

Briefing for the Town of Windsor, NC: Land Suitability Analysis for Post-Disaster Housing Relocation

Hurricane Matthew Disaster Recovery and Resilience Initiative
September 2018

Note: This Appendix complements the Technical Memo for Land Suitability Analysis and contains the relevant details and results specific to the Town of Windsor.

Overview

Hurricane Matthew's heavy rainfall in October of 2016 led to major flooding on the Cashie River, significantly impacting about 60 homes as well as the historic downtown and commercial district. The associated flooding also damaged the County Library and Cooperative Extension building. Even before Hurricane Matthew, the town was dealing with challenges associated with an aging population, lack of affordable housing, and difficulty financing the management of their water and sewer systems. Hurricane Matthew represented the sixth major flood since Hurricane Floyd, which struck in 1999. The resilience of the town's residents and local leaders has certainly been tested, yet again.

Through a series of expert consultations and public discussions, Windsor has begun to address some of the town's major recovery issues through funding provided by a number of grants (via Community Development Block Grant – Disaster Recovery [CDBG-DR]¹, the Golden LEAF Foundation, etc.) that are tied to the reconstruction, repair and relocation of public facilities, infrastructure, and housing. Windsor officials are also exploring opportunities to floodproof downtown buildings and expand regional eco-tourism while working to address the immediate needs of the residents most heavily impacted by the storm.

With over 30 buyout participants expected through FEMA's Hazard Mitigation Grant Program, the town leaders are concerned about losing a portion of its tax base should individuals choose to relocate outside of municipal boundaries, which is likely given the lack of affordable housing options. To minimize this loss, Windsor can use the Land Suitability Analysis

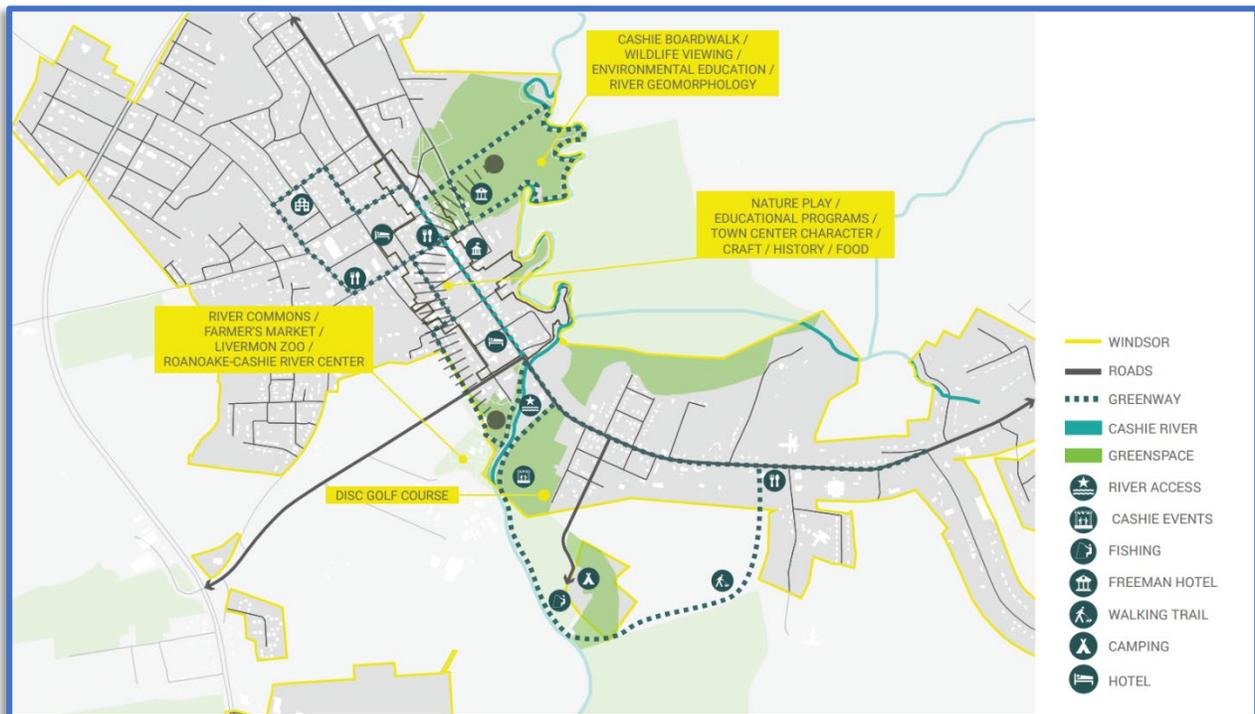
¹ CDBG-DR funds may supplement, but cannot duplicate, funding available from FEMA or other federal agencies. CDBG funds must be approved by Congress. These flexible grants, administered by the U.S. Department of Housing and Urban Development (HUD), can be used to assist disaster recovery and resilience efforts by local governments, states, or tribes. CDBG may be used to fund a broad range of activities so long as they meet at least one of three national objectives: 1) benefit low- and moderate- income persons, 2) help prevent or eliminate slums or blight, or 3) address urgent risks that pose a serious and immediate threat to the health and wealth of the community where other financial resources are unavailable (U.S. HUD, 2016).

