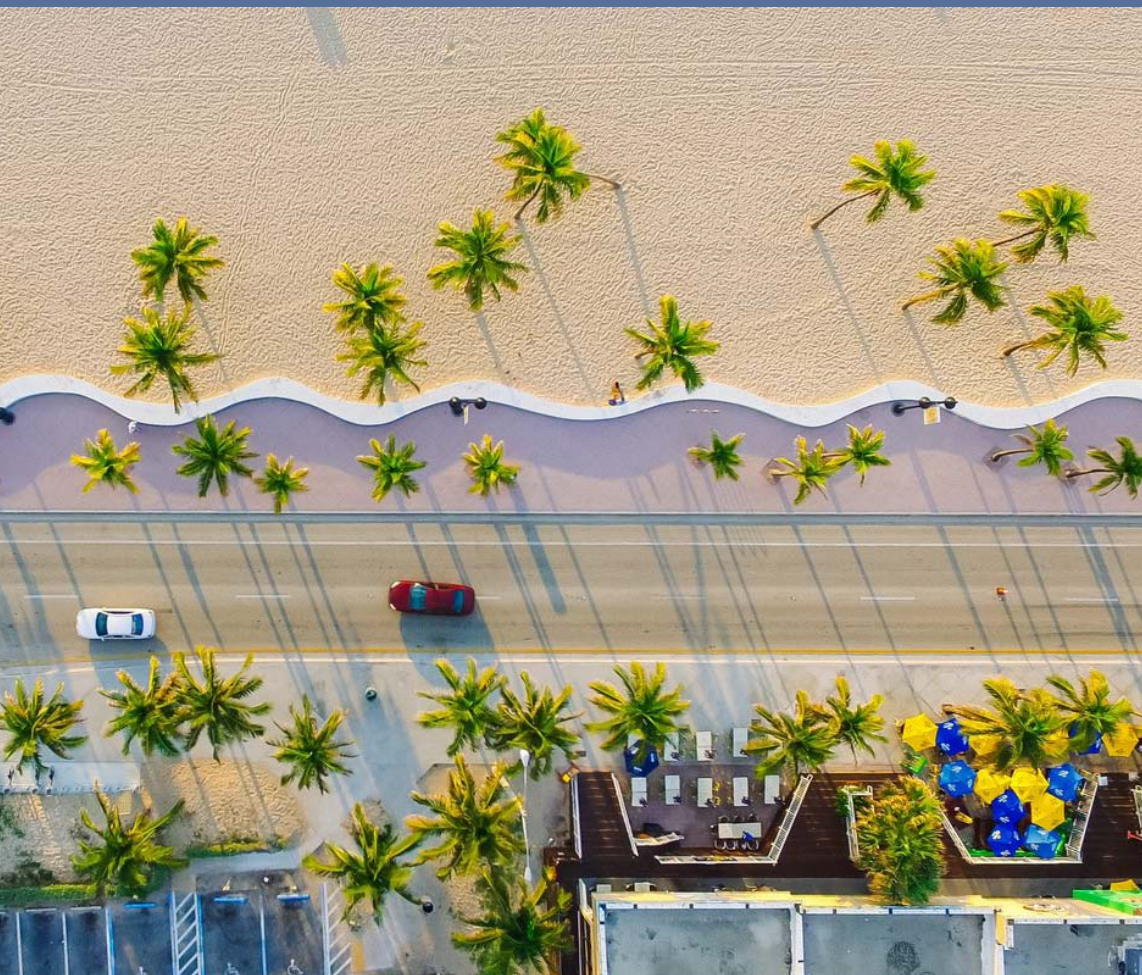


# Fort Lauderdale Florida

A ULI Advisory Services Panel Report

March 10–14, 2024



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# Fort Lauderdale Florida

## Building a Resilient Fort Lauderdale: Developing Criteria for Road Elevation

### A ULI Advisory Services Panel Report

March 10–14, 2024



Urban Land Institute  
2001 L Street, NW  
Suite 200  
Washington, DC 20036-4948  
[uli.org](http://uli.org)



ULI Southeast Florida/Caribbean  
500 West Cypress Creek Road  
Suite 120  
Fort Lauderdale, FL 33309  
[seflorida.uli.org](http://seflorida.uli.org)

# About the Urban Land Institute

**THE URBAN LAND INSTITUTE** is a global, member-driven organization comprising more than 48,000 real estate and urban development professionals dedicated to advancing the Institute's mission of shaping the future of the built environment for transformative impact in communities worldwide.

ULI's interdisciplinary membership represents all aspects of the industry, including developers, property owners, investors, architects, urban planners, public officials, real estate brokers, appraisers, attorneys, engineers, financiers, and academics. Established in 1936, the Institute has a presence in the Americas, Europe, and Asia Pacific regions, with members in 84 countries.

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Drawing on the work of its members, the Institute recognizes and shares best practices in urban design and development for the benefit of communities around the globe.

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## About ULI Southeast Florida/Caribbean

For more than 25 years, ULI Southeast Florida/Caribbean has served as a powerful voice for best practices and the latest trends in real estate in our region. Our more than 1,200 members live and work in Florida's seven southernmost coastal counties (from Indian River through Monroe) and throughout the Caribbean Islands.

We cultivate the involvement, energy, and engagement of our member leaders to promote responsible land use and development throughout our region. Our members are the driving force behind the programs we plan, the advising services we provide to local governments, our leadership development efforts, and content priorities such as housing affordability and resiliency.

# About ULI Advisory Services

## **THE GOAL OF THE ULI ADVISORY SERVICES PROGRAM**

is to bring the finest expertise in the real estate field to bear on complex land use planning and development projects, programs, and policies. Since 1947, this program has assembled well over 700 ULI-member teams to help sponsors find creative, practical solutions for issues such as downtown redevelopment, land management strategies, evaluation of development potential, growth management, community revitalization, brownfield redevelopment, military base reuse, provision of low-cost and affordable housing, and asset management strategies, among other matters. A wide variety of public, private, and nonprofit organizations have contracted for ULI's advisory services.

Each panel team is composed of highly qualified professionals who volunteer their time to ULI. They are chosen for their knowledge of the panel topic and are screened to ensure their objectivity. ULI's interdisciplinary panel teams provide a holistic look at development problems. A respected ULI member who has previous panel experience chairs each panel.

The agenda of an Advisory Services panel is tailored to meet a sponsor's needs. ULI members are briefed by the sponsor, engage with stakeholders through in-depth interviews, deliberate on their recommendations, and make a final presentation of those recommendations. A report is prepared as a final deliverable.

A major strength of the program is ULI's unique ability to draw on the knowledge and expertise of its members, including land developers and owners, public officials, academics, representatives of financial institutions, and others. In fulfillment of the mission of the Urban Land Institute, this panel report is intended to provide objective advice that will promote the responsible use of land to enhance the environment.

## ULI Program Staff

### **Kelsey Steffen**

Executive Director, Advisory Services

### **Julie Medley**

Executive Director, ULI Southeast Florida/Caribbean

### **Lindsay Brugger**

Vice President, Urban Resilience

### **Lauren McKim Callaghan**

Senior Director, Advisory Services

### **Barbra Gustis**

Director, Advisory Services and Key Leaders

### **David Zehr**

Manager, Advisory Services

### **Brittney Gilardian**

Senior Associate, Advisory Services and Global Leadership

# Acknowledgments

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ULI also thanks the more than 65 stakeholders who shared their experiences, perspectives, and insights with the panel, including members from ULI Southeast Florida/Caribbean. This Advisory Services panel was made possible in part by donations to the ULI Foundation. ULI is grateful for the support of The JPB Foundation.



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# ULI Panel and Project Staff

## Panel Chair

### **Jim Heid**

Founder  
CRAFT DnA and UrbanGreen  
Healdsburg, California

## ULI Panel Members

### **Allison H. Anderson**

Founding Principal  
unabridged Architecture  
Bay St. Louis, Mississippi

### **Chris DeWitt**

Principal  
VHB  
Williamsburg, Virginia

### **Hannah Glosser**

Director  
HR&A Advisors Inc.  
New York, New York

### **Charnelle Hicks**

President  
CHPlanning, Ltd.  
Philadelphia, Pennsylvania

### **Malaika Rivers**

Founder and President  
Pontem Resources  
Atlanta, Georgia

### **Byron Stigge**

Founder  
Level Infrastructure  
Brooklyn, New York

## ULI Panel Advisers

### **Anthony M. Graziano**

Chief Executive Officer  
Integra Realty Resources

### **Thomas K. Ruppert**

Assistant Provost, Coastal Resilience  
Director, Virginia Coastal Resilience Collaboration  
William & Mary

## ULI Project Staff

### **Julie Medley**

Executive Director, ULI Southeast Florida/Caribbean

### **Mallory Barker**

Manager, ULI Southeast Florida/Caribbean

### **Lauren McKim Callaghan**

Panel Project Lead  
Senior Director, Advisory Services

### **Barbra Gustis**

Director, Advisory Services and Key Leaders

### **Lindsay Brugger**

Vice President, Urban Resilience

### **Libby Riker**

Senior Editor

### **Melanie Donohue, Publications Professionals LLC**

Manuscript Editor

### **Deanna Pineda**

Graphic Designer

### **Nicole Long**

Traffic Manager

### **Craig Chapman**

Senior Director, Marketing Operations





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## Executive Summary

**THE CITY OF FORT LAUDERDALE IS IN BROWARD COUNTY, FLORIDA.** It has approximately 7 miles of shoreline, more than 300 miles of waterway coastline, and a generally flat topography. As sea levels rise, these factors affect the risk of flooding and tidal inundation throughout the city. The city's Public Works department provides the following description of the current challenges with flooding and where road elevation has been considered for the city's approach to addressing resilience:

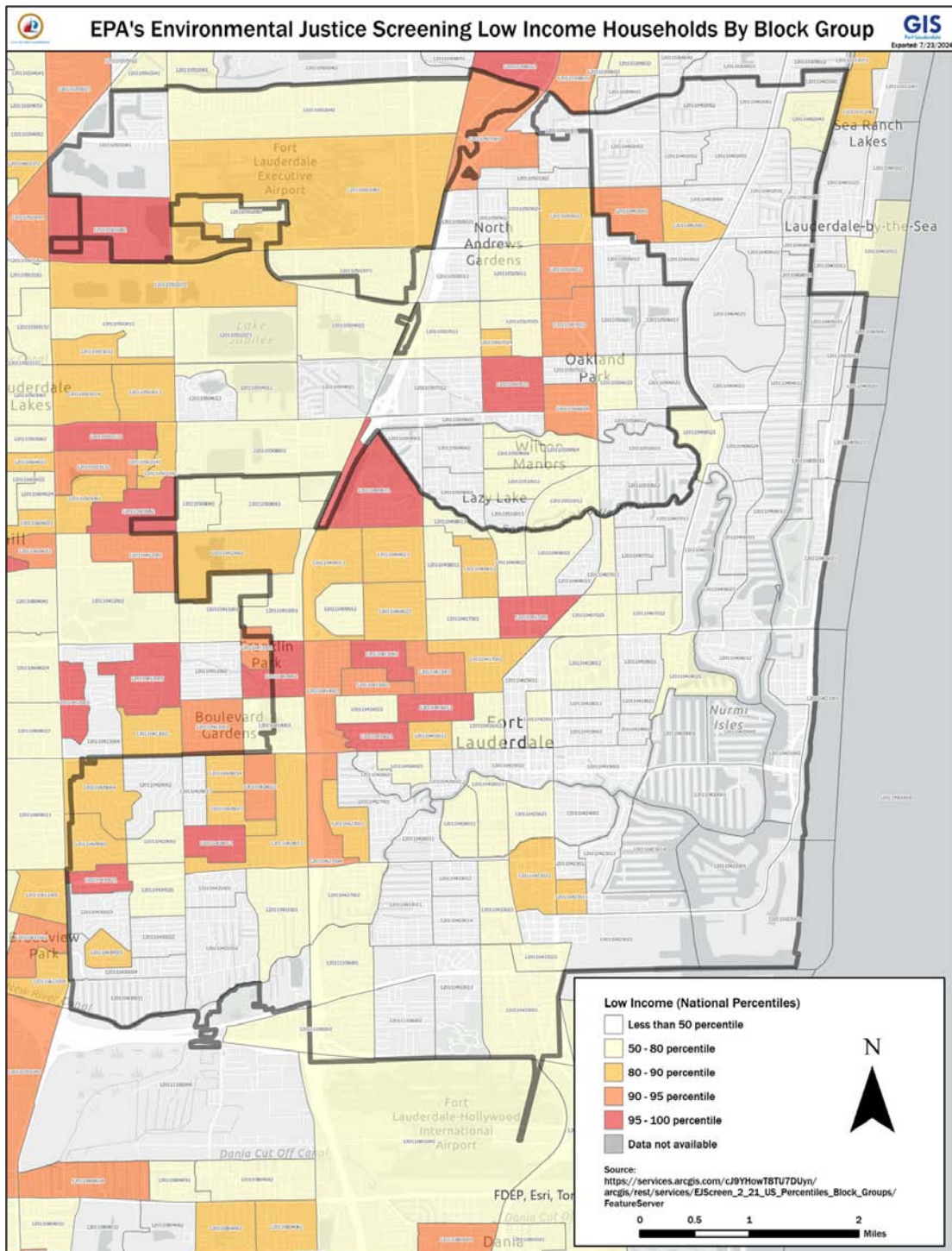
*As a peninsula, the state of Florida and all its coastal communities are extremely vulnerable to sea level rise. Fort Lauderdale already faces a challenging problem of loss of service to low lying roadways throughout the city as tidal inundation increases the frequency, intensity, and duration of flooding. An extended King Tide season, rising groundwater table, intense rainfall, and sea level rise all contribute to roadway flooding, creating public safety and limiting access to properties due to impassable roadways. The city has used several methods to reduce coastal flooding including raising seawalls and installing tidal valves (valves that keep seawater from entering the*

