2022

TOWN OF WINDSOR RESILIENCE STRATEGY

North Carolina Division of Coastal Management

Resilient Coastal Communities Program

Phase 1 and 2 Report

Prepared by SWCA Environmental Consultants

4/15/2022

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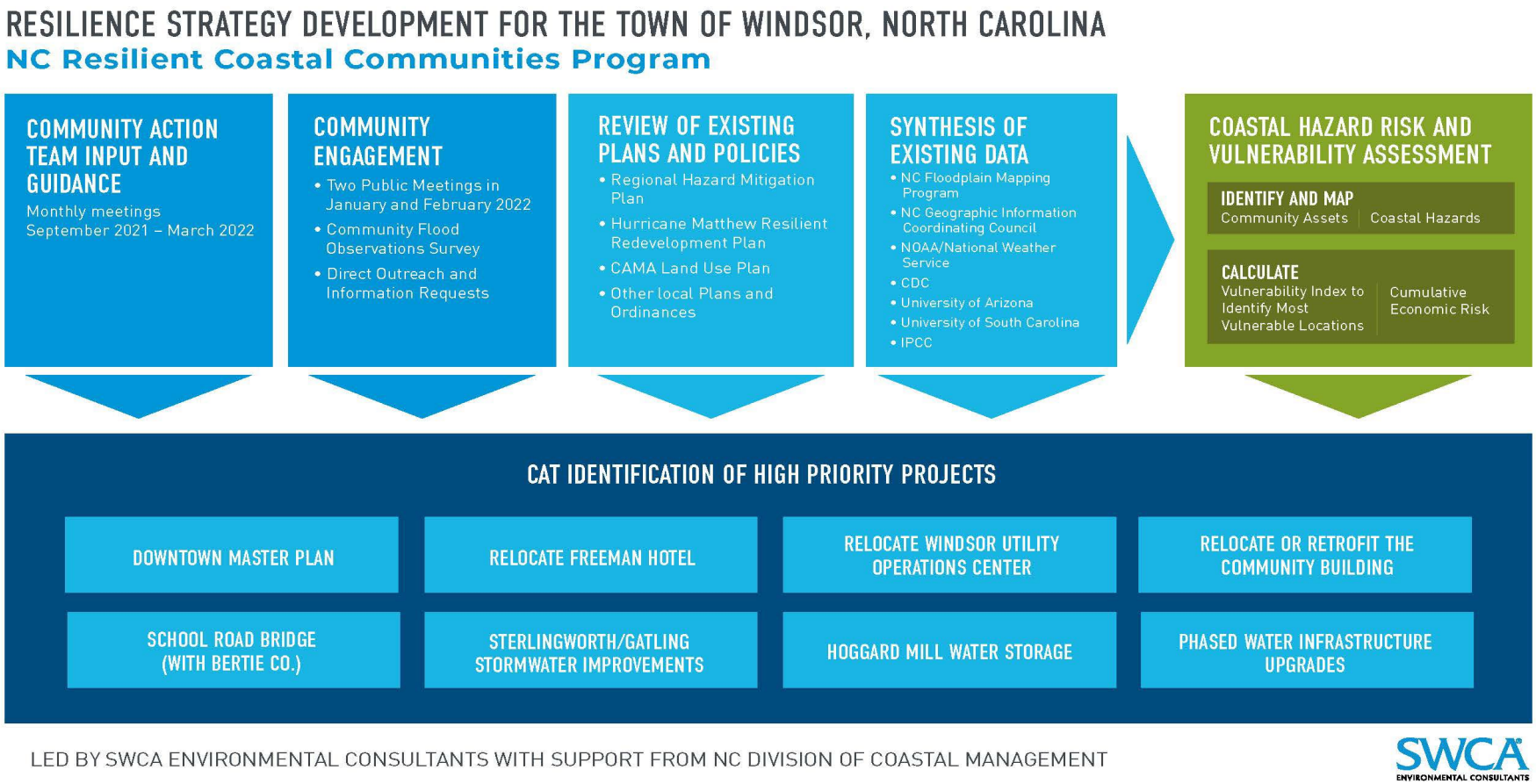
SUMMARY


RESILIENCE STRATEGY DEVELOPMENT FOR THE TOWN OF WINDSOR, NORTH CAROLINA
NC Resilient Coastal Communities Program
COMMUNITY ACTION TEAM INPUT AND GUIDANCE
Monthly meetings
September 2021 – March 2022
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Vulnerability Index to Identify Most Vulnerable Locations
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SCHOOL ROAD BRIDGE (WITH BERTIE CO.)
STERLINGWORTH/GATLING STORMWATER IMPROVEMENTS
HOGGARD MILL WATER STORAGE
PHASED WATER INFRASTRUCTURE UPGRADES
LED BY SWCA ENVIRONMENTAL CONSULTANTS WITH SUPPORT FROM NC DIVISION OF COASTAL MANAGEMENT
SWCA
ENVIRONMENTAL CONSULTANTS

1 INTRODUCTION

This Resilience Strategy was developed for the Town of Windsor under the North Carolina Resilient Coastal Communities Program (RCCP) by the North Carolina Division of Coastal Management (DCM) and SWCA Environmental Consultants (SWCA) in consultation with a local Community Action Team (CAT). The objectives of the RCCP are to 1) address barriers to coastal resilience in North Carolina at the local level, such as limited capacity, economic constraints, and social inequities; 2) assist communities with risk and vulnerability assessments and developing a portfolio of planned and prioritized projects; 3) advance coastal resilience projects to be shovel-ready, or ready for implementation; and 4) link communities to funding streams for project implementation. The RCCP includes four phases.

- Phase 1: Community Engagement and Risk/Vulnerability Assessment
- Phase 2: Planning, Project Identification, and Prioritization
- Phase 3: Engineering and Design
- Phase 4: Project Implementation

This Resilience Strategy document includes the results of Phases 1 and 2 of the RCCP: a risk and vulnerability assessment and a priority resilience project portfolio. The process to develop this Resilience Strategy took place between August 2021 and April 2022 and included monthly CAT meetings, community engagement via two public open house meetings, a community flood observations survey, and direct outreach to local stakeholders. Projects identified through this process are intended to build on and align with existing plans such as the regional Harard Mitigation Plan and CAMA Land Use Plan. At least one high priority project identified through this process will be eligible for Phase 3 funding to support design and engineering work beginning in summer 2022, and subsequent Phase 4 funding will support project implementation.

1.1 Community Overview

The town of Windsor is the county seat of Bertie County. Chartered in 1768 along the banks of the Cashie River, the town now has a population of just over 3,500 people (U.S. Census Bureau 2021) and includes an incorporated area of 2.8 square miles (U.S. Census Bureau 2020). The town of Windsor deals with riverine flooding directly associated with the Cashie River, which crosses through the eastern extent of the town's corporate limits (Figure 1). The town is very low lying, with significant portions of the downtown area lying within the 100-year and 500-year floodplains. Historically, the Cashie River generated flooding conditions during hurricanes, tropical storms, and heavy precipitation events. The town has already conducted extensive work to purchase and relocate residential structures impacted by the repeated flooding. The town's "Main Street" urban core has flooded regularly in recent years, forcing businesses to rebuild and attempt to open their doors again. With each flood, this becomes more difficult and increasingly impacts the town's economy. Addressing downtown flooding issues has been especially challenging due to lack of funding and support for non-residential property owners in flood recovery and resilience programs.

> ***Recent Major Floods*** *– Since 1999, Windsor has been impacted by 17 named hurricanes or tropical storm events. Hurricane Floyd was the initial major flooding event in 1999, followed by Tropical Storm Nicole (2010), Tropical Storm Julia (September 2016), and most recently Hurricane Matthew (October 2016). The back-to-back flood of 2016 had a devastating effect on downtown.*

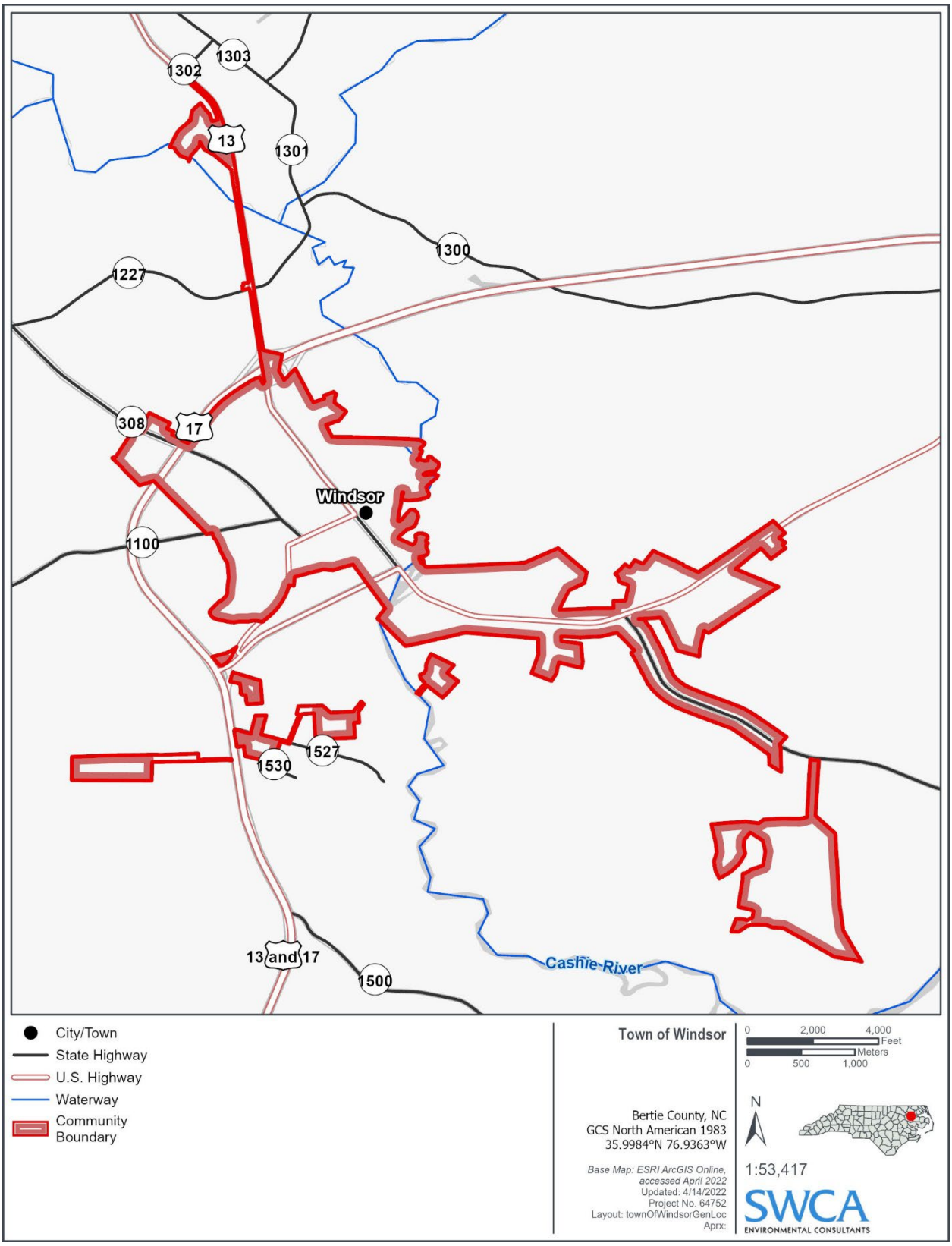

Figure 1. Map of the town of Windsor (red outlined areas) along the Cashie River in Bertie County, North Carolina.

2 COMMUNITY ACTION TEAM

Windsor's Community Action Team (CAT) was formed in consultation with the Town Administrator, and includes other town staff, the mayor, two town council members, and several interested residents, including representatives of local downtown businesses that have been impacted by flooding. A complete list of members is provided in Appendix A.

The CAT reviewed and provided feedback on the relevant coastal hazards, helped identify asset locations, identified additional local contacts with information about assets, provided review and feedback on the vulnerability and risk assessment results, supported planning and hosting of public open house meetings, agreed on criteria for prioritization of projects, contributed to definition of candidate projects, and reached agreement on the final list of high-priority projects included in this Resilience Strategy document.

CAT meetings were held approximately monthly between October and March for a total of seven CAT meetings. Summaries of all seven CAT meetings are provided in Appendix B.

3 VISION AND GOALS

The following vision and goals informed the development of Windsor's Resilience Strategy.

3.1 Vision

The Vision Statement was developed collaboratively by the CAT to reflect their resilience vision for the town and build upon what has been articulated in the Regional Hazard Mitigation Plan and Hurricane Matthew Resilient Redevelopment Plan:

> *Windsor is a resilient and vibrant community where citizens and visitors alike enjoy recreation and ecotourism activities. The town is committed to helping its residents thrive where they are placed and celebrating its riverfront, history, culture, and distinctive character while promoting commercial and residential growth and showcasing the beauty and natural resources of the Cashie River. The community rebounds quickly following hazard events due to strategic investments in flood mitigation projects, strong partnerships, and frequent communication with residents.*

3.2 Goals

Resilience Goals were developed collaboratively by the CAT following initial review of the Vulnerability and Risk Assessment results and preliminary project list. The goals are intended to reflect the general resilience priorities for the community and identify themes and concerns. Goals are intended to support the vision and to be used to identify priority projects.

1. Complete the Hoggard Mill project in the next 3 years
2. Maintain the vibrancy and historic nature of the downtown area and its economy
3. Create a downtown master plan
4. Education: Hold at least two educational sessions for the community about flooding and flood mitigation steps people can take themselves

5. Gather and review examples of resilience-oriented ordinances that may benefit the town of Windsor
6. Secure funding for X number of high-priority downtown resilience projects in [timeframe]
7. Pursue natural/nature-based solutions projects to complement structure and infrastructure solutions

The high-priority projects identified by the CAT are intended to align with this vision and move the town of Windsor toward completing these goals.

4 COMMUNITY ENGAGEMENT STRATEGY

The goals defined by the DCM for community engagement within the RCCP are to:

1. Promote representation and equitable outcomes for marginalized communities and vulnerable populations
2. Build trust, relationships, and partnerships
3. Provide feedback and validation of the Risk and Vulnerability Assessment developed by the CAT
4. Assist with prioritizing projects for Phases 3 and 4 of the Program

To achieve these goals, SWCA worked with the CAT to implement an approach to community engagement during Phases 1 and 2 of the RCCP that included the following elements.

4.1 Ongoing Online Engagement

Online engagement was conducted through the project website (Appendix C). The website included the following specific elements:

Interactive webmap – This map showed all the asset locations and hazard layers and allowed users to pan and zoom and turn on and off hazard layers to create a custom view showing the location and hazards of interest to them.

Online survey – The survey was available online and provided in hard copy at the first public meeting and asked respondents to identify the location, date, and time where they have observed flooding; describe the extend, observed depth, and maximum depth of the flooding; and to identify any critical locations or services they were unable to access during this flood event (e.g., school, workplace, medical facilities, clean water). The online version included an option for respondents to upload photographs of the flooding.

Links to additional resources about risk reduction/preparedness – These included the Ready NC Hurricane Preparedness Guide, guidance from the North Carolina Department of Health and Human Services on preventing and cleaning up mold/moisture, what to do with drinking water wells and septic systems in flooding conditions, and post-disaster resources from Legal Aid NC. The website also included project contact information, a sign-up field to receive email updates, and information about upcoming public meetings.

4.2 Direct Two-Way Information Sharing

Two-way information-sharing methods included the two in-person public open house meetings (see attendance list in Appendix D), and individual outreach to key stakeholders. SWCA and the CAT members shared information with the community about the RCCP process, the public open house meetings, and the online survey via hard copy fliers, social media postings (Figure 2), emails to project contacts and existing listservs, and notices in local news outlets. Details of the specific strategies used to engage specific audiences in Windsor during the RCCP process are detailed in Table 1.

Figure 2. Example social media post used to advertise the February public meeting.

Table 1. Engagement Strategies Used for Community Engagement in Windsor, North Carolina

Strategy	Audience and Timing	Goals
Direct Outreach to Individual Stakeholders Via email and telephone	People who may have key information to share, including town and county staff and those who serve or represent vulnerable and underrepresented groups *December–February*	-Gather key information missing from our assessment -Understand perspectives of people otherwise underrepresented in this process
Public Open House No. 1 – Risk Assessment -"Where I live and work" map at sign-in table -Big interactive map for identifying assets and hazards -Posters explaining types of resilience projects -Collect questions for follow-up -Collect survey responses and other information to incorporate -Kids' corner with drawing prompt	Local residents, town and county staff, and business owners *Mid-January*	-Introduce RCCP -Hear and answer questions about hazards and provide personal actions to decrease risk -Ground-truth the asset and hazard information collected and gather feedback and validation of the Risk and Vulnerability Assessment developed by the CAT -Collect contact information for interested parties for updates and follow-up
Survey with Interactive Map -Identifying specific locations on the map that have flooded in the past -Identifying how hazards have impacted assets and access to assets in the past -Online and linked on all public outreach materials -In hard copy at the open house	Local residents and business owners, including those who were unable to attend the open house when it was scheduled *January, during and following first open house*	-Ground-truth the asset and hazard information collected -Gather feedback with which to validate the Risk and Vulnerability Assessment -Gather input on criteria to be used in prioritizing resilience projects -Collect contact information for interested parties for updates/follow-up
Public Open House No. 2 – Priority Projects -Posters conveying preliminary project list -Collect additional project ideas -Collect questions for follow-up -Collect comments to incorporate	Local residents, town and county staff, and business owners *Late February*	-Review preliminary project list -Learn about which projects the community considers highest priority, to assist with prioritizing projects
Provide hazard preparedness activity for children at Public Open House meeting	Youth *At first open house session*	-Engage vulnerable and underrepresented populations

Strategy	Audience and Timing	Goals
Provide Spanish translations of RCCP program handout and some risk preparedness materials	People with limited English proficiency *For both open house sessions*	
Personal outreach through trusted community leaders	People living or with businesses in flood-prone areas *Leading up to both open house sessions*	

5 REVIEW OF EXISTING LOCAL AND REGIONAL EFFORTS

SWCA reviewed existing local and regional plans, ordinances, policies, and programs to identify resilience strategies already in place, previously identified assets, previously identified coastal hazards, and potential resilience projects to inform the RCCP process. Results of this review are summarized below in Table 2.

Table 2. Existing Documents Reviewed for the Town of Windsor

Document Name (Year)	Information Gleaned			
	Asset Locations	Hazard Information	Potential Resilience Projects	Resilience Strategies Already in Place
Northeast Region Hazard Mitigation Plan Update (2020)	•	•	•	•
NC State Resilience Plan (2020)				•
Flood Dynamics in the Bertie Water Crescent, NC LOW Report (2019)	•		•	
Town of Windsor Flood Mitigation Study (2018)			•	
State of North Carolina Hazard Mitigation Plan (2018)				•
Hurricane Matthew Resilient Redevelopment Plan – Bertie County (2017)			•	•
Downtown Flood Retrofit Report (2017)			•	
Northeast Region Hazard Mitigation Plan (2016)	•	•		•
CAMA Land Use Plan – Bertie County (2016)			•	•

6 RISK AND VULNERABILITY ASSESSMENT REPORT

To assess the overall coastal hazard risks and vulnerabilities the Town of Windsor faces, SWCA identified important places in the town (assets) and types of coastal hazards that could impact the town (hazards), with input and oversight from the CAT. SWCA used this information to evaluate the town's vulnerabilities and economic risks. The methods and results of this analysis are detailed below.

6.1 Identification and Mapping of Assets and Hazards

For purposes of this assessment, critical assets and natural infrastructure (assets) were defined as places that are important for emergency preparedness, response, recovery, and sustaining community life and sense of place. The types of assets identified in Windsor fell into the categories of Banks, Cemeteries, Cultural Sites, Emergency Services, Employers, Government Facilities, Health and Medical, Law Enforcement/Corrections, Parks and Recreation (including natural resources), Restaurants, Schools, and Utilities.

SWCA developed an initial asset list for the town starting with assets identified from existing information sources including the Northeast Regional Hazard Mitigation Plan and the National Register of Historic Places (NRHP). This list was then reviewed and revised by the CAT members and shared with other knowledgeable town and county staff for additional feedback. A preliminary map showing asset locations was shared during the first open house meeting in January and meeting attendees pointed out additional important locations, which were added to the asset list.

To identify relevant coastal hazards, SWCA looked at those identified as [high hazard] in the Regional Hazard Mitigation Plan and identified appropriate data sets to represent these hazards at the local level. Hazards evaluated for the town include Sea Level Rise (both along coast lines and in low-lying areas where increases in the water table can result in inland flooding), Storm Surge inundation (coastal storm surge from increasing high tides during simulated storm events), and flooding because of high Precipitation events (areas likely to be flooded such as Federal Emergency Management Agency [FEMA]-defined 100-year and 500-year floodplains as well as historical records of event flooding). Data sets used to represent these historical accounts include both geospatial data and input from community members at open house events). Data sets used to represent community hazards were selected after an extensive review of data documentation and similar reports in the region and are detailed in Appendix E.

In total, we identified and assessed vulnerability and risk from coastal hazards to 49 total asset locations for the Town of Windsor (Table 3).

6.2 Vulnerability Assessment

Vulnerability scores for town assets were calculated by expanding on the framework outlined in the RCCP Handbook. The handbook defined an asset's vulnerability as a combination of the risk to the asset from potential hazards based on the asset's location (Exposure), the degree to which an asset would be affected if exposed to hazards (Sensitivity), and any measures already taken to offset the negative impacts if the asset is exposed to hazards (Adaptive Capacity). To ensure a range of vulnerability scores for project prioritization, Exposure, Sensitivity, and Adaptative Capacity scores were calculated using a 0 to 5 scale.

Asset Vulnerability = Exposure + Sensitivity – Adaptive Capacity

Exposure, ranked from 0 (no exposure) to 5 (high exposure), represents the combined hazard exposure as an average of Sea Level Rise Exposure, Precipitation Exposure, and Storm Surge Exposure. Individual hazard exposure scores for Sea Level Rise and Storm Surge were calculated by assigning scores 0 to 5 to capture the likelihood of an asset being exposed to a hazard and the severity of that hazard, then using an exposure matrix (Figure 3) to classify the exposure as none (0), low (1), moderately low (2), moderate (3), moderately high (4), and high (5) (see Figure 3). Precipitation Exposure was calculated using a similar approach, but to account for localized flooding during high-intensity storm events, a Reported Event Inundation Factor of 2 or more points was added to each area to reflect the number of times data

showed it had been flooded during historical events. Additional information on how hazard severity and probability were assigned for each hazard type is provided below in the description of vulnerability assessment fields.

Sensitivity, ranked 0 (no effect) to 5 (highly affected), is the sum of the asset type sensitivity (0–3) and social sensitivity (0–2) of an asset. Asset type sensitivity scores were assigned categorically using assumptions about how a hazard would affect the physical infrastructure and functionality of an asset. Social Sensitivity was calculated by determining if an asset is in or serves a socially sensitive community based on social vulnerability index scores and input from stakeholder meetings (1 point) and if an asset inherently serves a socially vulnerable population (1 point).

Adaptive Capacity, ranked 0 (no ability to moderate hazard damage), –1 (minor retrofits to moderate some hazard damage), –3 (retrofitted/modified to moderate most hazard damage), –5 (retrofitted/modified to offset all hazard damage), was assigned on an asset-specific basis from CAT and community input during open house meetings.

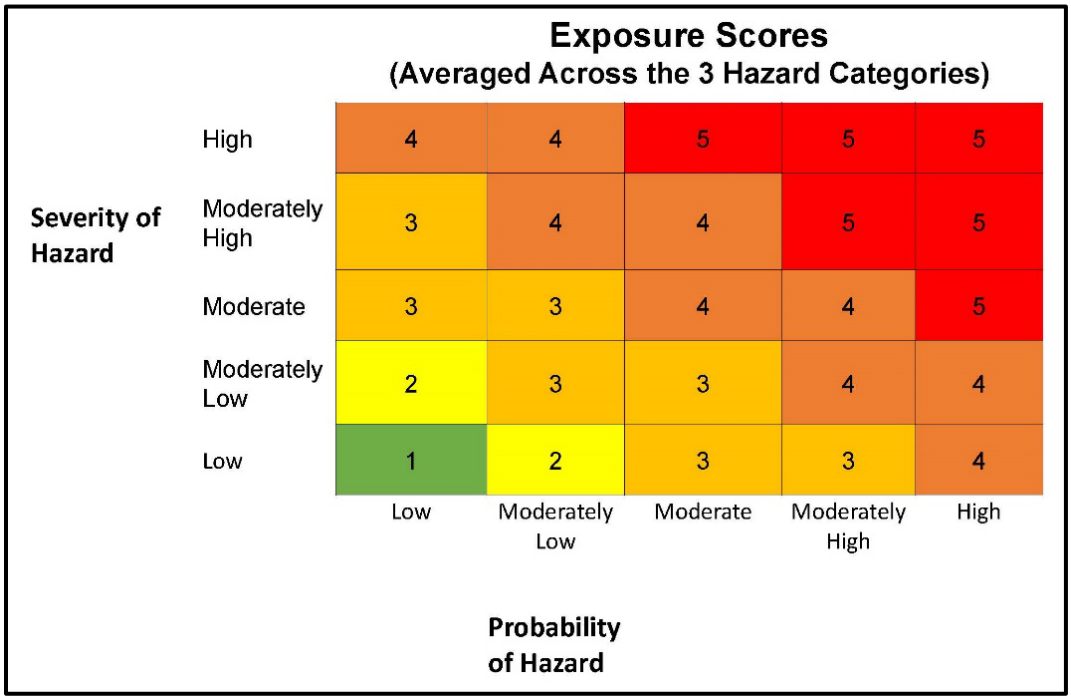

Figure 3. Exposure matrix used to calculate the level of exposure for each of three hazard categories.

