

Florida Community Resiliency Initiative Pilot Project

Adaptation Plan *for Escambia County, Florida*

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EXECUTIVE SUMMARY

Florida communities like Escambia County are already experiencing the adverse impacts of rising seas, more intense storms, and heavier downpours. The Florida Department of Economic Opportunity's Coastal Resiliency Initiative helps communities assess vulnerabilities to projected increases in coastal flooding and develop strategies to make affected areas more resilient.

This report is intended to complement Dewberry's Vulnerability Assessment and to provide Escambia County with a framework for pursuing coastal resiliency. The Vulnerability Assessment draws on data from federal agencies and on inputs from Escambia County officials and community members in order to characterize the nature, implications, and certainty of the most important ways in which Escambia County is vulnerable to the impacts of sea level rise (SLR) and changing weather patterns. The present document identifies tools available to Florida localities that might serve to effectuate appropriate responses to those vulnerabilities. At the City's request, it also identifies legal, political, economic, among other limits on the county's potential resiliency initiatives.

Information contained in the Strategic Adaptation Plan

Reference material. On the October 26, 2016 the Sabin Center for Climate Change Law, Dewberry, and state and local partners convened a Preliminary Workshop to introduce and discuss development of a Strategic Resiliency Plan. Some of the information covered in this document may be familiar to participants in that workshop, but has been included to provide a resource that officials and others can draw on as a reference point. For instance, the Preliminary Workshop introduced the Protection-Accommodation-Retreat adaptation rubric and a number of land use policy tools (including setbacks, transferrable development rights and conservation easements) suitable for coastal localities that want to adapt themselves to rising seas. However, many residents of Escambia County and at least some political representatives are likely unfamiliar with this material. Accordingly, we have referenced herein a robust universe of material, including material relevant to prioritizing particular resiliency measures. So that users of this report can get easy access to the documents referenced in its footnotes, including those that might sit behind paywalls, those documents have been stored using permanent internet hyperlinks.

Legal reference material. This document does not contain legal advice for Escambia County. Its descriptions of legal issues such as sovereign immunity and takings law do not tell a lawyer for the county everything they would need to know in order to anticipate the legal implications of a particular policy agenda. Descriptions of legal issues instead provide a summary—for lawyers and non-lawyers—of how the law might push, tether, or prohibit particular parties in relation to various rights and obligations implicated in actions intended to better adapt to changing environmental circumstances.

Summaries of key vulnerabilities. Dewberry’s Vulnerability Assessment provides an accessible, authoritative snapshot of the challenges facing Escambia County now and in the foreseeable future. This document’s short summaries of key vulnerabilities draw on that Assessment and on comments made during the Preliminary Workshop. Readers can refer the adaptation measures discussed in section 5 of this document directly to Dewberry’s Assessment, but section 3’s summaries make internal cross references available as well.

Circumstances unique to Escambia County. Discussion at the Preliminary Workshop brought to aspects of Escambia County’s situation that are critically important to prospective adaptation efforts. The most salient of these features, which section 4 discusses at greater length, are as follows:

- SLR is an urgent issue for Escambia, but not an emergency;
- Stormwater management system capacity is low and its improvement and upkeep would benefit from intergovernmental coordination;
- The county must vie with shrinking Special Flood Hazard Areas (SFHAs), due to proposed revisions of Flood Insurance Rate Maps;
- Encroaching seas will put pressure on Escambia’s responsibilities to preserve the coastal habitats of endangered and threatened species.

Potential responses to key vulnerabilities. Much of this document describes important parts of the context in which adaptation efforts would occur. Section 5 discusses adaptation measures that could serve adaptation efforts in Escambia County.

Suggestions for Adaptation in Escambia County

The following list summarizes proposals set forth in this report and notes the section(s) that discuss a particular proposal more fully. The first two proposals are overarching and meant to inform the way not just one but multiple adaptation measures are developed and implemented. The remaining proposals focus on policy tools or vehicles that can be applied to various vulnerabilities and on particular problems or decisions facing the city.

The two overarching proposals are as follows:

- *Identify opportunities to give stakeholders—business- and property-owners and the public at large—notice about what SLR impacts and policy responses to expect in the foreseeable future*

This suggestion appears in multiple places and forms throughout this document. Conveying to stakeholders how rising seas and changing weather are expected to affect the county will serve several purposes, chief among them facilitating better private investment decisions and ensuring adaptation efforts do not collide with opposing expectations on the part of the public. In many instances, this notice may occur by requiring private parties to give or take notice of known risks, for instance by requiring

disclosure in real estate transactions of the frequency and height of all types of flooding that affect the property, or by a survey of the capacity and state of repair of existing coastal armoring. It can also be given through, for instance, a well-publicized survey of the capacity and state of repair of existing coastal armoring and wetlands. In other instances, it might accompany revisions to the Future Land Use comprehensive plan element or announced changes to infrastructure location or capacity. Sections 2.1, 4, and 5 discuss various approaches to giving notice to stakeholders and the wider public about vulnerabilities and responses.

- *Build the case for adaptation using analytic tools that capture avoided costs*
Preliminary Workshop participants emphasized that the county’s residents and political leaders can be persuaded to take all manner of prudent adaptation measures, but that they would demand solid evidence of those measures’ prudence in advance. Section 5.3 discusses suitable analytic tools for this purpose, as well as examples of those tools’ application in the adaptation and hazard mitigation contexts. As that section notes, a critical component of arguments in support of most any proposal to address emerging vulnerabilities is an estimate of the costs of doing nothing. In addition to the discussion in section 5.3, sections 2.2.2 (Takings), 5.1 (Priority-Setting), 5.4.2 (Coastal management), 5.4.3 (Bridges), and 5.4.4 (Wastewater and stormwater systems) build on this suggestion.

Section 5.2 discusses the following three types of policy vehicles:

- *Engage in pre-disaster planning for post-disaster policy changes (section 5.2.1)*
Disasters highlight topography, systems, and structures that are vulnerable. Thus, in addition to causing damage, disasters also convey information. Ordinances and comprehensive plan elements can make use of that information by making the occurrence of a disaster a trigger for changes to land use restrictions or levels of service for vulnerable infrastructure segments. For Escambia, such a change could, for instance, provide the basis for restricting post-disaster permitting in highly vulnerable areas on barrier islands or coastlines—or near coastlines where communities and infrastructure are likely to become vulnerable to flooding risks in the foreseeable future.
- *Make levels of service or capital spending allocations contingent (section 5.1.2)*
Although Escambia County is not experiencing routine nuisance flooding of infrastructure such situations could be in the offing in higher SLR scenarios. Recognizing what is coming and acting now, when doing so would not be likely to have widespread or significant immediate effects on levels of service, could prepare the county well. Specifically, the county should consider adopting policies that limit spending in instances where retreat or redesign would be more cost-effective than reconstruction or hard armoring. The same can be said for planned capital investments.

