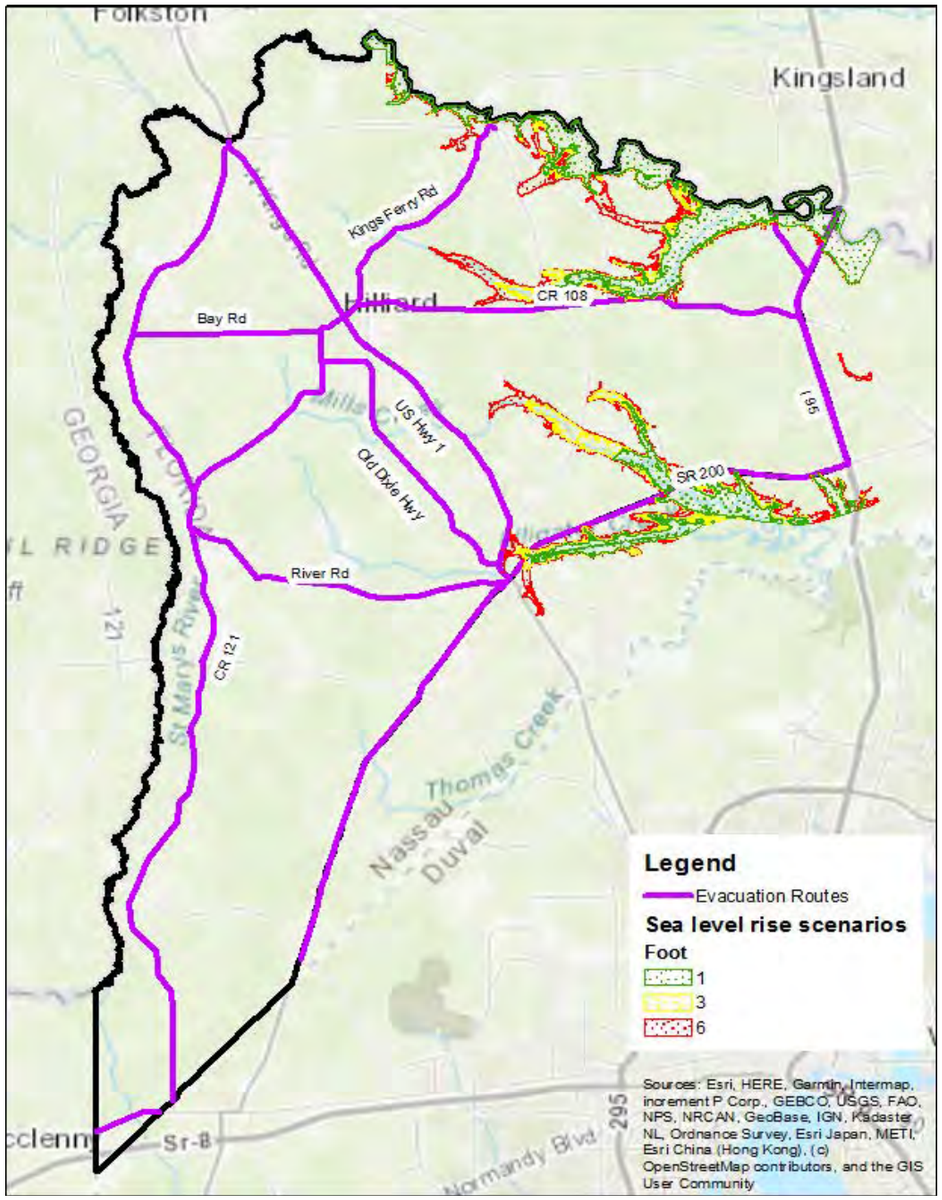


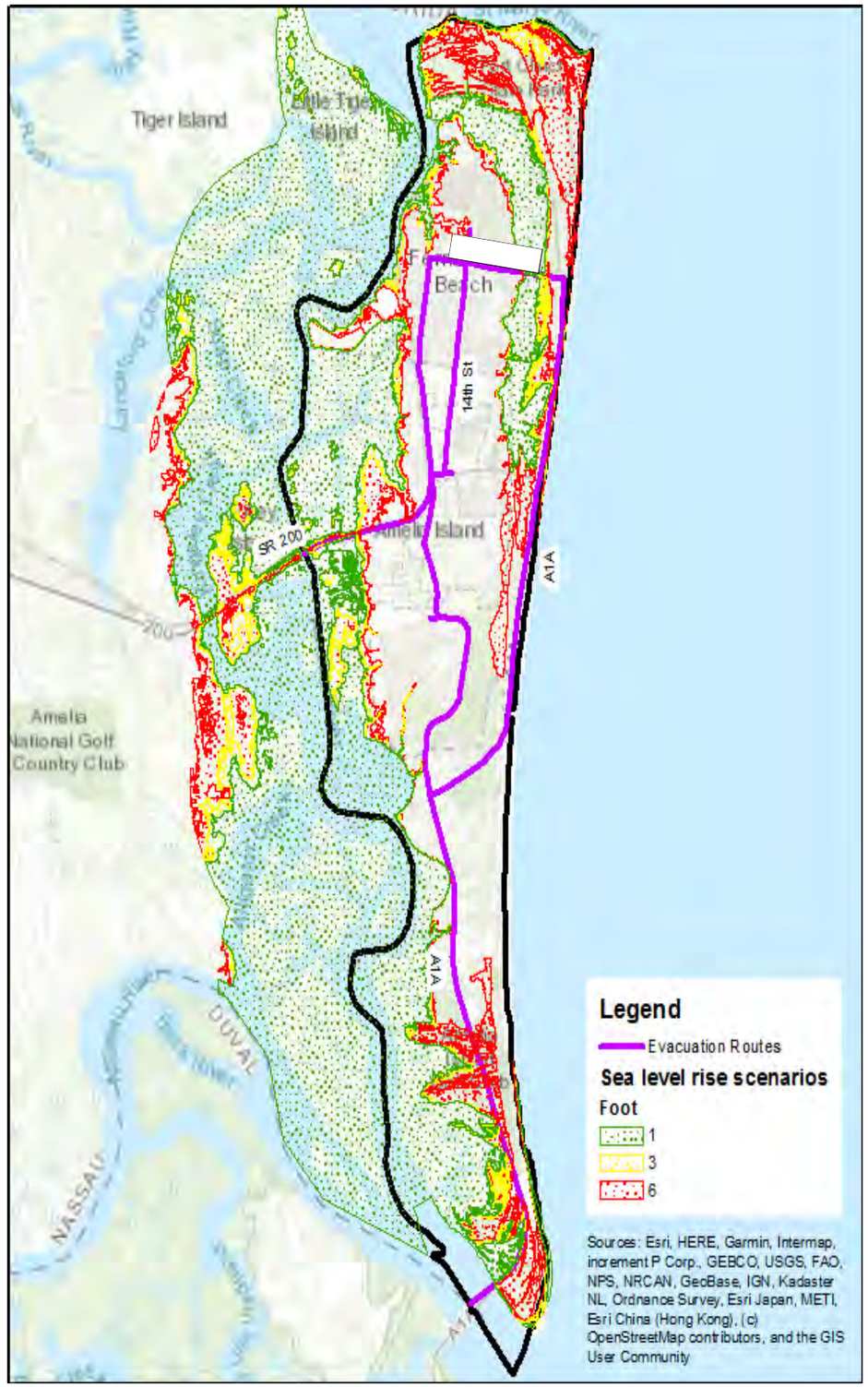
Sources: TBG Work Product; NOAA

Series 1 Map 3. Sea Level Rise Projections

Sea level rise data were compiled from the National Oceanic and Atmospheric Administration (NOAA). The data show areas anticipated to be inundated by sea level rise of +1, +3 and +6 feet (ft.). Low-lying areas proximal to the St. Marys River, the Intracoastal Waterway and the Atlantic Ocean would be most impacted, according to the most recent published sea level rise projections.

As with storm surge, large portions of Amelia Island are impacted by the 1 ft. sea level rise scenario, which is the scenario with the earliest occurrence.



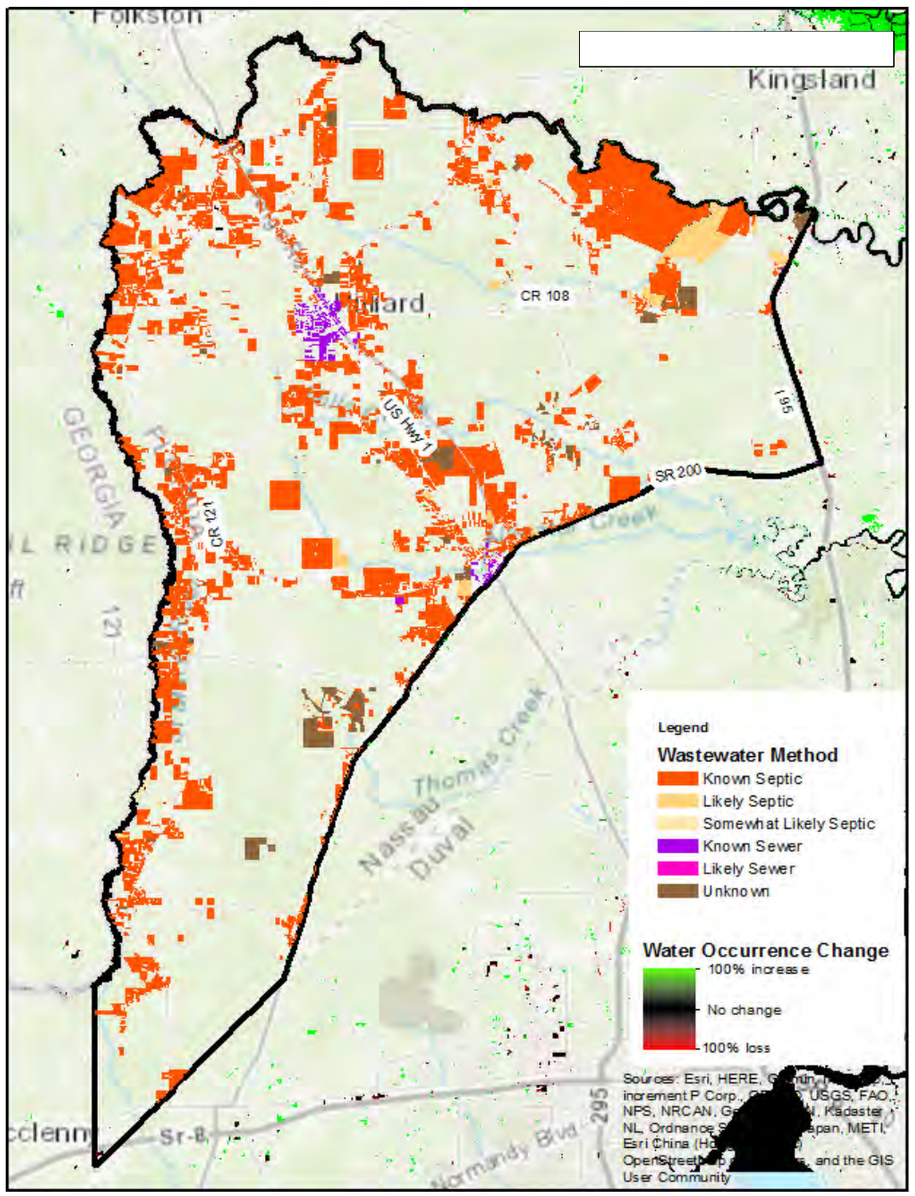


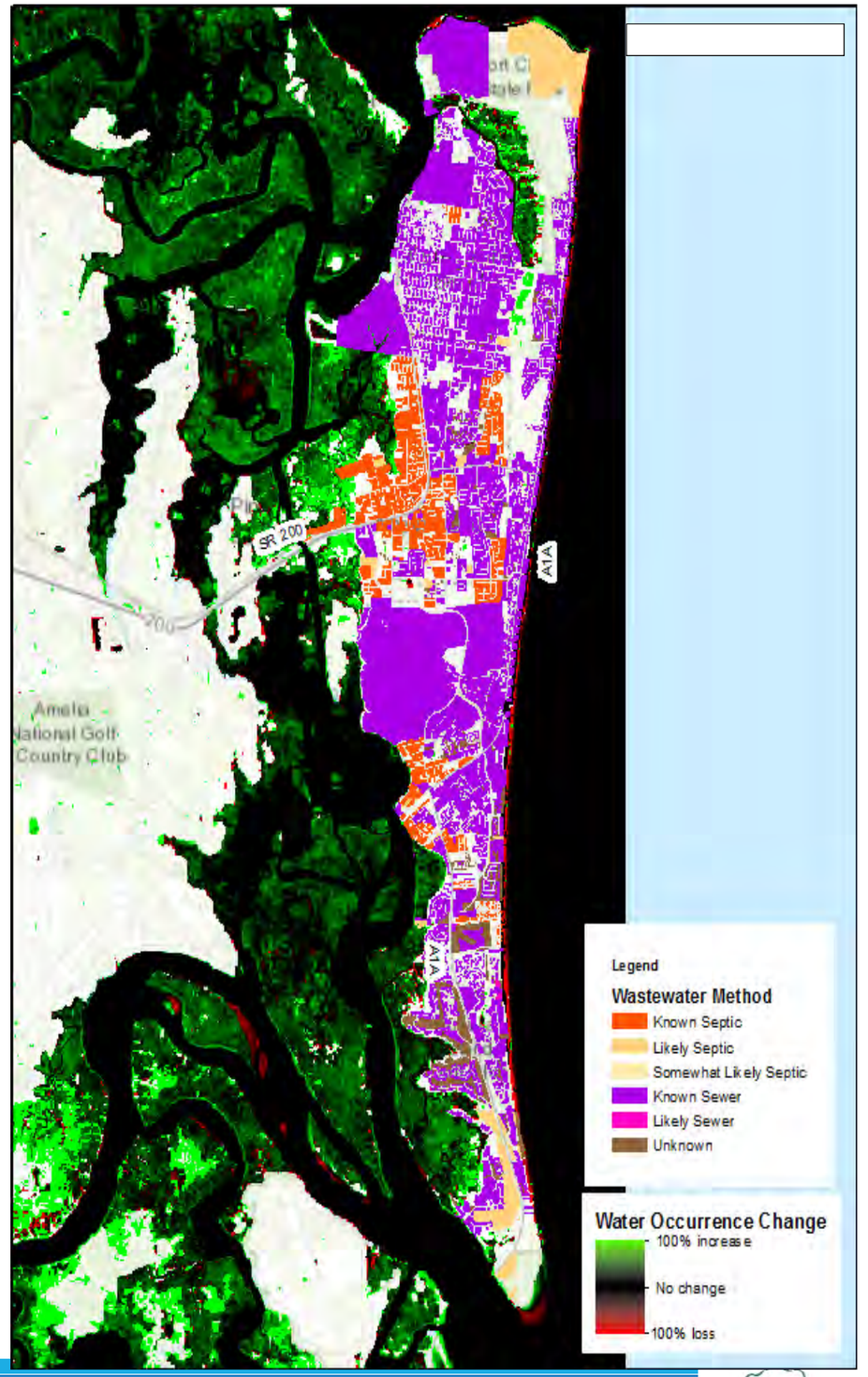
Series 2 Map 1. Wastewater Treatment Method and Water Occurrence Change

Wastewater treatment methods have been collected from the Department of Health. This map series shows parcels classified as septic or sewer based on their reported wastewater treatment method and relates them to areas subject to episodic flooding. In the West there are no reliable data for 47% of the parcels. Of the remainder, 43% are on septic and 10% rely on sewer. In the West area, there have been minimal increases in water frequency.

Almost 71% of the parcels on Amelia Island use sewer, 10% are on septic and reliable data are unavailable for the remaining 19%. Parcels near the Intracoastal Waterway are already affected by a more frequent presence of surface water. Of the parcels that use septic systems, most are in the surroundings of the SR 200 bridge at the Intracoastal Waterway.

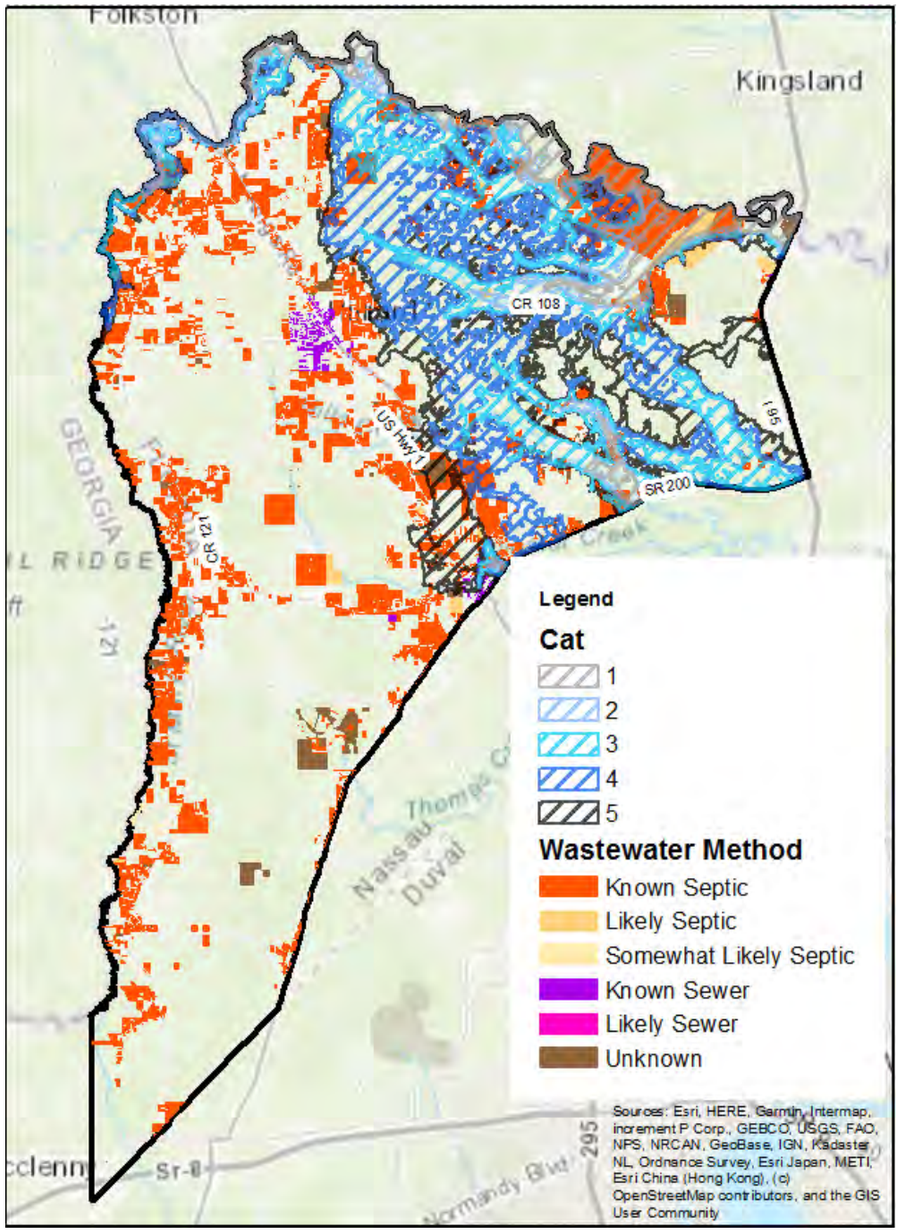
Increased water frequency is likely to increase the probability of septic system failure and health risks. A recent EPA study found that 70% of housing lots with septic tanks meeting standard Florida siting and depth requirements contained fecal coliform exceeding EPA standards during the wet season; higher water frequency is likely to increase this risk.

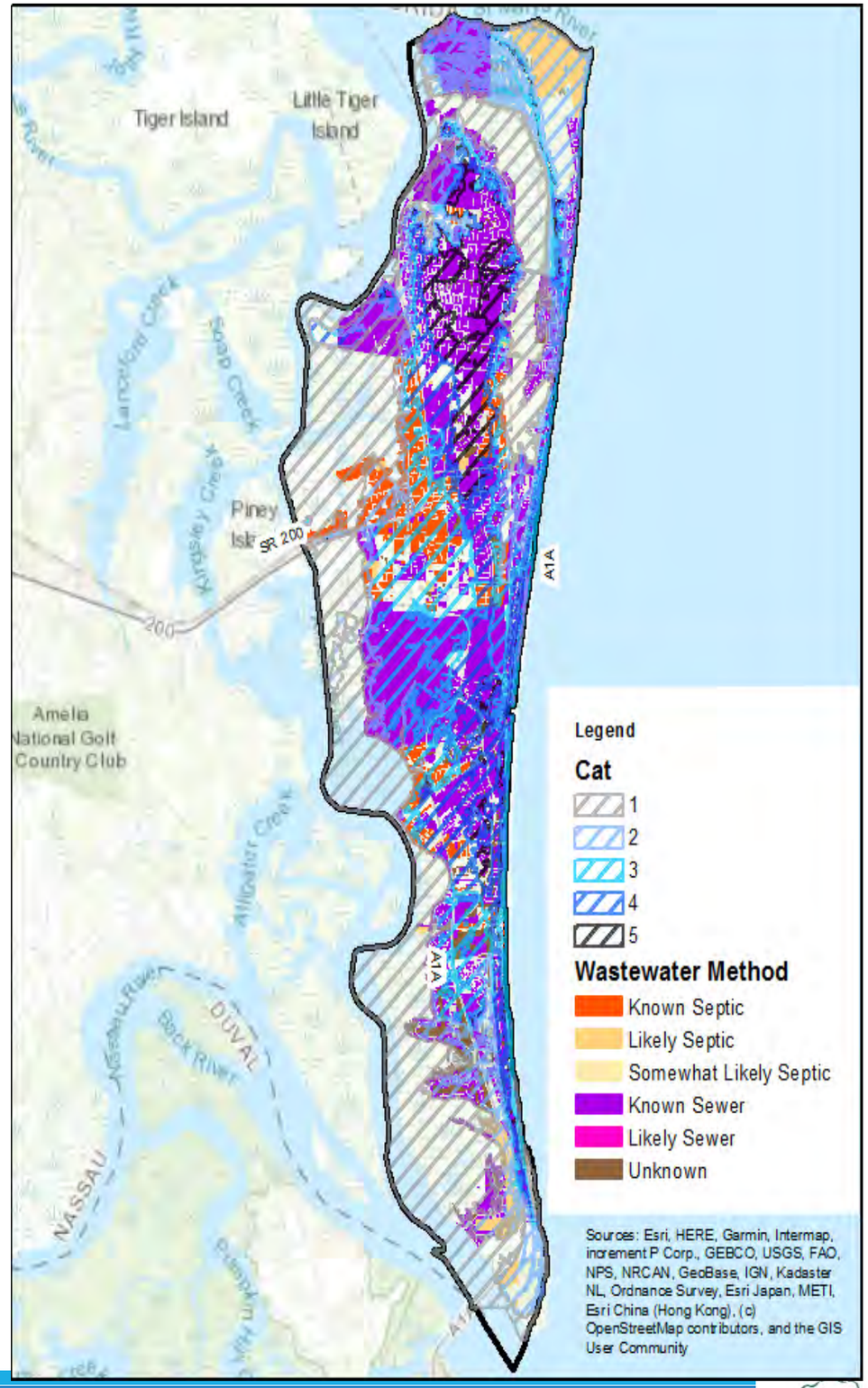




Series 2 Map 2. Wastewater Treatment Method and Storm Surge

Series 2 Map 2 overlays wastewater treatment methods with storm surge to evaluate which locations relying on septic tanks are at risk of event-driven flooding. In the West, parcels in the surroundings of the St. Marys Rivers would be vulnerable to Category I storm surges. In Amelia Island parcels using septic systems are concentrated mostly near the Intracoastal Waterway, and are vulnerable to the weakest and most frequent storm surges. It should be noted that most of the parcels relying on central sewer would also be vulnerable to a Category I storm surge.



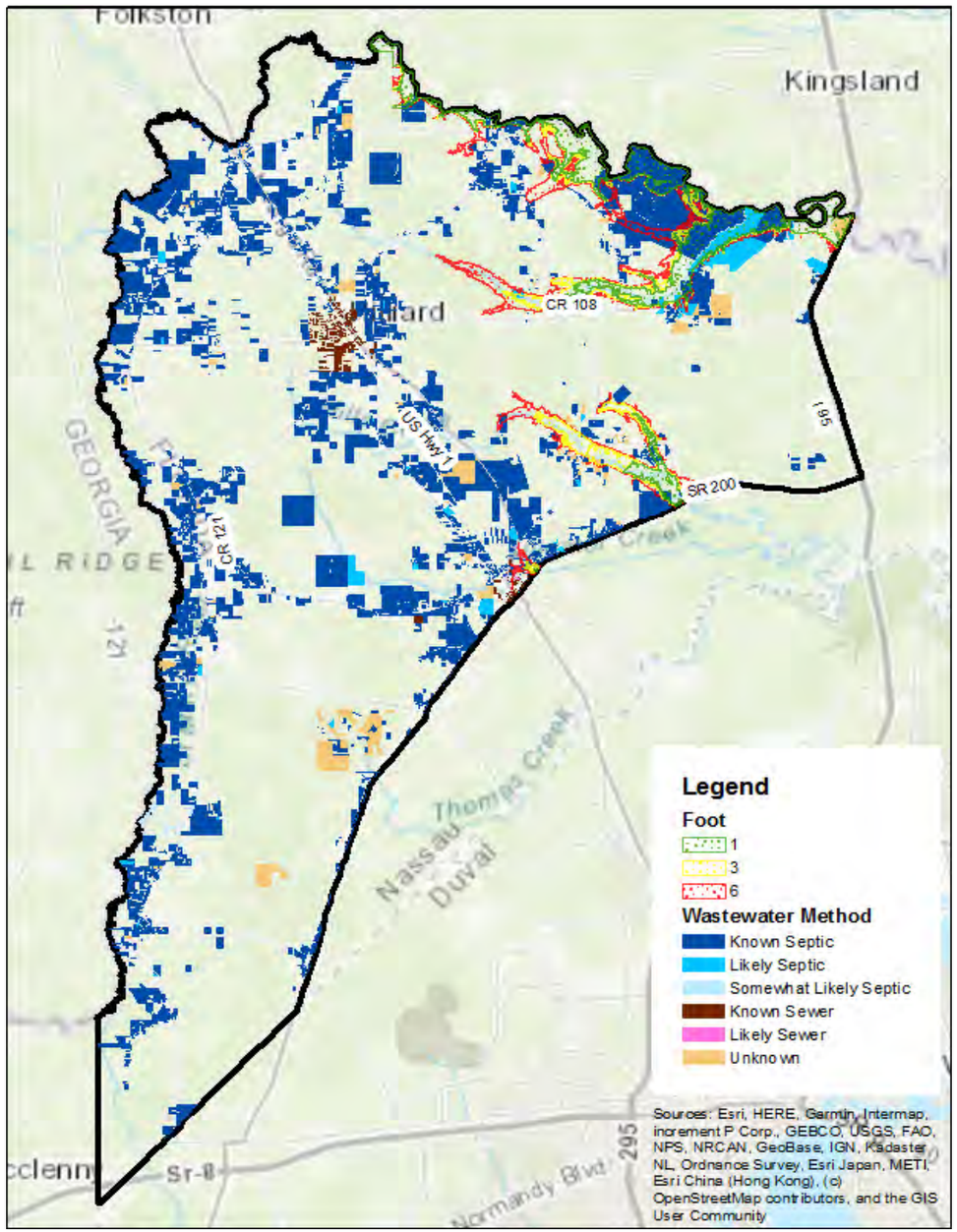


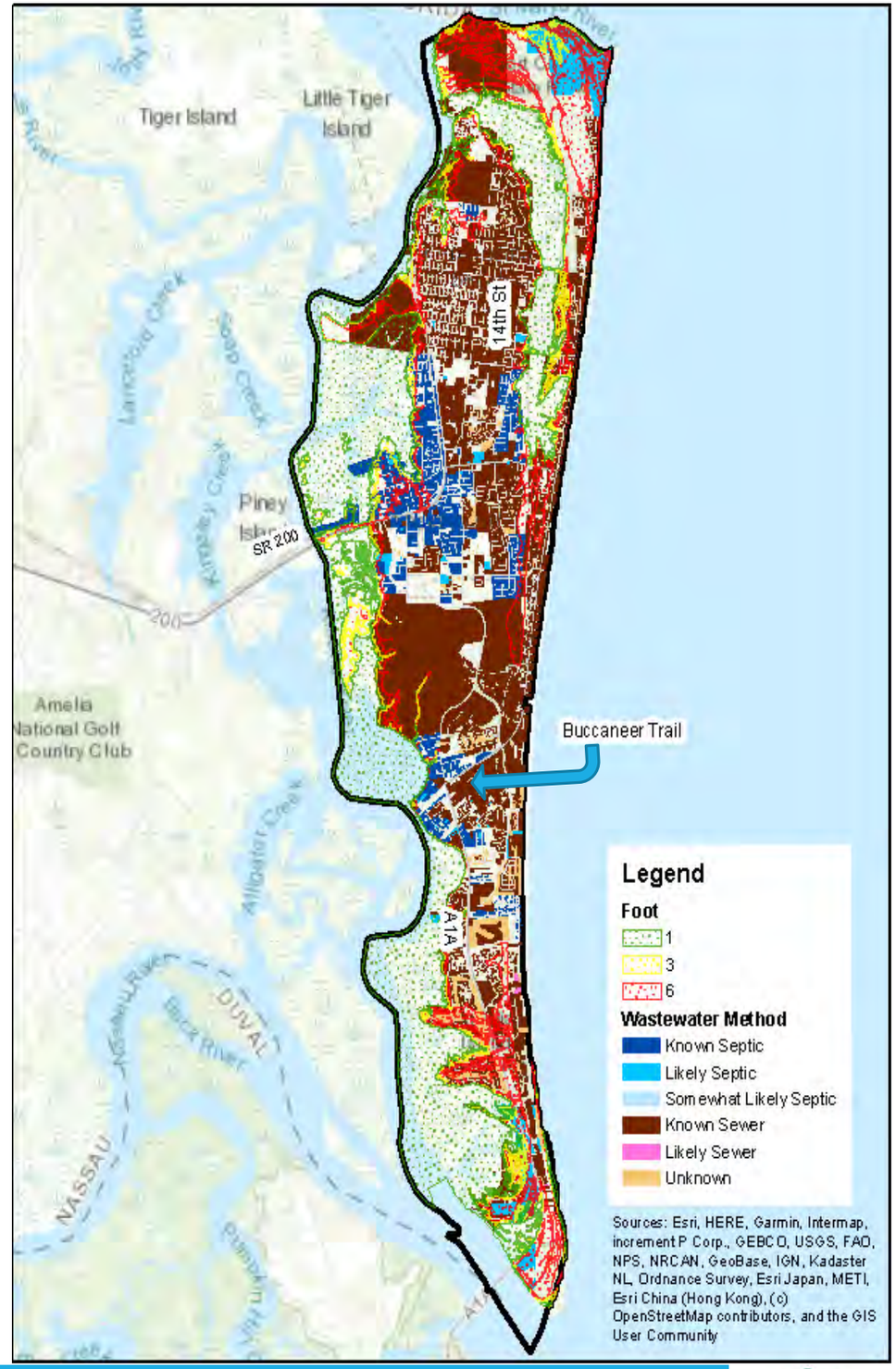
Sources: TBG Work Product; U.S. Department of Health; NOAA

Series 2 Map 3. Wastewater Treatment Method and Projected Sea Level Rise

Series 2 Map 3 overlays wastewater treatment methods with 1, 3 and 6 ft. sea level rise scenarios. In the West area sea level rise would affect parcels on septic tanks near the St. Marys River. On Amelia Island, sea level rise would impact parcels along the Intracoastal Waterway, although these rely on both septic and central sewer.

Most manufactured homes use septic systems as their wastewater treatment method, representing a health hazard under persistent elevated groundwater associated with sea level rise. Manufactured homes near Buccaneer Trail/A1A south of the Golf Club on Amelia Island and properties along the St. Marys River west of Interstate-95 would be the most exposed to sea level rise.



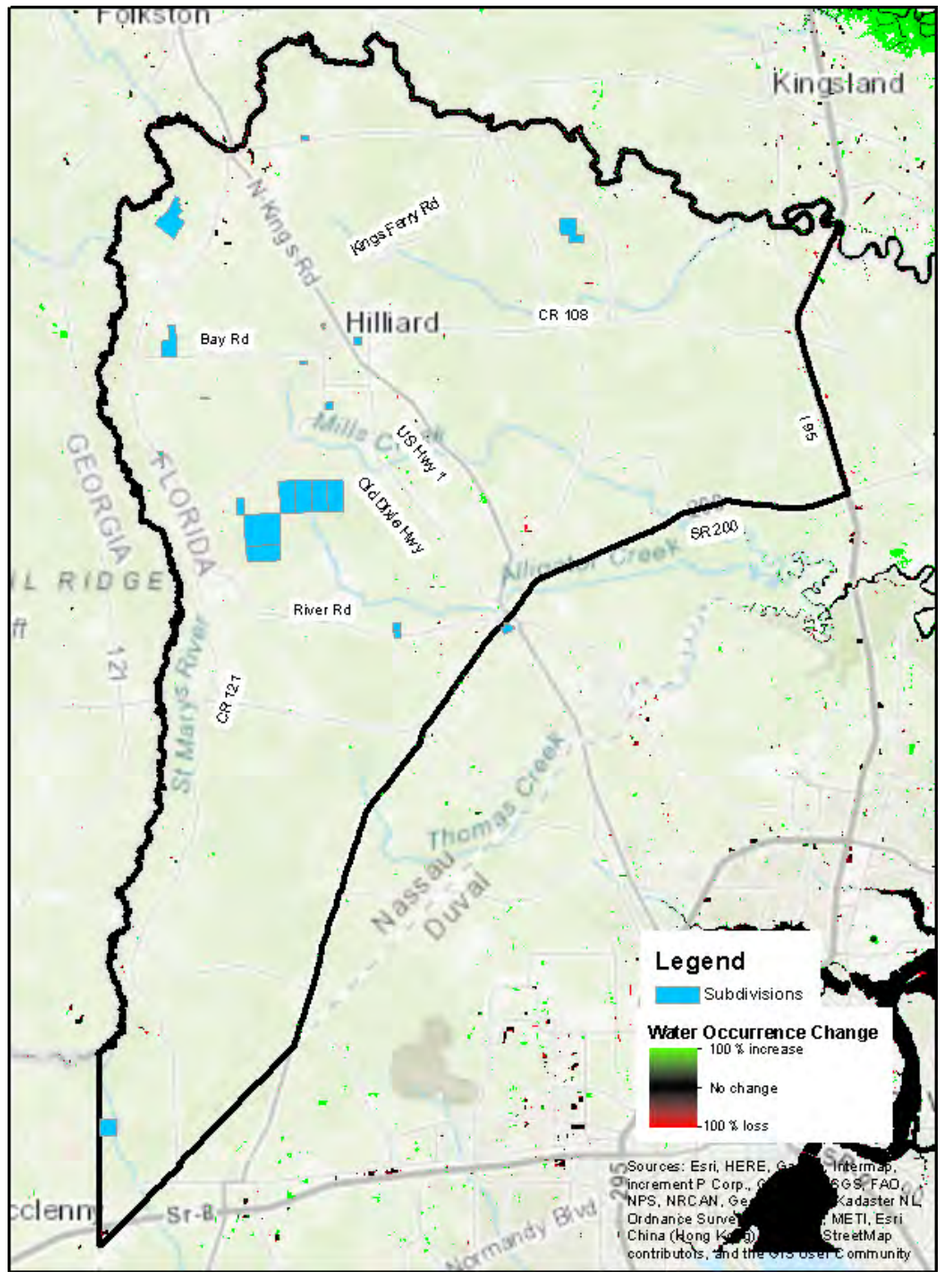


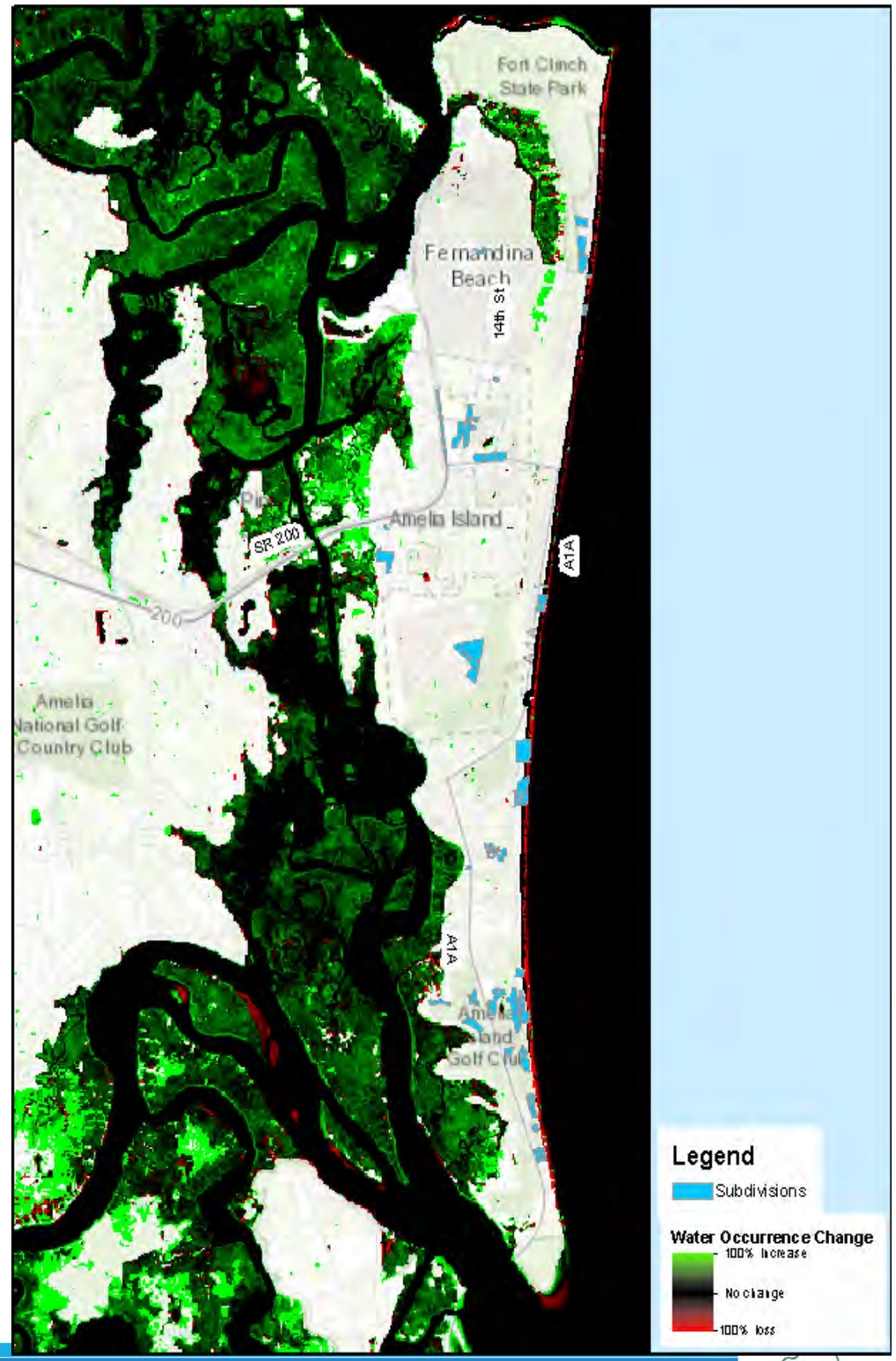
Sources: TBG Work Product; U.S. Department of Health; NOAA

Series 3 Map 1. Planned Subdivisions and Water Occurrence Change

Approved subdivisions with few to no developed residential parcels are shown in Series 3. This series assesses potential future development. In the West, there is no intersection of these undeveloped subdivisions with areas reporting increased water frequency.

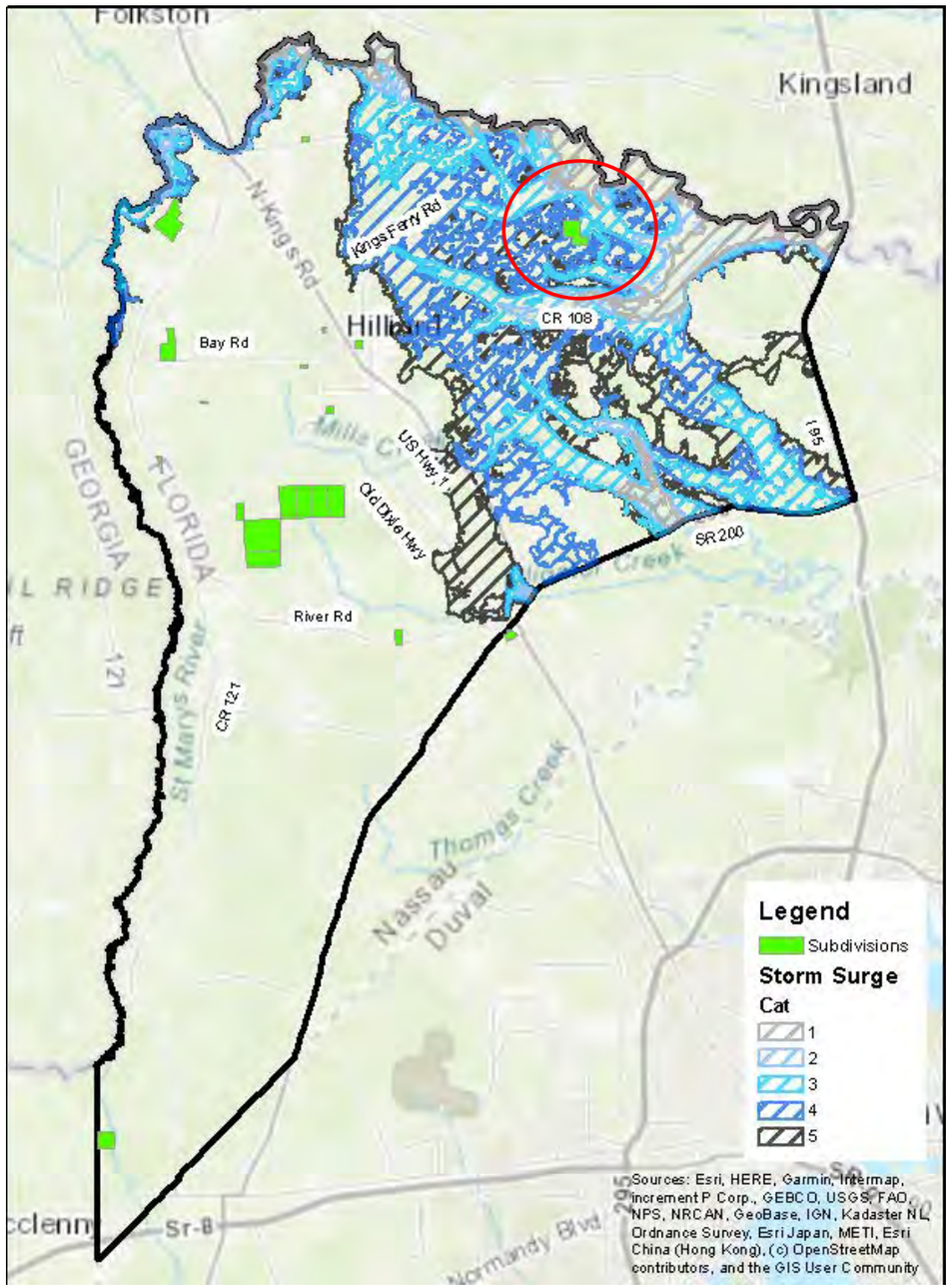
On Amelia Island there is limited overlap of undeveloped subdivisions with areas showing increased frequency of surface water.

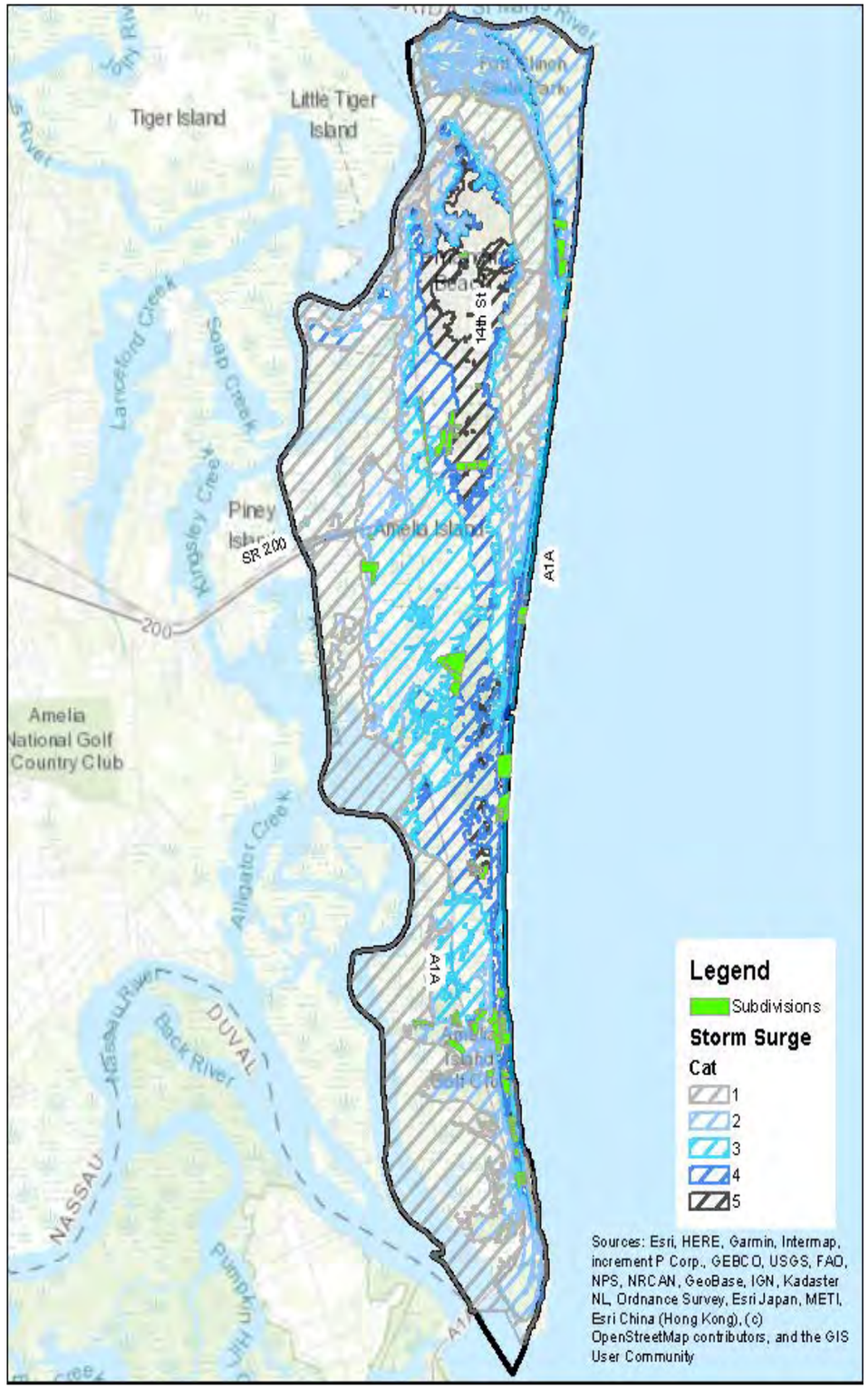




Series 3 Map 2. Planned Subdivisions and Storm Surge

In relation to storm surge and proposed development, there is significant overlap in Amelia Island as all of the undeveloped subdivisions are within areas subject to storm surge. In the West, there is one subdivision northeast of Hilliard (see red circle north of CR 108 for reference) that is at risk from storm surge.

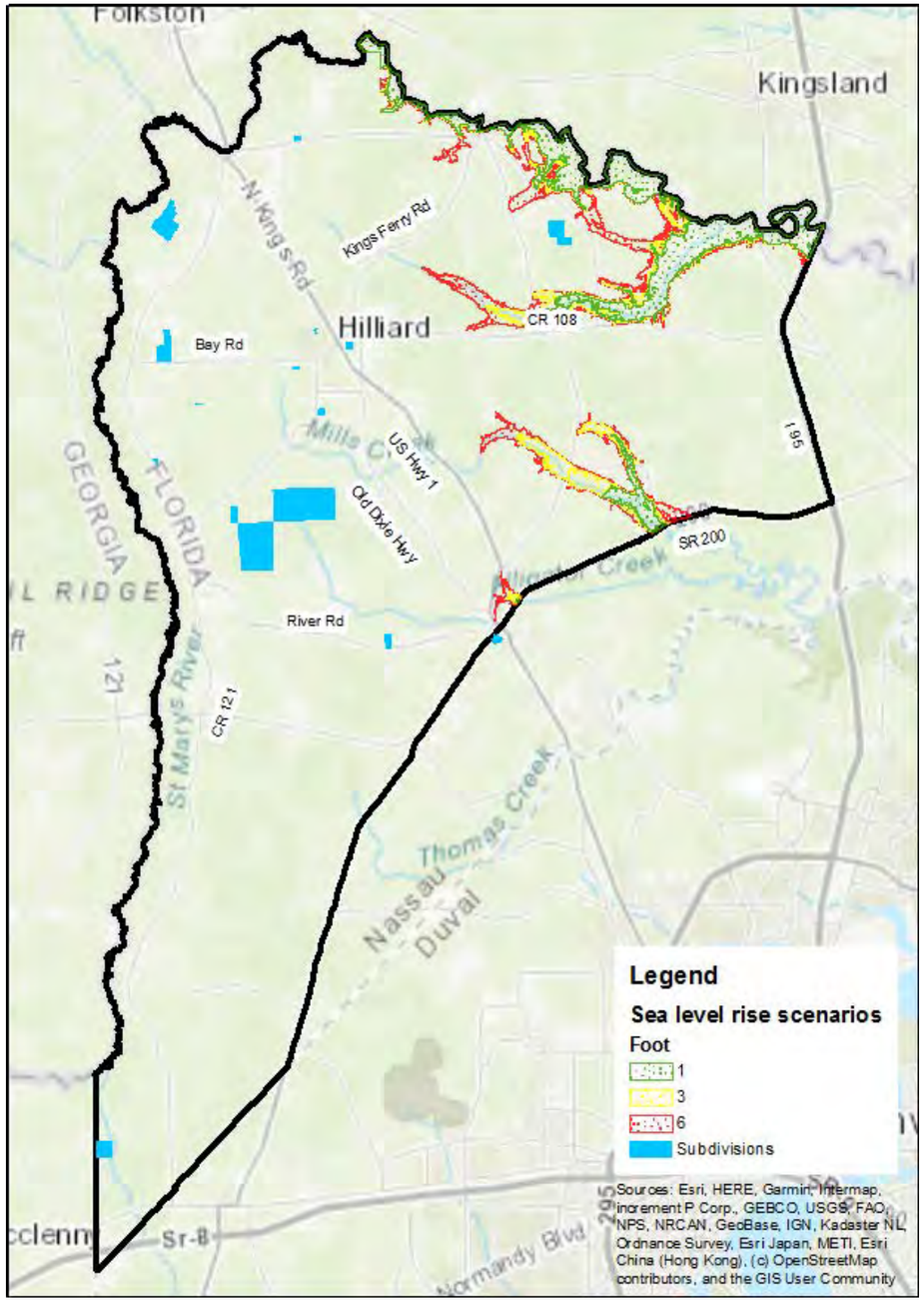


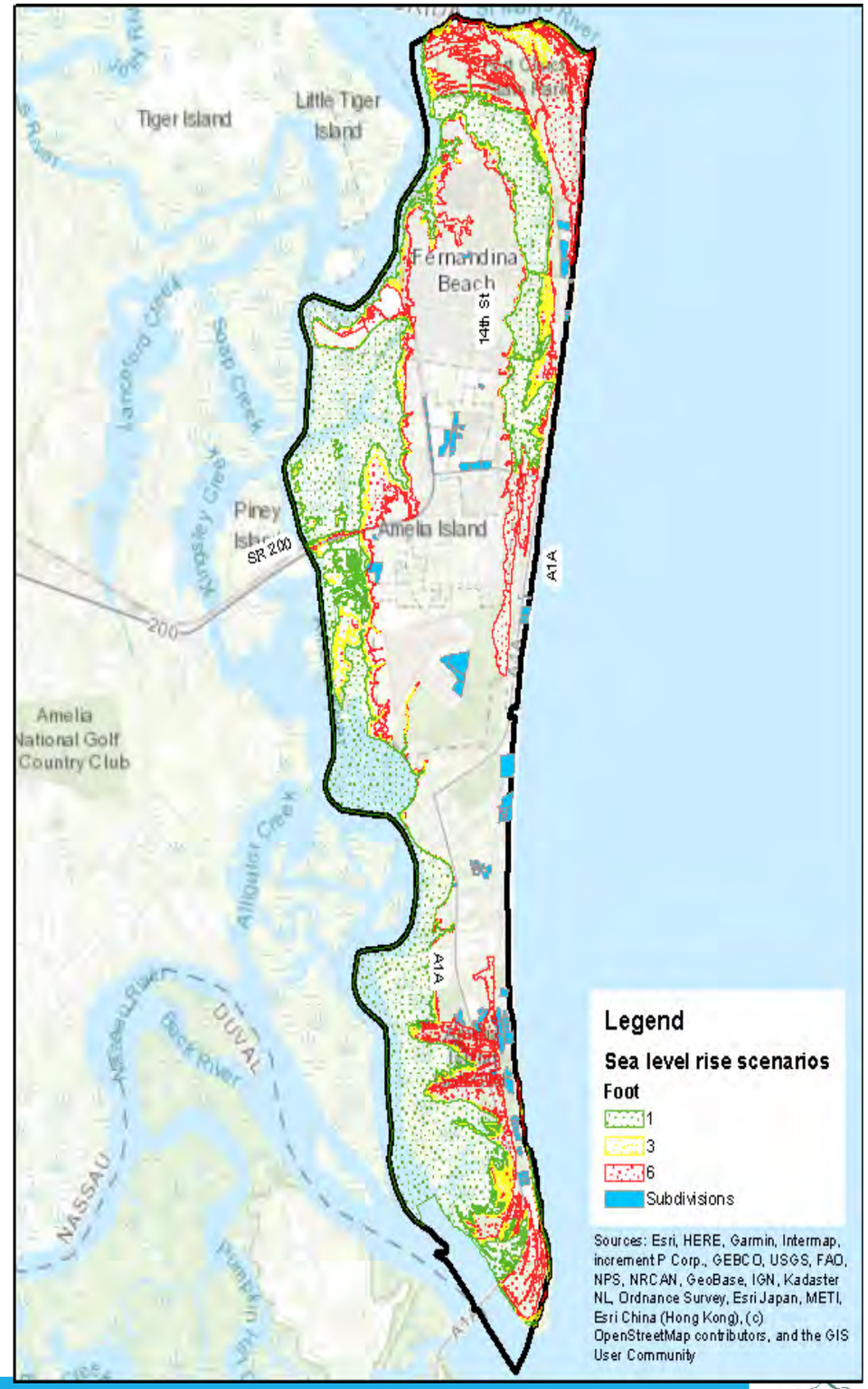


Sources: TBG Work Product; NOAA

Series 3 Map 3. Planned Subdivisions and Projected Sea Level Rise

On Amelia Island, the undeveloped subdivisions Island north of the Intracoastal Waterway and in the southern part of the Island are at risk from sea level rise. There are no such overlaps in the West area.