All asset vulnerability scores, factors used to calculate asset vulnerability, and asset attribute data have been compiled into a holistic Asset List to provide additional details for planners and community members (Table 3). Fields in this table include the following:

Asset Attribute and Characteristics Fields

- **Asset ID** – Since an asset may function as multiple asset types and the town may have multiple assets with the same name, a singular unique Asset ID was assigned to each asset.

- **Asset Name** – An asset's proper name was used when available, otherwise nondescript names were assigned (e.g., pumping station, solar farm).
- **Asset Type** – Asset types were assigned to categorize assets based on the services they provide to the town. Some locations provide multiple services and, therefore, were assigned multiple asset types. For assets assigned to multiple type categories, all types were considered in analysis, but only the primary asset type was mapped (e.g., a high school that functions as an emergency shelter would be included in both Schools and Emergency Shelters Risk Evaluation but would be displayed in Schools on report figures) Asset type categories are Banks, Cemeteries, Childcare, Communications, Cultural Sites, Emergency Services, Employers, Food and Supplies, Government Facilities, Health and Medical, Law Enforcement/Corrections, Parks and Recreation (including natural resources), Restaurants, Roadways, Schools, and Utilities
- **Jurisdiction** – The physical location of assets in terms of jurisdictional boundaries (Town, unincorporated)
- **Address/Location** – Throughout the process of compiling assets, addresses and location descriptors such as plats and intersections were collected from text documents, web pages, county parcel data, and the CAT.
- **Ownership** – The ownership of each asset was pulled from ownership information in county parcel data and categorized into Federal, State, County, Town, and Private ownership designations.
- **Estimated Value** – To provide an estimated value for each town asset, estimated values were assigned by finding the maximum value (Parcel Value, Land Value, or Improvement Value) associated with an asset's parcel (maximum values were combined for assets that spanned multiple parcels). The location and types of some assets (e.g., pumping wells, elevated water towers, frequently flooded streets) resulted in an under- or overestimation of value. For those assets, the general cost of infrastructure was assigned based on CAT input and publicly available information about infrastructure values. These values are estimates only, and do not necessarily reflect market value or replacement value for the asset.

Vulnerability Assessment Fields

- **Vulnerability** – Scored 1 through 10 with assets having a score greater than or equal to 5 being considered at risk. Calculated as: Exposure (0–5) + Sensitivity (0–5) + Adaptive Capacity (0, –1, –3, –5)
- **Exposure** – This provides an overall evaluation of how exposed the site is to coastal hazards, calculated as the average of Precipitation Exposure, Sea Level Rise Exposure, and Storm Surge Exposure
- **Precipitation Exposure (**Figure 4**)** – Calculated as: Floodplain Exposure (Current or Potential) + Reported Event Inundation Factor.
- **Floodplain Exposure** – Current Floodplain Exposure was derived from FEMA DFIRM data (North Carolina Flood Mapping Program 2020) and calculated as a function of the annual

Interpreting Vulnerability Index Values - *It is not necessarily a problem for a site to have a higher vulnerability index value. Even a site with very high Exposure may still be resilient if it has low Sensitivity. For example, a public boat launch site could have a very high Exposure score of 5 because it is subject to regular flooding, but because the asset can easily recover after flooding, is not located in a socially vulnerable area, and is not providing critical services to vulnerable populations, it has a low Sensitivity score of 1. Though its overall Vulnerability Index value may be on the higher end (6), this is not concerning for this site.*

probability of precipitation flooding hazard (moderately low, 1% annual probability, for 100-year flooding or low, 0.2% annual probability, for 500-year flooding) and the severity of precipitation flooding hazard (moderately high for assets in the 100-year floodplain during a 100-year flood event, moderately high for assets in the 500-year floodplain during a 500-year flood event, and high for assets in the 100-year floodplain during a 500-year flood event). To account for increases in precipitation due to climate change, low-lying areas (within an elevation range of 0 to 27 feet above mean sea level, defined by reviewing current floodplain elevations) not currently listed as being in a floodplain were given a blanket Floodplain Exposure score of 2 to represent a low probability of flooding hazard and a low severity of flooding hazard.

- **Reported Event Inundation Factor** – Additive factor used to highlight areas of known flooding during large precipitation events as reported from historical satellite imagery (Schaffer-Smith 2020) or community engagement. For areas with a Floodplain Exposure score greater than 0, 1 point was added for each historical flooding event recorded for that area. For areas with a Floodplain Exposure score of 0 that were reported as having historical flooding, 2 points were awarded to areas with at least one reported flooding event and 1 point was added for each additional storm event.
- **Sea Level Rise Exposure (**Figure 5**)** – Maximum Sea Level Rise Exposure score calculated for the asset. This exposure rating evaluated potential inundation from encroaching coastal lines and inland flooding as a result of higher water tables under 1- to 10-foot National Oceanic and Atmospheric Administration (NOAA) sea level rise projections (NOAA Office of Coastal Management 2017). Scores for the probability of an asset being affected by sea level rise were calculated by grouping scenarios into the following categories based off projected sea level rise under different Intergovernmental Panel on Climate Change (IPCC 2014) emission scenarios: high – 1 to 2 feet expected under all scenarios; moderately high – 3 to 4 feet expected under most scenarios, moderately low – 5 to 6 feet expected under some scenarios; low – 7 to 10 feet expected under only the highest scenario). The severity of sea level rise hazards was assigned considering the accumulative effects of subsequent increases in sea level. For example, under 1 to 2 feet of sea level rise an asset may have a moderately low severity, but under 3- to 4-foot sea level rise conditions that asset will see higher inundation levels and would have a severity score of moderate.
- **Storm Surge Exposure (**Figure 6**)** – Maximum Storm Surge Exposure score calculated for the asset. High tide, coastal storm surges from National Hurricane Center Slosh Model Simulated Category 1 through Category 5 storms (Zachry et al. 2015) were evaluated using the annual probability calculated from historical records for the state of North Carolina to assign probability values like Floodplain Exposure (Category 1 – high with greater than 10% annual probability; Categories 2, 3, and 4 – moderate with approximately 5% annual probability; Category 5 – moderately low with approximately 1% annual probability). Severity of exposure was calculated by categorizing simulated feet of inundation (low – 1 foot, moderately low – 2 to 3 feet, moderate – 4 to 5 feet, moderately high – 6 to 7 feet, high – greater than 8 feet)
- **Sensitivity** – Asset Type Sensitivity + Social Sensitivity, where social sensitivity is a function of both the social vulnerability by service type and by the asset's physical location
- **Asset Type Sensitivity** – For assets that were assigned multiple asset types, the highest categorical sensitivity score was used. Scores for asset categories are as follows: Cemetery, Parks and Recreation, and Restaurants (1); Banks, Cultural Site, Childcare, Employers, Schools (2); Communications, Emergency Services, Food and Supplies, Government, Hazardous Waste, Health and Medical, Law Enforcement/Corrections, Roadways, Utilities (3).
- **Social Vulnerability (geographic)** – Average of Asset Location Social Vulnerability Score and Asset Service Community Vulnerability Score where social vulnerability scores (SoVI) represent

the potential negative effects on communities caused by external stresses on human health (calculated by CDC/ATSDR/Division of Toxicology and Human Health Sciences/Geospatial Research, Analysis & Services Program 2020; Hazards and Vulnerability Research Institute 2011), and the asset service community is all Census Blocks or Tracts that intersected a 1-mile radius of the asset (this area was assumed sufficient as vulnerability data is at the Census Block and Tract scale). Social vulnerability of the asset location and community were found by assigning threshold values to already calculated SoVI values as follows: top 10% of socially vulnerable areas (1), top 20% of socially vulnerable areas (0.75), top 30% of socially vulnerable areas (0.5), top 50% of socially vulnerable areas (0.25).

- **Social Vulnerability (by service type)** – Service Type sensitivity scores were assigned to asset locations that have been shown in the documentation to provide services to vulnerable populations, including the elderly (e.g., nursing homes, food distribution systems), chronically ill or physically disabled people (e.g. dialysis centers, medical facilities), less wealthy or food insecure individuals and families (e.g., food pantries, schools, public fishing access, local housing authorities), and historically marginalized groups (e.g., community organizations and cultural sites of significance to African American communities), people without adequate health insurance (e.g., EMS and Emergency Services), incarcerated individuals (e.g., correctional facilities), and those experiencing abuse or violence (e.g., law enforcement, medical facilities), youth and families (e.g., schools and childcare facilities, community centers, parks), and people without reliable internet access (e.g., libraries).
- **Adaptive Capacity** – Scores of 0, –3, and –5 were assigned based on the degree of adaptation described in CAT input.

More details regarding the specific data sets referenced in calculating each of these elements of the Vulnerability Index are summarized in Appendix E.

See Appendix F for detail maps showing assets and hazards in each of the numbered areas below (Figure 7).

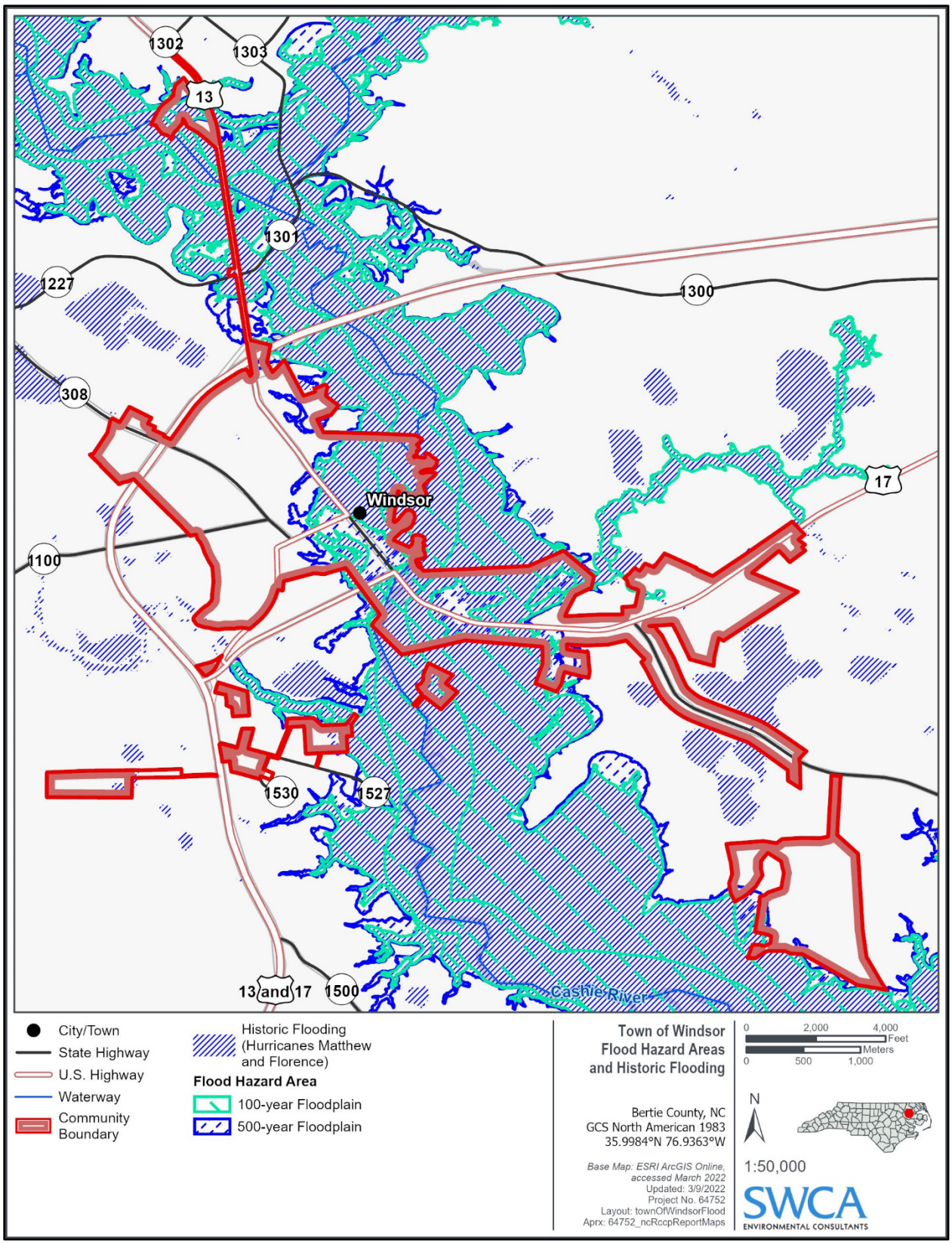

Figure 4. FEMA 100-year and 500-year floodplains and areas of historical flooding from Hurricanes Florence and Matthew around Windsor, North Carolina.

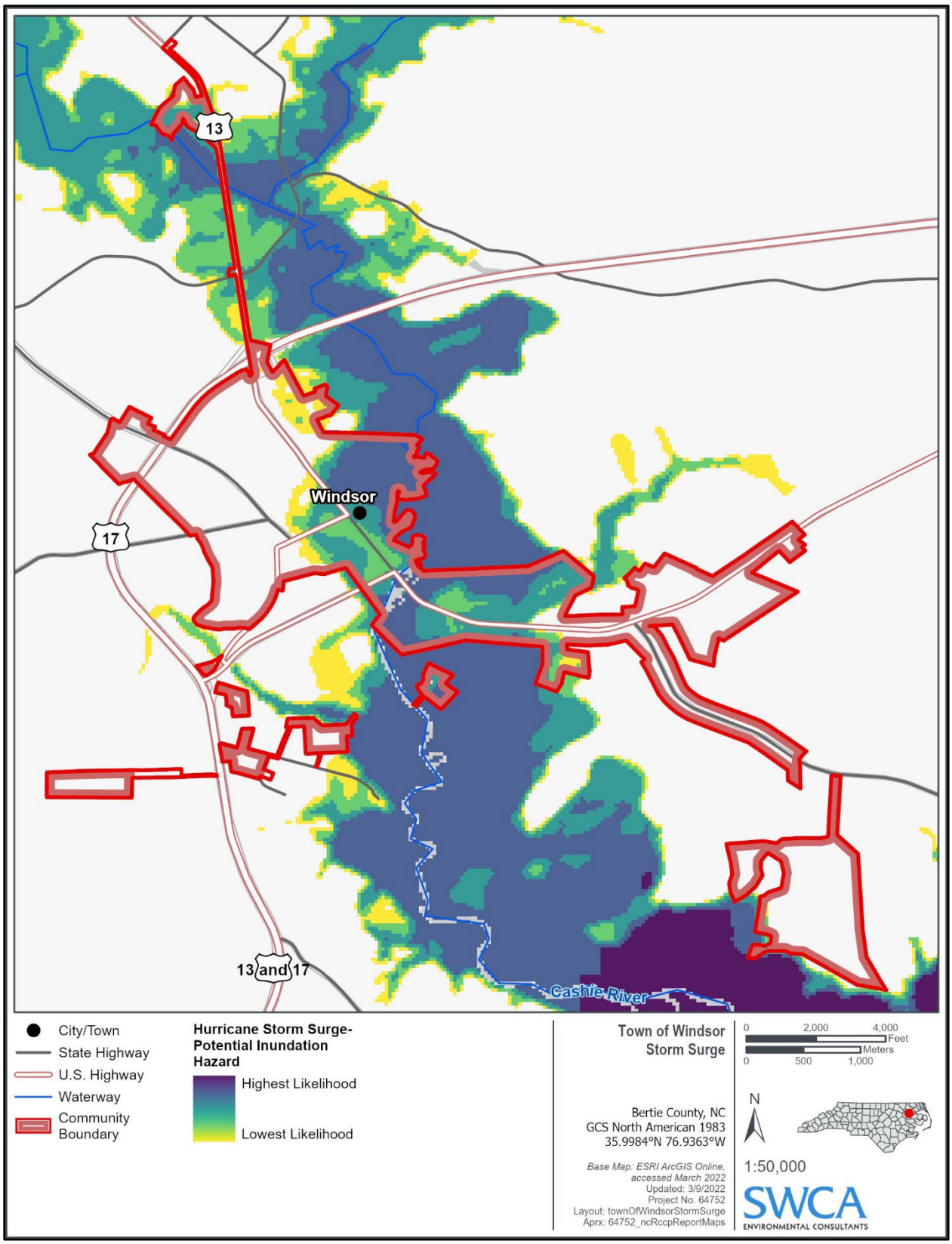

Figure 5. Areas with potential for storm surge inundation around Windsor, North Carolina.

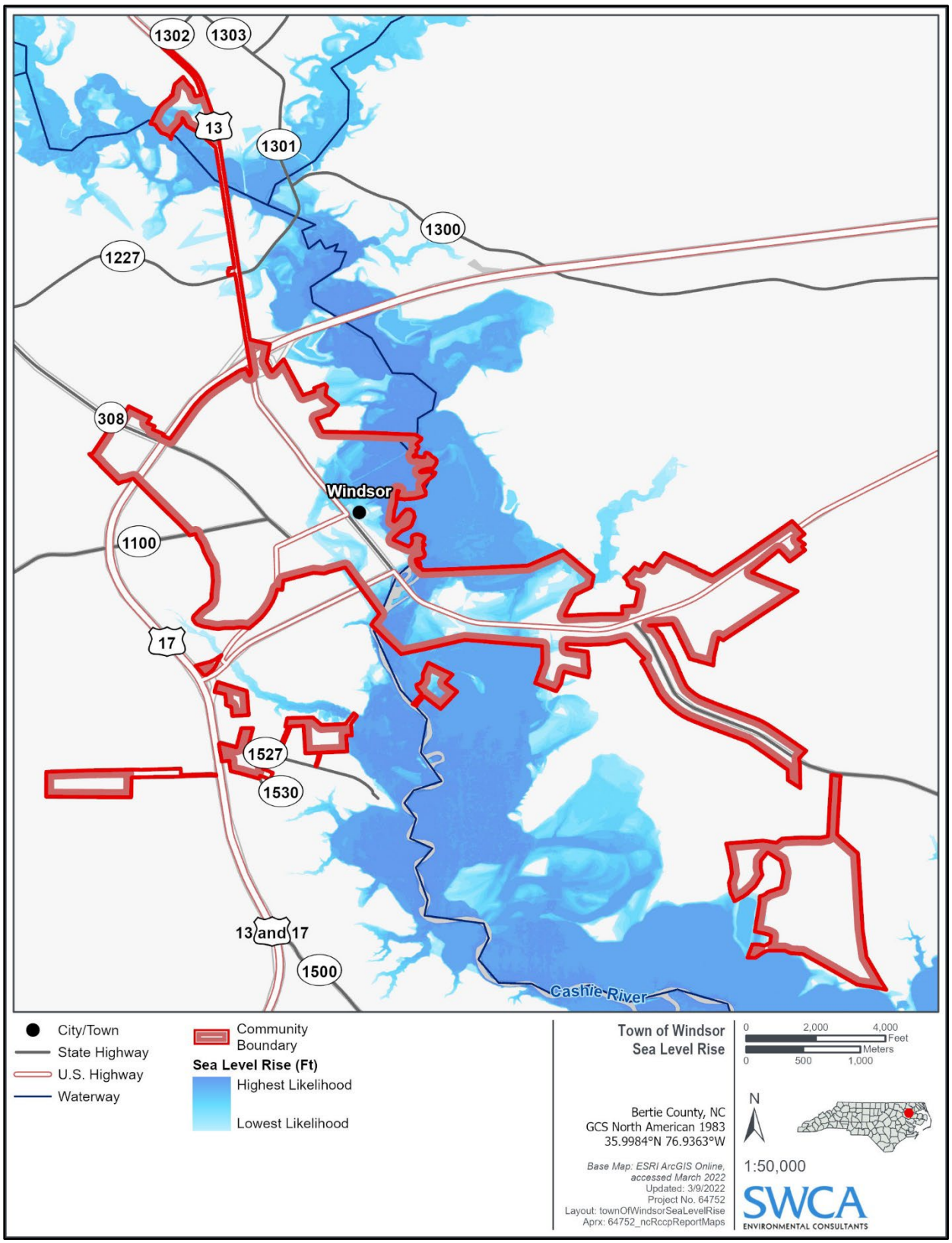

Figure 6. Areas at varying levels of risk from sea level rise from high likelihood of impact (dark blue) to lowest likelihood of impact (light blue) around Windsor, North Carolina. The existing areas of water are shown in gray.

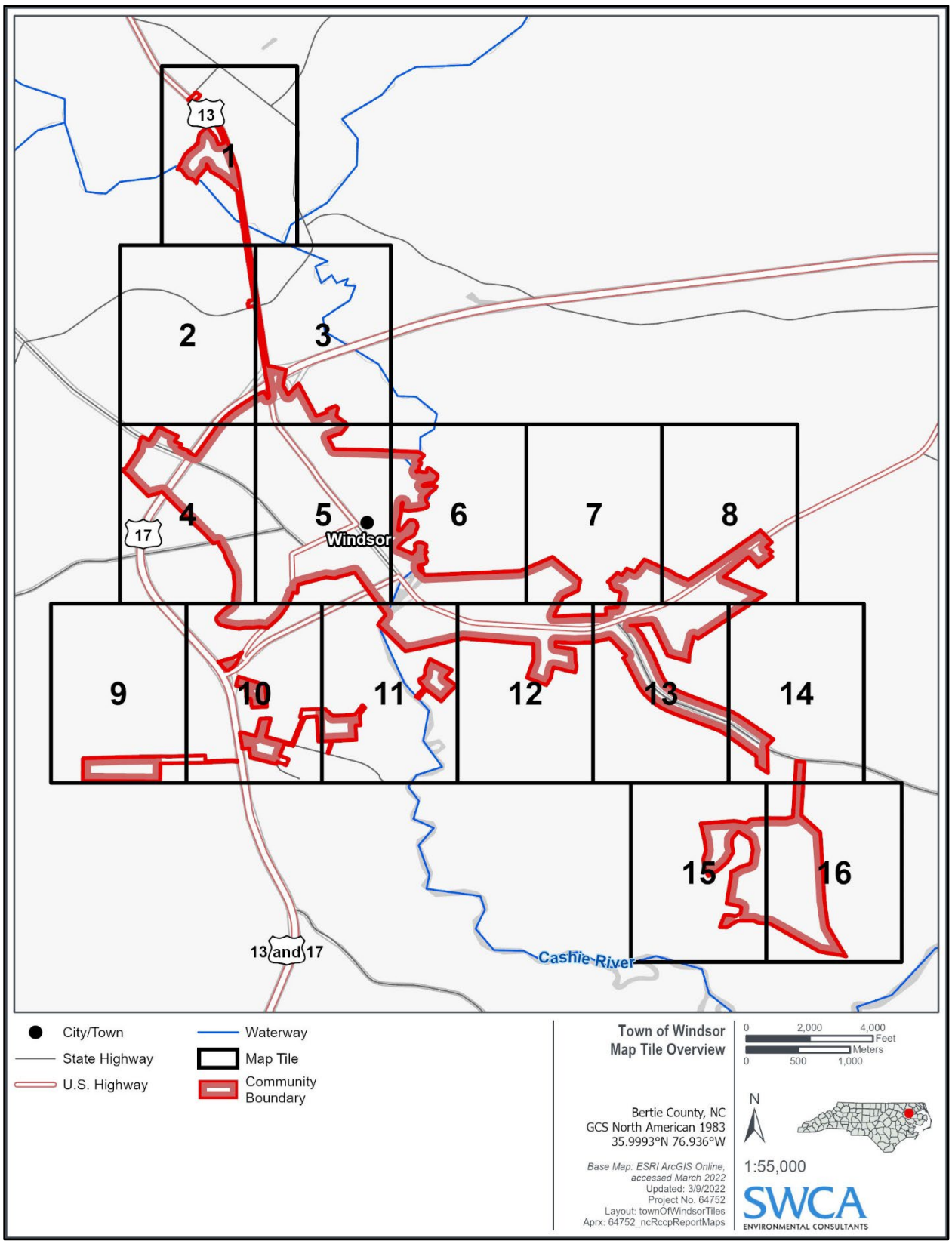

Figure 7. Map tile overview for maps showing details of assets and hazards around Windsor, North Carolina. Individual maps can be found in Appendix F.