(LSA) and HomePlace document to inform a more comprehensive Relocation Strategy (see Technical Memo on Land Suitability Analysis and Appendix A for details). However, getting from the LSA to the reality of flood survivors living inside safe and affordable homes will take a significant amount of time, energy, investment, and planning on the part of town officials and staff, their recovery partners, and of course, the survivors themselves. HMDRRI has worked to supplement and fill in gaps during the first steps of a long recovery process, including the following LSA which can inform future resilient housing development strategies for the town.

Linking Home Buyouts, Relocation and Greenspace Concepts

A major output of HomePlace for Windsor, a component of the broader Relocation Strategy, is a Greenspace Concept (Figure 1) that illustrates a set of potential recovery strategies. The concept includes actions such as improving access to and quality of experiences along the Cashie river boardwalk and transforming former residential areas over time to support expanded recreational opportunities through a network of interconnected trails, parks, and public spaces. (HomePlace, 2017). Because past and future flood buyouts must remain open space, the concept integrates these features into a system of eco-tourism and recreational assets. While the town is addressing a number of issues tied to infrastructure, public facilities, and economic development, one of the greatest challenges is to encourage flood survivors who were displaced from their homes to permanently relocate in areas within the community that are desirable to live in and are located outside the 100-year floodplain.

Figure 1. Windsor Greenspace Concept.



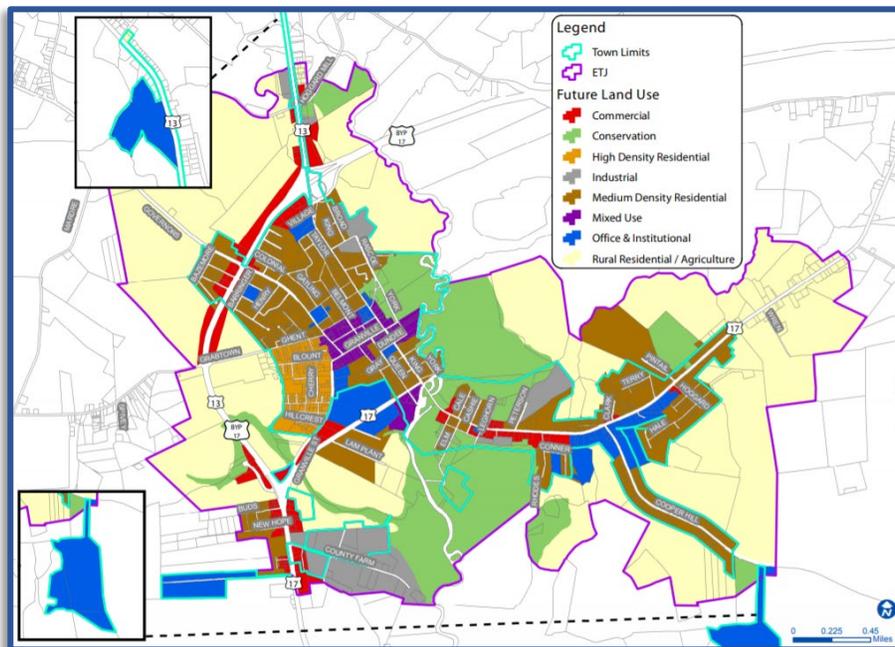
The LSA identifies the most suitable parcels for replacement housing based on a set of variables and thresholds. The intent of this process is to minimize the loss of local tax base and maintain the social connectedness of the residents participating in the buyout of flood-prone properties. The LSA and Affordable Housing Strategy aim to help address not only some of Windsor’s long-term recovery needs, but also supports the town’s overall resilience efforts.