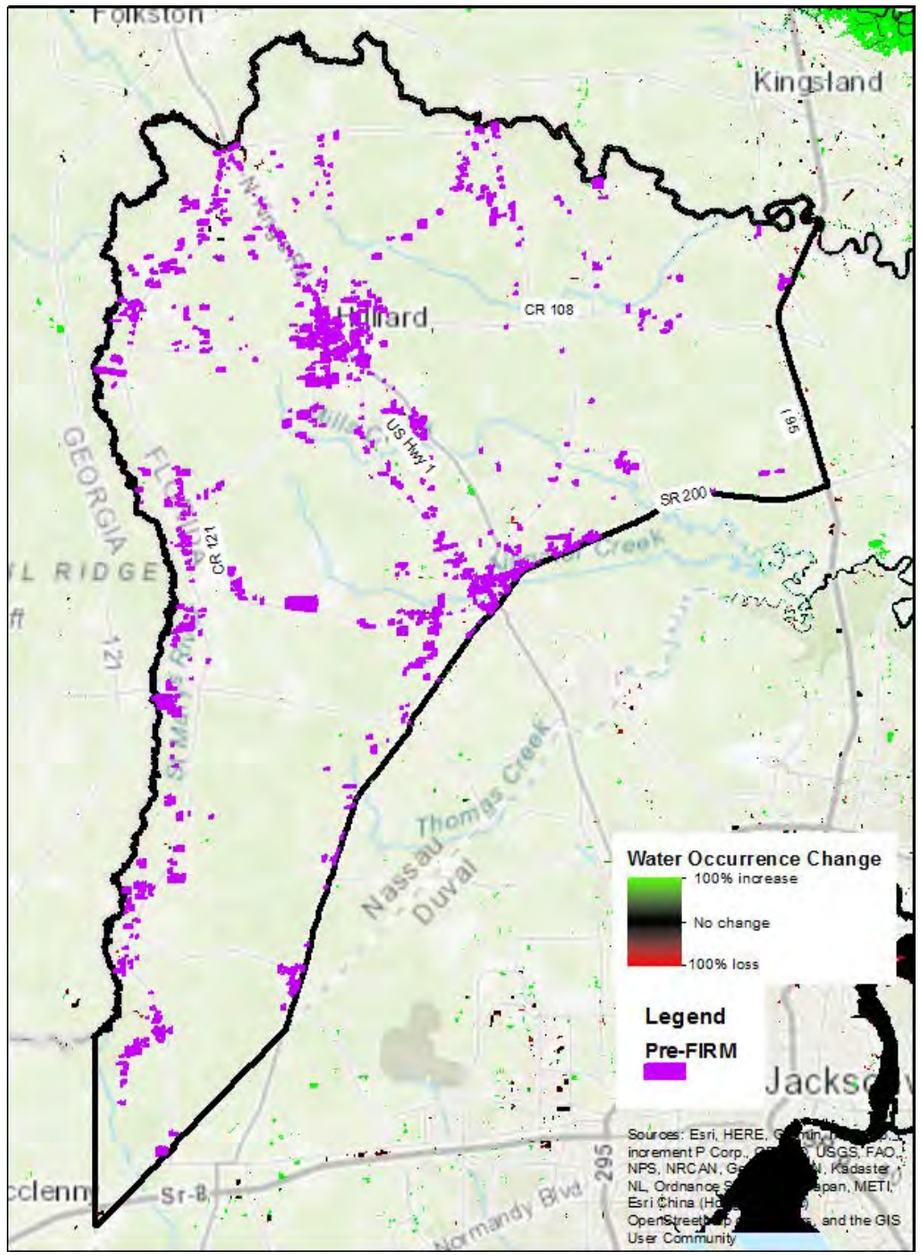
Sources: TBG Work Product; NOAA

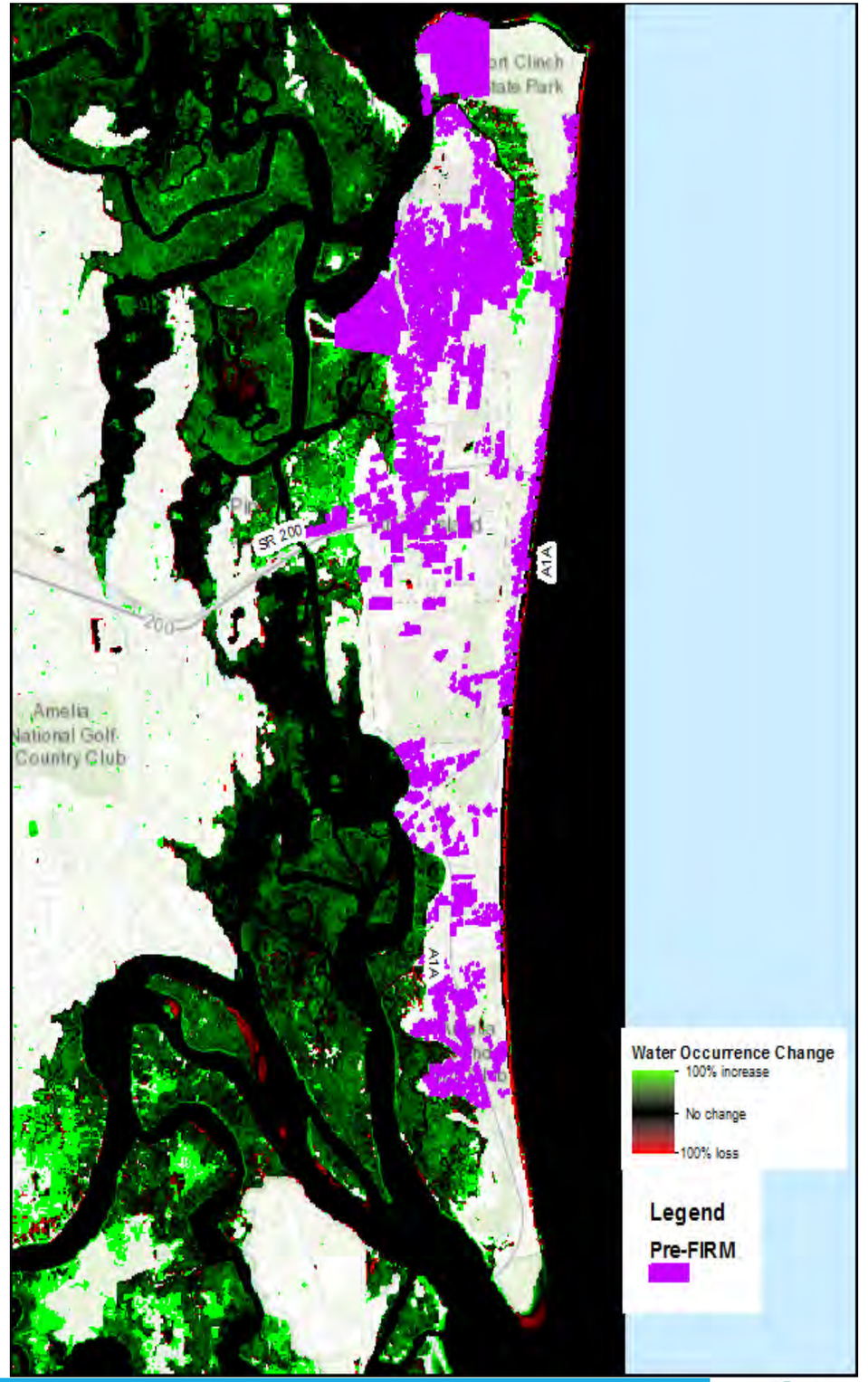
Series 4 Map 1. Pre-FIRM Buildings and Water Occurrence Change

Pre-Flood Insurance Rate Map (pre-FIRM) buildings are those built before the effective date of the first Flood Insurance Rate Map (FIRM) for a community. Pre-FIRM buildings were constructed before requirements for specific floor elevations were set, and may represent a higher risk of damage from flooding events.

In Nassau County, the first FIRM is from 1984. Series 4 Map 1 describes buildings that were built before this date relative to change in water occurrence. About 23% of the buildings in both study areas are pre-FIRM.

In the West there are no pre-FIRM buildings that would be impacted by change in water occurrence. On Amelia Island, pre-FIRM buildings more likely to be impacted by changes in water occurrence are those closer to the Intracoastal Waterway. Because of its historic development, there is a concentration of pre-FIRM buildings in the City of Fernandina Beach and its periphery.





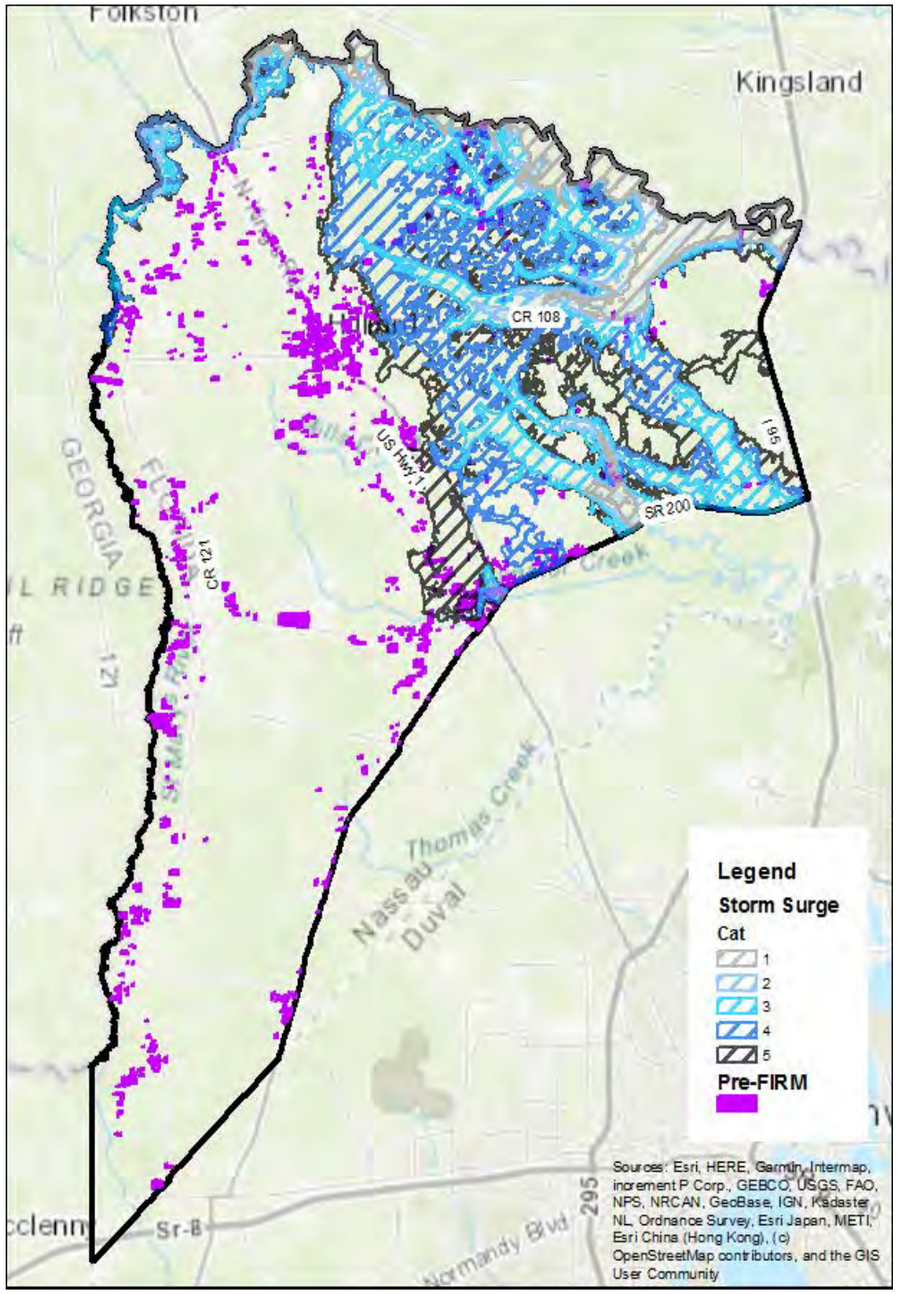
* FEMA

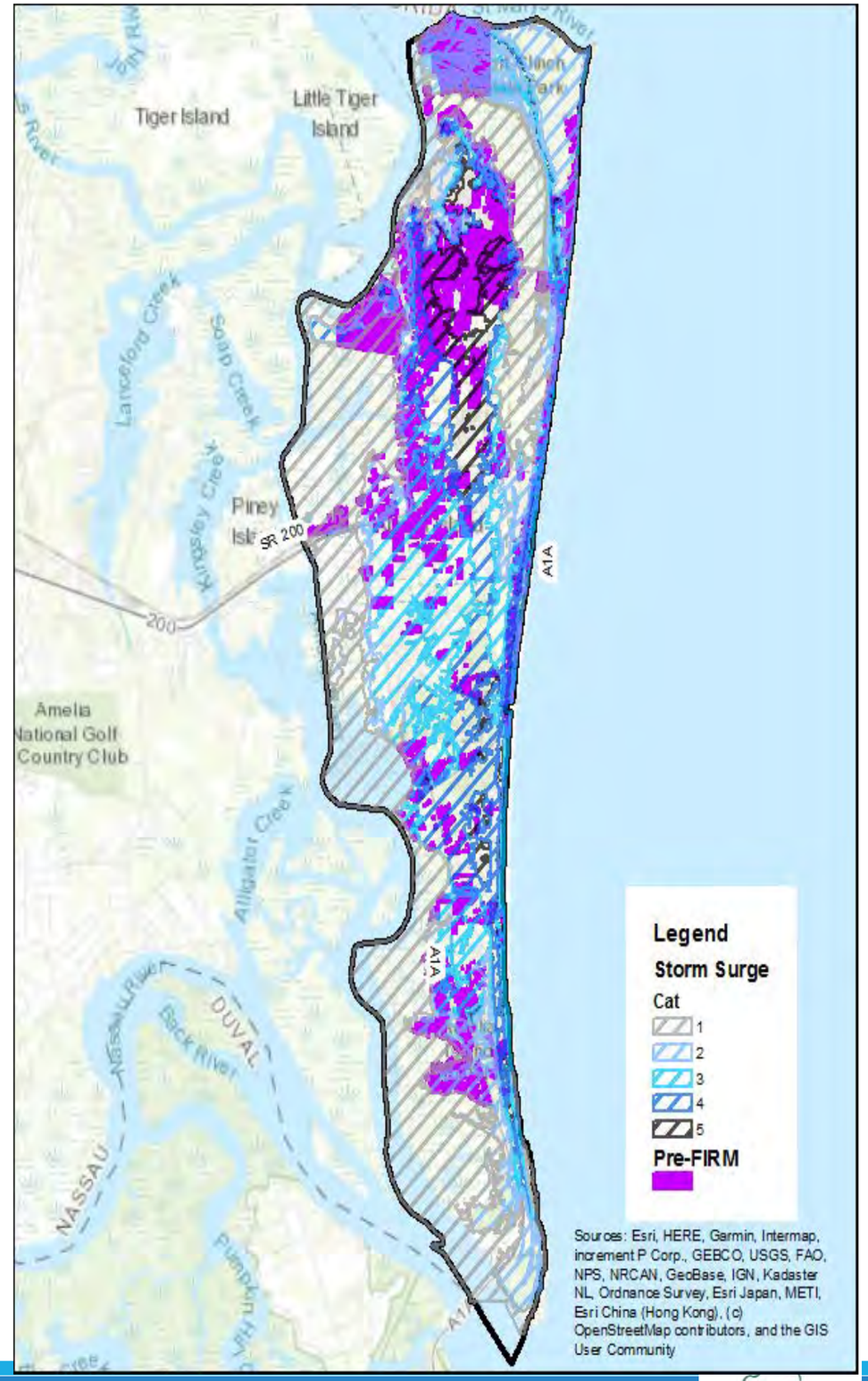
Sources: TBG Work Product; DOR; EC JRC/Google

Series 4 Map 2. Pre-FIRM and Storm Surge

Series 4, Map 2 identifies pre-FIRM buildings that are subject to storm surge. Overall, half of the pre-FIRM buildings in the two study areas are within zones subject to storm surge.

In the West, less than 1% of pre-FIRM buildings are within a Category 1 storm surge zone while 17% are within that of a Category 5 event. These properties are east of Callahan and Hilliard. Affected parcels are more evident on Amelia Island where 6% of pre-FIRM buildings are within a Category 1 storm surge zone and 93% of the buildings are within that of a Category 5 storm surge event.





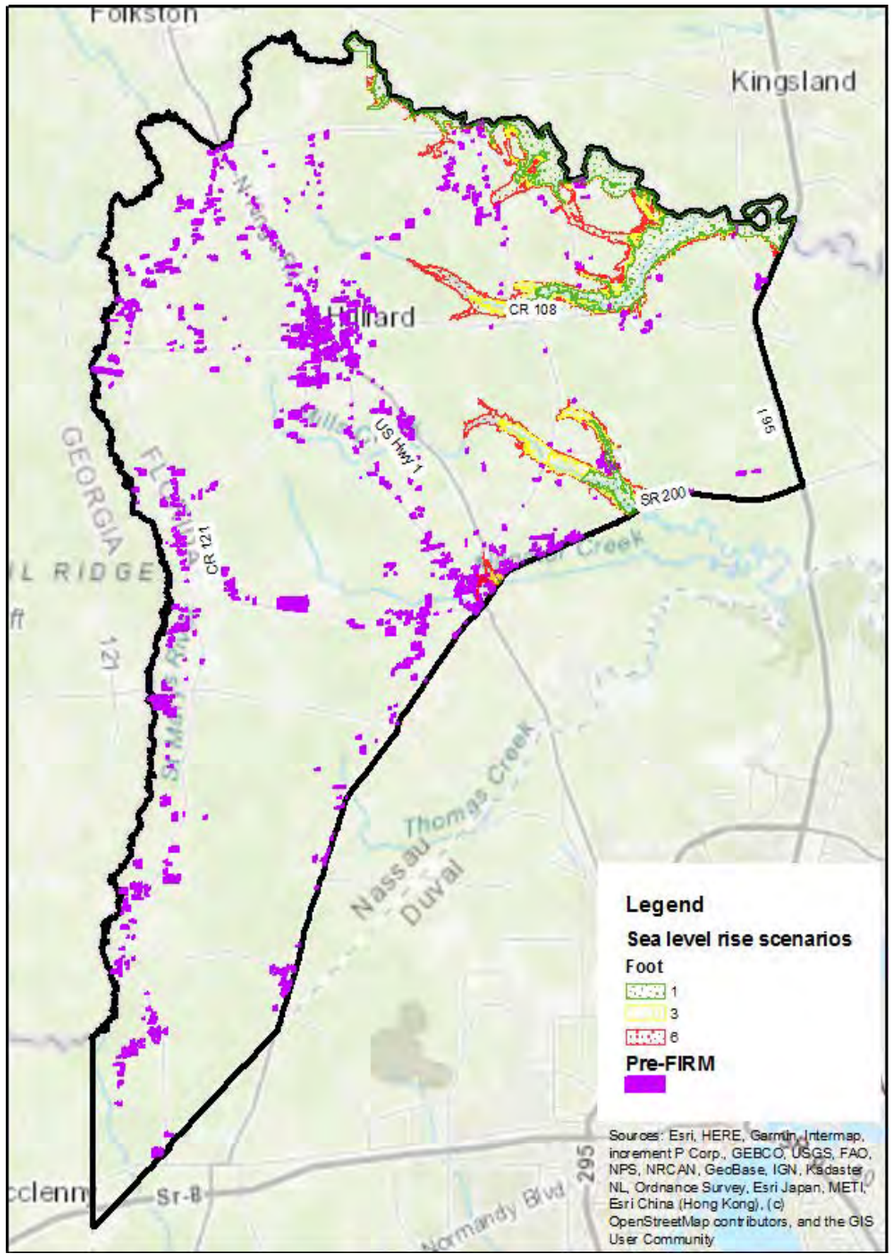
Sources: TBG Work Product; DOR; NOAA

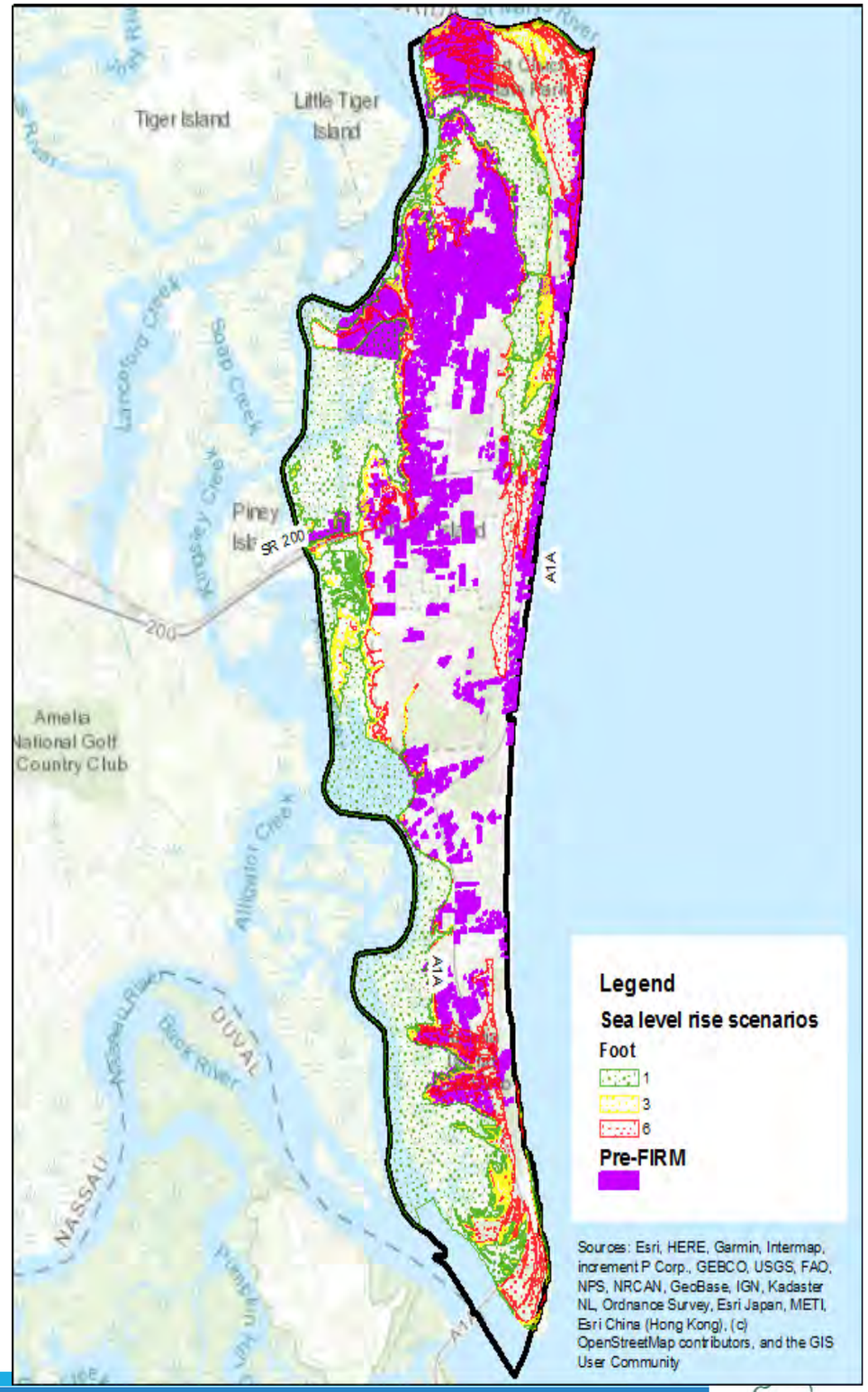
Series 4 Map 3. Pre-FIRM and Projected Sea Level Rise

Series 4 Map 3 examines the vulnerability of parcels with pre-FIRM buildings with the extent of land subject to sea level rise. In the West, less than 1% of pre-FIRM buildings are within the area inundated by a 1 ft. rise scenario and 2% are within the area associated with a 6 ft. sea level rise.

On Amelia Island almost 5% of pre-FIRM buildings are within areas subject to inundation by a 1 ft. sea level rise and 21% are within that of a 6 ft. scenario.

Aside from structures within Fort Clinch State Park, the concentration of pre-FIRM building on Amelia Island are impacted primarily by the 6' sea level rise scenario.





Sources: TBG Work Product; DOR; NOAA

2018 Florida Department of Revenue (DOR) land use codes were used to estimate the number of parcels and the total property value that would be impacted by storm surge (Table 1). There are a total of 19,788 residential parcels (DOR use codes 0 to 9) and 913 commercial parcels (DOR use codes 10 to 39) within the two study areas. Table 1 shows the number and dollar value of residential and commercial parcels that are in A or AE flood zones within the two study areas.

Table 1. Residential and Commercial Parcels Impacted by Flood Zone

West Area

	RESIDENTIAL		COMMERCIAL	
Flood Zone	Number of Residential Parcels	Total Just Value (in Millions)	Number of Commercial Parcels	Total Just Value (in Millions)
A	2085	163.43	49	9.74
AE	72	5.66	8	3.71
VE	-	-	-	-

Amelia Island

	RESIDENTIAL		COMMERCIAL	
Flood Zone	Number of Residential Parcels	Total Just Value (in Millions)	Number of Commercial Parcels	Total Just Value (in Millions)
A	-	-	-	-
AE	2420	1,029.90	97	291.05
VE	671	567.40	21	146.05

Under a Category 5 storm surge, it is estimated that there is approximately $3.7 billion and $567 million worth of residential and commercial parcels at risk, respectively (Table 2). Categories are not mutually exclusive; that is, parcels within a Category 1 storm surge are also in the higher categories.

Table 2. Residential and Commercial Parcels Impacted by Storm Surge

West Area

	RESIDENTIAL		COMMERCIAL	
Storm Surge Category	Number of Residential Parcels	Total Just Value (in Millions)	Number of Commercial Parcels	Total Just Value (in Millions)
1	91	8.24	-	0.00
2	142	12.67	4	0.70
3	388	35.98	8	1.62
4	727	66.73	21	5.33
5	1305	113.78	43	10.81

Amelia Island

	RESIDENTIAL		COMMERCIAL	
Storm Surge Category	Number of Residential Parcels	Total Just Value (in Millions)	Number of Commercial Parcels	Total Just Value (in Millions)
1	826	438.98	21	37.53
2	2979	1,243.66	130	183.64
3	6719	2,368.12	293	392.74
4	9584	3,223.79	508	511.30
5	11330	3,595.52	623	556.23

Using a similar, cumulative, approach as conducted for storm surge, the numbers of residential and commercial parcels impacted by the different sea level rise scenarios are described in Table 2. Parcels impacted under a 1 ft. scenario are also in the 3 ft. and 6 ft. scenarios. Under a 6 ft. sea level rise scenario, there would be approximately $1.1 billion and $174 million worth of residential and commercial parcels at risk, respectively.

Table 3. Residential and Commercial Parcels Impacted by Sea Level Rise

West Area

	RESIDENTIAL		COMMERCIAL	
SLR Scenario (Ft)	Number of Residential Parcels	Total Just Value (in Millions)	Number of Commercial Parcels	Total Just Value (in Millions)
1	87	7.32	-	-
3	117	12.91	-	-
6	165	17.02	4	0.92

Amelia Island

	RESIDENTIAL		COMMERCIAL	
SLR Scenario (Ft)	Number of Residential Parcels	Total Just Value (in Millions)	Number of Commercial Parcels	Total Just Value (in Millions)
1	584	352.95	17	31.98
3	966	489.25	24	50.14
6	2700	1,102.07	101	173.16

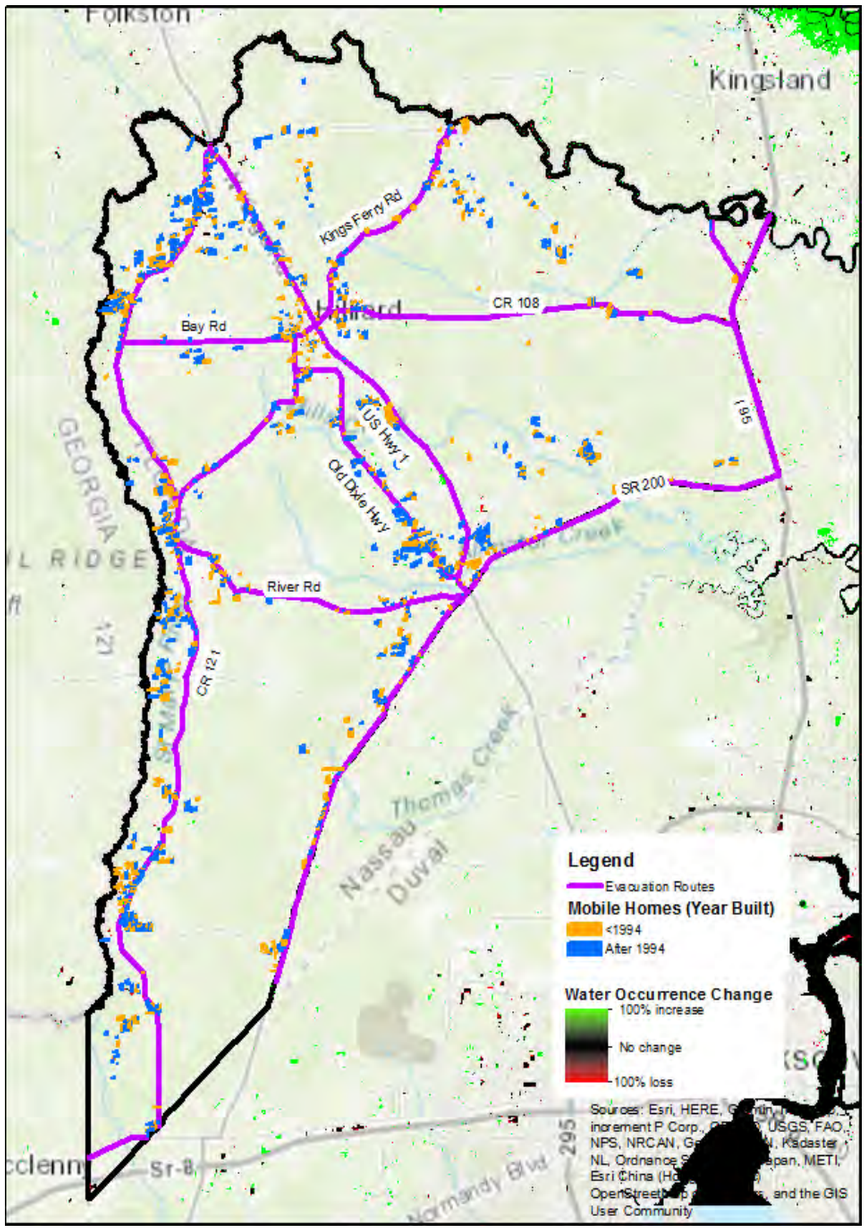
Series 5 Map 1. Manufactured Homes by Year Built and Water Occurrence Change

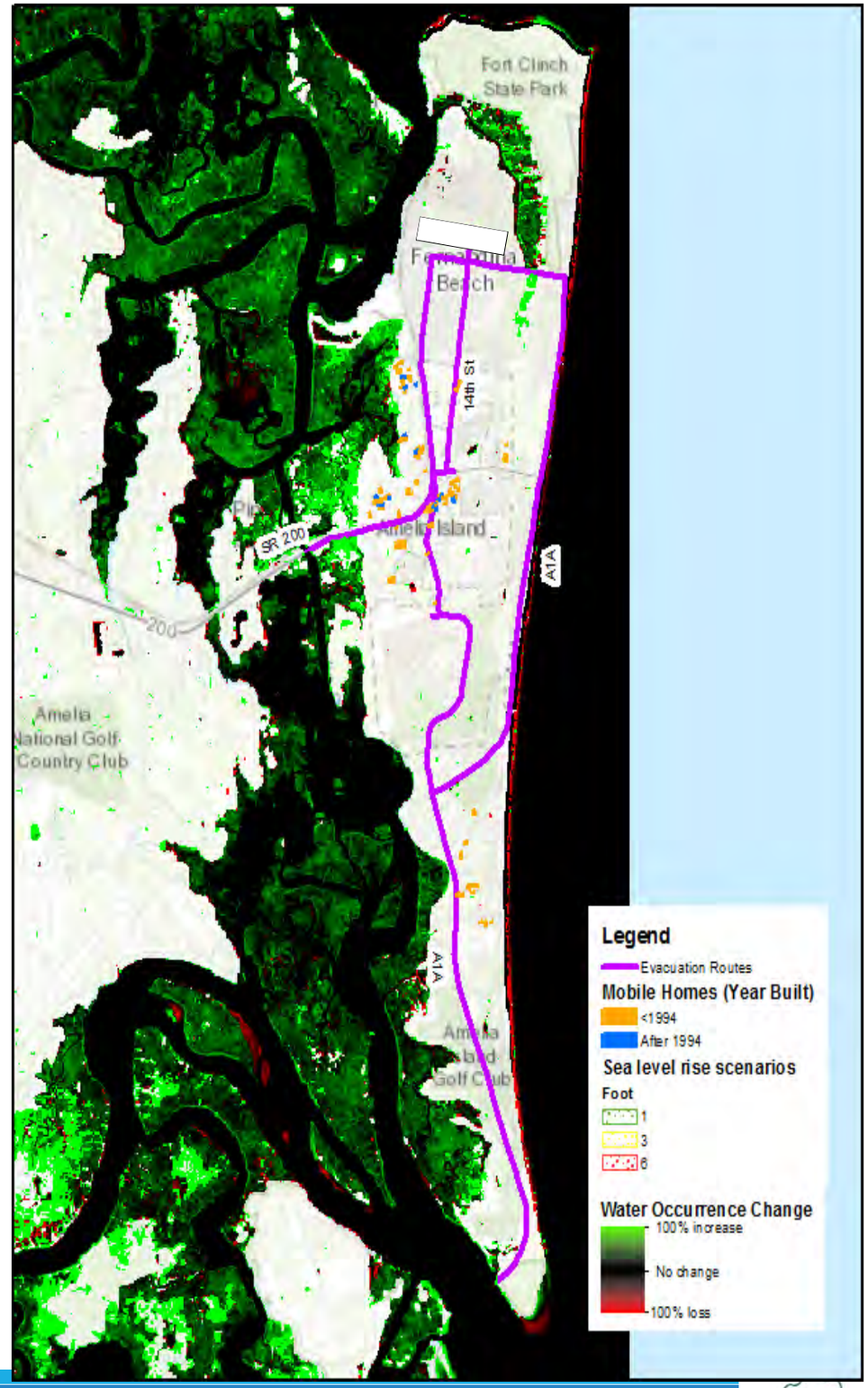
Given the high number of manufactured/mobile homes in Nassau County, locations of manufactured homes were mapped against the flooding scenarios.

Using the wind safety standards imposed on manufactured homes by the U.S. Department of Housing in 1994 and parcel data from the Florida Department of Revenue, mobile homes were classified into two groups - those built before 1994 and those built after 1994 - to evaluate the relative exposure of the two types of manufactured homes.

Overall, approximately 47% of the mobile homes within the study areas were built before 1994.

While no impacts are apparent in the West, risk to increasing water occurrence or episodic flooding on Amelia Island is likely near the Intracoastal waterway by SR 200.





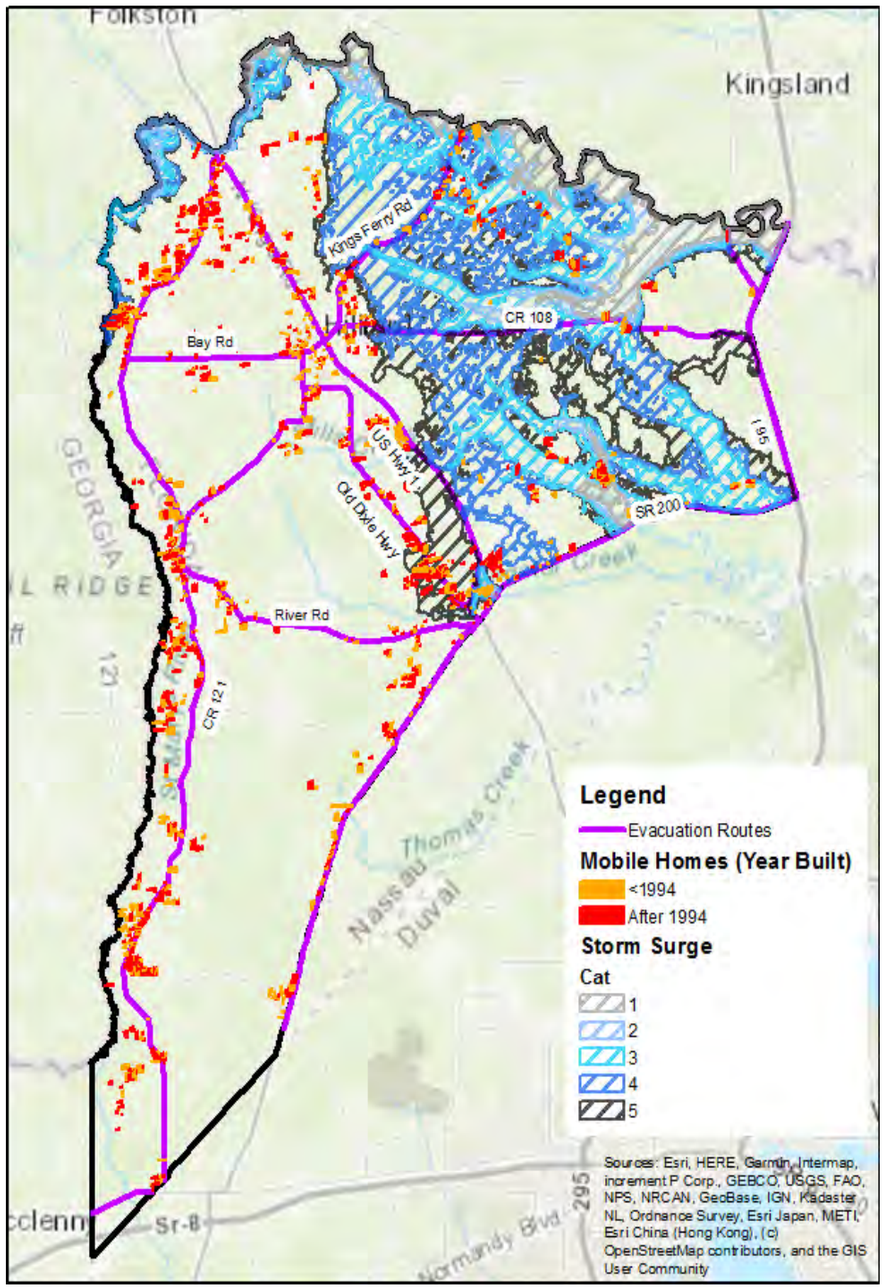
Sources: TBG Work Product; DOR; EC JRC/Google

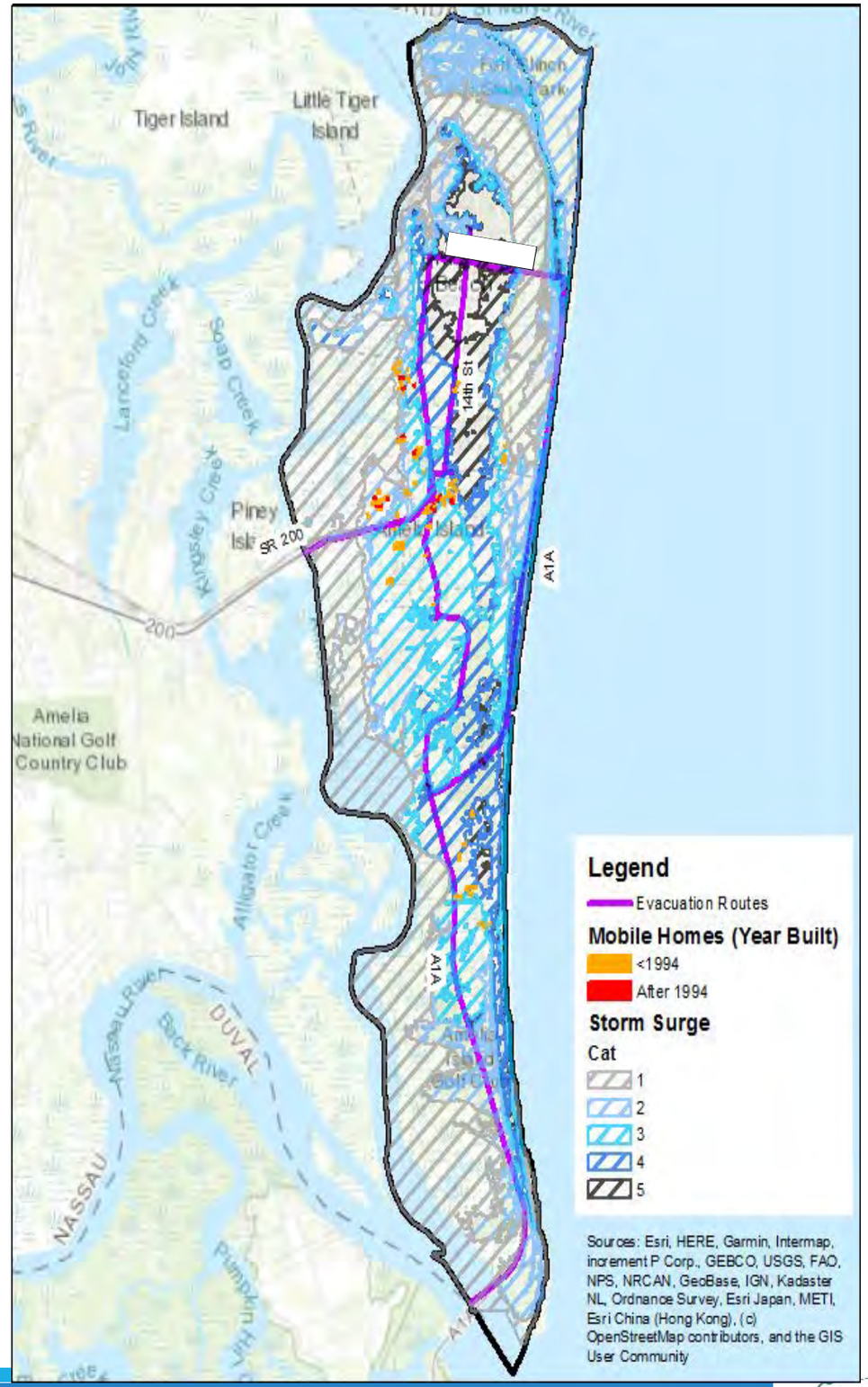
Series 5 Map 2. Manufactured Homes by Year Built and Storm Surge

To assess the vulnerability of manufactured homes to event-driven flooding the locations of the two categories of manufactured homes were mapped against storm surge (Series 5 Map 2).

Across both study areas, half of all manufactured homes built before 1994 are within any storm surge category.

In the West less than 1% of the manufactured homes are within a Category I storm surge while 18% are within a Category 5. This share is higher in Amelia Island, as 4 % are exposed to a Category I storm surge and all, without taking into account the year built, are within a Category 5 storm extent.





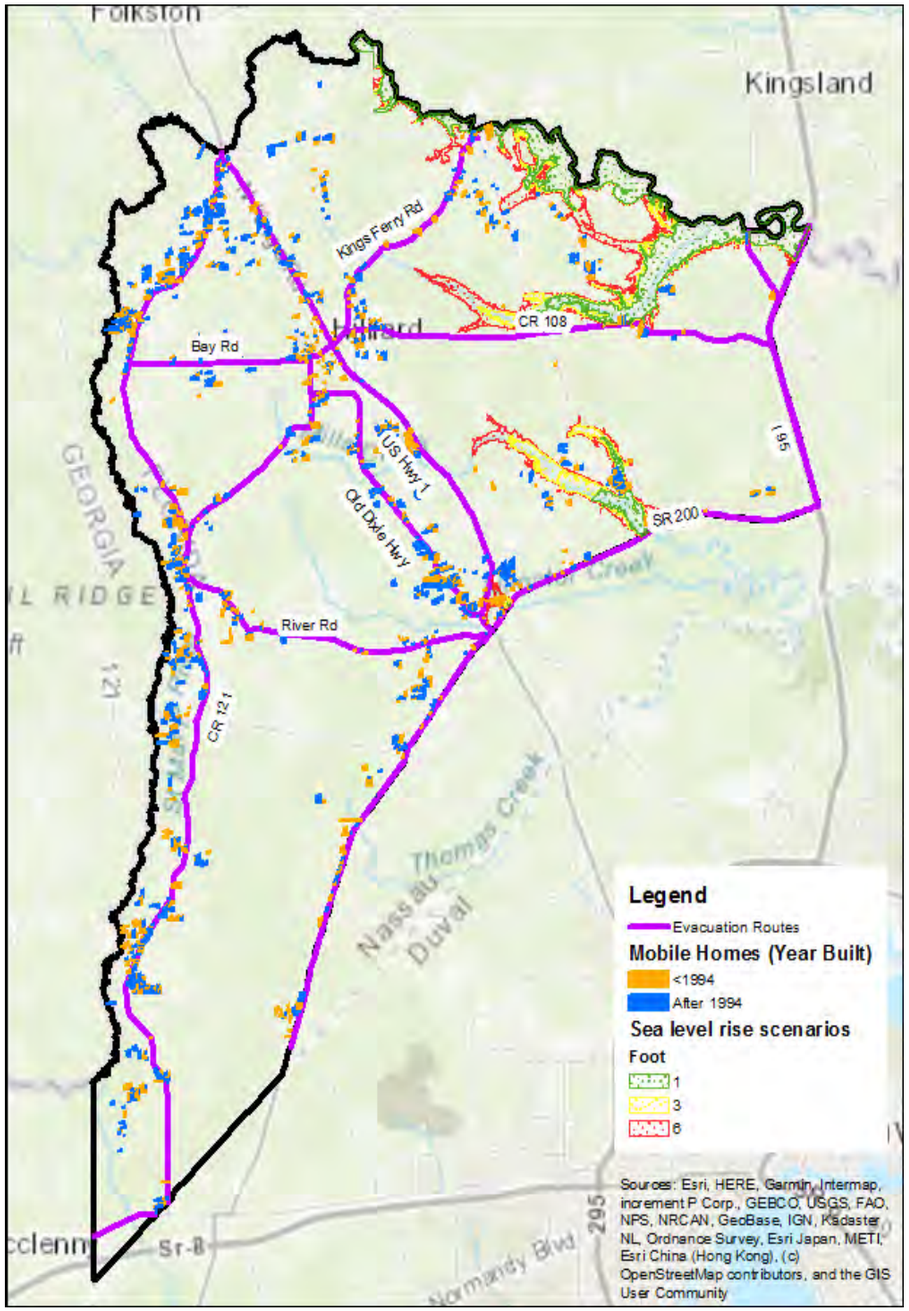
Sources: TBG Work Product; DOR; NOAA

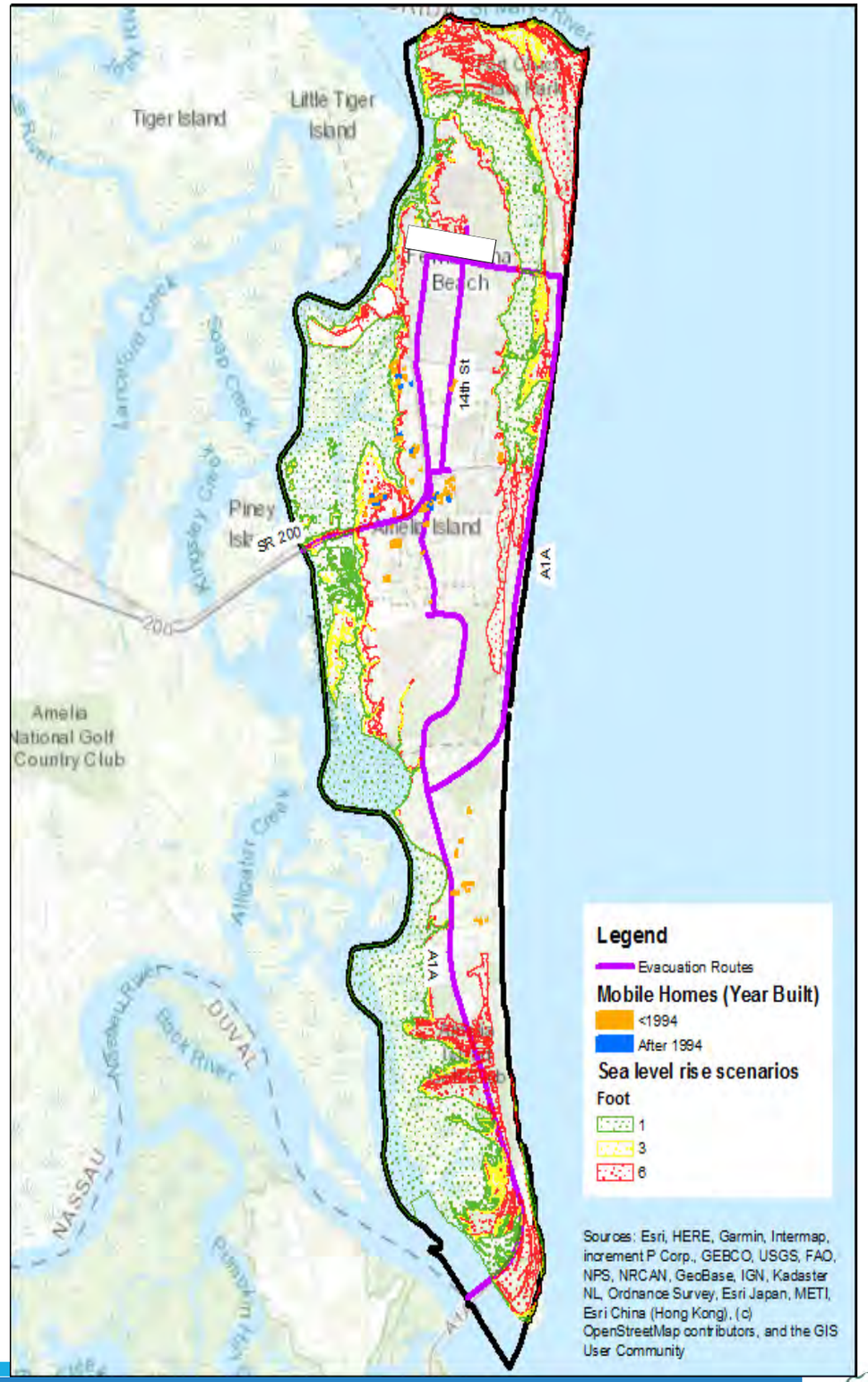
Series 5 Map 3. Manufactured Homes by Year Built and Projected Sea Level Rise

Manufactured homes were also mapped against sea level rise to determine whether there are flooding risks to communities living in manufactured homes.

Overall, only 3% of all manufactures homes, are within the area projected to be impacted by sea level rise.

In the West 1.5% of the manufactured homes are subject to a 1 ft. rise scenario while 2% are within a 6 ft. scenario. On Amelia Island 2% are within the are subject to the 1 ft. scenario and 22% are within the 6 ft. scenario.





Sources: TBG Work Product; DOR; NOAA

Demographic and Socioeconomic Information to Identify Vulnerable Populations

Census data (ACS 2012-2016) were used to assemble maps of population data by racial composition, age cohort, income, share of population with a disability, and employment. Census Block Group data were used for these populations, except for disability, which is available only at the Census Tract level.

As defined by the U.S. Census Bureau, Census Tracts are subdivisions of a county that generally have a population between 1,200 and 8,000 people. Block Groups are geographic and statistical subdivisions of Census Tracts.

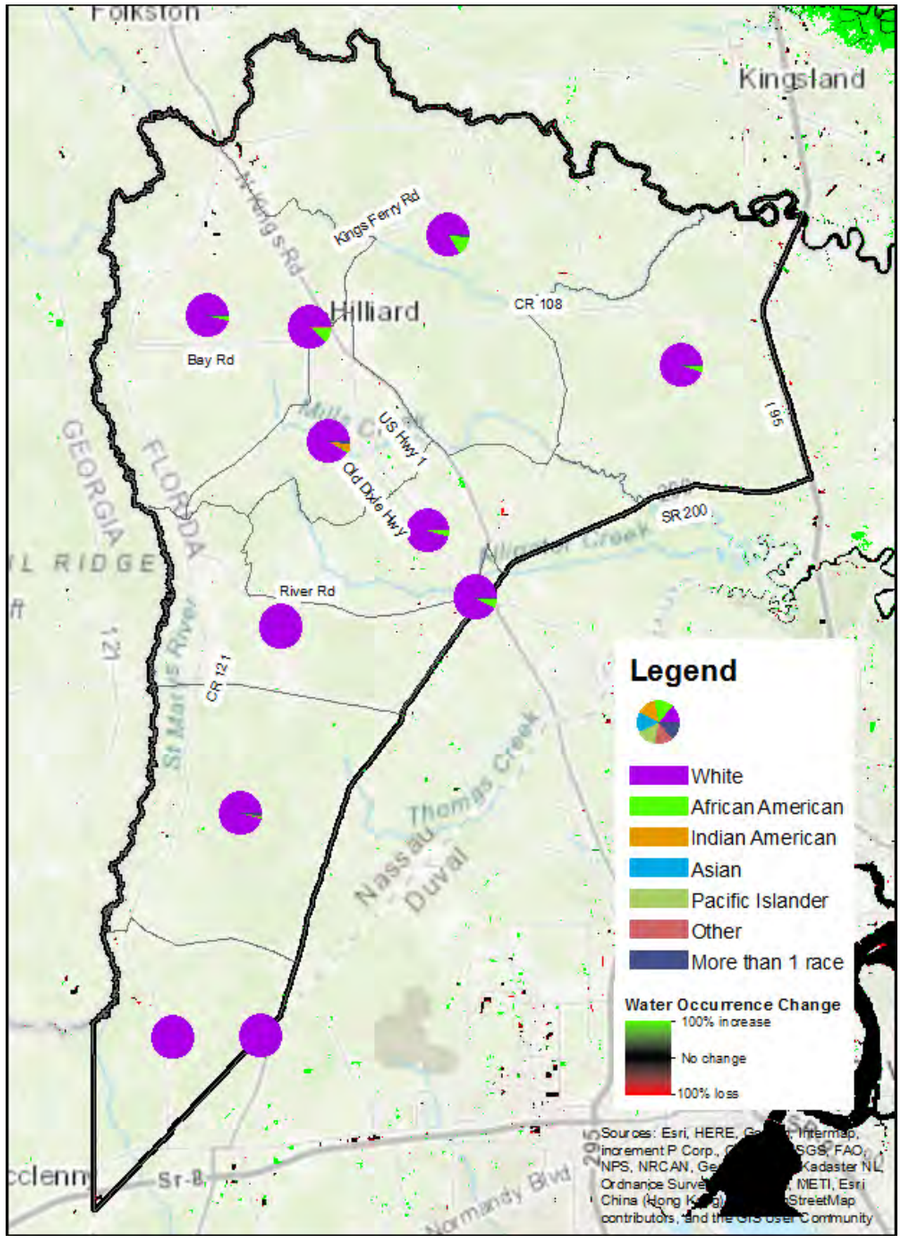
Employment data were collected from the U.S. Census Bureau OnTheMap application[1], which uses longitudinal employer-household data that include the residence of workers and where the workplace is. The most recent available data are for 2015 and were collected for workplace location, regardless of where the workers live, at the Block Group level.

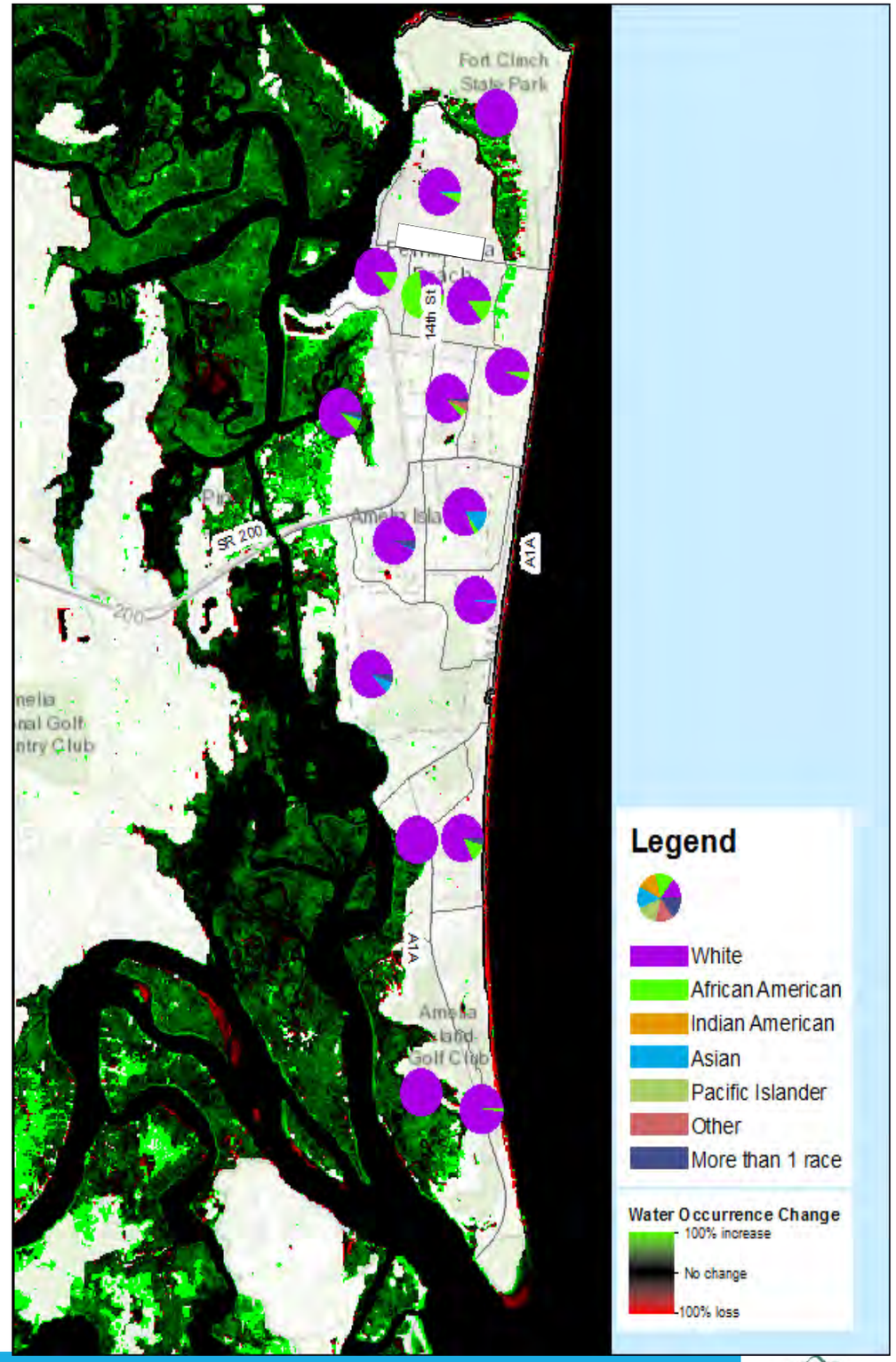
1. U.S. Census Bureau OnTheMap application. U.S. Census Bureau. (2017). LEHD Origin-Destination Employment Statistics (2002-2015). Washington, DC: U.S. Census Bureau, Longitudinal Employer-Household Dynamics Program, accessed on October 21, 2019 at https://onthemap.ces.census.gov. LODES 7.3

Series 6 Map 1. Racial Composition and Water Occurrence Change

Regarding racial composition, pie charts were created to show the shares of population of a given race within a block group and these were mapped against water occurrence (Series 6 Map 1).