*stormwater system during high tide but allow stormwater to flow out during low tide when the valve is open). For those locations where these methods have not resolved the tidal flooding, roadway elevation has been proposed as the next potential solution.*

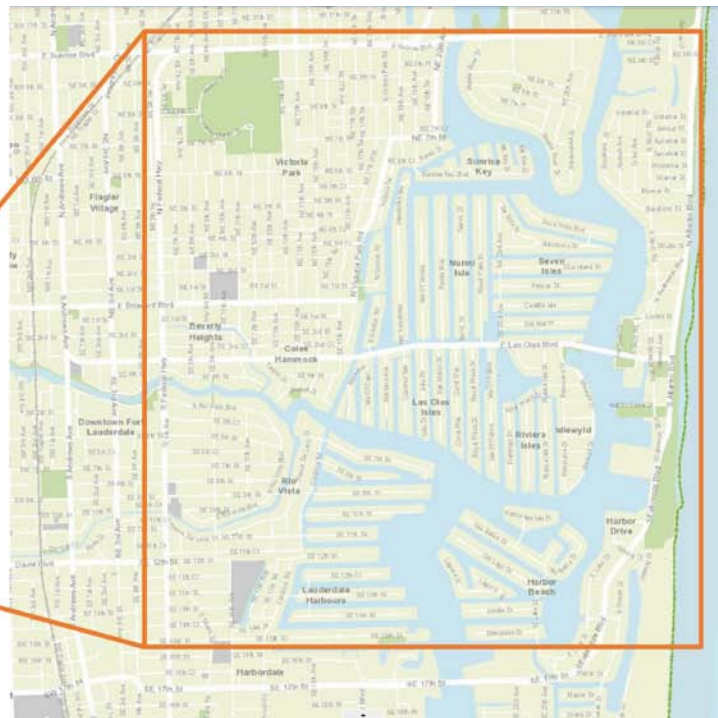
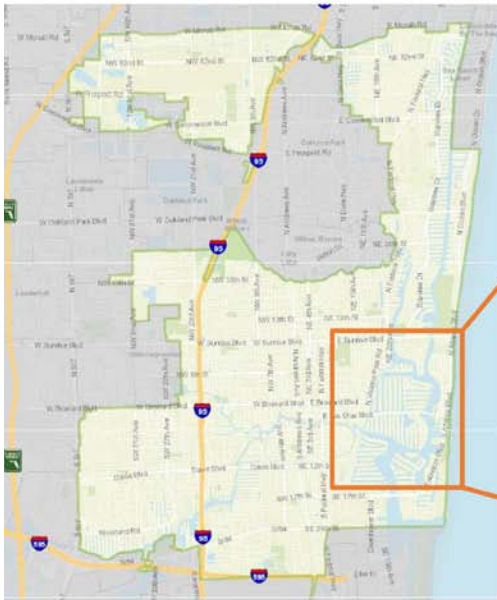
*The city's 2035 Vision Plan, Fast Forward Fort Lauderdale, imagines a future sustainable and resilient community. As the city population and tourist visitation grow, the impact of sea level rise on streets must be addressed in a strategic manner. Evacuation routes and popular roads such as commuter routes often are heavily used and the level of*

service, in conjunction with climate impacts, highlights the need for improved resilience. Residential roadways are often located at the interface of the public right of way and private property, and elevation of a roadway is complicated by the impact of private driveways, private landscaping, utilities such as underground water and wastewater pipes, and overall drainage. By elevating or not elevating

a roadway, the city may be subject to litigation for the consequences of impacting access to or flooding of private property. Criteria are needed to help set policy guidance for prioritizing what roads to elevate, how much to elevate them, when to elevate them and how to pay for the improvements.



Concentrations of low-income households (based on national percentiles within the city of Fort Lauderdale).



The study area includes portions of the commission districts within the southeast portion of the city to illustrate challenges with roadway flooding, but the panel was asked to develop a framework for a set of criteria for city-owned roadway elevation projects that would apply to the entire city.

## Current Socioeconomic Profile

Based on 2023 U.S. Census estimates, the city of Fort Lauderdale has a current population of 184,255. Approximately 55 percent of the population is white, and 29 percent is Black. Approximately 20 percent of the population is Hispanic or Latino.

The median household income in 2022 dollars is just above the national median income at \$75,376, based on 2022 American Community Survey five-year estimates, and 15 percent of persons in Fort Lauderdale are in poverty. According to information provided by the Environmental Protection Agency, the greatest concentrations of low incomes are in the western part of Fort Lauderdale, primarily in Commission District 3.

## Study Area

Four commission districts exist within the city of Fort Lauderdale. Much of the flooding that has generated discussions about road elevation occurs in District 2, within the residential neighborhoods comprised of finger isles. To provide context for the panel, the city outlined a study area in the southeast quadrant of Fort Lauderdale that included the southeast neighborhoods. It extended from Sunset Boulevard to the north, Southeast 17th Street to the south, the Atlantic Ocean

to the east, and Highway 1 to the west. However, the city and stakeholders noted that flooding also occurs within other, inland areas as well. Since the panel was asked to develop criteria for road elevation for the city to evaluate potential projects in all commission districts, the study area identified by the city was used as an illustrative example of the ongoing challenges with consistent roadway flooding issues within the city as a whole.

## Panel Assignment

The city of Fort Lauderdale asked ULI to convene an Advisory Services panel to outline recommended criteria for a policy to equitably guide the selection of city-owned roadways for elevation and next steps the city can take toward implementing this policy. Fort Lauderdale is interested in understanding how to prioritize which roads to raise and how to fund these improvements. The panel was asked the following questions:

- What are the recommended criteria for a policy to equitably guide the selection of city-owned roadways for elevation? What options should be evaluated before considering road elevation? Which elements take priority in the elevation criteria? The panel was asked to consider factors such as physical characteristics and limitations, timing, equity and stakeholder impact, and implementation needs and capacity.

- How does sea level rise affect the criteria and the city's actions?
  - How high should the road be elevated?
  - What are the city's legal obligations regarding street raising?
  - When should the city consider other options, such as retreating versus elevating roadways, as a strategy?
  - How can the city address harmonization—improvements needed on public versus private property after the roads are raised—and who covers the cost?
- What is the estimated range of cost associated with these projects?
  - How might the city fund these improvements?
  - How should the city balance road-raising needs within coastal districts of the city with other investments that may be needed in the city's inland districts?
- Road elevation is part of a larger set of climate adaptation tools. The city should start with a comprehensive, long-term approach to adaptation and tackle this complex problem with multiple infrastructure, policy, and programmatic solutions.
- Elevating roads is expensive and can push floodwaters to other locations. The panel recommends exhausting all other options and tools before considering road elevation.
- When the city does consider a road elevation project, the following principles should guide criteria:
  - Public safety is the top priority.
  - Stormwater improvements are essential.
  - Utilities should be protected.
- Among the criteria for evaluating road elevation projects on city-owned roadways, the following two are recommended to receive high priority, with roadways meeting both criteria receiving the highest priority:
  - Is the roadway a designated evacuation route or critical connector or does it serve public facilities?
  - Is the road within the 100-year floodplain?
- The criteria for evaluating road elevation projects should be one part of a larger assessment process that includes implementing other flood-resilience measures first, then meeting the criteria for evaluating road elevation projects, followed by assessing the scope and feasibility of the project, identifying funding, and finally proceeding with the road elevation project.
- To attract funding, the panel recommends creating a compelling message that communicates a need, developing strategic partnerships to leverage the needed funds and build a coalition of support, and viewing activities to secure funding as a long-term, ongoing commitment.
- Establish and implement a flood resilience policy to outline priorities and commitments, communicate goals, guide decisions, and direct planning efforts.
- Actively communicate the project process, ongoing efforts, and successes in addressing flooding and tidal inundation and building a more resilient Fort Lauderdale. Prioritize transparency and consistency.

## Panel Process

The ULI Advisory Services panel met over four days. Using a process honed over 75 years, an Advisory Services panel has three key parts: listening and learning, panel deliberation, and presentation of expert recommendations. The listening and learning portion of this panel included a full day of on-the-ground experiences: a briefing by the sustainability team from the Public Works department, a site tour, and an open, public listening session in which the panel heard from residents and other stakeholders for their perspectives on this topic. The panel then conducted small-group stakeholder interviews with more than 60 stakeholders representing a broad cross-section of interests. Using information gathered during these activities and briefing materials provided by the sponsor team, the Advisory Services panel team spent two days developing and drafting recommendations and producing a presentation. This presentation was made to the public on the fourth and last day of the Advisory Services panel. Although time was limited, the panelists made every effort to incorporate what they had learned and what they had heard. The recommendations in this report reflect this effort and what was known at the time by the panel.

## Key Recommendations

The following are key recommendations produced by the panel:

# Introduction

**THROUGHOUT THE PANEL WEEK, THE TEAM OF EXPERTS (PANELISTS)** who volunteered their time focused on three primary goals of planning for flood resilience as they began to frame their recommendations: to further inform the thinking on resilience and flooding for the entire city, to anticipate and respond to plans underway within Broward County, and to ensure these efforts are helping to create a more resilient region.

Using the briefing materials provided, site tours, and conversations with stakeholders, the panel began to deliberate and focused on these questions: What is the problem? Is the frequency of flooded streets just a nuisance for a few, or the sign of a more significant issue for all that needs critical attention? The conclusions: rising of the sea is real; the challenges and potential impacts are significant; despite road flooding issues, the area has a robust real estate market; and the answer to flooding needs to involve more than roads.

From stakeholder conversations and information gathered during the week, the panel believes that the following opportunities and challenges further frame the problem of flooding and the need for flood resilience in Fort Lauderdale.

## Opportunities

- Strong regional collaboration and cooperation, including the Southeast Florida Regional Climate Change Compact and several planning efforts focusing on resilience, are underway.
- The community recognizes that the problem with flooding and tidal inundation will be ongoing and needs to be addressed.
- Residents desire a holistic solution; although many recognize that road elevating is one solution, there were many requests to hear about the bigger strategy and how

road elevation can be one part of a bigger portfolio of solutions.

- Some of the most affected stakeholders, such as residents and business owners, are willing to be part of the solution.
- A robust real estate market could present an opportunity to use market-based mechanisms as flood adaptation tools.
- Funding and programs focused on resilience are increasing at the local, state, and federal levels as the recognition of the risks associated with issues such as sea level rise and extreme weather increase.

## Challenges

However, the panel also noted several challenges to a successful outcome if one's thinking is not adjusted:

- *Only* elevating roads will not result in an enduring solution for flooding and tidal inundation. The panel heard that in many cases, road elevation is a last resort.
- The costs of today's solutions are greatly increased by the need to address yesterday's infrastructure, from relocating existing utilities to public- and private-property

harmonization in situations where an elevated road would no longer connect with existing private-property infrastructure.

- Potential liability exists for many parties because property transactions do not provide full transparency of flooding potential. Buyers may not be aware of roadway flooding at the time of sale, and may then be surprised and angered when it happens on a recurring basis.
- Without a long-term solution, the real estate market could be at risk of a powerful reset. A major hurricane or a strong king tide could cause a price reset for what is today some of Fort Lauderdale's most valuable real estate. This might have a cascading impact on the broader market and affect the ability to take action in the future.

Expanding on these opportunities and challenges, the panel developed a set of recommendations and criteria to help the city determine when to invest in elevating a municipally owned road and how road elevation can fit within a larger approach to flood resilience throughout the city.



## A Comprehensive and Long-Term Approach

**ADDRESSING FLOODING AND TIDAL INUNDATION** is a complex and challenging problem. Given the varied nature of the needs for climate adaptation across the city, the panel recommends that the city expand and enhance its adaptation tools, particularly those related to flooding, and use them to the greatest effect before considering a road elevation project.

### Think Comprehensive and Long Term

The panel recommends that the city take a more comprehensive and long-term approach to climate adaptation. This includes a more intentional policy framework and the changes it might imply, new infrastructure investments, and program approaches to sufficiently address the problem. The panel recognizes that the needs across the city are varied and therefore require the use of various adaptation tools on different scales.