Previous LSA Efforts in Windsor & Future Land Use

The town’s most recent comprehensive plan (2015) identifies future land uses based on established planning goals (Figure 2). This designation was factored into HMDRRI’s LSA knowing that new development during recovery should strive to meet existing long-term planning goals established by the community. The comprehensive plan also includes a series of LSAs that were conducted to determine which areas were best suited for agriculture, conservation, and urban development (Town of Windsor, 2015). The LSAs also compared the three categories to identify potential conflict between the three preferred land uses.

The Urban Development Suitability (UDS) analysis in Windsor’s plan includes five variables: proximity to schools, proximity to parks/recreation facilities, proximity to water/sewer infrastructure, proximity to roadways, and lands outside the 100-year floodplain and floodway. The results from the UDS found that “areas with particularly high suitability for urban development, include land along Grabtown Road and the town center. While the UDS includes fewer variables, it is generally consistent with the results from HMDRRI’s LSA.

Figure 2. Windsor Future Land Use Map



LSA Variable Description and Weighting

The selection of variables to include in the LSA began with a broad review and consideration of 36 variables of various types such as proximity to community services, transportation, environment and topography, planning, and flood risk (see Appendix). Since many variables were not applicable in Windsor (i.e., proximity to hazardous waste sites) or may not be major determinants of a site's development potential (i.e., bus stop proximity, park proximity, etc.), members of the HMDRRI team prioritized the top 8-10 variables based on past LSA experience and available knowledge about flood risk. A comparison of each member's interpretation led to consensus about the most important factors on which to focus during the development of a preliminary LSA. Described in further detail below and in Table I, some of the key variables included the designated 100- and 500-year flood zones, proximity to existing water and sewer infrastructure, land/building vacancy, parcel size, and zoning.

Many variables such as the municipal boundary or 100- and 500-year flood zones have thresholds that are based on Boolean logic (binary in/out or yes/no) and therefore, were given simple criteria for point attribution. Other factors such as parcel size and zoning contained a range of quantitative and qualitative values, and needed criteria and thresholds established. These were determined after further exploration of the variability of each factor and discussion with HMDRRI team members about what planning and development concepts were most applicable. Descriptions and justifications of each variable, its associated thresholds, and data sources are explained below and summarized in Table I.

Table 1. Windsor LSA Variables and Criteria Thresholds.

