

# **Briefing for the Town of Princeville, 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 Princeville.*

## **Overview**

Hurricane Matthew's heavy rainfall in October of 2016 led to record flood levels on the Tar River, impacting over 350 homes and a majority of local businesses. The flooding surpassed the town's levee and significantly damaged the town Hall, local volunteer fire station, several businesses and the local elementary school. Even before Hurricane Matthew, the town was dealing with challenges associated with high levels of poverty, poor health and education indicators, a lack of affordable housing, and a struggling regional economy. Many conditions in Princeville have origins with its long history of periodic flooding, especially Hurricane Floyd, which struck 17 years earlier. Floyd caused unprecedented damage, both physical and financial, and it caused the departure of nearly all businesses from the town. Individuals and families suffered greatly. Hurricane Matthew has once again tested the resilience of this historic town's residents and community leaders.

Through a series of open-house meetings, public design workshops, and discussions, Princeville has explored and 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]<sup>1</sup>, the Golden LEAF Foundation, etc.), the delivery of technical assistance, and planning. Disaster recovery challenges include the reconstruction, repair and relocation of facilities, to include striking a balance between preserving key local institutions in their original locations while dealing with extreme flood hazard vulnerability.

Despite the uncertainty regarding the number of residents that will ultimately receive a home buyout through FEMA's Hazard Mitigation Grant Program (or other program), the town's

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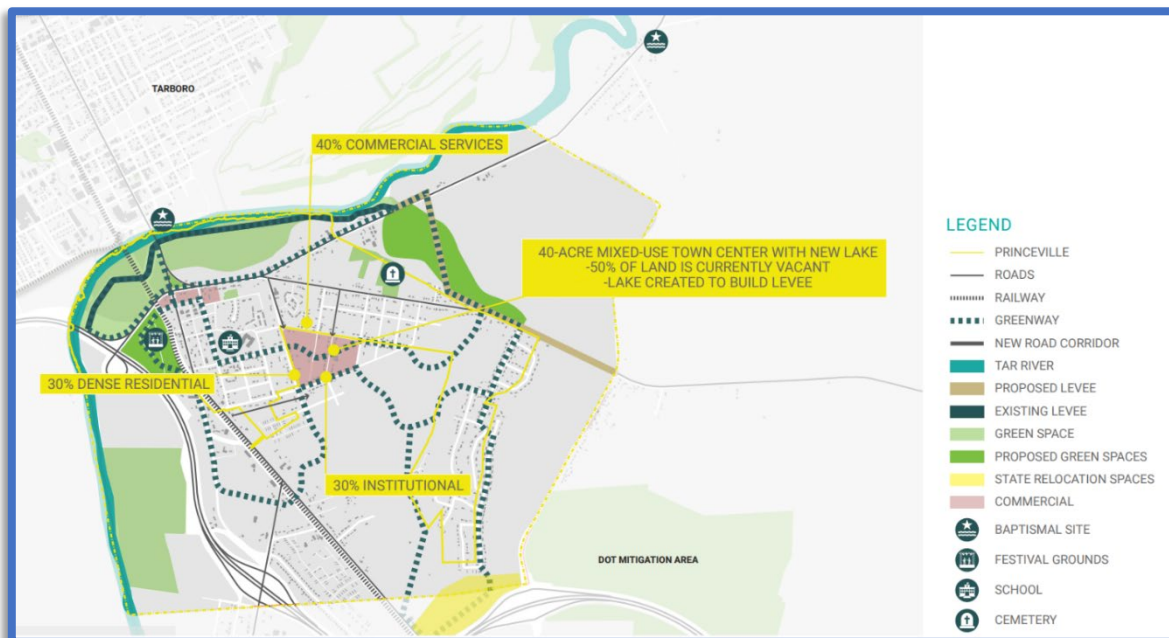
<sup>1</sup> CDBG-DR funds may supplement, but cannot duplicate, funding available from FEMA or other federal agencies. CDBG funds must be approved by Congress. These flexible grants, administered by the U.S. Department of Housing and Urban Development (HUD), can be used to assist disaster recovery and 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).