Risk cannot be considered in isolation, and it is critical to understand compounding risk. An example of compounding risk is when a king tide coincides with heavy-rain events,

exacerbating flooding in coastal areas. The panel advises taking a comprehensive approach that enables looking at systemwide links and relationships and allows understanding of how localized improvements might positively or negatively affect other properties or neighborhoods throughout the city. Continue with the Fort Lauderdale Vulnerability Assessments to establish a comprehensive understanding of tidal flooding and stormwater flooding, and use modeling to create a data-driven decision framework. The panel also recommends a comprehensive Fort Lauderdale–focused interactive map similar to the Broward County [Flood Viewer](#), which provides stakeholders with the ability to “visualize and compare inundation results and aboveground surface depth.”

The panel also suggests that the city reinforce resilience as a priority, facilitating a connection with the work already underway in Greater Fort Lauderdale. The Broward County Risk Assessment and Resilience Plan can be used as a comprehensive framework for long-term planning and to join existing plans such as the Fort Lauderdale Stormwater Master Plan, the Tidal-Barrier (Seawall) Ordinance, Fortify Lauderdale, and individual neighborhood plans to address unique risks. This comprehensive approach would also further government coordination, public communication, and stakeholder engagement. By framing adaptation and hazard mitigation efforts within this broader context, road elevation would be one solution within the toolbox that can be deployed in concert with other adaptation tools, such as infrastructure improvements, programs, policies, and other, market-based interventions.

## Equity and Adaptations to Reduce Flood Risk

The panel was asked how the city might balance adaptation needs across Fort Lauderdale, acknowledging that inland areas may face a different set of flood adaptation challenges not requiring roadway elevation. It is also the panel's understanding

### EXAMPLE ROAD ELEVATION PROJECT COSTS AND BENEFITS

#### Costs

- **Initial infrastructure upgrades** for city-owned properties, private properties, and utilities
- **Ongoing maintenance** of roads once elevated

#### Benefits

- **Economic** impacts, including the level of protection and number of people protected, avoided displacement, and avoided physical damages and losses to critical assets
- **Fiscal** impacts, such as avoided property tax loss and avoided business sales tax and corporate tax loss
- **Social** benefits, such as environmental protection, continued access to recreational and community amenities, and expanded equity in adaptation measures

that historically, the distribution of infrastructure investment has been uneven in neighborhoods across the city. Furthermore, the panel notes that although inland areas, such as those in District 3 and District 4, are at less risk of storm surge or tidal inundation, some areas have already experienced and are at considerable risk of surface flooding from rain events.

To address this issue, the panel recommends that the city focus on identifying the costs and benefits of adaptation measures to determine which options should be pursued first. The panel has broadly weighed costs and benefits within the criteria it presents and recommends that further consideration be given to this framing as the city refines and develops a policy for investments in road elevation projects that can benefit the greatest number of residents.

## Develop an Adaptation Toolbox

To facilitate a comprehensive, long-term approach to climate adaptation, the panel recommends that the city develop an adaptation toolbox. The panel has outlined an adaptation framework that the city should consider as it seeks to comprehensively address flood risk. The purpose of the toolbox and framework is to help the city assess the breadth of adaptation measures available to reduce flood risk. The toolbox can also serve as a foundation for discussions that include public education on this topic, as well as act as a resource for a wide range of stakeholders affected by or addressing this risk, such as the city, neighborhood and civic associations, homeowners, Florida Department of Transportation, and the Broward Metropolitan Planning Organization. Just one tool from the toolbox will not solve or address the city's flood risk challenges; the panel believes that these tools are most effective when used in combination.

## The Adaptation Tool of Last Resort

Elevating roads, in any context, is expensive. In addition to the cost of repaving, elevating a road even a few inches can result in a domino effect of additional costs associated with improving the underlying roadbed foundation, modifying any underground utilities, and making any necessary improvements to harmonize adjacent public and private property to the newly elevated road. A project of this scope also includes a risk of flooding for properties that are at elevations below the level of the newly elevated road.

The panel recommends that the city first exhaust all other infrastructure and engineering interventions before considering road elevation, including interventions already used by the city,



such as tidal valves, seawalls, and pumps and other stormwater management improvements. It also advises employing other interventions within the adaptation toolbox. The following are a range of interventions that might be included within an adaptation toolbox at various geographic levels. The panel's initial thoughts on interventions to include can be found in the [appendix](#). The panel suggests that the city use this Resilience Adaptation Toolbox as a reference guide. It outlines the type of intervention, the risk addressed, the general level of cost, and the likely responsible party or parties.

## Site/Building Interventions

Site/building interventions could be undertaken by individual property owners to work in conjunction with the broader measures and long-term strategies that the city uses. They could be privately funded or could benefit from some form of public/private partnership or loan program (such as the Property Assessed Clean Energy loan program).

- **Seawalls** address tidal flooding and may trap stormwater. Many property owners in the study area have raised their seawalls to the new city standard height of five feet (North American Vertical Datum [NAVD]), either as a stand-alone project or as part of larger site redevelopment. Additional improvements at individual sites could support the city's ongoing effort to raise their sections of seawall.
- **Building elevation** addresses risk of property damage. The panel observed that as properties redevelop, they are built at higher first-floor elevations. The panel advises the city to encourage owners to proactively elevate existing buildings that currently have finished floors below base flood elevation plus one foot (BFE +1). As an additional measure of protection, individual property owners of new or existing buildings can ensure that critical building systems, such as heating, ventilation, and air conditioning (HVAC), are raised above flood level.
- **Building or site "hardening"** addresses building risk from flooding. For structures that cannot be elevated, some form of structural protection at the lot and/or building level may prove necessary.
- **Stormwater management improvements** such as swales, pervious materials, rainwater cisterns, green roofs, and drainage improvements address the intensity and duration of flooding. Use of these interventions maximizes the amount of pervious surface and increases natural infiltration. While high groundwater and tide

levels will likely limit the effectiveness of these measures at certain times, the panel believes that they form an important component of the overall strategy to reduce flooding citywide. Further examples of how cities are incorporating green infrastructure and revising their stormwater management regulations can be found in the ULI 2017 publication [Harvesting the Value of Water](#).

## Street-Level Interventions

Street-level measures can be cooperative efforts between the city and residential or commercial properties within neighborhoods.

- **Tidal valves** address tidal flooding. The city has an active program to install, maintain, and replace tidal valves within its stormwater system. The panel advises continuation of the program to help address flooding, the compounding issues associated with tide levels, and rainwater runoff.



*Seawalls address tidal flooding and may trap stormwater.*

CITY OF FORT LAUDERDALE



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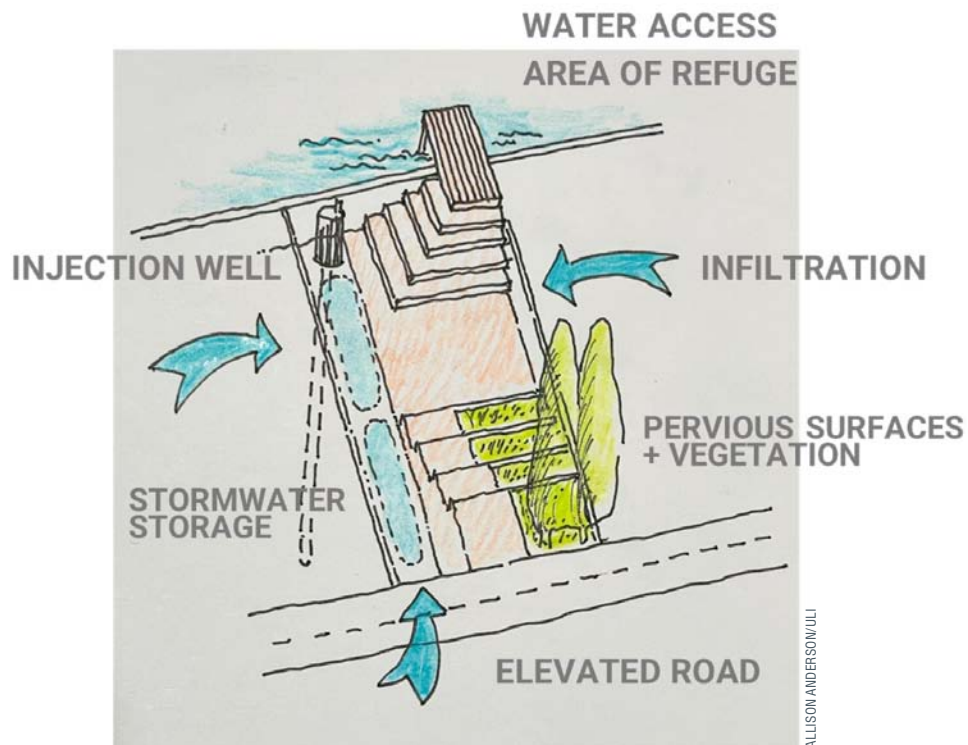
*A roadside swale is an area that gently slopes to manage water runoff and can include a natural element such as grass or other pervious materials.*

- **Stormwater pumps** deal with the intensity and duration of flooding. They can help manage the impacts of significant localized flooding.
- **Subsurface storage measures** also address the intensity and duration of flooding. Infrastructure such as injection wells or stormwater chambers can be used by the city to provide additional, temporary storage capacity for floodwater where subsurface conditions permit.
- **Swale improvements** within right-of-way are a stormwater intervention that can be used in a limited capacity, given groundwater levels. Where right-of-way is available, the city can increase the amount of pervious area alongside roadways.
- **Alternate means of access** could help streets that routinely flood and limit property access. A temporary, alternate means of access, such as a shared parking facility on dry ground adjacent to the flooded area, could be developed. Temporary pedestrian-only or boat-only routes to allow for access to individual properties might also be established.
- **Roadway inversion** may be appropriate in some circumstances. In these cases, portions of a roadway are lowered and infiltration measures are installed to accommodate temporary roadway flooding while protecting adjacent properties.
- **Roadway elevation** addresses tidal and rainwater flooding. When other measures have been exhausted, the city can consider elevating roadways, consistent with the criteria and approach outlined below.

### Neighborhood/District Interventions

Neighborhood/district-level measures require cooperation between the city, neighborhood and civic associations, and individual owners.

- **Green infrastructure and nature-based improvements** used in addition to and in coordination with drainage infrastructure, such as tide valves and pumps. The panel recommends that the city seek opportunities to incorporate elements such as rain gardens, infiltration swales, wetland restoration, and other nature-based solutions to help mitigate the intensity and duration of flooding in locations where land elevations will allow these measures to be effective.



An illustration of a resilience park concept that could provide a flood resilience benefit and serve as a local amenity.

- **Utility and stormwater infrastructure upgrades** by the city and private providers. These efforts are ongoing, and both entities should continue to maintain and upgrade the utility network.
- **Neighborhood resilience parks** with aboveground storage and/or injection wells address overall flood risk. Identifying and procuring space within neighborhoods for additional open space, pervious area, and other infrastructure can form an important part of the overall flood protection system. Additional examples of resilience parks can be found in the 2023 ULI publication [Parks That Protect](#).
- **Deployable-gate** installation, such as a lock and gate on the New River entrance, to be deployed in anticipation of king tides and storm surges. This intervention will require significant regulatory coordination and high cost but could have significant benefits.
- **Land reclamation** is possible if there are opportunities to construct living shorelines, restored wetlands, or other measures within the city waterways. These nature-based solutions provide additional infiltration opportunities for tidal and stormwater flooding. While these measures will not prevent tidal flooding, they can provide benefits for shoreline protection and help reduce the intensity and duration of stormwater flooding.

## Citywide Interventions

Larger-scale, high-cost items and citywide policies and programs would likely require city action, potentially in coordination with regional, state, and other agencies.

- **Seawall improvements**, whether raising or reinforcing, should continue. The city is actively elevating and improving its sections of the seawall, and this effort should occur in conjunction with seawall improvements by individual property owners.

## Moving Adaptation Measures Forward in Parallel

The citywide policy and programmatic interventions described in the following sections can create an enabling environment for long-term risk reduction that the city can advance in parallel with the infrastructure investments at the neighborhood, street, and building levels as described previously. As noted earlier, these tools and interventions are most effective when leveraged in combination.



Adaptation tools are often most effective when used together. This Norfolk neighborhood employs a number of flood mitigation techniques, including an elevated berm and living shoreline.

## Housing Mobility and Land Acquisition

The panel recommends that the city be prepared for housing mobility and land acquisition opportunities in the future. By establishing the foundation and design now for programs that facilitate housing mobility and land acquisition, the city will be well positioned to implement them quickly while leveraging existing services after an unforeseen disaster that makes some areas unlivable. This effort will also help the city further prepare for flood events by minimizing the number of houses and associated infrastructure at risk.