Category	Variable	Criteria Thresholds	Points	Max
Jurisdictional Boundaries	Municipal Limits	Out	0	1
		In	1	
	Extraterritorial Jurisdiction (ETJ)	Out	0	1
		In	1	
Proximity to Infrastructure	Water Line (0.25 mi. buffer)	Out	0	1
		In	1	
	Sewer Line (0.25 mi. buffer)	Out	0	1
		In	1	
Parcel Size*	Infill Potential	< 3,000 ft ²	0	2
		3,000 ft ² - 20,000 ft ²	1	
		20,000 ft ² - 100,000 ft ²	2	
	Multi-Structure Potential	100,000 ft ² - 500,000 ft ²	2	2
		> 500,000 ft ²	0	
Building/Land Vacancy	Land Vacancy	Buyout	0	3
		Occupied	1	
		Vacant	3	
Property Ownership	Town-Owned	Private	0	1
		Town-Owned	1	
Vulnerability to Flooding	100-yr Floodplain (Zone AE)	In	0	4
		Out	4	
	500-yr Floodplain (Zone X)	In	0	2
		Out	2	
Areas of Future Development	Existing Land Use	Institutional, Buyout, Recreational, Agricultural	0	2
		Commercial	1	
		Residential	2	
	Future Land Use	Industrial, Conservation, Agriculture, Institutional	0	2
		Commercial	1	
		Mixed-Use, Residential	2	
Environmental	Prime Farmland Soils	In	0	1
		Out	1	
*Each parcel, based on its size will fall into one of two categories: infill potential or multi-structure potential, both contributing to possible totals of 21.			Total:	21

Vulnerability to Flooding/Flood Risk

Source: NCEM, 2017

(100-Year Flood Zone; 500-Year Flood Zone)

Perhaps the most crucial set of factors for the Affordable Housing Strategy and LSA are related to flood risk and vulnerability. The 100-year floodplain (Zone AE) or base flood elevation delineates the area that is expected to be inundated by a 1% annual chance flood. The 500-year floodplain (Zone X) represents areas with a 0.02% annual chance of being inundated. Hurricane Matthew's Flood extent is also relevant, which fell within the boundaries of the 100- and 500-year floodplains. The event's flood extent represents areas that officials and residents have actually seen flood versus those depicted on Flood Insurance Rate Maps (FIRM's) which are calculated using hydrology and statistics and included a certain amount of uncertainty/inaccuracy. In Windsor's case, the FIRM's appear to be accurate and therefore, using hurricane Matthew's flood extent is unnecessary.

Together, these flood risk variables account for both estimated flood risk that is tied to various regulations and programs as well as the town's actual experience, which is easier to understand from the public's perspective. These factors provide a range of possible flood elevations, a more comprehensive view of a property's vulnerability to future flooding and meet a main goal of the Relocation Strategy, which is to build new housing in safer areas.

Jurisdictional Boundaries

Source: Bertie County, 2017; NC OneMap

(Municipal Limits; Extraterritorial Jurisdiction (ETJ))

Municipal governments in North Carolina have control and influence both within their corporate boundaries and its Extraterritorial Jurisdiction, or ETJ (see Owens, 2013). For a number of reasons, it is important for the Land Suitability Analysis to extend its view to include the ETJ. In order to promote orderly development and efficient investments in infrastructure and the provision of services, the most common practice is to annex land prior to development. Where that does not happen, the ETJ helps avoid problems by applying municipal development standards, zoning, and proper layout of subdivisions for residential, commercial and industrial development. Following a disaster in which buyouts occur in flood-prone areas, there may be insufficient land within the community to build replacement housing that is located outside the floodplain, thereby requiring an assessment of lands outside the community but within the ETJ. The Land Suitability Analysis, in combination with the Relocation Strategy, is well suited to this purpose. While in Windsor, the emphasis of the LSA is on residential relocations, it may be useful for commercial and industrial business applications as well.

Proximity to Existing Infrastructure

Source: NC OneMap, 1997

(Water Distribution System; Sewer System)

New housing development is much more cost-effective when it is located near existing water and sewer infrastructure. These factors are key to identifying suitable areas for infill development. One limitation of the data is that it is outdated (1997). The use of a 0.25-mile buffer helps to address some of this uncertainty.

Parcel Size

Source: NC OneMap, 2017

(Infill Potential; < 3,000 sq. ft.; between 3,000 and 20,000 sq. ft.; and between 20,000 and 100,000 sq. ft.)