- *Designate Adaptation Action Areas (AAAs) (sections 2.1.4 and 5.2.3)*

An AAA is a highly flexible form of zoning overlay that the Florida legislature devised for the purpose of facilitating local adaptation planning in the face of the impacts of SLR. Within the boundary of an AAA,** Escambia could employ one or more policies that are distinct from what governs other parts of the county. And, because Florida law leaves it to localities to devise criteria for designating AAAs, Escambia would have the option not only to choose where to draw the AAA's boundary but whether to do so in a way *that is expressly subject to change as environmental circumstances change*. Such an approach can send a powerful signal about future conditions *and* regulatory responses to those conditions.

In addition to its overarching suggestions and the three policy vehicles just described, this document also proposes the following more specific adaptation measures:

- *Act now to address the proposed revision to county Flood Insurance Rate Maps (FIRMs) (section 5.4.1)*

FEMA's updated FIRMs for Escambia County are still preliminary and will not become effective before February 2018; no date has been set for appeal. The county should consider two responses to that change. First, it should appeal the preliminary maps and request a reevaluation of the historical events selected to inform their statistical basis. Second, if the first option is not politically feasible or fails to generate different results, the county should consider adopting some form of policy-substitute, perhaps using an AAA designation, in locations where the FEMA floodplain will shrink upon the preliminary maps becoming effective.

- *Lay the groundwork for eventual retreat from the barrier islands (section 5.4.2)*

Different SLR scenarios have widely different implications for communities on the county's barrier islands. However, as section 3.1.2 (Flooding hotspots) explains, it is not a question of whether they will become highly vulnerable to destructive wave action, but when. Recognizing what this will mean, the county should pursue three objectives: restricting further development there; facilitating eventual and voluntary retreat, perhaps by establishing a transferrable development rights (TDR) scheme; and helping residents and businesses strike a balance between investing in accommodation and *not* investing needlessly in assets that will likely be stranded by rising seas before the end of their useful life.

- *Study the counties' bridges to determine when SLR-driven flood risk will require their redesign (section 5.4.3)*

** As is noted in section 5.b.iii, Preliminary Workshop participants indicated that overlay zones have worked well in Escambia, but that AAAs hold limited appeal. Because of their versatility, this document nonetheless recommends that the county consider making use of one or more AAAs—even if it refers to them by some other name.

Bridges require repair and eventually replacement. At present, many of Escambia County's bridges do not suffer significant vulnerabilities to routine flooding—or even severe flooding. However, this is likely to change in the coming decades. While the need to evaluate various bridges' design parameters is not pressing, timing any needed design changes to coincide with preexisting repair or replacement schedules would avoid needless spending. Thus Escambia should review its bridges' repair and replacement schedules, compare them to projections in Dewberry's Vulnerability Assessment, and seek to coordinate these timeframes so as to optimize the costs of county-wide bridge upkeep.

- *Stormwater: make system-wide and targeted improvements, and explore alternative fiscal arrangements (section 5.4.4)*

The county should consider several measures, all of them complementary, for closing the present gap between stormwater management system capacity and the level of service required of the system now and in the foreseeable future as SLR and weather make circumstances increasingly difficult. Substantive improvements include: more aggressive support for Low Impact Development / Green Infrastructure on public and private property; targeted investments in components in need of repair, replacement, or redesign; and a more systematic approach to enforcement of detention pond maintenance by private property owners. (The last of these three could begin with a pilot study.) Paying for some or all of these and other measures would be helped by revising the county's current fiscal approach to stormwater, which relies unduly on a one-time drainage impact fee. Section 5.4.4 also discusses possible alternatives to this approach, including a higher one-time fee and a stormwater utility fee.

What is not in this document?

This document does not contain instructions for Escambia County about how to respond to its changing environmental circumstances. It does not contain an exhaustive list of adaptation options, or a map of the legal issues the county might encounter if it opts for one approach instead of another. Instead, it contains information about the challenges that Escambia already faces and can expect to face as sea level rises, information about approaches other localities have taken to similar challenges, and proposals and measures—all of which would need to be fleshed out and refined before they could be considered for implementation by one or more of the county's departments.

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Introduction: Sea Level Rise in Florida and the Coastal Resiliency Initiative

Florida communities are experiencing adverse effects of sea level rise (SLR), stronger coastal storms, and more intense precipitation events,¹ and these effects are expected to become increasingly severe in the coming years and decades.² Seeing what is happening now and recognizing what lies ahead, a number of Florida communities have begun working to adapt to present and projected impacts.³ Although Florida communities have taken somewhat diverse approaches to adaptation, their efforts have generally aligned with the approach suggested in the National Oceanic and Atmospheric Administration’s U.S. Climate Toolkit: 1) identify climate-related changes and risks, 2) assess vulnerabilities, 3) investigate possible responses, 4) prioritize responses to achieve near- and longer-term adaptation goals, and 5) execute and evaluate outcomes.⁴

The Florida Department of Economic Opportunity (DEO) is leading the pilot phase of the Community Resiliency Initiative in partnership with the Florida Department of Environmental Protection and with support from the Division of Emergency Management and the National Oceanic and Atmospheric Administration. The Initiative provides technical assistance to coastal communities in Florida that want to integrate effective adaptation and improved resiliency into their plans for development in the midst of SLR. By inviting localities to take the lead, the Initiative ensures that the efforts it supports are consistent with local circumstances and priorities regarding public safety, the economy, natural resources, and others.

Escambia County is one of three localities participating in the Community Resiliency Initiative pilot, which entails tasks that correspond to the second and third steps of the Climate Toolkit approach to adaptation listed above. Concretely, the Initiative will provide Escambia with a Coastal Vulnerability Assessment and this Adaptation Strategic Plan. During Phase I of the Initiative, Dewberry, Inc. developed the Coastal Vulnerability Assessment in collaboration with local stakeholders. The Assessment integrates multiple layers of mapping information—

¹ L.M. Carter et al., *Ch. 17: Southeast and the Caribbean*, in *Climate Change Impacts in the United States: The Third National Climate Assessment* 396, 400–05 (J.M. Melillo et al., eds., 2014), <https://perma.cc/8AG2-7ASJ>; Florida Oceans and Coastal Council, *Climate Change and Sea-Level Rise in Florida: An Update of “The Effects of Climate Change on Florida’s Ocean and Coastal Resources.”* [2009 Report] (2010), <https://perma.cc/44Q3-EUMJ> (discussing effects of SLR on coastal ecosystems and infrastructure).

² U.S. Global Change Research Program, Chapter 1: Overview and Report Findings, in *Climate Change Impacts in the United States: The Third National Climate Assessment* 8 (Jerry M. Melillo, Terese (T.C.) Richmond, and Gary W. Yohe eds., 2014), <https://perma.cc/6S2L-66DV>.

³ *See, e.g.*, Kathryn Frank et al., *Planning for Sea Level Rise in the Matanzas Basin: Opportunities for Adaptation* (Aug. 2015), <https://perma.cc/X593-XYNX>; James W. Beever III et al., *Southwest Florida Regional Planning Council, Lee County Climate Change Resiliency Strategy* (Oct. 6, 2010), <https://perma.cc/B5XT-EBGZ>.