leaders and many residents expressed concern about preserving the historic core of the town and minimizing the potential loss of its tax base should individuals relocate outside of municipal boundaries. To minimize this loss and explore areas for the relocation of some critical facilities that sustained major damage during Matthew, and the construction of housing to replace those lost following the buyout, Princeville can use results from the Land Suitability Analysis (LSA), HomePlace document, and Princeville Design Workshop, each of which are discussed in the Princeville Disaster Recovery Plan. 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 the town officials and staff, their recovery partners, and of course, the survivors themselves. HMDRRI has facilitated taking many of the first steps in 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 Princeville, 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: creating a mixed-use town center off of Neville Street and Otis Avenue, connecting historical sites such as Freedom Hill and Shiloh’s Landing with expanding and interconnected greenway systems, and rebuilding substantially damaged facilities and homes on land purchased by the State (HomePlace, 2017). The Greenspace concept shows the ‘State Relocation Space’, which is a roughly 53-acre site located outside the 100-year floodplain, and a

Figure 1. Princeville Greenspace Concept

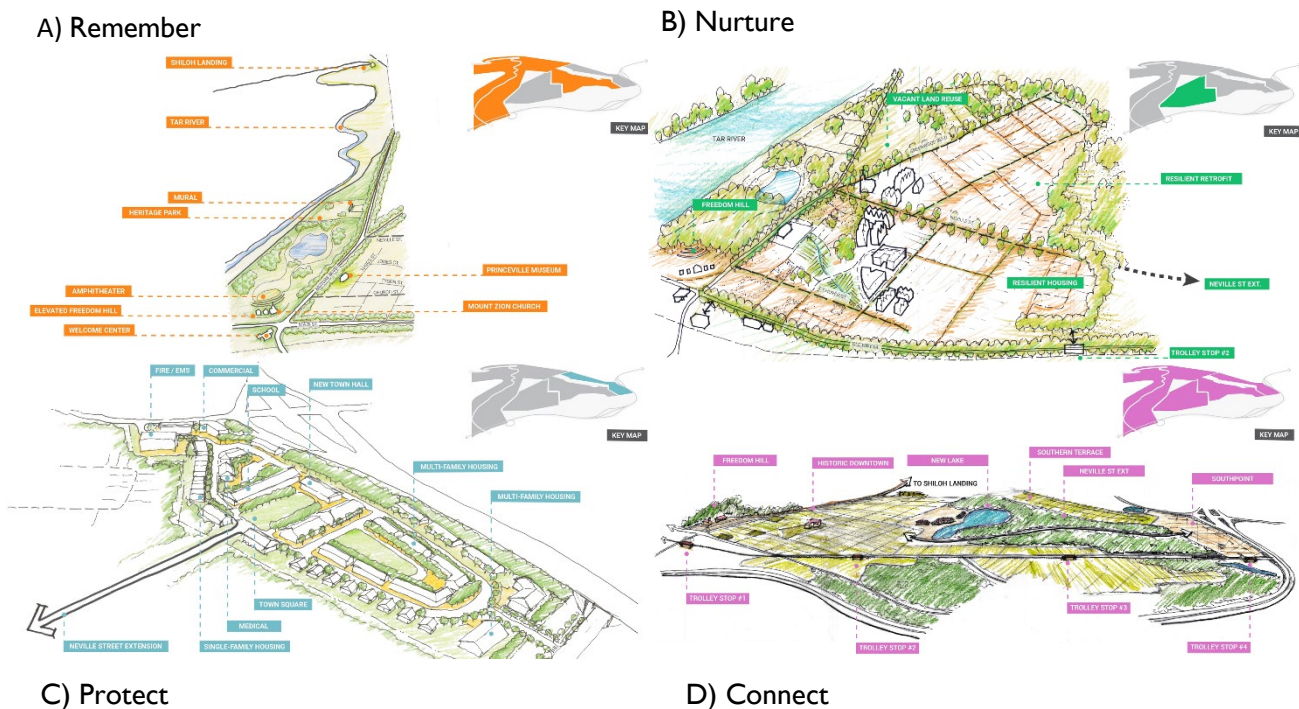


focus of the Princeville Design Workshop. The LSA highlights on a parcel by parcel basis the most suitable locations based on a large set of variables and thresholds. While the town’s Disaster Recovery Plan has identified eight major issue areas, including infrastructure, public facilities, and economic development, among others, 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 and face a substantially reduced risk of future flooding. The culmination of this work, including the LSA and Relocation Strategy aim to help address not only some of Princeville’s long-term recovery needs but support the town’s overall resilience efforts.