The data shows that the western part of Nassau County has a high share of white population (purple in the pie charts). The concentration of African Americans (green) and Asian groups (blue) increase at the north of Amelia Island. In these areas of Amelia Island , two block groups in the north subject to increased water occurrence.



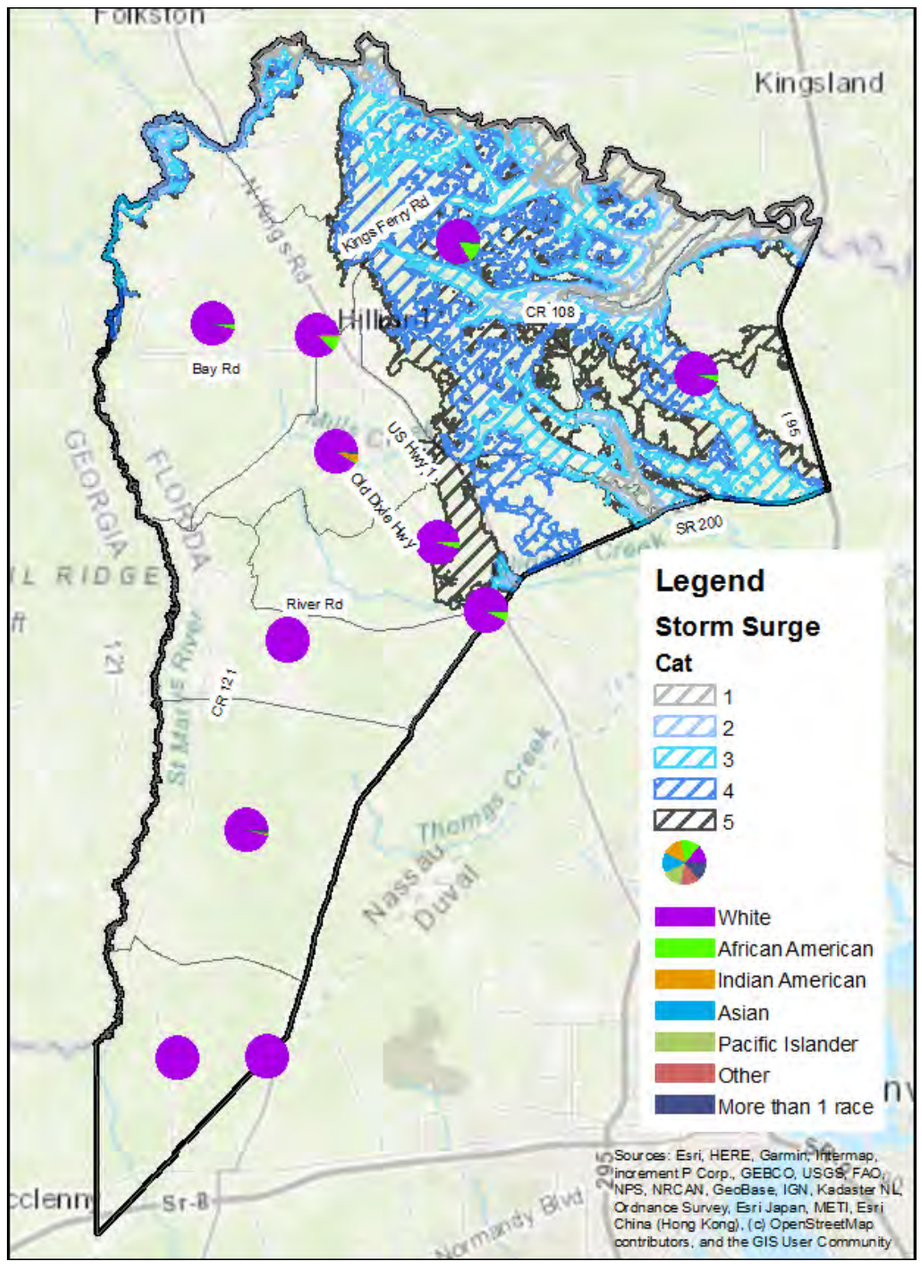


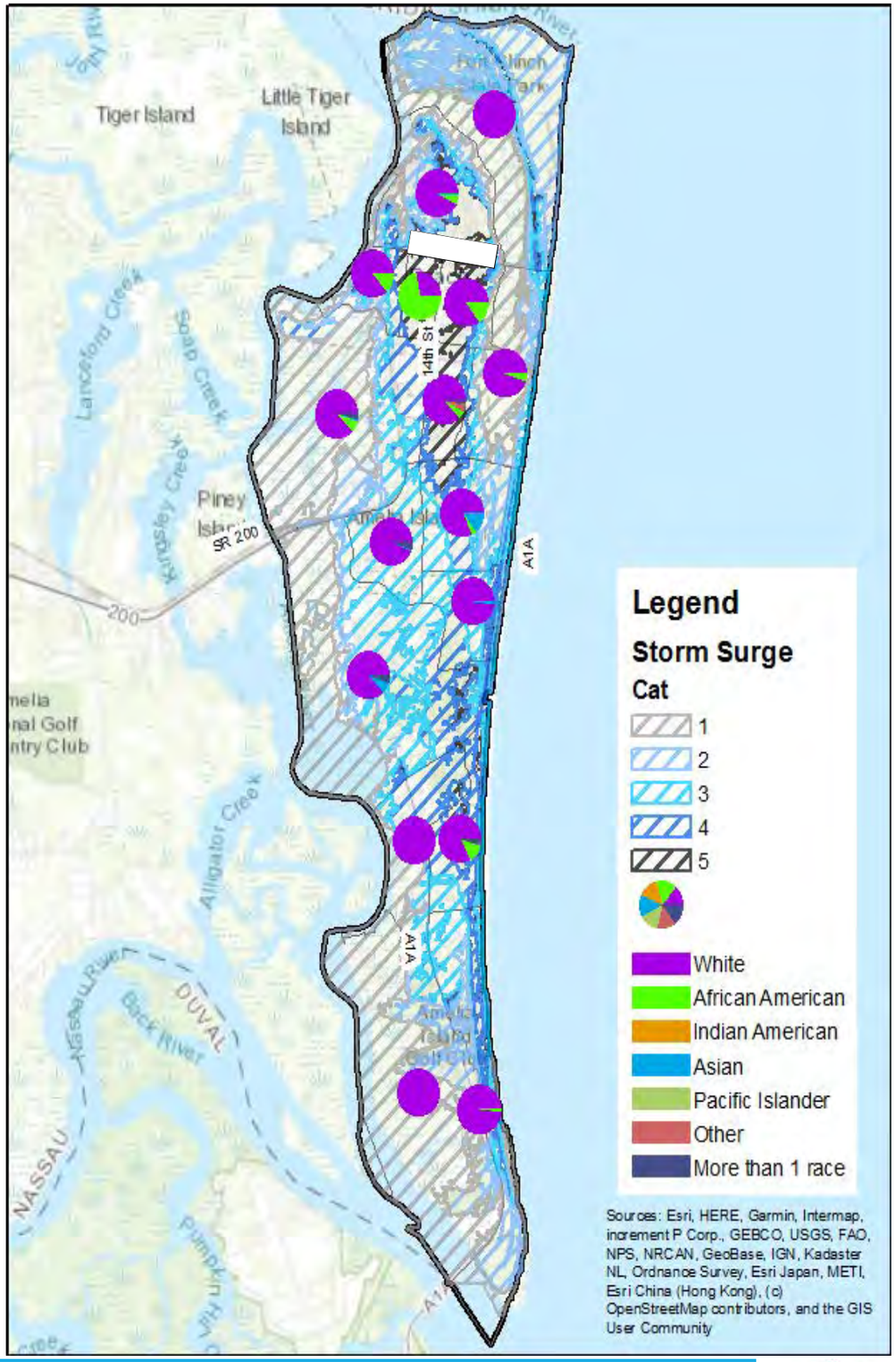
Series 6 Map 2. Racial Composition and Storm Surge

To assess which populations are vulnerable to event-driven flooding Series 6 Map 2 illustrates race and storm surge.

In the West study area, block groups north of SR 200 and east of Hilliard (where white population comprises at least 85% of the total population) are vulnerable to storm surge associated with Category 1-3 events

On Amelia Island the highest concentration of African Americans is in the block group near 14th St and Atlantic Ave. The elevation makes this community vulnerable to a Category 5 storm surge (but not to lower intensity events). The block groups closest to the coastline are more white and these are vulnerable to even the weakest and most likely storm surge events.

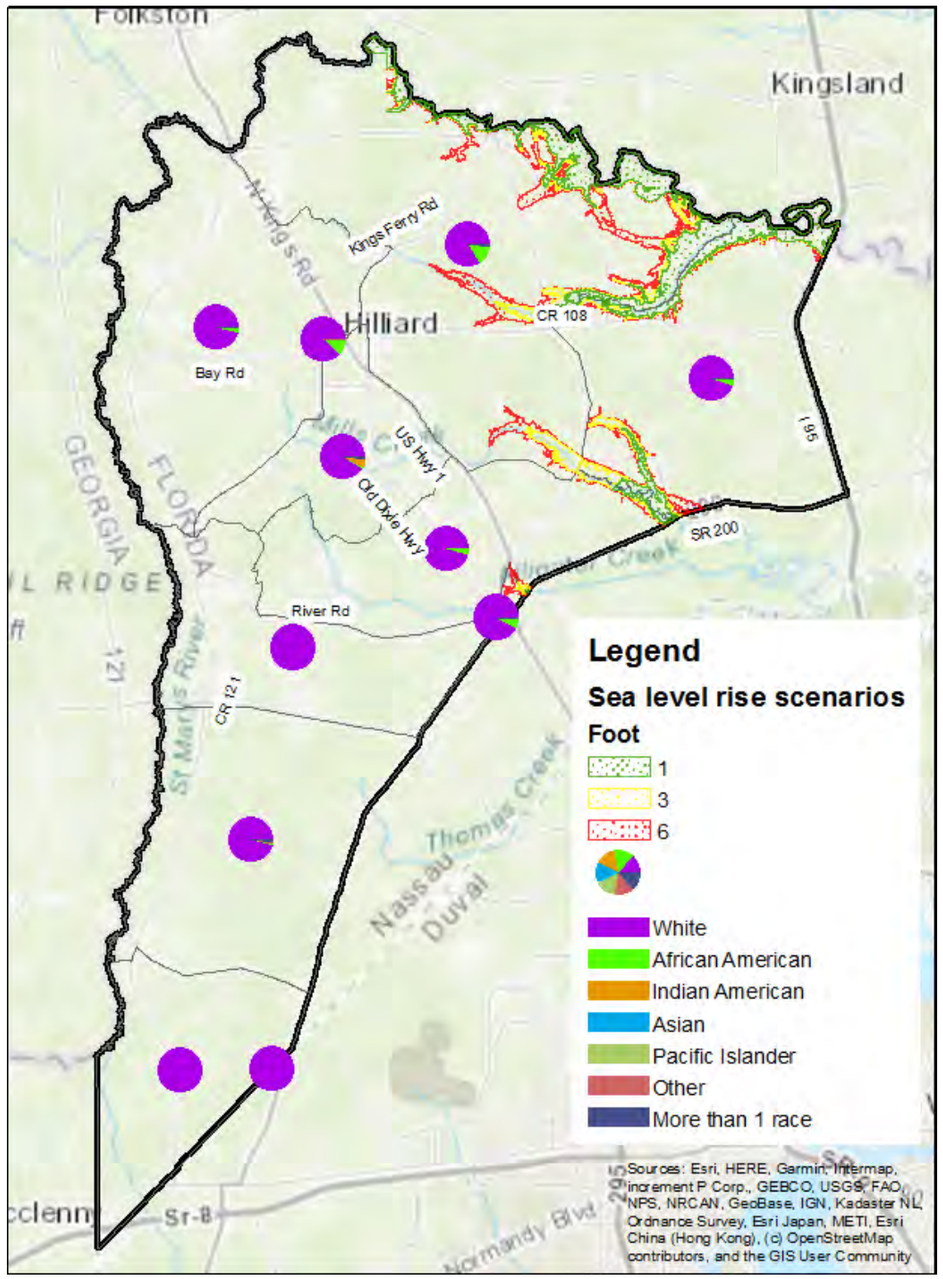


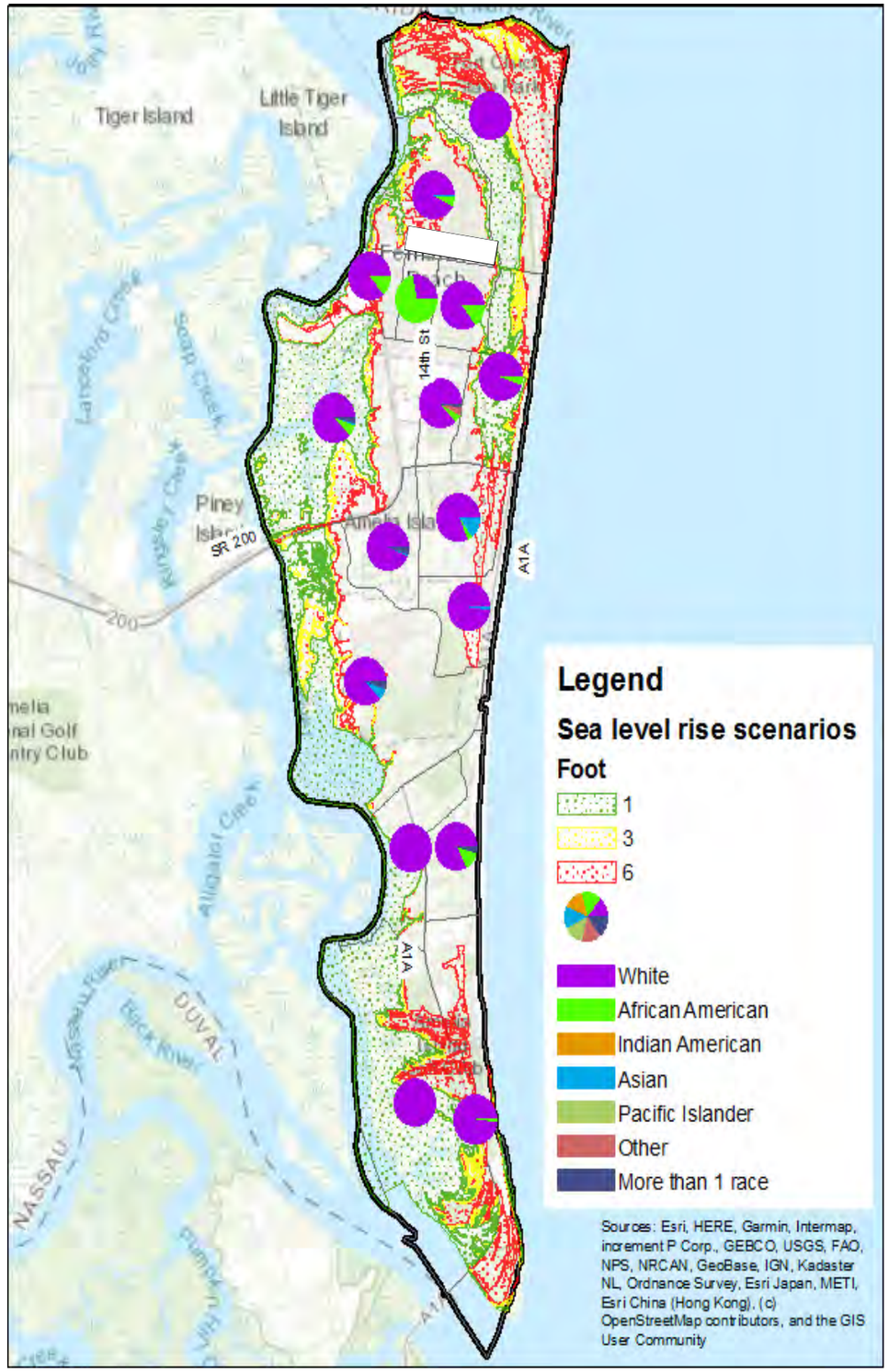


Sources: TBG Work Product; U.S. Census; NOAA

Series 6 Map 3. Racial Composition and Projected Sea Level Rise

Series 6 Map 3 describes the relationship between race and areas subject to sea level rise. In the West, census block groups near the St. Marys River would see some sea level rise impacts. On Amelia Island, block groups by the Intracoastal Waterway are more vulnerable to sea level rise. More than 85% of the population in these block groups are white.

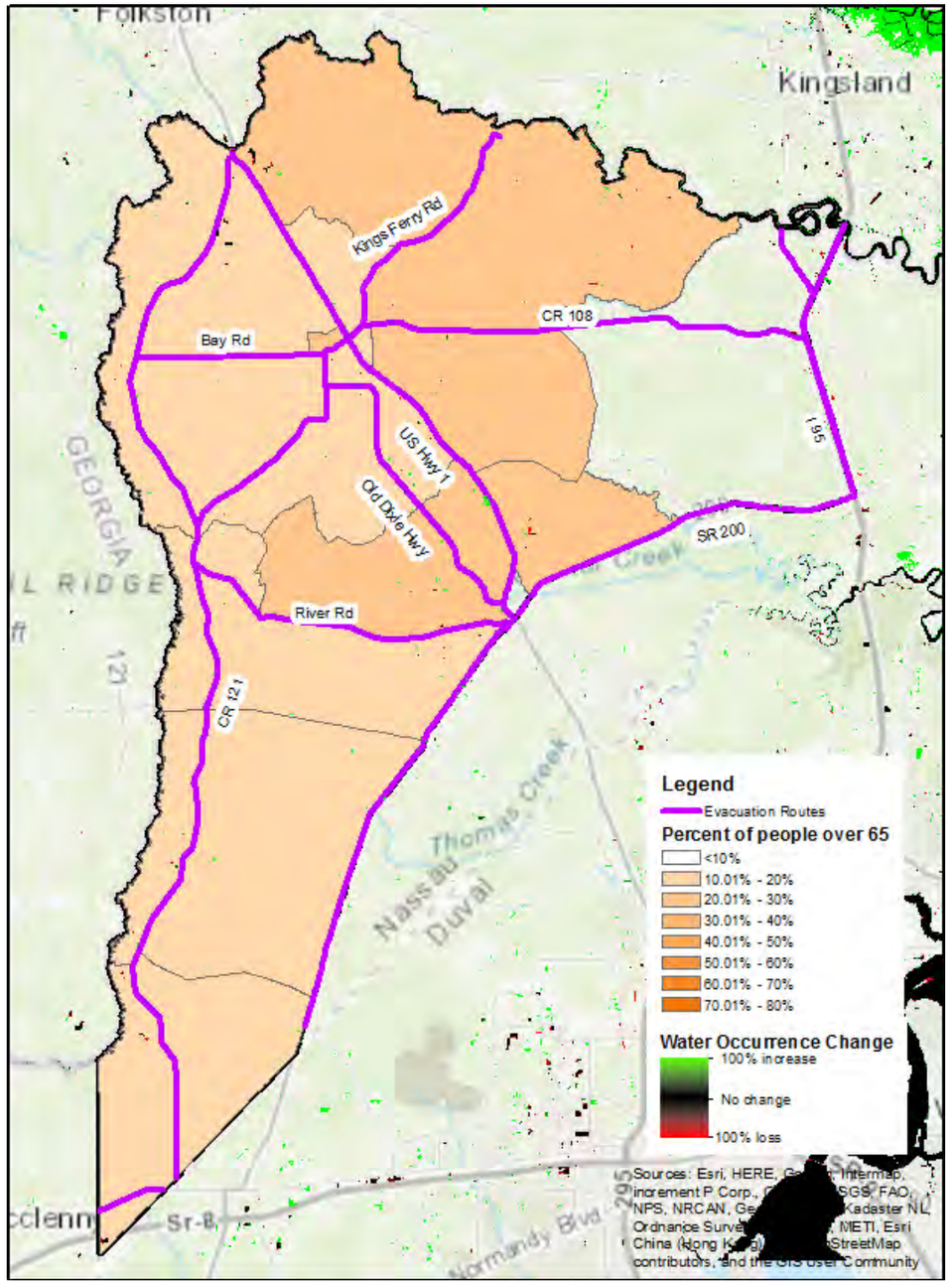


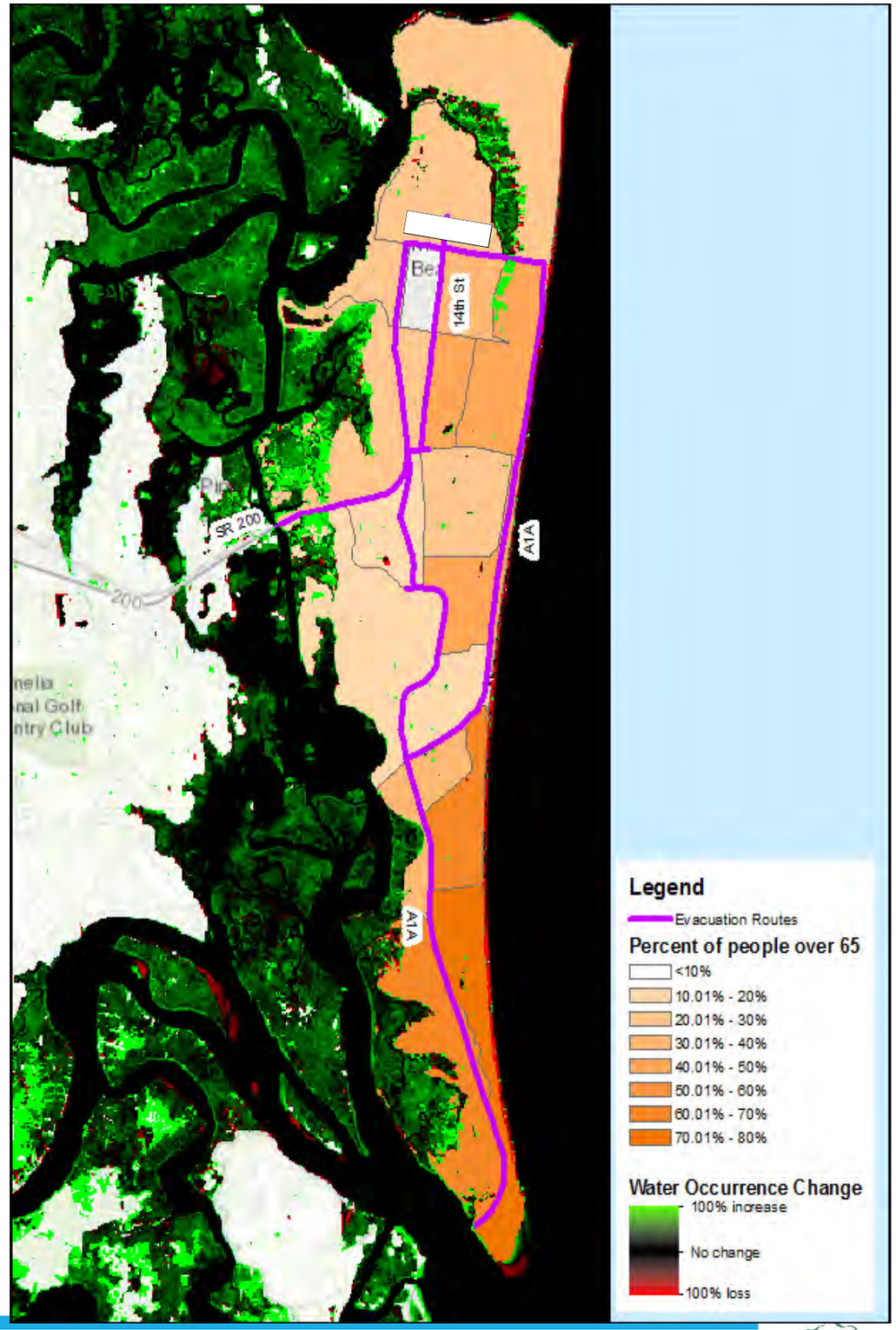


Sources: TBG Work Product; DOR; NOAA

Series 7 Map 1. Percent of Population over 65 and Water Occurrence Change

Series 7 Map 1 shows the confluence of elderly populations with flooding incidence data. In the West, there is limited overlap between areas of increased inundation with census tracts with higher percentages of populations older than age 65. On Amelia Island, block groups near the coast show higher shares of elderly population and these overlap with higher incidence of increased inundation.



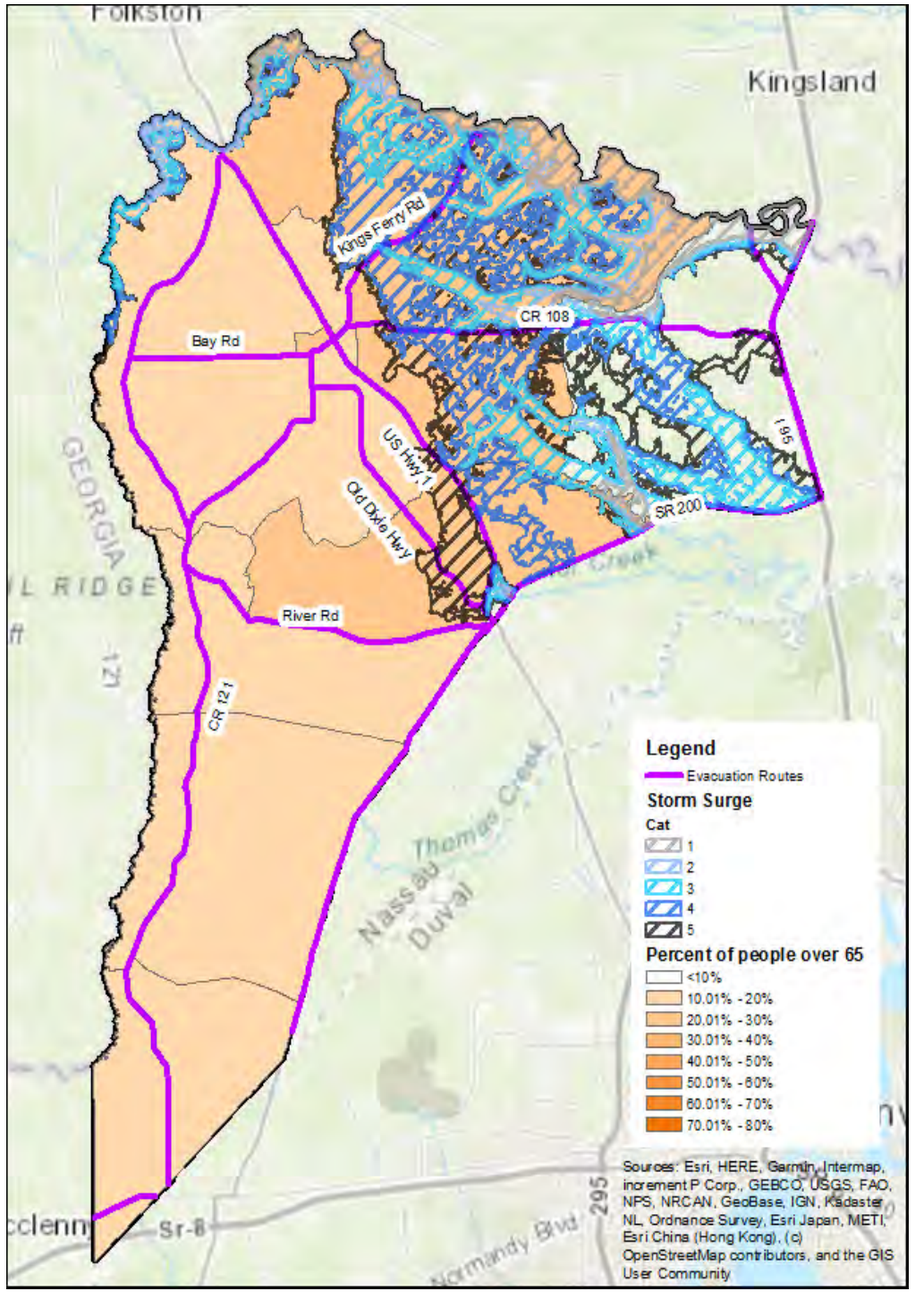


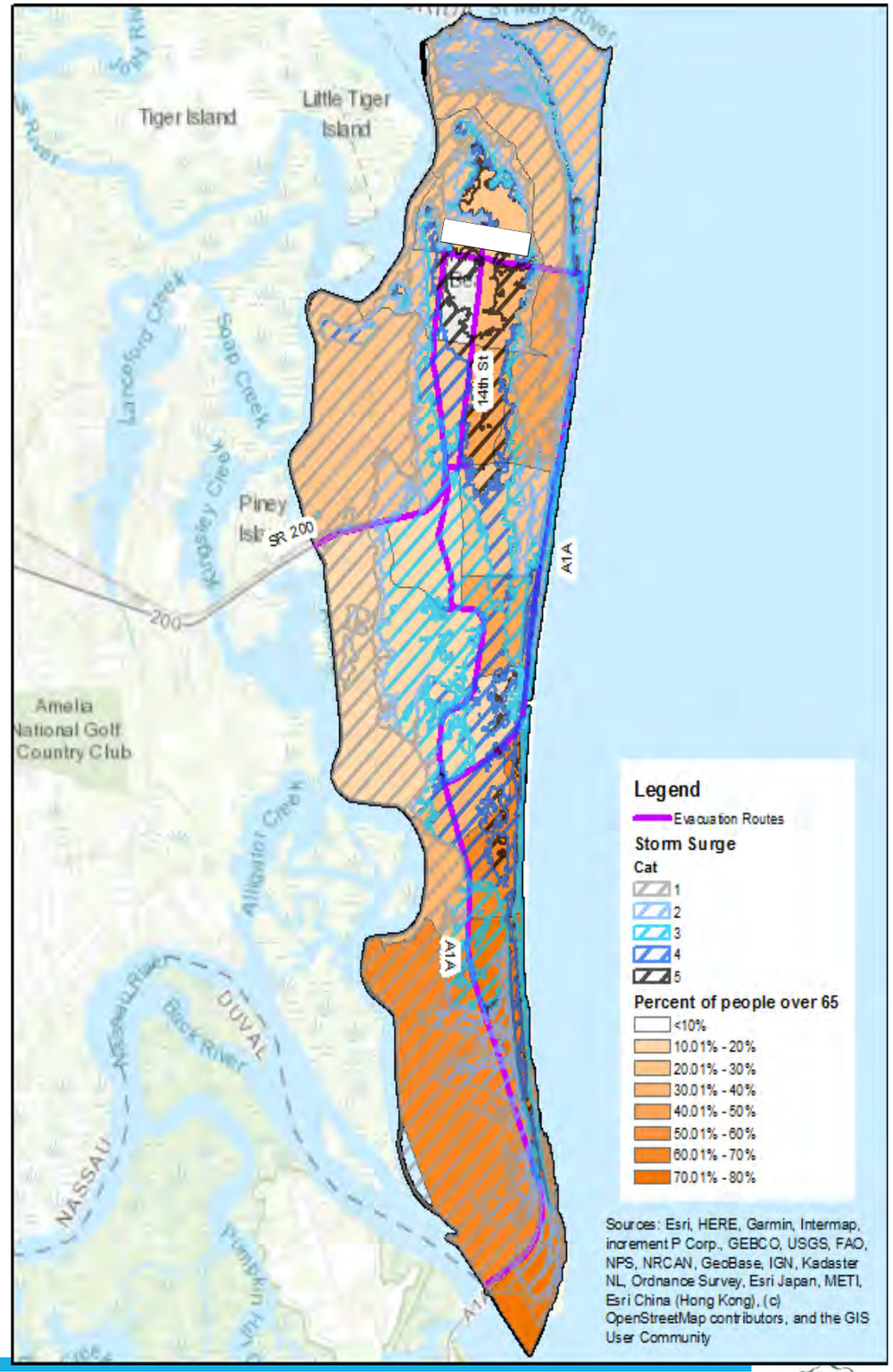
Sources: TBG Work Product; U.S. Census; EC JRC/Google

Series 7 Map 2. Percent of Population over 65 and Storm Surge

Series 7 Map 2 shows the confluence of elderly populations with storm surge scenarios to determine which of these are more vulnerable to event-driven flooding.

In the West, several block groups east of US 1 have higher percentages of elderly (at 30-40%) and these are subject to storm surge. Block groups on the south end of Amelia Island indicate higher shares of elderly population overlap areas with higher likelihood of storm surge.



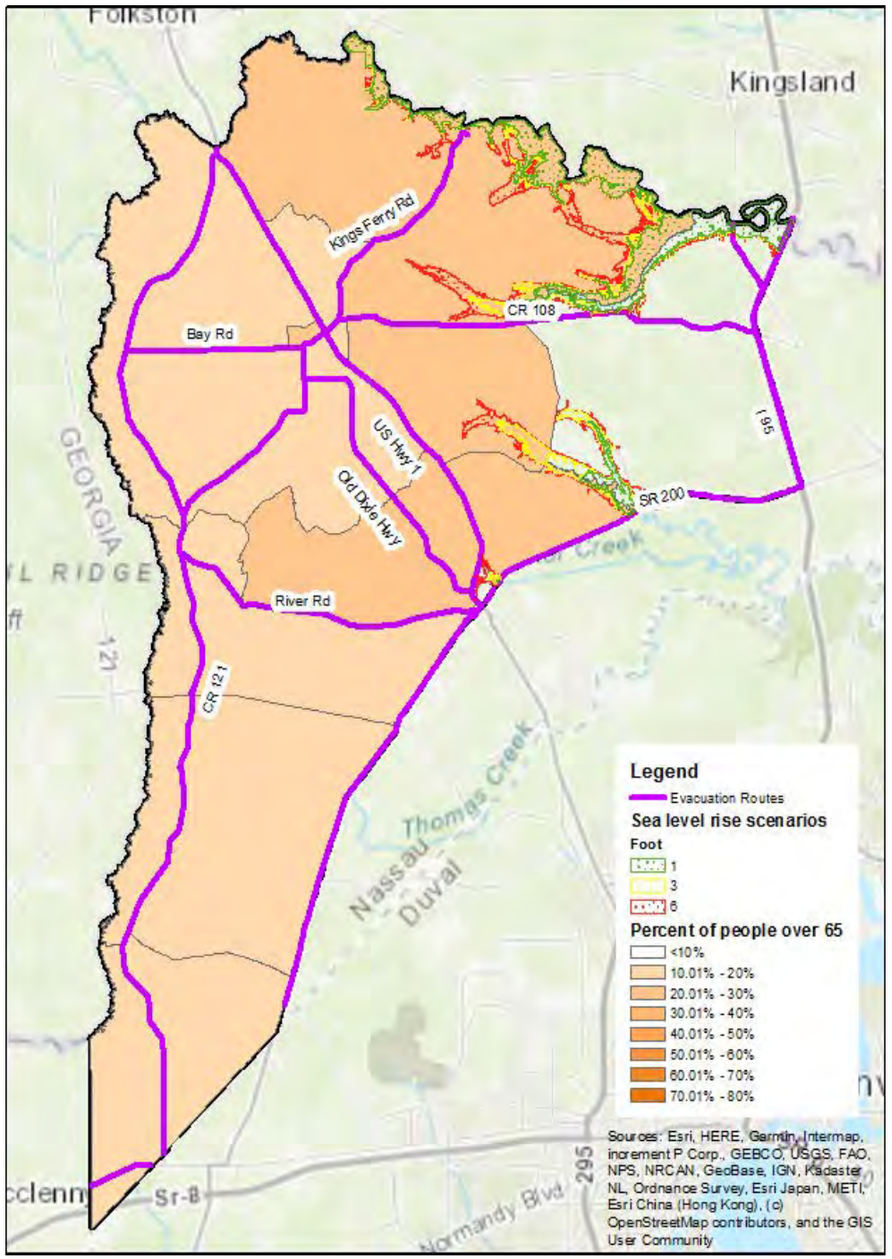


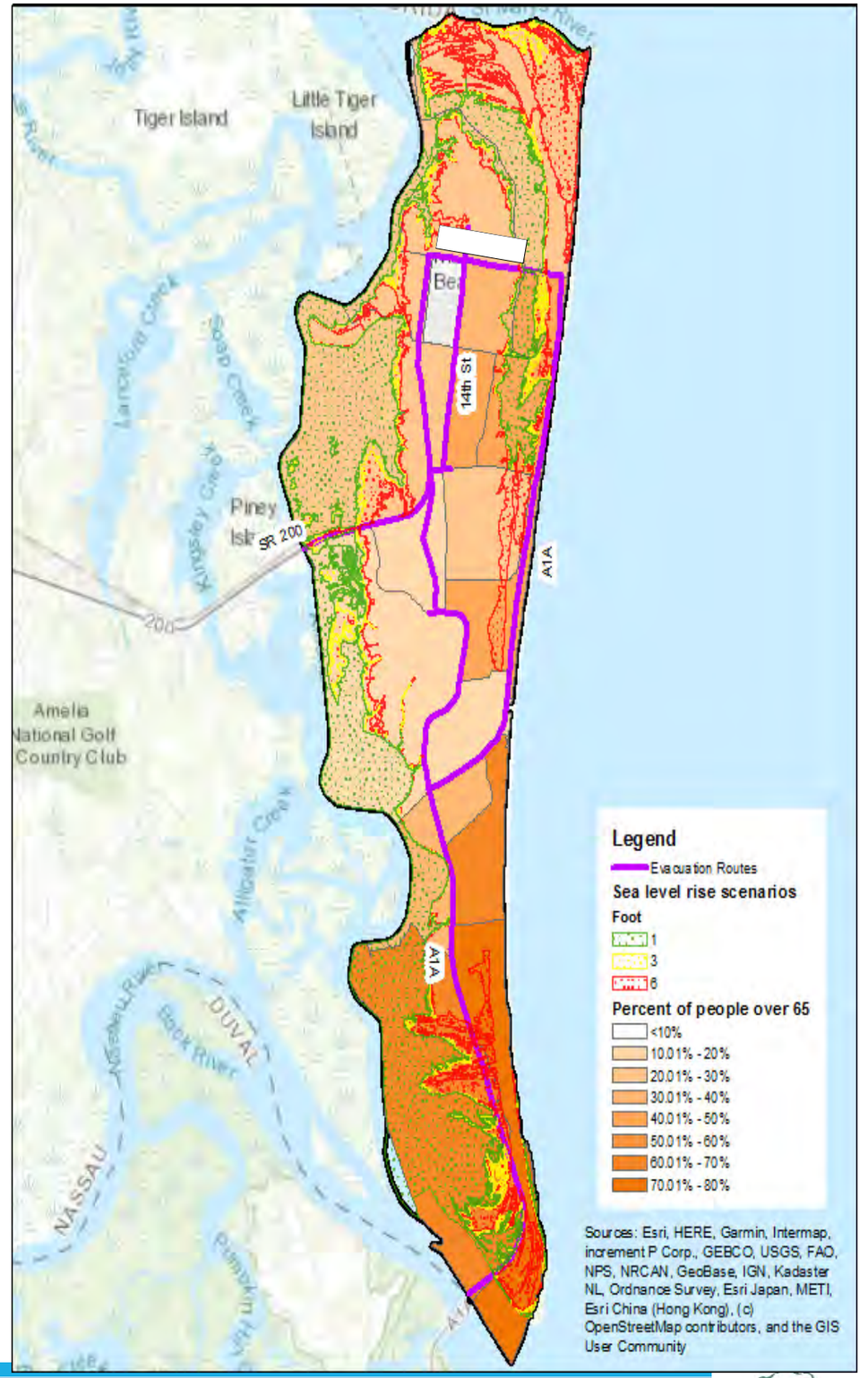
Series 7 Map 3. Percent of Population over 65 and Projected Sea Level Rise

Series 7 Map 3 shows the confluence of elderly populations with sea level rise to see which of these populations are more vulnerable to this type of flooding.

Block groups with the higher share of elderly populations within the West area have limited impacts under the several sea level rise scenarios.

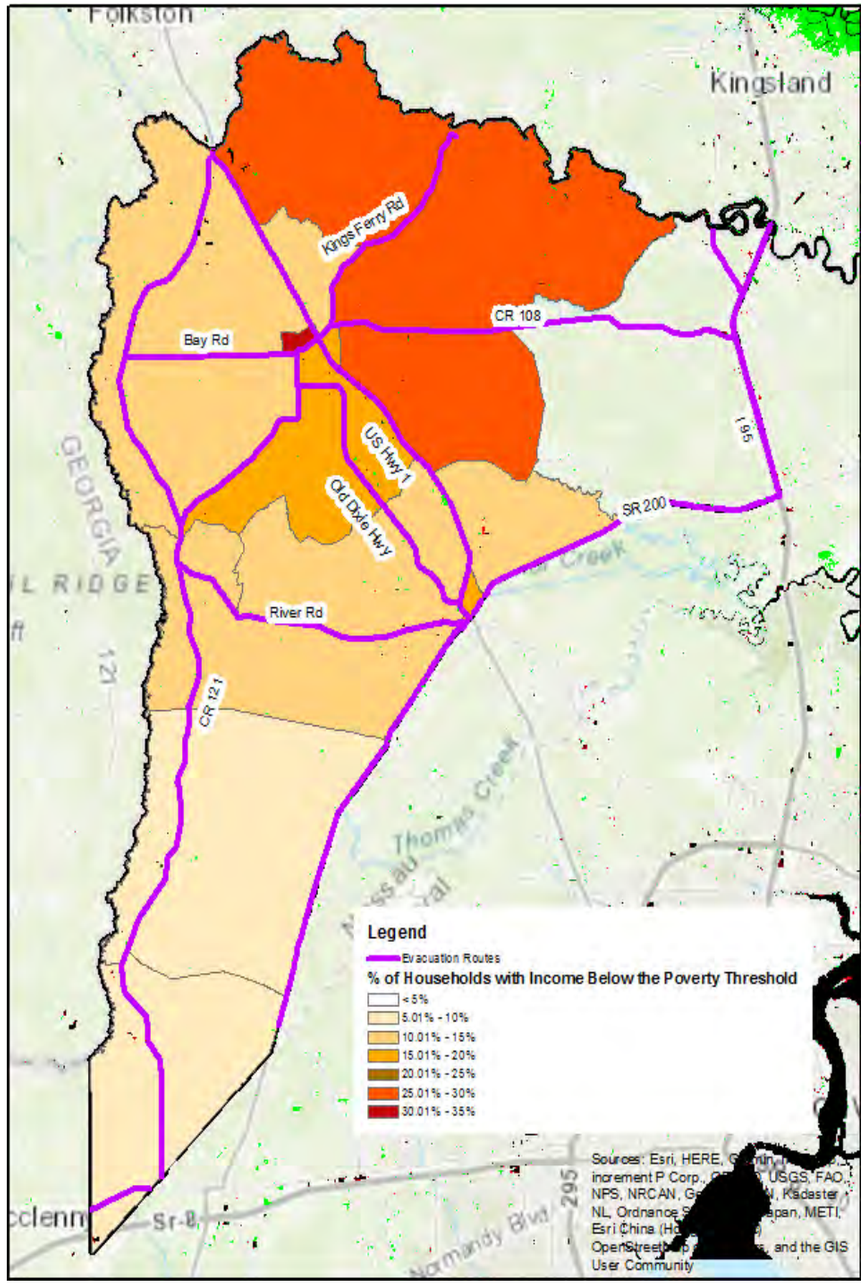
In the southern portion of Amelia Island, areas indicating higher shares of elderly population are subject to inundation under a 1 ft. sea level rise.

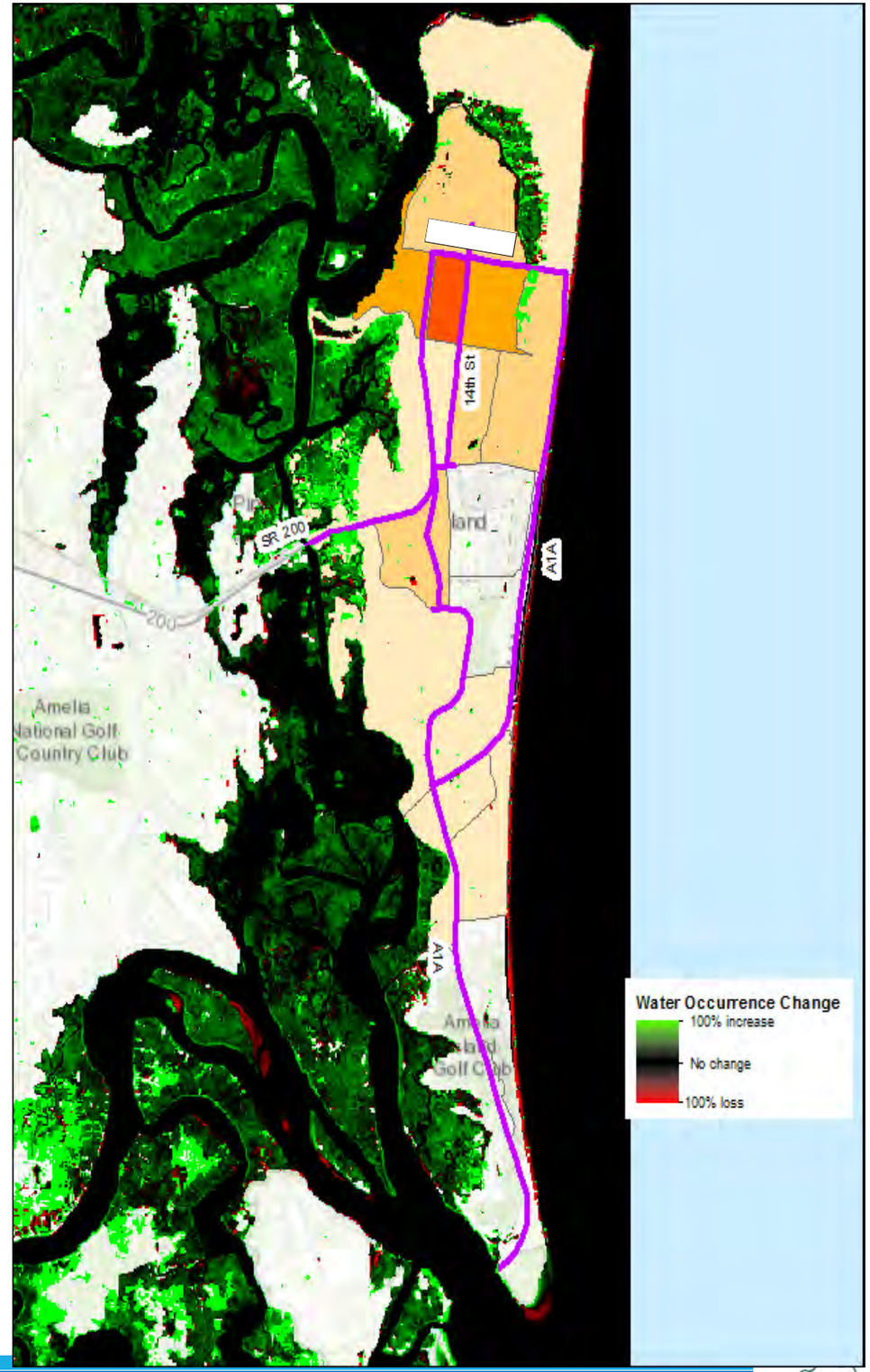




Series 8 Map 1. Percent of Households with Income below Poverty Threshold and Water Occurrence Change

Series 8 Map 1 illustrates block groups with higher shares of households living on incomes below the poverty threshold. The areas with the highest share of households living below the poverty threshold are northeast of Hilliard, the area adjoining the intersection of Bay Rd and US 1, and the northern section of Amelia Island at the intersection of 14th St and Atlantic Ave. However, these households appear to have no impacts from increased episodic events.





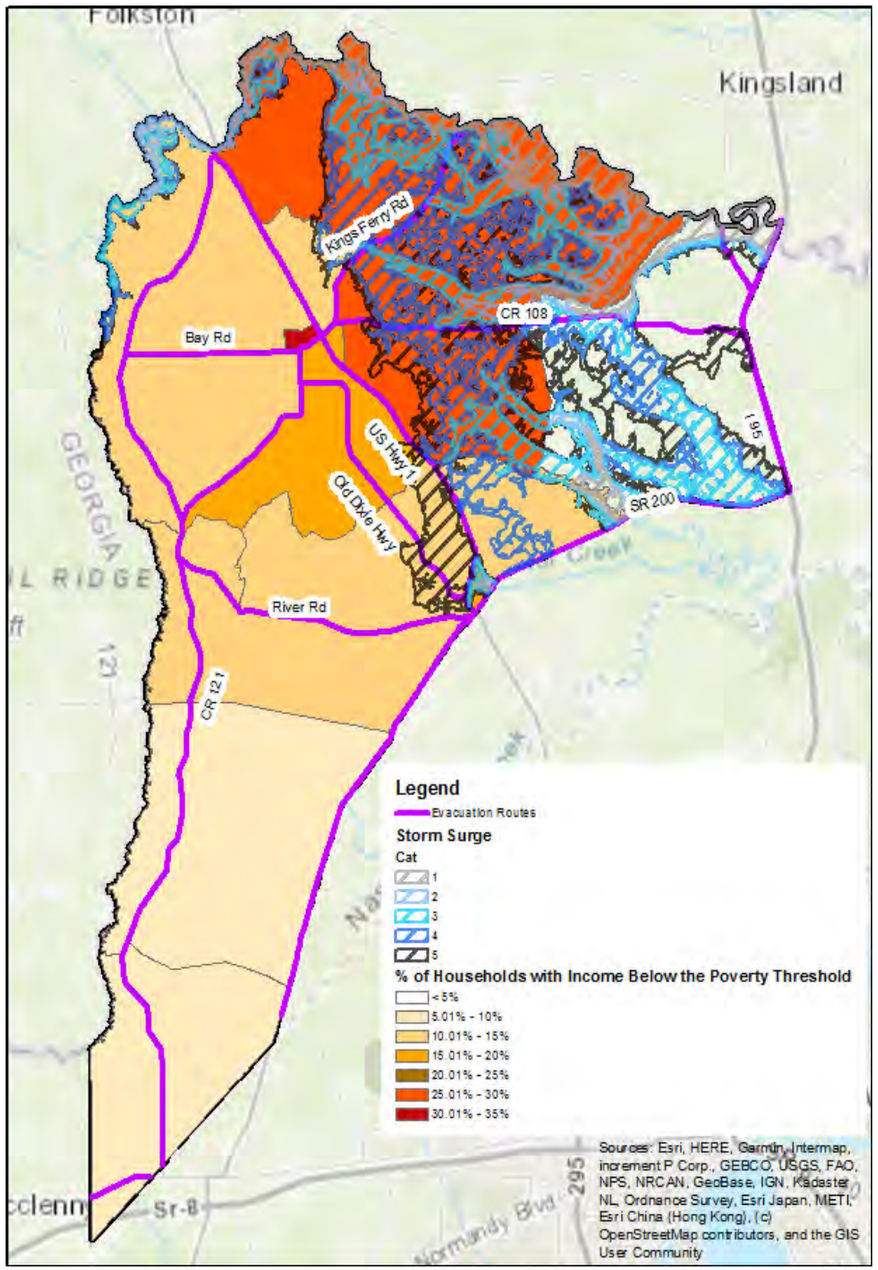
Sources: TBG Work Product; U.S. Census; EC JRC/Google

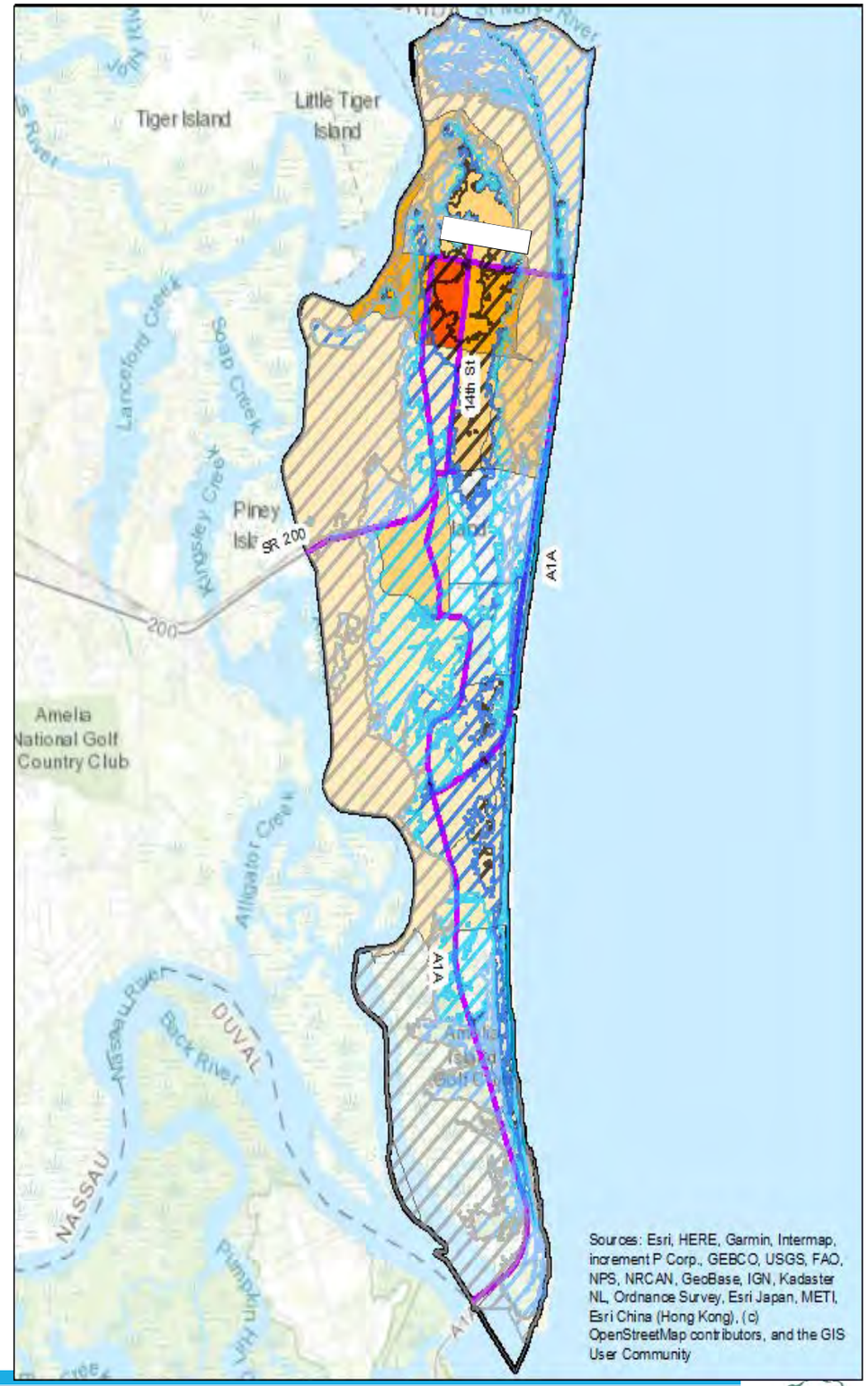
Series 8 Map 2. Percent of Households with Income below Poverty Threshold and Storm Surge

To determine if poorer households are more exposed to event-driven flooding, the percent of households living with incomes below the poverty threshold were mapped against storm surge.

In the West , the block group with the highest share of households living with incomes below the poverty threshold (intersection of Bay Rd and US Highway 1) is outside of the storm surge. However, block groups northeast of Hilliard, where the share of households living with incomes below the poverty threshold is still high, would be affected by a Category I storm surge.

On Amelia Island, households with incomes below the poverty threshold that are in block groups south of Atlantic Ave and 14th St would be impacted by Category 4 storm surge.