Some lot sizes are suitable only for development of single-family homes or lower densities. The thresholds were selected based on the size of existing single-family home building footprints and lots sizes within Windsor. The smallest existing lots in the town that have single family homes on them are at least 3,000 sq. ft. and the median parcel size found within 500 feet of the town boundary is about 21,000 sq. ft. Therefore, any parcel less than 3,000 sq. ft. would not be considered suitable while the other two categories already do support or could accommodate a small- to medium-size single-family home and larger homes for which existing lots did not exceed 100,000 sq. ft. The “square foot” unit was used instead of acres because some lot sizes are so small that multiple decimal places would have been required to display variability.

Multi-Structure Potential: between 100,000 and 500,000 sq. ft.; > 500,000 sq. ft.

Larger lots may be suitable for multifamily structures, to include apartment buildings. This form of development could be more attractive to developers or investment partners if a larger number of units can be placed on a given site. Thresholds were selected based on size of larger parcels within town that had multifamily structures on them.

Land Vacancy

Source: NC OneMap, 2017

(Buyout, Not-Vacant, Vacant)

NC OneMap land use description characterize the property as being a flood buyout, occupied, or vacant. Currently occupied lots are not ideal for redevelopment unless they are large enough to support additional structures on them. Buyout lots cannot be developed according to federal rules that require them to be maintained as open space in perpetuity. Vacant parcels are the most suitable for new, affordable and resilient housing development and would be subject to current codes.

Land Ownership

Source: Town of Windsor, 2017

(Ownership: Vacant, Town-Owned)

Not having to pay to acquire private property is one less financial barrier in the housing development process. By identifying land already owned by the town that they wish builders to develop, housing recovery partners would have a ready-made list of properties to invest in, assuming they are otherwise suitable. Ownership by other public entities such as Bertie County may be considered as well.

Areas of Future Development

Source: Town of Windsor, 2017

(Land Use: Commercial, Industrial, Residential, Institutional)

Current land use patterns reflect the community's previous intent for the layout of urban activities, which is different from zoning which designates what can be built today. It may be more difficult to develop replacement housing on properties that have existing development or is zoned for something other than residential, such as 'industrial' whereas a property already being used for and is zoned for residential uses, will not require a rezoning, variance, or other procedural action. Land uses of greatest interest for the Relocation Strategy and LSA include commercial and residential uses, both of which would require little to no extra administrative burden. Developing housing in areas whose existing land use is designated as agricultural may conflict with prior planning goals and require rezoning.

(Future Land Use: Industrial, Conservation, Agriculture, Institutional, Outside ETJ, Commercial, Mixed Use, Medium Density Residential, High Density Residential)

Described in the town's land use plan and map, future land use designations represent the type of development or growth the town is striving to achieve over time and is based on planning goals. This information is crucial for integrating into the LSA as the spatial distribution of the type and intensity of development inform where new housing is ideally located. Table 2 shows the various categories of future land use codes.

Table 2. Windsor Future Land Use Codes.

Future Land Use Code	Future Land Use
IND, CONSERV, RA, OI, OutETJ	Industrial, Conservation, Residential-Agriculture, Office/Institutional, Outside ETJ
COM	Commercial
MIX, MDR, HDR	Mixed Use, Medium Density Residential, High Density Residential

Environmental

Source: Town of Windsor, 2017

(Designated Soil Type: Any combination of Areas of Prime Farmland, Farmland of Statewide Importance, and Prime Farmland if Drained)

Given the strong value and presence of the agricultural community in and around Windsor, it is appropriate to consider areas within the town's ETJ that may or may not be high quality, productive working farms which is primarily based on its soil classification. Windsor's Comprehensive Land Use Plan outlines three categories of soil types that would not be considered suitable for residential or other types of development. The plan also notes that combined, the three soil types cover greater than 90% of the hydric soils, which is another cause for a property to be considered unsuitable. Locating new housing development outside of areas designated as productive farmland reduces future conflicts with existing growth management and agricultural preservation strategies.

The thirteen variables determine a parcel's composite suitability for replacement housing. The factors and thresholds inform the results of the LSA which guide the decisions that meet the goals of the HMDRRI Relocation Strategy to reduce flood risk, retain flood survivors within the community, and minimize construction costs.