Table 3. Asset Information and Calculation of Vulnerability Index for Each Asset for Windsor, North Carolina. (Assets are listed from highest vulnerability to lowest vulnerability index. See Section 6.2 above for description of how scores were calculated.)

Asset ID	Asset Name	Asset Type	Location	Ownership	Estimated Value ($)[1]	Jurisdiction	Vulnerability Index	Average Exposure (0–5)	Precipitation (0–5)	Sea Level Rise (0–5)	Storm Surge (0–5)	Total Sensitivity (0-5)	Sensitivity (0–3, by asset type)	Social Vulnerability (by location)	Social Vulnerability (by service)	Adaptive Capacity
TW-024	Lawrence Memorial Library	Government	204 E Dundee St	County	341,097	Town of Windsor	9	4	5	4	2	5	3	1	1	0
TW-007	Bertie Ambulance Service	Emergency Services	606 S King St	Private	396,064	Town of Windsor	8	3	4	4	0	5	3	1	1	0
TW-008	Bertie County Rescue Squad	Emergency Services	208 E Granville St	Town	147,129	Town of Windsor	9	4	5	4	2	5	3	1	1	0
TW-009	Bertie County Sheriff's Office	Emergency Services	104 Dundee St	County	3,079,472	Town of Windsor	8	3	3	4	1	5	3	1	1	0
TW-022	Windsor Post Office	Government	130 N King St	Federal	438,018	Town of Windsor	8	4	5	4	2	4	3	1	0	0
TW-026	Community Building	Government	1 S Queen St	Town	99,174	Town of Windsor	8	3	5	4	1	5	3	1	1	0
TW-038	Bunn's barbecue	Restaurants	127 N King St	Private	33,311	Town of Windsor	8	4	5	5	3	4	3	1	0	0
TW-048	Windsor Historic District	Cultural Site	Windsor	Federal, State, County, Town, Private	22,383,679	Town of Windsor	8	5	5	5	4	3	2	1	0	0
TW-050	Solar Farm – Built 2017	Utilities	159D Cooper Hill Rd	County	182,875	Town of Windsor	8	4	5	4	2	4	3	1	0	0
TW-006	Saint Thomas Church Building	Cultural Site	302 S Queen St	Private	569,861	Town of Windsor	7	4	5	4	2	3	2	1	0	0
TW-012	Windsor Police Department	Emergency Services	128 South King Street	Town	321,830	Town of Windsor	7	3	4	4	0	5	3	1	1	-1

[1] These values are based on state assessor data and other publicly available information. These are estimates only, and do not necessarily reflect market value or replacement value for the asset. Values for historic district include all parcels within the historic district.

Asset ID	Asset Name	Asset Type	Location	Ownership	Estimated Value ($)[1]	Jurisdiction	Vulnerability Index	Average Exposure (0–5)	Precipitation (0–5)	Sea Level Rise (0–5)	Storm Surge (0–5)	Total Sensitivity (0-5)	Sensitivity (0–3, by asset type)	Social Vulnerability (by location)	Social Vulnerability (by service)	Adaptive Capacity
TW-021	Bertie County Emergency Management	Government	106 Dundee St No. 220	County	3,079,472	Town of Windsor	7	2	3	3	0	5	3	1	1	0
TW-030	Three Rivers Health and Rehabilitation Center	Health and Medical	1403 Conner Dr	Private	1,846,765	Town of Windsor	7	2	3	3	0	5	3	1	1	0
TW-033	Livermon Park and Mini Zoo	Parks and Recreation	103 N York St	Town	52,173	Town of Windsor	7	4	5	5	3	3	1	1	1	0
TW-034	Windsor Boat Access Area	Parks and Recreation	400 Elm St	State	13,169	Town of Windsor	7	5	5	5	4	2	1	1	0	0
TW-043	Utility Operations Center	Utilities	108 S York St	Town	70,259	Town of Windsor	7	3	5	4	1	4	3	1	0	0
TW-045	Water Supply Well No. 2	Utilities	Sutton Dr	Town	40,000	Town of Windsor	7	3	4	4	1	4	3	1	0	0
TW-049	Bertie County Game Land	Parks and Recreation	Off 905 Woodard Rd	State	491,379	Bertie County Unincorporated	7	5	5	5	4	2	1	1	0	0
TW-53	Cashie River Walk	Parks and Recreation	112 W Water St	Town	37,031	Town of Windsor	7	5	5	5	4	2	1	1	0	0
TW-001	Southern Bank	Banks	101 N King St	Private	754,591	Town of Windsor	6	3	5	4	1	3	2	1	0	0
TW-020	Bertie County Courthouse	Government, Cultural Site	108 Dundee Street	County	3,079,472	Town of Windsor	6	2	3	3	0	4	3	1	0	0
TW-023	Windsor Town Hall	Government	128 S King St	Town	112,377	Town of Windsor	6	3	4	4	0	4	3	1	0	-1
TW-037	Cashie Treehouses Campground	Parks and Recreation	400 W Elm St	Town	295,742	Town of Windsor	6	4	5	5	2	2	1	1	0	0
TW-042	Windsor Municipal Water facilities	Utilities	106 Dundee Street	County	3,079,472	Town of Windsor	6	2	3	3	0	4	3	1	0	0
TW-044	Substation	Utilities	107 W Water St	Town	27,644	Town of Windsor	6	2	4	3	0	4	3	1	0	0

Asset ID	Asset Name	Asset Type	Location	Ownership	Estimated Value ($)[1]	Jurisdiction	Vulnerability Index	Average Exposure (0–5)	Precipitation (0–5)	Sea Level Rise (0–5)	Storm Surge (0–5)	Total Sensitivity (0-5)	Sensitivity (0–3, by asset type)	Social Vulnerability (by location)	Social Vulnerability (by service)	Adaptive Capacity
TW-051	Solar Farm – Built 2017	Utilities	159E Cooper Hill Rd	County	287,071	Town of Windsor	6	2	5	2	2	4	3	1	0	0
TW-002	Edgewood Cemetery	Cemetery	349 US Hwy 13 N	Town	137,421	Town of Windsor	5	3	5	3	0	2	1	1	0	0
TW-010	Coastal Medical Transport	Emergency Services	101 S Granville St	Private	141,353	Town of Windsor	5	0	1	0	0	5	3	1	1	0
TW-011	Windsor Fire Department	Emergency Services	501 N King St	Town	476,134	Town of Windsor	5	0	1	0	0	5	3	1	1	0
TW-014	County of Bertie	Employers	106 Dundee St	County	3,079,472	Town of Windsor	5	2	3	3	0	3	2	1	0	0
TW-025	Bertie County Library	Government	102 Lancaster Ave	County	1,877,615	Town of Windsor	5	0	0	0	0	5	3	1	1	0
TW-028	Vidant Bertie Hospital	Health and Medical	1403 S King St	County	7,120,642	Town of Windsor	5	0	1	0	0	5	3	1	1	0
TW-029	Brian Center Health and Rehabilitation-Windsor	Health and Medical	1306 S King St	Private	1,651,321	Town of Windsor	5	0	1	0	0	5	3	1	1	0
TW-031	Southern Touch Assisted Living	Health and Medical	205 W Watson St	Private	169,771	Town of Windsor	5	0	0	0	0	5	3	1	1	0
TW-032	Bertie Correctional Institution	Law Enforcement/ Corrections	218 Cooper Hill Rd	State	51,661,574	Town of Windsor	5	0	0	0	0	5	3	1	1	0
TW-036	Roanoke-Cashie River Center	Parks and Recreation	112 W Water St	Town	149,101	Town of Windsor	5	3	4	4	1	2	1	1	0	0
TW-016	Gillian Bros. Peanuts	Employers	406 Spring St	Private	948,565	Town of Windsor	4	1	1	2	0	3	2	1	0	0
TW-019	Food Lion	Food and Supplies	117 US Hwy 13 Byp	Private	2,741,737	Town of Windsor	4	0	0	0	0	4	3	1	0	0
TW-039	Serendipity School	Schools	117 County Farm Rd	Private	171,129	Town of Windsor	4	0	0	0	0	4	2	1	1	0

Asset ID	Asset Name	Asset Type	Location	Ownership	Estimated Value ($)[1]	Jurisdiction	Vulnerability Index	Average Exposure (0–5)	Precipitation (0–5)	Sea Level Rise (0–5)	Storm Surge (0–5)	Total Sensitivity (0-5)	Sensitivity (0–3, by asset type)	Social Vulnerability (by location)	Social Vulnerability (by service)	Adaptive Capacity
TW-040	Windsor Elementary	Schools, Parks and Recreation	104 Cooper Hill Rd	County	3,425,327	Town of Windsor	4	0	0	0	0	4	2	1	1	0
TW-041	Matin Community College, Bertie County	Schools	409 W Granville St	Private	1,357,423	Town of Windsor	4	0	1	0	0	4	2	1	1	0
TW-046	Water Supply Well No. 3 Elevated Tank	Utilities	Wall St	Town	400,000	Town of Windsor	4	0	0	0	0	4	3	1	0	0
TW-047	Water Supply Well No. 5	Utilities	Country Club	Town	40,000	Town of Windsor	4	0	0	0	0	4	3	1	0	0
TW-005	Bertie Memorial Hospital	Cultural Site	401 Sterlingworth St	Private	822,923	Town of Windsor	3	0	0	0	0	3	2	1	0	0
TW-013	Home Life Care, Inc.	Employers	1006 N King St	Private	206,140	Town of Windsor	3	0	0	0	0	3	2	1	0	0
TW-018	Windsor Motel	Employers	1523 S King St	Private	199,557	Town of Windsor	3	0	0	0	0	3	2	1	0	0
TW-003	Hillcrest Cemetery	Cemetery	508 Mountain St	Town	18,365	Town of Windsor	2	0	0	0	0	2	1	1	0	0
TW-017	Bertie County Peanuts	Employers	217 US Hwy 13 N	Private	464,610	Town of Windsor	2	0	0	0	0	2	2	0	0	0

6.3 Evaluation of Risk

To quantify the potential economic risk to town assets, Estimated Values for assets with a vulnerability score of 5 or greater were summarized by asset type and ownership (Table 4 and Table 5**).** Estimated values were assigned by finding the maximum value (Parcel Value, Land Value, or Improvement Value) associated with an asset's parcel. A threshold of 5 for the risk evaluation was used because it represents assets in a community with an average or above average vulnerability. In the Town of Windsor 36 assets with an estimated total value of $89,318,707 were determined to be at risk (defined as Vulnerability Index of 5 or higher). This value was calculated by assuming the value of assets that overlap are reflected in the cost estimate of the larger asset area (i.e., the cost of a government building in a historic district would be captured in the overall estimated cost for the historic district). This assumption was carried over into grouped estimated value calculations, and spatial duplicates were removed within each category. Estimated values for each Asset Type should be considered independently since assets with multiple type designations were included in the evaluation of each of their assigned types.

Table 4. Calculation of Total Asset Value at Risk (defined as Vulnerability Index of 5 or higher) for Each Asset Type for Windsor, North Carolina

Asset Type	Number of Assets at Risk	Estimated Asset Value at Risk ($)
Banks	1	754,591
Cemetery	1	137,421
Cultural Sites[2]	2	22,383,679
Emergency Services	6	2,098,405
Employers	1	615,895
Government	6	3,484,176
Government, Cultural Site	1	615,895
Health and Medical	4	10,788,499
Law Enforcement/Corrections	1	51,661,574
Parks and Recreation	6	1,038,595
Restaurants	1	33,311
Utilities	6	1,223,744

Table 5. Calculation of Total Asset Value at Risk (defined as Vulnerability Index of 5 or higher) for Each Ownership Type for Windsor, North Carolina

Ownership Category	Number of Assets at Risk	Estimated Asset Value at Risk ($)
Private	9	19,824,668
Federal	2	438,610
State	3	51,948,476
County	11	13,043,106
Town of Windsor	14	4,063,849

[2] Includes all parcels within historic districts.

7 PROJECT PORTFOLIO

7.1 Identification and Prioritization of Resilience Projects

The overall purpose of the RCCP is to support coastal communities to identify and pursue priority resilience projects that reduce and minimize risks posed by coastal hazards. The CAT referenced the following criteria (based on those in the RCCP Handbook) as well as their vision and goals in reaching agreement on a set of seven high-priority resilience projects for the town.

- Impact
  - Overall benefit to the community as a whole
  - Advances prior efforts/aligns with other plans
  - Has potential co-benefits, e.g., provides a recreational amenity, contributes to local economy, preserves a habitat, strengthens resilience to non-climate stressors like pandemics
  - Important for long-term resilience (i.e., taking climate change, sea level rise, and other future conditions into account)
  - Reduces vulnerability of key assets to coastal hazards
  - Reduces economic risk posed by coastal hazards in one or more sectors
  - Supports social equity
- Feasibility
  - Capacity to implement
  - Technical soundness
  - Likely positive benefit-cost ratio
  - Identifiable sources of funding

7.2 Prioritization Process

To develop a priority list of resilience projects for the Town of Windsor, SWCA first created a list of potential projects based on review of existing documents including the Northeastern NC Regional Hazard Mitigation Plan Update (North Carolina Emergency Management Division [NCEM] 2020), the Bertie County Hurricane Matthew Resilient Redevelopment Plan (NCEM 2017), Flood Dynamics in the Bertie Water Crescent report (North Carolina Land of Water 2019), and the Windsor Downtown Flood Retrofit 2017 Report (Hurricane Matthews Disaster Recovery and Resilience Initiative 2017).

Project prioritization proceeded in three rounds. In the first round, the CAT reviewed the full list of potential projects compiled from existing resources to remove projects already completed or no longer relevant to the town and add any additional projects for consideration. In the second round, CAT members added or refined some project ideas based on the criteria above and selected a short list to bring to the second public meeting for review and feedback (Figure 8). In the third round, CAT members refined and adjusted their high priority list based on the criteria above and to better reflect public input and the vulnerability assessment results.

The seven high-priority projects agreed upon by the CAT are described in more detail in the tables below. Generally, these projects were understood by the CAT to have broad community-wide risk-reduction benefits or to benefit vulnerable populations, to be feasible, to align with the town's long-term resilience goals, to build upon other plans, and to link to efforts already underway.

Figure 8. CAT members discuss potential projects at the February public meeting.

All other projects considered by the CAT are documented in Appendix G. Some of the other projects considered were not prioritized because they had been completed or were already in progress since being identified in previous planning efforts. Others were very localized and not perceived by the CAT to have sufficient benefit to the community at large to be considered high priority. Others would not substantially contribute to reducing coastal hazard risks or were considered infeasible by the CAT for any of the reasons noted in the criteria above, and so were not prioritized.

7.3 High Priority Projects

The following eight projects were identified as high priority by the Windsor CAT. Projects are *not* listed in order of priority; they are all high priority projects. Click the links below to jump to more details for each project:

7.3.1 Downtown Master Plan

Project Description	Evaluate and develop a comprehensive plan for the way the Historic downtown is integrated into the residential community. With amenities like the Freeman Hotel/Community Building constantly flooding and the loss of commercially zoned properties due to buyout, the downtown needs re-development outside of the floodplain and potentially utilizing the Granville St/Sterlingworth/King St corridors as well as giving more flexibility to the adjacent residential properties. Potential strategies or elements of the plan to be considered include: • Dry or wet flood proofing of buildings at locations noted in the Downtown Flood Retrofit Report • Downtown floodproof zone - Use a floodproof "curtain" and sewer backflow valves to isolate core downtown area from flood waters (see Flood Retrofit Report) • Relocation and/or retrofitting of commercial buildings, hotel, bank, post office, and utilities building • Redevelop a new "downtown" area outside the floodplain • Conduct ecological restoration of flood-prone building sites where structures are demolished to increase flood attenuation capacity and reduce maintenance needs on these properties. Specific properties that may be good candidates for this include the warehouse properties on King St, the utilities property on York St, and the former attorney office on Dundee St.
Location	Flood-prone buildings on Stokes Drive, and the Housing Authority offices at 104 White Street
Source	Downtown Flood Retrofit Report, Public meeting input, Discussion with CAT members
Scoping Questions	Should relocation include only the three southernmost buildings on Stokes Drive that are most clearly at risk, or should it include the whole complex? [NOTE: this may depend on funding source and quantity of available funds] Would elevation be a more effective strategy than relocation for either site?
Hazard(s) Addressed by Project	Precipitation-based flooding, storm surge, sea level rise
FEMA Community Lifelines	Safety and Security
Type of Solution	Non-regulatory Programs, Structure and Infrastructure, Nature-based Solutions
Project Estimated Timeline	To be determined
Responsible Entity	Town of Windsor with a contractor
Potential Partners	
Existing Funding	None identified by CAT
Potential Funding Sources	Building Resilient Infrastructure and Communities (BRIC)
Project Estimated Cost	Low – $40,000
Anticipated Benefit	High – Action would have a significant impact on risk reduction. .
Priority Rating	High

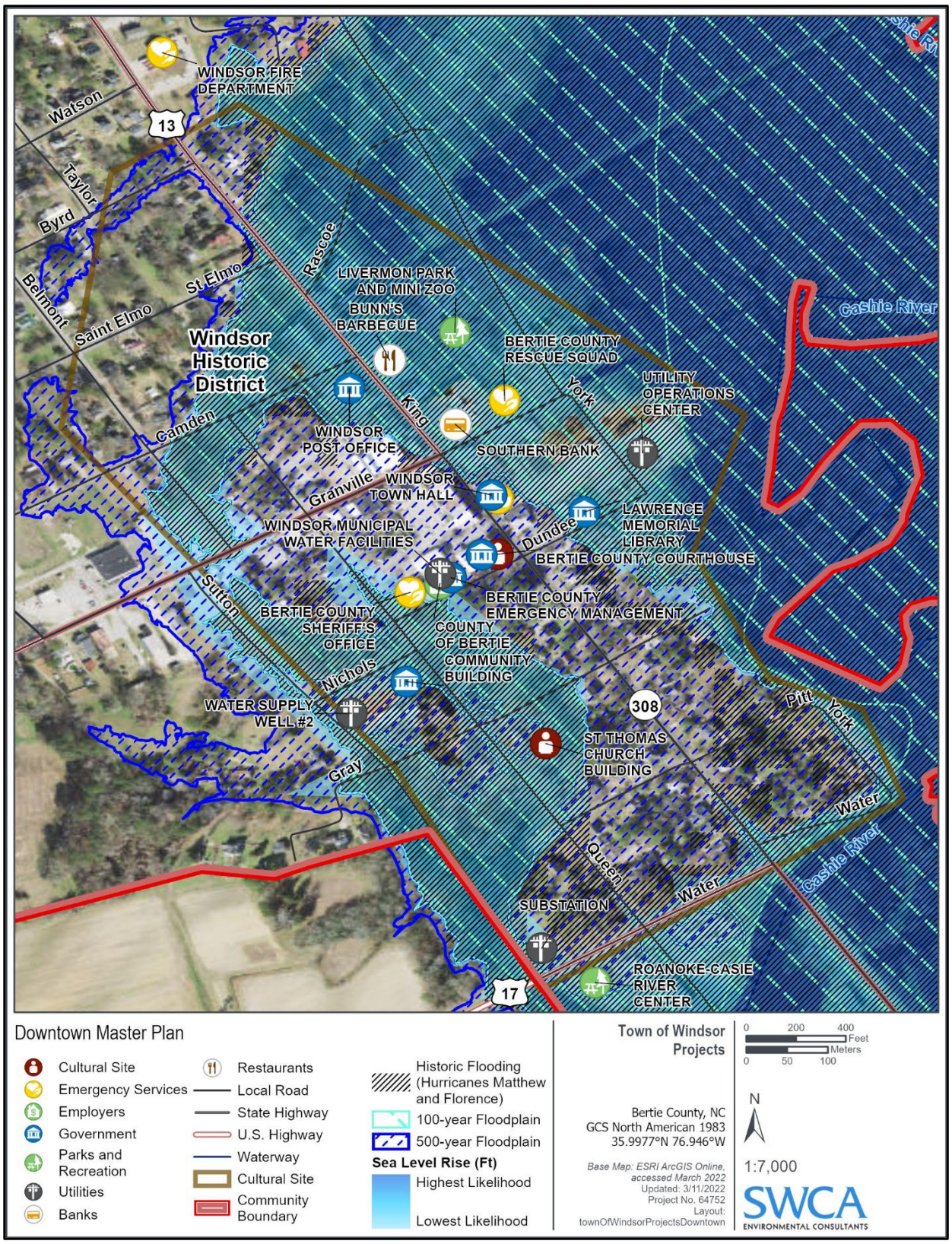

Figure 9. Location of Downtown Master Plan Area, showing assets and historic district location within historically flooded areas, the 100-year and 500-year floodplains, and at risk from sea level rise.

7.3.2 Relocate Freeman Hotel

Project Description	This project involves moving the existing historic Freeman Hotel building to a less flood-prone location.
Location	Relocate to 308 West Camden St
Source	Public Meeting Input
Scoping Questions	Can this be integrated into the Downtown Master Plan to maximize economic development benefit of this project?
Hazard(s) Addressed by Project	Precipitation-based flooding, storm surge, sea level rise
FEMA Community Lifelines	Safety and Security
Type of Solution	Structure and Infrastructure
Project Estimated Timeline	2 years
Responsible Entity	Town of Windsor
Potential Partners	
Existing Funding	The Town is awaiting response to an application for funding to support this project.
Potential Funding Sources	Florence funding may support this
Project Estimated Cost	Medium – $239,225 This includes the set-up at the new site and the clearance of the old site and any professional services needed.
Anticipated Benefit	Medium – Action would have an impact on risk reduction
Priority Rating	High

7.3.3 Relocate Windsor Utility Operations Center

Project Description	Develop a new facility for the Windsor Utility Operations Center at a new location to maintain water, sewer, power, and sanitation. Assists the Town of Windsor in adequately responding to utility calls and quickly providing a response. County has identified a suitable location for a new facility. The former site would then be restored to a more natural state to help attenuate flooding in this area and reduce long-term maintenance costs for the site.
Location	New location to be determined
Source	Hurricane Matthew Resilient Redevelopment Plan
Scoping Questions	Are there any known contaminants stored on the existing site? Could prevent restoration or make it significantly more expensive
Hazard(s) Addressed by Project	Precipitation-based flooding, Storm Surge, Sea Level Rise
FEMA Community Lifelines	Safety and Security; Food, Water, Shelter; Energy; Communications
Type of Solution	Structure and Infrastructure, Nature Based Solutions
Project Estimated Timeline	2 years
Responsible Entity	Town of Windsor
Potential Partners	
Existing Funding	None identified by CAT
Potential Funding Sources	NFWF, for design and implementation of the nature-based elements, Building Resilient Infrastructure and Communities (BRIC), Hazard Mitigation Grant Program (HMGP)
Project Estimated Cost	Medium – $251,000–$500,000 (from Hurricane Matthew Resilient Redevelopment Plan)
Anticipated Benefit	High – Action would have a significant impact on risk reduction. .
Priority Rating	High

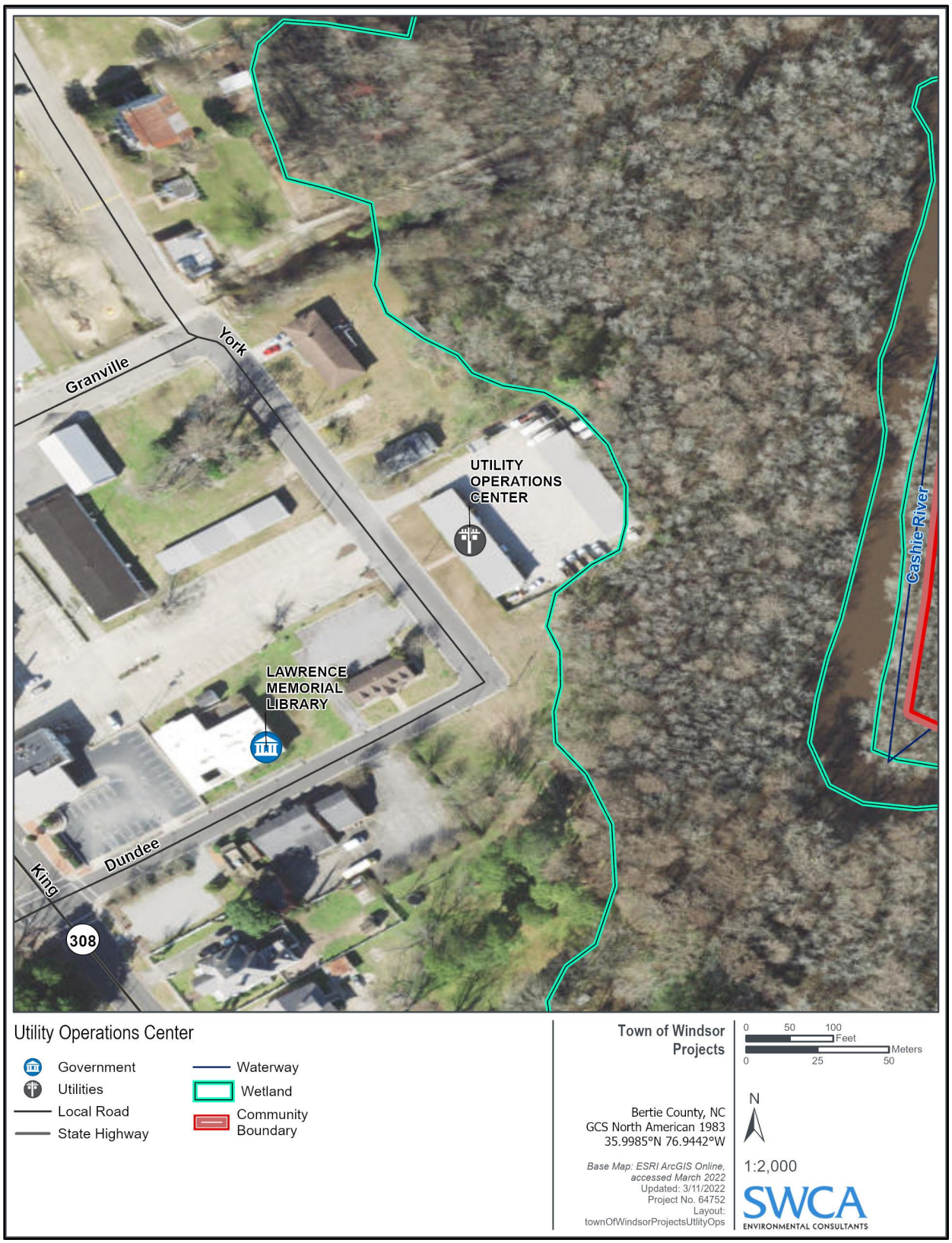

Figure 10. Location of Utility Operations Center immediately adjacent to Cashie River wetland areas that regularly flood.