⁴ U.S. Climate Resilience Toolkit, *Overview: Steps to Resilience*, <https://perma.cc/PAA4-3BMP> (last updated Nov. 16, 2016); *see also* Katherine Jacobs, Tom Wilbanks, et al., *National Academies of Sciences, Adapting to the Impacts of Climate Change* 135 fig. 4.1 (2010) (suggesting similar process), <https://perma.cc/D3DX-G3RR>. The Centers for Disease Control and Prevention (CDC) has developed a similar framework for improving community resilience. *See* Centers for Disease Control and Prevention, *CDC’s Building Resilience Against Climate Effects (BRACE) Framework*, <https://perma.cc/E6PG-538W>, (last updated Oct. 22, 2015).

topography, facilities and infrastructure locations, weather and flooding patterns, and SLR projections for the coming decades—and reflects stakeholders’ input stakeholders regarding the location and nature of local vulnerabilities.⁵ Faculty and staff at Columbia Law School’s Sabin Center for Climate Change Law and Professor Keith Rizzardi of the St. Thomas School of Law developed this Adaptation Strategic Plan using Dewberry’s Coastal Vulnerability Assessment and based on the input gathered from stakeholders in a Preliminary Workshop on October 26, 2016. Whereas Dewberry’s consultation with stakeholders clarified the location and nature of particular vulnerabilities, the Preliminary Workshop put those vulnerabilities into a policy and legal context and began to identify potential responses.

This Introduction has noted the programmatic context for Escambia’s adaptation efforts. The rest of this Adaptation Strategic Plan proceeds in five sections. Section 1 summarizes the generic adaptation framework and goals that are basic to this Plan. Section 2 describes the relevant legal context—it covers not only materials that were presented to stakeholders at the Preliminary Workshop but also additional information about requirements and limits for local action in support of adaptation. Section 3 reviews the vulnerabilities that Dewberry identified and that Preliminary Workshop participants discussed in more detail. Section 4 discusses local and regional circumstances relevant to both vulnerabilities and potential responses, with a particular focus on coastal development and the impacts of nuisance flooding on the management of stormwater, roads, and bridges. Section 5 discusses priority-setting potential responses to local vulnerabilities.

1. Conceptual Framework for Adaptation

This section introduces general answers to several key questions: What does adaptation to SLR involve? What does it aim to achieve? What policy tools are available to pursue those aims? What measures should take priority over others?

1.1 What does adaptation to SLR involve?

Answers to the first question sometimes use different terminology, but consistently describe the same basic measures for coastal communities confronting SLR:

- **protecting** current land uses and activities in vulnerable areas;
- **accommodating** SLR by modifying current uses and activities to reduce vulnerabilities;
- **retreating** from places vulnerable to SLR; or

⁵ Dewberry’s Coastal Vulnerability Assessment based its projections of SLR on those issued by NOAA in 2012 and the Army Corps of Engineers in 2015. Escambia County Vulnerability Assessment at 9–11 [hereinafter “EC VA”]; *see also* Adam Parris et al., NOAA, Global Sea Level Rise Scenarios for the United States National Climate Assessment: NOAA Tech Memo OAR CPO-1 (Dec. 2012), U.S. Army Corps of Engineers, Climate Change Adaptation: Sea-Level Change Curve Calculator (2015.46).

- **avoiding** development in locations where structures or people would be vulnerable.⁶

Protecting part of a coastline means interposing barriers between rising seas and landward infrastructure, assets, and people with the goal of preventing SLR from disrupting or otherwise forcing changes to existing landward patterns of economic and other activity. This category of adaptation measures uses “hard armoring,” such sea walls or revetments (see Figure 1 below), and “soft armoring,” such as beach renourishment or living shorelines. Although hard armoring measures can give the impression of preserving a given shoreline segment permanently and cheaply, such measures tend to displace wave action rather than abating it, causing the waves’ force to carve away—“scour”—the soils or sands adjacent to or seaward of the armored area, while also preventing natural erosion processes from replacing what is scoured away.⁷ This tends to create expensive problems over time.

Figure 1. Revetment in Santa Cruz, California (note the absence of a sand beach).⁸



⁶ South Florida Regional Planning Council, *Adaptation Action Areas: A Planning Guidebook for Florida’s Local Governments Regional Climate Action Framework: Implementation Guide 50–62* (2015), <https://perma.cc/2H39-7WUC>; John R. Nolon, *Protecting the Environment Through Land Use Law: Standing Ground 221* (2014).

⁷ South Florida Regional Planning Council, *Adaptation Action Areas: Policy Options for Adaptive Planning for Rising Sea Levels 17–18* (Nov. 2013), <https://perma.cc/U2NZ-TZMG> (“Many studies report that hard armoring does more damage in because flooding and erosion on neighboring properties can be exacerbated and natural resources such as beaches and wetlands can be damaged or stunted from migrating naturally”); Molly Loughney Melius et al., *2015 California Coastal Armoring Report: Managing Coastal Armoring and Climate Change Adaptation in the 21st Century 8–11*, (2015) <https://perma.cc/9AQA-4EXH> (describing adverse effects of hard armoring).

⁸ Gary B. Griggs, *The Effects of Armoring Shorelines—The California Experience*, in *Puget Sound Shorelines and the Impacts of Armoring—Proceedings of a State of the Science Workshop*, May 2009 (Hugh Shipman et al., eds. 2010), <https://perma.cc/FN54-7425>.

Soft armoring, sometimes also called “natural infrastructure,” is generally favored by scientists, planners, and civil engineers relative to hard armoring, but is usually feasible only where development (i.e., asphalt, concrete foundations, structures, and infrastructure) can be displaced or has not encroached too close to the water’s edge.⁹

Accommodation means changing how land in the path of SLR is used so that the assets and people engaged in or reliant on those uses are made less vulnerable. Examples of physical accommodation include elevating buildings, moving mechanicals from basements to upper floors or rooftops, up-rating machinery and infrastructure to endure inundation by saltwater, and retrofitting stormwater management systems with one-way valves that allow stormwater to drain into the ocean but prevent seawater from flowing to low-lying streets (see Figures 2 and 3, below).