### Linking History and Flood Risk Reduction to Community-Driven Design

Elements of the LSA process were used to frame discussions and activities pursued during the 5-day Princeville Design Workshop, where design, planning and engineering professionals from across the state and country came together to explore what a more resilient Princeville might look like. Community engagement throughout the workshop was crucial to the process of ground-truthing potential design solutions and developing a compelling vision for flood recovery that respects the deep cultural and historical values of the town.

Figure 2. Four Recovery Concepts from Princeville Design Workshop



At the conclusion of the workshop, four themes of ‘remember’, ‘nurture’, ‘protect’, and ‘connect’ emerged which characterized the potential strategies (Figure 2). ‘Protect’ illustrated how the relocation or redevelopment of housing and some key facilities on the 53-acre parcel of land

were more suitable for development in terms of a reduced flood risk than much of the current town. The LSA results described below generally support this idea, though whether or not these concepts are formally pursued or funded, remains to be seen.

## **Engineering Studies of the Princeville Levee**

Following Hurricane Floyd in 1999, the US Army Corps of Engineers undertook a multiyear study of the Princeville levee and the overall risk environment of Princeville. A report of this analysis was circulated as a draft in 2014 and finalized in early 2016. It noted design issues and construction shortcomings of the original levee, which was built in 1965. When Hurricane Matthew struck in October 2016, the limitations of the levee were evidenced by extensive floodwater entering Princeville from multiple directions. The NC Department of Transportation Hydrology Unit commissioned a study by the engineering firm, Moffatt & Nichol and the results were announced at a town meeting on January 16, 2018, in Tarboro.

The major findings of the study were 1) the levee's original design and construction problems were exacerbated by changes in stormwater management features accompanying reconstruction of the adjacent highway, US 64; 2) the effective level of protection at the time of Hurricane Matthew was at the level of a 25-year event rather than the required 100-year (1% annual chance); 3) remedial work on the highway's stormwater features was performed in the summer of 2017 that succeeded in raising the level of protection to a 70-year event; and 4) further improvements to the Princeville levee are not anticipated for the next 10 to 15 years.

In May, 2018, the NC Division of Emergency Management released a study by ESP Associates of the entire Tar River basin. It evaluated a wide range of options for reducing flood threats in the 2,000-square-mile basin that impact a number of communities and rural areas. Many of the alternatives studied by ESP were ruled out because they were found to exacerbate flooding elsewhere. The ESP study conclusions regarding the Princeville area are generally consistent with those of Moffatt & Nichol. All the studies and planning processes are summarized in Figure 1, below.

For purposes of the Land Suitability Analysis, the engineering evaluations of Princeville flooding call attention to residual risk. While the risk from smaller precipitation events is somewhat mitigated by the Princeville levee, the most prudent thing the town can do is respect the evidence of previous storms such as Matthew and Floyd. Consequently, the method shown in Table I and the factors summarized take into account the town's history of flooding. All parcels that were affected by Hurricane Matthew are displayed in the beige color to reflect this status.