7.3.4 Relocate or Retrofit the Community Building

Project Description	This long-standing meeting space is an affordable location for residents to hold private events and is also used for public events such as voting. It floods frequently and would benefit from relocation or retrofits to reduce the extent and cost of recovery after flood events.
Location	201 S Queen St
Source	Community Action Team
Scoping Questions	Need to evaluate best options for protecting this facility or whether to relocate it
Hazard(s) Addressed by Project	Precipitation-based flooding, storm surge, sea level rise, runoff
FEMA Community Lifelines	Safety and Security
Type of Solution	Structure and infrastructure
Project Estimated Timeline	2–5 years depending on approach
Responsible Entity	Town of Windsor
Potential Partners	
Existing Funding	None identified by CAT
Potential Funding Sources	Building Resilient Infrastructure and Communities (BRIC), Hazard Mitigation Grant Program (HMGP)
Project Estimated Cost	Medium – TBD depending on methods to be used. Retrofit could be somewhat cheaper than relocation.
Anticipated Benefit	Medium – Action would have an impact on risk reduction.
Priority Rating	High

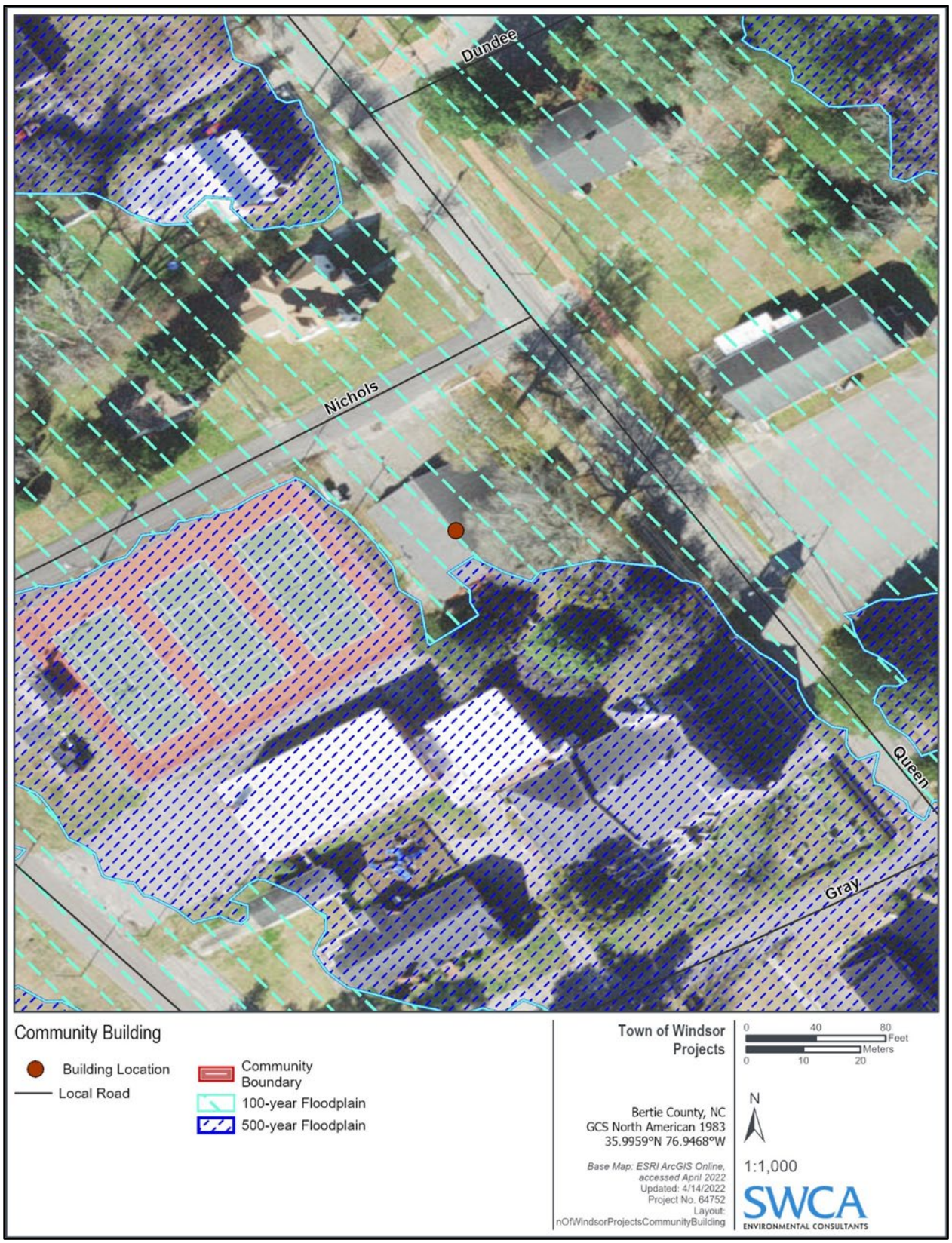

Figure 11. Location of Windsor Community building within the 100-year and 500-year floodplains.

7.3.5 School Road Bridge (with Bertie County)

Project Description	School Road washed out and stranded many people and the High School (emergency shelter) was cut off. This Cashie River swamp area floods regularly. The project involves construction of a higher bridge over the swamp area to maintain better access, and development of a water control process according to findings from the Windsor Flood Reduction Feasibility Study and/or the planned Bertie County Frequently Flooded Roadways Feasibility Study to reduce peak flows downstream that affect flooding in Windsor.
Location	School Road between Sand Pit Rd. and Route 13 (See map below)
Source	Hurricane Matthew Resilient Redevelopment Plan - Bertie County
Scoping Questions	
Hazard(s) Addressed by Project	Precipitation-based flooding
FEMA Community Lifelines	Safety and Security; Transportation
Type of Solution	Structure and Infrastructure
Project Estimated Timeline	2–5 years
Responsible Entity	Bertie County
Potential Partners	NCDOT, Town of Windsor
Existing Funding	None identified by CAT
Potential Funding Sources	Building Resilient Infrastructure and Communities (BRIC), Hazard Mitigation Grant Program (HMGP)
Project Estimated Cost	High – $1 million +
Anticipated Benefit	High – Action would have a significant impact on risk reduction.
Priority Rating	High

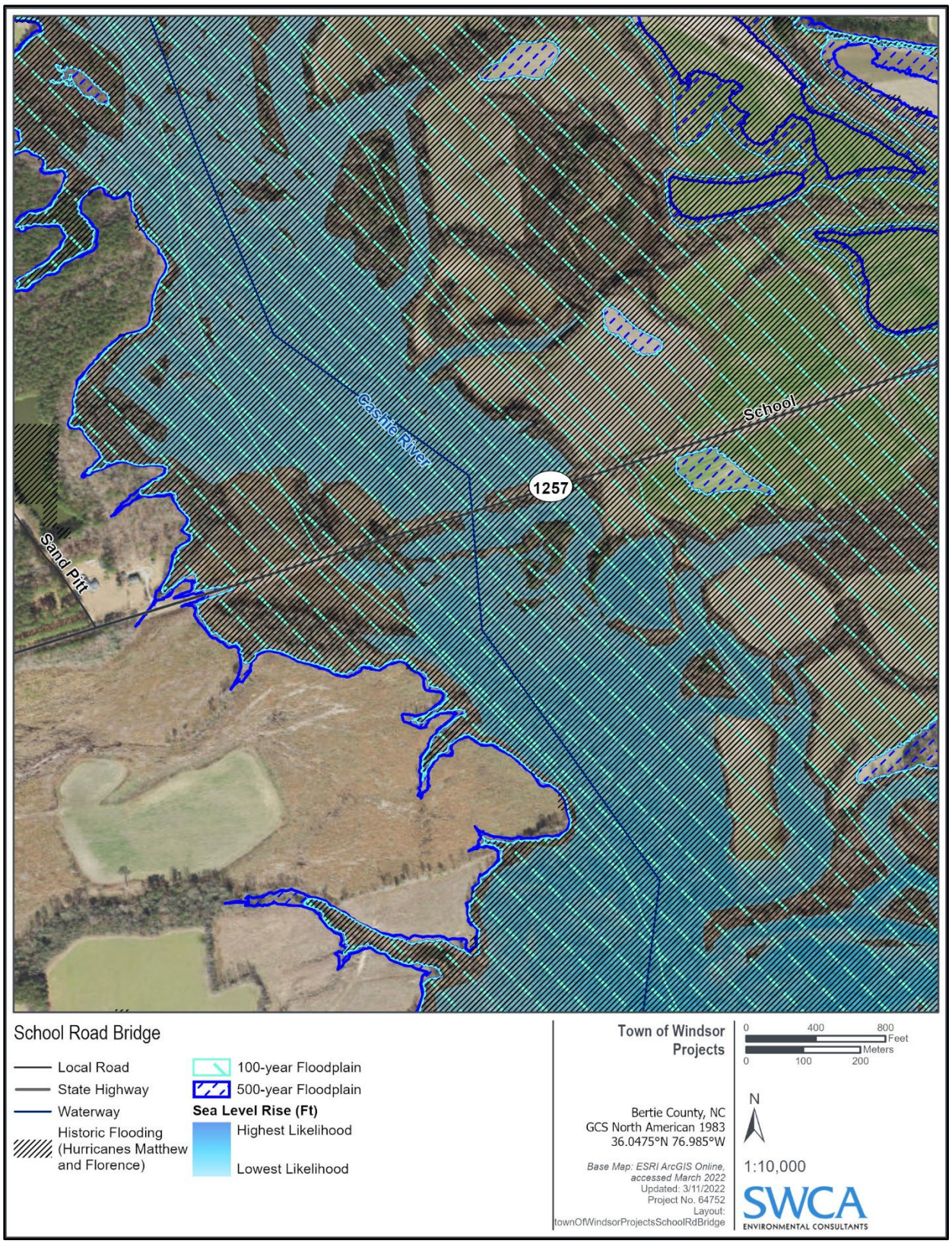

Figure 12. School Road bridge location within historically flooded areas, the 100-year and 500-year floodplains, and at risk from sea level rise.

7.3.6 Sterlingworth/Gatling Stormwater Improvements

Project Description	Continuation of successful stormwater management improvements from the Ghent/Gatling area into the Sterlingworth/Gatling area.
Locations	Pipe crossing in the vicinity of 606 Sterlingworth St
Source	Discussion with CAT
Scoping Questions	
Hazard(s) Addressed by Project	Runoff, Precipitation-based flooding
Type of Solution	Safety and Security
FEMA Community Lifelines	Structure and Infrastructure, Nature Based Solutions
Project Estimated Timeline	
Responsible Entity	NCDOT
Potential Partners	Town of Windsor
Existing Funding	None identified by CAT
Potential Funding Sources	Clean Water State Revolving Fund, NCDEQ Water Resources Development Grant
Project Estimated Cost	Medium – $350,000 depending on exact nature of improvements to be made
Anticipated Benefit	High – Action would have a significant impact on risk reduction.
Priority Rating	High

Figure 13. Location of Sterlingworth and Gatling stormwater improvements.

7.3.7 Hoggard Mill Water Storage

Project Description	There is an opportunity through an existing dam structure to impound approximately 3-5 miles of water and reduce downstream impacts on developed areas, including Windsor. The project involves redevelopment of the existing dam structure and fortification of the levee wall according to findings from the Windsor Flood Reduction Feasibility Study. The potential downstream water reduction from this project alone is roughly 30%. 1.Repair the existing Hoggard Mill embankment and spillway 2.Construct new Hoggard Mill lower embankment and spillway 3.Construct new Hoggard Mill lower and upper embankments and spillways 4.Construct new Hoggard Mill lower embankment and spillway plus embankment and reservoir on the mainstem of the Cashie River 5.Construct new Hoggard Mill lower and upper embankment and spillway plus a third embankment and reservoir on the mainstem of the Cashie River
Location	Near intersection of Hoggard Mill Road and Greens Cross Road
Source	Hurricane Matthew Resilient Redevelopment Plan – Bertie County, Windsor Flood Mitigation Study
Scoping Questions	Will have to show multiple benefits/uses for the project, not just flood control.
Hazard(s) Addressed by Project	Precipitation-based flooding
Type of Solution	Safety and Security
FEMA Community Lifelines	Structure and Infrastructure
Project Estimated Timeline	3 years
Responsible Entity	Town of Windsor
Potential Partners	Bertie County
Existing Funding	Funding has been received for previous phases of this project, including land acquisition.
Potential Funding Sources	Building Resilient Infrastructure and Communities (BRIC)
Project Estimated Cost	High – $1 million +
Anticipated Benefit	Medium – Action would have an impact on risk reduction.
Priority Rating	High

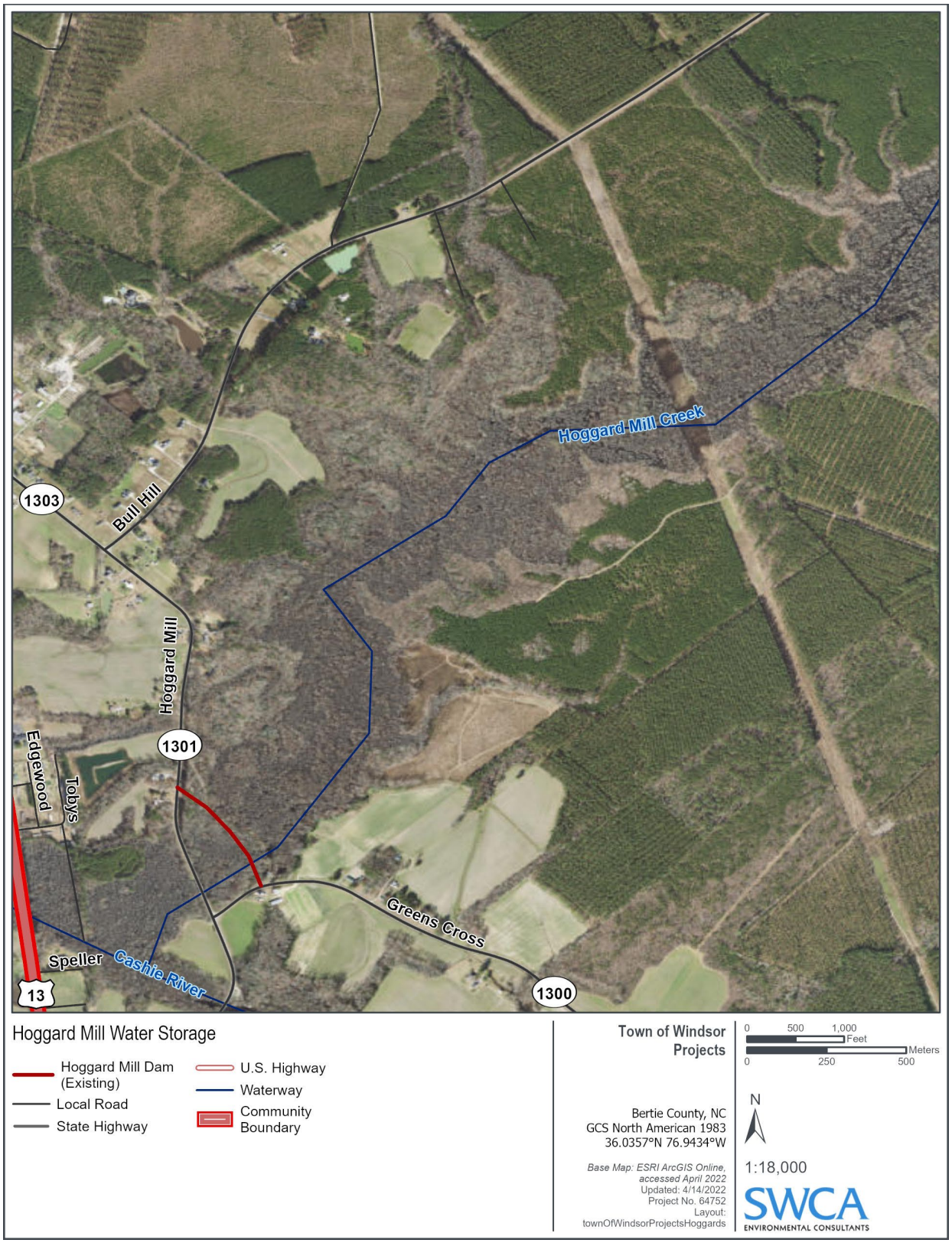

Figure 14. Location of Hoggard Mill water storage.

7.3.8 Phased Water Infrastructure Upgrades

Project Description	Elm Street Pump Station (highest priority) – Install wheeled generator that can be moved as needed to avoid damage. Elevate control panels. Water Street Pump Station – Install wheeled generator that can be moved as needed to avoid damage. Elevate control panels. Sutton Drive Well House (lowest priority) – Elevate the entire pump station to withstand future storm events.
Location	See Figure 15 below
Scoping Questions	Hurricane Matthew Resilient Redevelopment Plan – Bertie County
Hazard(s) Addressed by Project	Precipitation-based flooding, Storm surge, sea level rise
FEMA Community Lifelines	Safety and Security
Type of Solution	Structure and Infrastructure
Project Estimated Timeline	5-7 years
Responsible Entity	Town of Windsor
Potential Partners	
Existing Funding	None identified by CAT
Potential Funding Sources	Goldenleaf Grants (the town has used these previously to fund retrofit/elevation of a pump station), Clean Water State Revolving Fund, NCDEQ Water Resources Development Grant
Project Estimated Cost	Medium – $150,000–$250,000 (based on estimates provided in Hurricane Matthew Resilient Redevelopment Plan)
Anticipated Benefit	High – Action would have a significant impact on risk reduction.
Priority Rating	High

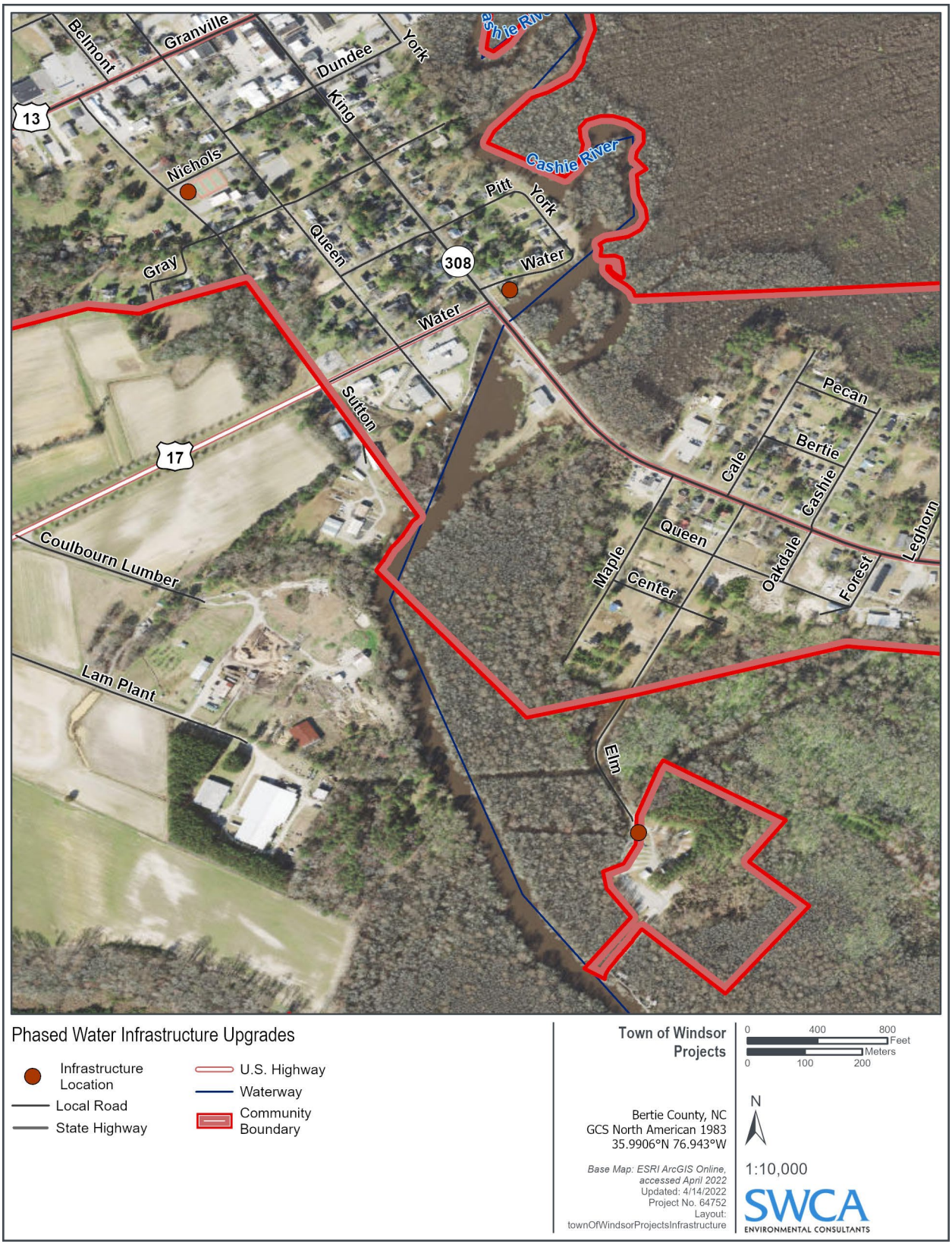

Figure 15. Locations of water infrastructure upgrades.

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APPENDIX A

Community Action Team Members

Table A-1. Community Action Team Members for Windsor, North Carolina

Name	Title/Affiliation
Allen Castelloe	Town Administrator
Crystal Goodwin	Southern Bank Vice President
Chris Hilbert	Insight Planning and Development
James Hoggard	Former Mayor
Lewis Hoggard	Mayor, Chamber of Commerce Director
Russell Phelps	Downtown Business Owner
Randy Walston	Town Commissioner
Cathy E. Wilson	Town Commissioner
Matt Wilson	Town Public Works Director

APPENDIX B

Community Action Team Meeting Summaries

Click the links below to jump to the summary of a specific meeting:

MEETING SUMMARY
TOWN OF WINDSOR CAT

Meeting No. 1, Tuesday September 28, 2021, from 4:00 to 5:00 p.m.