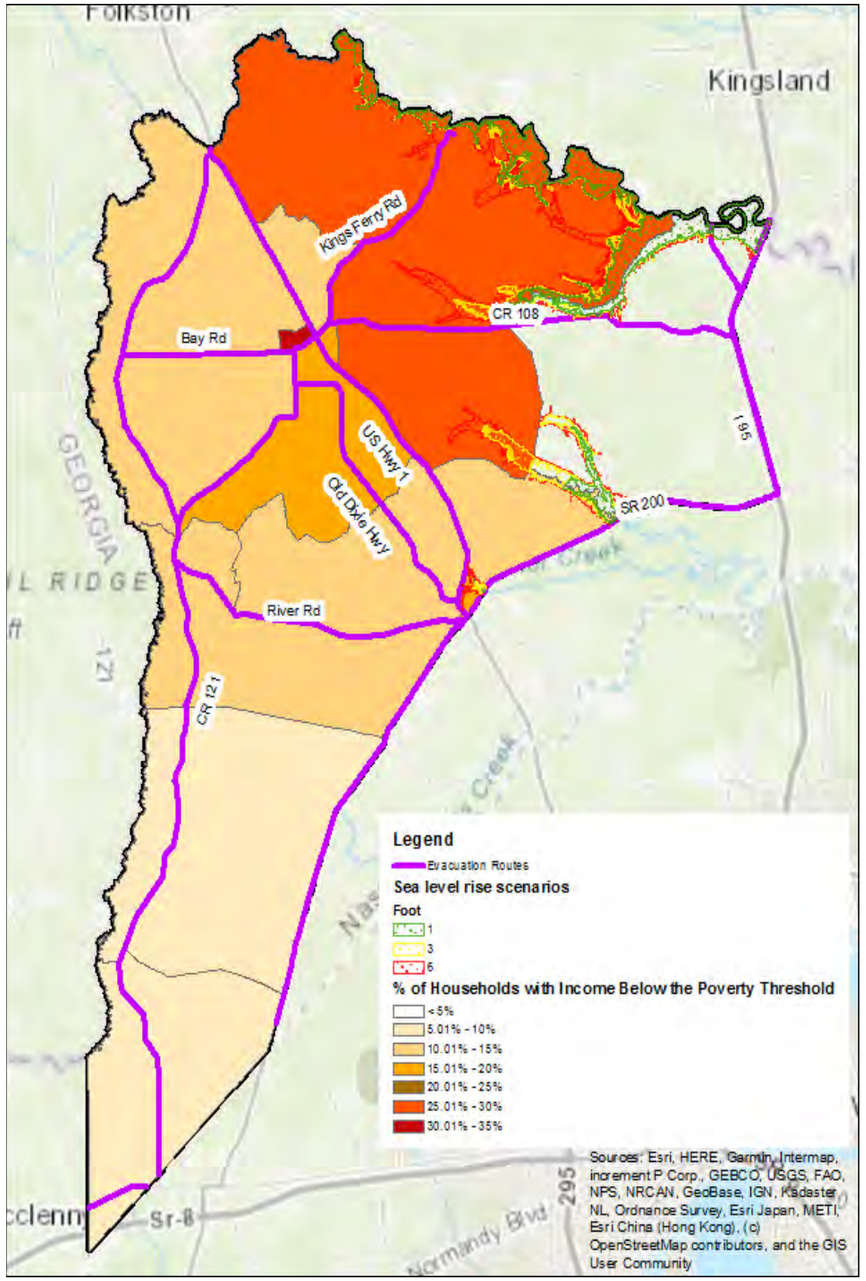
Sources: TBG Work Product; U.S. Census; NOAA

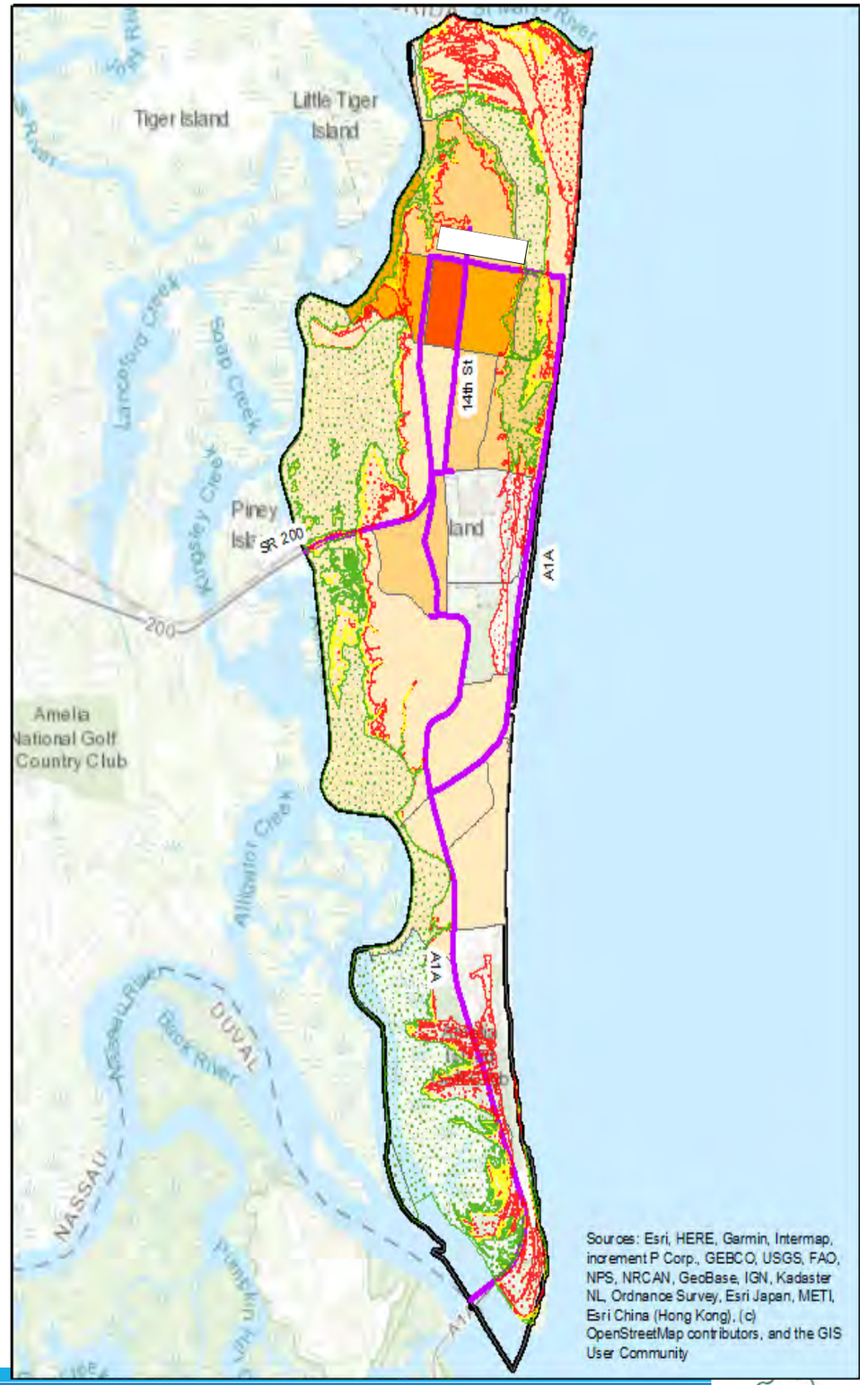
Series 8 Map 3. Percent of Households with Income below Poverty Threshold and Projected Sea Level Rise

To determine if poorer households are more exposed to flooding under a more long-term perspective, households with incomes below the poverty threshold were mapped against sea level rise.

In the West, while impacts from either a 1 ft or 3 ft sea level rise would be nominal, a 6 ft rise in sea level would significantly impact some households with income below the poverty threshold that live in the surroundings of St. Marys River.

The handful of block groups on Amelia Island unaffected by storm surge would also not be impacted by any of three sea level rise scenarios. All other block groups would be, however.





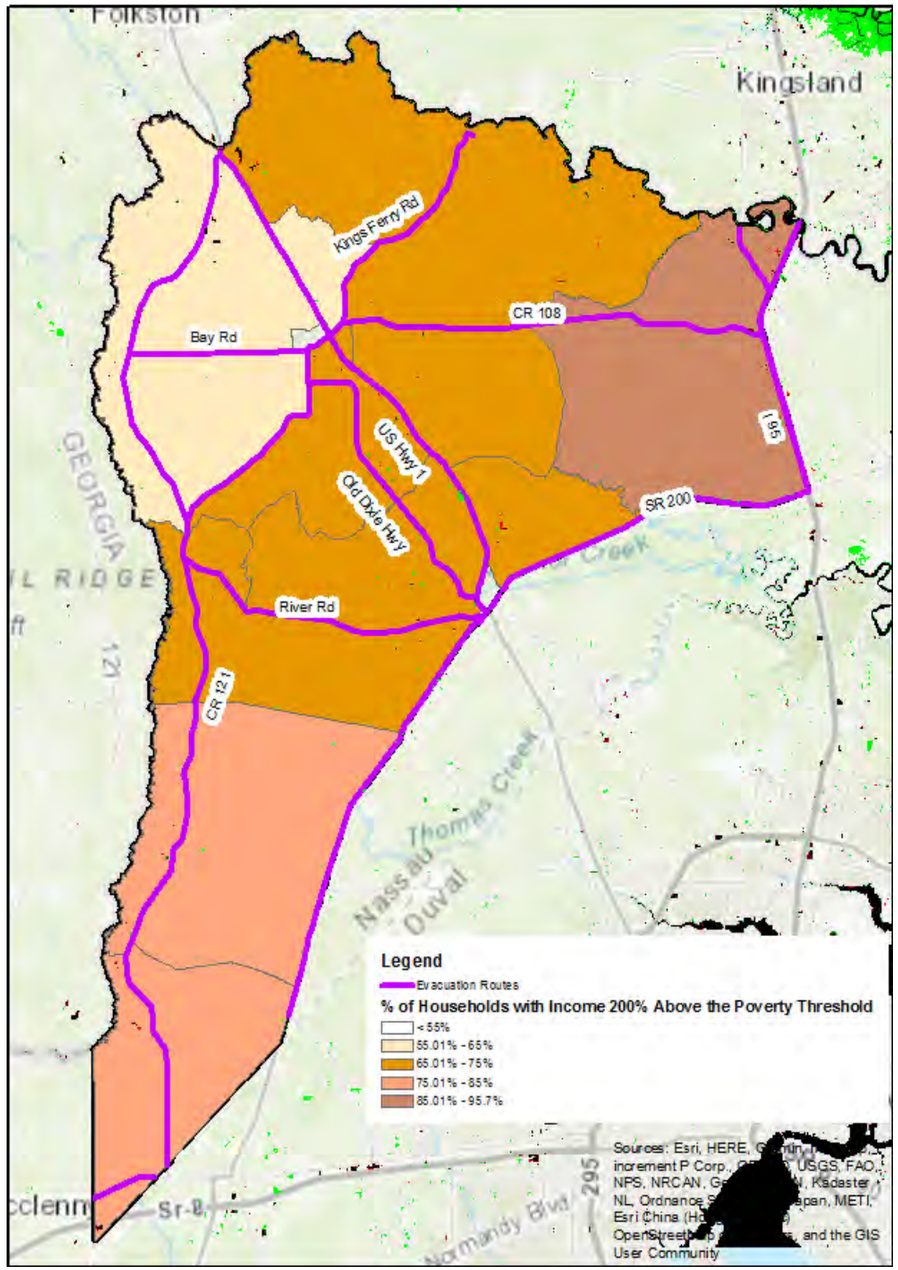
Sources: TBG Work Product; DOR; NOAA

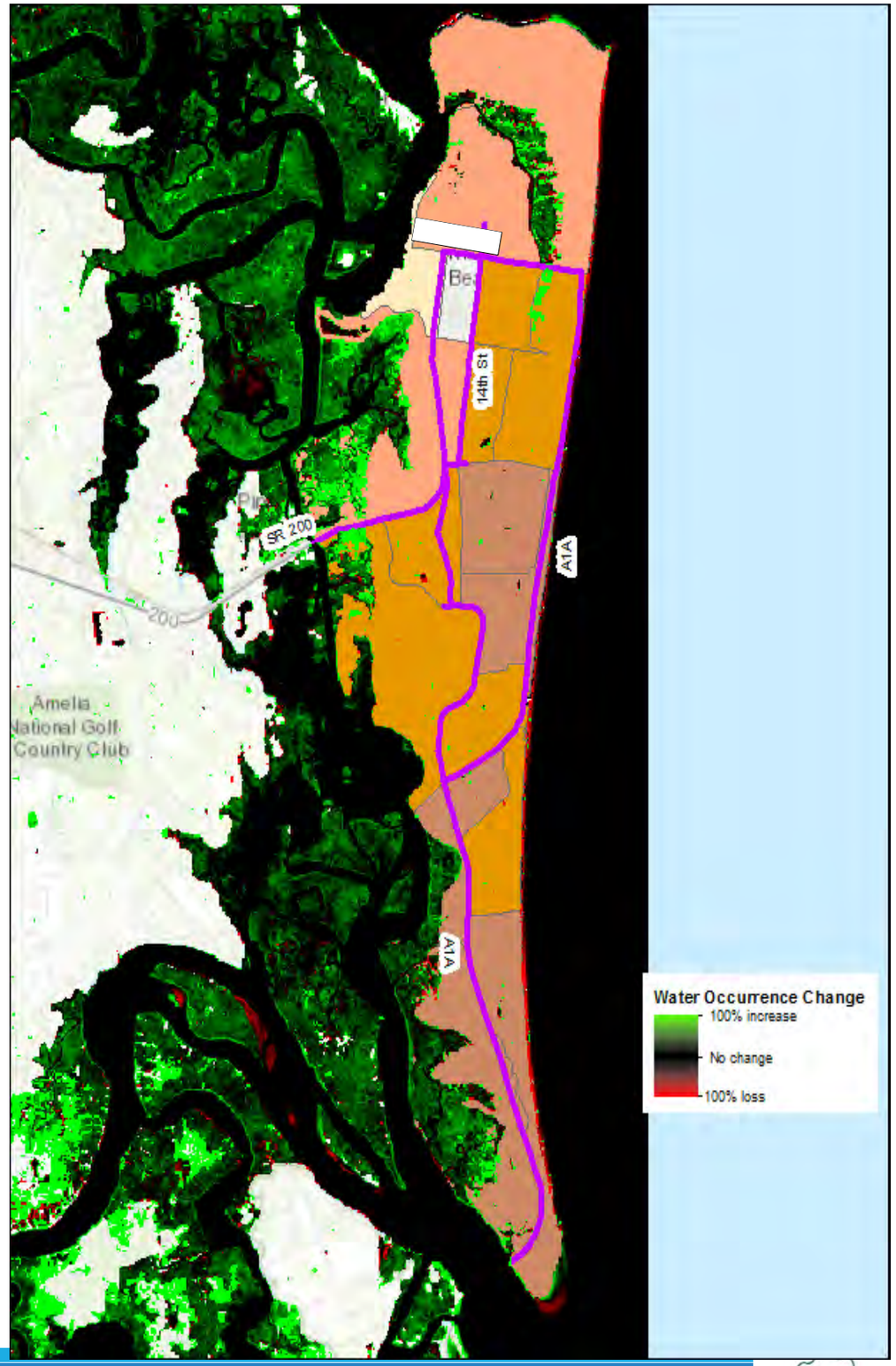
Series 9 Map 1. Percent of Households with Income 200% above Poverty Threshold and Water Occurrence Change

It is also important to evaluate whether locations with higher income households have been impacted by episodic events (Series 9 Map 1). For purposes of the assessment, households with incomes 200% over the poverty threshold are considered higher income.

In the West, there is limited overlap between increased episodic events and block groups with a higher percentage of households living on incomes 200% above the poverty threshold.

However, in the southern portion of Amelia Island, block groups with the highest shares of households living on incomes 200 percent above the poverty threshold, have been subject to an increase of episodic events by the Intracoastal Waterway.



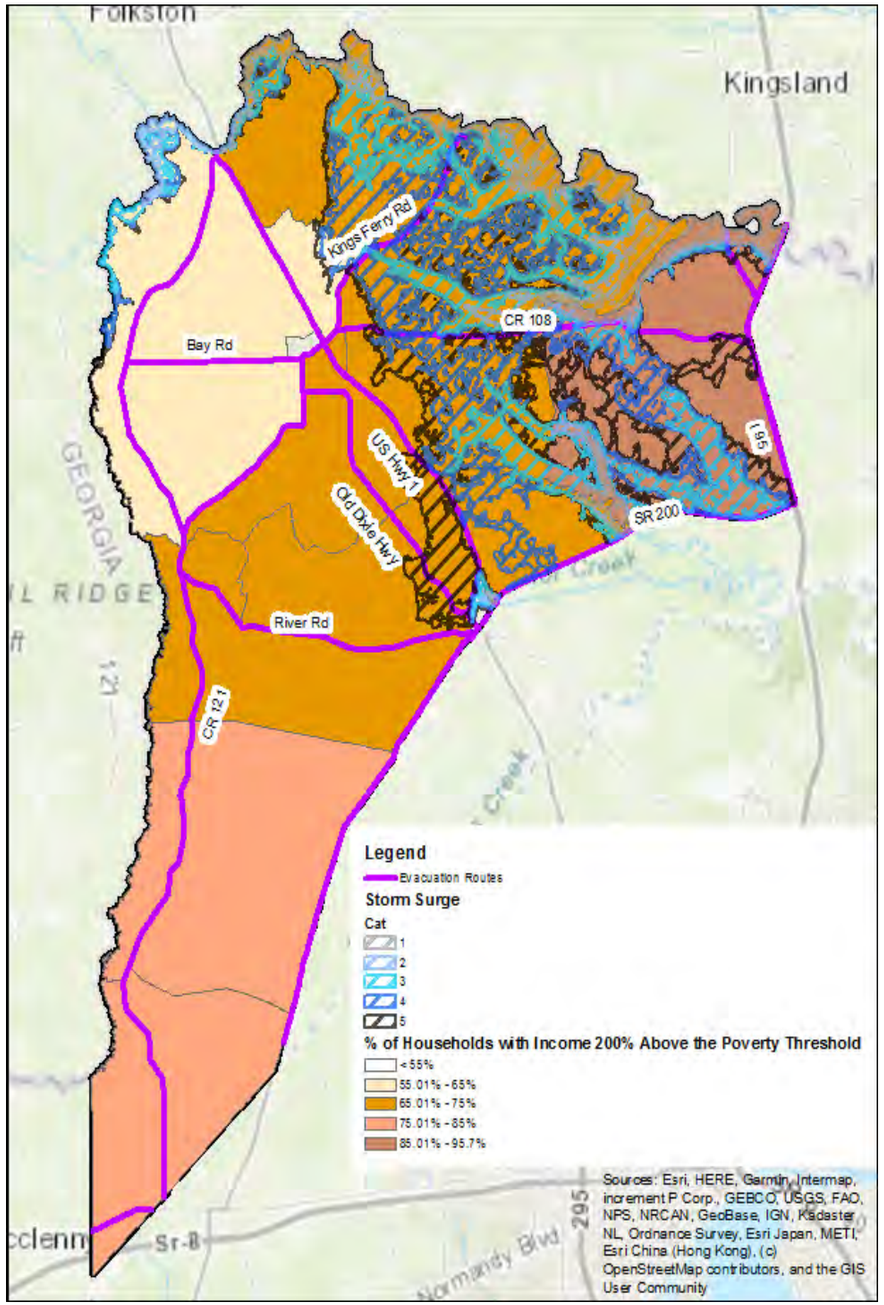


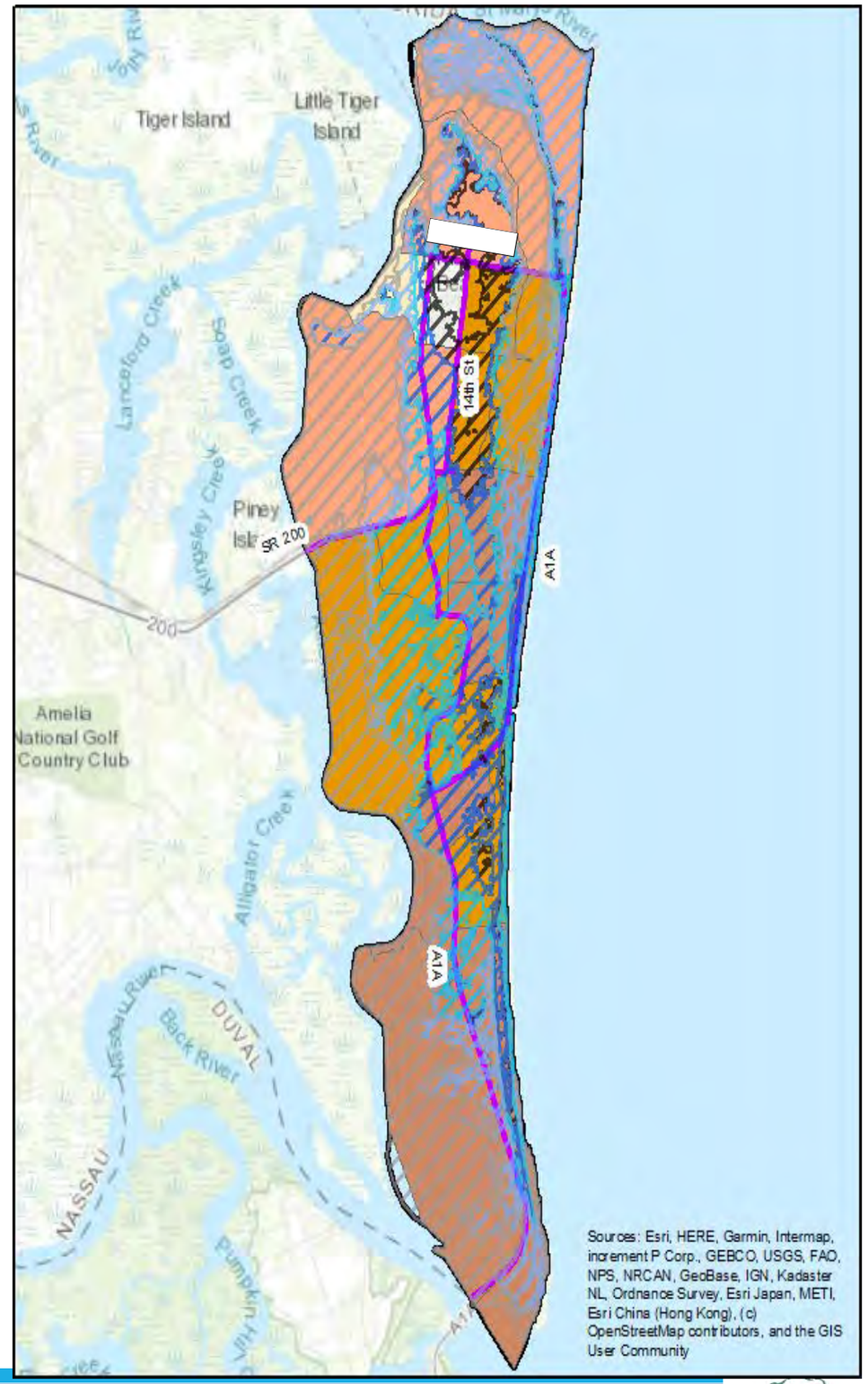
Sources: TBG Work Product; U.S. Census; EC JRC/Google

Series 9 Map 2. Percent of Households with Income 200% above Poverty Threshold and Storm Surge

Series 9 Map 2 compares the percent of households living on incomes 200% above the poverty threshold to areas subject to storm surge.

The highest shares of households living on income 200% above the poverty threshold are in the south of Amelia Island, and north of SR 200 and immediately west of I-95. These are significantly impacted even by the weakest and most likely storm surge.



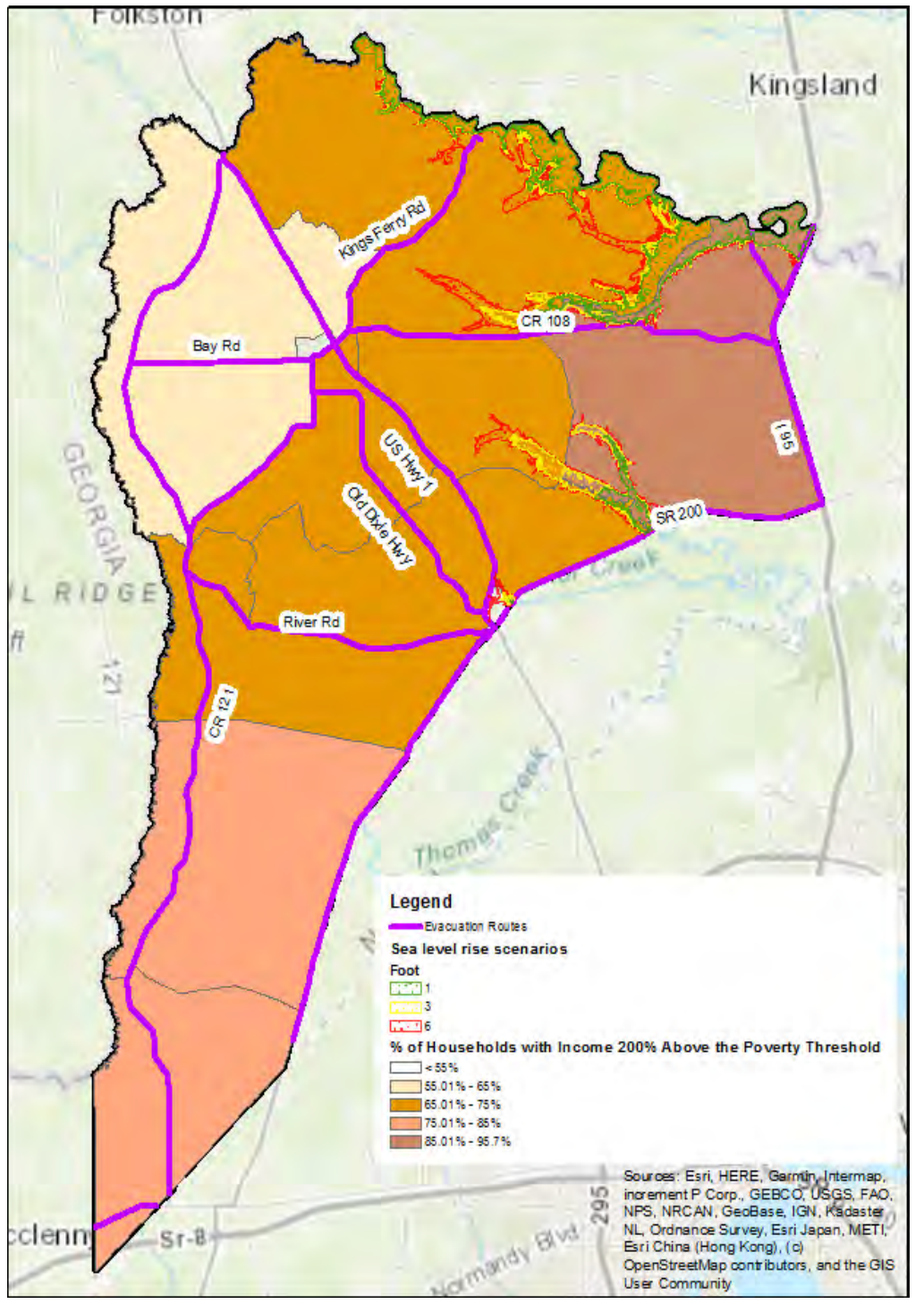


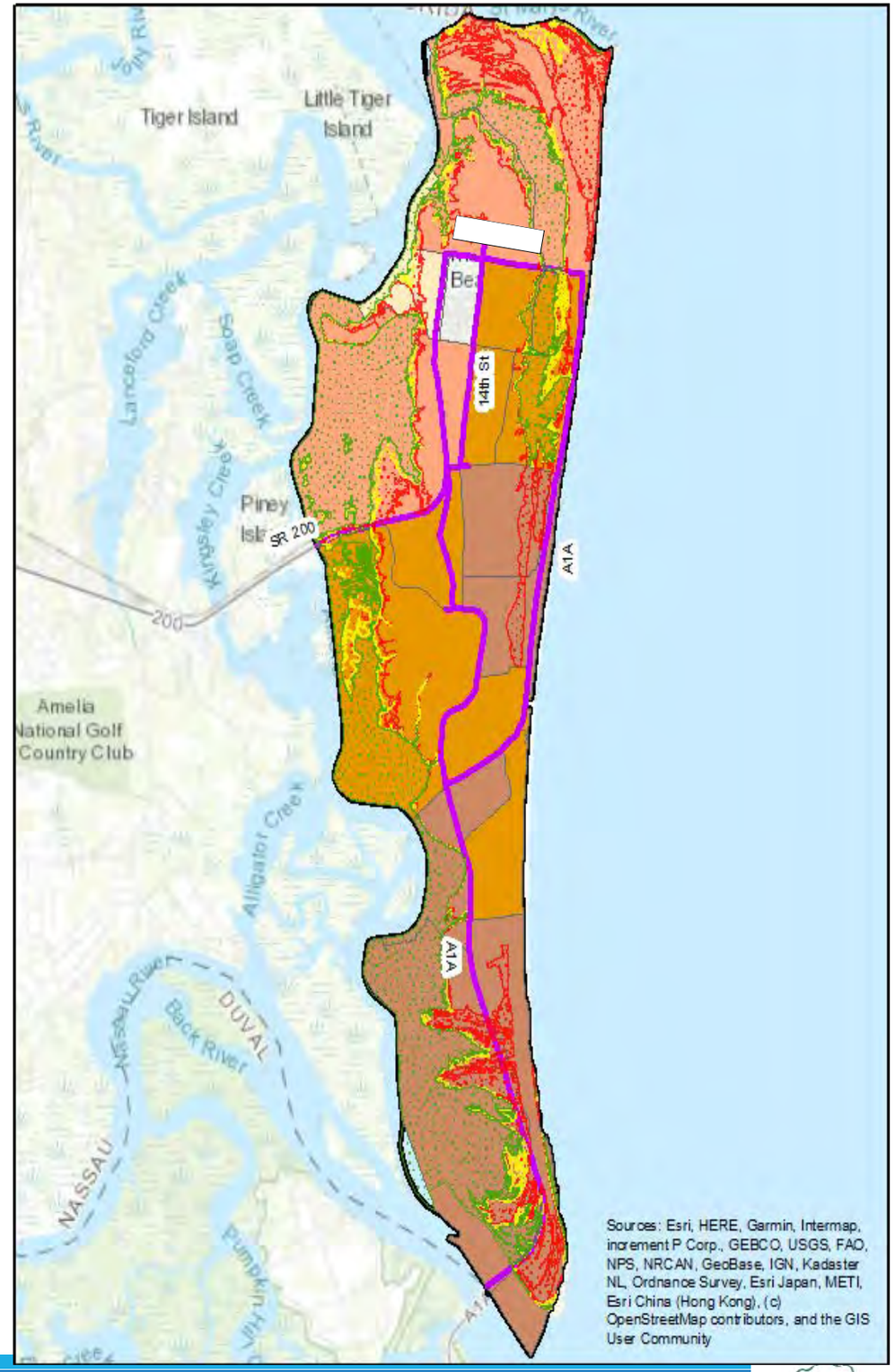
Series 9 Map 3. Percent of Households with Income 200% above Poverty Threshold and Projected Sea Level Rise

Series 9 Map 3 compares the percent of households living on incomes 200 percent above the poverty threshold to sea level rise.

The block group with the highest share of households living on incomes 200% above the poverty threshold in the West is north of SR 200 and west of I-95. This block group would have some sea level rise impacts near SR 200 and north by the St. Marys River.

Higher income areas in the southern section of Amelia Island will be impacted even under a 1 ft. sea level rise scenario.



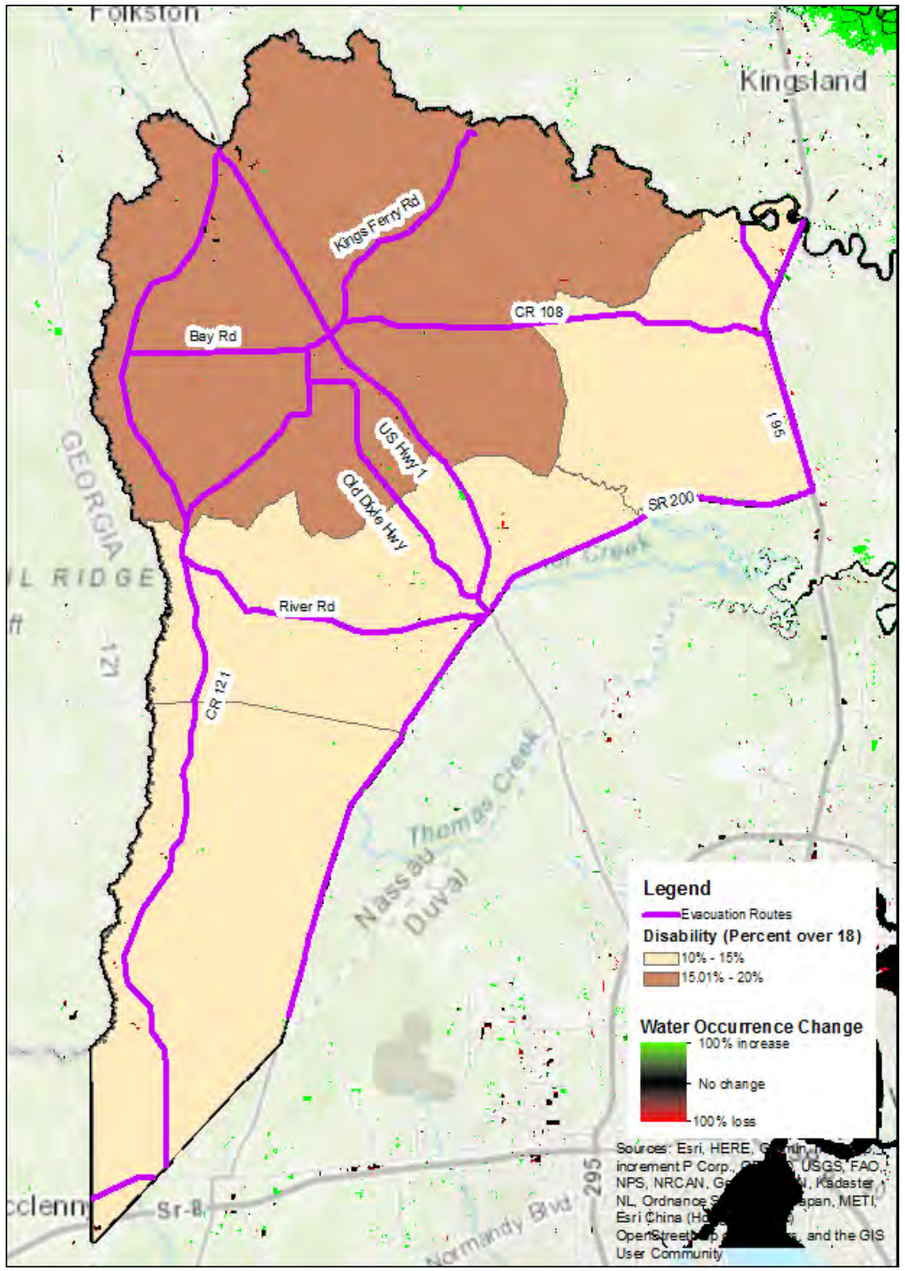


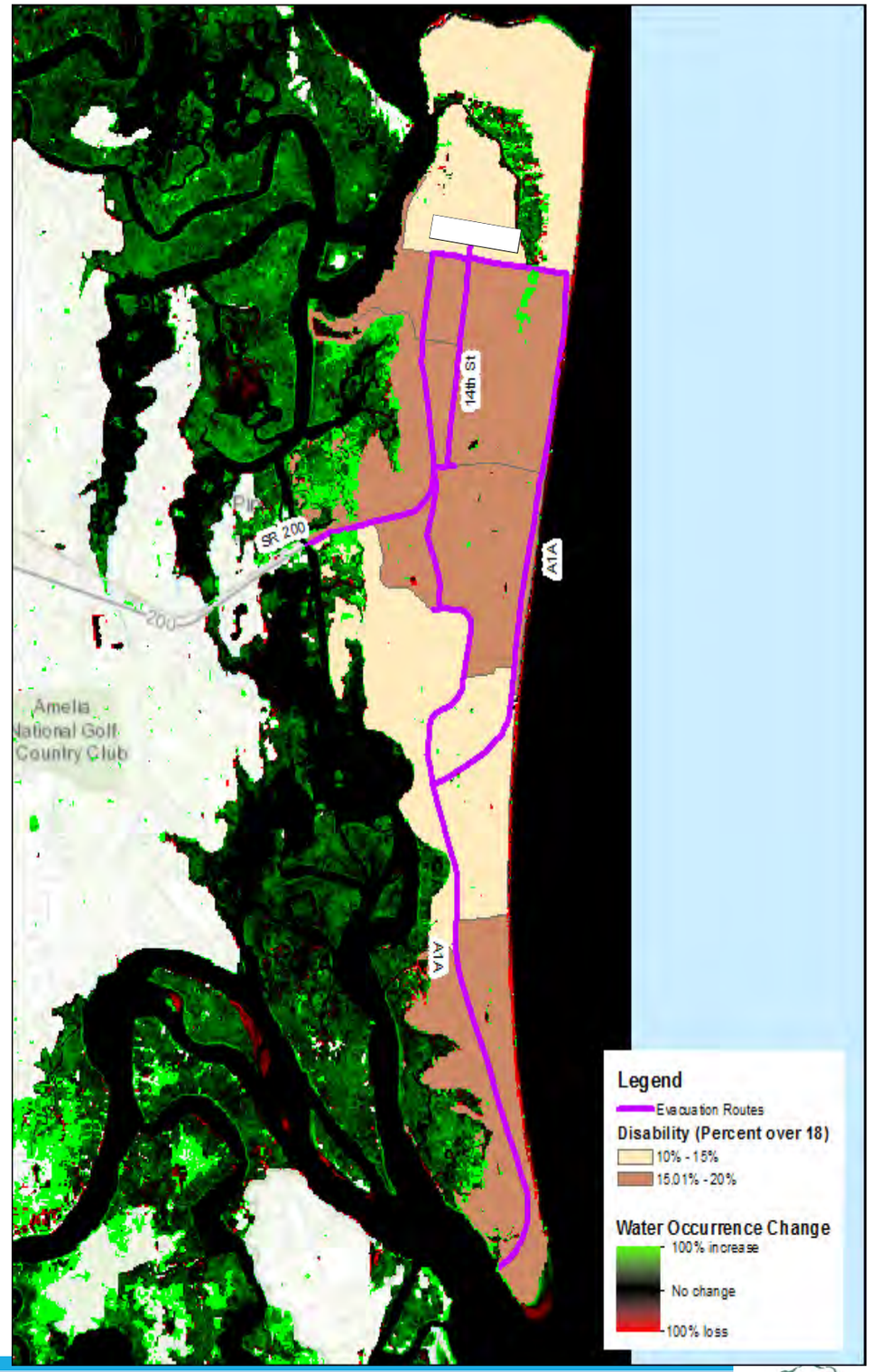
Sources: TBG Work Product; DOR; NOAA

Series 10 Map 1. Percent of Disabled Non-institutionalized Population over 18 and Water Occurrence Change

Series 11 Map 1 shows the percent of non-institutionalized population with a disability over 18 years old. Non-institutionalized population refers to all U.S. civilians not residing in institutional group quarters facilities such as correctional institutions, juvenile facilities, skilled nursing facilities, and other long-term care living arrangements (U.S. Census Bureau).

The highest shares of affected populations are concentrated in three areas. The first is the south of Amelia Island (which also features higher shares of elderly and households with income 200% above the poverty threshold). Episodic flooding has increased mostly by the Intracoastal Waterway. The second area is the surroundings of City of Fernandina Beach, and the third area centers on Hilliard. In this latter area, however, there is little to no acreage affected by episodic events.





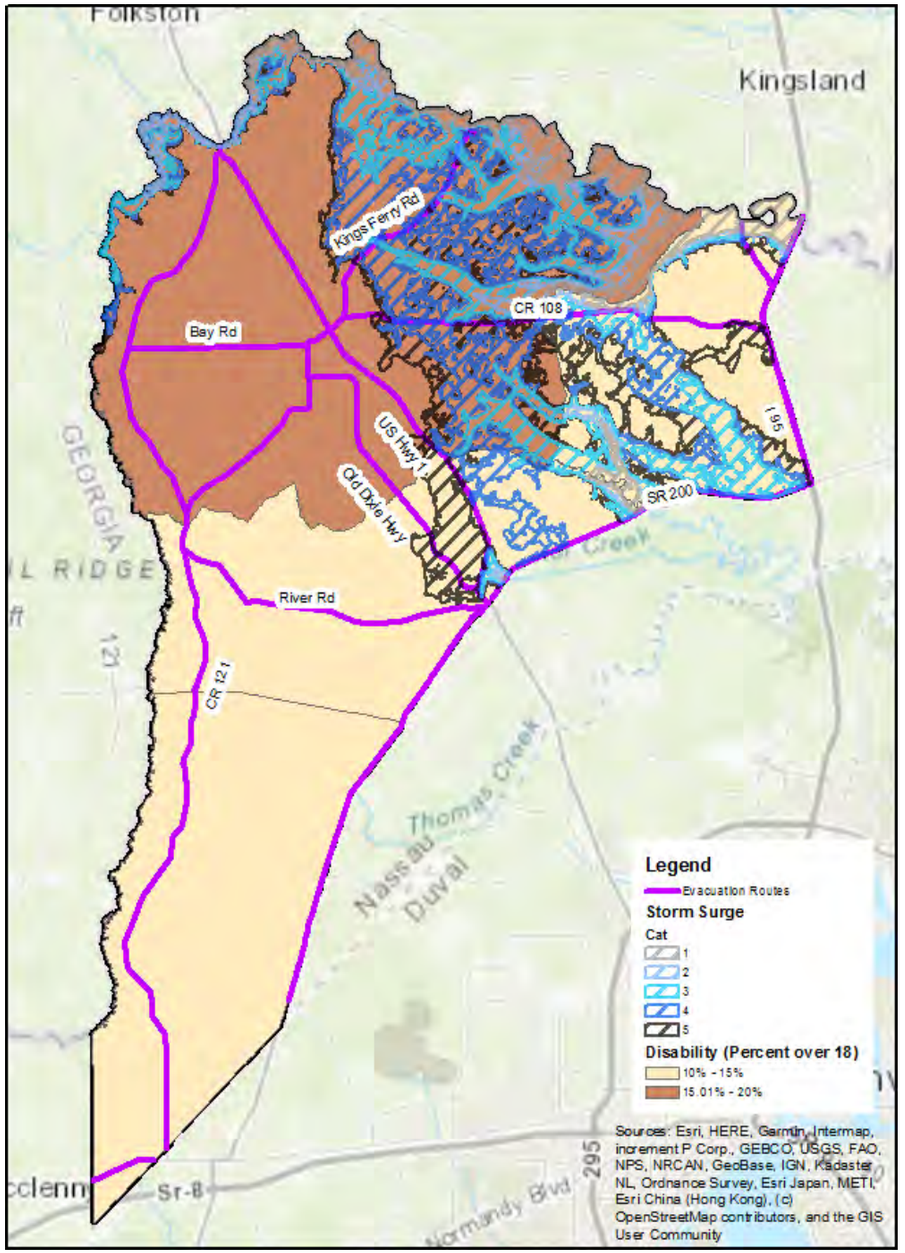
Sources: TBG Work Product; U.S. Census; EC JRC/Google

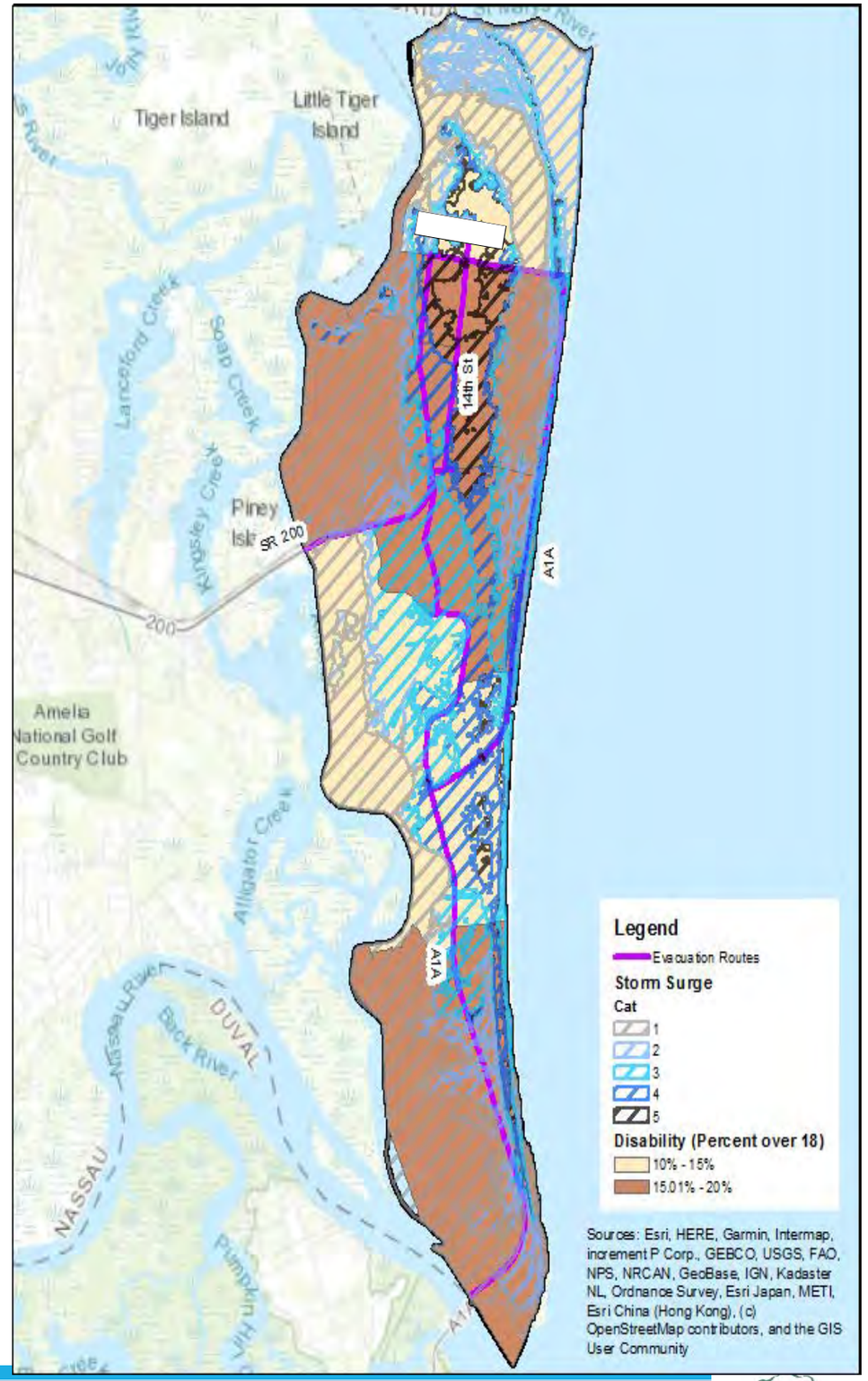
Series 10 Map 2. Percent of Disabled Non-Institutionalized Population over 18 and Storm Surge

To assess if the population with a disability is more exposed to event-driven flooding, the percent of non-institutionalized population with a disability was mapped against storm surge.

In the West, block groups with the highest percentages of disabled are northeast of Hilliard, where they would be impacted by a Category 3 or higher storm surge.

However, the non-institutionalized disabled population most impacted by storm surge is located on Amelia Island where this population would be impacted even by a Category 1 storm surge.

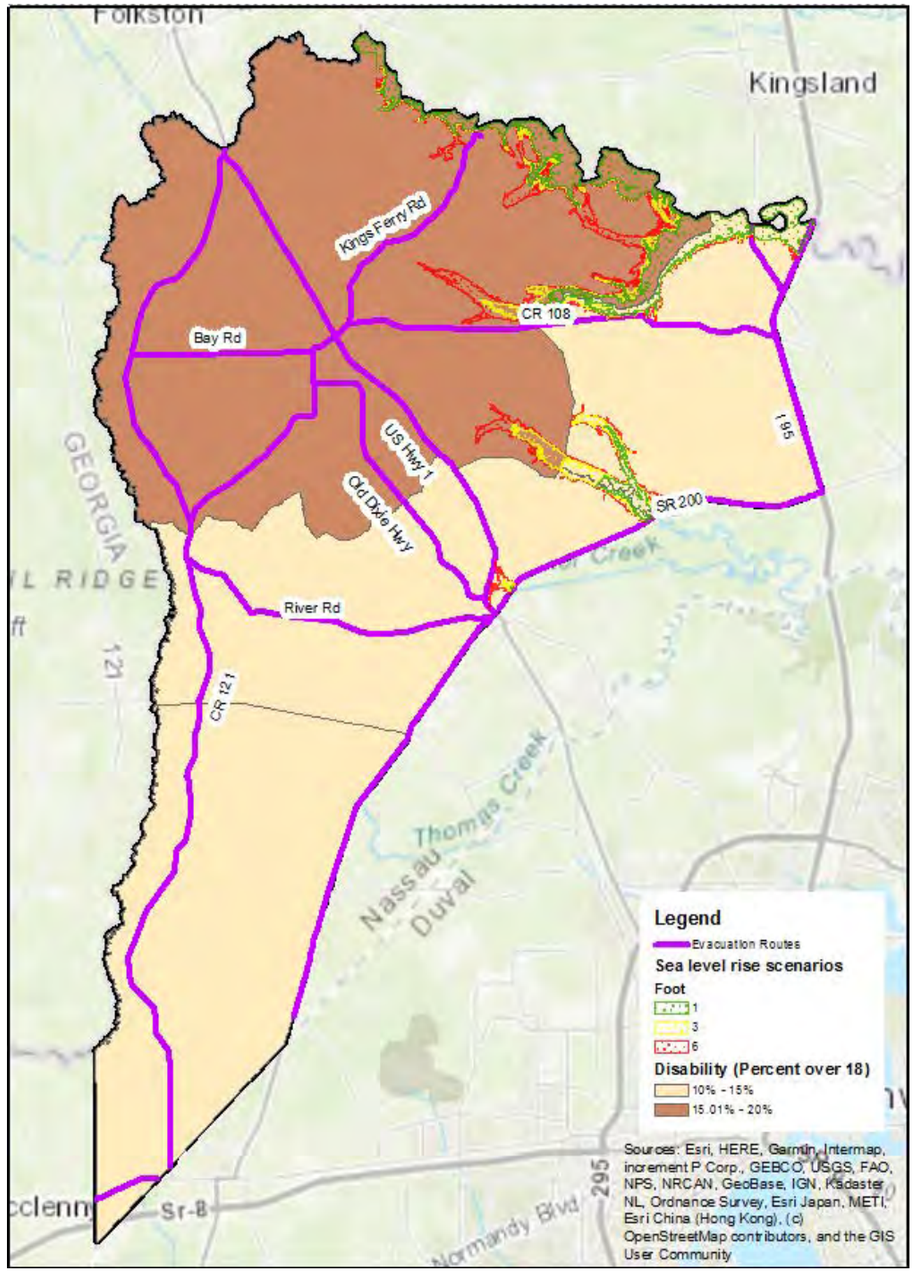


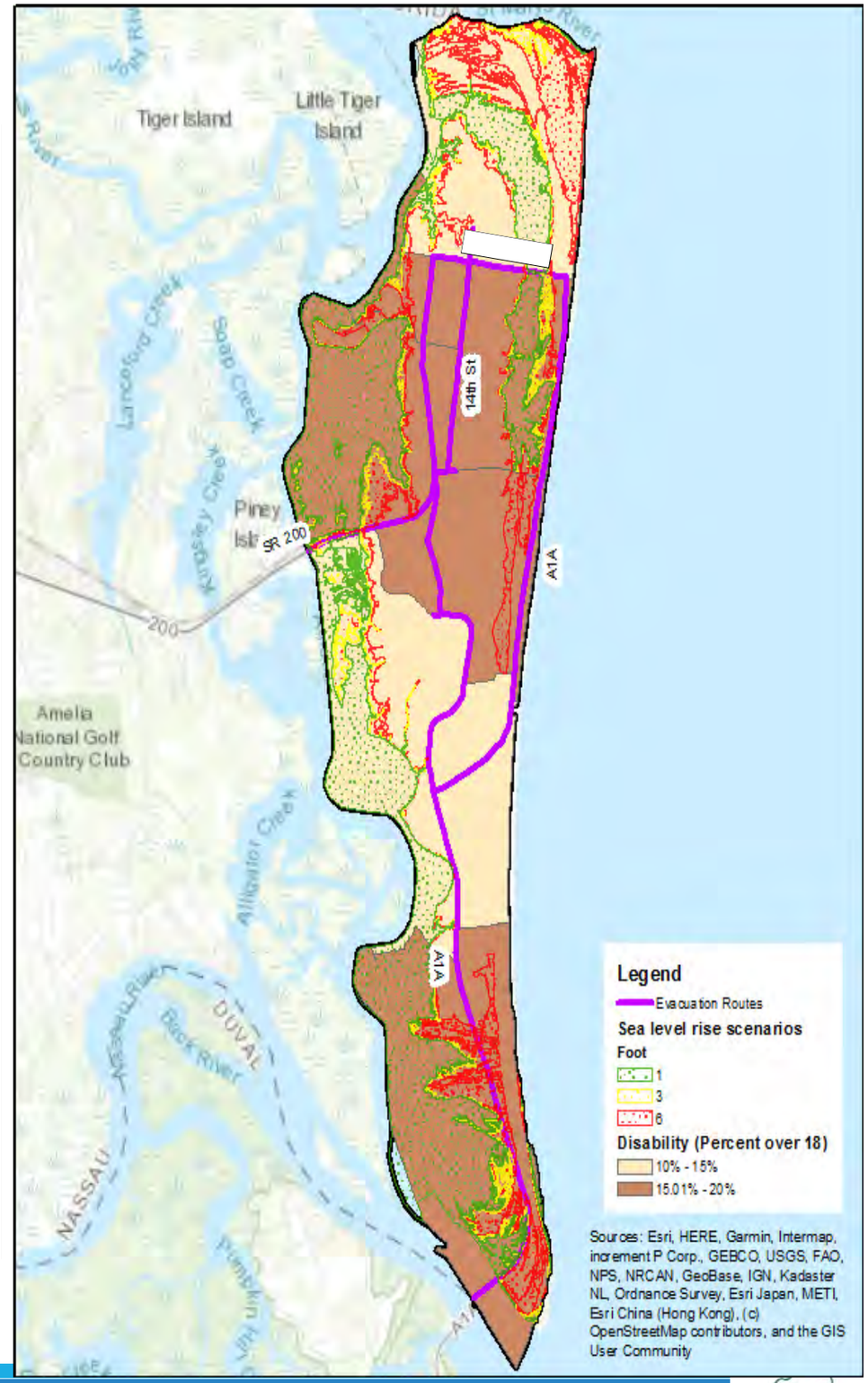


Series 10 Map 3. Percent of Non-Institutionalized Population over 18 and Projected Sea Level Rise

Similarly, to assess exposure of the disabled population to long-term sea level rise, the percent of non-institutionalized population with a disability was mapped against the three sea level rise scenarios.

In the West, those by the St. Mary's River are impacted by any sea level rise scenario. However, the most impacted disabled population by sea level rise is at the south end of Amelia Island, where even a 1 ft rise in sea level is expected to cause persistent flooding.