Figure 2. Building floodproofing options for different FEMA-designated zones.¹⁰

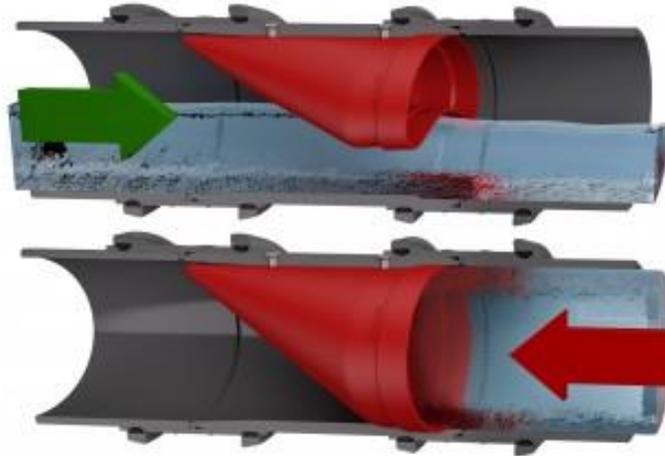
	A ZONE		V ZONE
FLOOD PROTECTION STRATEGY	DRY FLOODPROOFING WATERTIGHT STRUCTURE e.g. FLOOD SHIELDS	WET FLOODPROOFING WATER TO RUN-IN / RUN-OUT e.g. FLOOD VENTS	ELEVATED STRUCTURE VIRTUALLY OPEN STRUCTURE e.g. OPEN LATTICE
GROUND FLOOR CONFIGURATION			
	<p>LOWEST OCCUPIED FLOOR ALLOWED TO BE EXCAVATED BELOW GRADE NOT PERMITTED FOR ENTIRELY RESIDENTIAL BUILDINGS</p>	<p>LOWEST OCCUPIED FLOOR TO BE AT OR ABOVE DESIGN FLOOD ELEVATION</p>	<p>BOTTOM OF LOWEST STRUCTURAL MEMBER TO BE AT OR ABOVE DESIGN FLOOD ELEVATION</p>
PERMITTED USE BELOW DFE	<ul style="list-style-type: none"> ✓ PARKING ✓ ACCESS ✓ STORAGE ✓ NON-RESIDENTIAL ✗ RESIDENTIAL 	<ul style="list-style-type: none"> ✓ PARKING ✓ ACCESS ✓ STORAGE ✗ NON-RESIDENTIAL ✗ RESIDENTIAL 	<ul style="list-style-type: none"> ✓ PARKING ✓ ACCESS ✓ STORAGE ✗ NON-RESIDENTIAL ✗ RESIDENTIAL

⁹ Robert Verchick & Joel Scheraga, *Protecting the Coast, in The Law of Adaptation to Climate Change: United States and International Aspects* 18–19 (Michael B. Gerard and Katrina Kuh, eds., 2012).

¹⁰ See, e.g., City of New York Department of City Planning, *Coastal Climate Resilience: Designing for Flood Risk* 16–17 (June 2013), <https://perma.cc/7VWS-BLFL>.

“BFE” indicates base flood elevation; “DFE” indicates design flood elevation, which in New York City is BFE plus freeboard requirements designated for particular areas and building types.

Figure 3. Diagram of tidal backflow prevention insert.



Flexible insert gives way to water flowing from one direction but blocks water flowing from the other.

Accommodation also encompasses changes not just to physical structures but to systems and information—such as revised emergency planning protocols or mandatory notices in real estate transactions for vulnerable properties—and patterns of use—such as shifting commuter car traffic away from a coastal route to a more landward one.

Partial or full retreat involves abandoning land made vulnerable by rising seas and is appropriate in situations where SLR makes continued use and maintenance of existing structures—even in modified form—prohibitively costly. Retreat is conceptually simple, but establishing criteria and implementing decisions to retreat is nearly always complex and politically difficult.¹¹ In particular, efforts to undertake retreat often raise contentious questions about ownership, value, and liability in relation to assets that are to be moved, demolished, or left behind. Even more fundamentally, retreat tends to strain community cohesion and residents’ shared sense of place.

Retreat necessarily involves avoiding new development in the area being abandoned to rising seas. Whether such avoidance follows retreat or precedes any effort to develop a vulnerable area in the first place, it entails a prohibition on development. Thus while the result of

¹¹ See C. Kousky, *Managing shoreline retreat: a US perspective*, 124 *Climatic Change* 9, 9 (2014), <https://perma.cc/GGL2-DESG> (“Retreat could be left to the market . . . however, the market is unlikely to lead to optimal levels or types of retreat in all locations.”).

this strategy is avoiding new vulnerabilities, it can usefully be thought of as a prohibition on imprudent development.¹²

In rare instances, a community might adopt measures that fit squarely and exclusively into just one of the foregoing four adaptation categories. The Quinault Tribe of Washington State, for instance, is not repairing the sea wall that is losing the battle to protect its village of Taholah from the encroaching Pacific Ocean.¹³ Instead, the tribe is simply retreating. That is, they are moving the whole village, which is home to about 700 people, to higher ground.¹⁴ But their case is exceptional; more often, coastal communities looking to adapt will make use of all four of the foregoing types of measures in combination.

1.2 What does adaptation aim to achieve?

Using some combination of the approaches described above, coastal communities vulnerable to SLR generally pursue one or more—or all—of the following five goals:

- make infrastructure and the built environment robust to expected changes;
- make systems—physical or organizational—that are vulnerable to SLR more flexible by altering and/or moving their components;
- enhance the ability of natural systems to reduce vulnerabilities;
- identify maladaptations and begin undoing them; and
- inform the public about the short- and long-term risks that SLR will create.¹⁵

Some of these goals obviously complement each other: for instance, making built systems more flexible can involve enhancing neighboring natural systems' capacity for resilience. However, some of these goals can potentially conflict: for instance, making infrastructure robust to change can mean reinforcing rather than undoing maladaptations. Just as conflicting adaptation measures make each other less cost-effective, ensuring that adaptation efforts are mutually supportive is a means of avoiding unnecessary expense.¹⁶

1.3 What policy tools are available to pursue these aims?

In the Preliminary Workshop conducted on October 26, 2016, we reviewed various policy tools available to localities seeking to adapt to SLR:

¹² *Id.* (“realistically, the actual choice may be allowing development to occur and persist past the optimal time or at a greater intensity versus preventing it altogether.”).

¹³ NOAA, U.S. Climate Resilience Toolkit, *Case Studies: Quinault Indian Nation Plans for Village Relocation*, <https://perma.cc/3PC4-79B3> (last updated Dec. 2, 2016).

¹⁴ *Id.*

¹⁵ Richard J.T. Klein & Richard S.J. Tol, *Adaptation to Climate Change: Options and Technologies, An Overview Paper*, United Nations Framework Convention on Climate Change Secretariat, FCCC/TP/1997/3, at 6 (Oct. 1997), <https://perma.cc/N52P-7EM6>.

¹⁶ See National Academies of Sciences, *supra* note 4, at 135 fig. 4.1 (noting importance of identifying opportunities for synergies and co-benefits across sectors).

- Transferable Development Rights;
- Incentives;
- Setbacks and Buffers;
- Building Codes and Design;
- Floodplain Regulations;
- Zoning and Overlay Zones;
- Hard- and Soft-Armoring Permits;
- Conditional Development;
- Rebuilding Restrictions;
- Stormwater Utility;
- Special Assessments;
- Impact Fees;
- Conservation Easements;
- Real Estate Disclosures;
- Coastal Land Acquisition Programs; and,
- Land Trusts.