Meeting Objectives

- Introduce the purpose, milestones, and schedule for the RCCP process
- Review and answer any questions about the role of the CAT members
- Review existing information available and gaps for consideration under RCCP, including:
    - Priority hazards for assessment
    - Initial discussion of assets to be mapped
- Confirm next steps following this meeting

Participants

Town of Windsor Staff
Allen Castelloe, Town Administrator
Randy Walston, Town Council
Matt Wilson, Public Works

Other Members
Lewis Hoggard, Chamber of Commerce

Facilitation and Support Staff
Kathryn Gardner, SWCA Environmental Consultants
Meg Perry, SWCA Environmental Consultants
Tancred Miller, NC Division of Coastal Management

Action Items

CAT Members

- Share any additional existing materials to review, hazards or assets to focus on, or recommended avenues for sharing information with the community beyond this group - by Monday, Oct. 11

SWCA

- Share meeting recording and summary with CAT members – by Monday, Oct. 4
- Share examples of vision statements for CAT consideration – by Monday, Oct. 4
- Invite CAT members to access the SharePoint folder – by Monday, Oct. 4
- Follow up with Allen Castelloe and Chris at Insight Planning about utilizing publicinput.com for Community Engagement – by Friday, October 8
- Follow up about the location of the following – by Friday, Oct. 8
    - Farm Chemical Businesses and other major employers

Summary of Key Points from Presentation and Discussion

Program Overview
Meg Perry, SWCA Environmental Consultants, introduced the four-phase Resilient Coastal Communities Program (RCCP). The four phases of the program are outlined below and explained in further detail in the Program Handbook:

- *Phase 1: Risk and Vulnerability Assessment* (approximately September – December 2021) Evaluating local assets, hazards, and vulnerabilities. This phase will include one public open-house event.
- *Phase 2: Planning, Project Identification, & Prioritization* (approximately December – March 2022) Identifying priority actions (such as infrastructure repair or creation of living shorelines) to reduce the risks identified in Phase 1. This phase will include a second public open-house event.
- *Phase 3: Engineering and Design* (approximately February – September, 2022)
- *Phase 4: Project Implementation*

Tancred Miller, Division of Coastal Management (DCM), explained that DCM will share information about how to apply for funding from the state for Phase 3 in early 2022. DCM expects to provide approximately $40,000 – 50,000 to each of the 26 communities currently participating in the program. These funds will support Phase 3 design for one priority project. Phase 3 is expected to run through late summer/early fall of 2022. After Phase 3, communities will have the opportunity to apply via a competitive proposal process for Phase 4 implementation funds.

Ms. Perry explained that the Division of Coastal Management has contracted with SWCA to provide technical support to four communities in completing Phases 1 and 2 of the Program between now and March 2022. The four communities SWCA is supporting are Bertie County, Hertford County, Town of Hertford, and Town of Windsor.

Community Action Team Role

Ms. Perry explained the role of the CAT is to provide guidance and input for Phases 1 and 2 to ensure the Resilience Strategy developed by SWCA reflects the community's vision and goals and accurately reflets the issues and needs in the community.

Meetings are scheduled for November and December to discuss the Risk and Vulnerability Assessment process and results. Additional meetings will be scheduled in January – March 2022 focused on development of the prioritized project portfolio and review of the final Resilience Strategy document.

Community Resilience Goals

Ms. Perry shared the following general goals for this effort:

1. Prepare the Town to implement projects that reduce risks and speed recovery from coastal hazards by evaluating local risks and vulnerabilities and identifying and scoping priority coastal resilience projects.
2. Qualify the Town for project funding through the RCCP and other funding programs

She asked CAT members to consider what specific vision and goals for resilience this program can help the Town of Windsor pursue. This will be discussed further in subsequent meetings.

Review of Existing Materials

Ms. Perry explained that the SWCA team has begun reviewing the existing materials related to resilience planning that the Town has previously created or approved. She asked CAT members to share any other existing information that might be relevant to SWCA's analysis. The following is a list of studies and plans SWCA is currently reviewing:

- NE Regional Hazard Mitigation Plan (2020)
- NCLOW Flood Dynamics Report (2019)
- Town of Windsor Flood Mitigation Study (2018)
- Downtown Flood Retrofit Report (2017)
- County Hurricane Matthew Resilient Redevelopment Plan (2017)

- CAMA Land Use Plan (2016)
- County Vulnerability Assessment (2010)

Discussion of Hazards

In addition to general hazard types that SWCA plans to assess, which include flooding/stormwater, storm surge, rainfall/runoff, erosion, and sea level rise, the group identified some specific hazard concerns, as follows:

- Wind events (hurricanes and tornadoes)
- Ice events in the winter that could impact the town-run electric utility
- Flooding that impacts local businesses (e.g., farm chemical business in the floodplain). In past flood events, 60% of businesses have been impacted. Some businesses repair, but others depart the area completely, which has negative economic impacts.

Discussion of Assets

The group identified a preliminary list of assets that may not be captured in existing plans and reports, including:

- Major employers
- Freeman Hotel
- Public Utilities Building

Next Steps

The hazards and assets discussed during this call will inform work by SWCA to map the Town's coastal hazards and community assets, building on information in the existing plans and reports the Town has already developed or approved. The next meeting of the CAT is scheduled for **Wednesday, November 3 from 3:30 – 4:30 p.m.**

MEETING SUMMARY
TOWN OF WINDSOR CAT

Meeting No. 2, Wednesday November 3, 2021, from 3:30 to 4:30 p.m.

Meeting Objectives

- Review draft map of information available and gaps for consideration under RCCP, including:
  - Priority hazards for assessment
  - Assets to be mapped
- Review Vision Statement
- Confirm next steps following this meeting

Participants

CAT Members
Allen Castelloe, Town of Windsor
Crystal Goodwin, Southern Bank
Chris Hilbert, Insight Planning & Development
Lewis Hoggard, Chamber of Commerce
Russell Phelps, Cooper Insurance
Randy Walston, Commissioner
Cathy Wilson, Commissioner
Matt Wilson, Public Works

Facilitation and Support Staff
Kathryn Gardner, SWCA Environmental Consultants
Tom Hale, SWCA Environmental Consultants
Meg Perry, SWCA Environmental Consultants
Mackenzie Todd, NC Division of Coastal Management

Action Items

CAT Members
- Review draft vision statement and provide any suggested edits to Meg Perry (meg.perry@swca.com) by Friday, Nov. 19
- Review asset list and send suggested additions to Meg Perry (meg.perry@swca.com) by Tuesday, November 30

SWCA
- Share draft asset list and link to interactive draft asset and hazard map for CAT members to review by Friday Nov. 12
- Confirm timing and location for 1st Public Input Meeting by Friday Nov. 19

Summary of Key Points from Presentation and Discussion

RCCP Process

Meg Perry, SWCA, reminded the group about the four phases of the RCCP process. The CAT and SWCA are currently focused on Phase 1 Risk and Vulnerability Assessment (see Figure 1 below).

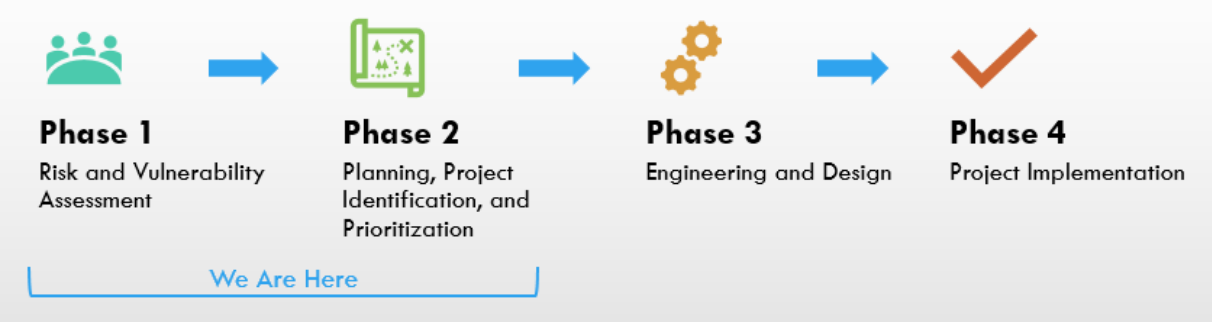


Figure 16. Phases of the Resilient Coastal Communities Program.

Elements of Phase 1 In Progress

The Phase 1 Vulnerability Assessment will look at all the community asset locations to determine: 1) their Exposure – what hazards might occur at this location, 2) Sensitivity – how damaging those hazards would be to the asset, and 3) Adaptive Capacity – how much opportunity is there for this asset to change or adjust to reduce risk from coastal hazards. These factors will be summarized in a single number (Vulnerability Index) for each asset that indicates how vulnerable it is to hazards.

Phase 1 also includes a Risk Assessment that will estimate the cumulative economic risk of hazard impacts in the community. The current work to collect and map asset and hazard information will ultimately feed into these two assessments.

Vision Statement

Each community needs a Vision Statement to help guide decision making and prioritization. It is also useful to have a Vision Statement prepared when applying for funding. Ms. Perry shared the following elements of a vision statement to help guide the CAT in developing theirs (Figure 2).

During the meeting, the group reviewed several example vision statements based on those in use by other communities and drawing upon vision language in existing planning documents. The group selected language from the examples that is applicable to their community and made additional edits resulting in the following preliminary vision statement:

> **Windsor is a resilient and vibrant community where citizens and visitors alike enjoy recreation and ecotourism activities. The town is committed to helping its residents thrive where they are placed and celebrating its riverfront, history, culture, and distinctive character while promoting commercial and residential growth and showcasing the beauty and natural resources of the Cashie River. The community rebounds quickly following hazard events due to strategic investments in flood mitigation projects, strong partnerships, and frequent communication with residents.**

CAT members should send any suggested adjustments to this vision statement language to Ms. Perry (meg.perry@swca.com).

Figure 17. Elements of a resilience vision statement.

Draft Hazard and Asset Map Review

The group reviewed a preliminary version of the assets and hazards map which included assets and hazards from the following sources:

Asset Data Sources	**Hazards Identified**
2016 & 2020 Regional Hazard Mitigation Plans	100 & 500 year flood plain
USGS Data	National Hurricane Center high tide inundation storm surge (by storm category)
National Register of Historic Places	Historical Hurricane Florence Data
Sites Identified During 1st CAT Meeting	

The group identified additional hazard and asset types it would like to see included in the final version, including:

Assets Needed	**Hazards Needed**
Natural & Cultural Features	Historical Hurricane Matthew Data
Utilities	Historical Hurricane Floyd Data
Economic Hubs	Sea Level Rise Projections (at least out to 30 year)
Transportation	Localized drainage and inland flooding data
	NC DOT Road flooding data based on rainfall not storm surge

Next Steps

The next CAT Meeting will focus on review of the draft Risk and Vulnerability Assessment and initial discussion of the resilience projects. The first of two public open house meetings is tentatively scheduled for the evening of Wednesday, January 12 in-person. The next meeting of the CAT is scheduled for **Wednesday, December 8 from 4:00 – 5:00 p.m.**

MEETING SUMMARY
TOWN OF WINDSOR CAT

Meeting No. 3, Wednesday December 8, 2021, from 4:00 to 5:00 p.m.

Meeting Objectives

- Provide Risk Assessment Status Update
- Plan for Public Meeting(s) in January
    - Review public outreach materials in development
    - Confirm meeting format, timing, and next steps
- Confirm next steps
    - Schedule for 2022 CAT Meetings

Participants

CAT Members
Allen Castelloe, Town of Windsor
Crystal Goodwin, Southern Bank
Chris Hilbert, Insight Planning & Development
Lewis Hoggard, Chamber of Commerce
Russel Phelps, Cooper Insurance
Randy Walston, Commissioner
Cathy Wilson, Commissioner
Matt Wilson, Public Works

Facilitation and Support Staff
Kathryn Gardner, SWCA Environmental Consultants
Meg Perry, SWCA Environmental Consultants
Mackenzie Todd, NC Division of Coastal Management

Action Items

CAT Members

- Review draft asset list and provide any suggested edits to Meg Perry (meg.perry@swca.com) by Monday, Dec. 13

SWCA

- Update maps in preparation for public open house by Monday, Jan. 3
- Finalize materials for public open house advertising by Monday, Dec. 20

Summary of Key Points from Presentation and Discussion

Review of Hazard Maps
Three maps were provided for review by the CAT:

1) Flood Plain Map – shows the 100 and 500 year flood plain
2) Historical Flood Map – shows historical data of area flooded during Hurricanes Matthew and Florence, data was collected via satellite imagery
3) Sea Level Rise Map – shows areas at risk of sea level rise based on 'bathtub' modeling. Areas lower in the landscape are more susceptible to sea level rise first and areas higher in the landscape would be impacted at more severe levels of sea level rise. This is not based on a timeline prediction because there are many factors that may influence how quickly sea level rise occurs.

Asset Discussion

There was discussion about shelter areas and access to shelters during a storm. If the shelter is in one side of the river, but bridge access is disrupted during the storm, that my impede recovery.

CAT members should respond to Meg (meg.perry@swca.com) no later than Monday, December 13 to identify any other missing assets. Examples include:

- Community landmarks and gathering places
- Locations important for safety during a storm
- Assets important for recovery and rebuilding after a storm

Public Open House

The first of two open house meetings is tentatively planned for **January 12th from 4-7pm at Windsor Town Hall**. Allen and Meg will coordinate after the meeting to finalize meeting details. CAT members are asked to attend if available to help answer questions from attendees. Mackenzie offered DCM to help with refreshments.

Next Steps

The next CAT Meeting will focus preparation for the first public open house and is scheduled for **Wednesday, January 5 from 4:00 – 5:00 p.m.**

MEETING SUMMARY
TOWN OF WINDSOR CAT

Meeting No. 4, Wednesday January 5, 2022, from 4:00 to 5:00 p.m.

Meeting Objectives

- Prepare for Open House Meeting
- Hear an update and share input on the Vulnerability and Risk Assessment

Participants

CAT Members
Allen Castelloe, Town of Windsor
Crystal Goodwin, Southern Bank
Lewis Hoggard, Town of Windsor and Chamber of Commerce
Cathy Wilson, Commissioner

Facilitation and Support Staff
Kathryn Gardner, SWCA Environmental Consultants
Meg Perry, SWCA Environmental Consultants

Action Items

CAT Members

- Help advertise the public meeting on 1/12 - COMPLETED

SWCA

- Work with Allen Castelloe to get updated asset information for maps - COMPLETED
- Prepare print materials for public meeting - COMPLETED
- Create master list of existing project ideas and add new project ideas - Prior to next CAT meeting

Summary of Key Points from Presentation and Discussion

Public Meeting Preparation
The group reviewed plans and publicity materials for the upcoming Open House Meeting. Meg Perry, SWCA, explained that SWCA has arranged for newspaper and radio announcements. CAT members were encouraged to circulate the announcement using the flier and social media post prepared by SWCA.

The website for program information and survey collection is now live and accessible to the public: https://nc-rccp-community-portal-swcagis.hub.arcgis.com/

Information collected during this meeting will inform the vulnerability assessment and help identify potential projects to include on the project list. A brief report on key themes from the public meeting will be circulated to the CAT following the meeting.

Risk and Vulnerability Assessment
Meg explained the next step in the process will be to evaluate each asset based on 3 criteria:

1) Exposure – How often or severely is an asset exposed to flooding hazards

2) Sensitivity – How much would this location be impacted by flooding (e.g., temporarily impacted and easy to repair, significant repairs needed and longer duration of inoperability, or likely to be completely destroyed by a flood)
3) Adaptive Capacity – What measures are already in place to protect or reduce flooding impacts at this location?

This information will be used to develop a "Vulnerability Index" – a single number that indicates how vulnerable that location is to coastal hazards. This will enable the CAT to compare the vulnerability of different sites and can help identify and prioritize potential resilience projects.

Next Steps

The next CAT Meeting will focus on review of the vulnerability assessment results and preliminary project list on **Wednesday, February 2 from 4:00 – 5:00 p.m.**

MEETING SUMMARY
TOWN OF WINDSOR CAT

Meeting No. 5, Wednesday February 2, 2022, from 4:00 to 5:00 p.m.

Meeting Objectives

- Review Preliminary Project List and Discuss Resilience Goals
- Review Preliminary Vulnerability Scores
- Prepare for February Open House

Participants

CAT Members
Allen Castelloe, Town of Windsor
Crystal Godwin, Southern Bank
Chris Hilbert, Insight Planning & Dev.
Lewis Hoggard, Chamber of Commerce
Russell Phelps, Business Owner
Randy Walston, Commissioner
Cathy Wilson, Commissioner

Facilitation and Support Staff
Kathryn Gardner, SWCA Environmental Consultants
Meg Perry, SWCA Environmental Consultants
Mackenzie Todd, NC Division of Coastal Management

Action Items

CAT Members

- Review draft goals and provide any suggested edits to Meg Perry (meg.perry@swca.com) by Friday, Feb. 11
- Review preliminary project list and share any information about current status of projects on the list or other projects that should be added with Meg Perry (meg.perry@swca) by Friday, Feb. 11.

SWCA

- Confirm with Allen the status of projects to identify any already completed – Wednesday, Feb. 9
- Share updated project list and asset list with vulnerability scores in advance of the next meeting – by Monday, February 14.

Summary of Key Points from Presentation and Discussion

Review of Project Types and Preliminary Project List
Existing sources of project information have been combined into a single table for review by CAT Members. CAT members should respond to Meg (meg.perry@swca.com) no later than Friday, February 11 to identify projects that have already been completed or need to be taken off the list.

Goals
Goals are important to direct the work of the CAT members moving forward. The draft goals identified by the group are listed below:

- **Complete the Hoggard Mill project in the next three years**
- **Maintain the vibrancy and historic nature of the downtown area and its economy**
    - Creating a downtown master plan?
    - Identify and secure funding to support downtown resiliency projects

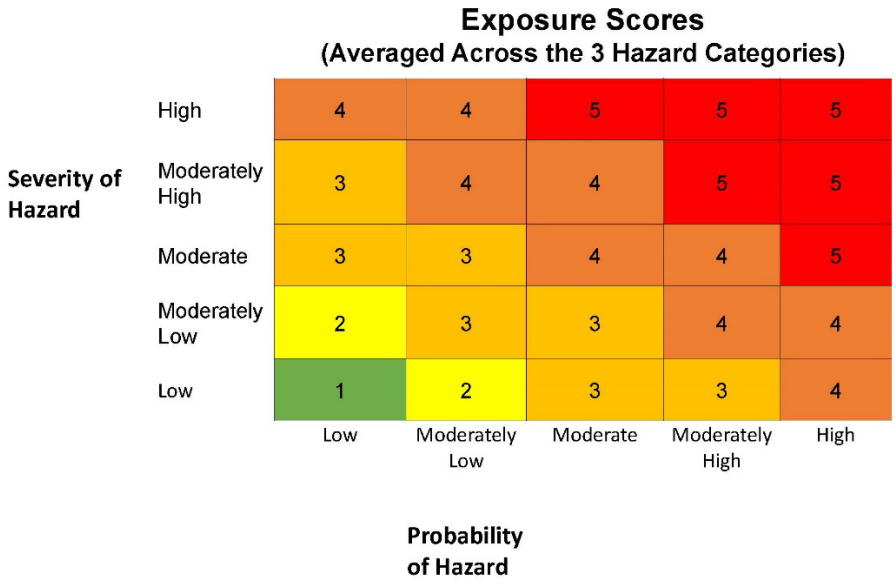
- **Education:** Hold at least two educational sessions for the community about flooding and flood mitigation steps people can take themselves
- **Gather and review examples of resilience-oriented ordinances that may benefit the town of Windsor**
- **Secure funding for X number of high priority resilience project in [timeframe]**
- **Natural/nature-based solutions projects**

CAT Members should respond to Meg (meg.perry@swca.com) no later than Friday, February 11 to provide feedback on the goals.

Review of Vulnerability Scores

A draft version of the vulnerability scores for each asset was presented to the group. The vulnerability score combines the Exposure, Sensitivity, and Adaptive Capacity for each asset.

The exposure score is measured by assessing the probability that an asset will be exposed to each of three flooding hazard types and the severity of that type of flooding at that location. Then the scores for the three flooding types are averaged to generate a final exposure score that ranges from 0 (no exposure) to 5 (high exposure).



Sensitivity and Adaptive Capacity scores will be finalized for review by the next CAT Meeting.

Public Open House

The second of two open house meetings is tentatively planned for **February 23rd from 11am -1pm** at Windsor Town Hall. CAT members are asked to attend if available to share input and help answer questions from attendees.

Next Steps

The next CAT Meeting will focus on refinement of the project list in preparation for the second public open house and is scheduled for **Tuesday, February 15 from 2:00 – 3:00 p.m.**

MEETING SUMMARY
TOWN OF WINDSOR CAT

Meeting No. 6, Thursday February 17, 2022, from 2:00 to 3:00 p.m.

Meeting Objectives

- Review and Refine Updated Project List
- Confirm plans for February Public Meetings

Participants

CAT Members
Allen Castelloe, Town of Windsor
Crystal Godwin, Southern Bank
Lewis Hoggard, Mayor
Randy Walston, Town Commissioner
Cathy Williams, Town Commissioner
Matt Wilson, Town of Windsor

Facilitation and Support Staff
Kathryn Gardner, SWCA EnvironmentalConsultants
Meg Perry, SWCA Environmental Consultants

Action Items

CAT Members

- Help advertise the public meeting on 2/23 by making direct invitations

SWCA

- Prepare print materials for public meeting by 2/23

Summary of Key Points from Presentation and Discussion

Preliminary Project List

The group reviewed slides describing different project types, and a preliminary list of potential projects identified from previous studies and public meetings to be discussed in more detail at the public meeting on Wednesday February 23.

Discussion Notes

- Remove elevation of York Street; feasibility study revealed cost was too high for benefit
- Remove King Street Bridge project from public posters – it has been discussed and no interest in moving forward has been received from the public. The King Street study can be left on the list as completed.
- Established 5 ft. freeboard – completed
- The shelter should be on the County's project list
- Parcels purchased for demolition will be reverted to natural areas

Public Meeting Preparation

The second of two open house meetings is scheduled for Wednesday February 23 from 11am-1pm at Windsor Town Hall. The group reviewed plans and publicity materials for the upcoming Open House Meeting. Meg explained that SWCA has arranged for newspaper announcements. CAT members were

encouraged to personally invite members of the community to attend and provided with copies of a flier and social media posts to use.

Next Steps

The next CAT Meeting will focus on confirming the CAT's high priority project list and is scheduled for **Wednesday, March 2 from 4:00 – 5:00 p.m.**

MEETING SUMMARY
TOWN OF WINDSOR CAT

Meeting No. 7, Wednesday March 2, 2022, from 4:00 to 5:00 p.m.

Meeting Objectives

- Confirm high priority projects
- Confirm plans for review of draft report

Participants

CAT Members
Randy Walston, Town Commissioner
Chris Hilbert, Insight Planning

Facilitation and Support Staff
Kathryn Gardner, SWCA EnvironmentalConsultants
Meg Perry, SWCA Environmental Consultants
Mackenzie Todd, Division of Coastal Management

Action Items

SWCA

- Draft final Resilience Strategy report and send to CAT for review by 3/14

CAT Members

- Provide feedback on draft report by 4/1

Summary of Key Points from Presentation and Discussion

Priority Project List

The group reviewed and discussed the project list in light of feedback and discussions at the public meeting, previously identified criteria and goals, and the results of the vulnerability assessment. The CAT members agreed on a group of high priority projects to be described in more detail in the final Resilience Strategy report:

- Downtown Flood Risk Mitigation Approaches
    - Downtown Master Plan
    - Relocate Freeman Hotel
    - Relocate Windsor Utility Operations Center
    - Relocate Community Building
- School Bridge Road
- Sterlingworth/Gatling Stormwater Improvements
- Hoggards Mill Water Storage
- Upgrades to Specific Facilities
    - Phased Water Infrastructure Upgrades including Elm Street Pump Station, Water Street Pump Station, and Sutton Drive Well House
- Nature-Based Solutions: Ecological Restoration at old building sites that are flood prone

Next Steps

SWCA will provide a draft report to the CAT members by **March 14th** for review. CAT members are requested to review the draft report and provide feedback by **April 1st**. The final report will be delivered by mid April.

APPENDIX C

Project Website Content

Figure C-1. Example screenshot of the project website, 1 of 4.

The four phases of the program include:

Phase 1: Community Engagement and Risk & Vulnerability Assessment- Current Phase

Phase 2: Planning, Project Selection and Prioritization

Phase 3: Engineering and Design

Phase 4: Implementation

By completing the Resilience Strategy (Phases 1 and 2), the town becomes eligible for additional state funding to support design and engineering for a priority resilience project and will strengthen grant proposals to other funders.

North Carolina
RESILIENT COASTAL COMMUNITIES PROGRAM

Learn more about the N.C. Resilient Coastal Communities Program

What does the Resilience Strategy do?

A Resilience Strategy-

- Identifies areas at risk from coastal hazards such as flooding, storm surge, and sea level rise
- Integrates hazard data and local knowledge to identify where community assets may be at risk
- Identifies strategies to reduce risks from coastal hazards
- Identifies priority projects for resilience funding

Timeline for Completion

The target completion date for the Resilience Strategy is March 2022.

Planning Process and Community Engagement

To create the Resilience Strategy, your community and its supporting contractor, SWCA Environmental Consultants will:

- Create a Community Action Team (CAT) to help guide the planning process
- Define a resilience vision and goals
- Map assets and coastal hazards
- Assess vulnerability and economic risk
- Identify strategies to reduce vulnerability to coastal hazards
- Develop a priority list of resilience projects for funding and implementation

Community members will have the opportunity to provide input in three ways:

- Online survey – January 2022
- Public Open House meeting focused on community assets and hazard areas – January 2022
- Public Open House meeting focused on resilience project priorities – February 2022

Be Prepared!

Check out the resources below to prepare your household for future floods and storms:

- Ready NC Hurricane Preparedness Guide (also available in Spanish)
- Preventing and Cleaning Up Mold/Moisture
- What to do with Drinking Water Wells and Septic Systems in Flooding Conditions
- Post-Disaster Resources from Legal Aid NC

Contact Us

Additional Information on community contacts can be found on your community portal.