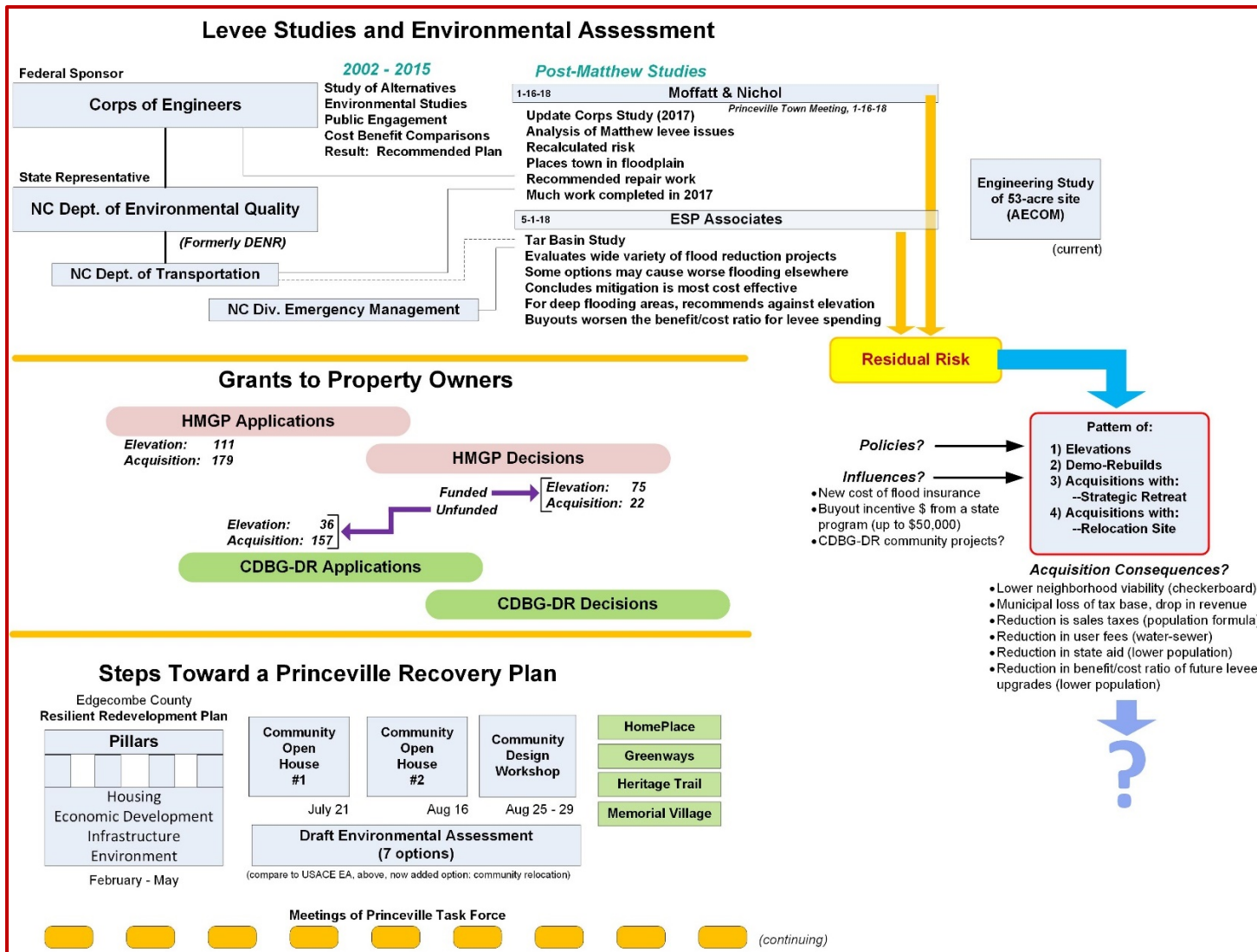


Figure 3. Integrated view of Princeville Recovery studies and influences.

## **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 listed in the Technical Memo. Since many variables were not applicable in Princeville (i.e., proximity to hazardous waste sites, sea level rise vulnerability) 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 issues. Comparison of each member's interpretation led to strong consensus on the most important factors on which to focus during development of the 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, Hurricane Matthew flood extent, land/building vacancy, parcel size, and zoning.