The South Florida Regional Planning Council’s *Adaptation Action Areas Planning Guidebook*, and *Policy Options for Adaptive Planning For Rising Sea Levels*, both of which are available online,¹⁷ describe each of these tools. For example, whereas a conventional setback simply demarcates the line beyond which private property owners may not develop their property, a tiered setback restricts particular types development based on risk: bigger and less resilient structures must be set back farther than smaller and more resilient ones.¹⁸ A tiered approach to setback can be combined with use of annual erosion lines to demarcate where each tier begins.¹⁹ Georgetown Climate Center’s 2011 Adaptation Toolkit also provides a helpful set of summaries and more thorough descriptions of how each of these tools can be applied to the task of adapting to SLR.²⁰

In addition to describing these tools and noting examples of their use in particular localities (e.g., transferrable development rights in Monroe County, an overlay zone in Yankeetown, a stormwater utility in Bay County), the *AAA Planning Guidebook* also provides two tables that align each tool with a particular “management category”(for instance, “setbacks and buffers” align with shoreline conservation and also with stormwater management).²¹ As these tables show, a given tool can be useful for more than one category of infrastructure management or adaptation.

1.4 What measures should take priority over others?

Translating adaptation goals and tools into a plan for action means making a series of decisions, first about what the community wants, then about how much the community is willing to spend, and finally about how and when to allocate that spending among competing priorities. In practical terms, the last of these means deciding both what measures would be most cost-

¹⁷ Adaptation Action Areas Guidebook, *supra* note 6, at 50–62, <https://perma.cc/2H39-7WUC>; Policy Options for Adapting Planning, *supra* note 7, at 12–26, <https://perma.cc/U2NZ-TZMG>.

¹⁸ Adaptation Action Areas Guidebook, *supra* note 6, at 54.

¹⁹ *Id.*

²⁰ Jessica Grannis, Georgetown Climate Center, Adaptation Tool Kit: Sea-Level Rise and Coastal Land Use How Governments Can Use Land-Use Practices to Adapt to Sea-Level Rise 2–4, 19–62 (Oct. 2011), <https://perma.cc/L4KJ-PM6E>.

²¹ Adaptation Action Areas Guidebook, *supra* note 6, at 62, 132.

effective and the order in which they should be undertaken. The South Florida Regional Planning Council, recognizing that social, political, and economic factors—as well as technical ones—are highly relevant to the process of setting adaptation priorities, recommends use of the STAPLEE framework for decisionmaking.²² STAPLEE is intended to help organize a process that takes all of the following considerations into account:

- Social - The action should be socially acceptable.
- Technical - The action should be technically feasible, help to reduce losses in the long term, and have minimal cumulative and secondary impacts.
- Administrative - The action should be implementable by the state or local government.
- Political - The action should be politically acceptable.
- Legal - The state or local government must have the legal authority to implement/enforce the action.
- Economic - The action should be cost-effective and be likely to pass a benefit-cost analysis.
- Environmental - The action should meet statutory considerations and public desire for sustainable and environmentally healthy communities.²³

The Georgetown Climate Center’s Adaptation Tool Kit provides a summary illustration (see Figure 4 below) of how a version of the STAPLEE framework can be used to evaluate applications of the tools listed above:

²² *Id.* at 63; *see also* NOAA, *Adapting to Climate Change: A Planning Guide for State Coastal Managers* 52–53 (2010), <https://perma.cc/E4M2-M6Y7>; FEMA, *Developing the Mitigation Plan: Identifying Actions and Implementing Strategies* (2003), <https://perma.cc/56PU-K5CS> (listing STAPLEE factors in detail).

²³ NOAA, *Adapting to Climate Change: A Planning Guide for State Coastal Managers* 52–53 (2010), <https://perma.cc/E4M2-M6Y7> (citing FEMA, *Developing the Mitigation Plan: Identifying Actions and Implementing Strategies* (2003), <https://perma.cc/56PU-K5CS>).

Figure 4. SLR policy tools and criteria for decisionmaking.²⁴

Potential Responses	Evaluation Criteria			Governance Criteria	
	Economic	Environmental	Social	Administrative	Legal
PLANNING TOOLS					
1. Comprehensive Plans*	*	*	*	*	*
REGULATORY TOOLS					
2. Zoning and Overlay Zones*	*	*	*	*	*
3. Floodplain Regulations*	*	*	*	*	*
4. Building Codes and Resilient Design	~	~	~	~	+
5. Setbacks/Buffers	~	+	~	~	~
6. Conditional Development and Exactions	~	+	+	~	~
7. Rebuilding Restrictions	~	+	~	~	~
8. Subdivisions and Cluster Development	+	+	~	~	+
9. Hard-Armoring Permits	!	!	~	~	~
10. Soft-Armoring Permits	~	~	~	~	~
11. Rolling Coastal Management / Rolling Easement Statutes	~	+	~	~	!
SPENDING TOOLS					
12. Capital Improvement Programs	~	+	~	~	~
13. Acquisitions and Buyout Programs	!	+	~	~	+
14. Conservation Easements	+	+	+	~	~
15. Rolling Conservation Easements	~	~	+	!	!
TAX AND MARKET-BASED TOOLS					
16. Tax and Other Development Incentives	~	+	+	~	~
17. Transferable Development Credits	+	+	+	!	+
18. Real Estate Disclosures	~	~	~	~	~

Advantageous (+)	The tool maximizes benefits and is feasible.
Neutral (~)	The tool may present some disadvantages or some feasibility problems.
Disadvantageous (!)	The tool may be difficult to implement because of costs or infeasibility.

Figure 4 simplifies the type of characterization that the STAPLEE process might arrive at for the tools listed in the left column, and serves to illustrate the utility of anticipating how a given adaptation tool is likely to fare when proposed to different groups of stakeholders. For instance, some tools—such as rolling easements—might be socially acceptable but limited in application

²⁴ Georgetown Adaptation Tool Kit, *supra* note 20, at 10–11.

and subject to legal uncertainty.²⁵ By bringing into focus the benefits, sources of support, and potential sources of opposition to application of a given tool, STAPLEE can help guide decisionmakers as they convene stakeholders and present arguments about why using particular tools to pursue particular goals can strike an optimal balance for the community.

In addition to encouraging a planning process that deals with all contentious issues as early as possible, adaptation planning literature counsels that communities should seek “no regrets,” “low regrets,” and “flexible” solutions when deciding about allocations and timing.²⁶ Each of these terms emphasizes the importance of not locking a community’s scarce resources into investments whose value could be undermined by foreseeable potential changes to the climate and shoreline.²⁷ They also reflect the crucial fact that adaptation is an ongoing process rather than a finite one.²⁸

2. Legal Context

Various aspects of the law governing Escambia County compel, support, permit, or limit its authority to pursue an adaptation agenda. This section does not provide an exhaustive list of relevant legal structures and provisions, but it identifies several that are especially salient and that should or must be considered as Escambia takes steps to adapt to SLR.