The panel also notes that other factors within the market may lead to organic opportunities to use both of these adaptation tools. When the real estate market begins to account for flood risks, homeowners may be more inclined to participate in a voluntary housing mobility program. The potential shift in property values associated with factoring in flood risks might also better position the city to acquire land. There may be cases where flood protection measures have limited applicability and/or effectiveness; in those situations, the city could consider an owner buyout program, possibly coupled with a community-led effort to encourage residential relocation. Buyouts could also present opportunities to create the neighborhood resilience parks discussed earlier in this section. The 2021 ULI publication

## [On Safer Ground: Floodplain Buyouts and Community Resilience](#)

highlights the approaches of local governments across the United States and how they overcame existing barriers to implementing buyout programs and reducing flood risk.

## Land Use and Zoning Code Standards

The panel recommends that the city continue to monitor and update local development codes to promote pervious cover and encourage development in less flood-prone areas. New development and rehabilitation standards should also be constructed to further align property-level intervention measures with existing and future flood risks, like those included within the *Design and Construction Manual for a Sustainable and Resilient Community and Cohesive Public Realm*. The panel also highlights the importance of and expanded focus on converting research and data about resilience into technical guidance for creating critical public infrastructures, such as roads, sewer systems, hospitals, and public housing, as are present within New York City's [Climate Resiliency Design Guidelines](#).

## Maintenance and Enforcement

The panel recommends continued code enforcement of flood-affecting violations, such as repairing damaged seawalls on

private property. Stormwater and sewer facility maintenance, which is ongoing within the city, is also an important element of the overall flood protection program and should be prioritized accordingly.

## Other Tools

The panel identified several other tools, some of which are further outlined in this report, that the city can add to its larger adaptation toolbox to address flooding and other resilience issues.

- Continue to update and gather accurate flood risk projections. The sponsor team indicated that tides are consistently observed at higher levels than predicted. This suggests that regular tracking and updating data are essential to understanding current and future flood risks.
- Enhance and continue efforts to tell residents, future homebuyers, and key stakeholders about the flood risk,

active adaptation measures being implemented by the city, and planned or programmed improvements.

- Pursue a group purchase of flood insurance at the community or citywide level to share the burden and, ideally, decrease premiums.
- Add a property-level disclosure that includes street flooding at the time of sale or when a permit is pulled.
- Expand upon the existing king tide flood warning system to alert residents and visitors to a range of potential flood events from tides as well as heavy rainfall.
- Encourage individual property owners to undertake measures such as seawall upgrades, home elevation, and yard improvements. This might be incentivized by establishing a loan program for improvements, possible tax mitigation, or imprest/incidental expenses fund assistance.

## CHARLOTTE-MECKLENBURG FLOODPLAIN BUYOUT PROGRAM

CHARLOTTE, NORTH CAROLINA

In the booming metro area of Charlotte, strengthening stormwater infrastructure to reduce impacts to buildings and residents is key. When this need was not being met, Mecklenburg County, the city of Charlotte, and six surrounding towns created a joint stormwater services utility to enhance flood resilience across the region. The utility's fees generate perennial revenue based on impervious area used exclusively for flood infrastructure, water quality improvement, and stormwater management programs. One of the more significant programs proactively works with homeowners on sensible, compassionate buyout plans that reduce potential harm from a future flood event. Having funds available to develop locally initiated buyouts and to match federal grants when feasible enables the utility to plan buyouts with residents in a more comprehensive way geographically.

Historically, Charlotte developed significantly before floodplains were mapped. Therefore, some building took place in zones where flooding along creeks was likely, said Tim Trautman, the flood mitigation program manager for Charlotte-Mecklenburg Storm Water Services (CMSWS).

Since 1999, CMSWS has purchased more than 450 flood-prone homes, apartment buildings, and businesses throughout the Charlotte-Mecklenburg region. The website

touts their success: "Over 700 families and businesses have moved to less vulnerable locations outside of local floodplains. 185 acres of public open space has been 'undeveloped' to allow the floodplain to function during heavy rain and provide a long-term community asset. Storm Water Services also estimates these buyouts have avoided \$25 million in losses and will ultimately avoid over \$300 million in future losses."

The utility's authority, says Trautman, comes wrapped in compassion, and the decisions his team encourages appeal to long-term health, safety, and quality of life. Successful buyouts, backed with the county's available cash from stormwater fees, can save property owners from physical and emotional loss. They also save the county from water rescues, overtime hours, shelter opening, temporary housing, and nail-biting unknowns that are caused by heavy storms. "Charlotte-Mecklenburg floodplains have a lot of urban flash flooding," Trautman explained. "They require quick action and emergency response."

Read the full case study at <https://developingresilience.org/case/charlotte-mecklenburg-floodplain-buyout-program/>.



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## The Road of Choice

**ONE OF THE KEY CHARGES GIVEN TO THE ULI PANEL** by the sponsor was to offer a set of criteria the city could use to establish a policy for evaluating which public road elevation projects to pursue. In response to this challenge, the panel developed a rubric that highlights key criteria but leaves finer-grain prioritization and weighting of those criteria to the city to determine. The panel recommends that the city see the criteria as one part of a broader process of evaluation and implementation of potential projects, one that places the criteria near the beginning of the process, not at the end (discussed in greater detail in the following section).

These criteria developed by the panel are intended to strategically guide prioritization of city projects to maximize benefits and minimize impacts of road elevation. The goal is to determine an objective, transparent methodology for prioritization of actions. This is just an example of a rigorous process that the city should go through to create a clear road map for future projects. The city should review and vet the specific criteria outlined in this report and establish a point system. The panel also pointed out that even after the completion of any road elevation project that meets the criteria, roadways may continue to experience flooding.

### Guiding Principles and Roadway Types

To develop the criteria, the panel identified the following set of guiding principles:

- Public safety is the top priority. Emergency routes and critical connections to essential facilities are necessary to maintain access.
- Stormwater improvements are essential. Drainage improvements maintain dry conditions on roadways, ensure regulatory compliance and environmental protection, and provide aesthetic benefits.

- Utilities should be protected to provide continuity of service for water, sewers, power, and communications.

## Roadway Types

The panel identified the following three major types of roadways in Fort Lauderdale:

- **Critical** (evacuation routes and critical roadways): evacuation routes that provide egress from an area that contains an imminent threat or hazard. Critical roadways provide access to critical facilities (hospitals, fire department, and police) and remain accessible for post-flooding access to critical services. **High priority for road elevation if the road is at risk.**
- **Collector** (commercial corridors/commuter streets): streets connecting multiple neighborhoods and supporting essential economic development activities. **Moderate priority for road elevation if the road is at risk.**
- **Local** (neighborhood residential roadways): roadways within neighborhoods, providing access to primarily residential properties. **Low priority for road elevation if the road is at risk.**

## Criteria and Guidelines for Use

The panel provided the following guidelines for the city on how to use the criteria to evaluate public road elevation projects throughout Fort Lauderdale:

- Inventory all city-owned roads and classify on the basis of three road types: **critical** (evacuation routes and critical roadways), **collector** (commercial corridors and commuter streets), and **local** (neighborhood residential roadways).
- Assess the project and determine how well the proposed road segment aligns with the criteria.
- Compare projects across type based on priority, using an established threshold.

## Key Criteria for Road Elevation

The panel identified the following criteria as the most essential for evaluating potential road elevation projects. The main considerations are as follows and should receive the highest priority in the criteria:

- **Is the roadway an evacuation route or critical connector, or does it serve essential public facilities?** Public health, safety, and welfare are of paramount importance to community safety during hazard events and everyday emergencies.
- **Is the road within the 100-year floodplain?** These areas are susceptible to greater flooding now and in the future.

The remaining criteria that the panel recommends the city use to evaluate road elevation projects are as follows, in no particular order:

- **Have adjacent buildings been damaged by flooding?** This is a good predictor of whether flood damage will continue or accelerate if no action is taken.
- **Does the road experience frequent or intense flooding from king tides?** Such locations have a history of flooding and are likely points of future inundation.
- **Are bridges along the roadway below the 100-year floodplain?** Many bridges are old, low, or compromised and should be included in the consideration of roadway elevation.
- **Have other flood solutions been installed?** Road elevation is the solution of last resort, as discussed previously in this report. If other flood mitigation strategies have addressed flooding intensity or frequency, raising roads may not be a priority; if they have not yet been tried, they may be effective.
- **Are a large number of people served by the roadway?** More people living or working along or using a roadway to access other roads necessitates higher priority for elevation.
- **Does the roadway serve a disadvantaged community?** Vulnerable populations may have fewer resources to address temporary displacement, interruptions to work, or the ability to work remotely.
- **Do the majority of adjacent property owners support road elevation?** Local acceptance of this solution is essential, and local resources may contribute to funding the solutions.

- **Can road elevation catalyze associated benefits?**  
A project may be able to leverage funding to provide bike lanes, beautification, sidewalks, or other benefits to the community.

## Ranking and Scoring

Beyond the two criteria that have been suggested to receive high priority, the panel recommends that the city work with key stakeholders and city departments to determine the relative importance of the remaining eight key benchmarks. The panel's overall prescribed approach is as follows:

1. Assign a set of scores based on the project's level of alignment with each criterion: high, partial, or limited alignment.
2. Assign a weight to each criterion based on conversations with key stakeholders, ensuring that the critical routes and 100-year floodplain criteria receive greater weight.
3. Add up the assigned scores and apply the weights.
4. Establish a score threshold and then use it to compare projects.
5. Proceed with determining feasibility of qualifying projects.

## Illustrative Application of the Municipal-Owned Road Elevation Project Criteria

High alignment
  Partial alignment
  Limited alignment

EXAMPLE PROJECTS BY ROAD TYPE							
CRITERIA	CRITICAL	CRITICAL	COLLECTOR	COLLECTOR	LOCAL	LOCAL	LOCAL
Is the roadway an evacuation route or critical connector, or does it serve public safety facilities?	High	High	Limited	Limited	Limited	Limited	Limited
Is the road within the 100-year floodplain?	High	Partial	High	High	Partial	High	High
Have adjacent buildings been damaged by flooding?	High	Partial	Limited	High	Limited	High	High
Does the road experience frequent flooding from king tides?	High	Partial	High	High	Limited	High	High
Are bridge elevations along the roadway below the 100-year floodplain?	Partial	Partial	Limited	Limited	Partial	High	High
Have other flood solutions (tidal valves, stormwater improvements) been installed?	High	Partial	Limited	High	Partial	High	High
Are a high number of people (living, working, commercial uses) served by the roadway?	High	High	High	High	Partial	Limited	Limited
Does the roadway serve a disadvantaged community? (See <a href="https://www.energy.gov/justice/justice40-initiative">https://www.energy.gov/justice/justice40-initiative</a> )	High	High	Limited	High	Limited	Limited	Limited
Do a majority of adjacent property owners want road elevation?	Partial	Limited	Partial	Limited	High	Partial	High
Can the road elevation project be a catalyst for other benefits (alternative transportation, beautification)?	Partial	Partial	Limited	High	Limited	Limited	High

An example of how the criteria might be applied to projects with various roadway types. Each project receives a level of alignment for each criterion (high alignment, partial alignment, and limited alignment).



Road type is not the only determinant of a project's level of alignment. While critical roadways might more often receive a score consistent with their priority and high alignment to the criteria, collector and local roadway projects may receive higher or lower scores relative to one another based on their alignment with individual criteria.

## CRITERIA ALIGNMENT CAN VARY ACROSS ROADWAY TYPES

Below are *illustrative* examples of a scenario in which variation by project and road type might occur.

- **Project A: Critical Roadway—Score 85**  
Essential evacuation route with multiple segments subjected to flooding. Many interventions have been installed with positive impact, but the roadway is still at risk.
- **Project B: Critical Roadway—Score 75**  
This critical roadway is subject to flooding but has a right-of-way that may preclude accessory benefits such as bike lanes or sidewalks.
- **Project C: Collector Street—Score 70**  
Roadway is within the floodplain; the commercial corridor serves a large number of residents, including disadvantaged residents; many flood interventions have been installed; and the roadway provides the opportunity for accessory benefits such as bike lanes or sidewalks.
- **Project D: Local Street—Score 70**  
This local roadway has been subject to multiple interventions to reduce flooding but still experiences frequent and intense flooding. The residents support roadway elevation, and the project can catalyze other improvements.



## Project Evaluation Process

**ONCE ALL ADAPTATION INTERVENTIONS HAVE BEEN IMPLEMENTED** and a series of roads in need of elevation have been identified, further assessment of the viability of a road elevation project is necessary. Therefore, the panel strongly advises that the city and stakeholders view the criteria for road elevation projects offered in this report as part of a larger project evaluation process: prepare, prioritize, scope, fund, and implement.