Project Contact- Meg Perry- Project Manager, SWCA Environmental Consultants

- Phone: 984.275.4317
- Email: meg.perry@swca.com

Technical Support Contact

- Email Project Team

Figure C-2. Example screenshot of the project website, 2 of 4.

Figure C-3. Example screenshot of the project website, 3 of 4.

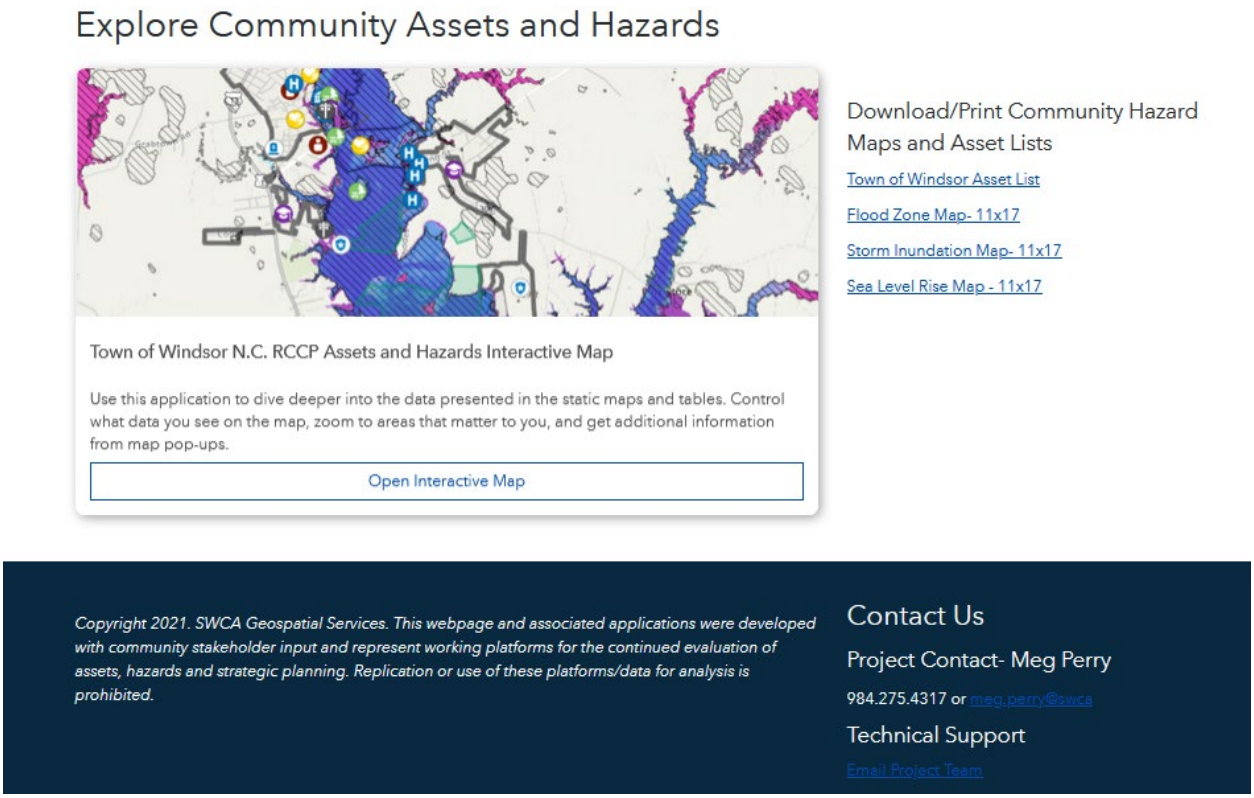


Figure C-4. Example screenshot of the project website, 4 of 4.

APPENDIX D

Public Meeting Attendees

Table D-1. Attendance at the Two Public Meetings Held in January and February 2022 for Windsor, North Carolina

First Name	Last Name	Affiliation	Meeting 1	Meeting 2
Attendees				
Langston	Alexander	Nicholas School of the Environment, Duke University	X	
Allen	Castelloe	CAT/Town Administrator	X	X
Crystal	Goodwin	CAT/Southern Bank		
Chris	Hilbert	CAT/Insight Planning	X	X
Jim	Hoggard	CAT	X	
Lewis	Hoggard	CAT/Mayor	X	X
L.C.	Hoggard	Town Commissioner		X
Russell	Phelps	CAT/Downtown Business Owner	X	
Camille	Rascoe	Town Commissioner		X
Randy	Walston	CAT/Town Commissioner	X	X
Cathy	Wilson	CAT/Town Commissioner	X	
		Total Attendees	**8**	**6**
Support Staff				
Kathryn	Gardner	SWCA Environmental Consultants	X	X
Tancred	Miller	NC Division of Coastal Management	X	
Meg	Perry	SWCA Environmental Consultants	X	X
Mackenzie	Todd	NC Division of Coastal Management	X	X

APPENDIX E

Data Used in Vulnerability and Risk Assessment

Table E-1. Data Used in Assessment of Asset Vulnerability and Risk for Windsor, North Carolina

Field/Variable	Data Used to Define Field/Variable	Data Summary	Use in Risk and Vulnerability Assessment	Additional Information on Source Data
Flood Plain Exposure	North Carolina Preliminary Flood Zones	Areas representing the area within the flood mapping boundaries defined by the engineering models for the 100-year (1% annual chance), 500-year (0.2% annual chance) and floodway (river channel and adjacent land areas for flood discharge).	Floodplain type was categorized and used to assess current climate precipitation induced flood risk under varying conditions across the landscape.	Data was produced by North Carolina Floodplain Mapping Program in 2020 at 6-m spatial resolution
Flood Plain Exposure	High Resolution Elevation (DEM 20')	Elevation data was created using LiDAR collected by NC Floodplain Mapping Program	Elevation data was processed to find low-lying areas outside the current 500-year flood plains that have the potential for precipitation-induced flood risk under future climate conditions across the landscape.	Data was produced by North Carolina Department of Transportation in conjunction with the North Carolina Floodplain Mapping Program in 2020 at 6-m spatial resolution
Reported Event Inundation Factor	Hurricane Matthew Inundated Areas	Areas that experienced flooding during Hurricane Matthew, based on aerial photographs taken October 8 to 16, 2016.	Inundated areas were used assess extreme precipitation event flood risk across the landscape.	Data was produced by the Center for Biodiversity Outcomes, Arizona State University in 2020 at 5-m spatial resolution
Reported Event Inundation Factor	Hurricane Florence Inundated Areas	Areas that experienced flooding during Hurricane Florence, based on aerial photographs taken September 18 to 22, 2018.	Inundated areas were used assess extreme precipitation event flood risk across the landscape.	Data was produced by the Center for Biodiversity Outcomes, Arizona State University in 2020 at 5-m spatial resolution
Reported Event Inundation Factor	Community Flood Reporting Point	Areas outside of the 100- and 500-year floodplains that were identified by the public as having frequent or severe flooding during large precipitation events.	Point locations were converted to inundated areas based on the underlying elevation and topography. These inundated areas were used to assess extreme precipitation flood risk across the landscape.	Data was collected via analog maps at community stakeholder engagement meetings and online flood reporting survey

Field/Variable	Data Used to Define Field/Variable	Data Summary	Use in Risk and Vulnerability Assessment	Additional Information on Source Data
Sea Level Rise Exposure	Sea Level Rise (SLR) Inundation Extent 1-foot to 10-foot Scenarios	Data represents where water would be present along coast lines and intertidal waterways (under normal, non-flood conditions) at increasing sea levels. This is based on a "modified bathtub model," which identified the areas of land that would be covered with water if you increased the water height by a specific amount. It does not address when or how quickly the sea level might increase.	Simulated scenario data was combined with Sea Level Rise (Low) Inundation data and categorized into severity values 1 through 5 used to assess sea-level rise risk under varying conditions across the landscape.	Data was produced by the National Oceanic and Atmospheric Administration, Office for Coastal Management in 2017 at 10-m spatial resolution
Sea Level Rise Exposure	Sea Level Rise (Low) Inundation Extent 1- to 10-foot Scenarios	Data represents where water would be present in inland areas (under normal, non-flood conditions) at increasing sea levels. This is based on a "modified bathtub model," which identified the areas of land that would be covered with water if you increased the water height by a specific amount. It does not address when or how quickly the sea level might increase.	Simulated scenario data was combined with Sea Level Rise (SLR) Inundation data and categorized into severity values 1 through 5 used to assess sea-level rise risk under varying conditions across the landscape.	Data was produced by the National Oceanic and Atmospheric Administration, Office for Coastal Management in 2017 at 10-m spatial resolution
Sea Level Rise Exposure	Duck Pier Local Sea Level Rise Scenario Statistics	Data lists northern North Carolina regional projected sea level rise in feet sea for five IPCC emissions scenarios.	Data was used to determine the likelihood of sea level rise inundation per emission scenario	Data was produced by the National Oceanic and Atmospheric Administration, National Weather Service in coordination with the IPCC in 2017
Storm Surge Exposure	Sea, Lake, and Overland Surges from Hurricanes (SLOSH) Category 1–5 High Tide Simulations	Data depicts the simulated storm surges from tropical cyclones, developed using tens of thousands of simulations of climatology-based hypothetical tropical cyclones.	Modeled data from Category 1 through 5 storms were combined and inundation depth was categorized into severity values 1 through 5 used to assess storm surge risk under varying conditions across the landscape.	Data was produced by the National Oceanic and Atmospheric Administration, National Weather Service, National Hurricane Center in 2018 at 30-m spatial resolution

Field/Variable	Data Used to Define Field/Variable	Data Summary	Use in Risk and Vulnerability Assessment	Additional Information on Source Data
Storm Surge Exposure	Hurricane Landfall Statistics	Data lists all recorded hurricanes by category that have made landfall in the state of North Carolina since 1851.	Data was used to determine likelihood of storm surge exposure event by hurricane category.	Data was produced by the National Oceanic and Atmospheric Administration, National Weather Service
Social Vulnerability (geographic)	Social Vulnerability Index (SVI) 2018	Data represents a combination of socioeconomic factors that are used to identify and map the communities that will most likely need support before, during, and after a hazardous event.	Total SVI rankings were categorized using the flag approach and used to assess the most current socially vulnerable populations in the community.	Data was produced by the CDC's Division of Toxicology and Human Health Sciences, Geospatial Research, Analysis & Services Program (GRASP) in 2020 at the tract level
Social Vulnerability (geographic)	Social Vulnerability Index (SoVI) 2000	Data represents a combination of socioeconomic factors that are used to identify and map the communities that will most likely need support before, during, and after a hazardous event.	Total SoVI rankings were categorized using the flag approach and used to assess the socially vulnerable populations in the community at a localized scale.	Data was produced by the Hazards and Vulnerability Research Institute, University of South Carolina in 2011 at the block group level
Estimated Cost	Assessor Parcel Boundaries	Data represents county-level parcels with standardized attributes such as ownership, addresses, and assessed monetary values.	Monetary value fields such as Parcel Value, Land Value, and Improvement Value were used to calculate total estimated cost values for assets considered at risk.	Data was produced by the North Carolina Geographic Information Coordinating Council in coordination with local government agencies and last updated 2022

APPENDIX F

Detail Maps of Assets and Hazards

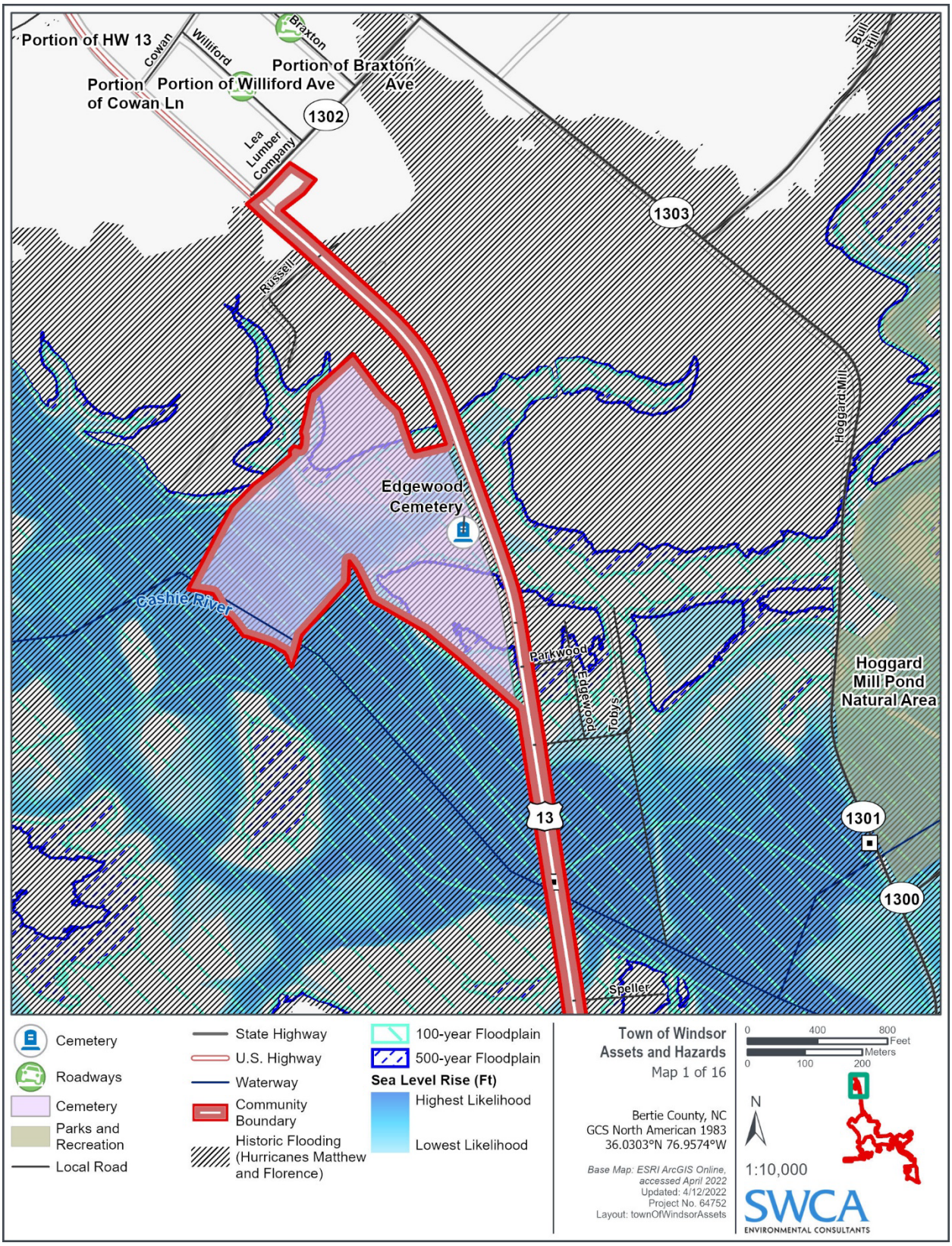


Figure F-1. Detail map of assets and hazards, keys to Figure 7.

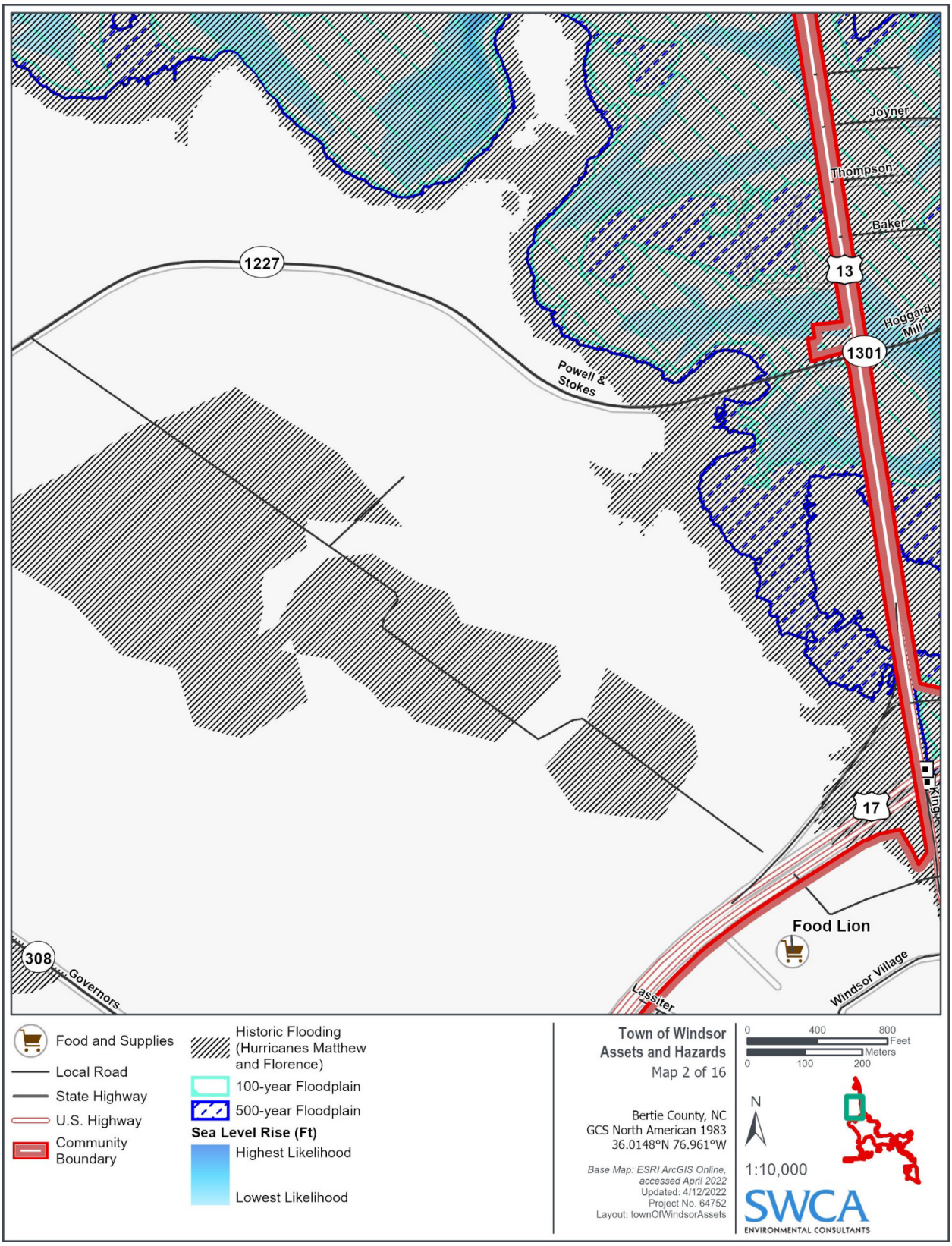


Figure F-2. Detail map of assets and hazards, keys to Figure 7.

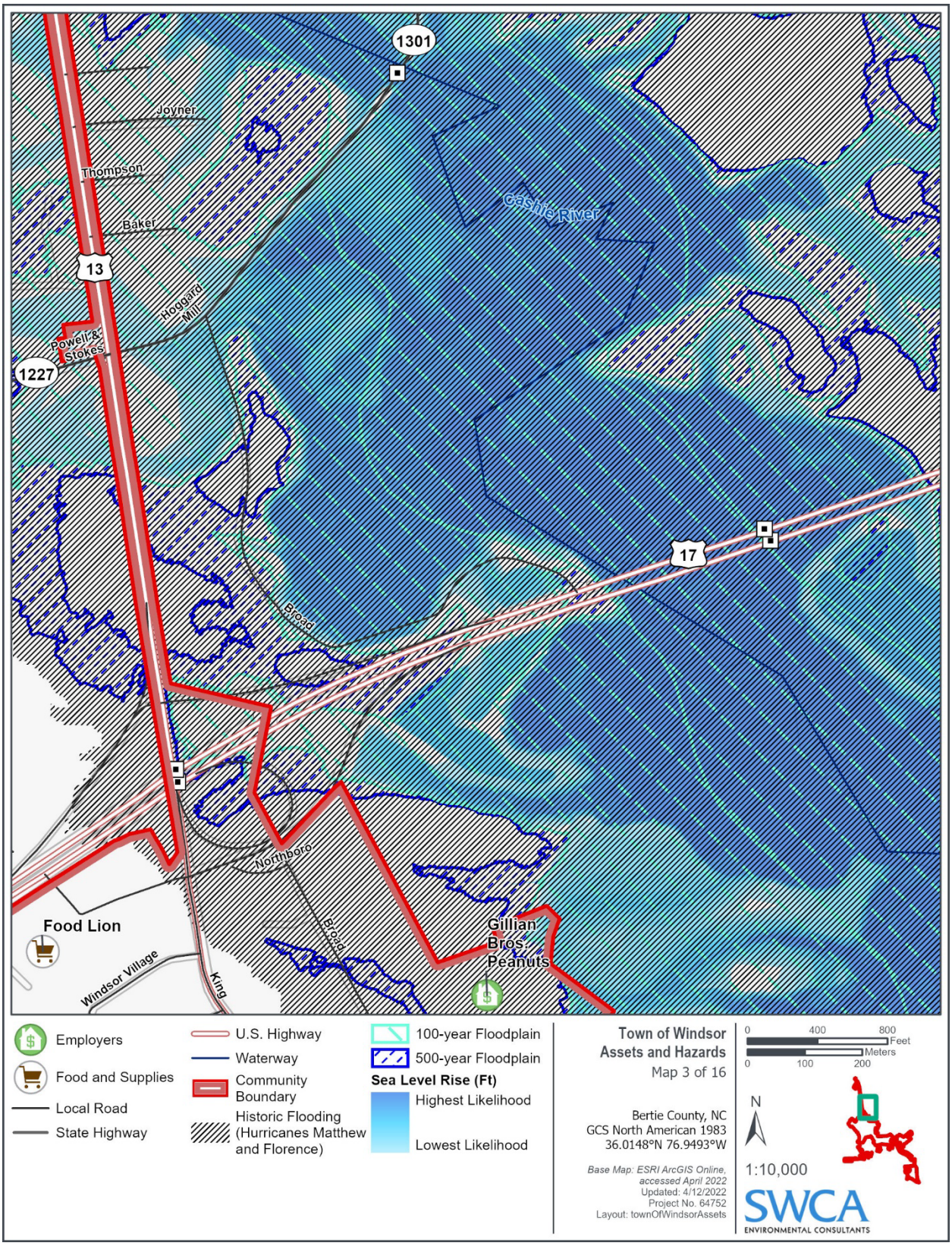


Figure F-3. Detail map of assets and hazards, keys to Figure 7.

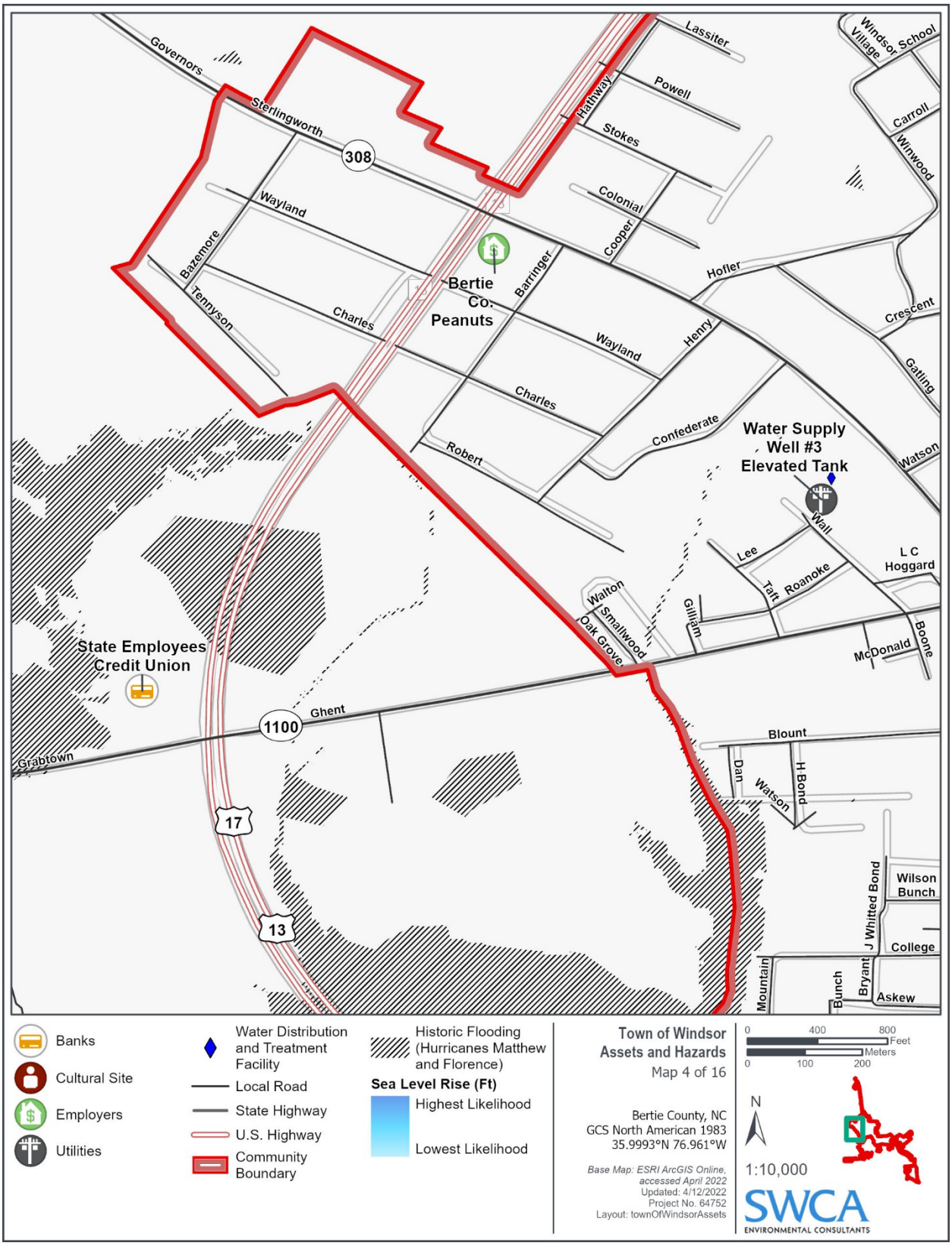


Figure F-4. Detail map of assets and hazards, keys to Figure 7.