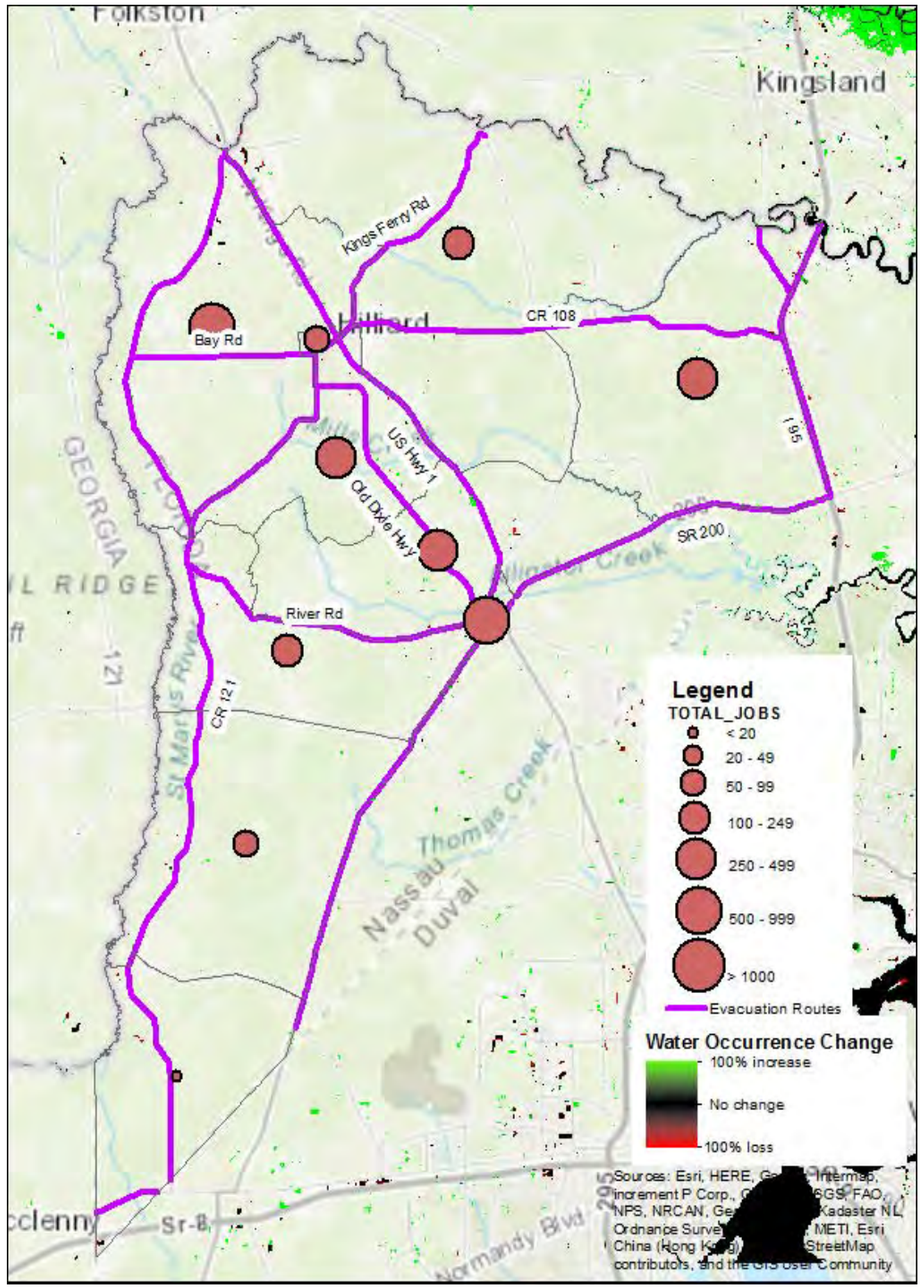


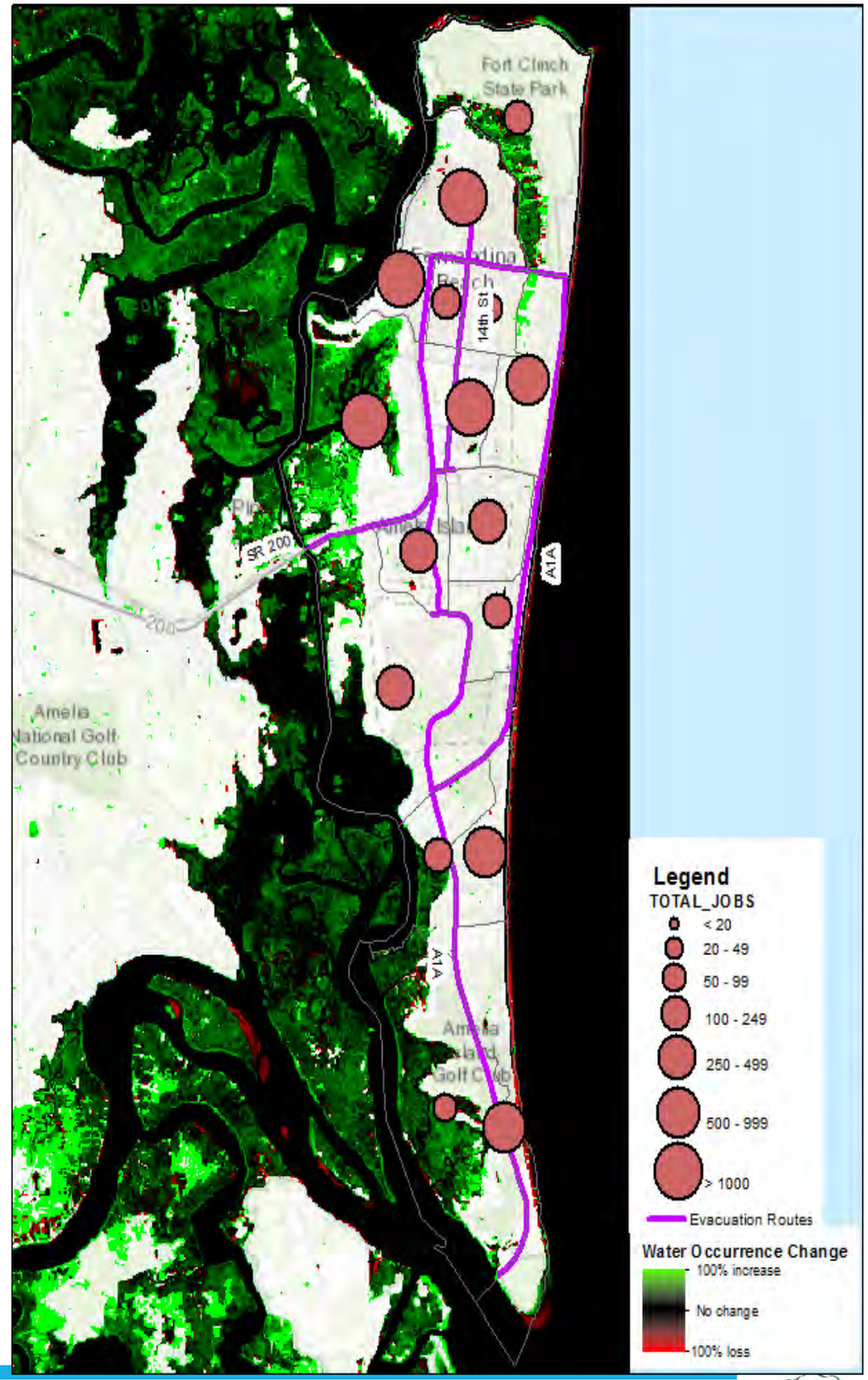
Series 11 Map 1. Employment Location by Block Group and Water Occurrence Change

Series 11 Maps illustrate the location of employment by block groups in 2015. These data include location of the workplace, but does not take into account the residences of workers (i.e., access to work is not addressed). The size of the dot indicates the relative number of reported workers in a block group. Additionally, the locations of the dots do not necessarily represent where employment is concentrated within that particular block group.

In the West, the largest employment center is in Callahan and there have been limited impacts due to increased episodic events.

On Amelia Island, employment centers are concentrated towards the northern portion of the island which includes paper mills, the marina, the historic district of Fernandina Beach. Those closer to the Intracoastal Waterway have been more impacted by episodic events.



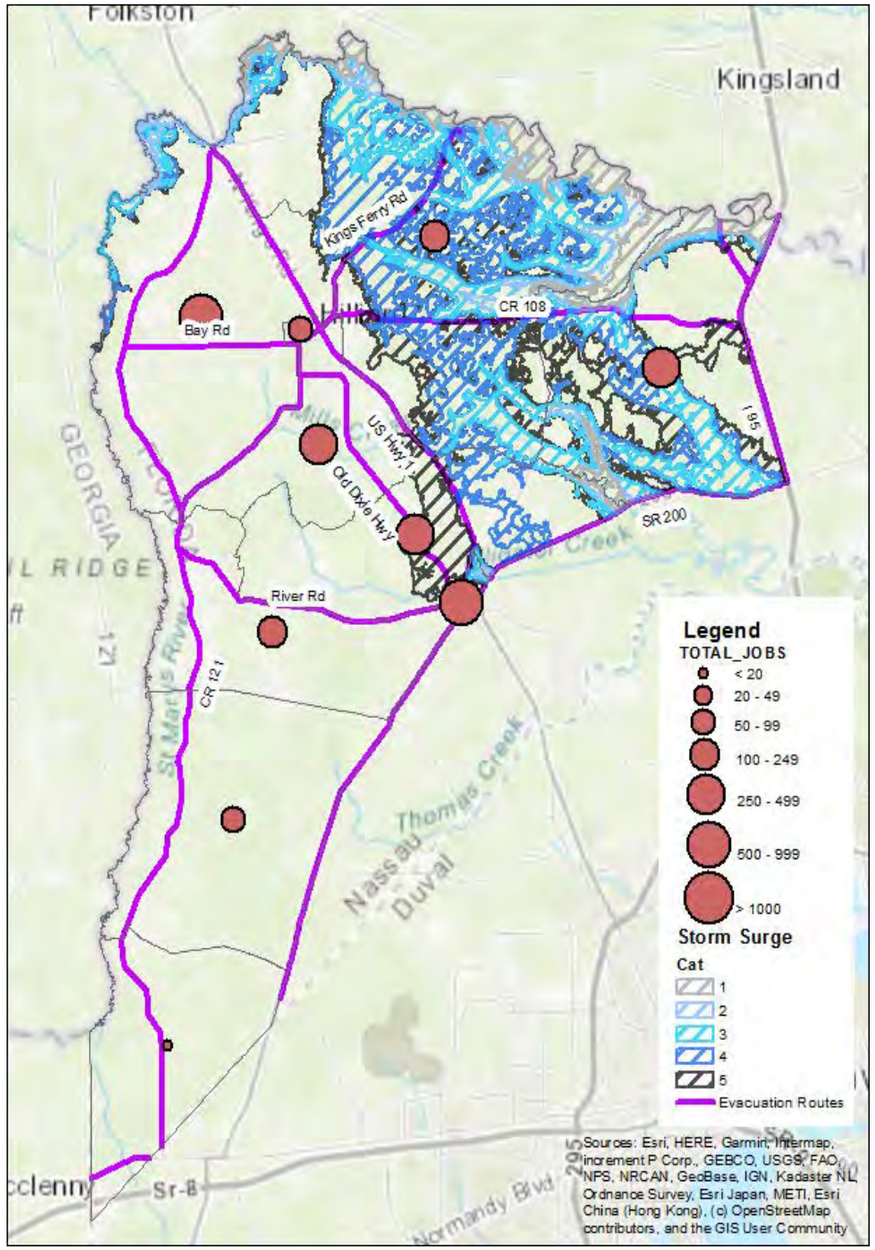


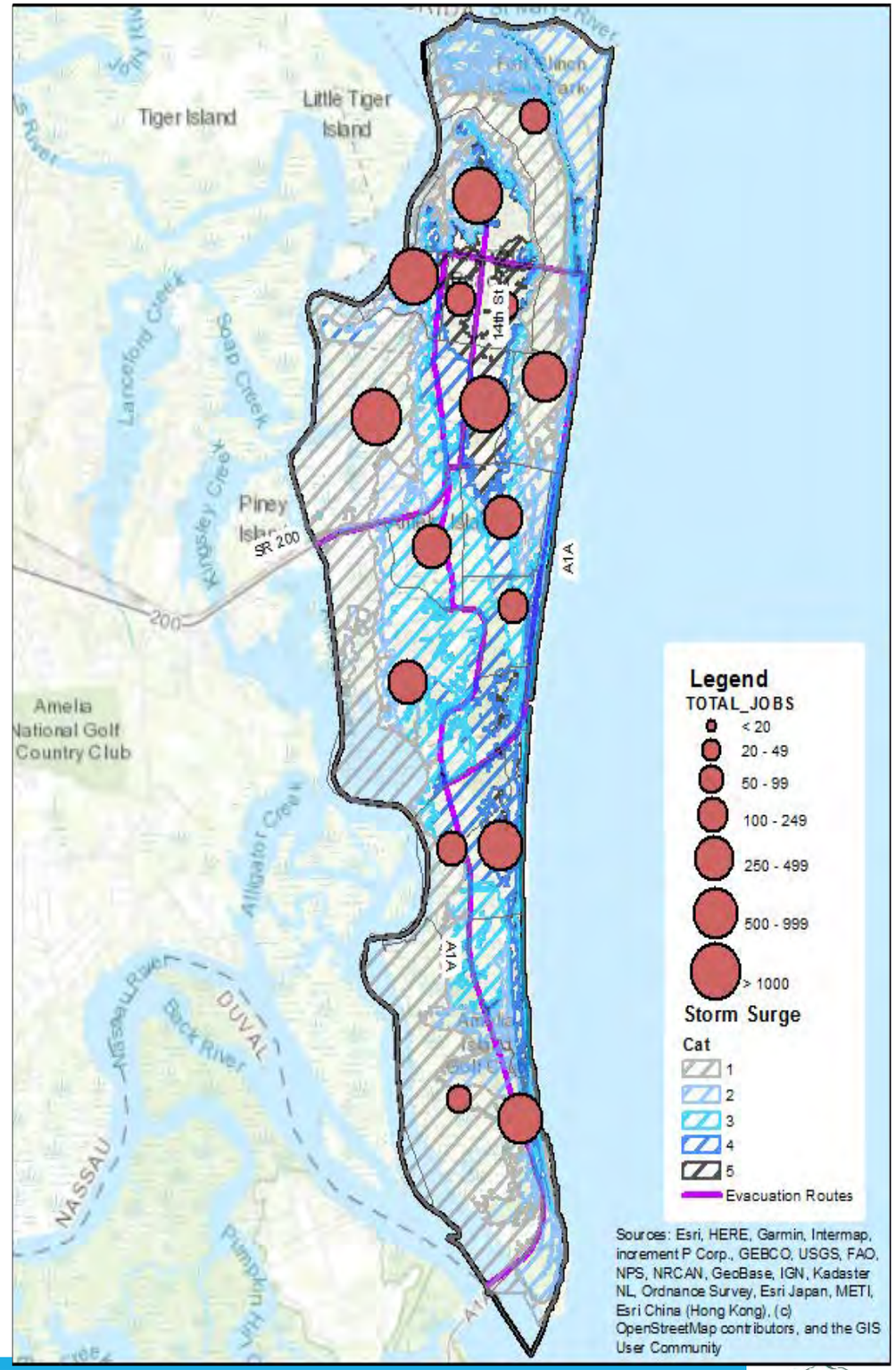
Sources: TBG Work Product; U.S. Census; EC JRC/Google

Series 11 Map 2. Employment Location by Block Group and Storm Surge

In contrast, Series 11 Map 2 evaluates how employment would be affected by storm surge. In the West area, the largest employment is found near Callahan, which would not have many impacts until a Category 3 storm surge.

In Amelia Island, the largest employment is in block groups near the City of Fernandina Beach. Coastal block groups would be impacted by a Category 1 storm surge, while those block groups located towards the interior of the islands would be inundated by surges accompanying stronger storms.





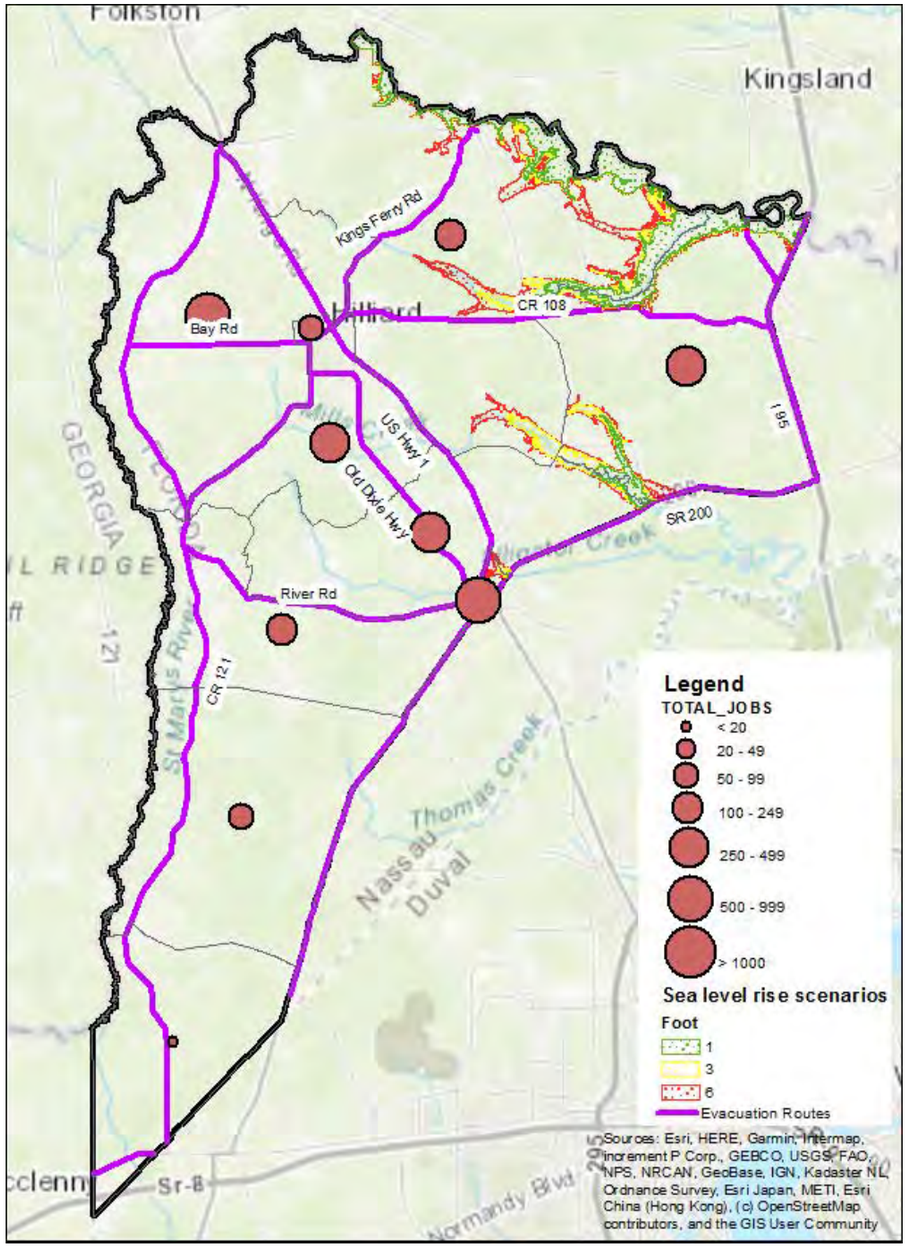
Sources: TBG Work Product; U.S. Census; NOAA

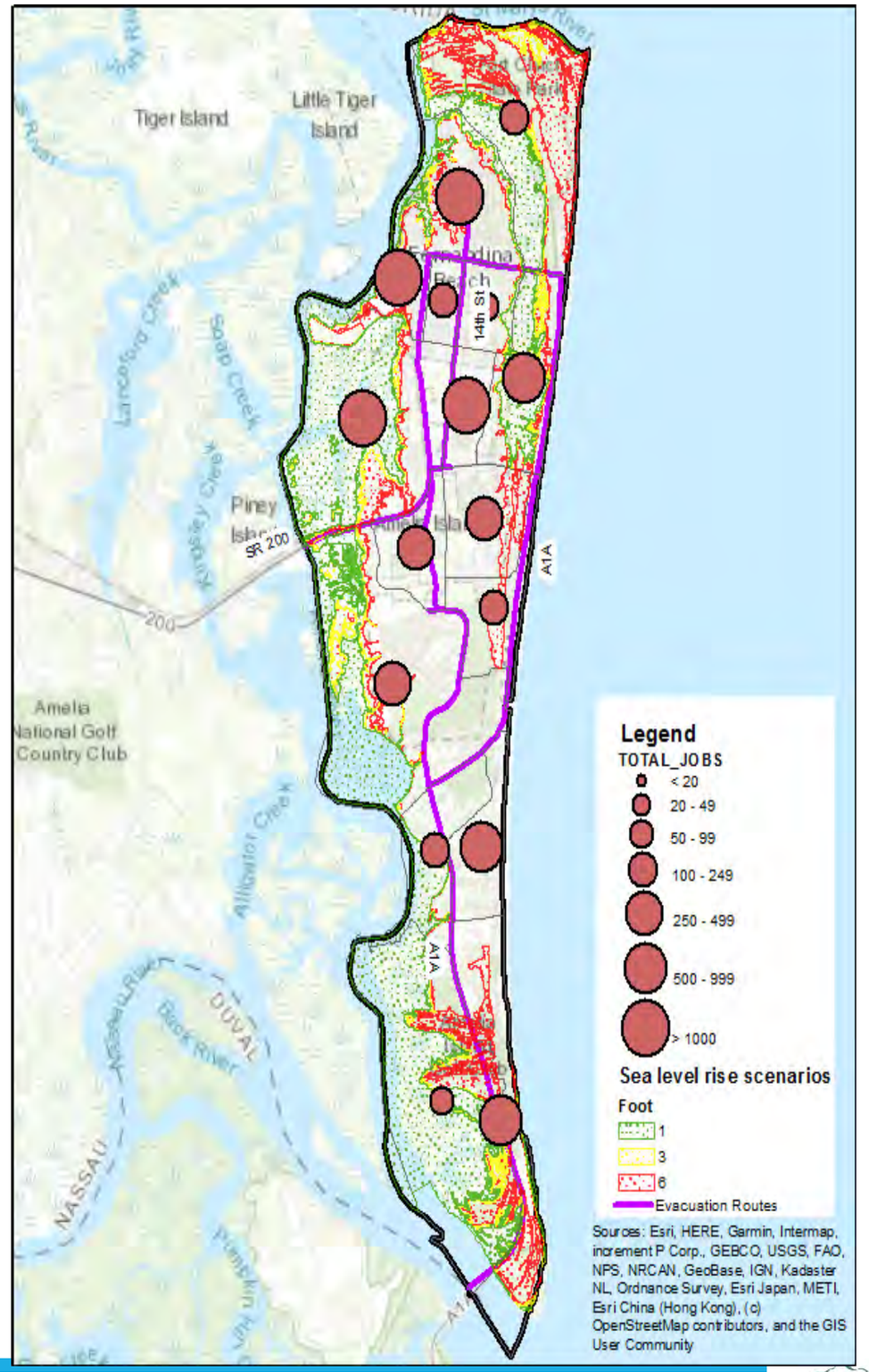
Series 11 Map 3. Employment Location by Block Group and Projected Sea Level Rise

Similarly, Series 11 Map 3 illustrates the concentrations of employment with respect to sea level rise.

In the West, the largest employment is near Callahan, where there is minimal sea level rise.

Coastal areas on Amelia Island are the most affected by any sea level rise scenario.



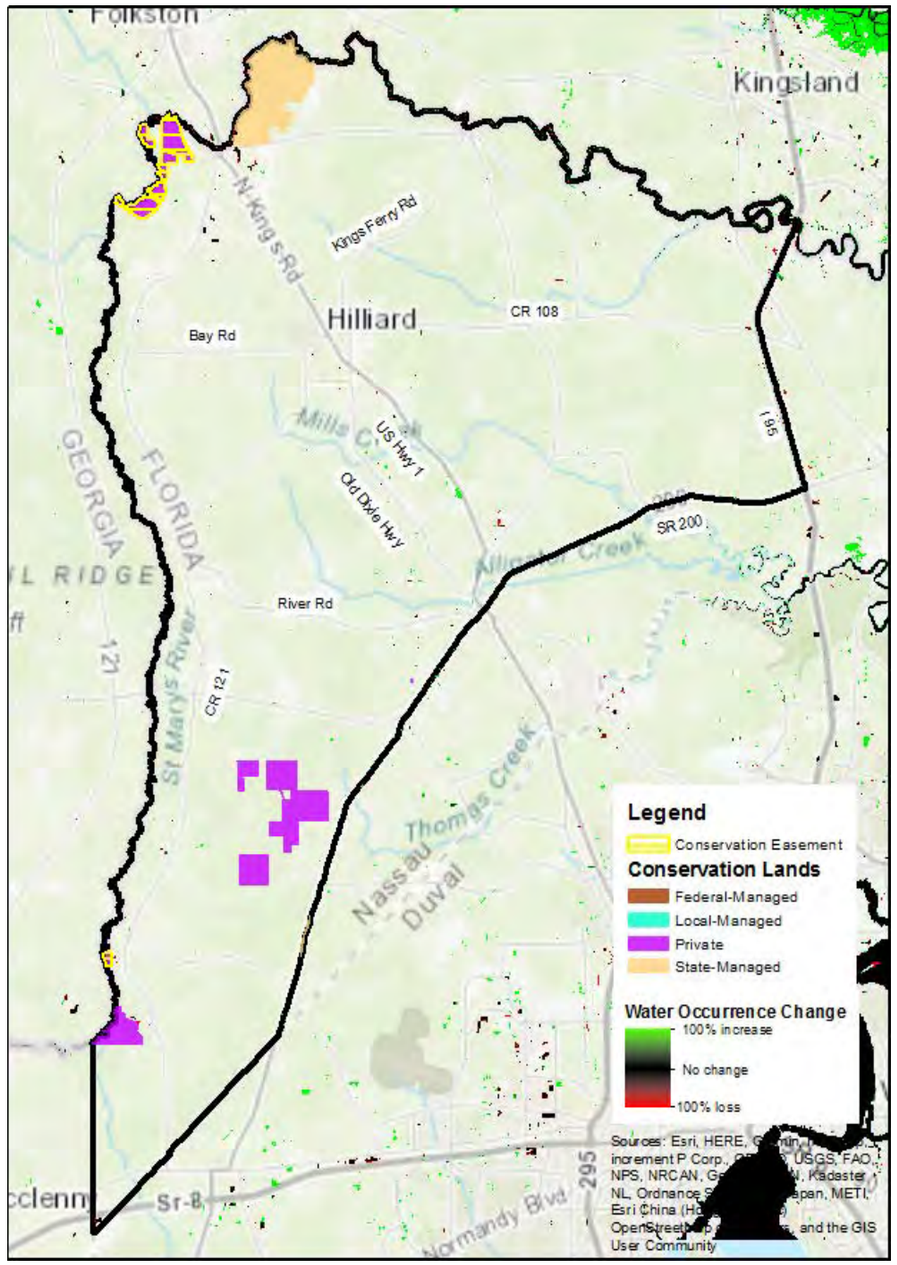


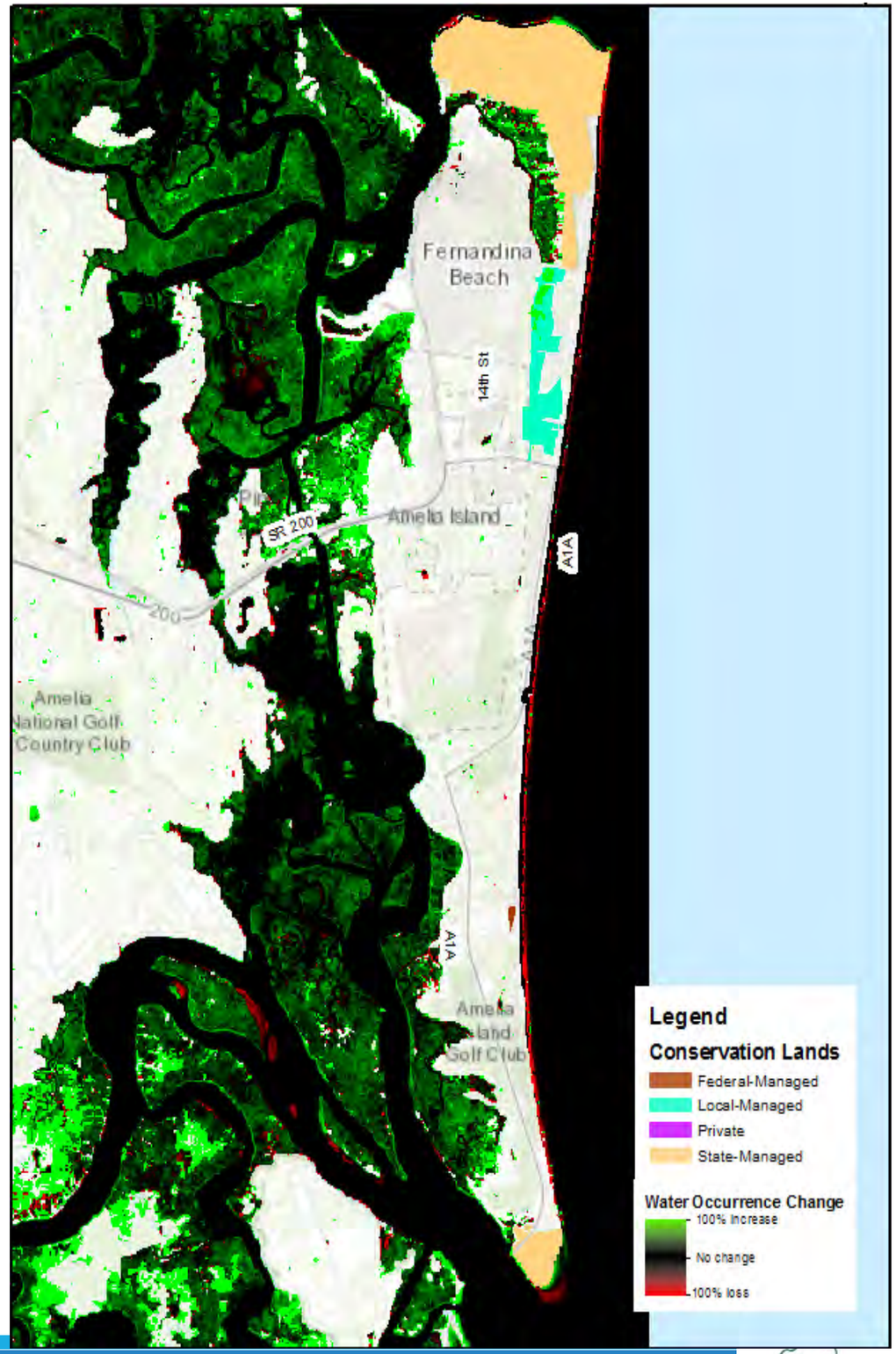
Series 12 Map 1. Conservation Lands and Water Occurrence Change

The Florida Natural Areas Inventory (FNAI) tracks areas managed by federal, state, local and private agencies for conservation. Series 12 Map 1 shows these existing state and privately managed conservation lands in the context of increased water frequency.

There are approximately 12,000 and 22,000 acres of such managed lands on Amelia Island and in the West, respectively.

According to FNAI and the Natural Resources Conservation Service (NRCS), the West area includes the St. Mary's River Ranch Conservation Easements.



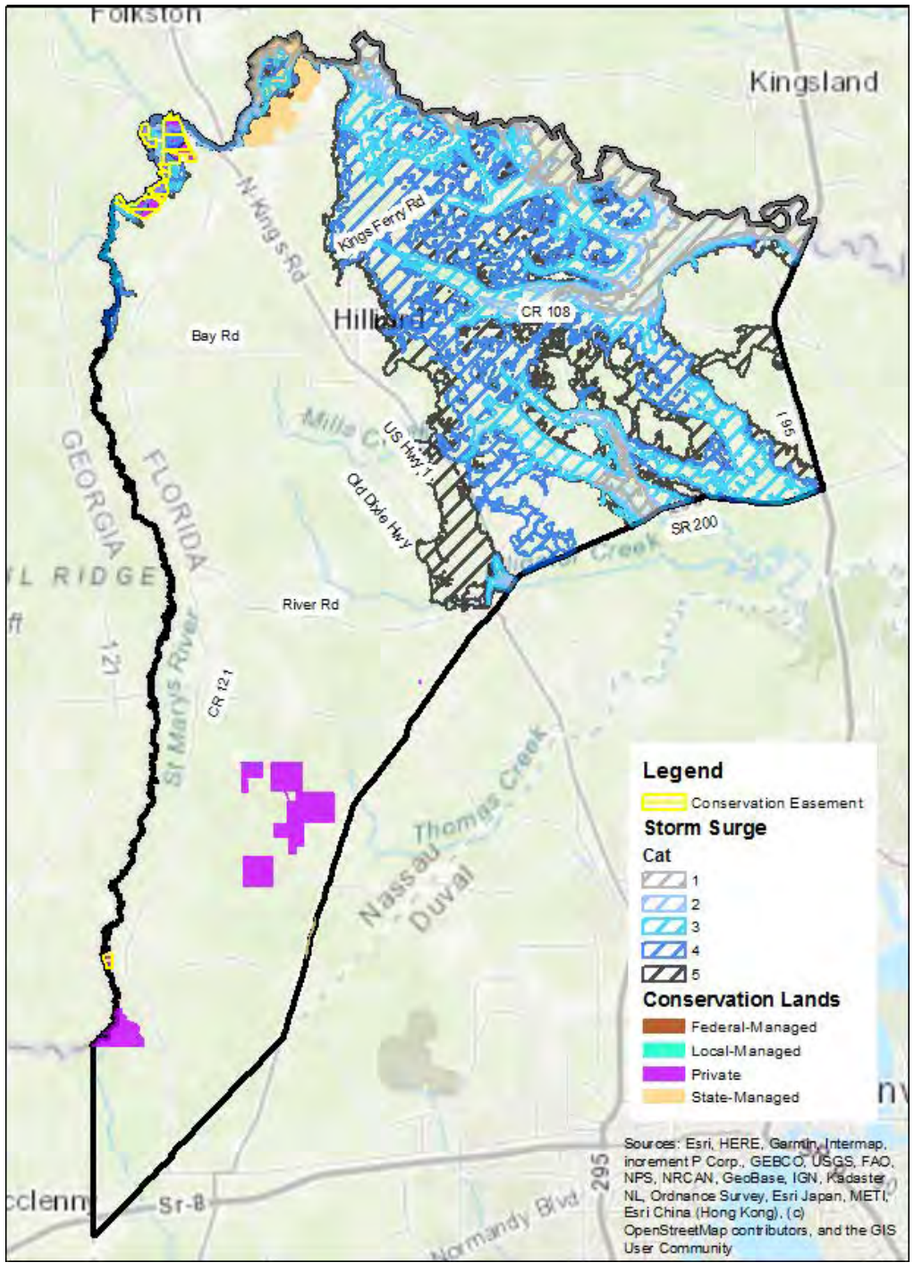


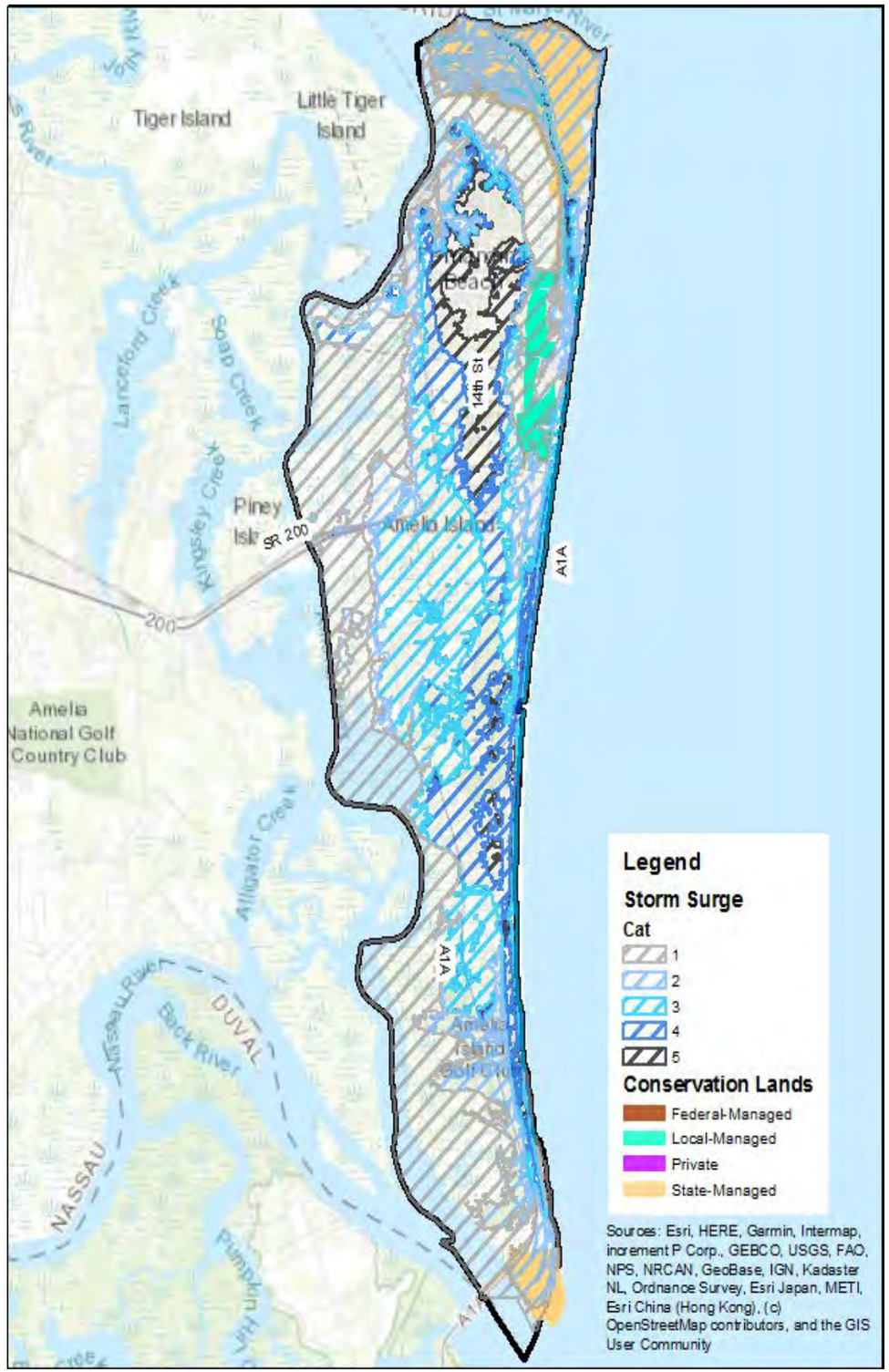
Series 12 Map 2. Conservation Lands and Storm Surge

Series 12 Map 2 shows existing conservation lands in the context of storm surge zones. With the exception of the conservation lands that are in the southwest portion of the West study area, all of the conservation lands are within potential storm surge.

In the West, these include publicly owned properties along the St Marys River. [White Oak Plantation is addressed separately below.]

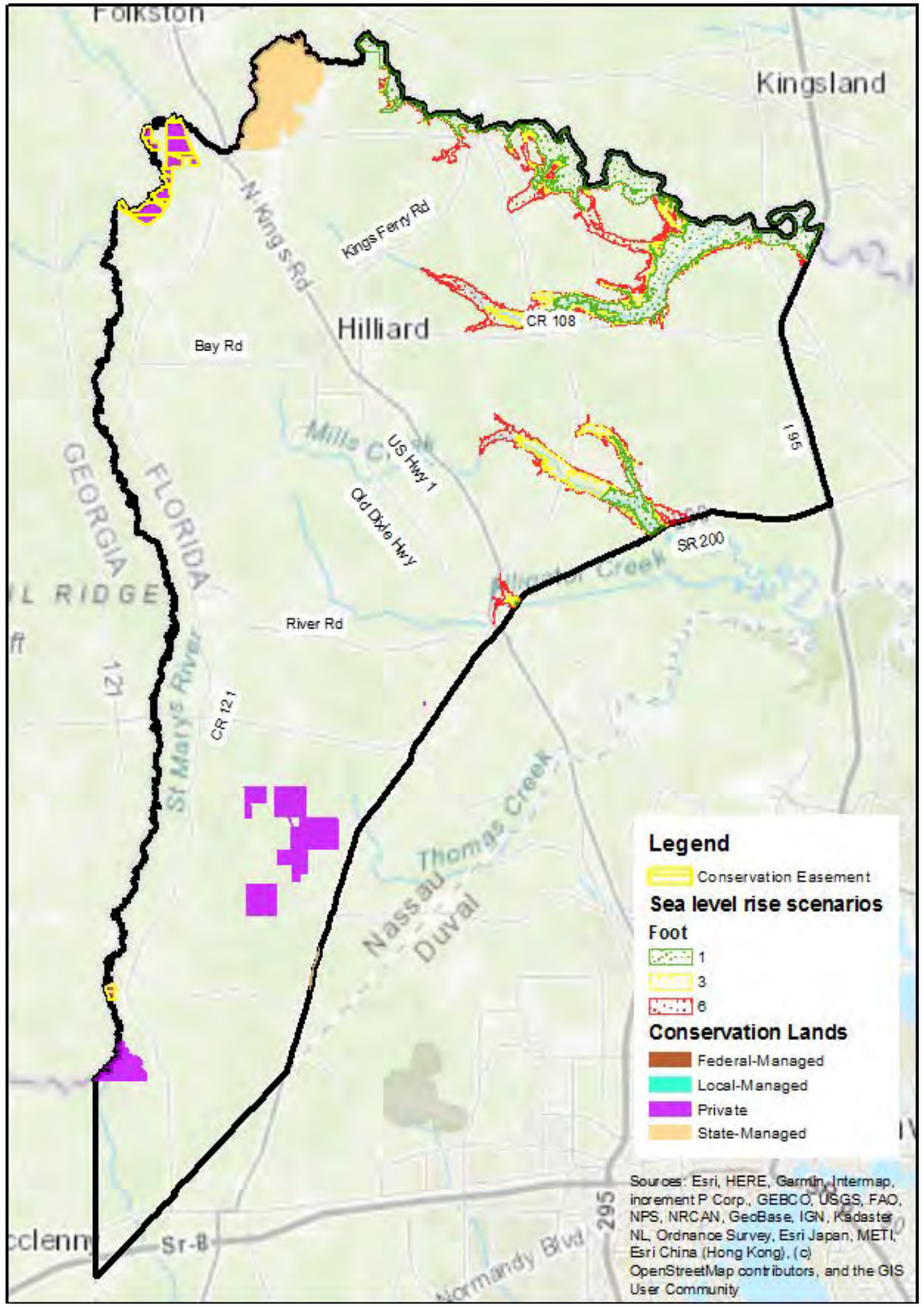
On Amelia Island, Ft Clinch State Park and the Egans Creek Greenway, both in the northeast side of the island, would be affected.

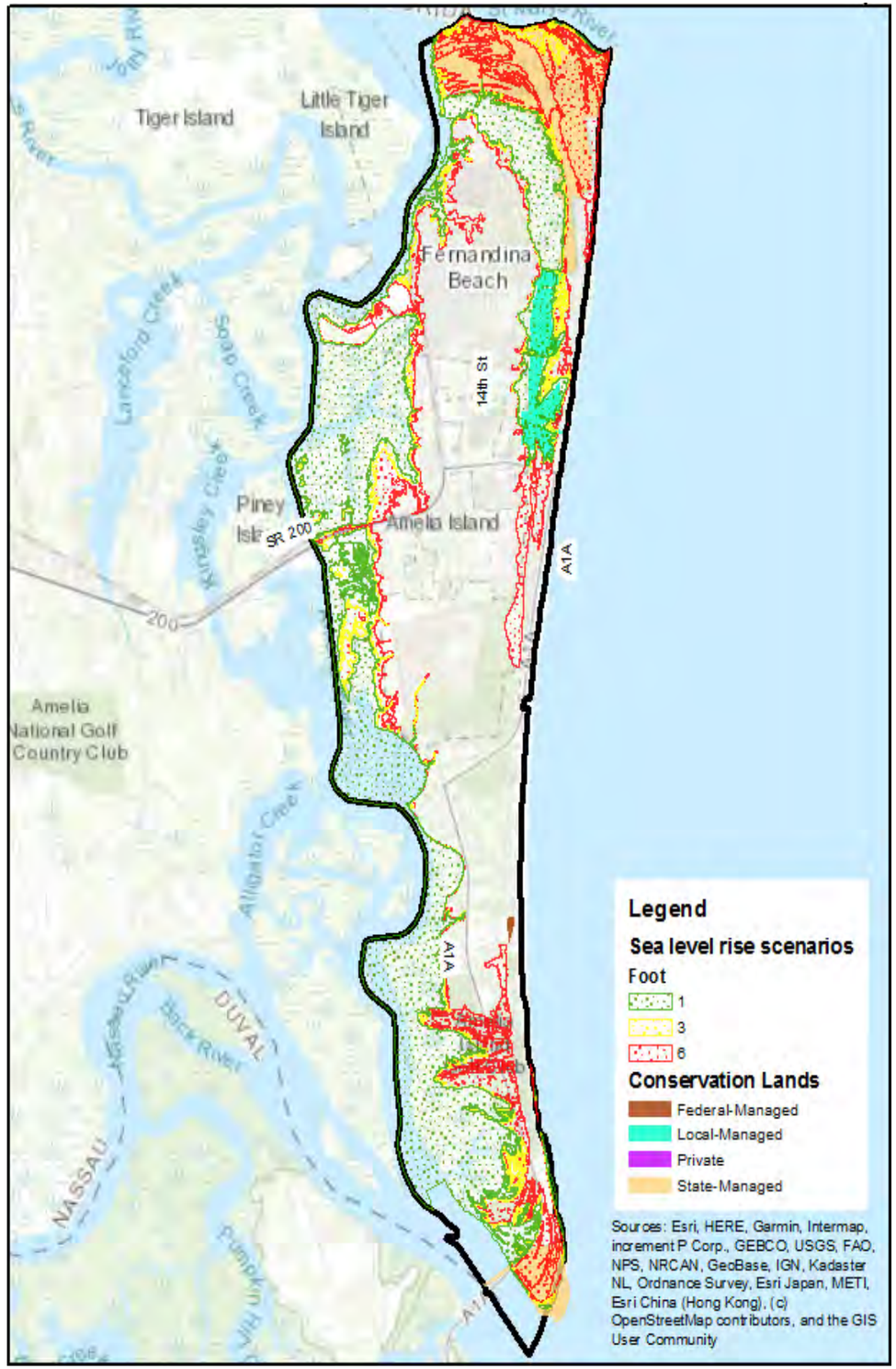




Series 12 Map 3. Conservation Lands and Projected Sea Level Rise

Series 12 Map 3 shows existing conservation lands in the context of projected sea level rise. While all conservation lands on Amelia Island overlap even a 1 ft. sea level rise, none of the lands in the West overlap with sea level rise projections.



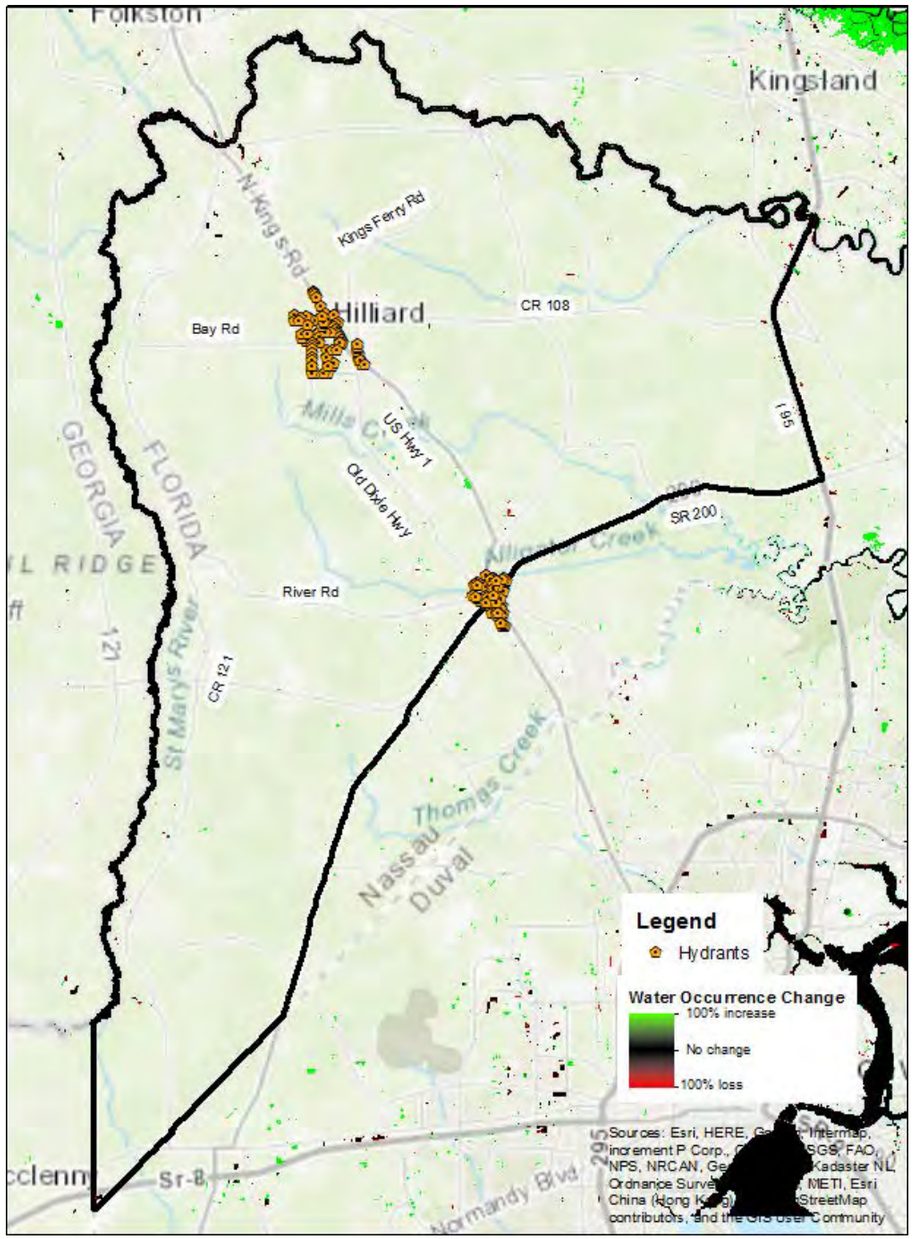


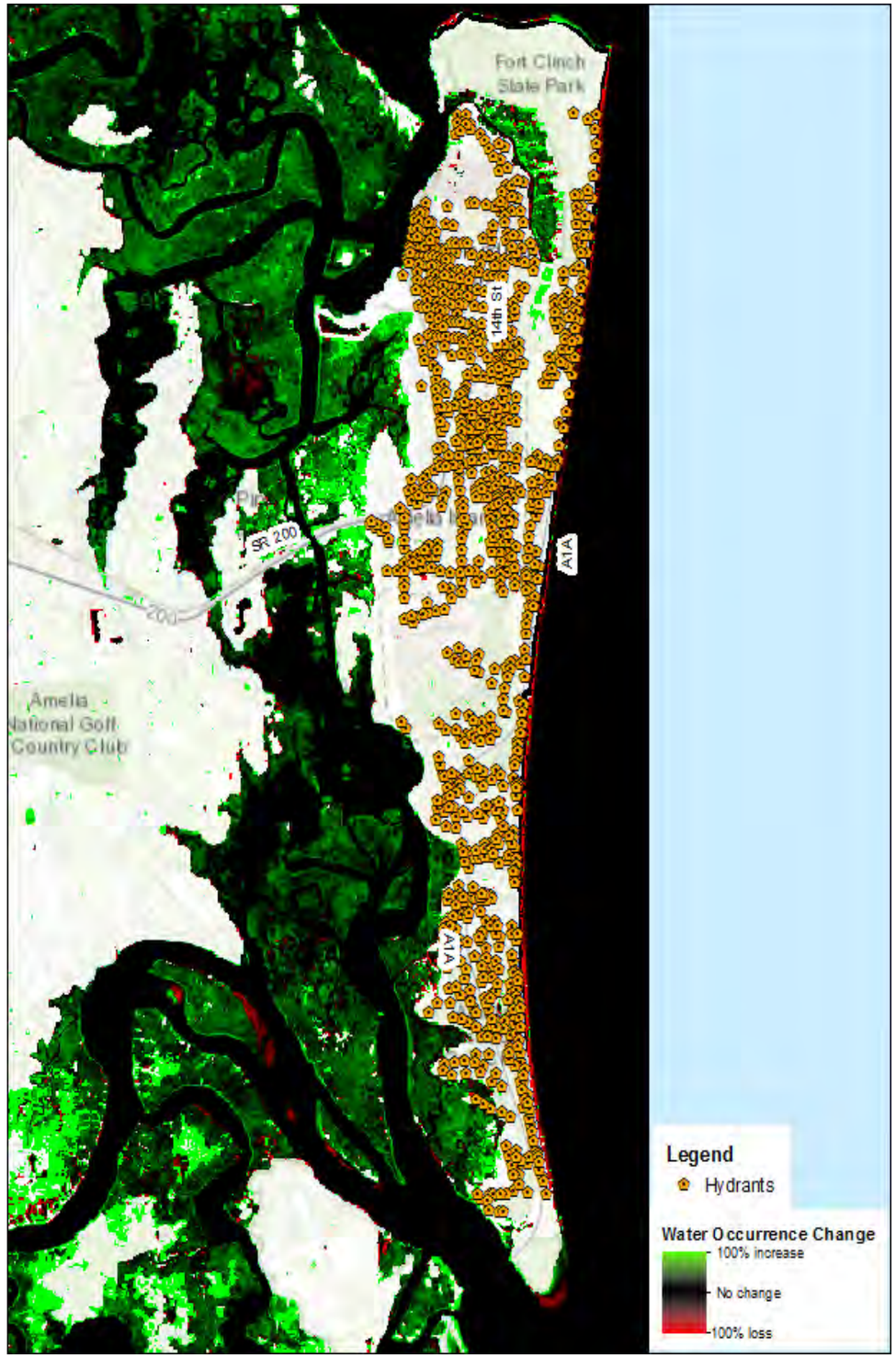
Series 13 Map 1. Critical Infrastructure: Hydrants and Water Occurrence Change

Series 13 Map 1 presents assessment of the County's critical infrastructure as it shows existing hydrants (i.e., potable water mains) in the context of water frequency changes.

Hydrants are evaluated because they may represent risks to availability of potable water in the event of vulnerability to the scenarios assessed in this study.

No hydrants in the West are within areas of increased water frequency. On Amelia Island, hydrants closer to the Intracoastal Waterway are more exposed to increased water frequency.



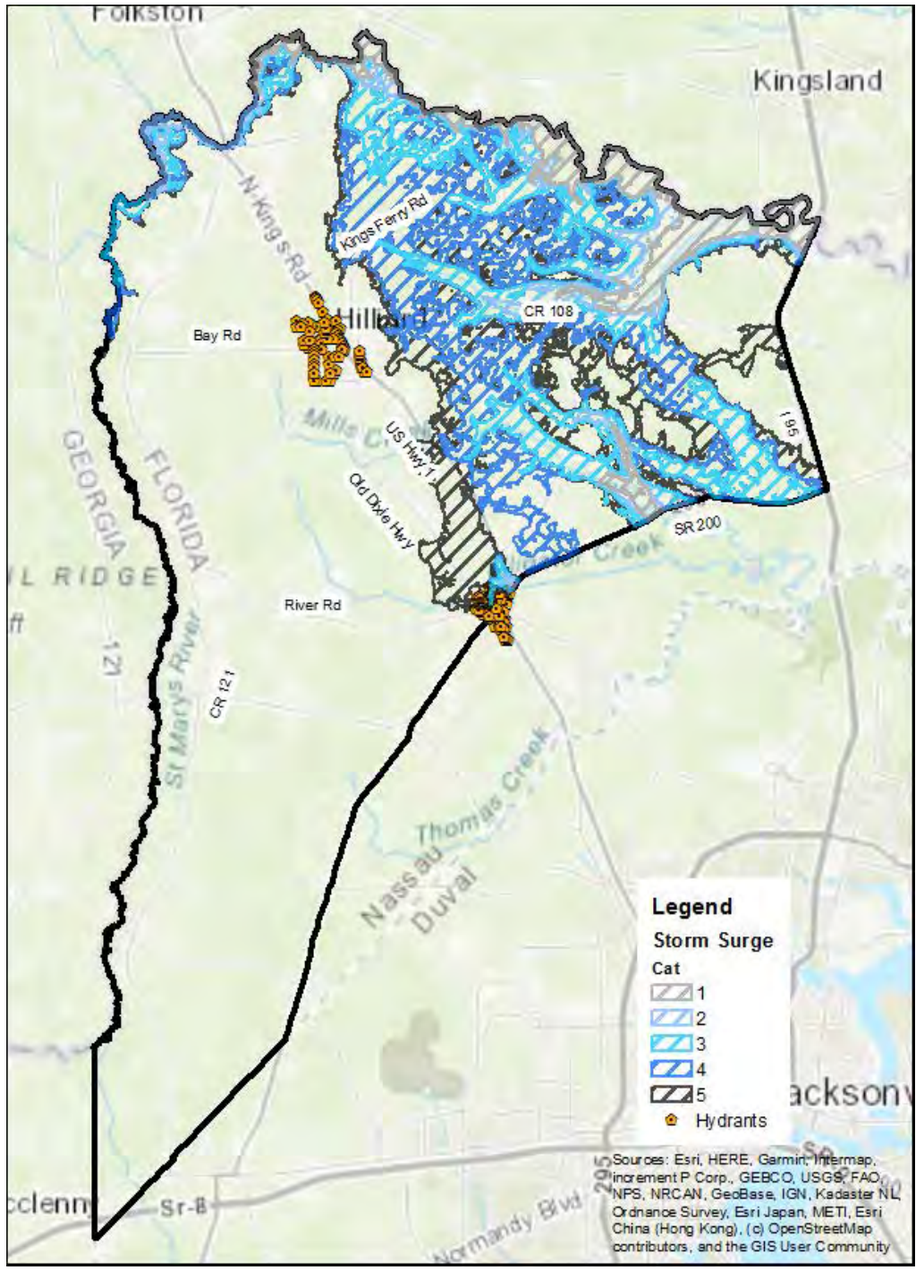


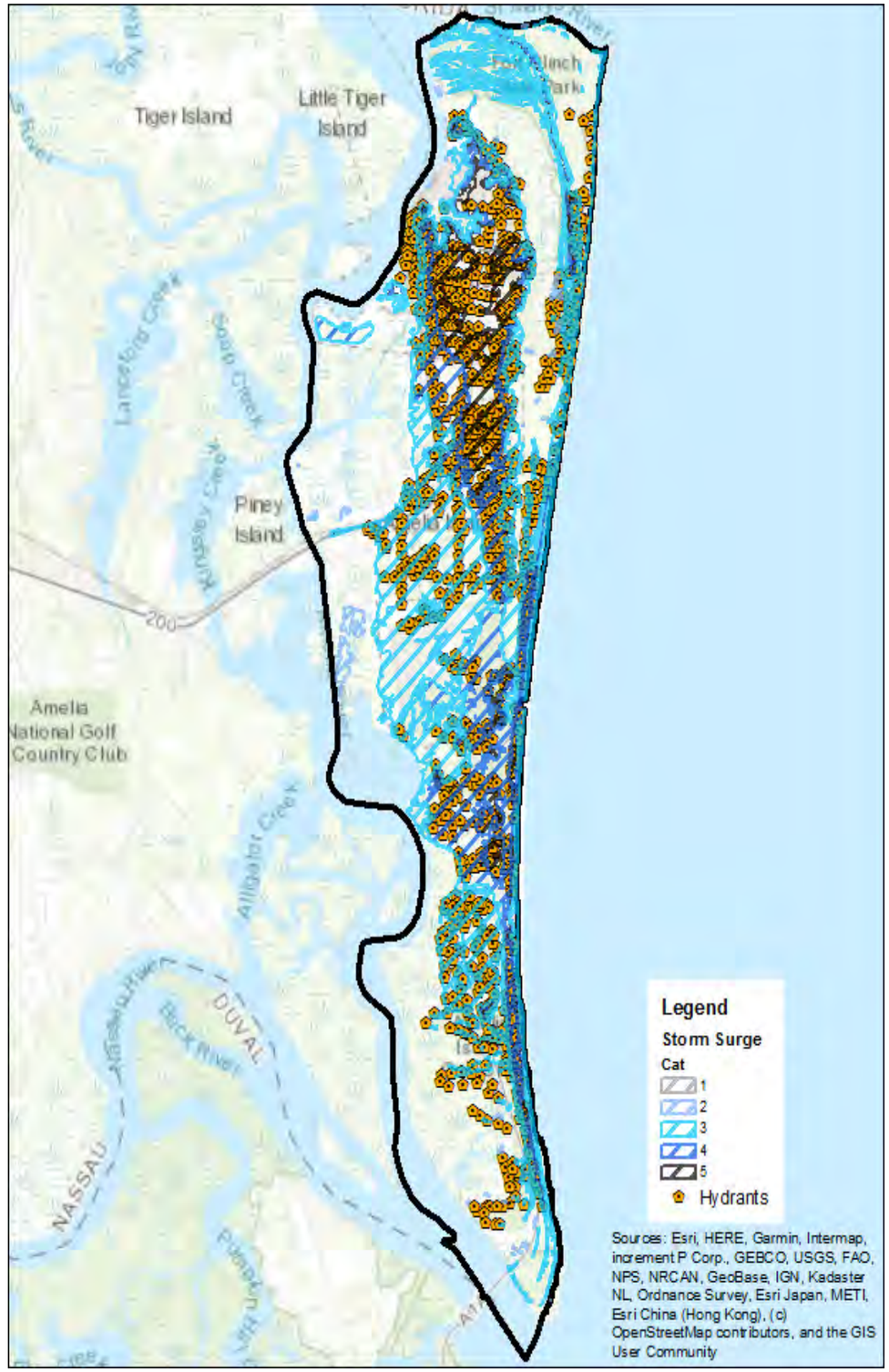
Series 13 Map 2. Critical Infrastructure: Hydrants and Storm Surge

Series 13 Map 2 shows existing hydrants in the context of storm surge zones.