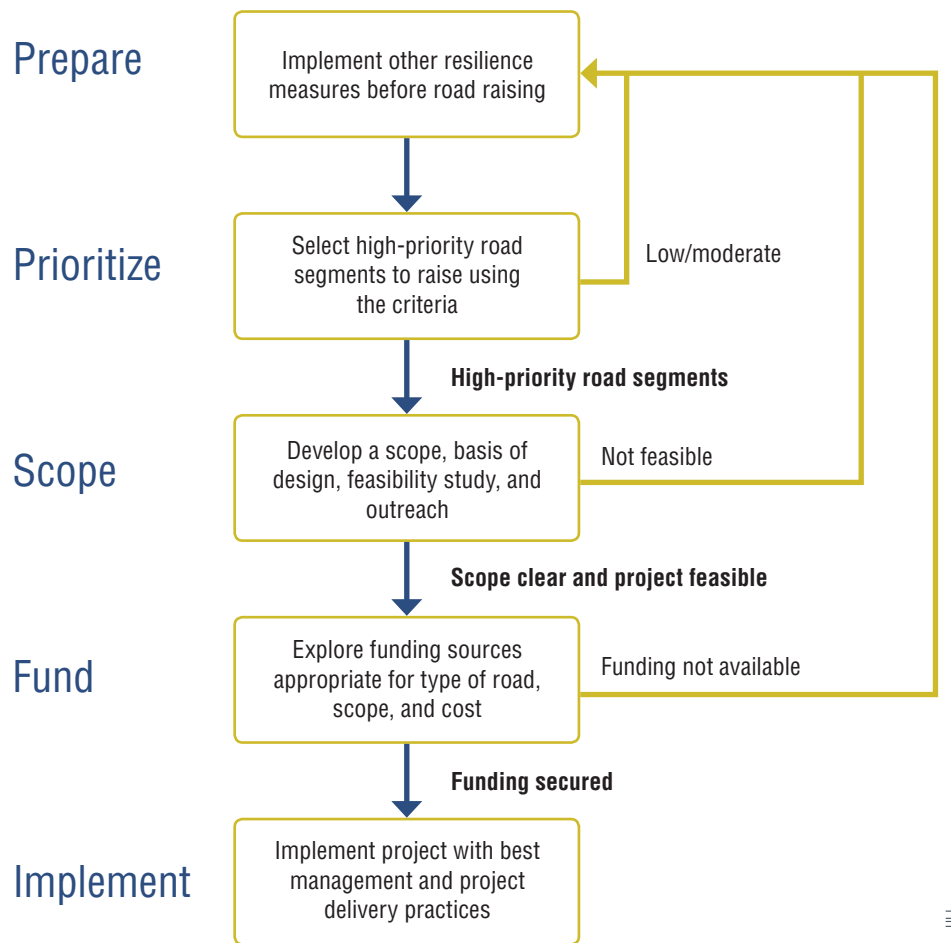
Preparing for road elevation by first implementing all other resilience measures to address flooding, and prioritizing the selection of high-priority road segments on the basis of the criteria are described in detail in this report. But what's next? For projects that are closely aligned with the requirements and meet the established score threshold, the next phase is to begin a scoping and feasibility study. The panel recommends this step before searching for funding opportunities because its experience has shown that when project cost estimates and funding are secured too soon, there can be misalignment of costs and expectations.

The project evaluation process is iterative. For projects that do not meet the established scoring threshold, efforts to address flooding should continue using an adaptation toolbox, particularly those strategies that might previously have been untenable. Additional intervention and adaptation measures can be implemented and the project can be reevaluated as conditions change.

### Scoping and Feasibility

Having a clear scope of work that all stakeholders agree upon is key to successful projects. Often stakeholders have a point of view that defines their impression of the scope, but when expectations differ, conflicts can arise.

## Project Evaluation Process



The panel recommends that the Public Works department is a key stakeholder in the scoping effort for road elevation projects because it is a critical part of successful project implementation. However, a private organization could also take the lead if the city hires consultants to complete this phase.

A scoping document should define the goals of the project and its boundaries and outline the basis of design.

A scoping process should begin with project goals such as the following:

- Ensure accessibility of emergency services and evacuation routes
- Reduce the frequency, duration, and intensity of flooding on roadways during king tides
- Reduce the risk of flood damage to properties from storm surges or compound flooding
- Prepare for long-term impacts of sea level rise

- Minimize impact on landscape and driveways on private properties along road segment

A project boundary should be established and agreed upon by all stakeholders. There may be a variety of boundaries for different types of work within the project, such as the following:

- Preliminary limit of roadway construction (public road right-of-way)
- Boundary of properties directly adjacent to the project
- Border of all properties affected by the project

It is also vital that a project design basis be prepared before preliminary design and feasibility studies. This document is often a more specific version of project goals that sets values, design criteria and standards, and other goal-level statements. Ensuring that all stakeholders understand the specific constraints of the project will reduce conflict during and after road raising.

## Design Considerations

A feasibility study should begin with a preconcept design. It should include design considerations such as existing and proposed roadway elevations, stormwater upgrades, finished floor of existing adjacent properties, and nature-based solutions. At this stage, engaging key project stakeholders, including directly affected properties, private utilities, and public utility departments, is also important.

Further design considerations include determining how much to raise the road. The panel recommends the following approach.

- **Critical roads:** The ideal elevation for critical roadways is above the 100-year flood elevation to allow emergency and evacuation access during an extreme storm event. A design criterion of the 2024 100-year Federal Emergency Management Agency (FEMA) BFE +1 is advised.
- **Collector roads:** Elevations for collector roads should be above the king tide levels, sea level rise 2070 predictions, and 20-year rain event levels of inundation to reduce damage to properties during major rain events with a high tide. The panel suggests that these roads be raised to approximately the 2024 100-year FEMA BFE, but that additional modeling should be done to minimize flooding of adjacent properties over the project's service life.
- **Local roads:** The recommended elevation for local roads is also based on the 2024 100-year FEMA BFE. The panel suggests an elevation of BFE minus one foot but recommends additional modeling to minimize flooding of adjacent properties over the project's service life.

In all three cases, the panel recognizes that the recommended road elevations may be several feet above current road levels. Existing buildings along these roadway sections may be older and will have first-floor elevations below recent flood elevations. As new FEMA flood insurance rate map data become available and flood levels in some areas continue to rise, the number of buildings with first-floor elevations below recent flood levels may increase.

In some cases where a road-raising project is being considered and properties along the roadway have a mix of first-floor elevations, it may or may not be possible to use harmonization methods discussed in this report to minimize potential flood risk that could be exacerbated by road elevation. This may result in the project being deemed infeasible at that time even if

it meets the criteria and the panel recommends that the project stakeholders use the strategies within an adaptation toolbox.

The panel also notes that, as articulated in the criteria, if properties at lower elevations have not been damaged by flooding, the road elevation project may be a lesser priority.

## Harmonization

Harmonization, or addressing impacts of public improvements on private properties (i.e., road-to-lot grade differences, utility connections, driveways), is not uncommon in public infrastructure projects. Repaving of sidewalks may lead to the need to repave private driveway entrances, for example. Harmonization related to road elevation projects can be challenging and can affect project feasibility. Existing roadways can be narrow, presenting limited space for ingress and egress as construction occurs and for smooth grade changes between private property and raised roadways that meet existing (modern) standards. Adjacent, existing properties that have a finished floor elevation below the new road elevation present another challenge, since flooding of the property may be the result of an elevated road. This is why the panel recommends criteria that limit the number of properties affected in this way within a project area. In cases where the project is deemed to meet the criteria, only modest harmonization efforts on a few properties may make the project feasible. The panel suggests the following harmonization techniques be used or adopted:

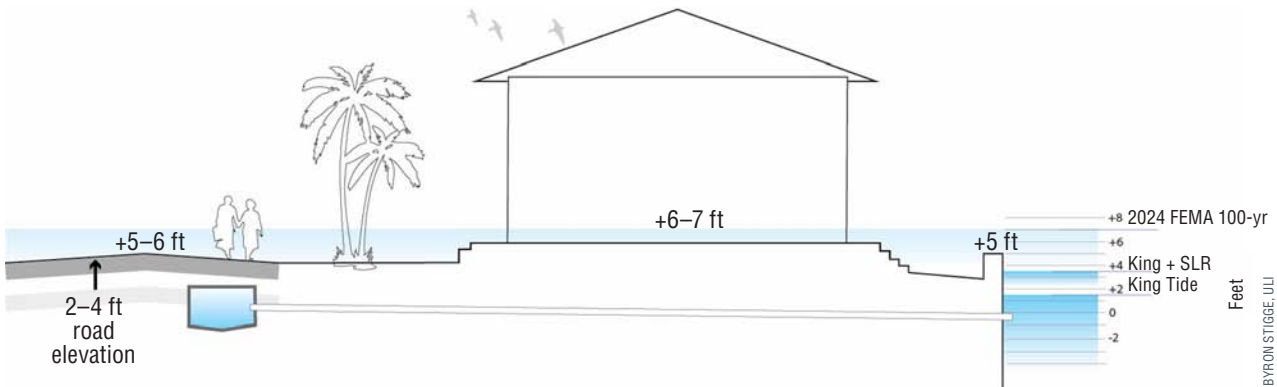
- Slightly raise the edge or angle the curb to prevent road runoff into private property.
- Temporarily harden perimeter of home with floodwalls and gates.
- Temporarily install stormwater ejector pump at low point in yard to discharge into new storm conveyance.
- Support or require rebuilding at an elevation a minimum of one foot above the proposed adjacent roadway elevation.

## Stormwater Upgrades

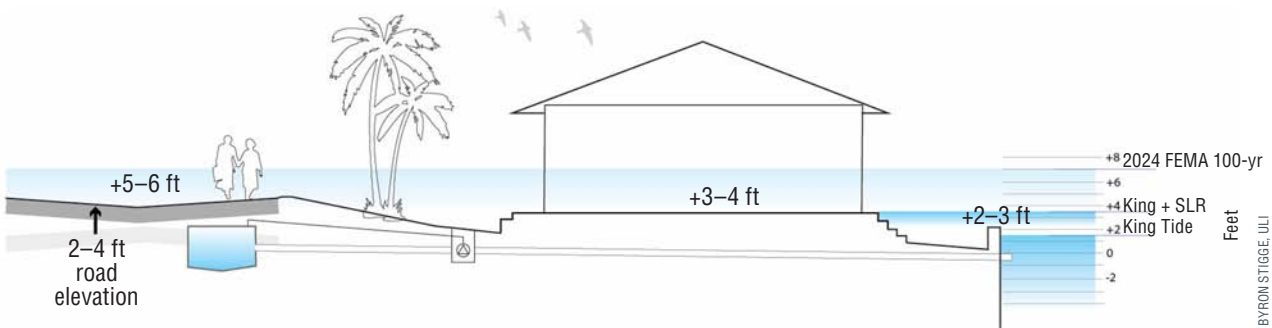
The panel believes there is an opportunity to reimagine the stormwater management system. More catch basins in streets and additional elevation will allow more gracious slopes and higher-capacity conveyance for future rain events. Conveyance pipes could be oversized to serve as storage to help manage flow from extreme rain events. Where outfalls (such as pipes,

## Properties *Raised* Prior to Road Elevation

- Current finished floor: Approximately BFE +1 (+6–8 feet)



## Properties *Not Raised* Prior to Road Elevation



While new properties are built at a higher elevation to meet current standards, existing properties that have a finished floor elevation below the proposed new road elevation may present a challenge, since flooding of the property may be the result of an elevated road. Therefore, the panel recommends including criteria that consider the number of properties affected in this way within a project area. If a project is deemed to meet the criteria, project feasibility may be further determined based upon the extent of harmonization efforts needed.

ditches, and swales) exist and discharge is allowed, the stormwater management system can discharge to external water bodies through tidal valves or backflow preventers. The panel does acknowledge that high tides concurrent with rainfall will limit the effectiveness of this discharge approach until the tide goes out.

Some road segments may have limited discharge capacity. In these cases, gravity deep injection wells, which are becoming standard practice for larger projects in Fort Lauderdale, may be an option in locations where the groundwater table will support them. Stormwater could also be conveyed to a space available in the right-of-way or to a resilience parcel that

houses injection wells and storage, such as a raised tank. This additional capacity could also be used to meet requirements for a gravity well.

Nature-based solutions can add to the greenery of the city and have a variety of benefits, such as dispersing stormwater runoff, improving water and air quality, adding shade, and reducing the urban heat island effect. The panel recommends the following:

- Swales and landscaping within roadway right-of-way where possible

- Acquiring a parcel in each Isle (one or two of the low-elevation parcels), which could serve as a neighborhood park and include a range of stormwater conveyance features and community cobenefits:
  - New stormwater conveyance directed to this parcel
  - Stormwater retention cells
  - Deep injection wells
  - New stormwater pump station
  - Raise the elevation of some portion of the parcel even to BFE plus three to four feet for area of refuge, after evaluation of the potential flood impact on adjacent properties
  - Boat access during emergency conditions

### Engaging Key Project Stakeholders

As noted above, several key project stakeholders need to be engaged before a project starts to provide input, help set expectations, and establish a culture of frequent and consistent coordination. They include owners and residents of directly affected properties, private utilities, public safety, and public utility departments.

#### Private Utilities

The private utilities in Fort Lauderdale play an important role in the design and feasibility of road elevation. It is important to continue close collaboration with local private utilities for electricity (Florida Power & Light Company), gas (Teco), and communications (such as AT&T and Xfinity), and any private utilities within a right-of-way of a road segment considered for raising should be engaged in the feasibility process.