While this analysis was done for siting potential replacement housing, the results are also useful for addressing the lack of affordable housing. A similar method could be used for other planning objectives such as siting future park/greenspace or other public facilities, similar to the conservation and agriculture LSAs already completed. A further description of these possibilities is provided in the Technical Memo for the LSA.

LSA Results and Interpretation

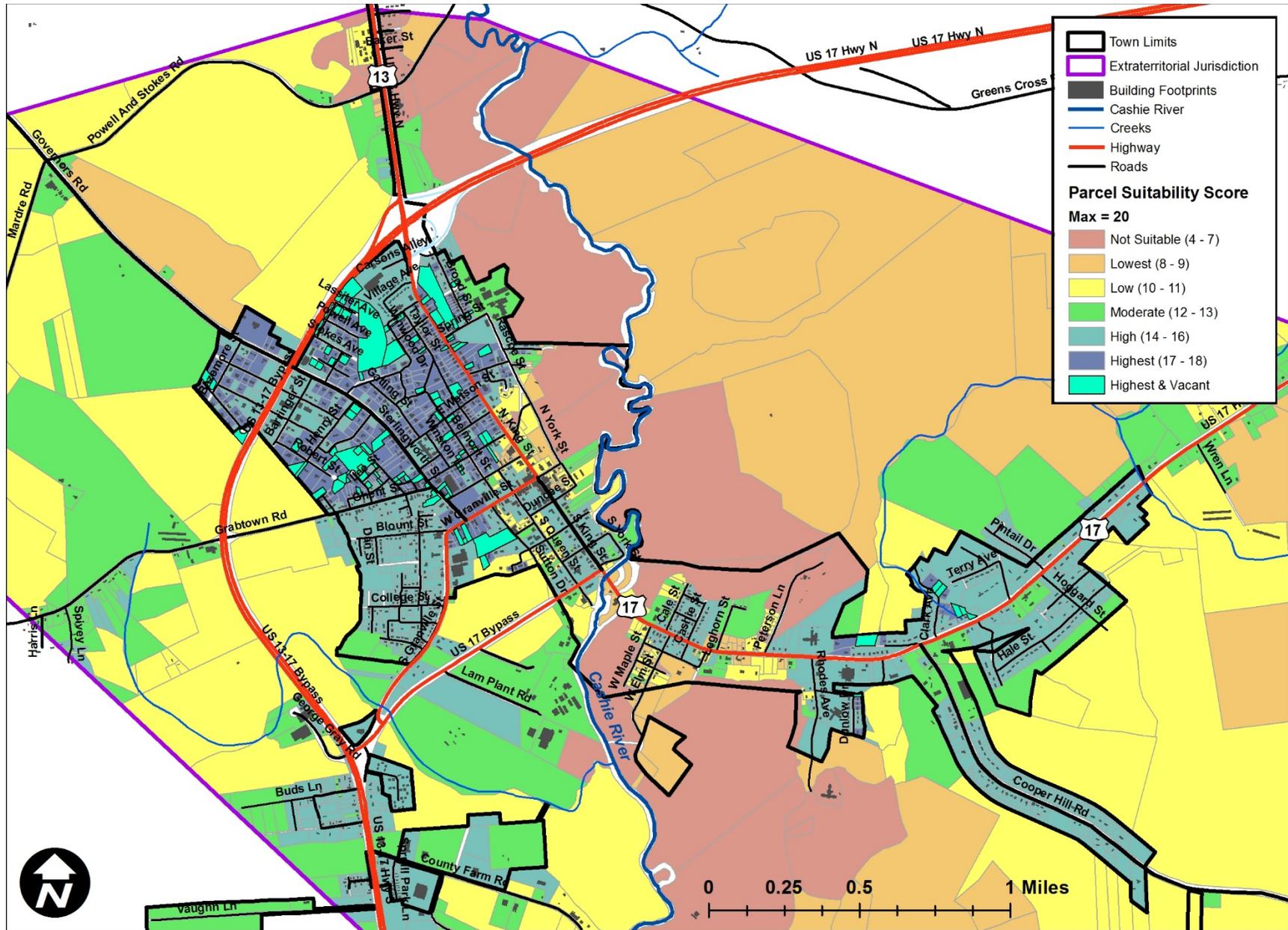
The results of the LSA reveal significant spatial variation in the total suitability score within the town's ETJ. For instance, there are areas in close proximity to one another, but with major differences in suitability, most likely a result of the irregular shape of the floodplain boundary and its relative weight and influence on the scoring. Of the parcels analyzed that fall within the town limits, there are more than 50 parcels that received a 'highest' suitability score and are listed as vacant. These parcels are generally located west of the Cashie River and North King Street, outside of the floodplain and highlighted in the turquoise color (Figure 3). Several highly suitable and vacant parcels are found in the area south of Sterlingworth Street and east of Henry Street. A number of other highly scoring small parcels are scattered throughout residential neighborhoods and may be able to support infill development. A few larger lots also found to be highly suitable and vacant may be appropriate for multi-family