In the West, none of the hydrants in Hilliard are within the zone of any storm surge category. Near Callahan, about 8% are within a Category 5 storm surge.

On Amelia Island, 1% of the hydrants are within a Category 1 storm surge, 43% are within a Category 3, and 93% are within a Category 5.



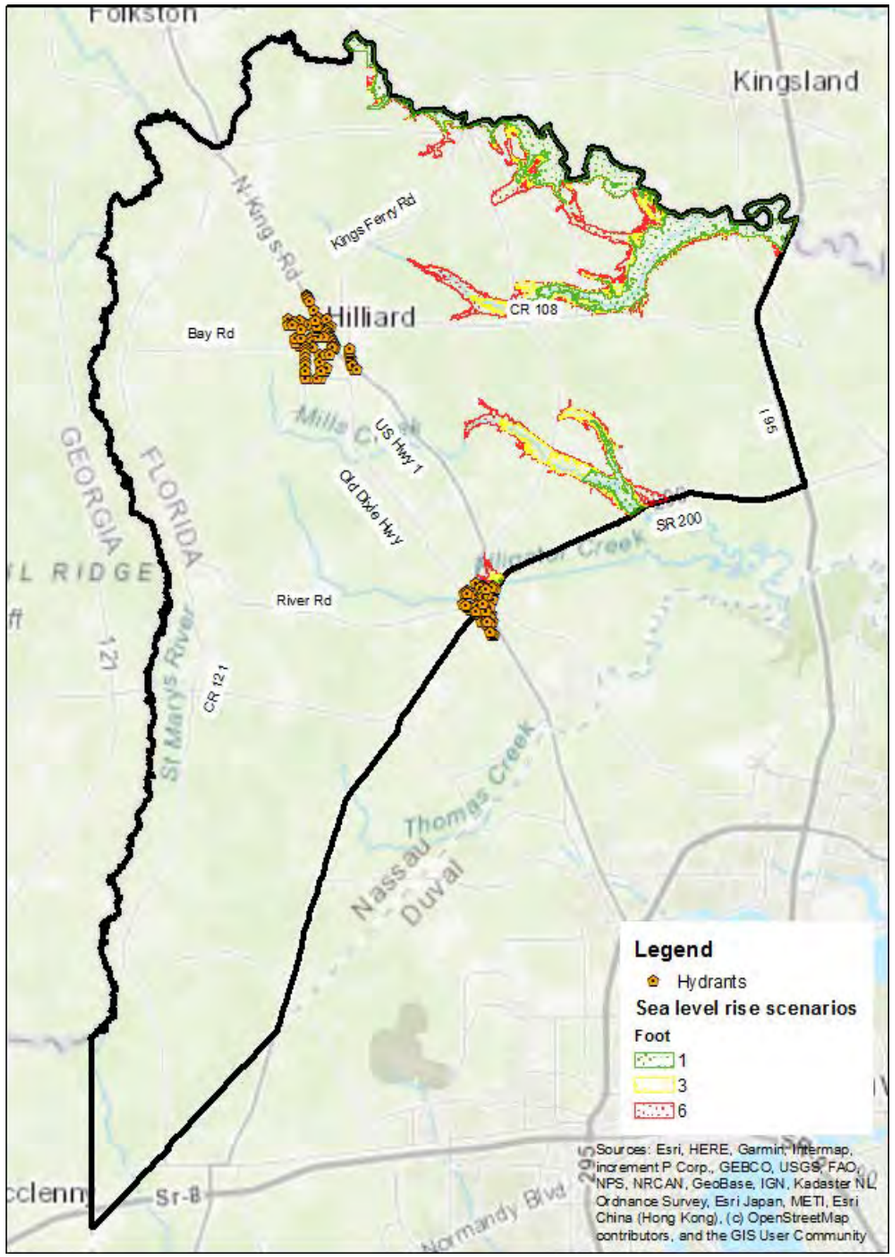


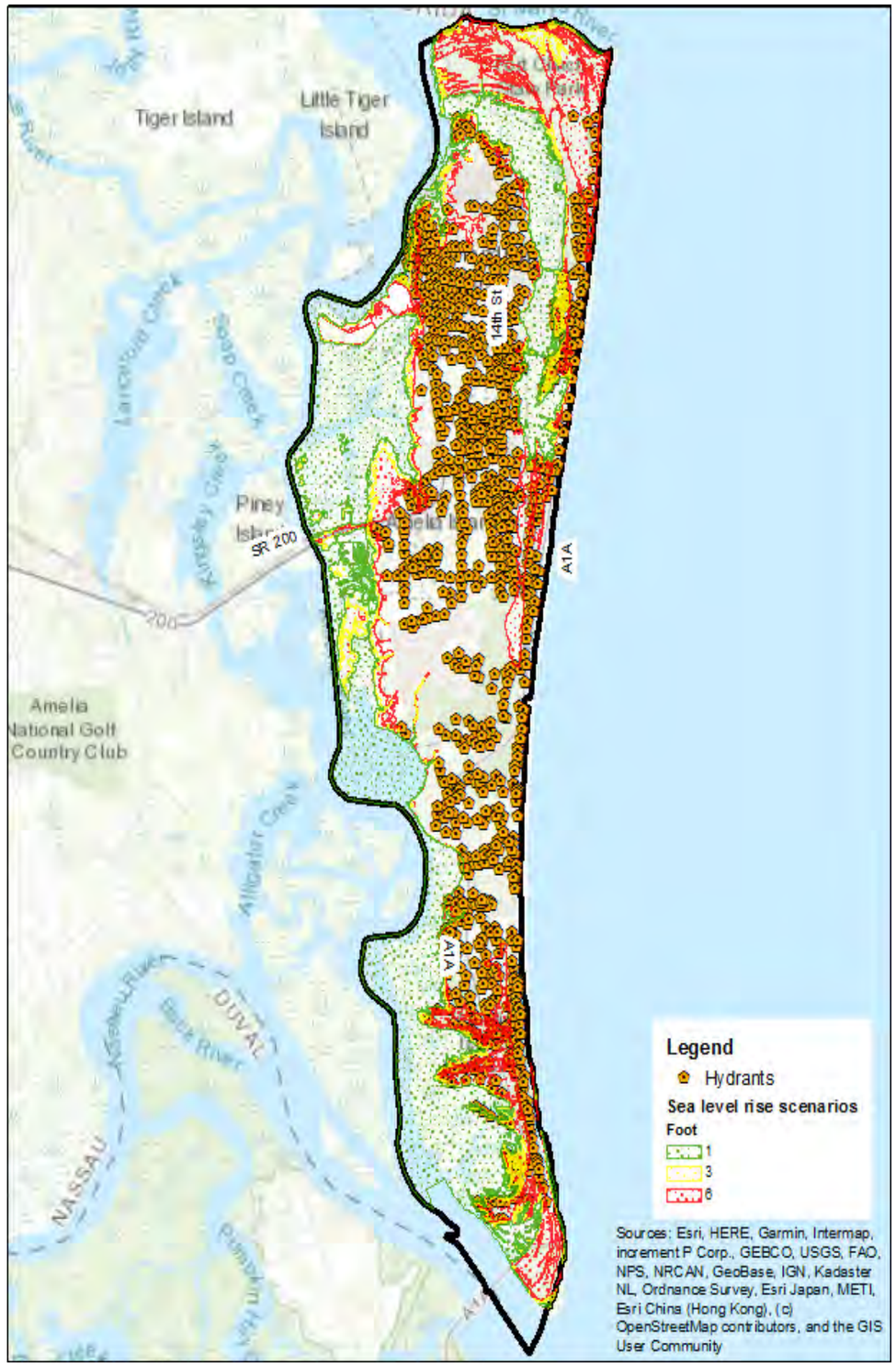
Sources: TBG Work Product; FNAI; NOAA

Series 13 Map 3. Critical Infrastructure: Hydrants and Sea Level Rise

Series 13 Map 3 shows existing hydrants in the context of sea level rise. None of the hydrants in the West are at risk of sea levels rise.

On Amelia Island, less than 1% of the infrastructure are within an area subject to a 1 ft. rise and 15% are within a 6 ft. rise in sea level.



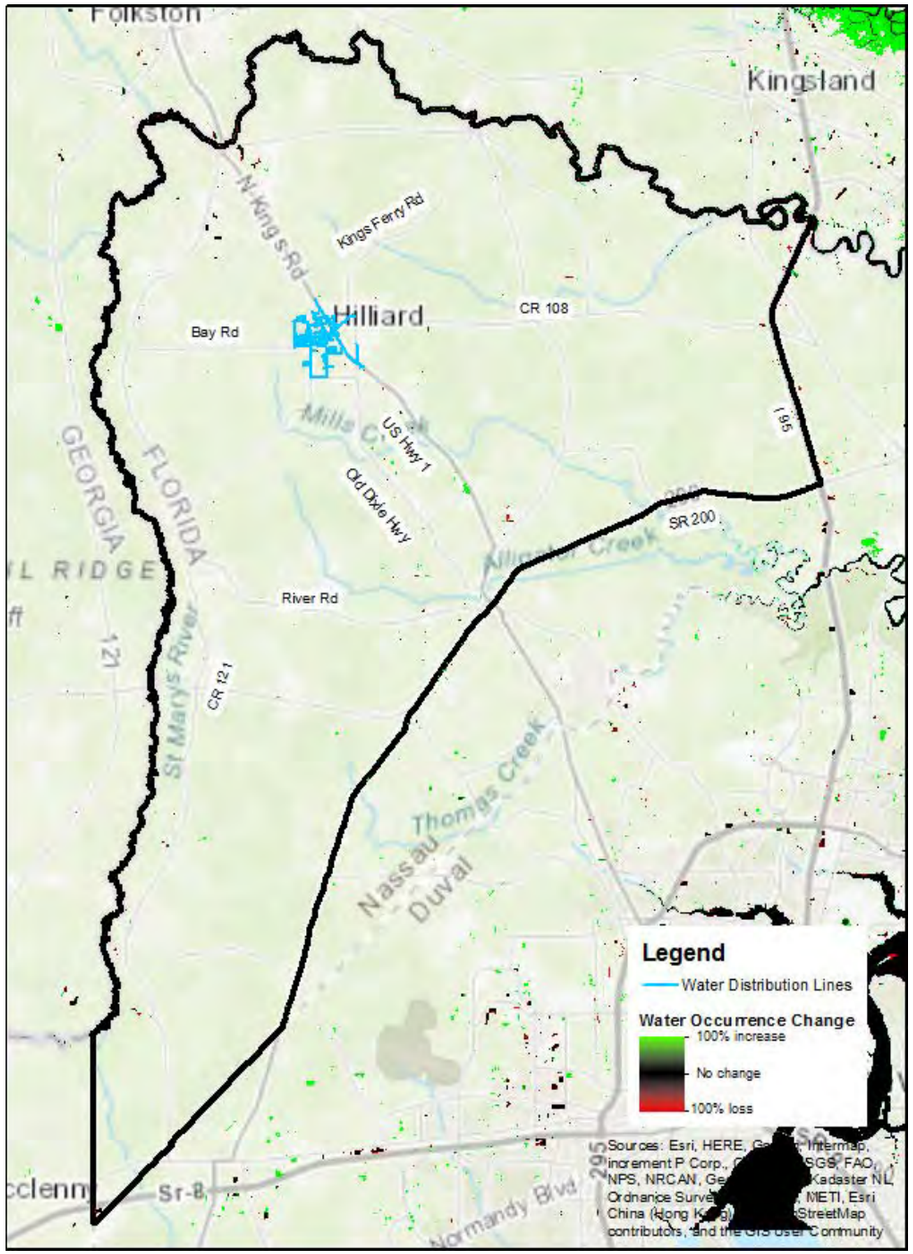


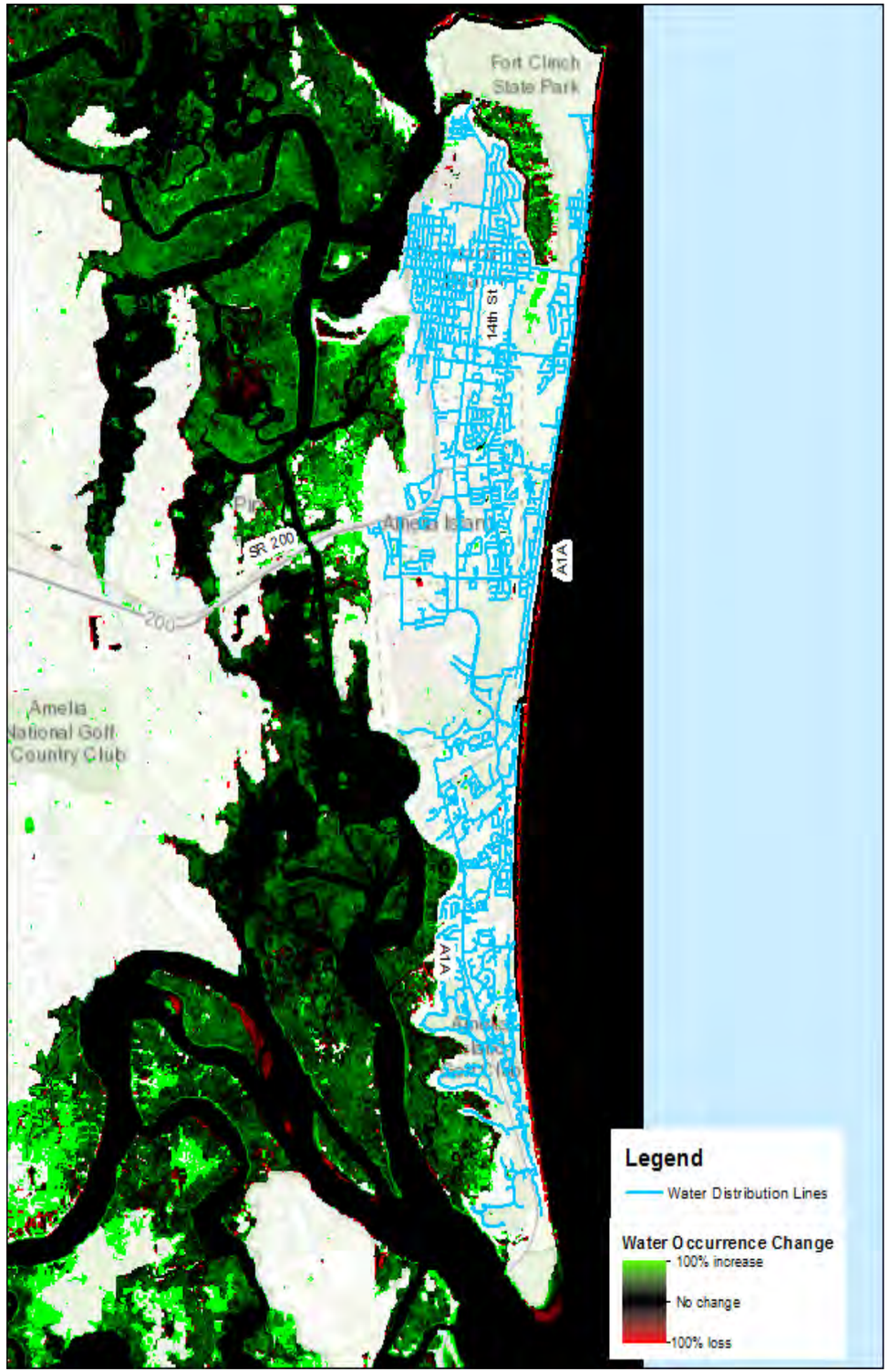
Series 14 Map 1. Critical Infrastructure: Water Distribution Lines and Water Occurrence Change

Potable water distribution pipelines are an additional portion of the County's critical infrastructure. Series 14 Map 1 shows water distribution pipelines in the context of water frequency.

Water distribution pipelines are of interest in a vulnerability framework to the extent that damage or access to infrastructure for maintenance becomes a concern.

There is no overlap of increased water frequency with the network in Hilliard. However, on Amelia Island there are several waterlines closest to the Intracoastal Waterway that are in areas documented to have experienced an increase in water frequency.



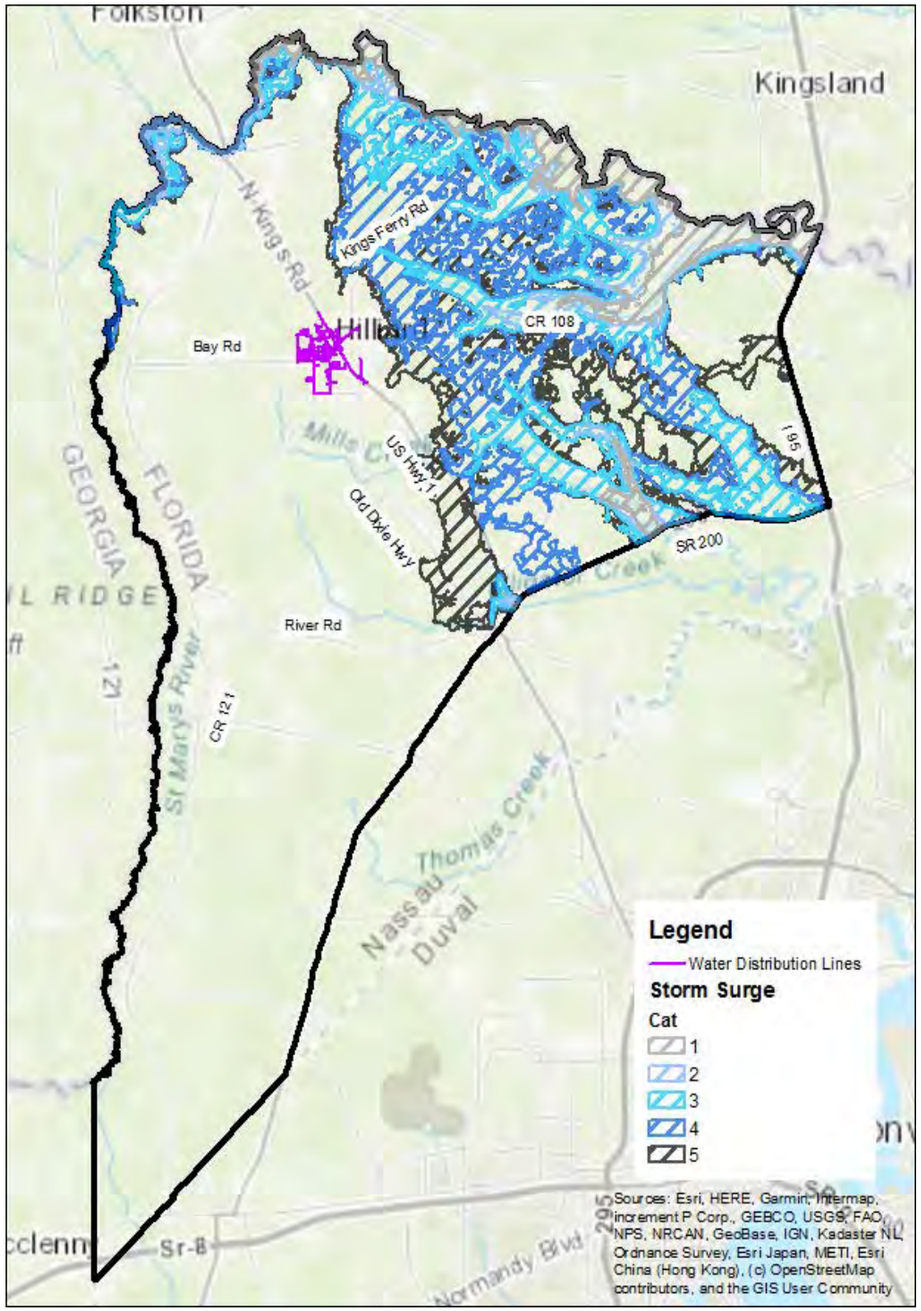


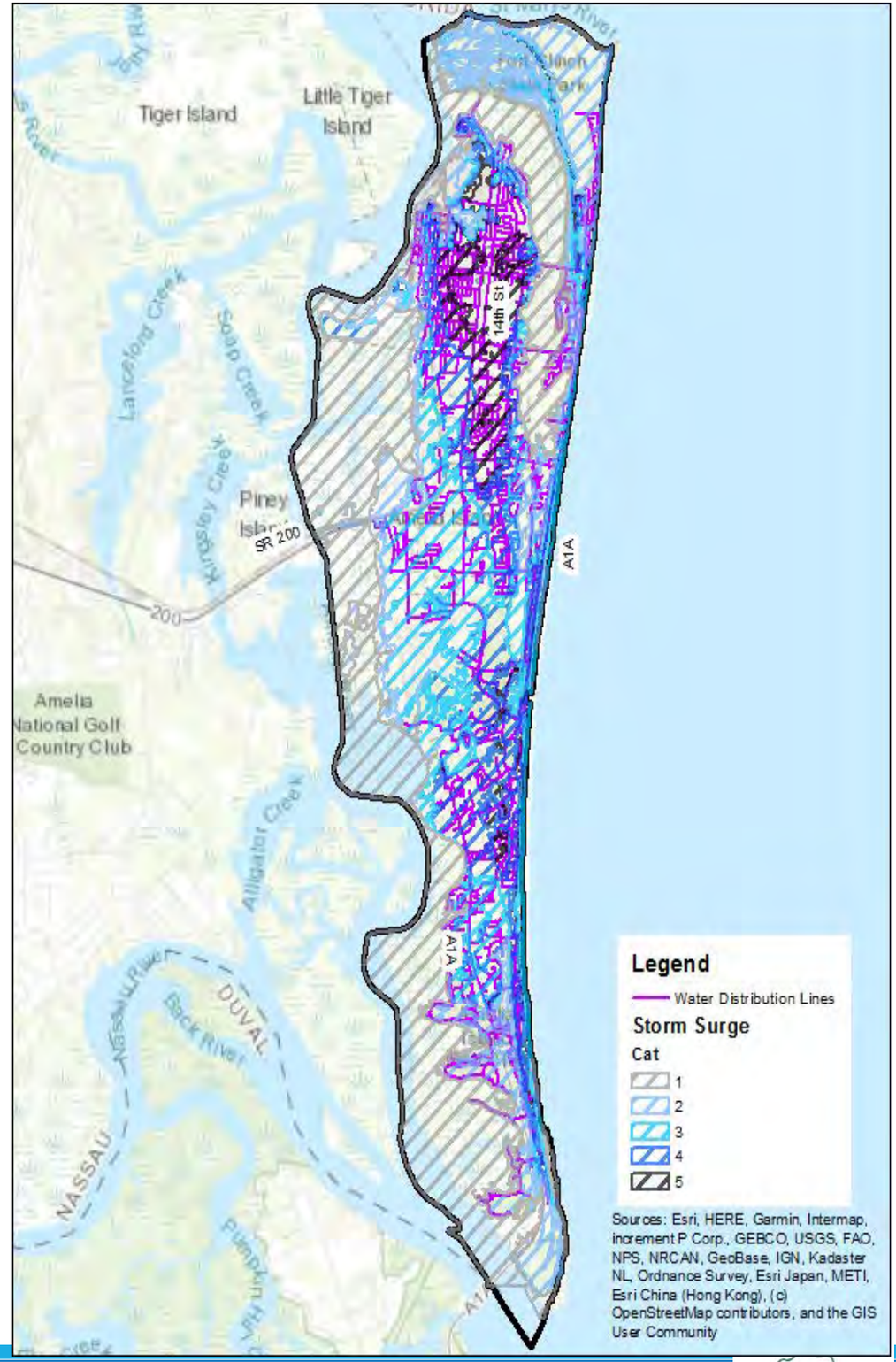
Sources: TBG Work Product; FNAI; NOAA

Series 14 Map 2. Critical Infrastructure: Water Distribution Lines and Storm Surge

Series 14 Map 2 shows exposure of water distribution pipelines to event-driven flooding (storm surge).

None of the pipelines in the West area are within storm surge. On Amelia Island, 3% are within a Category 1, 48% within a Category 3 and 96% within a Category 5 storm surge.



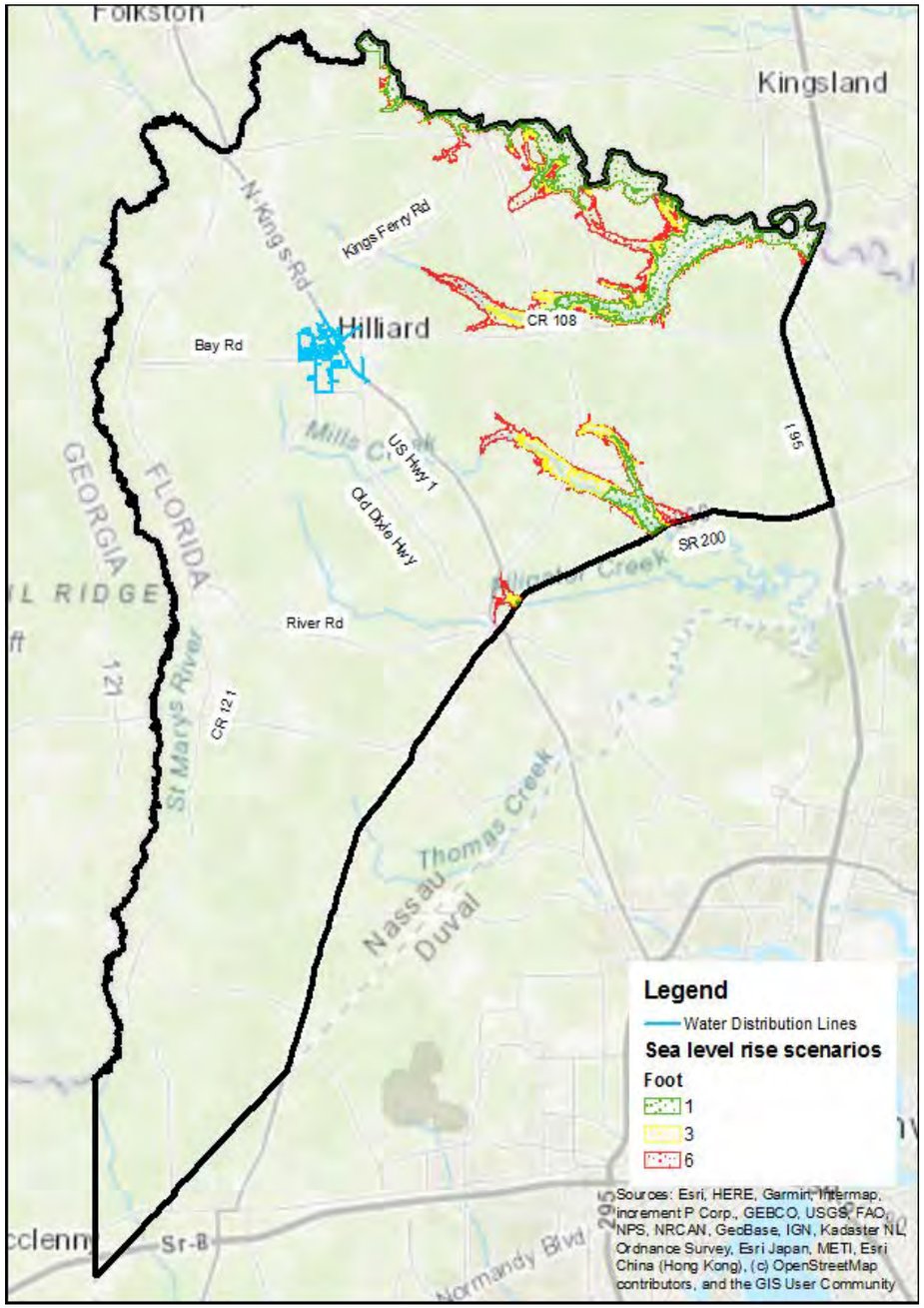


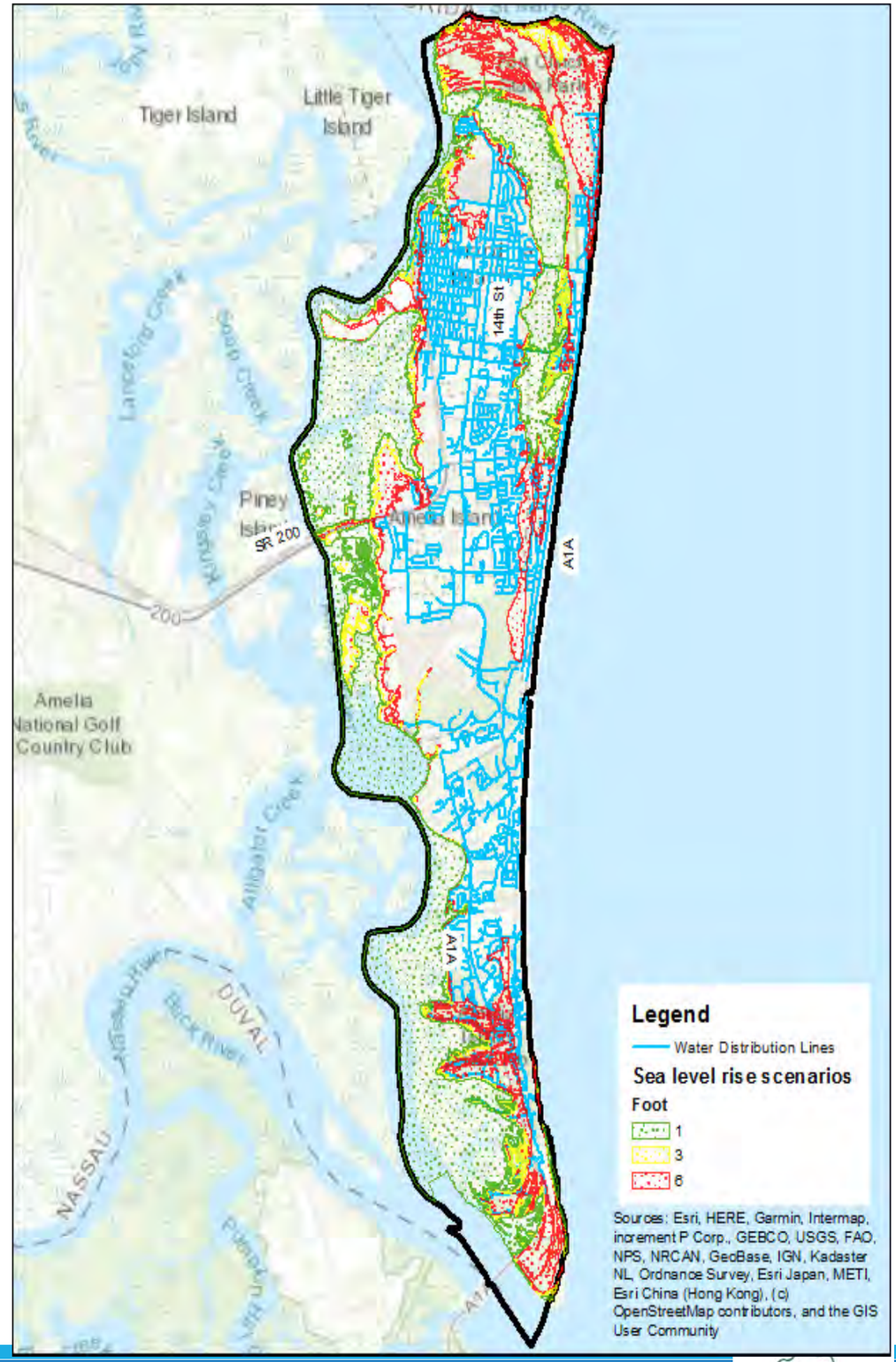
Sources: TBG Work Product; FNAI; NOAA

Series 14 Map 3. Critical Infrastructure: Water Distribution Lines and Sea Level Rise

Series 14 Map 3 shows the exposure of water distribution pipelines in the context of sea level rise.

None of the pipelines in the West are within a 6 ft. sea level rise scenario. On Amelia Island, 1% are within a 1 ft. rise and 21% are within a 6 ft. rise in sea levels.



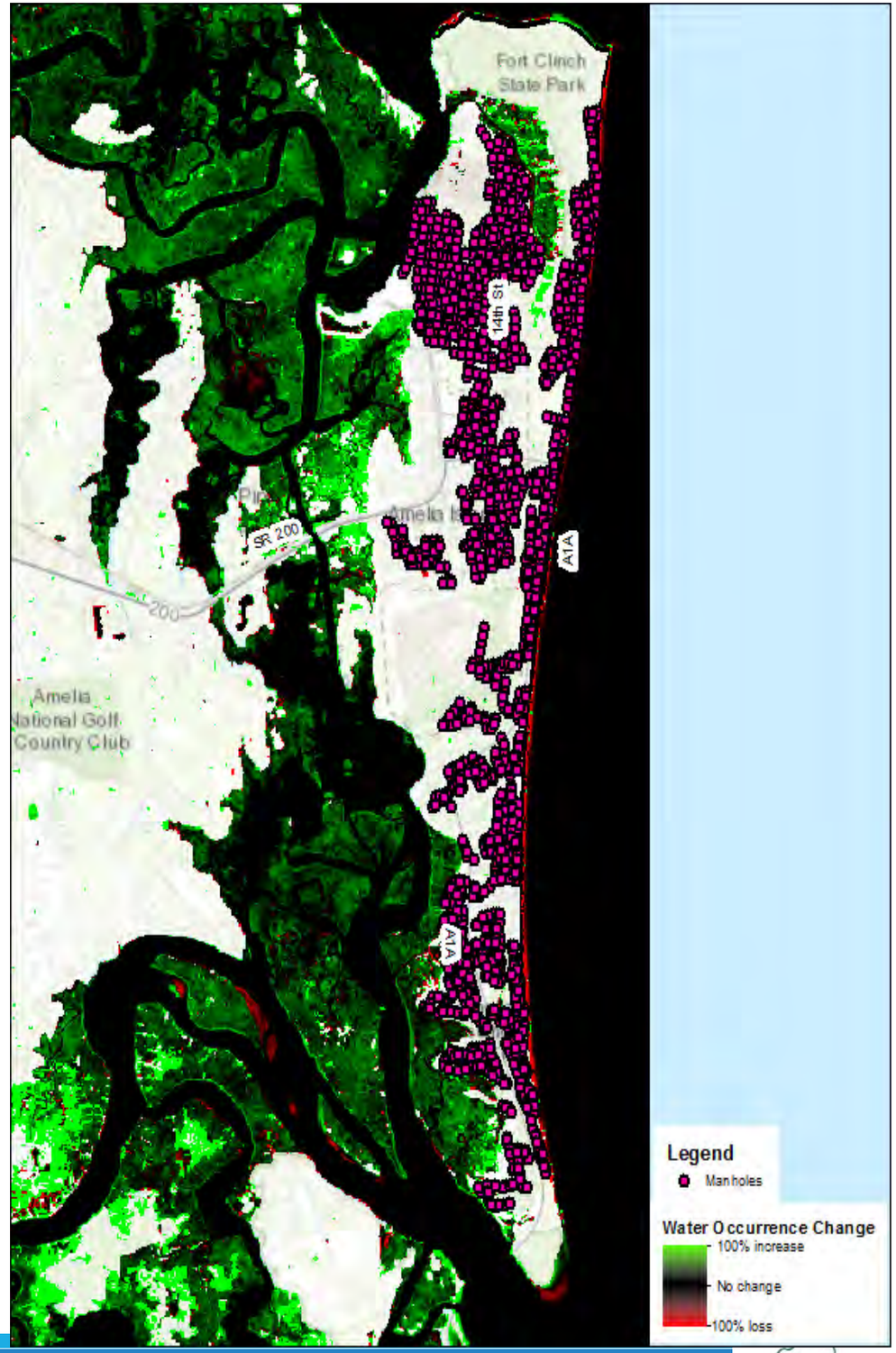


Sources: TBG Work Product; FNAI; NOAA

Series 15 Map 1. Critical Infrastructure: Sewer Infrastructure and Water Occurrence Change

Given that the West area does not have any sewer manhole data, the maps in Series 15 show sewer lines (map on left) and manholes (map on right) for Amelia Island only.

Series 15 Map 1 shows this infrastructure in the context of water frequency changes. Infrastructure closest to the Intracoastal Waterway are in areas documented to have experienced an increase in water frequency.



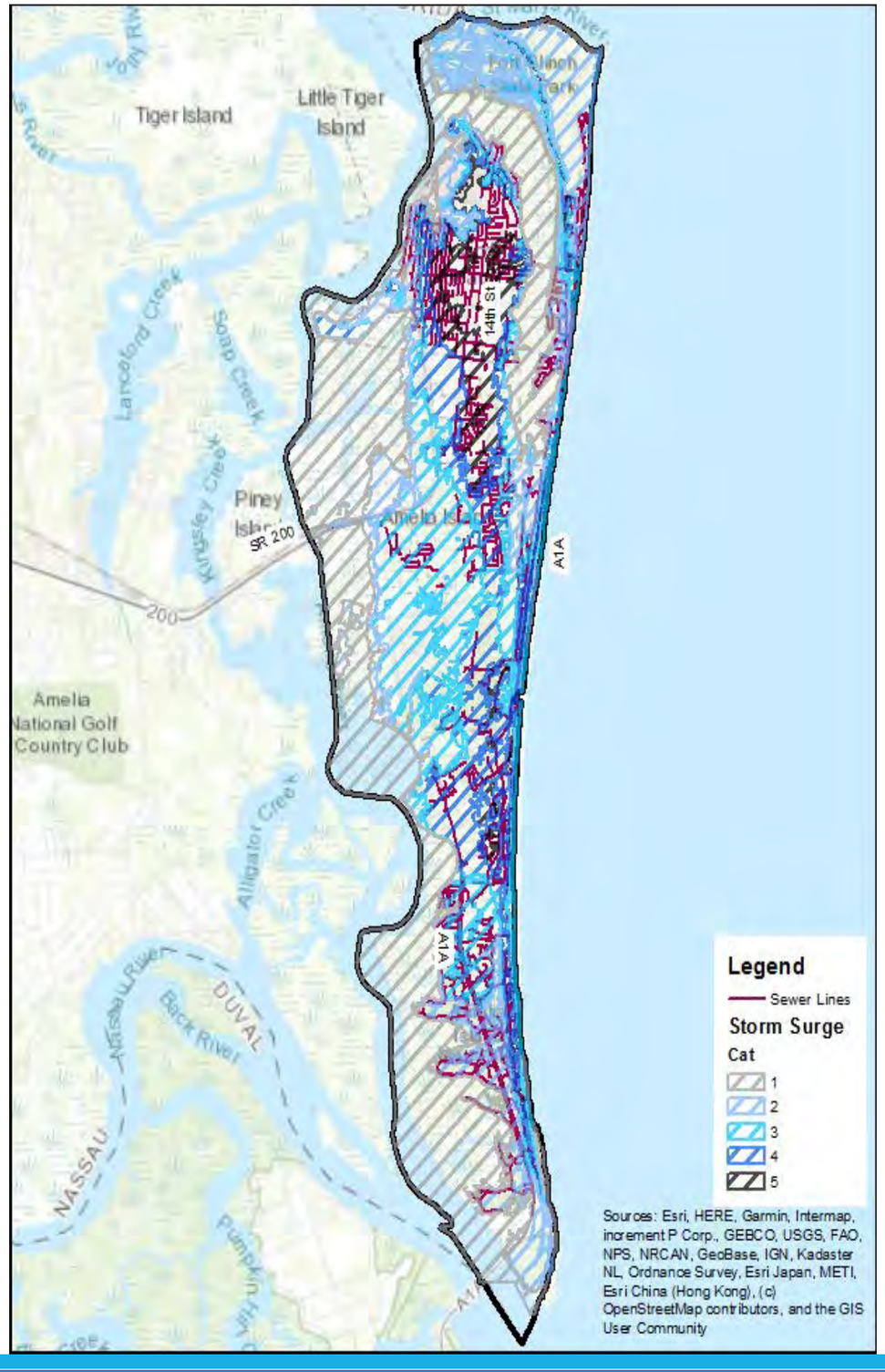
Sources: TBG Work Product; FNAI; EC JRC/Google

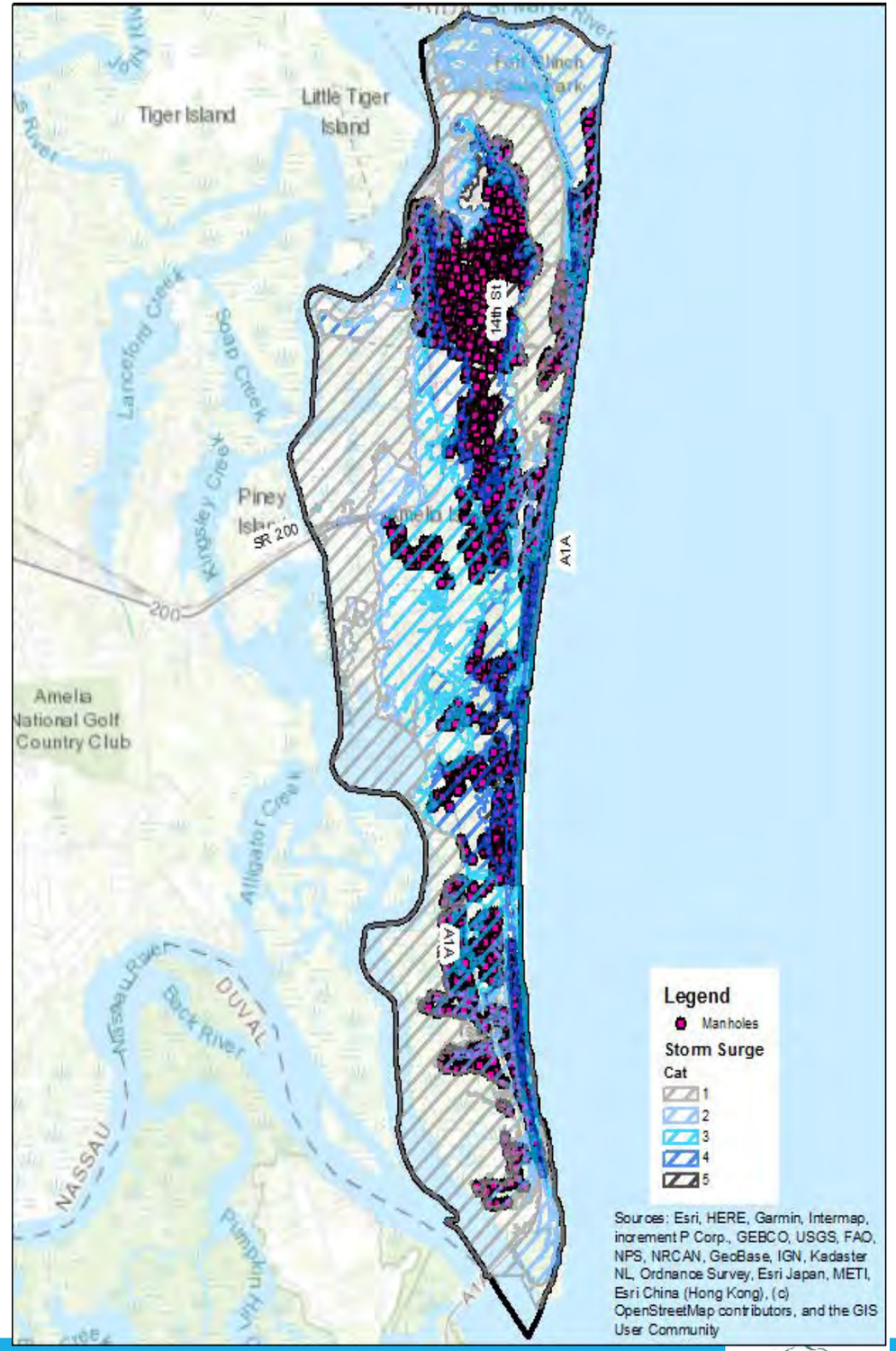
Series 15 Map 2. Critical Infrastructure: Sewer Infrastructure and Storm Surge

Series 15 Map 2 shows the exposure of sewer lines and manholes to event-driven flooding (storm surge).

Three percent (3%) of the sewer mains are within a Category 1, 52% are within a Category 3 and 95% are within a Category 5 storm surge.

In regards to sewer manholes, 1% are within a Category 1, 44% are within a Category 3 and 91% are within a Category 5 storm surge.





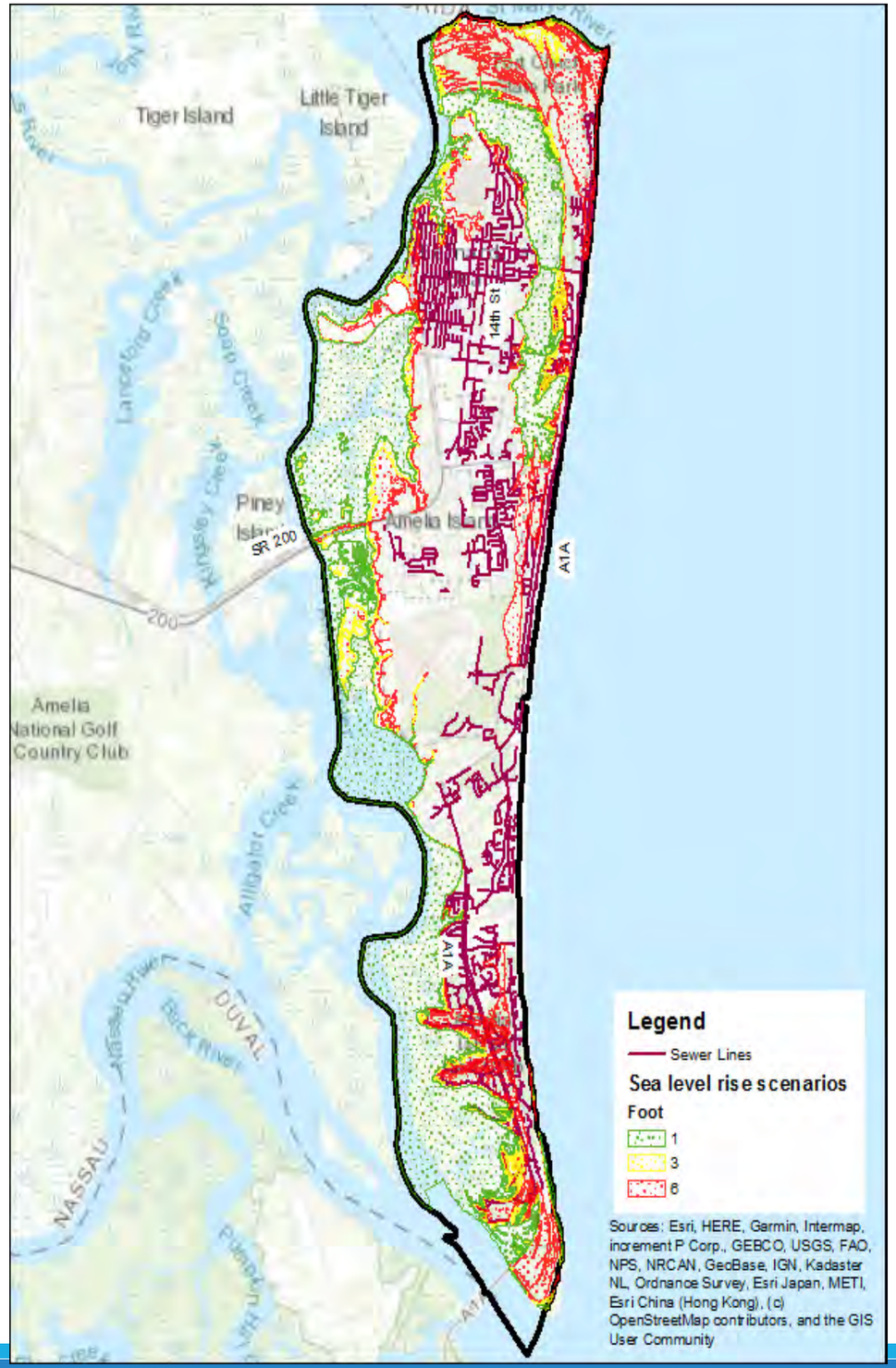
Sources: TBG Work Product; FNAI; NOAA

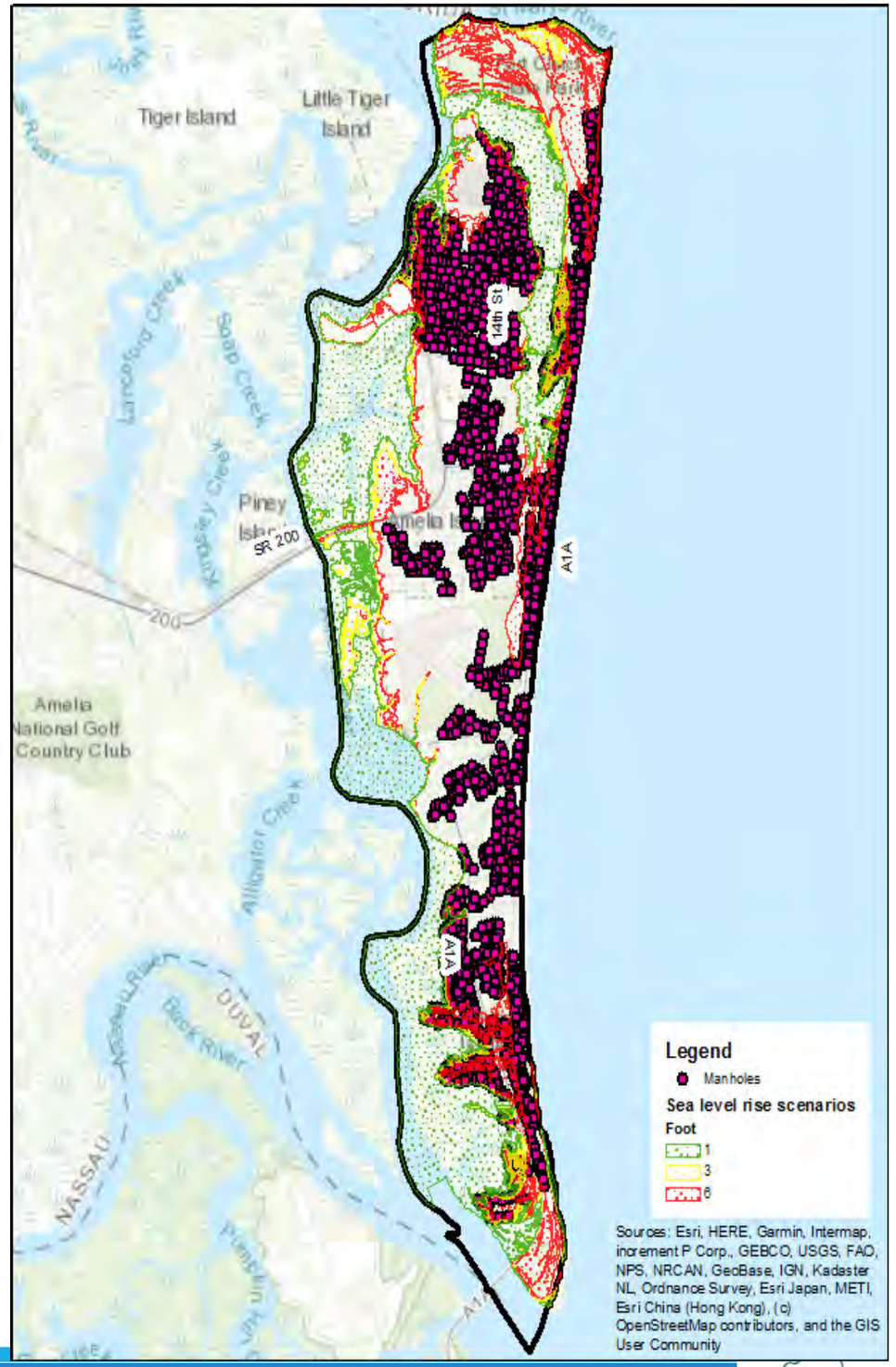
Series 15 Map 3. Critical Infrastructure: Sewer Infrastructure and Sea Level Rise

Series 15 Map 3 shows exposure of sewer lines and manholes to sea level rise.

One percent (1%) of the sewer mains are within the area impacted by a 1 ft. sea level rise, 6% are within that of a 3 ft. rise, and 27% are within a 6 ft. sea level rise scenario.

In regards to sewer manholes, less than 1% are within a 1 ft., 3% are within a 3 ft. and 17% are within a 6 ft. rise.