If utility segments are past their useful life and appropriate for inclusion in their own capital improvement budget, the utility may want to take advantage of the opportunity to upgrade its service. There could be cost savings and streamlining of already planned upgrades that fit nicely within the road raising. In some areas of Fort Lauderdale, saltwater intrusion has corroded or otherwise affected underground utilities, causing deterioration much sooner than would occur in a typical useful life; these utilities may benefit from being raised along with a roadway. Long-term planning should be done, with additional duct banks or manholes to allow future expansion and modernization without further roadwork.

However, in some cases, depending on the conditions of the utilities and the amount of road raising, utilities may choose to leave functioning lines in place and simply raise manholes and access points up to the level of the raised road. In either situation, private utilities are one of the key stakeholders in the feasibility and understanding of cost allocation for a road elevation project.

#### Upgrading Public Utilities

Fort Lauderdale operates public utilities for drinking water, stormwater management, and sanitary wastewater collection and treatment. Road raising will likely require replacement of existing drinking water, stormwater, and sanitary sewer lines, among other utilities, if elevations increase more than two or three feet. Fire hydrants and meter boxes also need to be considered. New stormwater conveyance networks will be crucial to the long-term resilience of roadways and water management as well.

Considering the age of some utilities in the study area and the impact of saltwater intrusion, many of the public utilities will need to be replaced and raised along with the roadway. This is a chance to use newer materials and methods for stormwater, water, and sanitary sewer networks.

Feasibility and cost for public water and sewer utilities will be a substantial component of road-raising projects, but these investments will ensure long-term functionality and resilience of newly modernized roadways.

#### Community Engagement

The panel highlights prioritizing engagement with directly affected residents and property owners (detailed at a citywide level elsewhere in this report). It is the panel's understanding that the Public Works department is already involved with residents on a regular basis to address existing flooding and tidal inundation challenges. Should a road elevation project reach this phase in the evaluation process, community engagement will be needed for clear communication of the decision-making process, articulation of the extent to which adjacent properties will likely be better or worse off after the project's completion, and setting of clear expectations about key project elements, such as timelines, harmonization, and project visualizations.

## **Staff Capacity**

Efforts such as community and stakeholder engagement, as well as management of the road-raising project—from feasibility through design and then construction—will require considerable staff time and expertise. The panel advises that staff capacity to pursue the project be evaluated in the feasibility phase. Perhaps portions of a project can be assigned to a consultant or completed in partnership with existing efforts in other departments; however, Public Works staff will still need to be engaged to ensure success. Assessment of current staff time might also provide a holistic understanding of capacity for department priorities. Finally, supplemental staff may need to be hired to take on additional infrastructure projects.

## **Feasibility Determination**

With a clear project scope and stakeholders aligned with a feasible project, the city can begin to determine funding requirements for appropriate stakeholders. Depending on the direct beneficiaries of the road segment to be raised, the types of funding to seek will be different. Funds from public and private utilities will likely need to be budgeted and set into capital plans. Funds from grants, special assessments, or the general fund will also need to be allocated.

Once the city has confidence that funding from all stakeholders is secure, the implementation process can begin. Detailed engineering design can commence, approvals can be obtained, contractor procurement can begin, and ultimately construction and commissioning can be completed. As outlined, this is a multiyear process to determine feasibility, perform outreach, coordinate utility stakeholders, and fund and construct a road elevation project.



## Identifying Funding

**INFRASTRUCTURE PROJECTS, INCLUDING ROAD ELEVATION**, come with notable costs. Elevating a road 12 to 18 inches could cost several million dollars. It is the panel’s understanding that funding for road elevation is not currently budgeted in the city’s Five-Year Community Investment Plan. Therefore, identifying funding sources is critical to move forward projects that the evaluation process determines are feasible and essential. If funding is lacking, the panel recommends a review of the criteria and current issues, and perhaps an adjustment of the scope of the project, and proceeding through the process again.

Stakeholder interviews during the panel offered the following consistent themes regarding funding:

- All stakeholders (residents, government, and businesses) recognize that there is a problem that needs to be addressed.
- Stakeholders expressed a willingness to pay their fair share for intervention improvements, especially outside the right-of-way.
- Stakeholders noted that flooding is a citywide issue but that there are various levels of need and abilities to pay to address the need. In discussion of needed infrastructure

investment, the consensus was that there is not a “one-size-fits-all” way to deal with flooding.

### Setting the Stage

Three key elements are necessary to attract funding for infrastructure projects such as road elevation:

- Create a compelling message and communicate the need for funding.
- Develop strategic partnerships to leverage needed funds.
- Stick with it. Applying for and receiving funding takes time. It’s a marathon, not a sprint!



## A Compelling Message

The panel recommends developing a compelling message that indicates the need that the city is trying to address. It believes there is an opportunity to build upon what sets Fort Lauderdale and the Southeast Florida region apart. The city and the region can lead the way in developing adaptation and hazard mitigation techniques to address flood risk that can set an example for the rest of the country. This message would not only speak to regional funding partners, but also resonate at the state and federal levels. An example of such a message from the panel's perspective is as follows:

*Fort Lauderdale and Southeast Florida region are at a tipping point with flood risk. Other coastal areas throughout the country are as well, and even more will be facing this in the future. The current and future potential negative impacts of this risk require significant resources to address. Those at the forefront of this challenge, such as the city and the broader region, will set the stage for the rest of the country. A broad group of local and regional stakeholders is willing to take the lead in addressing this challenge, but state and federal assistance is necessary for these efforts to be effective.*

## Partnership Opportunities

A compelling message that communicates need is not enough. The panel advises also developing strategic partnerships that align with the city's priorities to help leverage funds. Even if the amount is small, when each partner brings funds to the table, those funds grow and can demonstrate buy-in and commitment to the projects and encourage further investment. For flood risk

in particular, the panel notes that this is not just a city issue, and regional partners from the public sector (local governments) and private sector (utilities, businesses, residents, and so forth) could aid in this effort. A compelling case for federal funding in particular can be assisted by demonstrating that the effects of the problem and the funds to address it will be not just local but regional and will affect multiple key stakeholder groups.

The panel also favors pursuit of public/private partnership opportunities to help with project funding and implementation efforts. If such partnerships are established, the panel recommends that the city remain engaged and supervise these projects, as with other infrastructure projects. Outlining expectations and identifying accountability measures are also critical to success. The following are examples of partnership opportunities.

**Special-Purpose Districts.** On the basis of information available from the Florida Association of Special Districts, there are 30 statutes currently enabling 1,900 districts, either residential or commercial, throughout the state of Florida to provide limited special-purpose government on a local level.

- **Stewardship district.** The district is a local unit of special-purpose government of the state of Florida, created pursuant to Chapter 2005-338, Laws of Florida, as amended (the Act). Among the purposes for which the district was established are financing the acquisition and construction of, and the maintenance and operation of, the infrastructure and other public facilities necessary for development of the lands within the district. The Act authorizes the district to issue bonds for purposes,

## Sample Funding Programs

Local	State	Federal
<ul style="list-style-type: none"> <li>• Special assessments</li> <li>• Real estate transfer taxes</li> <li>• Incentive programs and rebates</li> <li>• Development impact fees</li> <li>• Stormwater fees</li> <li>• Sales tax (example: tourism-based tax)</li> <li>• Stormwater bonds</li> </ul>	<ul style="list-style-type: none"> <li>• Florida Department of Transportation—Target Zero program, locally administered grants</li> <li>• Florida Department of Environmental Protection—Resilience Florida grant program</li> <li>• South Florida Water Management District—grant programs and technical support</li> </ul>	<ul style="list-style-type: none"> <li>• U.S. Department of Transportation—Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) program</li> <li>• U.S. Federal Emergency Management Agency (FEMA) — Building Resilient Infrastructure and Communities (BRIC), Flood Mitigation Assistance (FMA) program</li> <li>• U.S. Environmental Protection Agency—Community Lifelines (with FEMA)</li> <li>• National Oceanic and Atmospheric Administration (NOAA)—sea grants</li> <li>• U.S. Department of Energy—Property Assessed Clean Energy + Resilience (PACE+R)</li> </ul>

## PROPERTY ASSESSED CLEAN ENERGY + RESILIENCE (PACE+R)

“Financing PACE+R financing—known by various names (C-PACE for commercial, R-PACE for residential, and +R after resilience elements were added)—has grown in popularity as a financing strategy for retrofit projects, especially those related to energy efficiency. PACE+R financing, active and operating in 26 states, provides upfront capital with low interest rates and terms of often 20 years or more. The loan remains attached to specific properties as a tax assessment that transfers to new owners in case of sale, and typically 100 percent of hard and soft costs are covered.

Projects covered by PACE+R programs—like that of King County, Washington—usually include both energy projects, such as HVAC or lighting replacements and electric vehicle charging, and investments toward resilience, such as seismic hardening or wind and flood risk reduction. C-PACE is not available in all states, or globally, and not all states will fund physical risk resilience projects. In addition, PACE+R also requires primary mortgage or other lenders to consent to the assessment’s becoming senior to private financing, a significant barrier for many real estate firms, though this factor may be changing as lenders become more familiar with the program.”

Note: The PACE+R program will need to be legislated by the state of Florida for funds to be made available.

—Excerpt from *Resilient Retrofits: Climate Upgrades for Existing Buildings* by the Urban Land Institute

among others, of financing the cost of acquisition and construction of assessable improvements, including water management and control, water supply, wastewater management, reclamation and reuse, roadway improvements, landscaping, streetlights, parks, and other basic infrastructure projects within and, in accordance with the provisions of the Act, without the boundaries of the district.

- *Business improvement district (BID)*. The panel believes the city should consider expanding the existing beach BIDs to areas that are at risk for flooding and may require hazard mitigation and adaptation tools.
- *Community development district*. The district is a local unit of special-purpose government that was created to deliver urban community development services. It is governed by a board.

*Tax Increment Financing (TIF)/Tax Allocation Districts (TADs)*. The panel recommends considering both TIF districts and TADs because they provide opportunities to channel funds into specific geographies.

*Public Authorities*. Federally designated entities, such as metropolitan planning organizations, serve many functions, including raising revenue, applying for grants, and overseeing processes.

*Nonprofit Organizations*. For certain projects, there may be the opportunity to partner with local or national nonprofits to fund improvements to adjacent private property, including harmonization. An example of an existing program that addresses the need for resilient residential properties is [Habitat for Humanity’s Habitat Strong: Disaster Resilient Building Program](#).

### Strategically Position for Funds

After a compelling message is established and key stakeholder partnerships are identified, the next step is to take steps to strategically position the city and its possible partners to apply for and receive funding, particularly for federal discretionary grants. The panel recommends the following steps:

- *Identify the project scope*. A powerful enough effect is essential. The panel recommends bundling projects, such as multiple flood mitigation and road elevation projects, to achieve a strong impact.
- *Gather key data*. Collect a wide range of data, including economic and fiscal impacts of the project, a cost-benefit analysis, socioeconomic data, and environmental data, among others.
- *Build coalitions*. Bring together multijurisdictional (city, county, authorities) and private (business, nonprofit, neighborhood) entities.

- *Identify the capital stack.* When a local match is required, sometimes as much as 20 percent, leverage partnerships to distribute the funds that need to be committed.
- *Tell a story.* Show the need and the “but for” (that is, but for these federal funds, this problem will not be addressed) argument for federal funds. Demonstrate the project’s scalability to other coastal communities and the opportunity to pilot federal investments.

## Long-Term Commitment

Pursuing funding, particularly public or federal, for a project takes persistence and a long-term commitment. It’s a marathon, not a sprint. The city and its future partners in this effort are strongly encouraged to stick with it. The panel believes that it is worth the time to identify the compelling message and problem statement and gather the necessary partners to pursue the funding needed to address flood risk.

## A Note on Private Funding

It is the panel’s understanding that there might be instances in which property owners of a particular area may wish to privately fund a road elevation project to accelerate its implementation. Given this potential, the panel recommends that the city consider the following in reviewing such proposals:

- Regardless of whether the project meets the road elevation criteria threshold, the project scope and feasibility still need to be established consistent with methodology adopted by the city.
- The city should manage these projects to coordinate the key stakeholders and ensure that improvements meet proper standards.
- Even if hard costs are being provided by property owners, city staff time should be included in the costs for the project. If not, project costs should account for the need to hire staff to manage the project.
- Clear communication to the public about the project, its sources of funding, and any impact on existing priorities within the Public Works department is essential to ensure there is no interpretation of inequitable use of public funds.



# Implementation

**THE PANEL'S PRIMARY CHARGES WERE TO FOCUS** on equitable criteria for road elevation projects and to identify funding opportunities. In responding to these questions, the panel offered the following strategies for implementation, including thinking more broadly about resilience and the importance of flood resilience policy, as well as approaches to community engagement, both of which are important steps to implementing the recommendations offered in this report.