Several features of Florida law, described briefly here, deserve special attention because they are both unique to Florida and significant to any adaptation agenda. They include local comprehensive plans, legal authority for the establishment of Adaptation Action Areas,²⁹ SB 1094 (“Peril of Flood”),³⁰ and the Bert Harris Jr. Private Property Rights Protection Act.³¹

2.1 Comprehensive planning

Comprehensive plans have a constitutional quality for Florida localities.³² Each Florida locality must maintain a comprehensive plan,³³ and all development in that locality must

²⁵ See Thomas Ruppert, *Use of Future Interests in Land as a Sea-Level Rise Adaptation Strategy in Florida* (Aug. 2012), <https://perma.cc/6SJM-58B5>.

²⁶ William H. Butler et al., *Low-Regrets Incrementalism: Land Use Planning Adaptation to Accelerating Sea Level Rise in Florida’s Coastal Communities*, *J. Planning Edu. & Res.* 1, 9–10 (2016); see also Donald Watson, *Literature Review: Principles and Practices of Coastal Adaptation in the Era of Climate Change*, in *Coastal Change, Ocean Conservation and Resilient Communities* 23, 25–26 (2016) (emphasizing need to plan for uncertainty, in part by enabling multiple programmatic options).

²⁷ NOAA, *Adapting to Climate Change: A Planning Guide for State Coastal Managers* 53 (2010), <https://perma.cc/E4M2-M6Y7>.

²⁸ National Park Service, *Coastal Adaptation Strategies Handbook 2* (2016), <https://perma.cc/PAN7-EA6V>.

²⁹ HB 7202, *Florida Community Planning Act of 2011*, *codified at* Fla. Stat. § 163.3177.

³⁰ SB 1094, *codified at* Fla. Stat. §§ 163.3178, 195.088.

³¹ Fla. Stat. § 70.001.

³² David L. Markell, *Emerging Legal and Institutional Responses to Sea-Level Rise in Florida and Beyond*, 42 *Colum. J. Envtl. L.* 1, 6–7 (2016) (citing *Machado v. Musgrove*, 519 So. 2d 629, 632 (Fla. 3d DCA 1987)).

³³ Fla. Stat. § 163.3177(1)(b)(2) (2015) (“Each local government shall maintain a comprehensive plan”). See also *id.* § 163.3177(1) (plans are meant to “provide the principles, guidelines, standards, and strategies for the orderly and balanced future economic, social, physical, environmental, and fiscal development of the area. . .” and to “establish

conform to the local Plan’s provisions.³⁴ Those provisions appear in particular “elements,” some of which are mandatory.³⁵ Florida’s 2011 Community Planning Act removed several restrictions on local governments’ authority to revise elements of their comprehensive plans,³⁶ a process that involves two public hearings and approvals by the local governing authority, as well as receipt and review of comments by state agencies and affected localities regarding potential adverse effects.³⁷ The rest of this subsection discusses: (1) particularly important planning elements and the statutory language that guides their formulation; (2) data and analysis appropriate for planning; (3) timeframes for planning; and (4) Adaptation Action Areas—a form of zoning overlay that localities can use to coordinate adaptation plans and efforts.

2.1.1 Key planning elements

Nearly all of Escambia’s comprehensive plan elements relate to adaption efforts in some fashion,³⁸ but this section focuses on two elements that are indispensable to the actions discussed in section five of this document: future land use and coastal management.

Future Land Use Plan Element. Florida law does not expressly instruct localities to incorporate consideration of SLR or adaptation goals into their future land use plan element, but several Florida Statutes provisions provide a solid legal basis for adding to or revising the existing element’s Goals, Objectives, and Policies for that purpose. First and most fundamentally, a future land use element “shall establish the long-term end toward which land use programs and activities are ultimately directed.”³⁹ This directive would support, for instance, including a Goal pursuant to which *Escambia shall ensure that land uses are compatible with sea level rise scenarios projected by the National Oceanic and Atmospheric Administration and the U.S. Army Corps of Engineers through 2050*. Other Florida Statutes provisions further buttress including language of this sort, whether as a Goal or Objective. Florida Statutes § (6)(a)3, for instance, instructs that “[t]he future land use plan element shall include criteria to be used to: . . . Coordinate future land uses with the [sic] topography and soil conditions, and the availability of facilities and services.” And, similarly, section (6)(a)8 requires future land use map amendments to be based on “analysis of the suitability of the plan amendment for its

meaningful and predictable standards for the use and development of land and provide meaningful guidelines for the content of more detailed land development and use regulations.”)

³⁴ *Id.* § 163.3161(6) (“no public or private development shall be permitted except in conformity with comprehensive plans”).

³⁵ *Id.* § 163.3177(1)(a). Mandatory elements include: capital improvements; future land use; transportation; general sanitary sewer, solid waste, drainage, potable water, and natural groundwater aquifer recharge; conservation; recreation and open space; housing; intergovernmental coordination; and, for coastal localities, coastal management. *Id.* § 163.3177(6).

³⁶ Fla. L. c. 77-331, Community Planning Act of 2011, *amending* F.S. §§ 163.3161, 163.3217.

³⁷ Fla. Stat. § 163.3184.

³⁸ Escambia County’s current comprehensive plan is available here: <https://perma.cc/Q3LF-K8TY>.

³⁹ Fla. Stat. § 163.3177(6)(a).

proposed use considering the character of the undeveloped land, soils, topography, and historic resources on site.”

Other statutory language would support more focused plan element amendments. For instance, section (6)(a)3g, which directs that the “element shall include criteria to be used to: . . . Provide for the compatibility of adjacent land uses,” has clear importance for shoreline armoring and coastal development permitting. Hard armoring is arguably incompatible with either soft armoring or a lack of armoring on adjacent parcels. Similarly, hard armoring or other forms of development reduce the buffering capacity of a shoreline vis-à-vis proximate landward property.

Some of the statutory provisions discouraging urban sprawl also lend themselves to plan element amendments focused on SLR adaptation. In particular, among the indicators of sprawl (which “the future land use plan element shall discourage”), are “[f]ail[ure] to adequately protect and conserve natural resources, such as wetlands, floodplains . . . shorelines, beaches, estuarine systems, and other significant natural systems;” and “[a]llow[ance] for land use patterns or timing which disproportionately increase the cost in time, money, and energy of providing and maintaining facilities and services”⁴⁰

Coastal Management Plan Element. The state-level legal underpinnings of this plan element are unique for *requiring* consideration of SLR. SB 1094, enacted in 2015, revised Florida Statutes to instruct coastal localities to include a redevelopment component in their coastal development plan element. Even prior to 2015, that element was to “outline[] the principles that must be used to eliminate inappropriate and unsafe development in the coastal areas when opportunities arise.”⁴¹ SB 1094 specified that the “principles, strategies, and engineering solutions” described in that component must address flood risk arising from several sources, *including SLR*. Although these requirements are phrased a bit elliptically, they can properly be read as providing state sanction for coastal localities seeking to limit—or even “eliminate”—development that is “inappropriate and unsafe” because it is foreseeably vulnerable to the adverse impacts of SLR.