Many variables such as the municipal boundary or 100- and 500-year flood zones have thresholds that apply Boolean logic (binary in/out or yes/no) and therefore, had 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. Princeville 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	
Parcel Size*	Infill Potential	< 3,000 ft <sup>2</sup>	0	2
		3,000 ft <sup>2</sup> - 20,000 ft <sup>2</sup>	1	
		20,000 ft <sup>2</sup> - 100,000 ft <sup>2</sup>	2	
	Multi-Structure Potential	100,000 ft <sup>2</sup> - 500,000 ft <sup>2</sup>	0	2
		500,000 ft <sup>2</sup> - 1,000,000 ft <sup>2</sup>	1	
		> 1,000,000 ft <sup>2</sup>	2	
Building/Land Vacancy	Vacant/Abandoned Building	Occupied - FP	0	4
		Vacant - NO FP	4	
Flood Risk	100-yr Floodplain (Zone AE)	In	0	4
		Out	4	
	500-yr Floodplain	In	0	1
		Out	1	
Areas of Future Development	Zoning	Industrial	0	2
		Commercial	1	
		Residential	2	
*Each parcel, based on its size will fall into infill potential or multi-structure potential each contributing to a possible total of 18			Total:	18

## Vulnerability to Flooding/Flood Risk

Source: NCEM, 2017

(100-Year Flood Zone; and Hurricane Matthew Flood Extent)

Perhaps the most crucial set of factors for the Recovery 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. Hurricane Matthew’s flood extent is also relevant as the most recent major flood for the town, only surpassed by Floyd. The event’s flood extent represents areas that officials and residents have actually seen flood inundation, knowing the levee can and has failed, versus mapped floodplains which are calculated using hydrology and statistics and included a certain amount of uncertainty or inaccuracy. To highlight this area, HMDRRI designated all parcels affected by Matthew with a single color to help narrow down the areas of least flood risk. Because Floyd’s flood extent covers the entire municipality and beyond, it would not have had an effect either way if



included. (See also the discussion of flood risk in engineering studies cited previously on page 4 and in Figure 3.

Together, these flood risk variables account for both estimated flood risk that is tied to various regulations and programs as well as the lived 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 meets a main goal of the RS to develop in safer areas.

## **Jurisdictional Boundaries**

**Source: Edgecombe County, 2017**

***(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 (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 the 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 on flood-prone land, for example, there may be insufficient land within the community to find relocation sites not hampered by hazard vulnerability, requiring an assessment of lands outside the community but within the ETJ. The Land Suitability Analysis concept, in combination with the Relocation Strategy, is well suited to this purpose. For the reasons cited above, annexation prior to development is the best practice but planning prior to annexation is fully appropriate, and this fits with the planning support offered through the use of the LSA. In the Princeville Disaster Recovery Plan, emphasis is placed on residential relocations, however the LSA may be useful for public facilities, commercial and industrial development as well.

## **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 only suitable 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 the Princeville. 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 the town limits 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 or could support a small- to



medium-size single family home and larger homes for which existing lots didn't exceed 100,000 sq. ft. Square feet was used instead of acres because some lot sizes were so small that multiple decimal places would've been required to display variability.

***Multi-Structure Potential: between 100,000 and 500,000 sq. ft.; between 500,000 and 1,000,000 sq. ft.; and >1,000,000 sq. ft.)***

Larger lots may be suitable for development of multiple structures, including apartment buildings. This form of development could be more attractive to developers or investment partners that seek to build a larger number of units on a given site. Thresholds were selected based on the size of larger parcels within town that had multiple housing structures on them.

## **Land Vacancy**

**Source: NC OneMap and NCEM, 2017**  
***(Building Footprint Present: FP or NO FP)***

A proxy was created to determine which lots were vacant and had no building footprint because they would be the easiest to develop, whereas if there is a building footprint (FP), it may or may not have to be demolished. The latest building footprint data was obtained through North Carolina Emergency Management and used to identify properties that do not have a building footprint on them. Parcels were assigned either Occupied – FP, if a footprint existed or Vacant - NO FP, if there was none. This does not account for the possibility that a parcel is large enough to support additional structures beyond the footprint that exists currently.