development. In line with the town's own UDS method and future land use map, areas both north and south of Ghent Road, west of downtown, but within town limits, had high scoring parcels. There are several vacant properties in this area that are designated as medium-density or high-density residential on the future land use map.

These suitable areas are distinctly separate spatially from the lower scoring, low-lying areas adjacent to the Cashie River which contain a number of homes and the entire commercial downtown district (Figure 3). Properties in neighborhoods immediately east of the Cashie River off of West Maple Street scored in the 'low', 'lowest', or 'not suitable' categories. Properties that were previously acquired through FEMA's Hazard Mitigation Grant Program are in this same area where the disc golf course is located. Other known flood areas near South Queen Street and Sutton Drive scored poorly, as well.

Windsor should use these findings to delve deeper into potential suitable properties for infill or larger housing development and consider additional factors not included in this analysis such as land value/acquisition cost, proximity to downtown or other key community assets.

Figure 3. Windsor Land Suitability Analysis.



Conclusions and Next Steps

As a first step in utilizing the LSA results, community leaders in Windsor can further investigate and explore characteristics of the most suitable parcels. There are a few dozen parcels within Windsor's town limits that are considered to have 'high' composite suitability, may be vacant and/or acquirable and could support multiple types of housing. Located primarily just west of downtown at significantly higher elevation, a number of small-medium size vacant lots exist in areas of reduced flood risk that could support infill development of single-family homes. One or two larger parcels meet all the same criteria, may be vacant and could support a cluster of single-family homes or denser multi-family buildings that could help to alleviate the lack of affordable housing in the area.

Moving forward, the town of Windsor may consider combining the results of this and previous LSAs to facilitate discussions about housing recovery in coordination with Bertie County and others. Suggested considerations for more general improvements to the process are listed in the concluding remarks of the Technical Memo on Land Suitability Analysis. Other potential steps for getting the most out of the LSA and linking it to Windsor's greater recovery efforts include:

- Exclude other non-suitable areas such as parks, past and expected future buyout properties, or others as identified to narrow the scope of suitable properties.
- Share LSA method and results with the town's planning consulting team, housing stakeholder groups (local/state housing finance agencies, financial institutions, housing developers, engineers, architects, landscape architects, planners, real estate companies, religious groups, non-profits, and private foundations) to inform programs and funding mechanisms that support housing recovery goals.
- Consider pairing the existing or revised results of the LSA with additional design-oriented public engagement activities during all relevant community plan development or update processes (i.e., comprehensive and use plan, bicycle and pedestrian Plan, hazard mitigation plan, etc.).