A redevelopment component is the logical place to include guidelines and restrictions that do not take effect until they are triggered by an event, such as flooding of a particular depth, a natural disaster, or even just encroachment of the shoreline to a particular height. Florida’s Department of Consumer Affairs has published a resource that can help inform such provisions, titled *Post-Disaster Redevelopment Planning: A Guide for Florida Communities*.⁴² SB 1094’s requirements provide communities with good reason to adopt such measures, and also with a potent tool for inoculating restrictions on development against takings claims (discussed below).

⁴⁰ Fla. Stat. § (6)(a)9a(IV) & (VIII).

⁴¹ Fla. Stat. § 163.3178(2)(f).

⁴² Florida Department of Consumer Affairs, *Post-Disaster Redevelopment Planning: A Guide for Florida Communities* (Oct. 2010), <https://perma.cc/923X-V4R5>.

* * *

It is important to recognize that merely mentioning SLR in these and other comprehensive plan elements will not suffice to steer Escambia County to adapt. A recent survey of references to SLR in plan elements across hundreds of Florida localities identified a number of instances where “SLR language appears in a comprehensive plan and indicates that a government ‘shall’ do something” but the language calling for action “is often not self-executing.”⁴³ As a result, the local government’s comprehensive plan language “appears more proactive than the tangible actions of a local government in day-to-day operations.”⁴⁴ The University of Florida’s Conservation Clinic has developed model planning language to help localities inclined to do more.⁴⁵ Their model makes the protect-accommodate-retreat rubric described above into the basis for planning zones: similar issues get different treatment in the managed retreat zone than they do in the protect zone. Selections from that model, which are excerpted in several places below, can be useful even when taken out of that context.

2.1.2 Appropriate data and analysis for planning

Comprehensive plans must be informed by an analysis of “relevant and appropriate data,”⁴⁶ which Florida law requires to be gathered from “professionally accepted sources” or generated by the local government itself “so long as methodologies [for gathering data] are professionally accepted.”⁴⁷ Usable data thus include not just the of Engineers (NOAA) and Army Corps datasets underlying Dewberry’s Vulnerability Assessment but also data published by the Intergovernmental Panel on Climate Change, the Southeast Florida Regional Compact on Climate Change,⁴⁸ or other similarly authoritative sources.⁴⁹ Florida law also requires changes to comprehensive plans to be supported by analysis, and that such analysis must reflect reasonable

⁴³ Thomas Ruppert & Alexander Stewart, Summary and Commentary on Sea Level Rise Adaptation Language in Florida Local Government Comprehensive Plans and Ordinances 4 (July 2015), <http://perma.cc/7VU6-ZGF4>.

⁴⁴ *Id.*

⁴⁵ Krystle Macangdang & Melisa Newmons, Sea Level Rise Ready: Model Comprehensive Plan Goals, Objectives and Policies, to Address Sea Level Rise in Florida (May 2010), <https://perma.cc/JF7U-N4FY>. Among other things, this model language formulates Goals, Objectives, and Policies for inclusion in planning elements based on the protect-accommodate-retreat rubric. *Id.* at 11.

⁴⁶ Fla. Stat. § 163.3177(1)(f).

⁴⁷ *Id.*

⁴⁸ Southeast Florida Regional Climate Compact, Unified Sea Level Rise Projection, (Oct. 2015), <https://perma.cc/49LA-WP6A>.

⁴⁹ FEMA flood insurance rate maps (FIRMs) would also be an authoritative source. However, FIRMs currently represent a snapshot in time that ignores SLR. FEMA, Coastal Frequently Asked Questions: Flood Hazard Mapping Questions, <https://perma.cc/HYN7-XMY5> (last updated Aug. 17, 2016) (“In accordance with the current Code of Federal Regulations, FEMA does not map flood hazards based on anticipated future sea levels or climate change.”). Unless and until FIRMs integrate SLR projections, their utility for planning purposes should be considered limited to the short term.

and proportionate applications of the data cited.⁵⁰ “Scientific certainty” is *not* a required feature of supporting data or their analysis.⁵¹

The flexibility given to localities regarding data and analysis means that Dewberry’s Vulnerability Analysis will not operate as either a “floor” or a “ceiling” for planning purposes. Should Escambia refer to the Vulnerability Assessment as supporting particular language or parameters, the county would only need to articulate a logical link between the Assessment and the action—it would not be legally prevented from adopting language that embodied more or less cautious expectations about SLR than contained in the Assessment.

2.1.3 Planning timeframes

Until the legislature enacted SB 1094 in 2015, Florida law instructed localities to use two time frames for planning: five years and ten years. This directive has allowed localities to effectively ignore slow-developing future circumstances that fall outside of this timeframe, such as SLR. SB 1094 changed this by providing that “[a]dditional planning periods for specific components, elements, land use amendments, or projects shall be permissible and accepted as part of the planning process.”⁵² This invitation to designate time frames freely has vital implications for plans involving assets or facilities whose useful life exceeds 10 years and whose location makes them potentially vulnerable to SLR. Armed with this option, local governments considering the costs and benefits of infrastructure design parameters, planning restrictions, and capital investment options, among other things, can ensure that SLR projections inform their plans. The University of Florida’s Conservation Clinic has drafted model comprehensive plan language that ensures all adaptation planning employs an appropriate timeframe:

Policy 1.2.1: [Planning Horizon] Utilize a (___) year planning horizon when considering the adoption of any protection, accommodation, and managed retreat strategy within the City/County.⁵³

Notably, because SB 1094’s provisions do not *require* use of timeframes of more than 10 years, the law permits a locality to treat information about looming SLR impacts as beyond the mandatory planning timeframe. A locality looking to exclude consideration of SLR from consideration when making decisions about investments in, say, a facility or infrastructure asset with a 30- or 50-year useful life could therefore do so without legal consequence under this provision. Such an exclusion would be imprudent, however, given the certainty of some amount

⁵⁰ The statutory language is somewhat muddier: “To be based on data means to react to it in an appropriate way and to the extent necessary indicated by the data available on that particular subject at the time of adoption of the plan or plan amendment at issue.” *Id.*

⁵¹ See *Haire v. Florida Dep’t of Agric. & Consumer Servs.*, 870 So. 2d 774, 786 (Fla. 2004) (quoting approvingly from opinion below the proposition that “legislatures are not limited to acting only where there is scientific certainty.”).

⁵² Fla. Stat. § 163.3177(5)(a).

⁵³ Macangdang & Newmons, *supra* note 45.

of future SLR, and given that Dewberry’s projections identify where and how much particular locations, assets, and systems are likely to become vulnerable over the coming decades. Such an exclusion might also subject a locality to other legal action. (See section 2(b), below.)