Roadways are integral to flood management, and road elevation is just one way that the city can use the transportation system to enhance flood resilience. The transportation system is a significant long-term investment. It houses utilities, it's how residents get to the places they need to go, it supports commerce and tourism, and every member of the community interacts with the transportation system nearly every day. The panel applauds the city's effort to look at a traditional element of the transportation system to manage flooding. Flood management is essential to the city's duty to handle health and safety challenges. Addressing flood inundation, using all the adaptation tools and perhaps road elevation, can also help protect the historical and cultural landmarks as well as manage

financial risks for the public sector and private individuals and help maintain quality of life.

## Establishing a Flood Resilience Policy

The panel strongly encourages the city to establish a flood resilience policy. This is a set of statements that everyone in the community can support and that the governing body adopts. The policy can be used as a guide to raise community priorities and guide government decisions. Creating and adopting a policy will require time and a deliberate process, but once in place, it can serve as the North Star for the city's efforts and investments to address flooding and tidal inundation in the

future. Because the policy informs city actions, including where resources are allocated and when plans are implemented and actions are taken, every part of government has a role. Although the Public Works department will have a notable role in addressing flooding, the Development Services (planning and code compliance), Transportation and Mobility, Parks and Recreation, and Police and Fire Rescue departments can all contribute as well. A flood resilience policy provides a unified message and goal that outlines how everyone can participate and how resources can be directed to implement the recommendations in this report and further support efforts already underway.

To serve as inspiration, the panel developed the following example of a flood resilience policy to illustrate essential elements and emphasis:

*Fort Lauderdale will be South Florida's most resilient city. We will consistently provide a high quality of life for residents and visitors who enjoy our coastal resources and amenities.*

*Our communities will adapt to recurrent and new weather and flooding conditions in a way that prioritizes preservation of life and property.*

*Our Community Investment Program and other public services will consider flood resilience in our planning, design, and development.*

*Every business, every resident, and every visitor will recognize and understand the important roles of our natural environment, our social fabric, and our economic vitality.*

*We will continue to grow and adapt in a manner that allows future generations full enjoyment of all that the city has to offer.*

## Implementing Policy

A policy also serves to inform other partners of the city's priorities and focus so that everyone in the community understands what the goals are, what the community wants to achieve, and what role they might play. For example, school districts are educating the next generation of experts and civil servants who will continue to address this issue for years to come. Developers, while not governed directly by this policy, will better understand the priorities of the city and the direction in which the community wishes to go and can adjust their projects accordingly.

## EXAMPLE POLICY IMPLEMENTATION ENTITIES

### *City of Fort Lauderdale*

Planning Council  
Development Services department  
Transportation and Mobility  
Public Works department  
Boards and Commissions  
Parks and Recreation department  
Community Enhancement and Compliance  
Police and Fire Rescue departments

### *Other Partners*

Other levels of government (county, state, and so forth)  
Health care and educational institutions  
Homeowners associations, homeowners, community organizations  
School districts  
Philanthropic organizations  
Chambers of Commerce  
Developers  
Businesses

The panel recommends developing and adopting a flood resilience policy because it provides guidance for all future decision-making surrounding the built environment. By making it clear that flood resilience is one of the top priorities of the city, a policy helps to authorize funding and procurements and focus planning activities. The panel also suggests that within planning documents, at either the neighborhood or the citywide scale, all related resilience guidelines should support the unifying, overarching flood resilience policy. A policy can also guide a task force or authority (such as a stormwater management authority) that can regularly address flooding and be a partner with the city in raising funds and managing programs. The panel acknowledges that such an authority would need to be created through legislation by the state with the support of the Broward Metropolitan Planning Organization.

## Communications and Engagement

The panel applauds the efforts by the Public Works department to communicate and engage with residents on this complex topic. It recommends furthering these efforts by emphasizing transparency. Over time, increasing transparency in communications and actions can help the community understand the rationale for specific investment and project decisions. To facilitate this, the panel recommends that the city do the following:

- Add flood resilience as a standing agenda item on internal and external meetings.
- Conduct ongoing outreach for the citywide approach to flood resilience as well as project-based outreach, including potential road elevation projects.
- Further community education efforts and provide maps and key resources to the public.
- Increase community awareness about flood risks and adaptation tools through media and messaging.
- Provide sufficient information on the opportunities, challenges, costs, and benefits of the city's actions to address flooding and tidal inundation to help level set expectations within the community.
- Clearly communicate progress—whether regular updates on a specific project or the broader city's efforts and investments to address flood risk overall—to show the community all the different ways this issue is being tackled.

The panel also believes that communication strategies should include providing or enhancing emergency management messaging to residents and households that are vulnerable to flooding. This is particularly critical for socially vulnerable communities and life-supporting facilities and services.

In conversations with stakeholders, the panel observed an inconsistent level of awareness of the successes and ongoing actions by the Public Works department to address flood risk and tidal inundation. Therefore, it advises that the city develop communications campaigns to celebrate successes. These successes include a range of topics, such as funding, code enforcement, and flood-resilient development projects. It is important to use consistent messaging and language across all efforts and to dedicate sufficient resources, both funding and staff capacity, for communications to both build support and highlight the progress that is being made.



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*Community engagement and consistent and transparent communication are essential to build support and provide an understanding of the rationale behind key decisions and investments.*

## Implementation Guide

The panel acknowledges that implementation of its recommendations will not happen overnight. However, the following are the first steps the city can take to begin building consensus on its approach to road elevation projects and addressing flooding and tidal inundation for the city in a resilient, holistic manner:

- Review the panel's criteria and establish the city's process and timeline to refine the approach and gain community and key stakeholder buy-in.
- Prioritize the development of a policy framework for resilience as a critical initiating step.

- Review panel recommendations for resilience tools that can be implemented immediately.
- Engage, integrate, and leverage the county’s resilience plan efforts.
- Identify available staff resources and public/private partners to seek funding.
- Inventory, integrate, and communicate all current efforts.

To facilitate implementation of the full range of the panel’s recommendations, below is a guide that outlines them as short, medium, long, and ongoing actions.

## Implementation Guide

### Comprehensive and Long-Term Approach

<b>Short Term</b>	<ul style="list-style-type: none"> <li>• Elevate flood resilience as a priority, facilitating a connection with the work already underway in Greater Fort Lauderdale, including at the county level. Engage, integrate, and leverage the county’s resilience plan efforts.</li> <li>• Develop an adaptation toolbox and use interventions in combination at the site/building, street, neighborhood/district, and citywide levels before considering road elevation.</li> <li>• Consider nature-based solutions that have a variety of benefits, such as dispersing stormwater runoff, improving water and air quality, adding shade, and reducing the urban heat island effect.</li> <li>• Focus on identifying the future costs and benefits of adaptation measures to determine which options should be pursued first. Costs and benefits should also be part of the conversation as the city refines and develops a policy for investments in road elevation projects according to the panel’s criteria.</li> <li>• Encourage individual property owners to undertake measures such as seawall upgrades, home elevation, and yard improvements.</li> </ul>
<b>Medium Term</b>	<ul style="list-style-type: none"> <li>• Prepare for the potential for housing mobility and land acquisition opportunities in the future by establishing the foundation and design for programs that facilitate both.</li> <li>• Add a recordable property-level disclosure that includes street flooding at the time of sale, or include as a part of the process for receiving a building permit.</li> </ul>
<b>Long Term</b>	<ul style="list-style-type: none"> <li>• Pursue a group purchase of flood insurance at the community or citywide level to share the burden and, ideally, decrease premiums.</li> </ul>
<b>Ongoing</b>	<ul style="list-style-type: none"> <li>• Take a comprehensive approach to flood resilience that enables looking at systemwide linkages and relationships and understanding how localized improvements might positively or negatively affect other properties or neighborhoods throughout the city. The panel recommends beginning by establishing a comprehensive understanding of tidal flooding and stormwater flooding, using modeling and updated flood risk projections to create a data-driven decision framework.</li> <li>• Continue to monitor and update local development codes to promote pervious cover and encourage development in less flood-prone areas. New development and rehab standards should also be created to further align property-level intervention measures with existing and future flood risks.</li> <li>• Continue code compliance of flood-affecting violations.</li> <li>• Enhance and continue efforts to tell residents and key stakeholders about the flood risk, active adaptation measures being implemented by the city, and planned or programmed improvements.</li> <li>• Use a community flood warning system to alert residents and visitors about anticipated king tides, heavy rainfall, and other events.</li> </ul>

### The Road of Choice (Criteria)

<b>Short Term</b>	<ul style="list-style-type: none"> <li>• Inventory all city-owned roads and determine the road classification based on three road types: critical (evacuation routes and critical roadways), collector (commercial corridors and commuter streets), and local (neighborhood residential roadways).</li> <li>• Work with key stakeholders and city departments to determine the relative priority and importance of the criteria beyond those given high priority by the panel.</li> </ul>
<b>Medium Term</b>	<ul style="list-style-type: none"> <li>• Assess the road elevation project and determine how well the proposed road segment aligns with the criteria.</li> </ul>
<b>Ongoing</b>	<ul style="list-style-type: none"> <li>• Compare projects across type on the basis of priority, using an established threshold.</li> </ul>

## Implementation Guide

### Project Evaluation Process

<b>Medium Term</b>	<ul style="list-style-type: none"> <li>• Lead the scoping effort, in most cases, as the primary implementation agency for road projects.</li> <li>• Complete a project design basis before preliminary design and feasibility studies.</li> <li>• Conduct a preconcept design as part of the feasibility study.</li> <li>• Evaluate staff capacity to pursue a project within the feasibility phase.</li> </ul>
<b>Long Term</b>	<ul style="list-style-type: none"> <li>• Use the feasibility phase to consider reimagining a stormwater management system that might add more catch basins in streets if found to be effective, and apply additional elevation to allow for more gracious slopes and higher-capacity conveyance for future rain events.</li> </ul>
<b>Ongoing</b>	<ul style="list-style-type: none"> <li>• Review road elevation projects as part of a larger project evaluation process: prepare, prioritize, scope, fund, implement.</li> <li>• Before a project starts, engage key stakeholders, including owners and residents of directly affected properties, private utilities, and public utility departments, to provide input, set expectations, and coordinate early and often.</li> <li>• Pursue community engagement, if the project reaches the scoping and feasibility stage, to clearly communicate the decision-making process, to articulate to what extent adjacent properties will likely be better or worse off after the project's completion, and to set clear expectations for key project elements such as timelines, harmonization, and project visualizations.</li> </ul>

### Identify Funding

<b>Short Term</b>	<ul style="list-style-type: none"> <li>• Develop a compelling message that indicates the needs that the city is trying to address.</li> </ul>
<b>Medium Term</b>	<ul style="list-style-type: none"> <li>• Identify and develop strategic partnerships that align with the city's priorities and leverage existing and future funds.</li> </ul>
<b>Long Term</b>	<ul style="list-style-type: none"> <li>• Take steps to strategically position the city and its possible partners to apply for and receive funding: identify the project scope, gather key data, build coalitions, identify the capital stack, and tell a story.</li> </ul>

### Implementation

<b>Short Term</b>	<ul style="list-style-type: none"> <li>• Establish a flood resilience policy to serve as the North Star for the city's efforts and investments to address flooding and tidal inundation, one that everyone in the community can support and that the governing body adopts.</li> </ul>
<b>Medium Term</b>	<ul style="list-style-type: none"> <li>• Increase community awareness about flood risks and adaptation tools through media and messaging.</li> <li>• Ensure that within planning documents, either at neighborhood or citywide scale, all related resilience guidelines support the unifying, overarching flood resilience policy.</li> </ul>
<b>Long Term</b>	<ul style="list-style-type: none"> <li>• Form a task force or authority (such as a stormwater management authority) that can regularly address flooding and tidal inundation and be a partner with the city in raising funds and managing programs.</li> </ul>
<b>Ongoing</b>	<ul style="list-style-type: none"> <li>• Provide sufficient information on the opportunities, challenges, costs, and benefits of the city's actions to address flooding and tidal inundation to help level set expectations within the community.</li> <li>• Clearly communicate progress, whether it is regular updates on a specific project or on the city's efforts and investments to address flood risk overall.</li> <li>• Develop communications campaigns to celebrate successes.</li> <li>• Add flood resilience as a standing agenda item in internal and external meetings.</li> <li>• Conduct outreach for the citywide approach to flood resilience as well as project-based outreach, including potential road elevation projects.</li> <li>• Further community education efforts and provide maps and key resources to the public.</li> </ul>





## Conclusion

**EVERY LIFE, EVERY HOME, AND EVERY VISITOR EXPERIENCE** is important to the long-term economy and livability of Fort Lauderdale. In addressing flooding and tidal inundation, the panel believes that everyone has a role and everyone's voice needs to be heard, but forward movement is critical if Fort Lauderdale is going to be ready for the future. The city should continuously encourage new ideas and new points of view on how to address this complex and critical issue, but balance process with the need to take action.

The infrastructure that is the focus of this panel might be in place for decades to come, perhaps half the lifetime of the children living in Fort Lauderdale today. The panel applauds the city's effort to tackle this issue and focus on flooding and tidal inundation specifically. It encourages the city to embrace the opportunities presented in this report to take a comprehensive, long-term approach to flood adaptation and address flood resilience for Fort Lauderdale.