## **Areas of Future Development**

**Source: Edgecombe County, 2017**  
***(Land Use: Commercial, Industrial, Residential,)***

Zoning patterns reflect the community's intent to use that property based on a number of factors. It may be more difficult to develop replacement housing on properties that have been zoned for industrial uses, for example, whereas a property already zoned for residential development, is less likely to require a rezoning or variance. HMDRRI consolidated 6 different zoning designations into 3 categories for simplicity (Table 2). Developing housing in zones such as commercial would go against prior planning goals and require rezoning. However, major flood events like Matthew can lead to redefined planning goals and therefore justified changes in zoning.

Table 2. Princeville Zoning Codes.

Zoning Code	Description
C	Commercial
I	Industrial
R-1, R-2, R-3, RA-1	Residential

The eight variables represent the factors that determine a parcel’s composite suitability for housing development or redevelopment. The factors and thresholds inform the results of the LSA which can guide decisions that meet the goals of the HMDRRI Recovery Strategy, to include reduce flood risk, retain flood survivors within their communities, and minimize construction costs. A similar method could be used by the town for other planning objectives such as siting future park/greenspace or other public facilities. A more detailed description of these possibilities is provided in the Technical Memo for the LSA and the Princeville Recovery Plan.

## LSA Results and Interpretation

The results of the LSA are meant to highlight areas that are suitable to support new housing development in less flood-prone areas. For instance, parcels that were inundated by Hurricane Matthew doesn’t mean that these areas were unaffected by flooding from Hurricane Floyd in 1999, considering that this was an event of greater magnitude. Understanding flood risk relative to areas in or adjacent to the town limits is key to making decisions that guide long-term recovery and resiliency goals.

Because the flood risk is an essential factor of the LSA and the levee does not provide protection against the 1% annual chance flood, only a couple of parcels are considered to have ‘high’ composite suitability, may be vacant and/or acquirable and could support multiple types of housing. These parcels are located primarily east of the original town, west of South Shiloh Farm Road and east of U.S. 64 adjacent to the Southern Terrace neighborhood. Some of these areas are at significantly higher elevations, with a number of small-medium size parcels in areas of reduced flood risk that could, if vacant, support infill development of single-family homes. A few larger undeveloped parcels meet all the same criteria, including the 53-acre site purchased for the town by the state government and the larger parcel to its north, south of Greenwood Blvd/NC-111. These could support a cluster of single-family homes or denser multi-family buildings along with the relocation of other public facilities as desired by the town and depicted in the Princeville Design Workshop drawings.