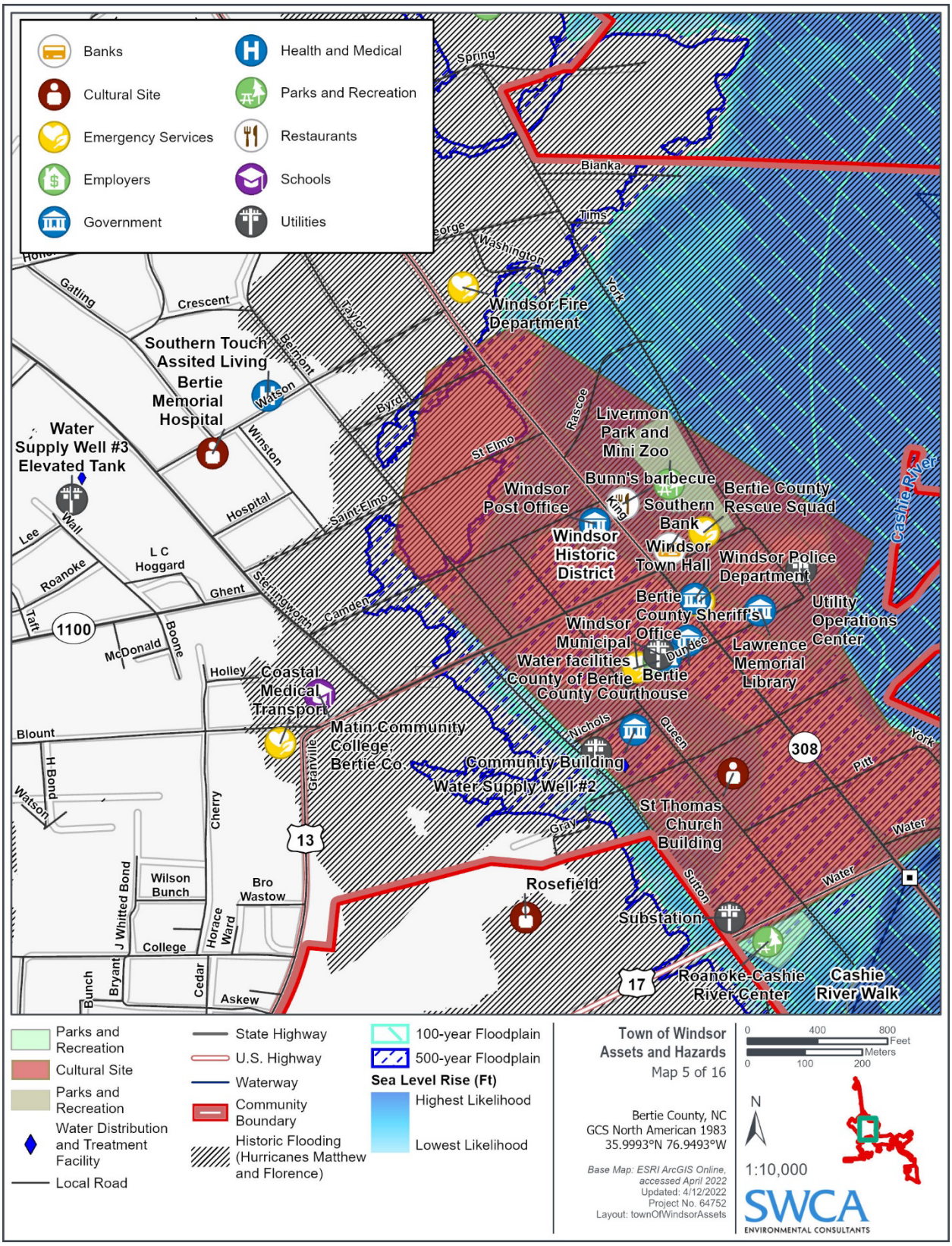


Figure F-5. Detail map of assets and hazards, keys to Figure 7.

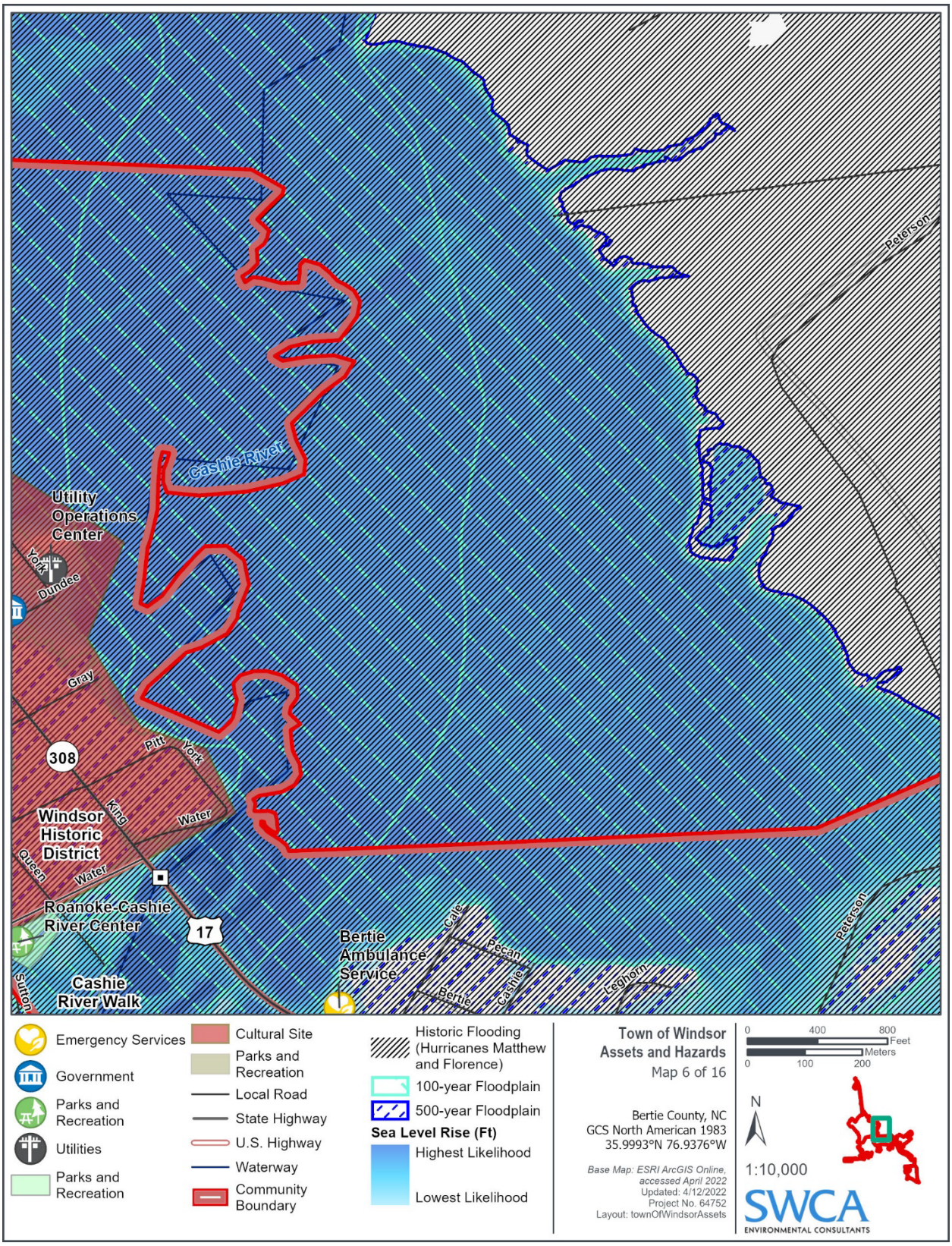


Figure F-6. Detail map of assets and hazards, keys to Figure 7.

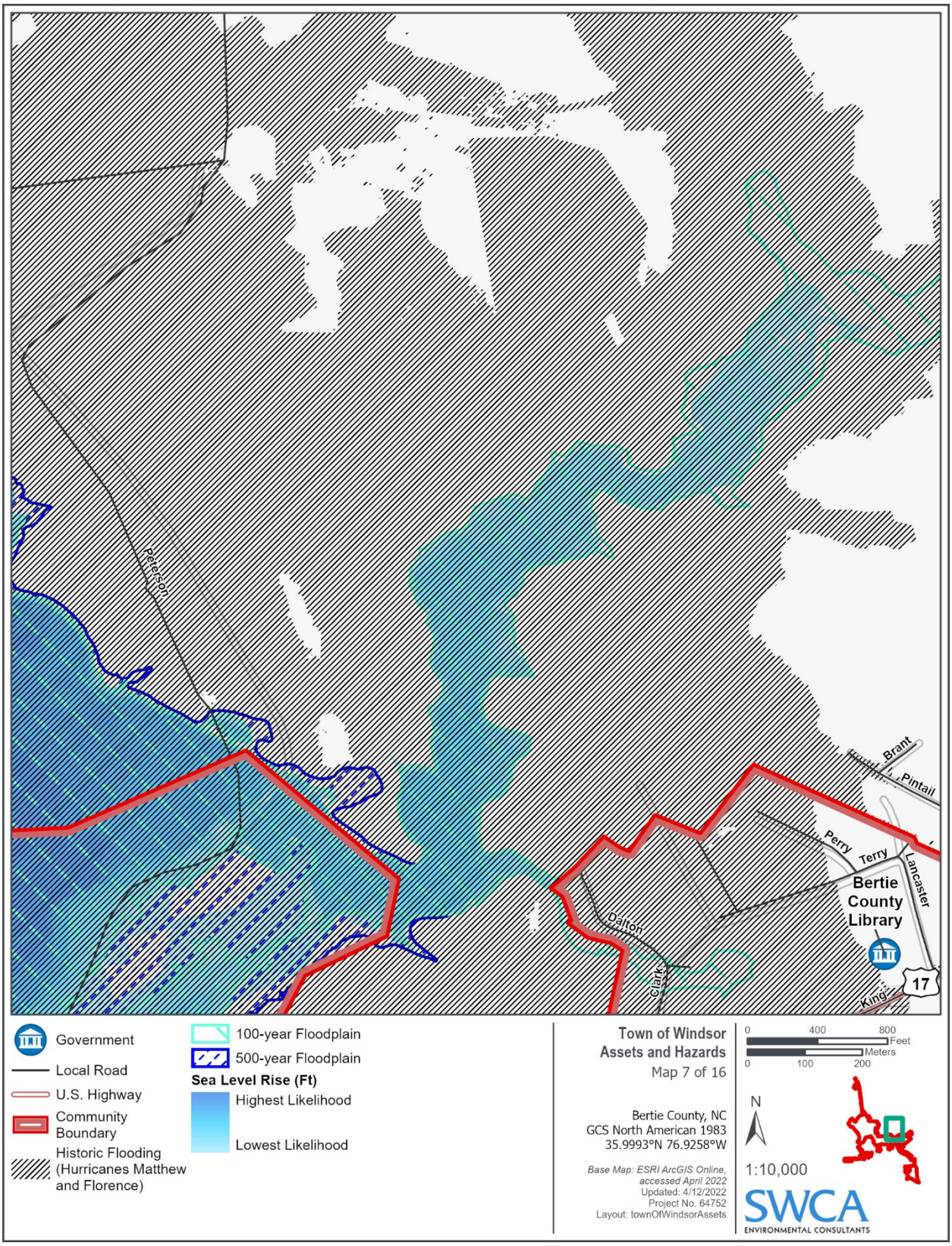


Figure F-7. Detail map of assets and hazards, keys to Figure 7.

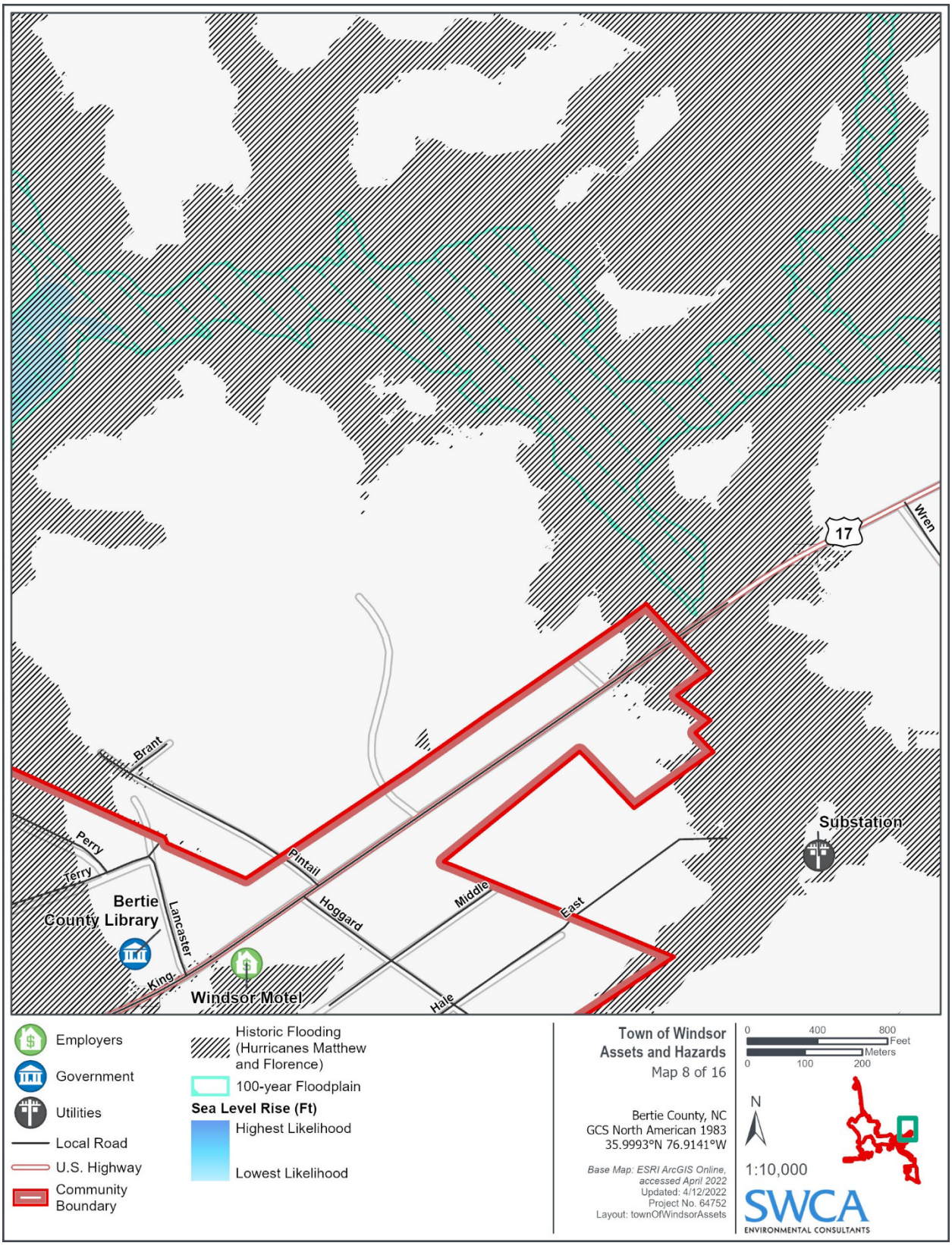


Figure F-8. Detail map of assets and hazards, keys to Figure 7.

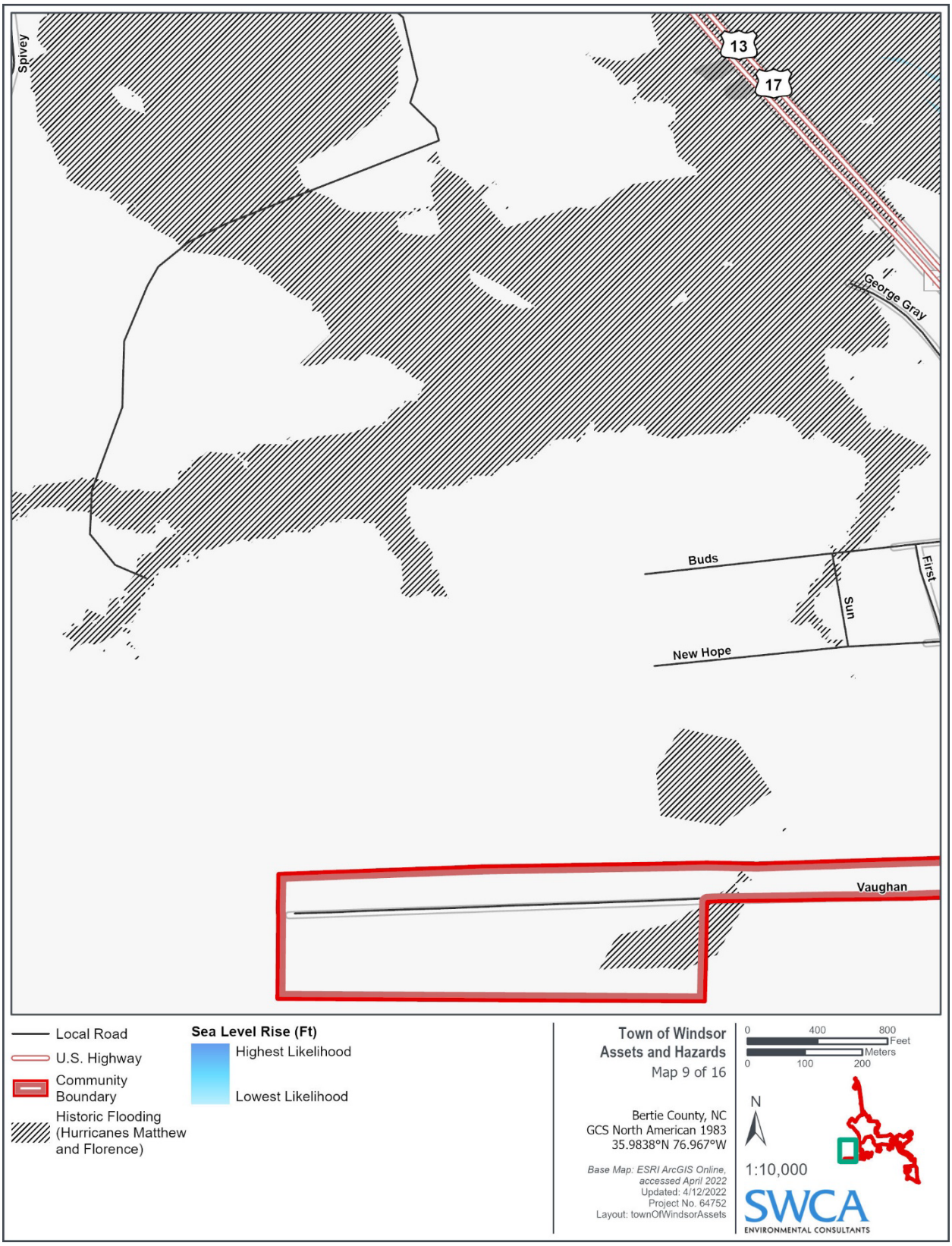


Figure F-9. Detail map of assets and hazards, keys to Figure 7.

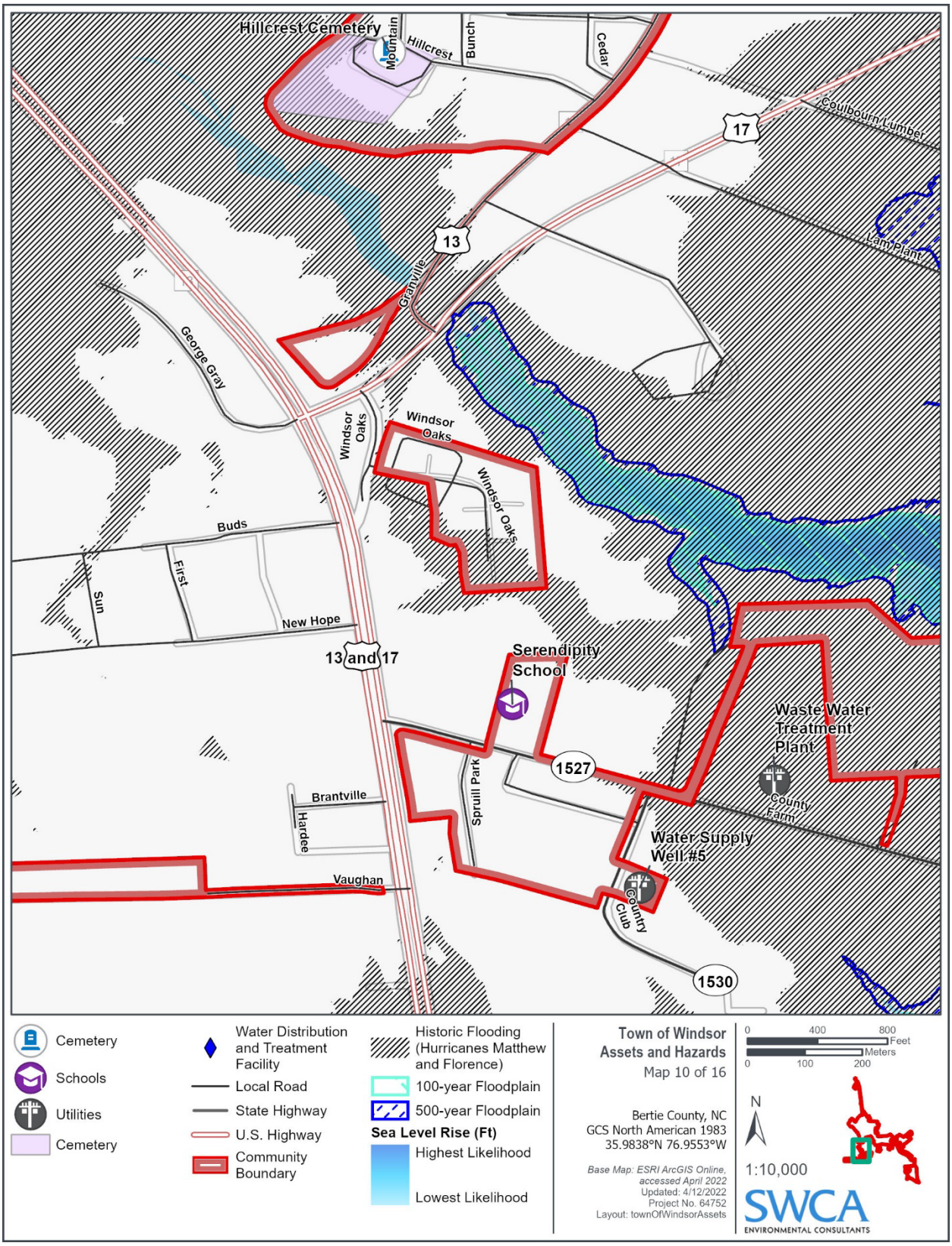


Figure F-10. Detail map of assets and hazards, keys to Figure 7.