Implications for Future Planning and Use of LSAs

Along with the devastation seen after Hurricane Matthew, the record-breaking 2017 hurricane season in the U.S. is a stark reminder of the great challenges we face in preparing for, responding to, and recovering from major natural hazard events. Along with recovery from these events, current and future generations will simultaneously try to understand how to plan and invest more effectively knowing that in an era of climate change, these risks are expected to increase. Major events like Hurricanes Matthew, Harvey, Irma, Maria, and now Florence have produced a set of extremely difficult circumstances for the thousands of people affected. They have also brought people together in amazing ways. The human spirit often shines during response and recovery as everyday heroes emerge and local officials call for the need to 'build back better'. However, the physical and emotional trauma that transpires in the aftermath of an event often reveals the disproportionate impact felt by communities of modest wealth and communities of color who were struggling prior to the event. Opportunities to invest in alleviating these impacts are limited and at the federal government level, lean towards a reactive instead of proactive approach. Pre-event planning offers another opportunity to create positive change with and for those with the greatest levels of vulnerability.

Every year, more accurate data is collected, analyzed, and visualized through new tools that increase awareness and understanding of our country's natural hazard risks. Some tools are also getting better at linking community goals and addressing multiple issues at once. HMDRRI's approach to the LSA is an example of how a tool can be flexible, yet powerful in its ability to inform a relocation strategy. Supported by the indigenous knowledge of a community, planning approaches like this can be used to guide a more resilient and equitable recovery.

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Appendices A, B, and C

Appendix A: HomePlace Report for Windsor

The HomePlace document's primary focus is on community-specific designs to include open space management and residential construction. The greenspace concept emphasizes an expanded trails network that takes advantage of the community's location on the Cashie River, and additional greenspace east of the downtown resulting from voluntary relocation and residential buyouts. In addition, several housing designs were developed to offer possible options for those choosing to build replacement housing. The Fair Bluff HomePlace document can be accessed at: <http://coastalresiliencecenter.unc.edu/wp-content/uploads/2017/10/HomePlace-Windsor.pdf>

Appendix B: Technical Memo: Land Suitability Analysis

This appendix provides a detailed description of the steps involved, reports generated and maps produced. Because this is a community-oriented decision support method, engagement with the community is needed when calibrating the weights or rankings of many factors. Participation may include municipal staff, advisory groups and elected officials. The appendix includes a flowchart of the process and sample tables and maps. The Technical Memo can be accessed at:

Appendix C: Master List of LSA Variables

Table A1. Master list of LSA variables considered.

Category	Criteria	Source	Used in LSA
Accessibility of service and facilities	Existing jurisdiction proximity	Census	
	Proximity to commercial area	Local/Plans	
	School proximity (primary, secondary, post-secondary)	Census	
	Hospitals proximity	Census	
	Utility infrastructure connectivity (water, wastewater, electricity, communications)	County/State	
	Park/playground proximity	Local	
Transportation	Bus stop proximity	Local	
	Major highway proximity	Census	
Socioeconomic Factors	Population density	Census	
	Community preference	Survey	
	Renter / owner	Census	
	Neighborhood Type	Local	
	Ratio of less mobile people / disability / aged	Local	
	Land value	Census	
Environment and Safety	Protective infrastructure integrity	Local	
	Drainage	Survey/Local	
	Reliance on protective infrastructure	Local	
	Proximity to water bodies	State	
	Proximity to known / potential environmentally hazardous waste sites	NC DEQ	
Topography	Slope	USGS	
	DEM	USGS	
	Water table depth	USGS	
	Tidal factors	USGS	
	Soil composition	SSURGO	
	Vegetation composition	State	
	Vegetation density	State	
Planning	Areas of future development (zoning or Future Land Use)	Local	
	Parcel Size	Local	
	Land/Building Vacancy	Local/State	
	Large infrastructure project	Plans	
	Economic development areas	Plans	
Flood Risk	Historical value / significance	Survey	
	FEMA Flood Zones (100- and 500-Year)	NCEM	
	Sea level rise (LiDAR)	NOAA	
	Hurricane Floyd flood extent	NCEM	
	Hurricane Matthew flood extent	NCEM	