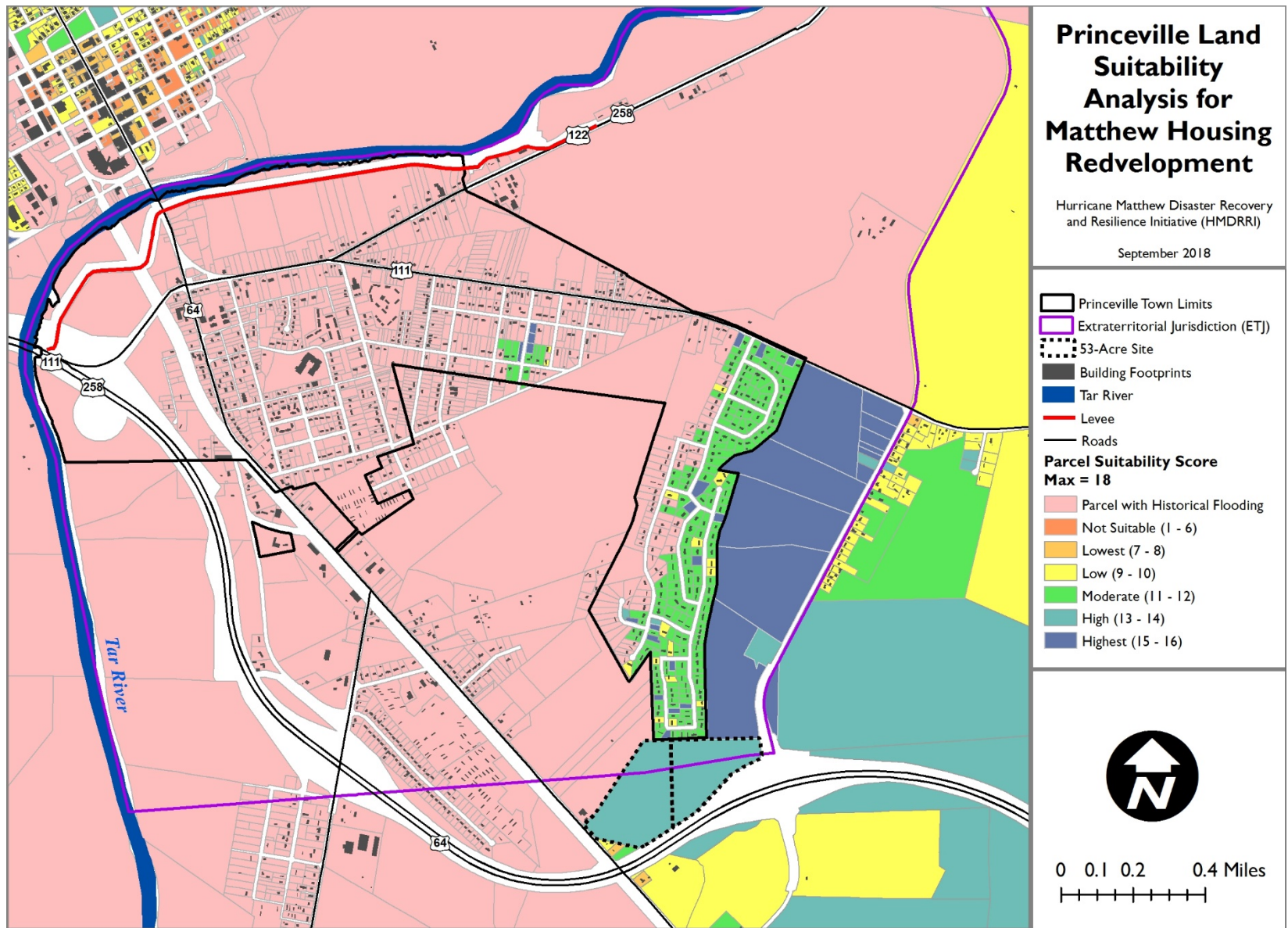


Figure 3. Princeville Land Suitability and Parcels with Historic Flooding.

It is important for residents, community officials and other leaders to understand any process that eventually determines how and where Princeville will rebuild. Princeville can use these findings along with other analyses and concepts to inform ongoing and future community recovery and redevelopment efforts

## Conclusions and Next Steps

As a first step in utilizing the LSA results, community leaders in Princeville should further investigate and explore characteristics of the most suitable parcels. Numerous options and concepts for the Relocation Strategy were developed during the 5-day Princeville Design Workshop and should be revisited as new information becomes available.

Moving forward, the town of Princeville may consider revising and expanding upon the LSA method for a variety of purposes in coordination with Edgecombe County, state agencies and other public, private, or non-profit recovery partners. Suggested considerations for more general improvements to the process are listed in the concluding remarks of the Technical Memo on Land Suitability Analysis. (See Appendix Z in the Princeville Recovery Plan) **ADD the proper letter for the plan's Appendix, including URL.** Other potential steps for getting the most out of the LSA and its connectivity to Princeville's Recovery Plan include:

- Exclude other non-suitable areas such as cemeteries, past and expected future buyout properties, land with poor soil conditions, or others as identified to narrow the scope of suitable properties.
- Explore conducting additional LSAs that focus on the feasibility of elevating certain structures and homes that lie within known flood risk areas, knowing there is great historic and sentimental value for those who prefer to stay the same location.
- Share the LSA method, it's results and related Recovery plan policies with housing stakeholder groups (local/state housing finance agencies, religious groups, non-profits, and private foundations) to aid in informing programs and funding mechanisms that support other housing recovery goals.

## 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 are trying to understand how to plan and invest more effectively knowing that in an era of climate change, these risks are only 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 reveal 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 together 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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