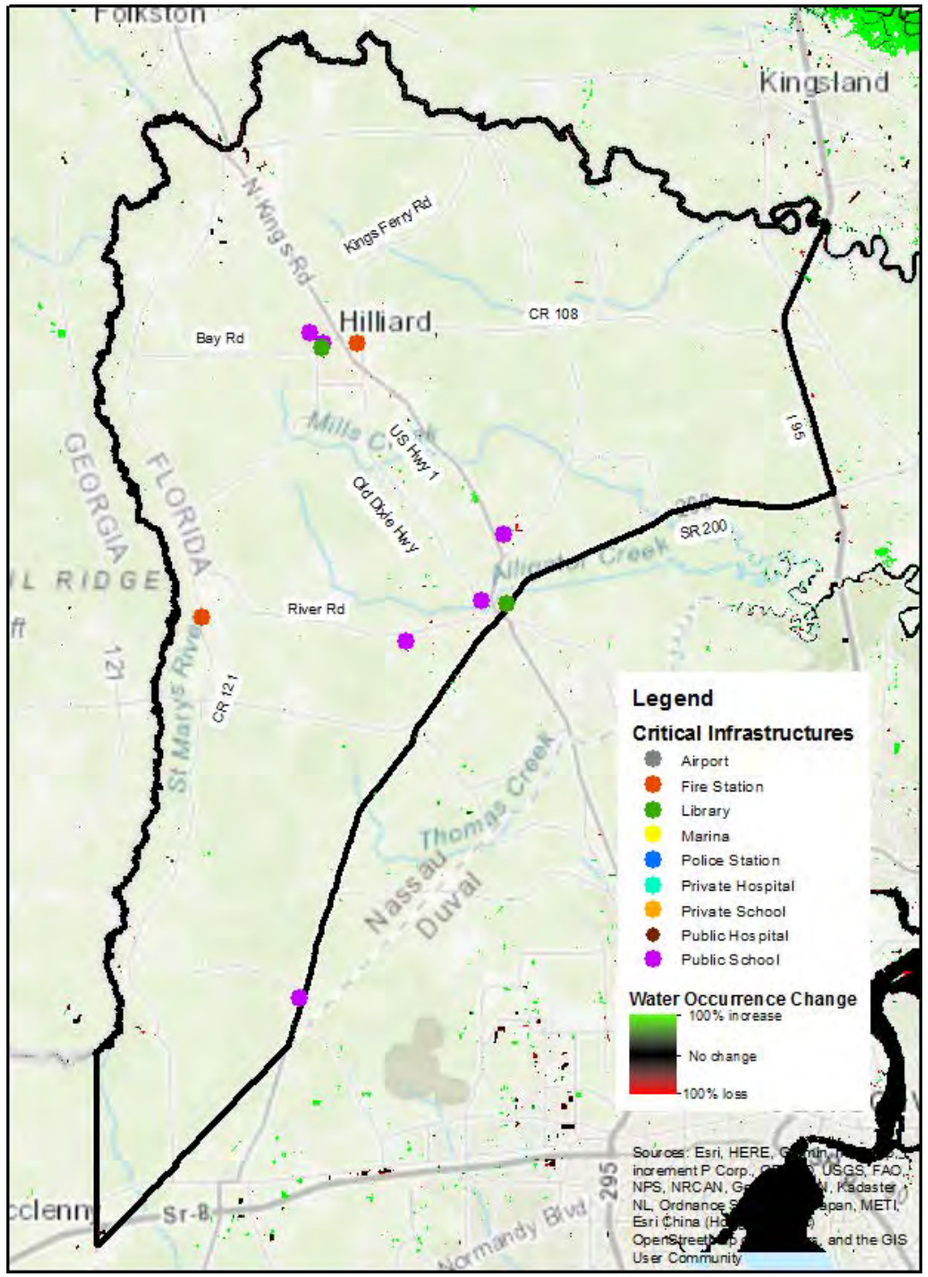


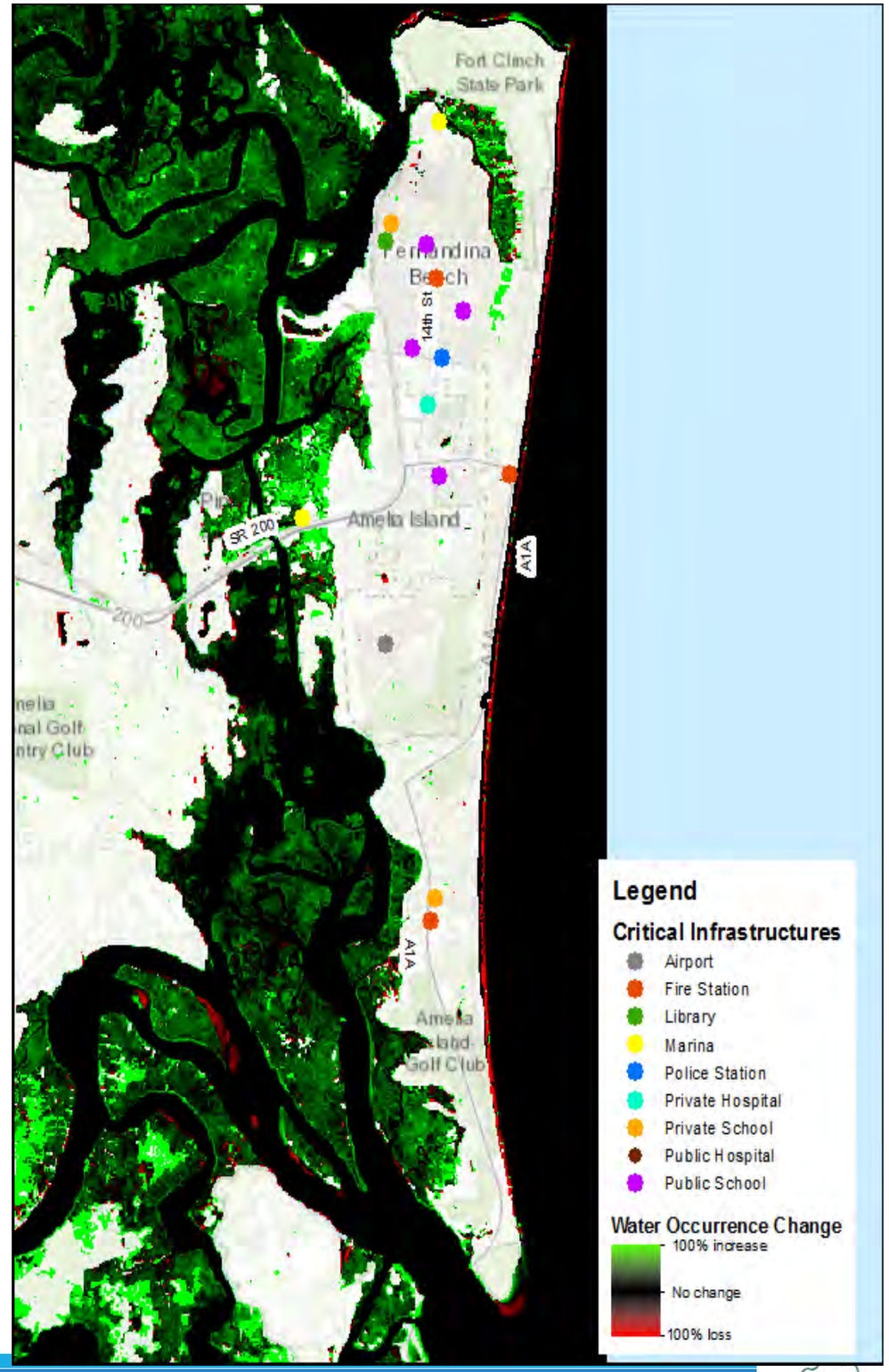
Sources: TBG Work Product; FNAI; NOAA

Series 16 Map 1. Critical Infrastructure and Water Occurrence Change

Series 16 Map 1 shows critical infrastructure such as fire stations, schools, libraries, police stations, hospitals and marinas in the context of water frequency change.

In both study areas (except for the Amelia Island Marina), these various components of critical infrastructure have not been impacted by more frequent episodic events.

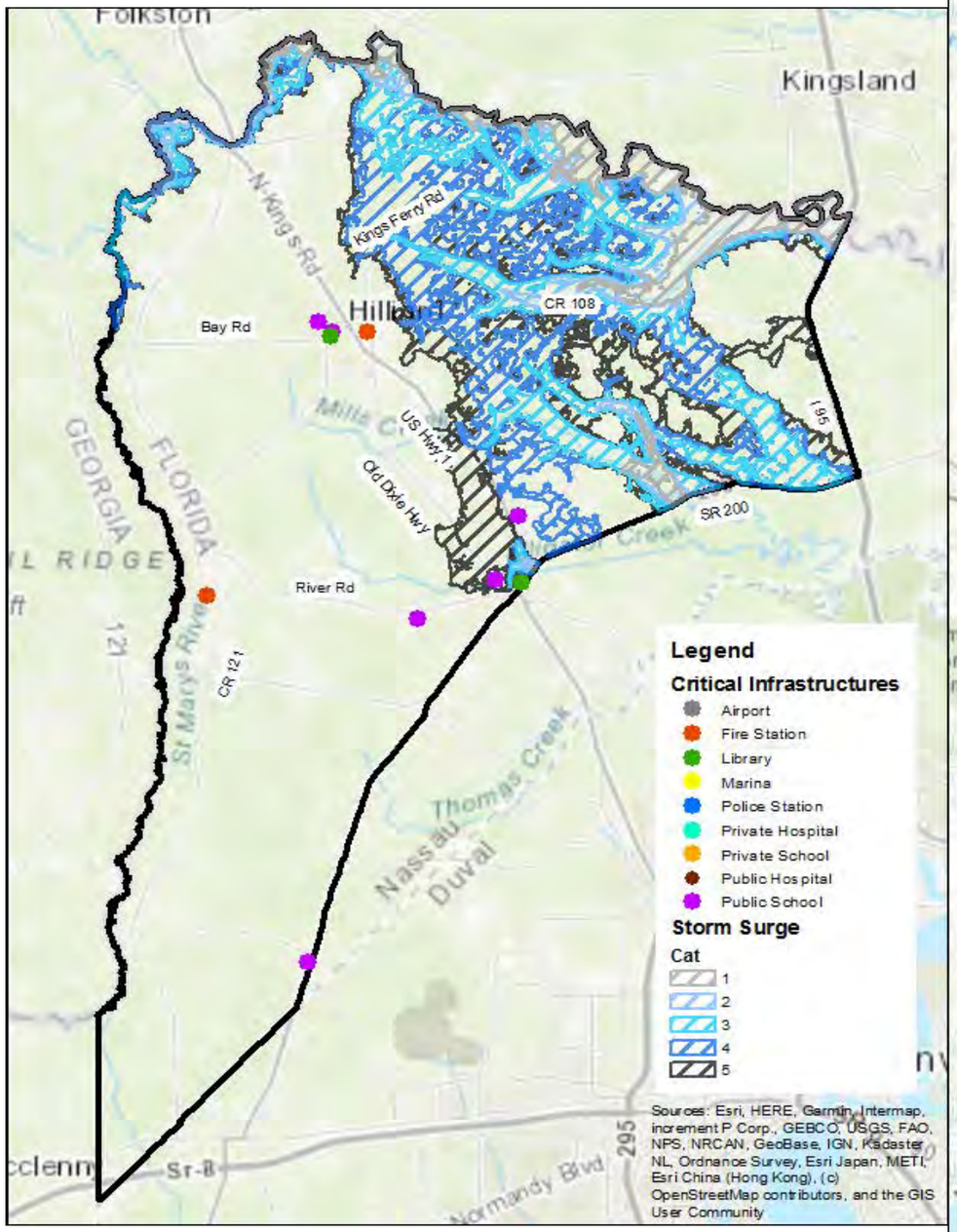


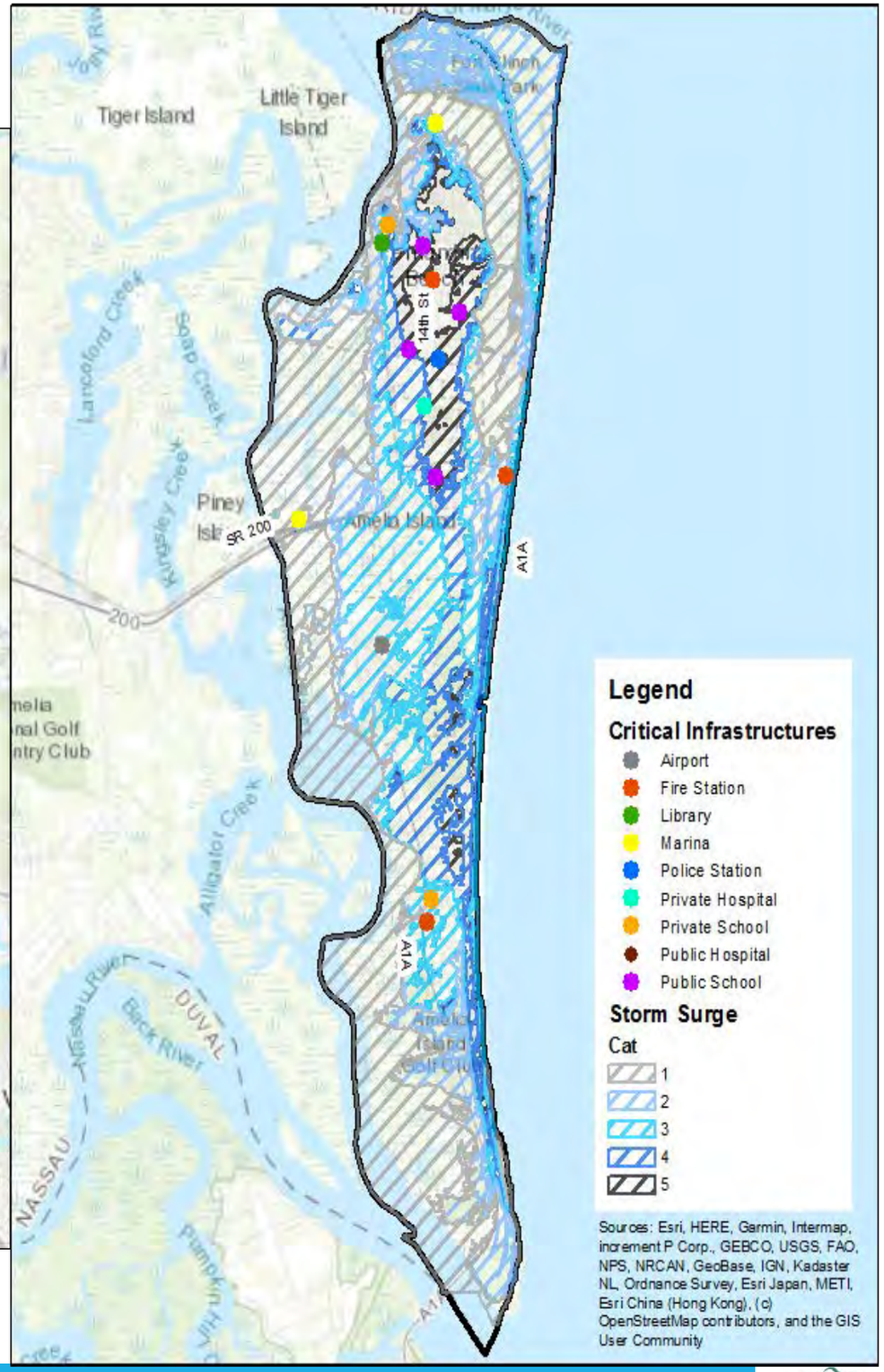


Series 16 Map 2. Critical Infrastructure and Storm Surge

Series 16 Map 2 shows critical infrastructure such as fire stations, schools, libraries, police stations, hospitals and marinas in the context of storm surge.

In the West, only a Category 5 storm surge would put listed critical infrastructure at risk. On Amelia Island 13% of all listed critical infrastructure are exposed to a Category 1 storm surge, almost half under a Category 3, and 94% would be exposed to a Category 5 storm surge.



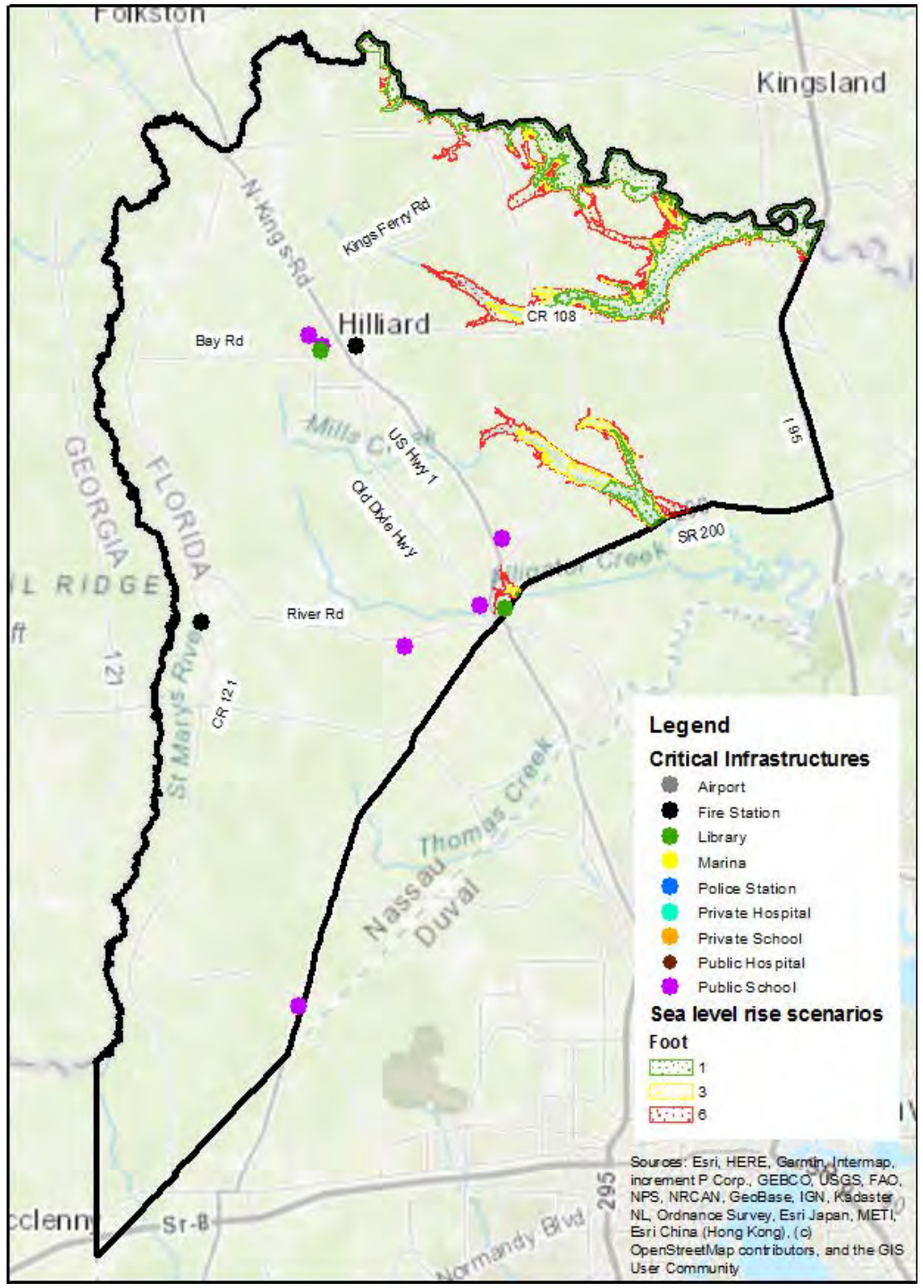


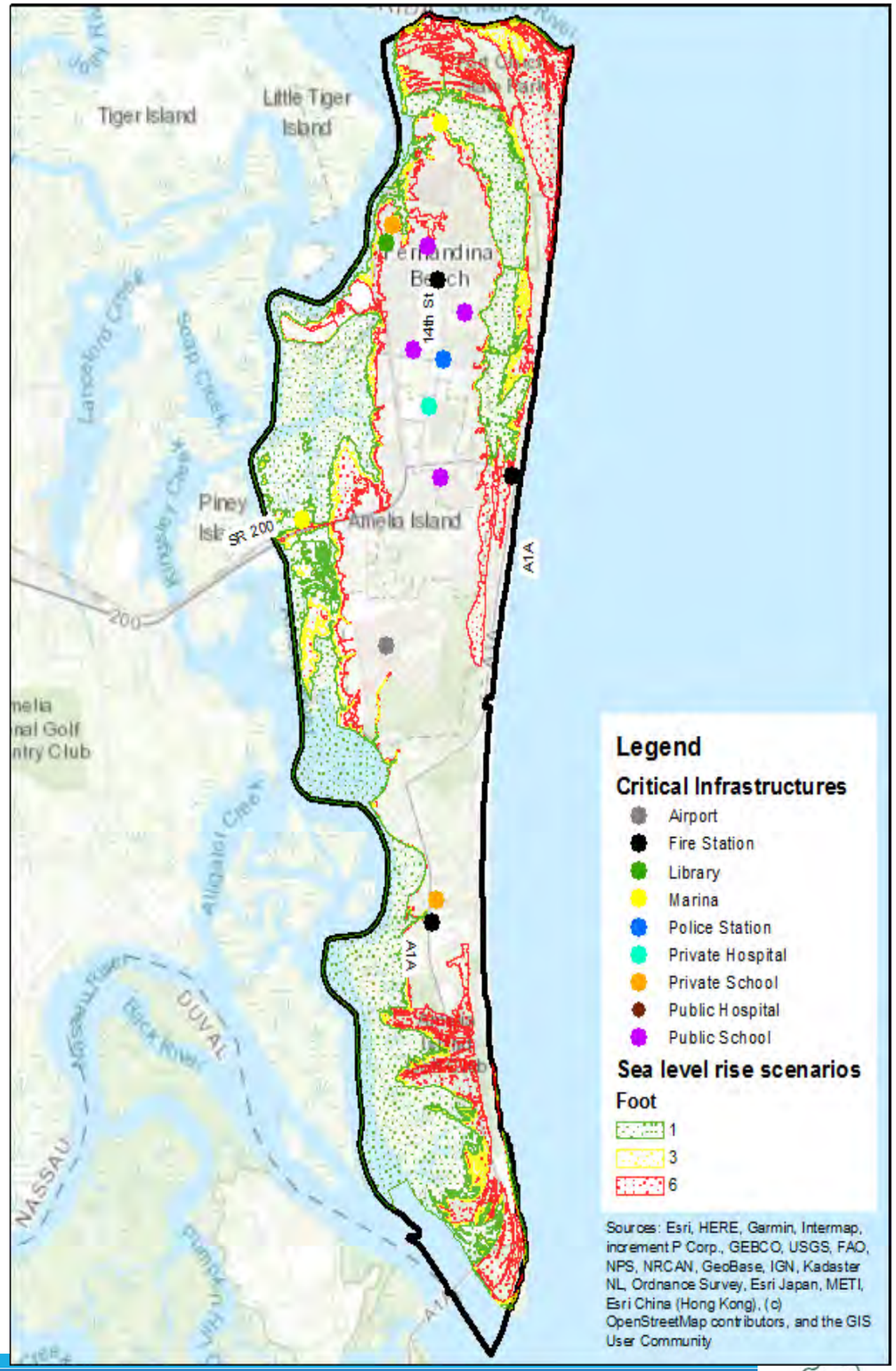
Sources: TBG Work Product; DOR; NOAA

Series 16 Map 3. Critical Infrastructure and Projected Sea Level Rise

Series 16 Map 3 shows critical infrastructure such as fire stations, schools, police stations and hospitals in the context of sea level rise.

None of the critical infrastructure in the West area overlap with sea level rise projections. On Amelia Island only the marina overlaps with the highest probability scenario of 1 ft. sea level rise.





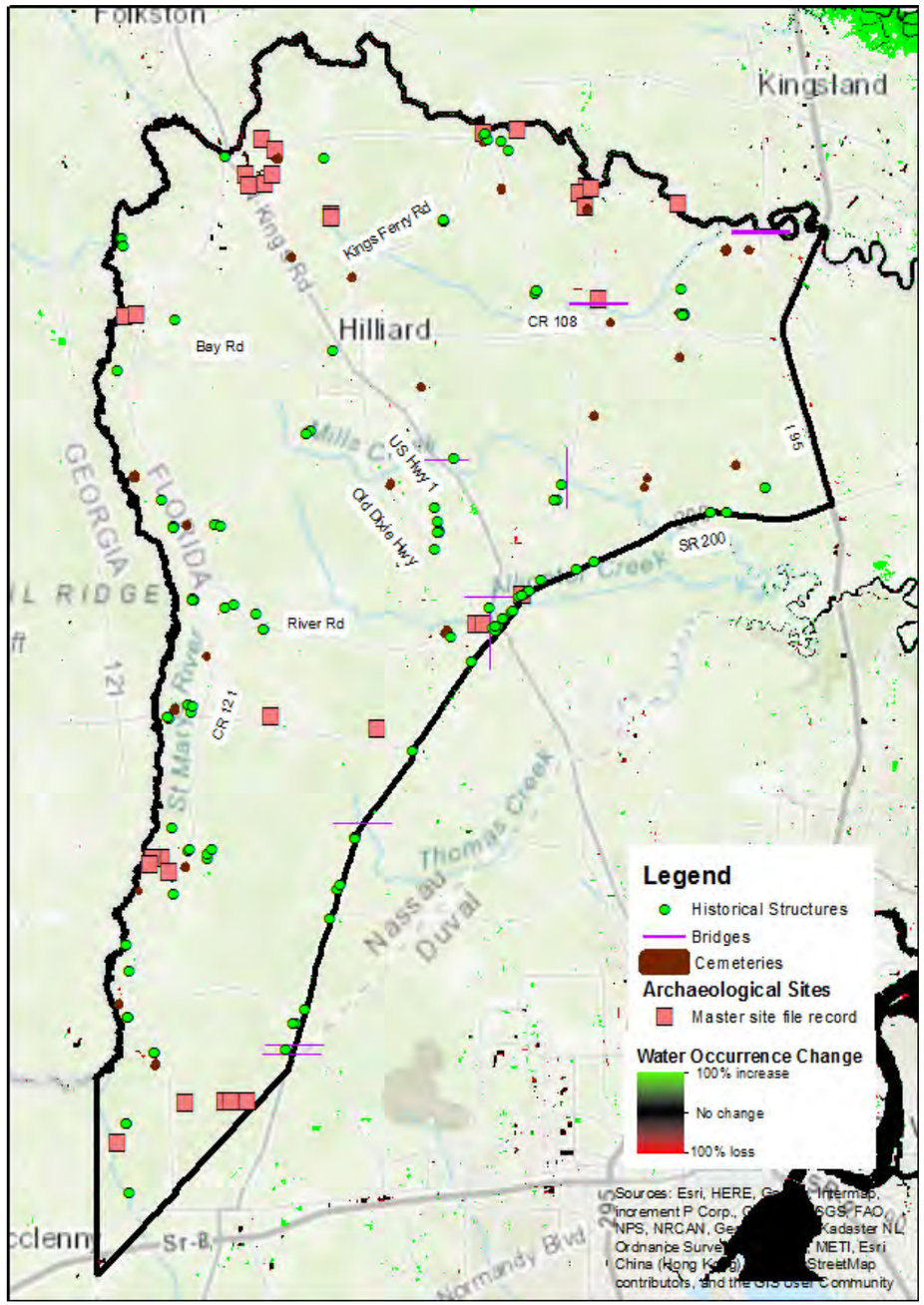
Sources: TBG Work Product; DOR; NOAA

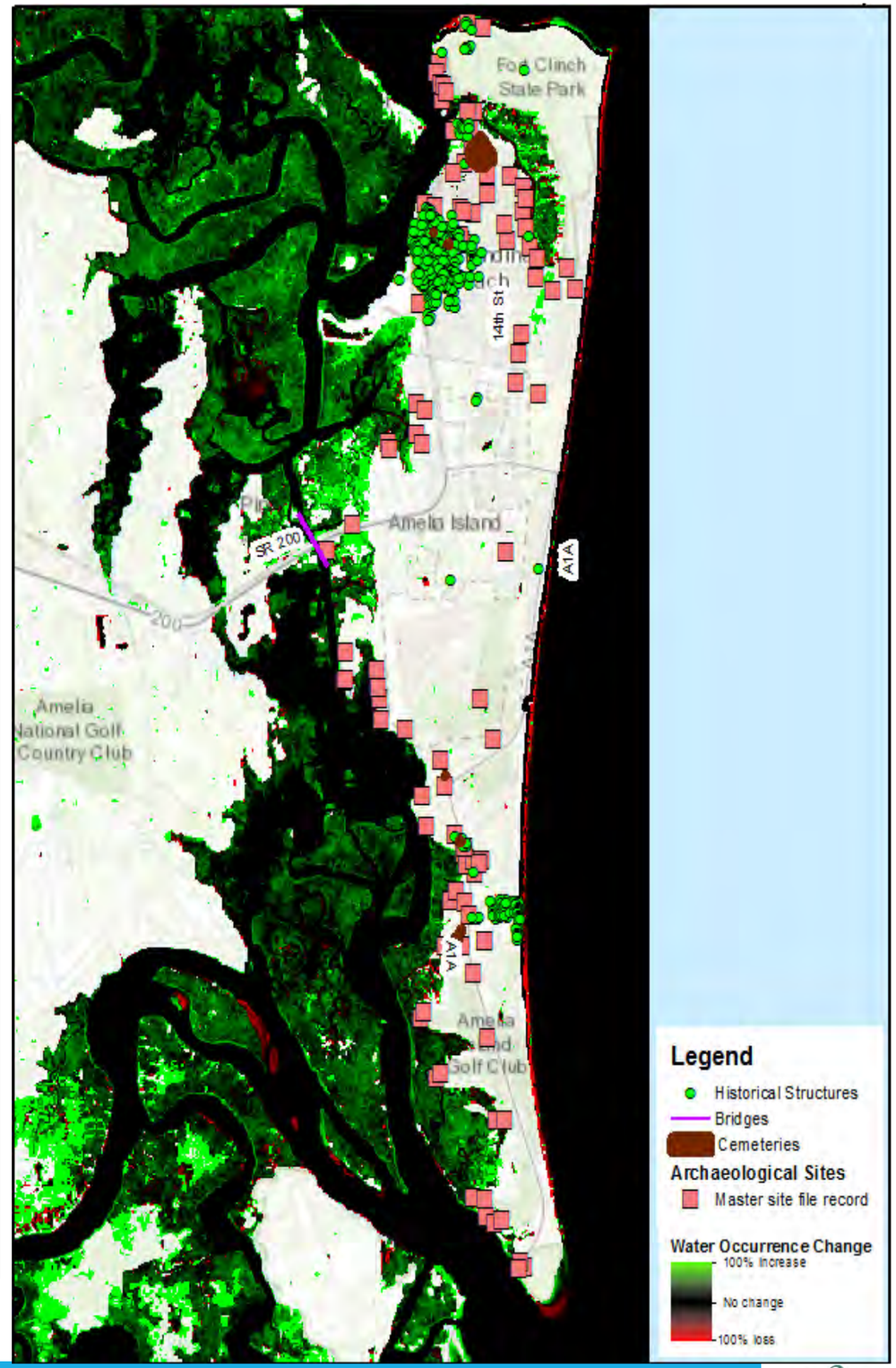
Series 17 Map 1. Cultural Resources and Water Occurrence Change

To evaluate if the County's cultural assets are at risk Series 17 describes individual structures and sites of cultural value while Series 18 examines more generalized areas of the County that have been surveyed for content.

Series 17 Map 1 compares changes in standing water frequency with historical structures, bridges, cemeteries and archaeological sites.
The data are from the Florida Master Site from the Florida Division of Historical Resources.

Overall, most historical structures in the West area have not been impacted by changes in water frequency. However, on Amelia Island, archaeological sites or structures near the Intracoastal Waterway in City of Fernandina Beach have been impacted by increases in water frequency.





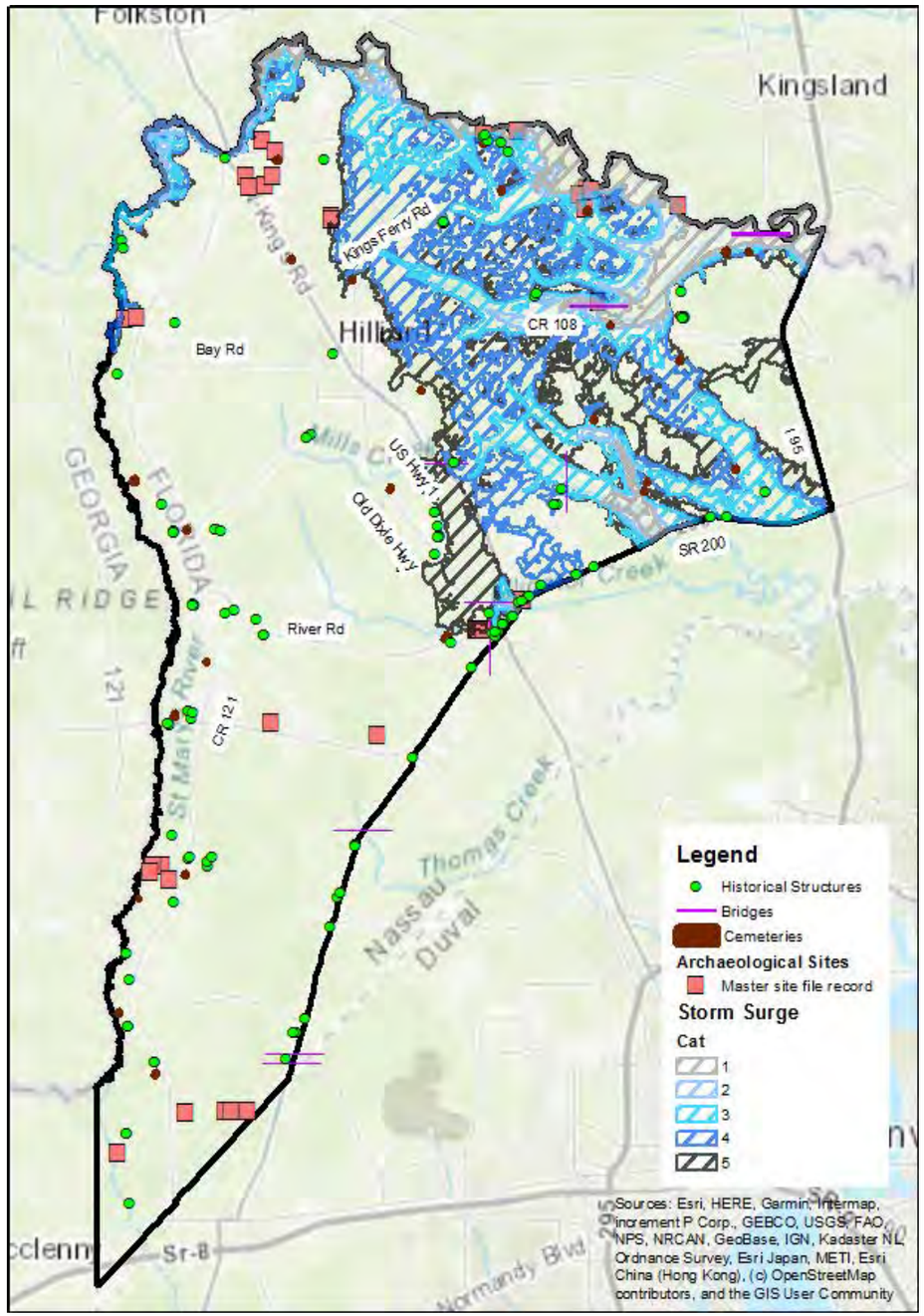
Sources: TBG Work Product; Florida Division of Historical Resources; EC JRC/Google

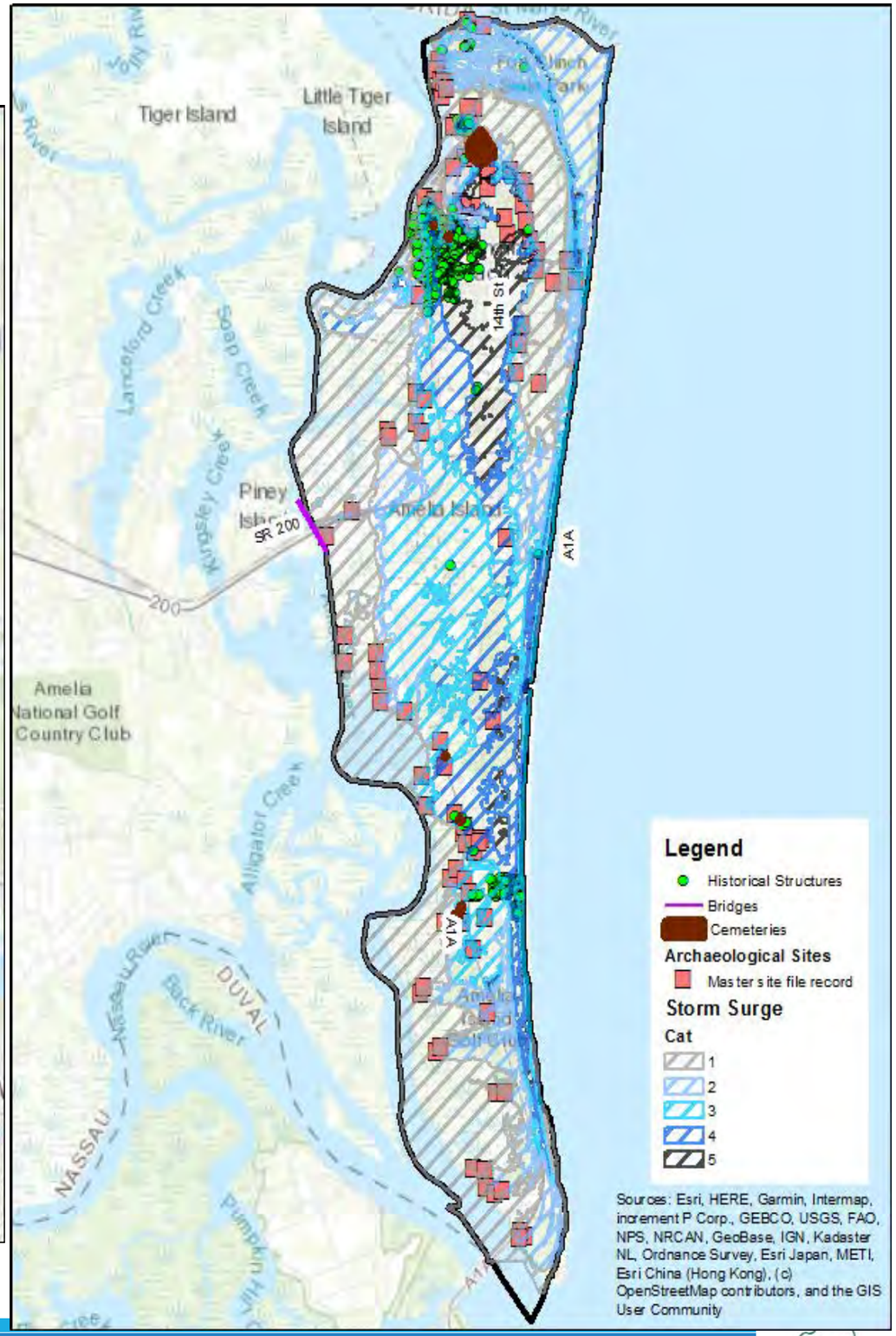
Series 17 Map 2. Cultural Resources and Storm Surge

Series 17 Map 2 compares locations of cultural resources to storm surge. This helps to assess the risk at which the County's assets are exposed to event-driven flooding.

In the West, about 15% of archaeological sites and 2% of historical structures are at risk under a Category 3 or lower storm surge. These increase to 30% and 16% under a Category 5 storm surge, respectively.

On Amelia Island, however, two-thirds of the archaeological sites and 35% of historical structures would be in the path of a Category 3 or lower storm surge. Approximately 90% of these resources would be at risk under a Category 5 storm surge.



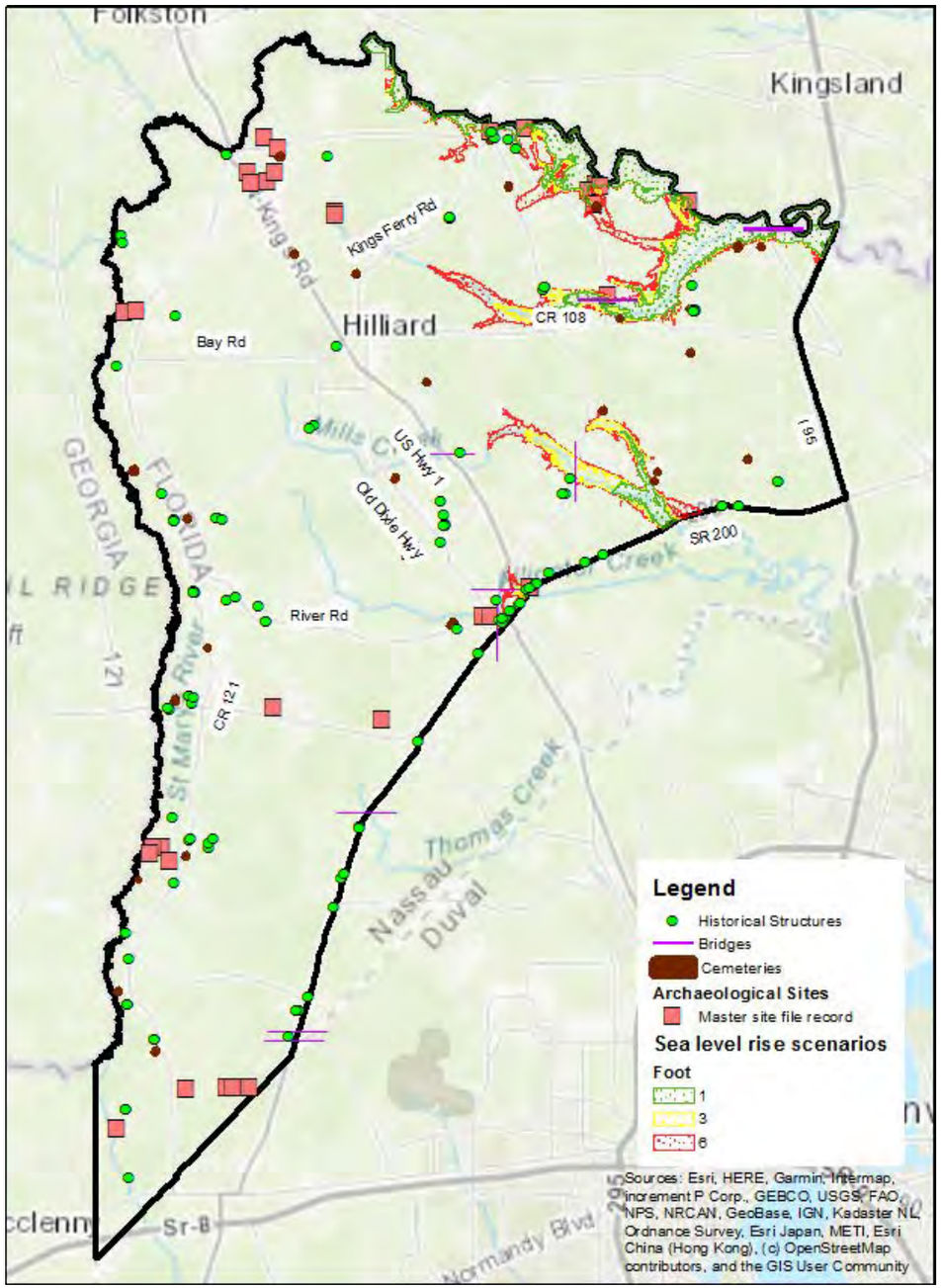


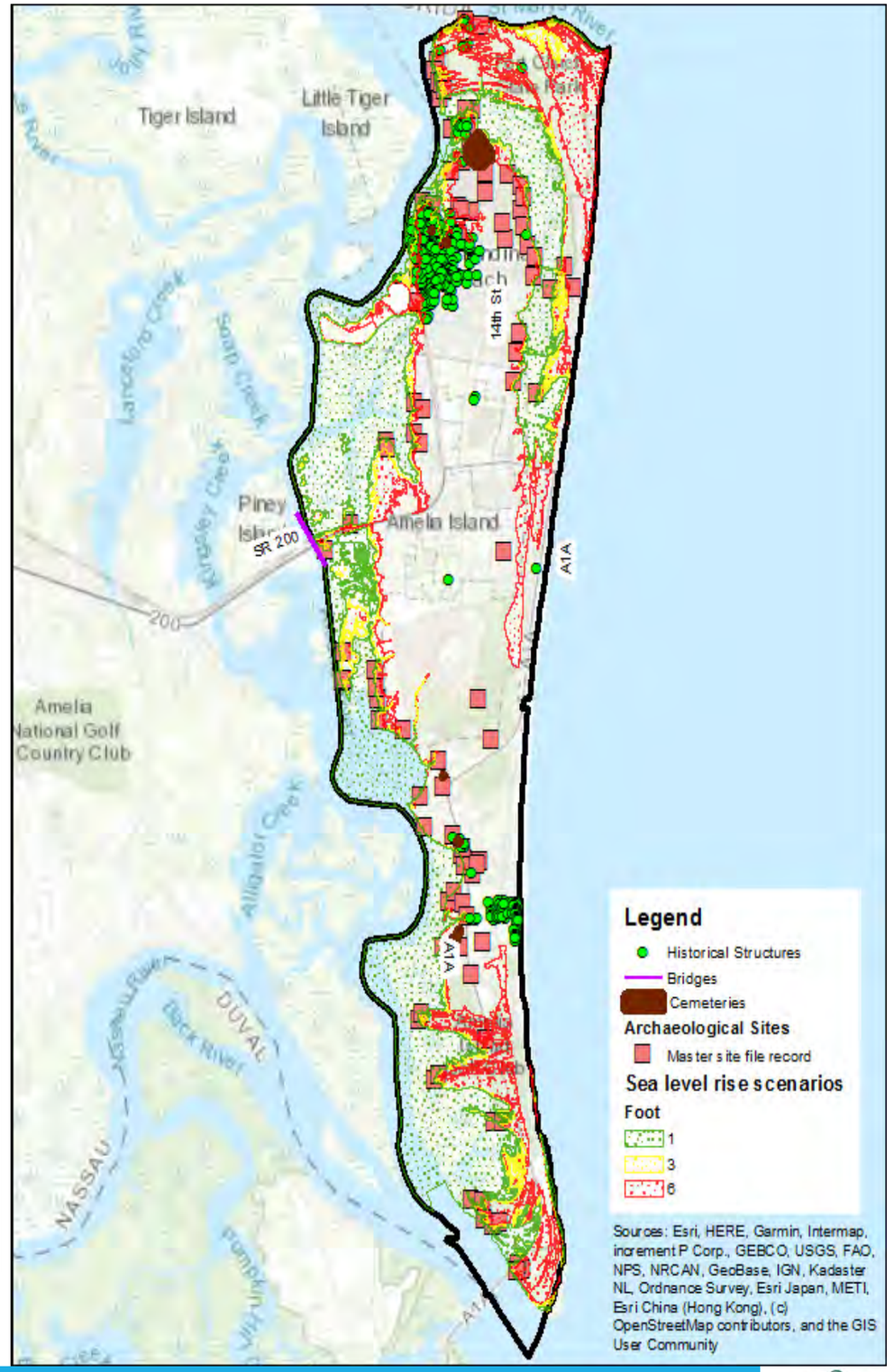
Sources: TBG Work Product; Florida Division of Historical Resources; NOAA

Series 17 Map 3. Cultural Resources and Sea Level Rise

Series 17 Map 3 relates cultural resources to sea level rise. Many of these historical and cultural resources are located at the edges of areas projected to be impacted by the sea level rise scenarios.

In the West, only a few Master Site File sites or structures near St. Marys River would be impacted by a 6 ft. rise in sea level. However, on Amelia Island, 45% of the archaeological sites and 8% of historical structures would be impacted by a 6 ft. sea level rise.



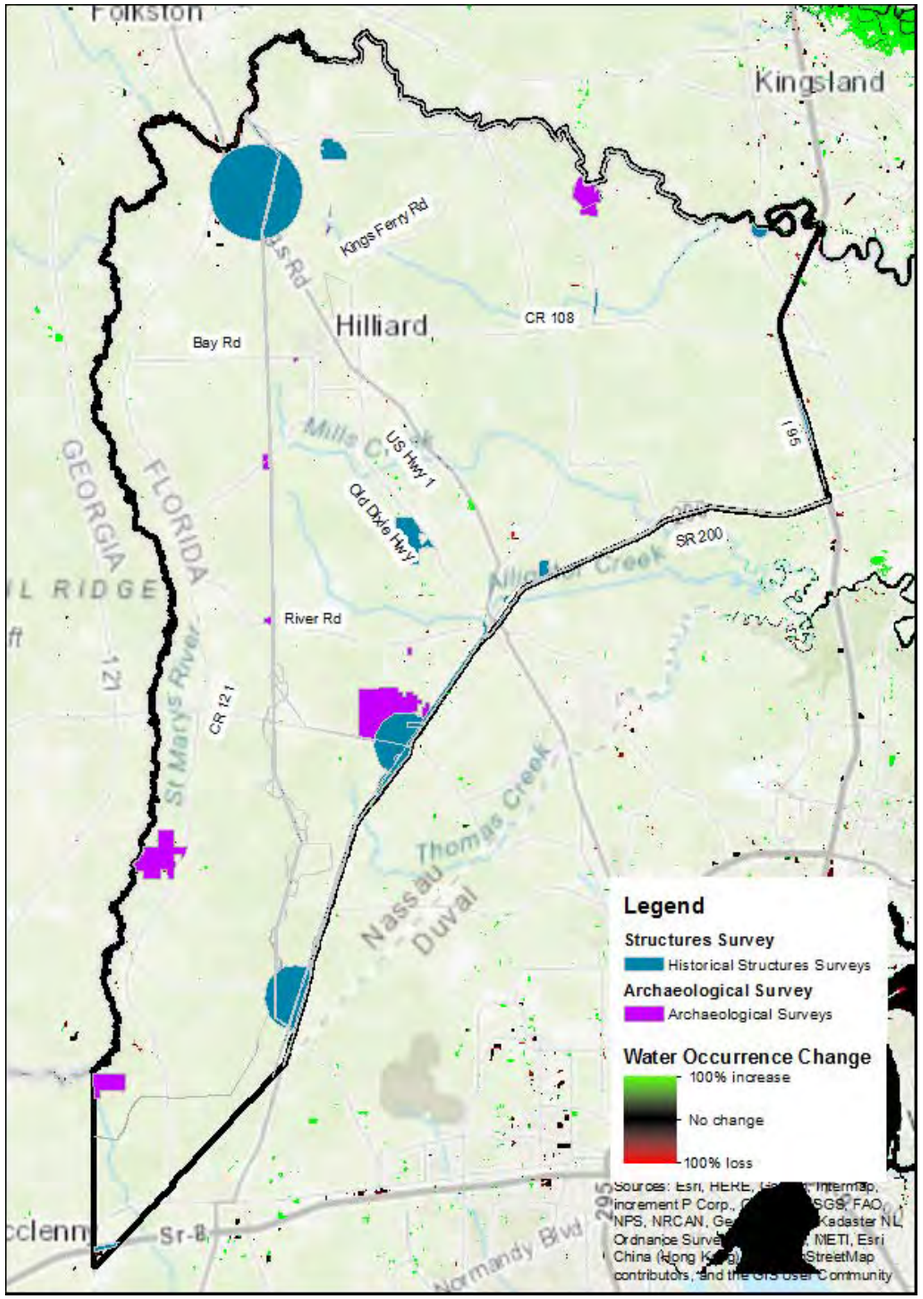


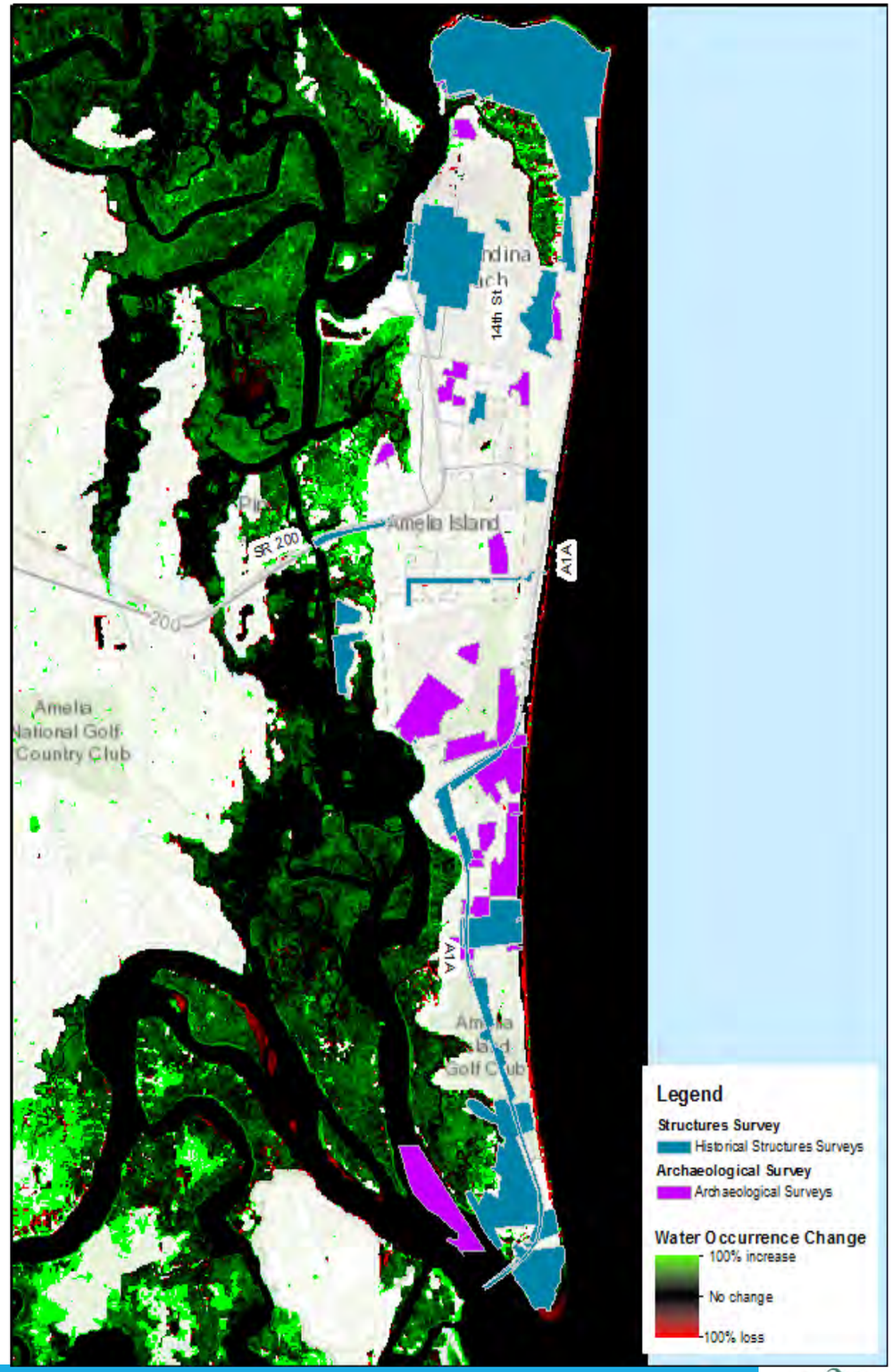
Sources: TBG Work Product; Florida Division of Historical Resources; NOAA

Series 18 Map 1. Cultural Resources Assessment Surveys and Water Occurrence Change

Areas that have been surveyed for historical structures or archaeological sites were compared with areas subject to increased water frequency occurrence. Similar to Series 17, this helps to assess the vulnerability of the County's cultural assets.

In the West there is little to no overlap between surveyed areas and increased water occurrence. However, several sites on Amelia Island have been impacted by increases in water frequency, particularly at the south end of the Island and South Amelia River.