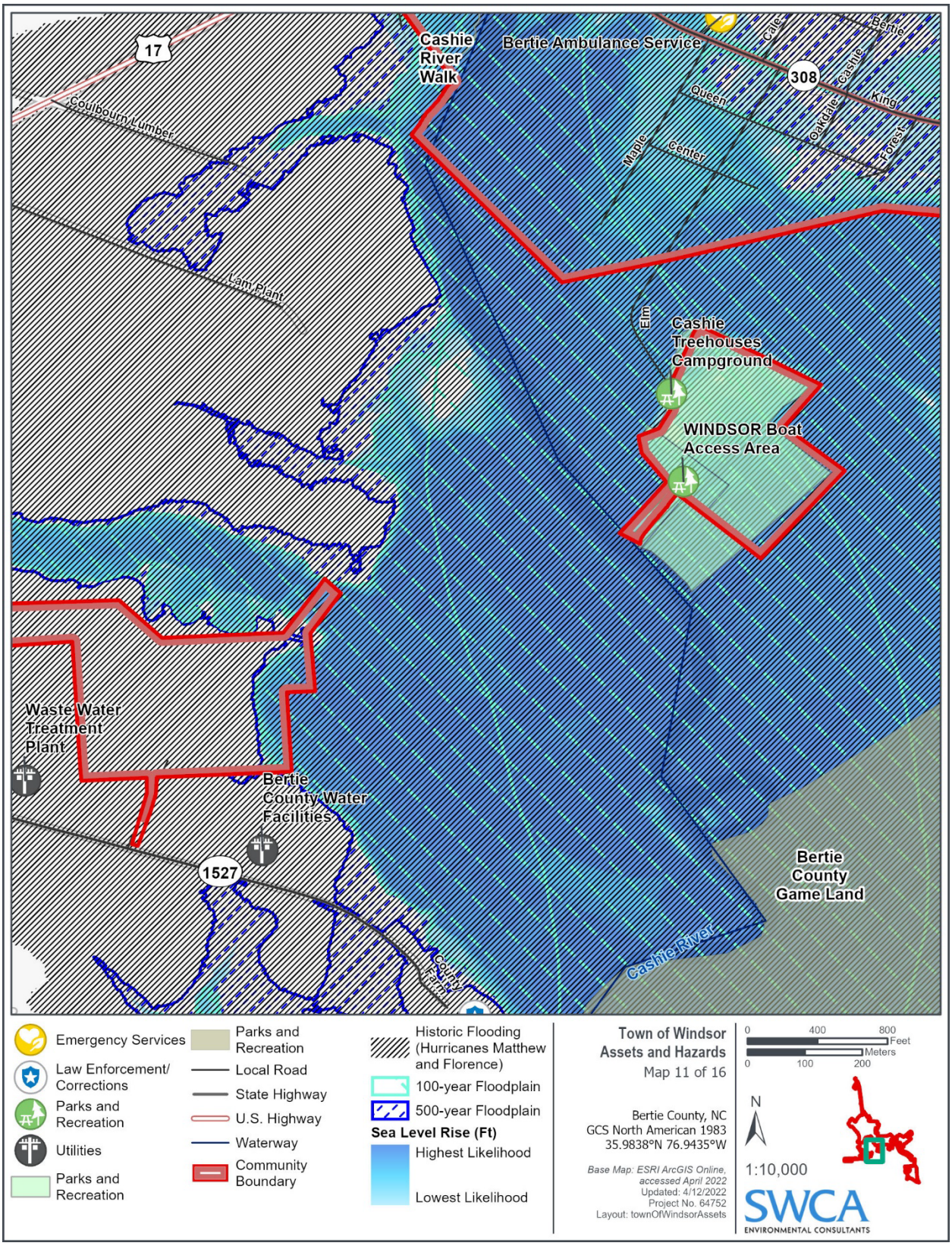


Figure F-11. Detail map of assets and hazards, keys to Figure 7.

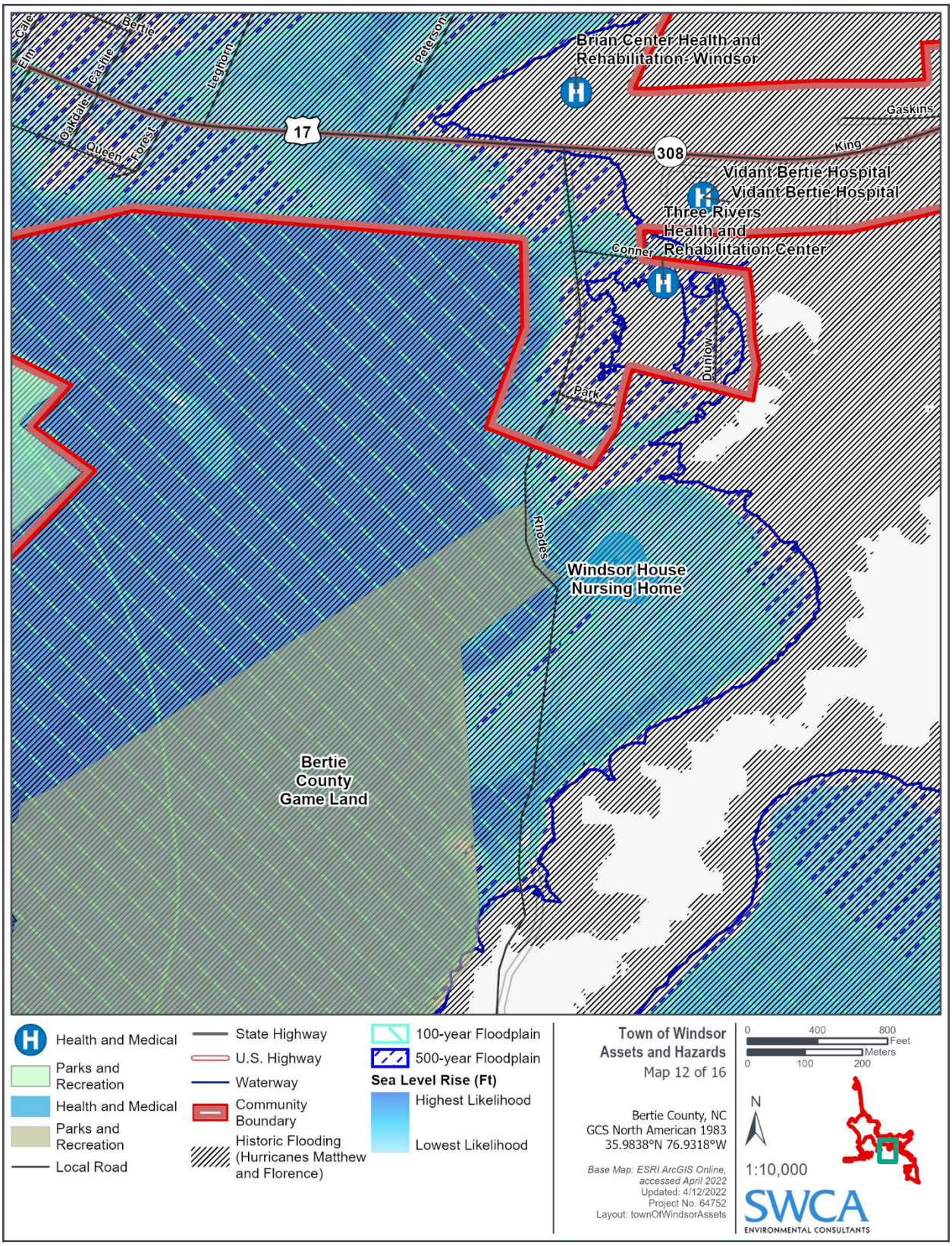


Figure F-12. Detail map of assets and hazards, keys to Figure 7.

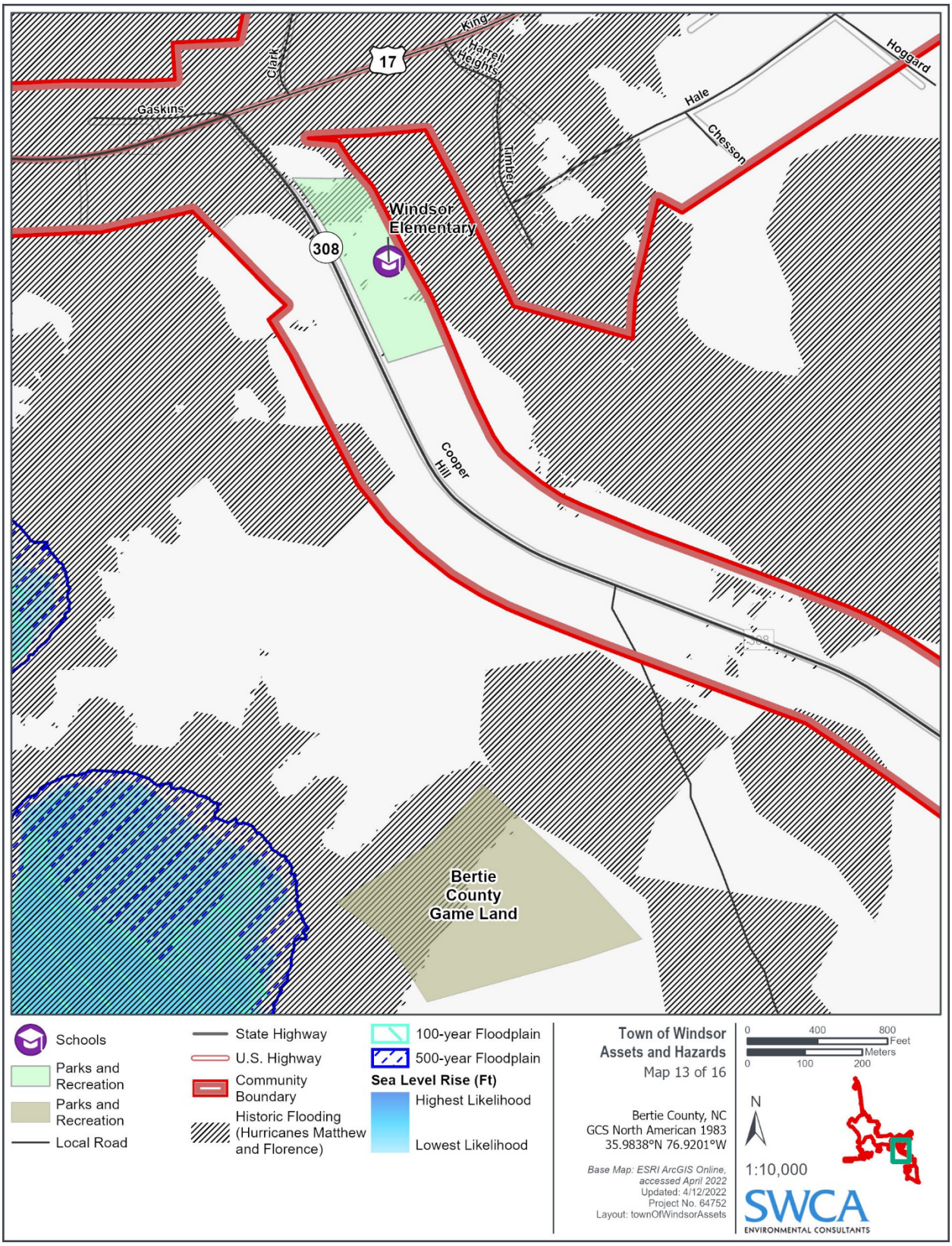


Figure F-13. Detail map of assets and hazards, keys to Figure 7.

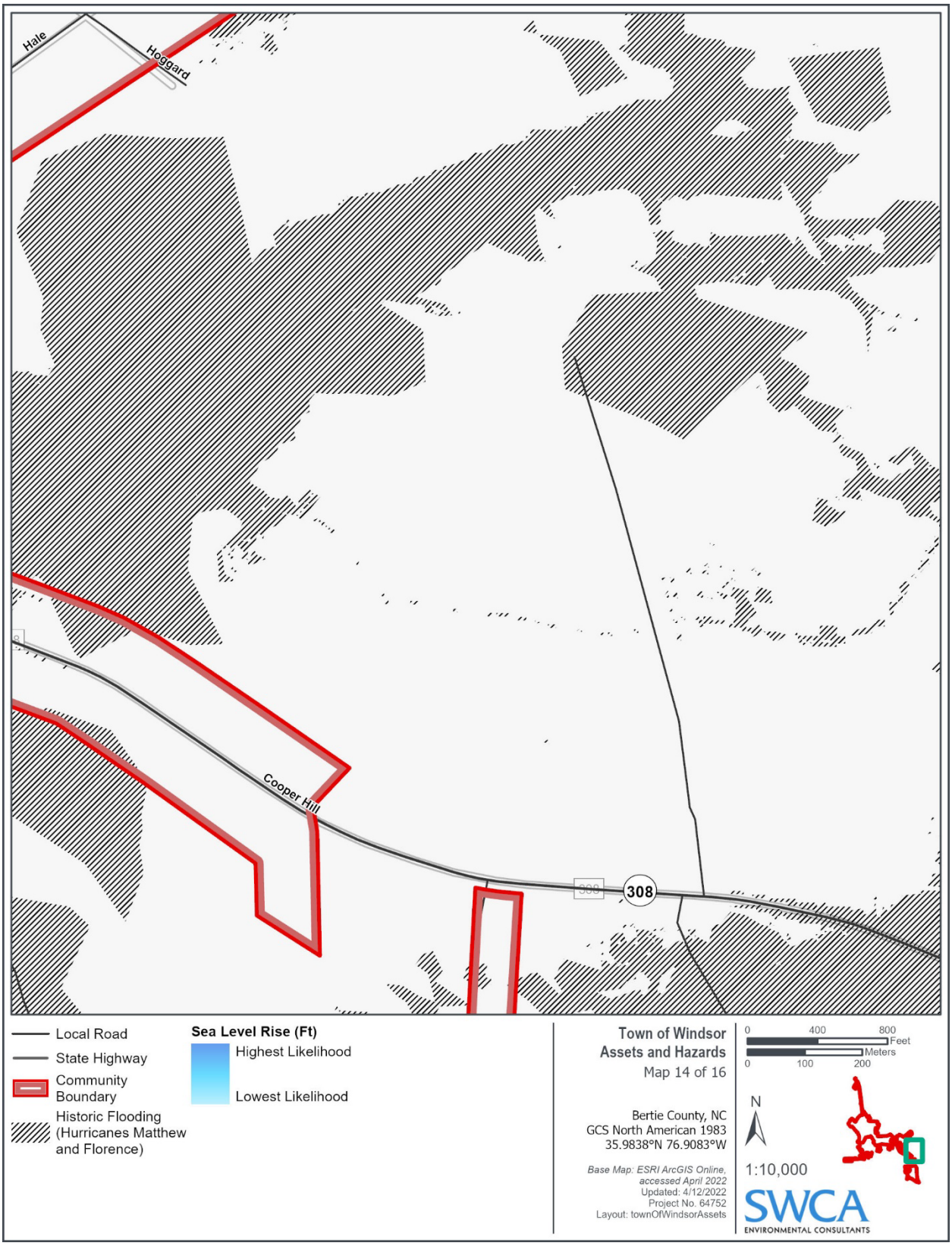


Figure F-14. Detail map of assets and hazards, keys to Figure 7.

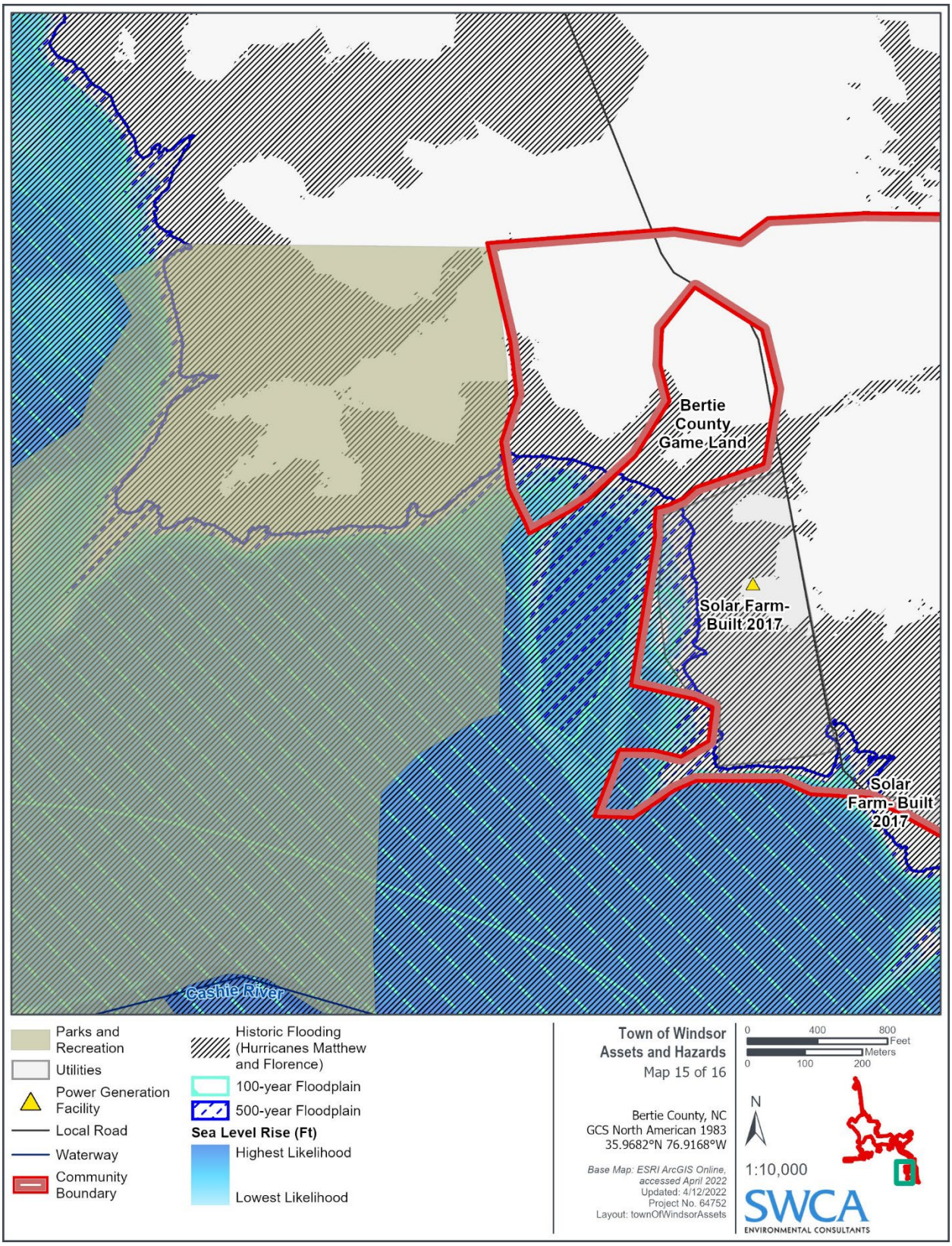


Figure F-15. Detail map of assets and hazards, keys to Figure 7.

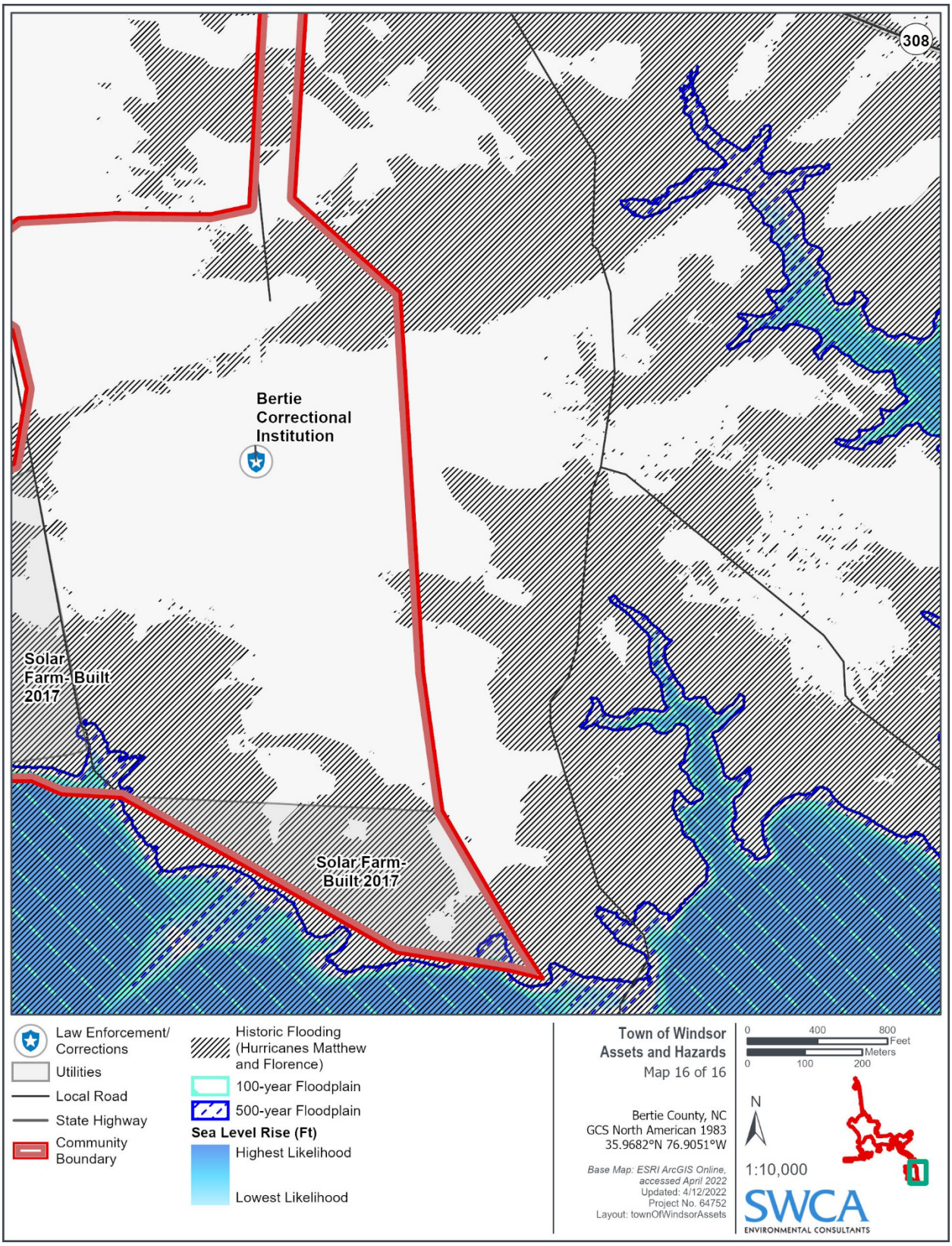


Figure F-16. Detail map of assets and hazards, keys to Figure 7.

APPENDIX G

Other Projects Considered

Table G-1. Other Projects Considered for Windsor, North Carolina

Project Name	Project Description	Source
Demolishing structures	(In progress) Buildings A, B, C, EE, DD, G, H, J, M, Y, X were recommended for demolishing in Downtown Flood Retrofit Report	Downtown Flood Retrofit Report
Windsor Flood Reductions Feasibility Study	(Completed) Conducted a joint ECU/NCSU study to develop engineering options that will reduce water flow into Windsor and other affected properties from fast-moving water of Cashie River basin. The project involves development of river models, mitigation options, and cost-benefit analysis.	Hurricane Matthew Resilient Redevelopment Plan – Bertie County
King Street Bridge Study	(Completed) Reevaluated the impact of Highway 17 Business bridge (King Street Bridge) on floodplain connectivity, flushing, and water quality during various flow conditions to address downstream controls.	Flood Dynamics in the Bertie Water Crescent (North Carolina Land of Water – S.R. Riggs)
Establish Regulatory Flood Height (with Bertie Co.)	(In place) Flood Damage Prevention Ordinance includes 5-foot freeboard. This should be periodically revisited and updated as needed.	Community Action Team
White Oak Drainage	Water is impounded by US 17 without a way to drain across to the south. The White Oak area receives that excess flood water, and the neighborhood is inundated. US 17 needs to have additional drainage installed so that water will flow across and under the corridor for future events.	Hurricane Matthew Resilient Redevelopment Plan – Bertie County
Davis Park Ballfields	The project involves upstream measures, like regular maintenance of drainage waterways and water storage projects, to reduce large-scale flooding of the Windsor area.	Hurricane Matthew Resilient Redevelopment Plan – Bertie County
Ghent/Gatling Neighborhood Stormwater Analysis	(Completed) Perform an updated stormwater management analysis to determine how to address the flooding along around US 17 into neighborhoods, especially through Gatling Street to Ghent Street and in the White Oaks neighborhood. Integrate this analysis with the county's strategy to provide upstream water storage along the Cashie.	Hurricane Matthew Resilient Redevelopment Plan – Bertie County
Ghent/Gatling Stormwater Improvements	(Completed) Improve storm water drainage, berm canal. Need storm water improvements, open channel, causes flooding. No real storm water infrastructure, culverts failed at Ghent / Gatling Streets, causes flooding to homes in area; Food Lion in area; open canal area.	Hurricane Matthew Resilient Redevelopment Plan – Bertie County
York Street Pump Station	(Completed) Three wastewater lift stations had major water damage and were not functional. The projects involved replacement of existing pumps with submersible types.	Hurricane Matthew Resilient Redevelopment Plan – Bertie County
Windsor EMS Facility	(Completed) Located new site and constructed replacement EMS facility outside of flood area.	Hurricane Matthew Resilient Redevelopment Plan – Bertie County
Residential Buyouts/Elevations	(Ongoing) Pursue buyouts for remaining residences eligible following Hurricane Matthew.	Public Meeting #1
Livermon Zoo	(Ongoing) Structural improvements to facilitate better evacuation of animals and mitigation of flooding.	Hurricane Matthew Resilient Redevelopment Plan – Bertie County