# Appendix

## Resilience Adaptation Toolbox

Solution	SCALE				INTERVENTION TYPE			RISK ADDRESSED				COST	RESPONSIBILITY
	Building	Street	Neighborhood	City	Infrastructure	Policy	Program	Storm Surge	Tidal Inundation	Groundwater Table Rise	Surface Flooding from Rain		
<b>Site/building level</b>													
Seawalls	x	x		x	x			High	High			Medium	Individual owners and city
Home elevation	x				x			Medium	High		High	High	Property owners
HVAC/electrical systems	x				x				Medium		High	Low	Property owners
Stormwater improvements	x				x				Low	Low	Low	Low	Property owners
Building or site "hardening"	x				x			Medium	Medium		Medium	Medium	Property owners
<b>Street level</b>													
Tidal valves		x	x		x				High		High	High	City
Pumps		x	x		x				High		High	High	City
Subsurface storage		x			x				Medium	High	High	High	City
Roadside swales		x			x						Low	Low	City
Alternate means of access	x	x			x				Medium		Medium	Low	Homeowners associations
Roadway elevation		x			x			High	High	High	High	High	City and/or homeowners associations
Roadway inversion					x			Low	Medium	Low	High	High	City and/or homeowners associations
<b>Neighborhood level</b>													
Green infrastructure		x	x		x			Medium	Medium	Medium	Low	Medium	City
Stormwater upgrades		x			x			Medium	Medium		High	High	City
Utility upgrades		x			x			Medium	Medium		High	High	Private utilities
Resilience parks		x	x		x			Low	Medium	Low	High	High	City
<b>City level</b>													
Seawalls	x	x		x	x			High	High			Medium	Individual owners and city
Deployable gate				x	x			High	High			High	City and regulatory agencies
Land reclamation				x	x			High	High		Medium	Medium	City
<b>Programmatic</b>													
Land use and zoning code standards	x			x		x		Low	Low	Low	Low	Low	City
Flood risk disclosures	x			x		x		Low	Low		Low	Low	City and private sector
Buyout and community-led relocation	x			x			x	High	High		Medium	Medium	City and community
Insurance	x			x			x	Low	Low	Low	Low	Low	Private sector
Loan program	x			x			x		Medium		Medium	Medium	City
Flood warning systems				x			x	Low	Low		High	Medium	City

# About the Panel

## Jim Heid

Panel Chair  
Healdsburg, California

Jim Heid is an infill developer and strategic real estate adviser concentrating on real estate development as a tool to create better communities. He founded CRAFT DnA to focus on incremental development and intentional place-building as a successor to his boutique consultancy, UrbanGreen. For over two decades, UrbanGreen pioneered community sustainability strategies for public- and private-sector clients. Heid's leadership in this space is evidenced by his role leading an international team to develop next-generation sustainable development standards for the Emirate of Abu Dhabi.

An active member of ULI, Heid has participated in more than 16 Advisory Service panels, chairing panels for Tower Renewal for Resilience in Toronto, Canada (2019); Place Branding Strategies for Napa's Oxbow District, Napa, California (2018); Bridging the Divide Through Resilience, St. Tammany Parish, Louisiana (2015); Building Resilience and Prosperity, Northern Colorado (2014); and Federal Government Relocation Evaluation, Moscow, Russia (2011).

Heid's book (*Building Small: A Toolkit for Real Estate Entrepreneurs*, ULI, 2021) has received national acclaim from entrepreneurial developers across the United States and captures his current focus on the importance of small-scale, incremental approaches to building community. With the success of *Building Small* and his twice-yearly Small-Scale Developer Forum, Heid launched [buildingsmall.mn.co](http://buildingsmall.mn.co), an online community for small developers. Now in its second year, the private network is approaching 1,000 members, filling a significant gap for experienced and emerging developers who want to build small.

Trained as a landscape architect at the University of Idaho, Heid went on to receive a master in real estate development from Massachusetts Institute of Technology (MIT) to more effectively integrate economics, development, and design thinking.

## Allison H. Anderson

Bay St. Louis, Mississippi

Allison Anderson is recognized for civic projects that are carefully crafted and inherently defensible against climate challenges. After Hurricane Katrina devastated her community, her firm, unabridged Architecture, incorporated adaptation and resilience into its established practice. She is a national leader in resilience and adaptation in the built environment.

During this period of unprecedented changes to the global environment, Anderson leads efforts to build wisely with the climate. With experience in diverse climates from Honolulu to Las Vegas to the Gulf of Mexico, she adapts designs to local conditions and creates appropriate solutions for new buildings and the preservation of existing buildings by integrating vernacular forms and transitional spaces. Community leadership in landscape conservation, smart growth, and urban restoration before Hurricane Katrina created a demand for high-performance solutions to be constructed along the Gulf Coast after the storm; the firm she founded, unabridged Architecture, responded with a deep understanding of the importance of place and tradition within the context of modern designs for community rebuilding.

Anderson was the first Leadership in Energy and Environmental Design (LEED)-accredited professional in Mississippi in 2002, a direct outgrowth of the lessons of climate conscience from the University of Southern California undergraduate program. She has taught architecture at the University of Texas, Louisiana State University, and Tulane University, including design studios at every level, plus aesthetics, design process, site design, portfolio, graphics, and other topics. She became a Fellow of the American Institute of Architects (AIA) in 2014.

Anderson leads research efforts at unabridged Architecture, focusing on resilience, coastal hazards, and adaptation. Her firm has won the AIA Award for Architecture, the COTE Top Ten Award for building performance and design, and the American Architecture Award. Anderson has served on the AIA Board Committee on Climate Action and Design Excellence and the Framework for Design Excellence Task Force. She has been a volunteer member of the scientific Gulf of Mexico Alliance

Community Resilience Team since 2010, bridging the gap between science and planning.

Anderson earned a bachelor of architecture from the University of Southern California in 1984 and a master of architecture from the University of Texas in 1990.

Anderson has written or contributed to a number of publications, including *Climate Adaptation for Architects*, “AIA Framework for Design Excellence,” “AIA Resilient Project Process,” “AIA Climate Action Business Playbook,” and “Adapting to Climate-Sensitive Hazards through Architecture.”

## Chris DeWitt

Williamsburg, Virginia

Chris DeWitt is a planner with 30 years of public- and private-sector experience. He is currently a principal with VHB, where he serves as Mid-Atlantic Planning + Design Service Leader. Throughout his career, he has focused on community-driven placemaking and design of public open space, parks, and active mobility improvements. DeWitt received a bachelor of city planning from the University of Virginia and is a member of the American Institute of Certified Planners, the ULI Virginia Regional Livable Communities Council, the Association of Pedestrian and Bicycle Professionals, and the Rails-to-Trails Conservancy. He has delivered presentations to a variety of conferences, including the annual American Planning Association—Virginia Chapter conference.

DeWitt began his career as a planner with Gloucester County, Virginia, where he helped implement the county’s Chesapeake Bay Preservation Ordinance and update the Comprehensive Plan, Zoning Ordinance, and Subdivision Ordinance. While with Gloucester County, DeWitt authored a grant application and helped manage the design of the Gloucester Courthouse Streetscape Improvements. He also represented Gloucester County on the regional Transportation Technical Committee.

During his tenure with VHB, DeWitt has managed the planning and design of local and regional streetscapes, trails, and parks, including the Mathews Main Street Enhancements, the

Virginia Capital Trail in Richmond, the Dismal Swamp Canal Trail in Chesapeake, the Friendly City Trail in Harrisonburg, and the James River Park Master Plan in Richmond. His work has also taken him to North Carolina’s Outer Banks, where he has managed the planning and design of the Town Park and Complete Streets in Duck and the Soundside Event Site in Nags Head.

DeWitt has also worked throughout the East Coast on projects with the National Park Service, including parks and recreation planning at locations such as Delaware Water Gap, Cape Cod National Seashore, and Roosevelt-Vanderbilt National Historic Sites. In his current role as Planning + Design Service Leader, he oversees VHB’s delivery of landscape architecture, urban design, and community planning projects throughout the Mid-Atlantic region.

## Hannah Glosser

New York, New York

As a director based in New York, Hannah Glosser works at the intersection of climate, community planning, and housing. Glosser is a leader in HR&A’s climate practice, where she advises governments, community-based organizations, and philanthropy on how to steer investments in decarbonization and climate adaptation. Working closely with the federal government, she provides technical assistance to communities across the United States on how to advance building upgrades in low- and moderate-income housing, tapping into new federal funding opportunities. To inform decision-making and infrastructure funding strategies, she evaluates the economic and social impacts of climate risks and climate adaptation investments for residents, businesses, property owners, and local governments. Making climate science more accessible, she engages the public through interactive open houses, community meetings, and surveys.

Before joining HR&A, Glosser worked at 100 Resilient Cities (100RC), managing the 100RC tools portfolio, which supported resilient strategy development and implementation in numerous cities. This also included leading capacity-building workshops in

cities, advising on tactical urbanism projects, and training city officials and staff. Glosser holds a bachelor of arts in political science from Colorado College.

## Charnelle Hicks

Philadelphia, Pennsylvania

Charnelle Hicks is president of CHPlanning Ltd., a firm specializing in land use, environmental, community, and airport planning, headquartered in Center City, Philadelphia. She has nearly 25 years of experience in transportation planning, comprehensive and regional planning, economic development, and public outreach.

In addition, Hicks has management consulting experience in business organizational development and frequently shares her professional knowledge on expert conference panels. Most recently, she gave a keynote address to the City Planning and Urban Design Conference 2016 in Istanbul, Turkey.

Hicks holds a bachelor of arts from Swarthmore College and a master of regional planning from the University of North Carolina. She is a member of the American Institute of Certified Planners and holds a New Jersey professional planners license. She is also a certified instructor for the Pennsylvania Municipal Planning Education Institute, where she provides in-depth planning, zoning, and subdivision instruction to elected officials, planning commissioners, zoning hearing boards, and zoning officers throughout Pennsylvania.

## Malaika Rivers

Atlanta, Georgia

Malaika Rivers is the founder and president of Pontem Resources. She helps businesses and governments work together to imagine and build great places. Rivers navigates clients through complex public/private partnership strategies to create and fund critical infrastructure. Her efforts result in cost-sharing development strategies that provide outsize returns for stakeholders.

Currently, Rivers is advising CIM, the development partner of the Atlanta Hawks, as it undertakes one of the nation's most prominent sports and entertainment districts, an 8 million-square-foot, 50-acre, \$5 billion redevelopment project in the center of Atlanta known as Centennial Yards. Prior to this, Rivers worked with the Atlanta Braves on Truist Park and the Battery, the highly successful 2 million-square-foot stadium and mixed-use development now emulated by sports teams nationwide.

The foremost expert on community improvement districts (CIDs), Rivers advises both business and government clients on these legislatively enabled special assessment districts as powerful development tools. She currently leads the efforts of more than 100 office, industrial, and retail property owners in a fast-growing metro Atlanta submarket. Before that, she led the efforts of Georgia's first CID for over two decades. Under her leadership, the area successfully leveraged \$140 million in commercial real estate value into more than \$2 billion in capital improvements. This advanced \$3 billion worth of real estate development, representing an additional 6 million square feet in office, retail, hotel, and multifamily products.

Rivers is one of the 100 Influential Women to Know, Georgia 500, and 25 Power Women to Watch. She received her bachelor from Virginia Tech and her Certificate of Management Excellence from Harvard Business School. She frequently contributes to various media outlets and publishes forward-thinking reports, including how CIDs may be positioned at the forefront of smart cities and digital transformation.

## Byron Stigge

Brooklyn, New York

Byron Stigge is the founder of Level Infrastructure, an engineering consulting firm based in New York City. Level Infrastructure's specialty is urban infrastructure design, with a focus on integrating principles of sustainability and resilience. His work in the United States includes Rebuild by Design, where he developed the concept for The Big U to respond to flood risk in New York City.

Stigge worked with HR&A on the U.S. cities involved in the 100 Resilient Cities program with the Rockefeller Foundation. Abroad, Level's resilience work includes a citywide infrastructure reconstruction plan for the city of Kabul, Afghanistan, with World Bank Group, and a resilience plan for New Clark City in the Philippines with Asian Development Bank. Level's expertise in transportation, stormwater management, water and wastewater systems, energy, and solid waste allows an integrated approach to building resilience across all infrastructure sectors.

Stigge has lectured and taught at Harvard, Columbia, MIT, Yale, Washington University in St. Louis, and Cornell. He has engineering degrees from Washington University in St. Louis and MIT and a planning degree from Harvard Graduate School of Design. He is the coauthor of *Infrastructural Ecologies* (MIT Press, 2016) and is on the Board of Directors of the Urban Design Forum.



Urban Land Institute  
2001 L Street, NW  
Suite 200  
Washington, DC 20036-4948  
[uli.org](http://uli.org)



ULI Southeast Florida/Caribbean  
500 West Cypress Creek Road  
Suite 120  
Fort Lauderdale, FL 33309  
[sefflorida.uli.org](http://sefflorida.uli.org)