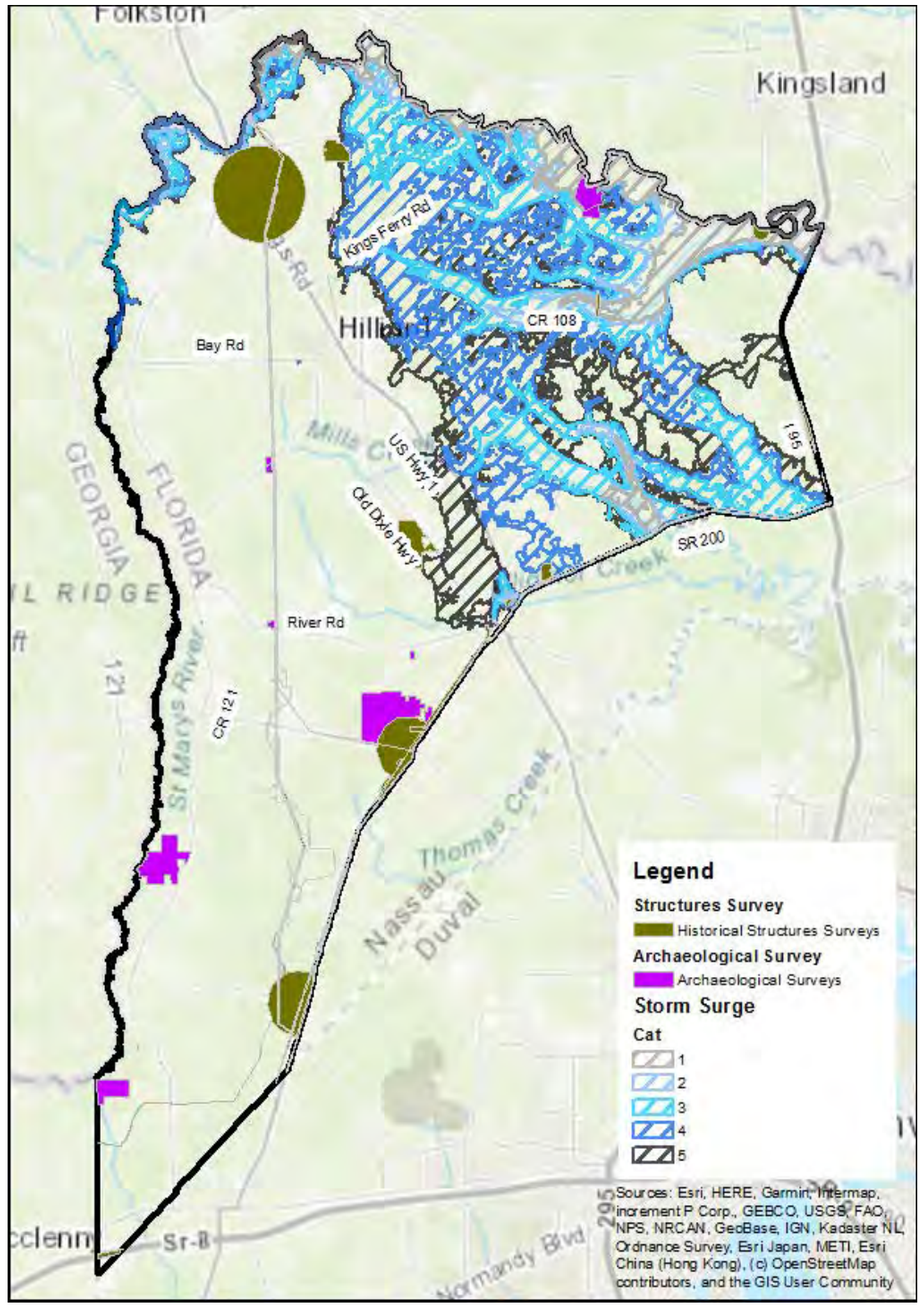
Sources: TBG Work Product; Florida Division of Historical Resources; EC JRC/Google

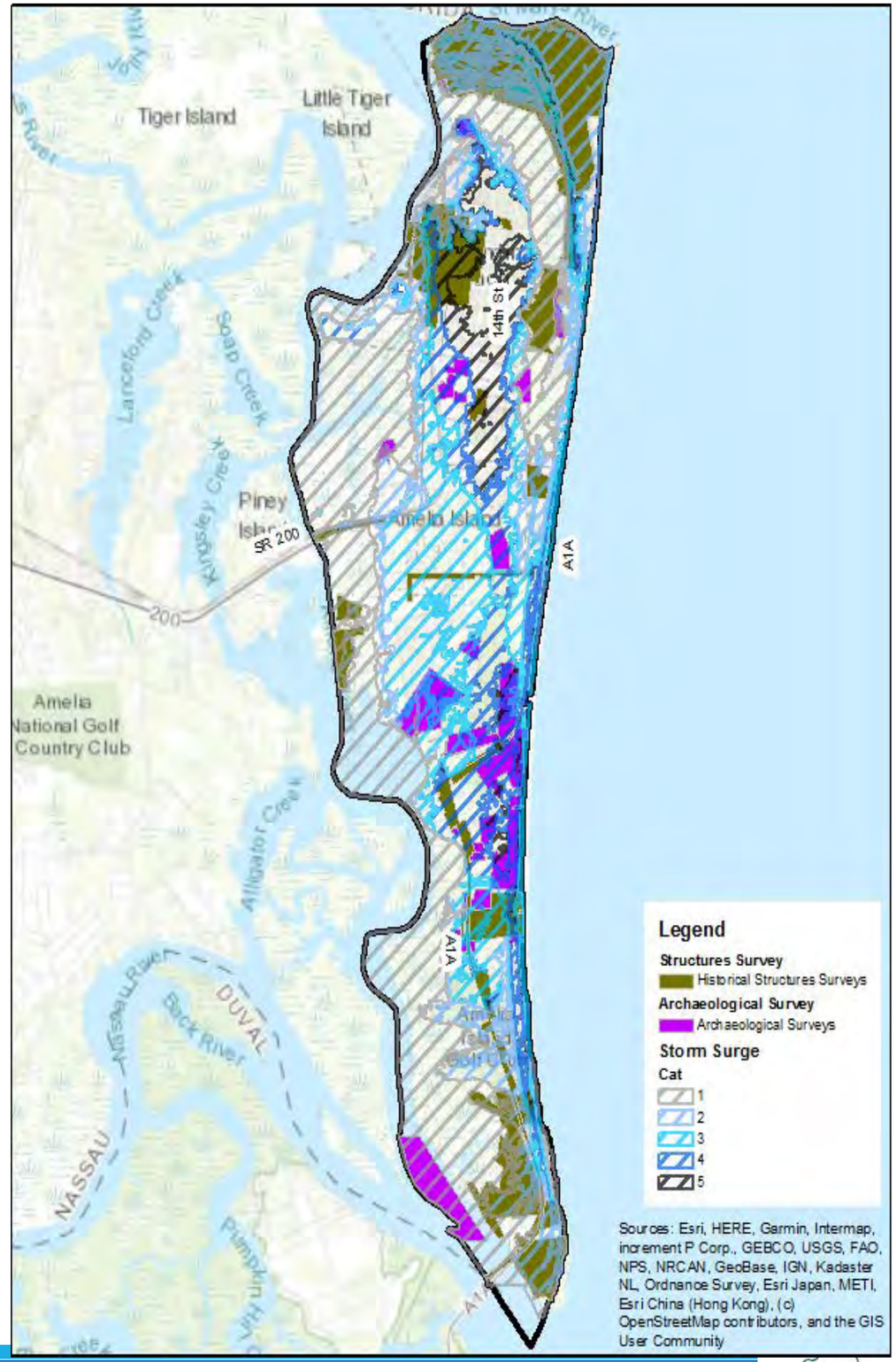
Series 18 Map 2. Cultural Resources Assessment Surveys and Storm Surge

To evaluate the exposure of cultural assets to event-driven flooding, Series 18 Map 2 compares areas that have been surveyed for cultural resources to areas affected by storm surge.

In the West area, only one archaeological site within White Oak Plantation along the St. Marys River is subject to a Category 2 storm surge.

All of the inventoried sites on Amelia Island are subject to a Category 5 storm surge, where those closer to the coast or Intracoastal Waterway are within a higher probability storm surge category (generally Categories 2 and 3).



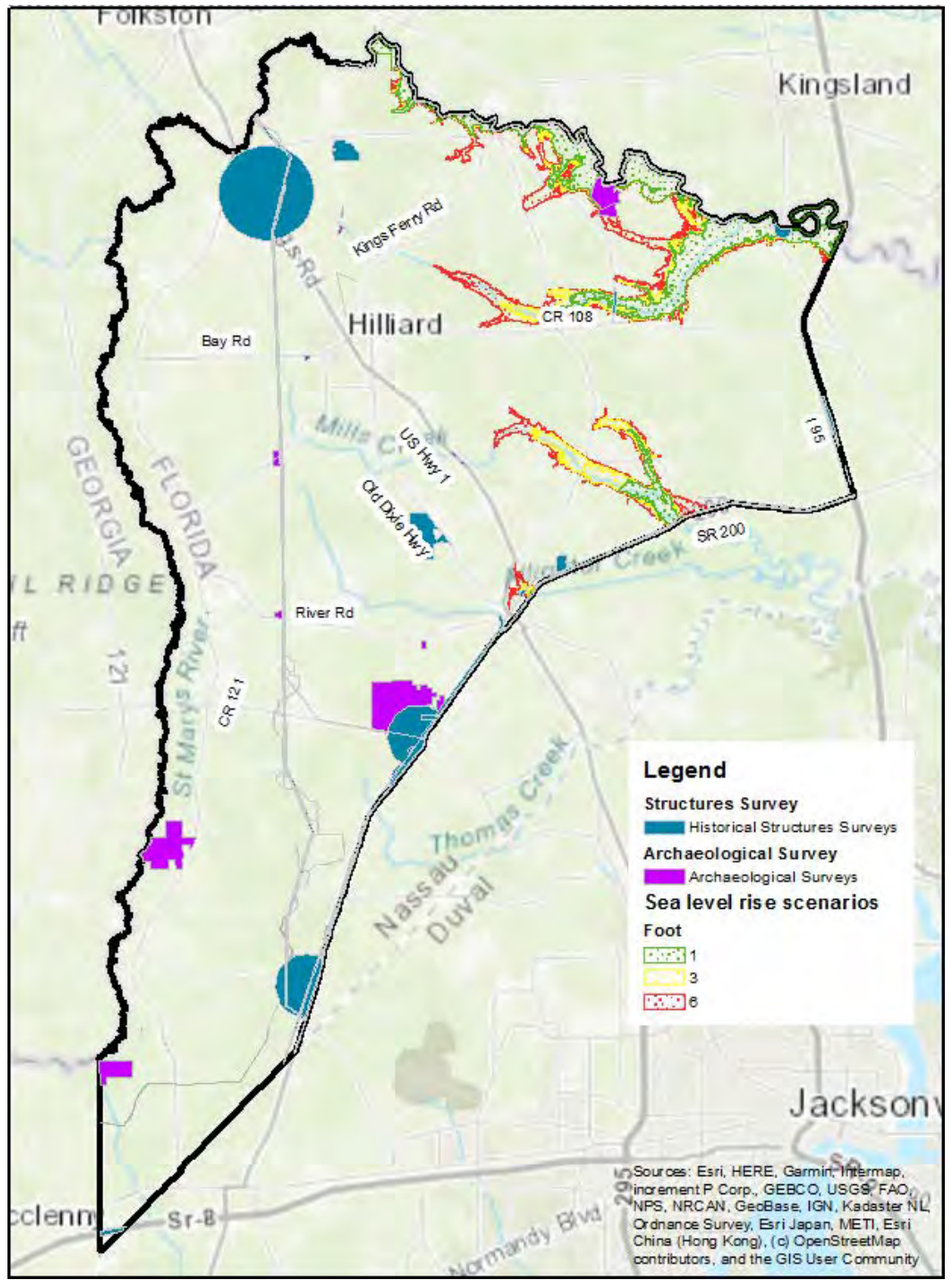


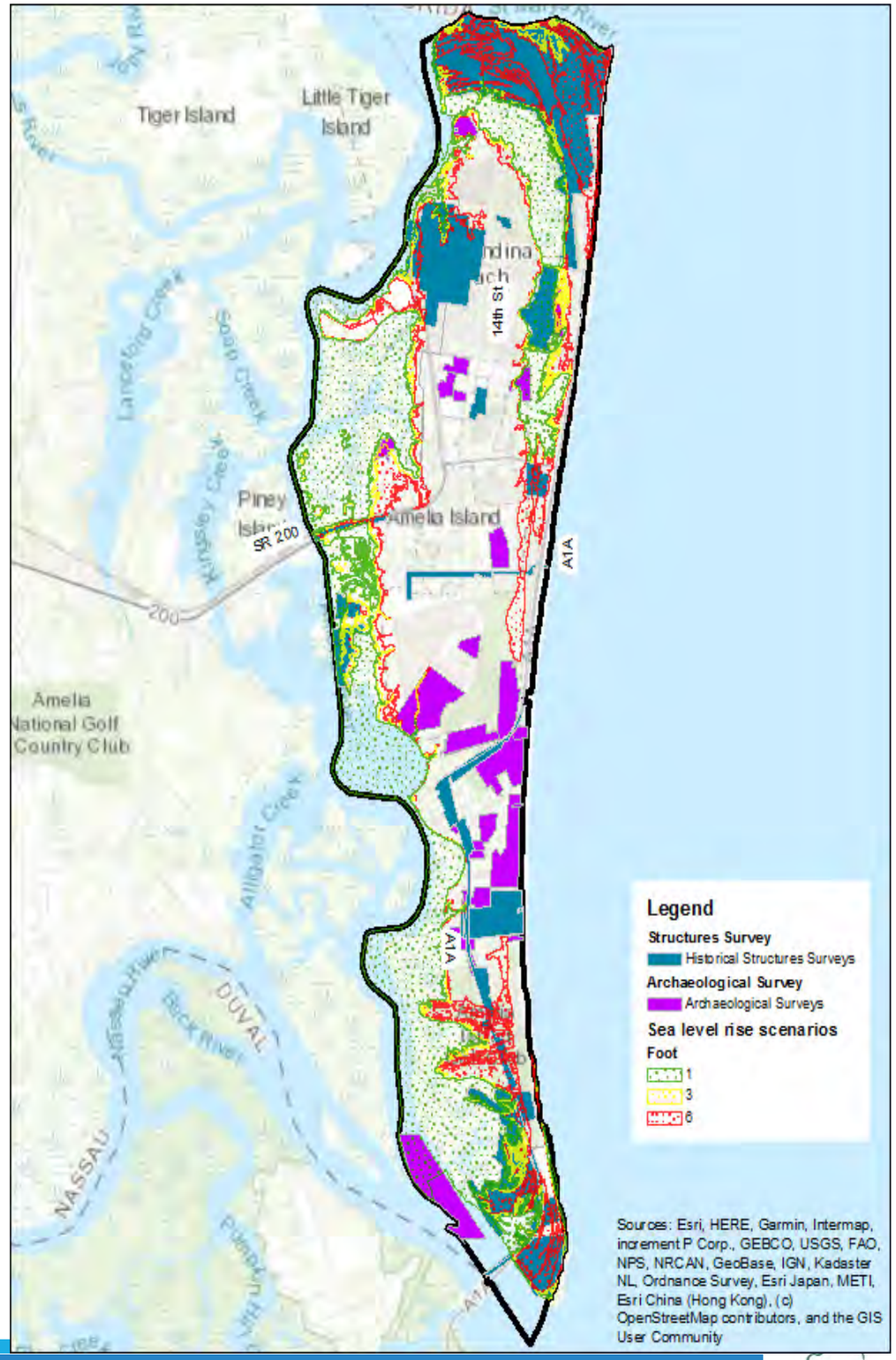
Sources: TBG Work Product; Florida Division of Historical Resources; NOAA

Series 18 Map 3. Cultural Resources Assessment Surveys and Sea Level Rise

To evaluate the exposure of cultural assets to sea level rise, Series 18 Map 3 compares areas that have been surveyed for cultural resources to sea level rise scenarios. In the West, the surroundings of the White Oak Plantation and St. Marys River overlap with a 1 ft. sea level rise.

Sites at the northern and southern ends of Amelia Island are more exposed to the several sea level rise scenarios. These include Amelia Island and Ft Clinch State Parks, and part of the City of Fernandina Beach Historic District (discussed below).





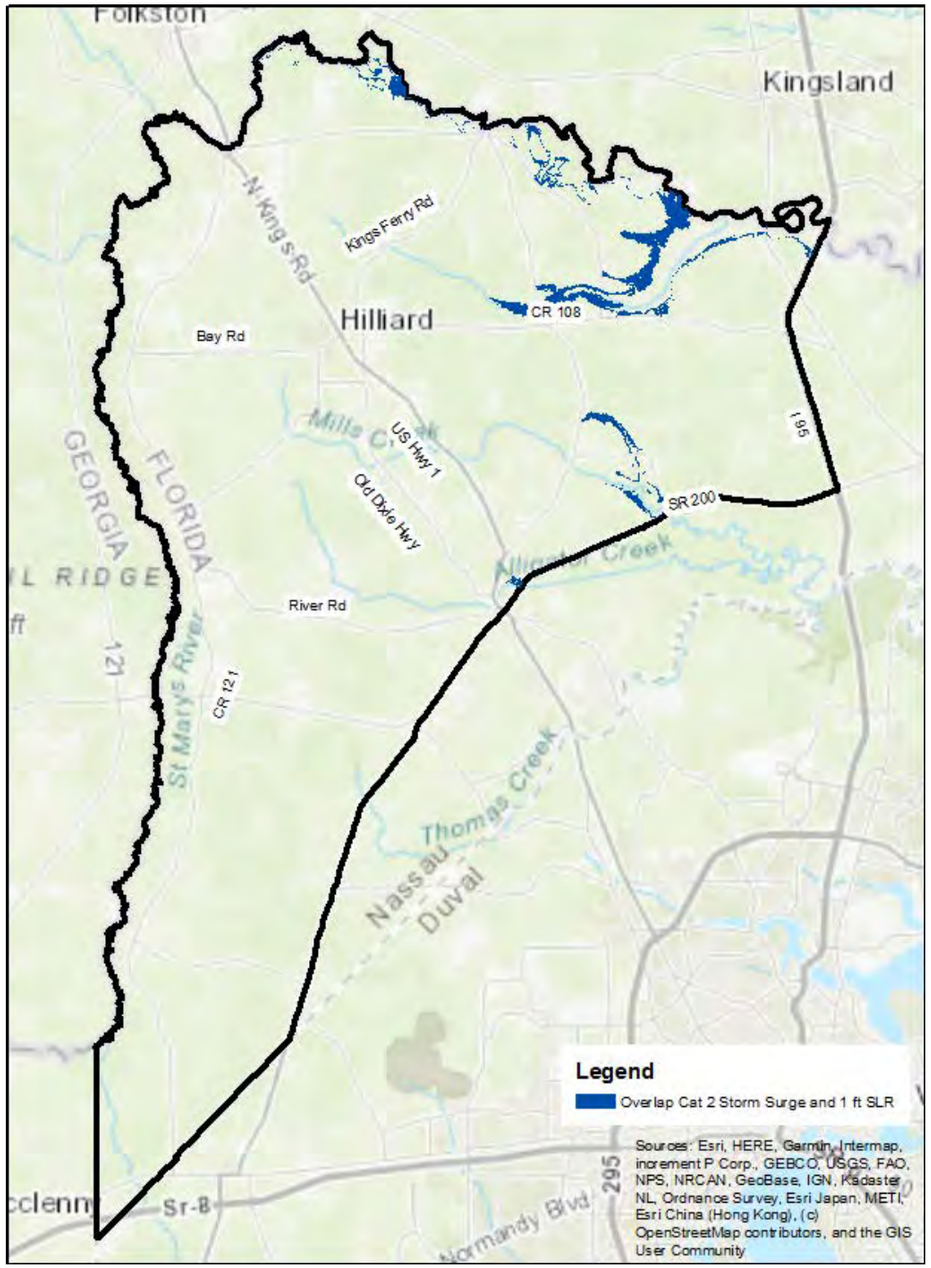
Sources: TBG Work Product; Florida Division of Historical Resources; NOAA

Figure 3. Compounded Effects of Storm Surge and Sea Level Rise

The storm surge maps shown throughout this report do not incorporate sea level rise. Figure 3 illustrates those areas where a Category 2 storm surge zone overlaps with area subject to inundation by a 1 ft. sea level rise zone.

While the true extent of impact has not been modelled hydrologically here, the zones that are highlighted may be representative of those areas expected to be inundated by a Category 1 storm event once sea level rise in the region has reached 1 ft. In sum, the impacts of lower intensity storm events will be magnified by sea level rise.

Both study areas include regions of increased risk. In the West, the St Marys tributary to the St Marys River is one such area. On Amelia Island, large areas at the north and south ends as well as parts of the City of Fernandina Beach and the SR 200 entry to the island are subject to this increased risk.



Sources: TBG Work Product; NOAA

Tourism-related and manufacturing parcels in Amelia Island were evaluated to estimate how much property value is at risk of storm surge and sea level rise. This was done using the same cumulative approach described elsewhere in the report for residential and commercial parcels impacted by storm surge and sea level rise. Table 4 and Table 5 are followed by figures that map the locations of these against the different flooding events.

If critical infrastructure is impacted, the costs to the community could include repair/rehabilitation expenses, loss of business use, which could lead to loss of sales and taxes, and potential loss of property value.

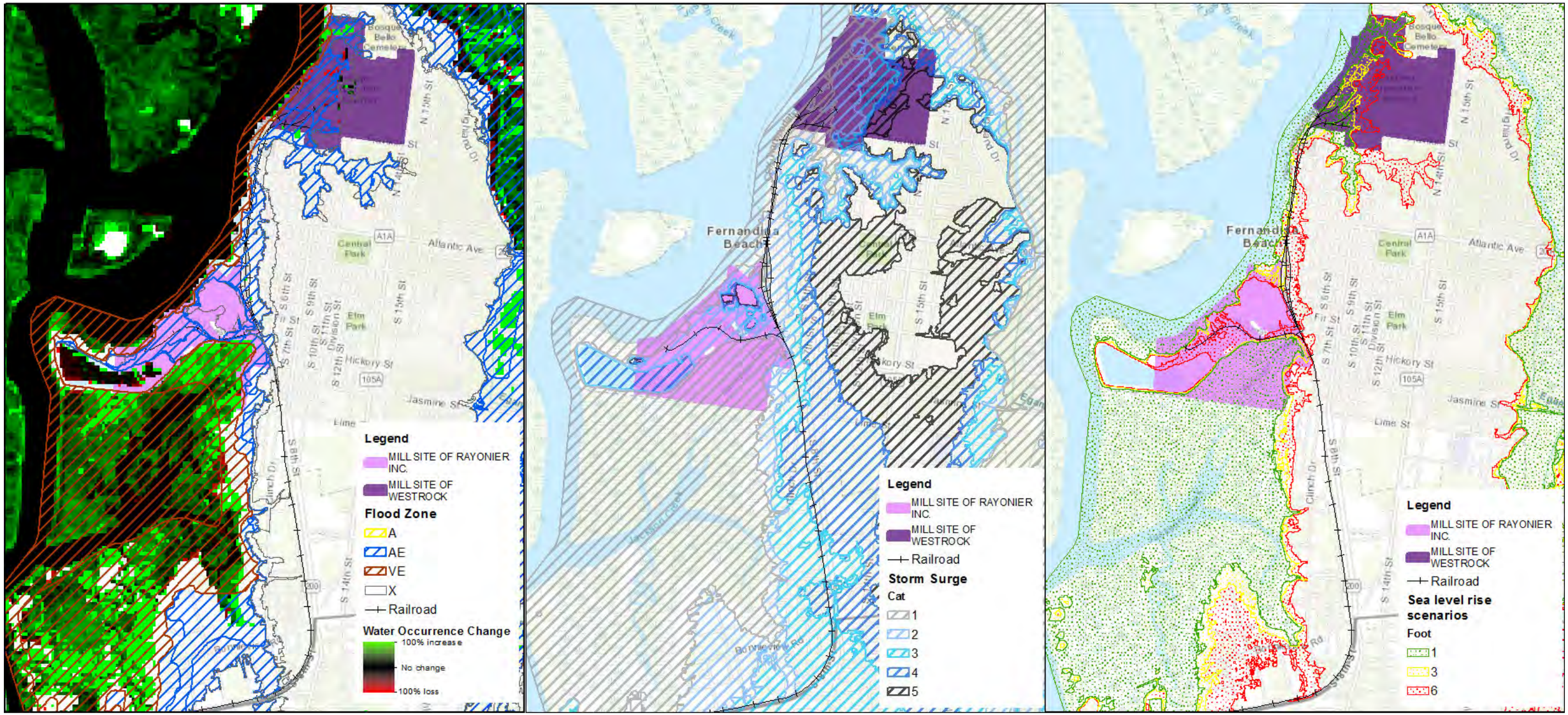
Table 4. Property Values (in Millions) Impacted by Storm Surge

Storm Surge Category	Hotels, Motels	Restaurants, Cafeterias	Drive-in Restaurants	Tourist attractions, permanent exhibits, other enterntainment facilities, fairgorunds	Historic District	Mill Sites	Airport	White Oak Conservation
1	13.33	0.74	-	-	6.36	48.36	-	-
2	113.74	8.43	0.66	0.33	44.01	48.36	-	-
3	240.59	15.51	3.44	0.33	78.53	48.36	9.28	11.86
4	247.31	20.75	4.27	0.33	142.39	48.36	9.28	11.86
5	250.72	24.04	4.82	0.83	177.39	48.36	9.28	11.86

Table 5. Property Values (in Millions) Impacted by Sea Level Rise

SLR Scenario (Ft)	Hotels, motels	Restaurants, cafeterias	Drive-in Restaurants	Tourist attractions, permanent exhibits, other enterntainment facilities, fairgrounds	Historic District	Mill Sites	Airport	White Oak Conservation
1	13.33	-	-	-	5.06	48.36	-	-
3	24.87	1.61	-	-	6.36	48.36	-	-
6	110.42	7.82	0.66	-	40.81	48.36	-	11.86

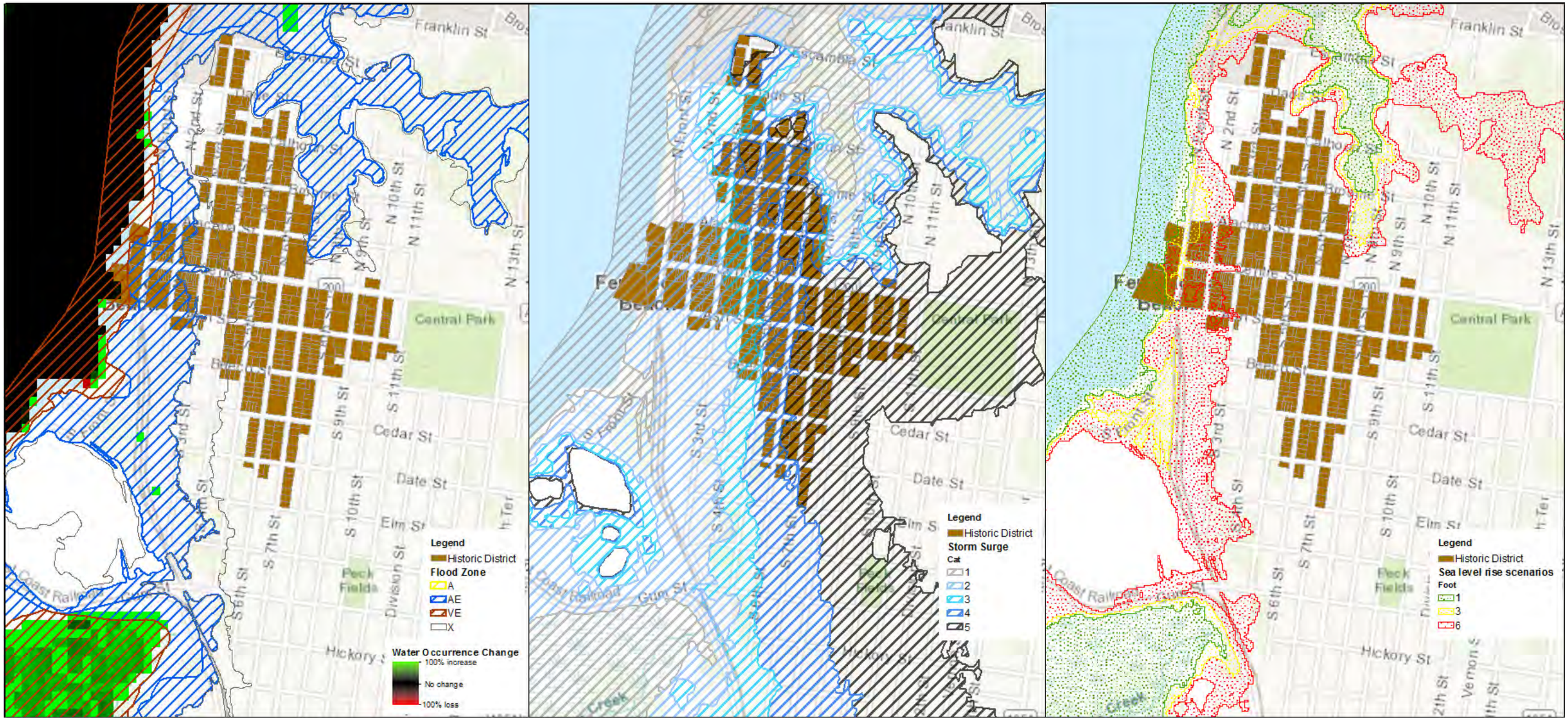
Figure 4. Paper Mill Sites



Given that paper-related manufacturing comprises more than 91% and 95% of Nassau County's manufacturing employment and wages, respectively, both mills were mapped against the three types of flooding events to assess their exposure. Both mills adjoin the Intracoastal Waterway, where there have been increases in surface water occurrence. However, these increases are more evident at the location of the Rayonier mill. Additionally, both sites are exposed to a Category 1 storm surge and a 1 ft. rise in sea levels.

Sources: TBG Work Product; DOR; EC JRC/Google; NOAA

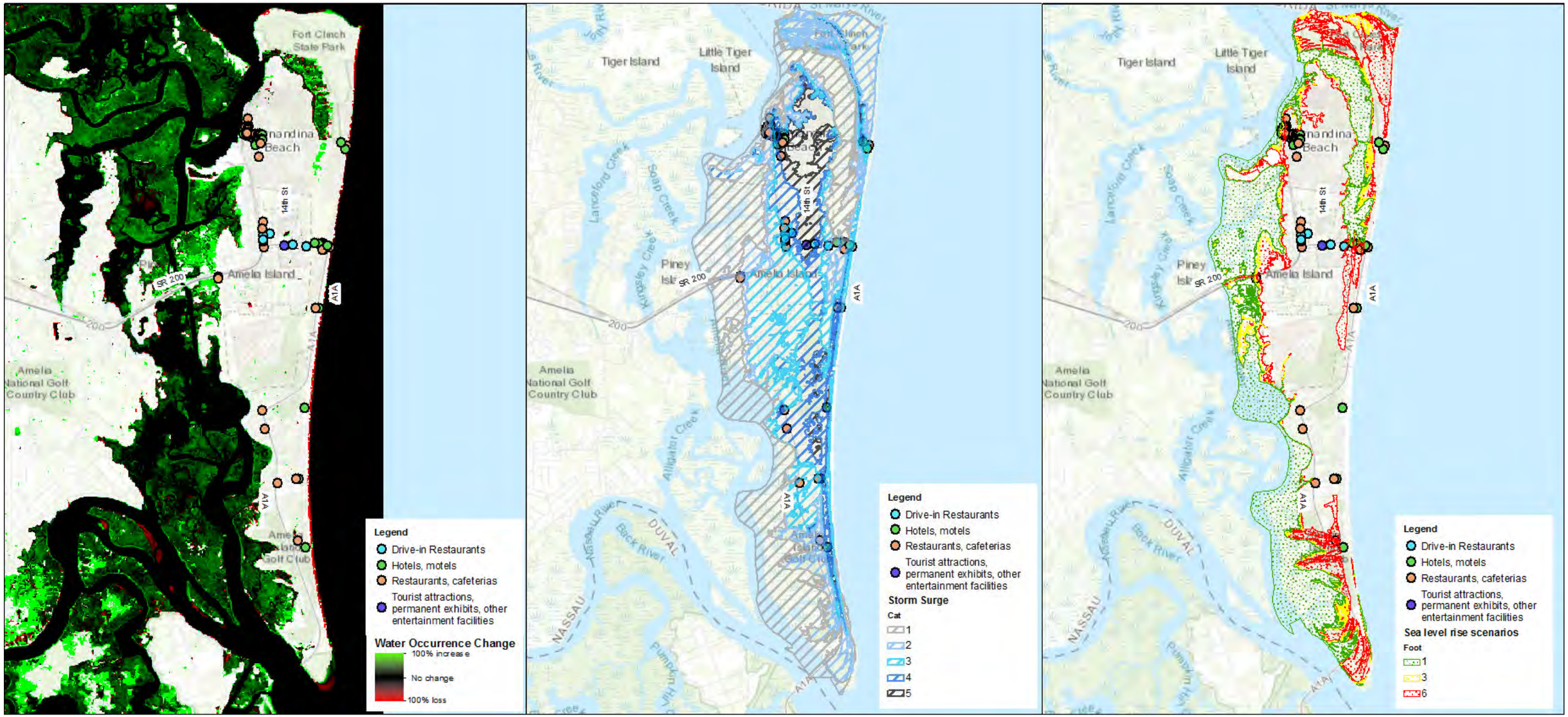
Figure 5. Historic District



Tourism is now the dominant component of Nassau County's economy and the historic district of Fernandina Beach plays a key role. 2% of parcels within the District are within the area subject to a Category 1 storm surge, 38% are within a Category 3, and 99% within a Category 5 storm surge. Additionally, 1.5% and 14% of the parcels are vulnerable to a 1 ft. and 6 ft. sea level rise, respectively.

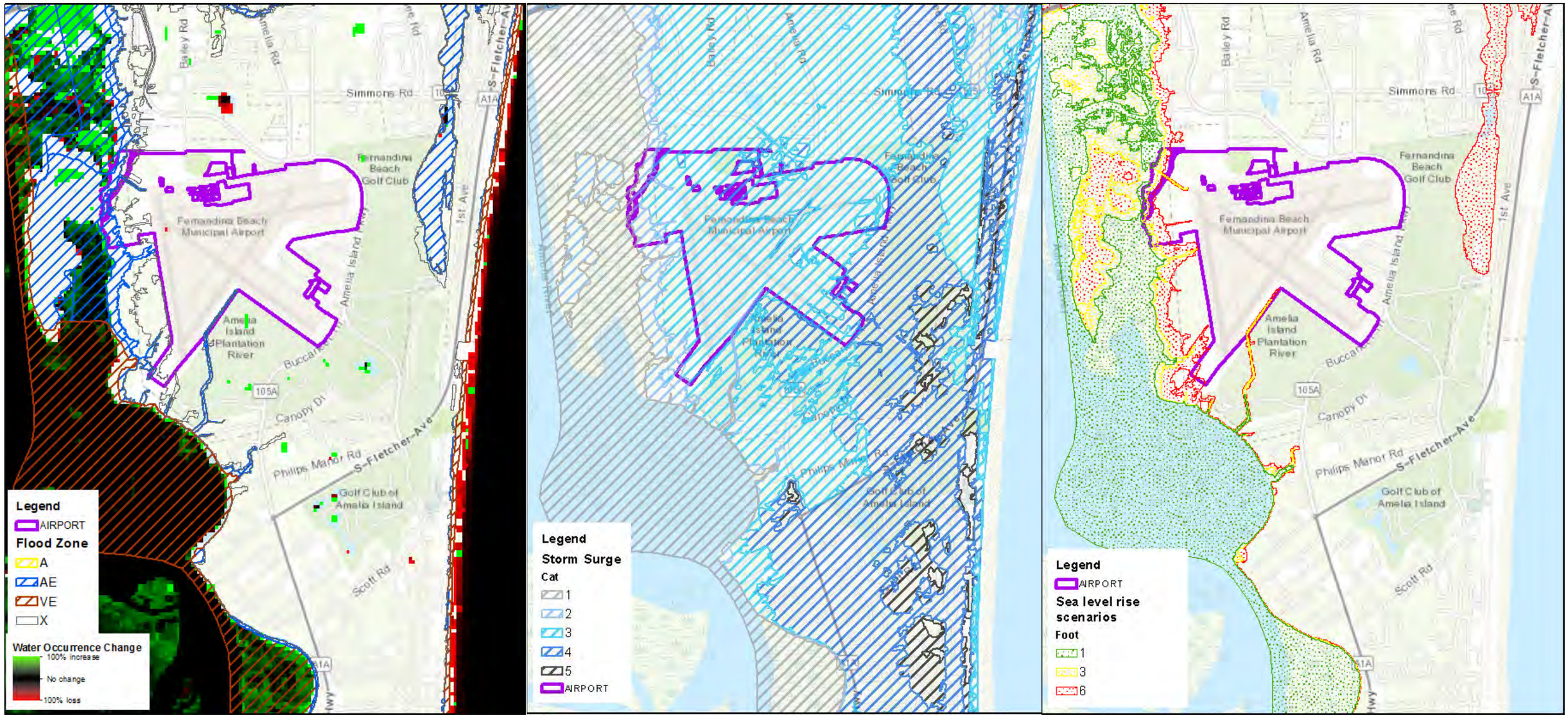
Sources: TBG Work Product; DOR; EC JRC/Google; NOAA

Figure 6. Amelia Island Tourism Sites



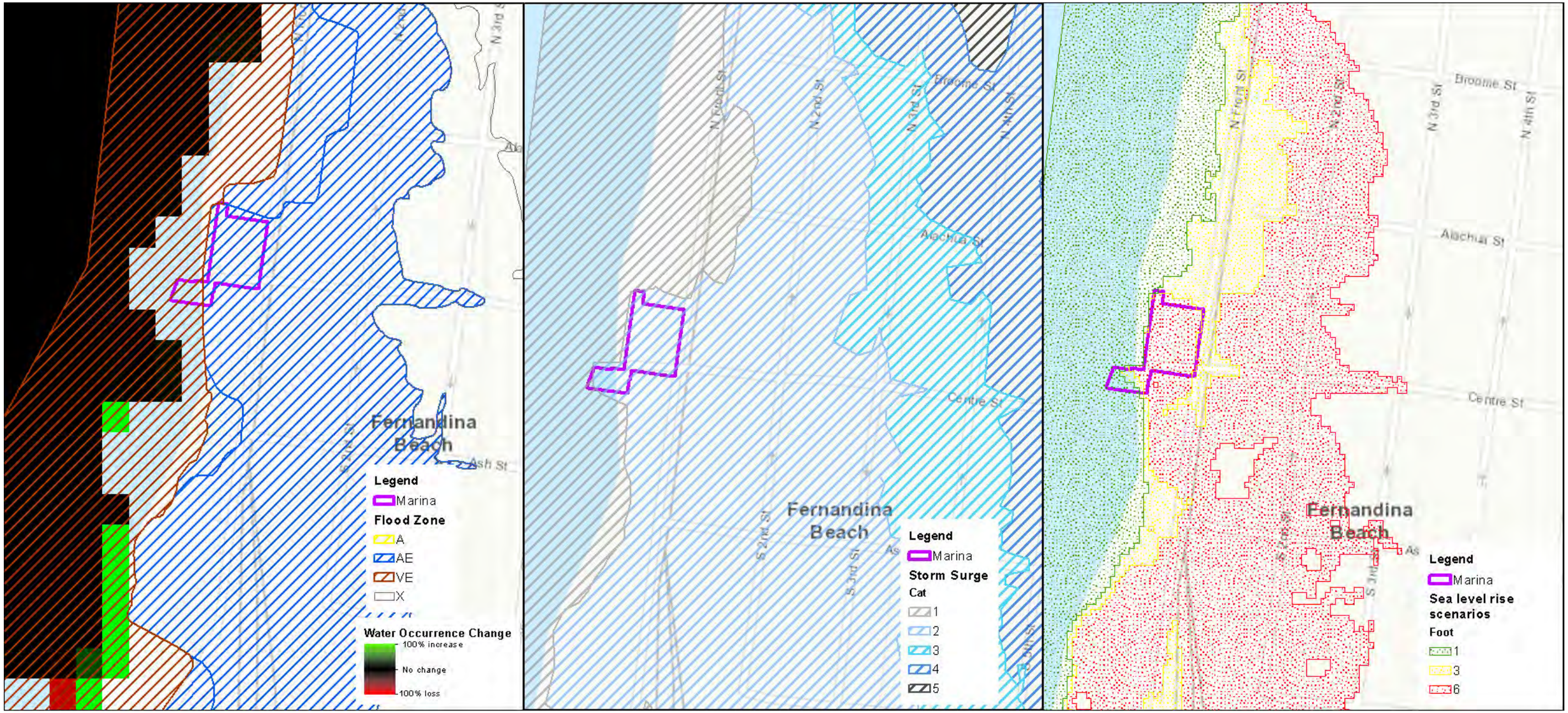
7% of hotels and motels on Amelia Island are within the area of a Category 1 storm surge, 37% are within a Category 3 and 74% are within a Category 5 storm surge. Additionally, 7% and 19% of the parcels are within a 1 ft. and 6 ft. sea level rise. In relation to restaurants and cafeterias on Amelia Island, 2% are within a Category 1, 59% are within a Category 3, and 88% are within a Category 5 storm surge. No restaurants are located within a 1 ft. sea level rise but 29% are within the area affected by a 6 ft. rise.

Figure 7. Fernandina Beach Municipal Airport



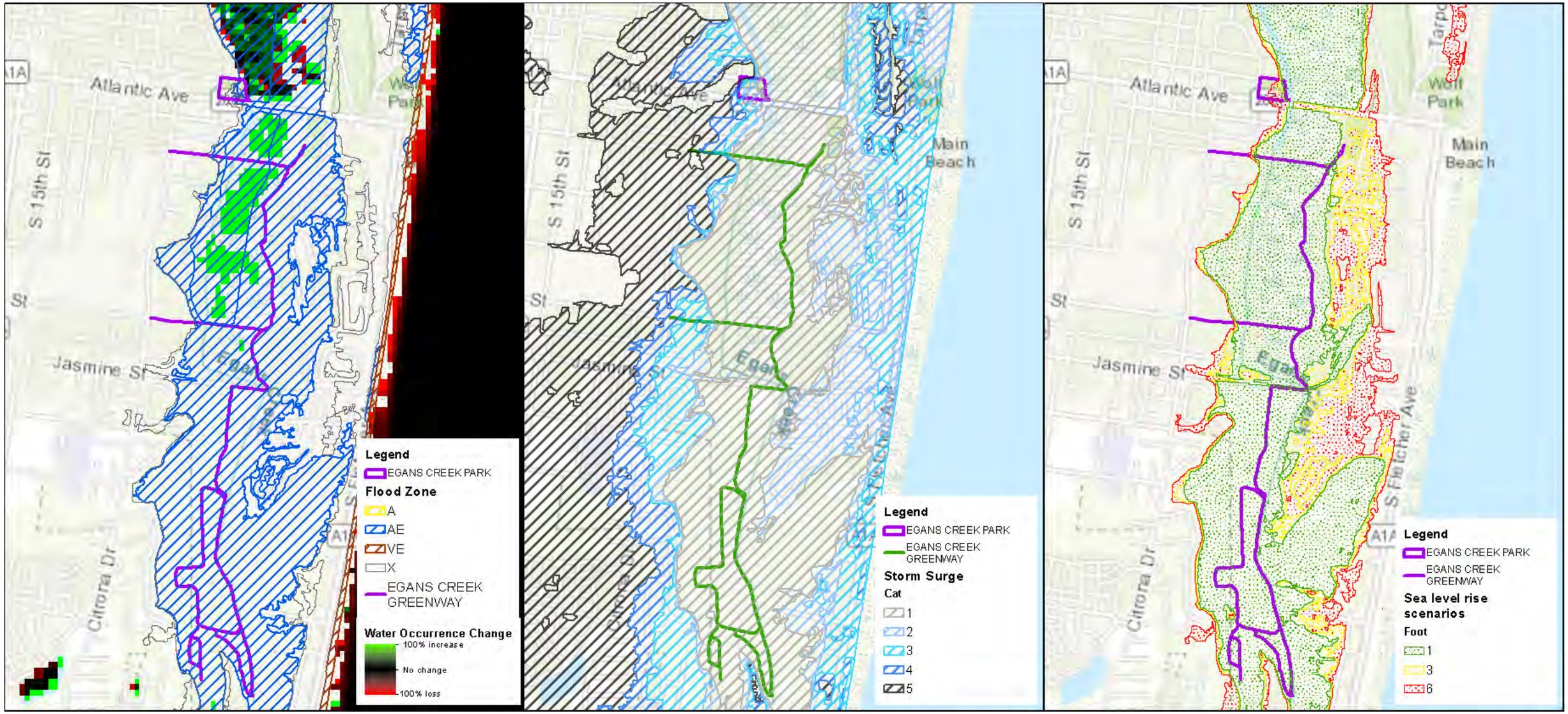
There has not been an increase in surface water occurrence within the parcel limits of the Fernandina Beach Municipal Airport. The airport would be impacted by a Category 3 or higher storm surge; a small portion in the western area of the airport parcel is within the areas affected by a 3 ft. and 6 ft. sea level rise.

Figure 8. Amelia Island Marina



The Amelia Island Marina provides access to the Intracoastal Waterway. The Marina is subject to impacts of a Category 1 or higher storm surge and a 1 ft. sea level rise. The vicinity of the Marina has experienced an increase in the incidence of water frequency (episodic and seasonal flooding).

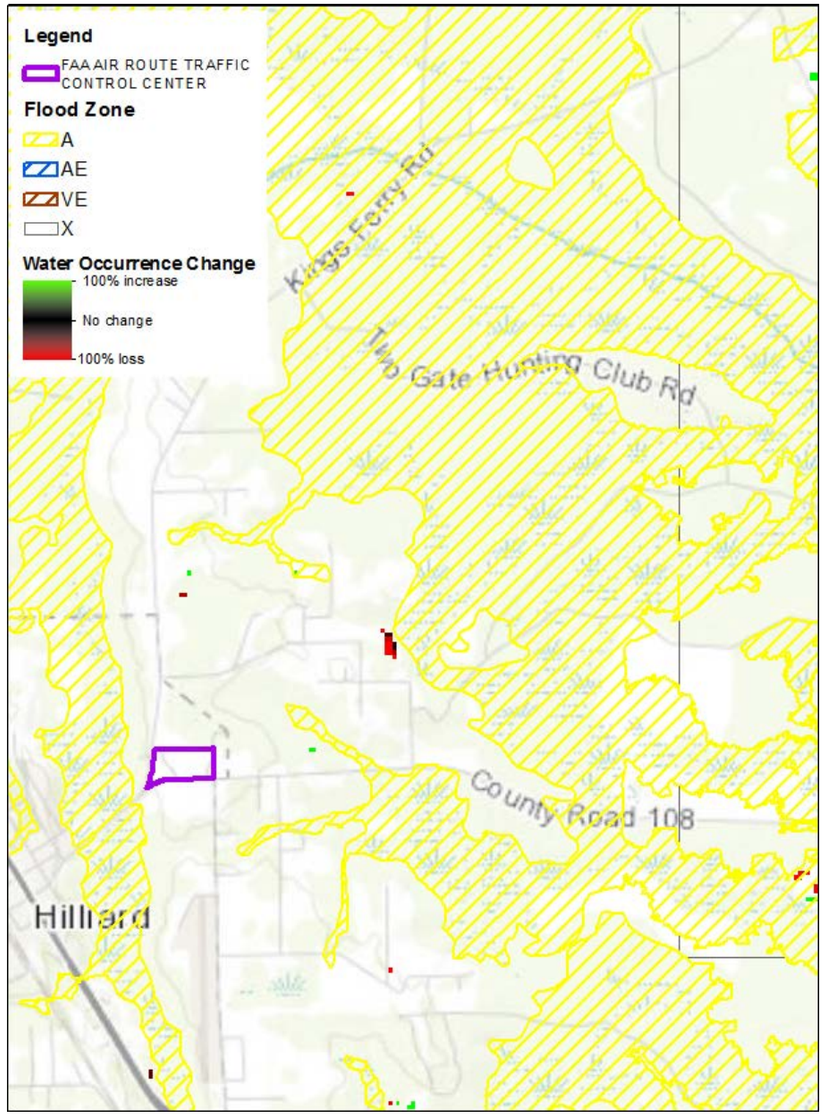
Figure 9. Egan's Creek Greenway

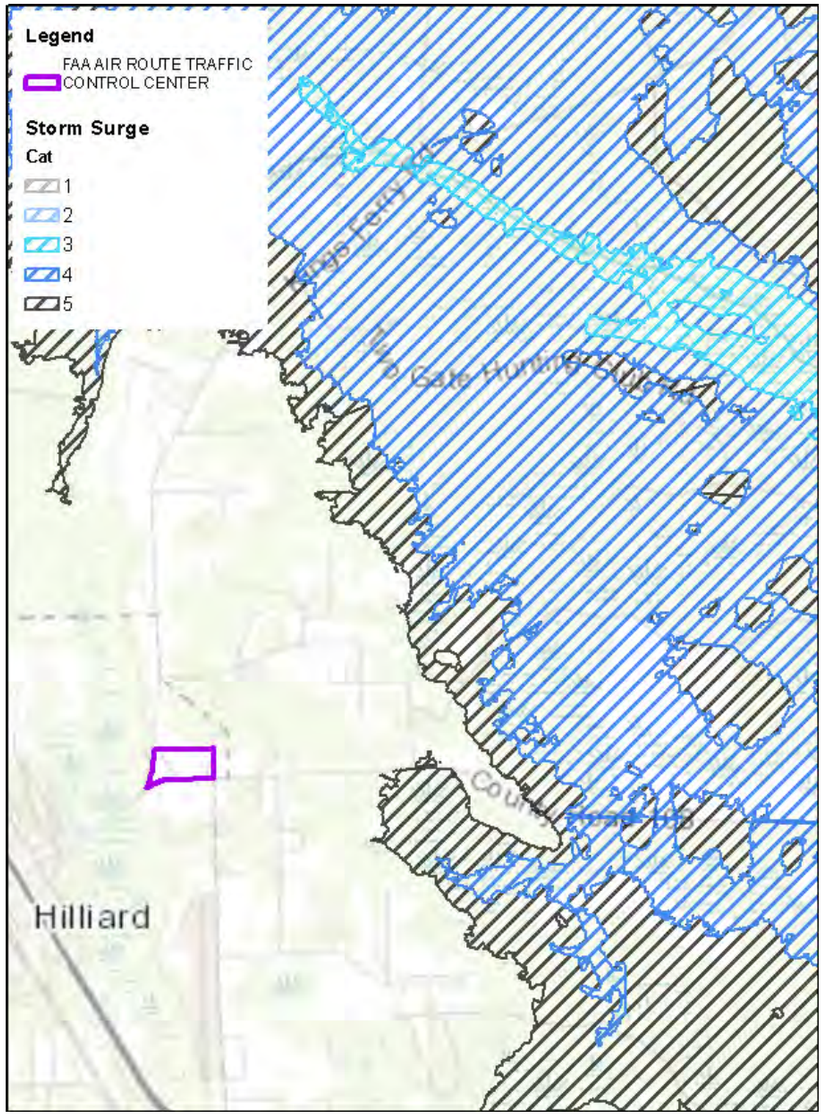


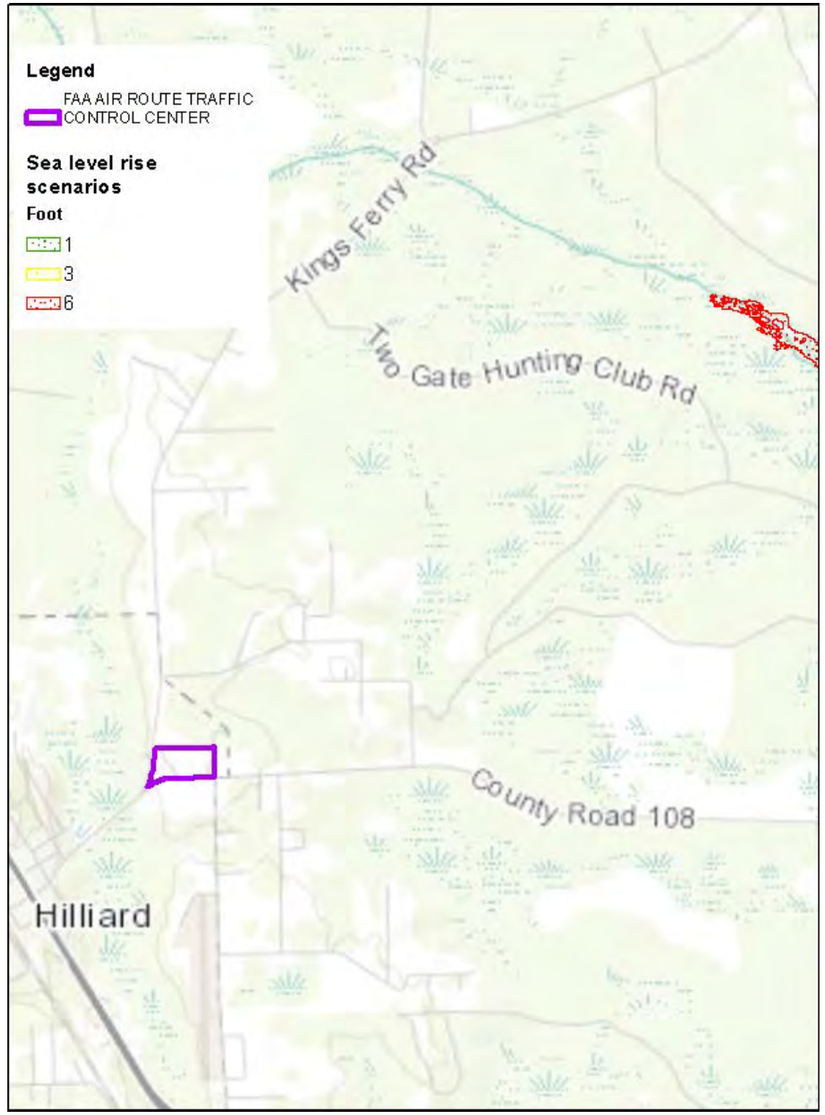
Since the 1980s there has been an increase in surface water occurrence in the surroundings of Egan's Creek Park on Amelia Island. Additionally, the park itself is subject to the impacts of a Category 1 storm surge and a 1 ft. sea level rise.

Sources: TBG Work Product; DOR; EC JRC/Google; NOAA

Figure 10. FAA Air Route Traffic Control Center

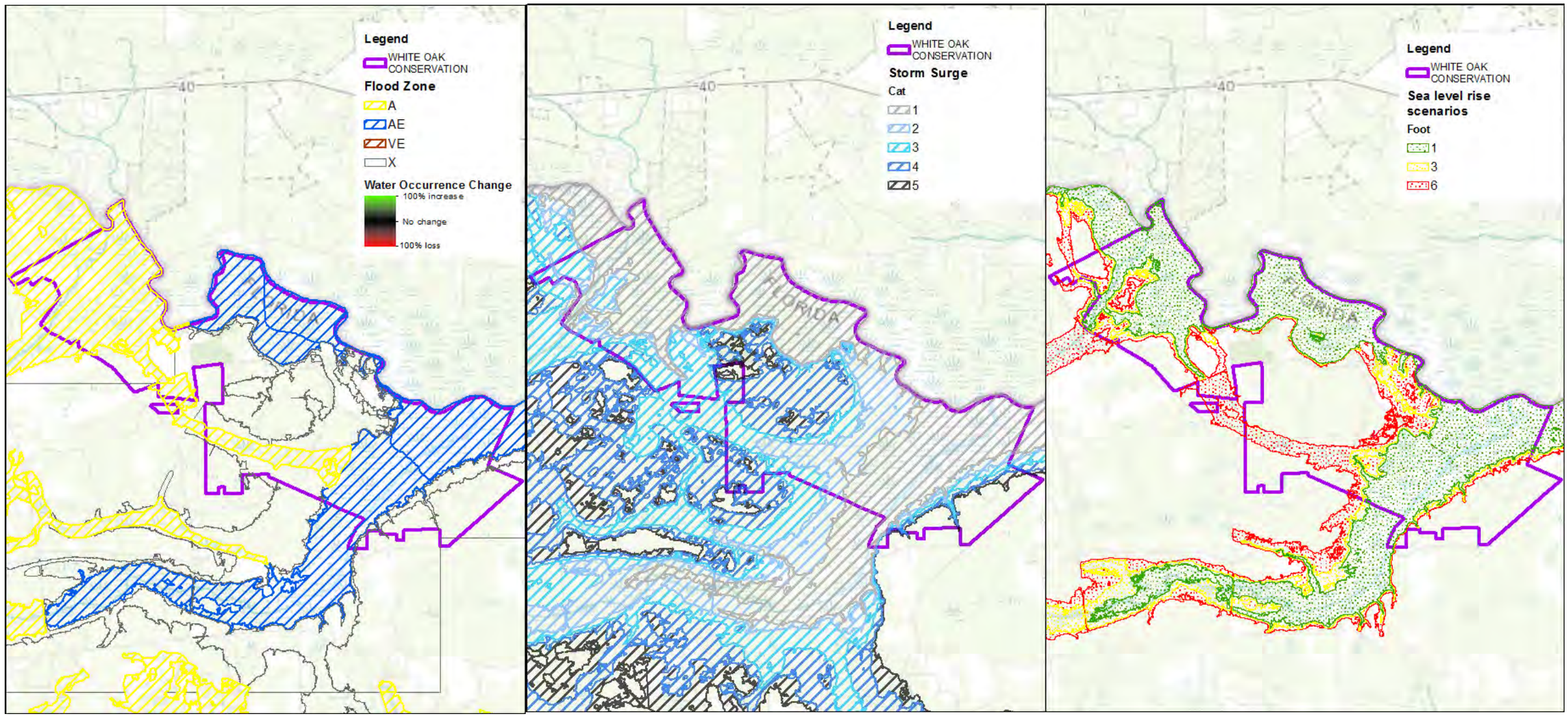






The property of the Federal Aviation Administration (FAA) air route traffic control near Hilliard does not overlap with any storm surge or sea level rise projections. Additionally, there is no evidence of increased surface water occurrence in the surroundings of the facility.

Figure 11. White Oak Conservation



White Oak Conservation owns several contiguous parcels by the St. Marys River and the Georgia border. While there have been nominal increases in surface water occurrence, parcels supporting White Oak's operations would be affected by either a Category 3 or greater storm surge or a 6 ft sea level rise.

Vulnerability Assessment: Findings

Nassau County conducted a vulnerability assessment focused on issues relating to flooding, drainage, storm events and sea level rise in two areas of the County: Amelia Island, and west of Interstate 95 on the mainland, north and west of State Road 200 / US 301. Both areas have additional development planned for locations that may be vulnerable to increased hazards.

The maps included in the vulnerability assessment reflect several overriding themes:

1. Much of Amelia Island is affected by the highest probability scenarios, including Category I storms and minimal sea level rise (1 ft.), including areas that are reasonably distant from the coastline. This may serve as a surprise to some residents and may begin a dialogue on measures that are needed to protect these areas from future damages.

2. Large areas that are served by septic tanks and drainfields are vulnerable to impacts from even minimal storm surge and sea level rise.

3. Vulnerable populations (elderly, poor, disabled) appear to be disproportionately affected by Cat I storm effects and minimal sea level rise.

4. Data reflecting increased water frequency shows concentrated impacts in areas with disproportionately high rates of poverty.

Sources

- European Commission Joint Research Centre (EC JRC)
- National Oceanic and Atmospheric Administration (NOAA)
- Northeast Florida Regional Council (NEFRC)
- Florida Department of Revenue
- Florida Division of Historical Resources
- Florida Natural Areas Inventory
- U.S. Census Bureau Topologically Integrated Geographic Encoding and Referencing (TIGER) data
- U.S. Census Bureau Longitudinal Employer-Household Dynamics data
- U.S. Department of Health, Florida Water Management Inventory