2.1.4 Adaptation Action Areas

In addition to giving localities more flexibility and autonomy when updating their planning elements, the 2011 Comprehensive Planning Act also authorized localities to designate as Adaptation Action Areas (AAAs) locations “that experience coastal flooding due to extreme high tides and storm surge, and that are vulnerable to the related impacts of rising sea levels.”⁵⁴ The 2011 Act contemplates two purposes for this designation: “prioritizing funding for infrastructure needs” and “adaptation planning.”⁵⁵ Designating one or more AAAs could also serve Escambia by providing the basis for various forms of notice to all property owners, permittees, and others with investments or interests in land or assets encompassed by the AAA boundary regarding SLR-related vulnerabilities and potential future changes to land use restrictions. In short, an AAA is a highly flexible and potent version of a zoning overlay,⁵⁶ which localities can rightly present to residents as expressly and specifically sanctioned by state law, and as a potentially important step toward seeking state and federal funds for adaptation efforts.

A further point about establishing the boundary of an AAA deserves further mention here. Florida law suggests but does not mandate criteria for AAA designation.⁵⁷ Whether Escambia County uses those suggested criteria and/or others, it should consider expressly stating that while the criteria for AAA designation will not change, the AAA’s boundary will be reviewed and updated periodically (e.g., every five years, which would align with the schedule of Escambia’s capital improvement element)⁵⁸ *as underlying features change*. Such a statement would serve as notice that the AAA is likely to expand or shift as SLR and related topographic changes proceed along current trend lines. It would also serve as notice that, even without revisions to the comprehensive plan, the substance of policies imposed within the AAA could eventually be applied to locations it did not initially encompass.

⁵⁴ F.S. § 163.3164(1) (defining AAA).

⁵⁵ *Id.*

⁵⁶ For descriptions of zoning overlays and examples of their application, see Anne Siders, Columbia Center for Climate Change Law, *Managed Coastal Retreat: A Legal Handbook on Shifting Development Away from Vulnerable Areas* 96–97 (Oct. 2013), <https://perma.cc/Z5A2-ALQB>; Jessica Grannis et al., A Model Sea-Level Rise Overlay Zone For Maryland Local Governments Expert Review Report v.3 (Nov. 2011), <https://perma.cc/67RX-PPWJ>; Douglas Codiga & Kylie Wager, Center for Island Climate Adaptation and Policy, *Sea-Level Rise and Coastal Land Use in Hawai‘i: A Policy Tool Kit for State and Local Governments* 24–26 (2011), <https://perma.cc/9QJR-HT25>.

⁵⁷ Fla. Stat. § 163.3177(6)(g)10: “Criteria for the adaptation action area may include, but need not be limited to, areas for which the land elevations are below, at, or near mean higher high water, which have a hydrologic connection to coastal waters, or which are designated as evacuation zones for storm surge.”

⁵⁸ Clearwater, Capital Improvements Element, at I-1, <https://perma.cc/UZ47-HVGB> (last updated Aug. 20, 2013).

2.2 Litigation Risk

Historically, local governments could seek safety from legal challenges by simply maintaining the legal/planning status quo. Now, as SLR shifts the ground under local governments' feet, there is no way to maintain the status quo in both physical and legal/planning terms. The result is potentially a “damned if you do, damned if you don't” situation with respect to litigation risk. If local governments act to address SLR, they could be sued by property owners claiming injury from limitations on the property's use or adverse effects on property values. But local governments could also be sued for *failing* to address SLR, either by persisting with a long-standing but imprudent approach to use of publicly owned land or facilities, or by failing to amplify spending or maintenance schedules to the degree made necessary by SLR to keep some element of coastal protection or infrastructure in good repair.⁵⁹ It is important not to overstate the risk of being sued for inaction, and the discussion in 2.b.ii clarifies the particular legal questions on this point that were raised and not fully answered by the *Jordan v. St. Johns County* case.

This subsection does not provide a thorough description of litigation risks related to adaptation, and is not intended to provide legal advice, but its summary of key factors highlights what courts may consider when deciding whether a government can be found liable for the effects of adaptation-related decisions.

2.2.1 Sovereign immunity

Sovereign immunity protects Florida local governments from legal challenge for some but not all of their actions.⁶⁰ Courts use four guideposts to determine whether a given action is immune, but “Florida courts have struggled to find consistency in their application of the waiver [of sovereign immunity].”⁶¹ The first is the “operational/planning test” articulated by Florida's Supreme Court for determinations of whether an action by a state or local government reflects “quasi-legislative policy-making,” which is immune from suit.⁶² The test has four conjunctive parts, meaning that a government action must qualify in all four ways to merit sovereign

⁵⁹ This is a developing area of law. In general, governments are not to be held liable for nonfeasance. See *DeShaney v. Winnebago County Department of Social Services*, 489 U.S. 189 (1989). However, there have lately been departures from this premise in recent decisions requiring local governments to maintain infrastructure in the face of changing coastlines. See Thomas Ruppert & Carly Grimm, *Drowning in Place: Local Government Costs and Liabilities for Flooding Due to Sea-level Rise*, 87 Fla. Bar J. 29 (Nov. 2013), <https://perma.cc/6SUM-36Q9> (discussing *Jordan v. St. Johns County*).

⁶⁰ *Wallace v. Dean*, 3 So.3d 1035, 1045 (Fla. 2009) (citing Florida Constitution article II, § 3, which provides for separation of powers among coordinate government branches).

⁶¹ James Wilkins, *Is Sea Level Risk "Foreseeable"? Does It Matter?*, 26 J. Land Use & Envtl. L. 437, 450 (2011). For a thorough discussion of sovereign immunity in Florida, see William N. Drake, Jr. & Thomas A. Bustin, *Governmental Tort Liability in Florida: A Tangled Web*, Fla. Bar J., Feb. 2003; Thomas A. Bustin & William N. Drake, Jr., *Judicial Tort Reform: Transforming Florida's Waiver of Sovereign Immunity Statute*, 32 Stetson L. Rev. 46 (2003).

⁶² *Wallace v. Dean*, 3 So.3d at 1041 (citing *Commercial Carrier Corp. v. Indian River County*, 371 So.2d 1010 (Fla. 1979)).

immunity.⁶³ If all four answers are affirmative then the action involves “planning,” is discretionary, and is immune from suit. If any of the answers is negative then the action is “operational,” meaning that the law *prescribes* governmental conduct rather than leaving that conduct to the government’s *discretion*, and does not immunize the government from suit for injury arising from that conduct.⁶⁴ Florida courts’ application of this test has not been especially consistent or predictable.⁶⁵

The second guidepost complicates the first. It divides governmental functions into four categories, two of which entail liability. They are 1) legislation, permitting, licensing, and executive functions; 2) law enforcement and protection of public safety; 3) capital improvements and property management; and 4) providing professional, educational, or general services for citizens’ health and welfare.⁶⁶ The Florida Supreme Court has stated that governments engaged in the first two types of functions have no duties for which they might be liable,⁶⁷ and that governments engaged in the fourth function—providing direct services—owe the same duties and bear the same risk of liability as private entities so engaged.⁶⁸ As for the third function, it seeks to distinguish between (a) initial decisions to acquire, build, or upgrade a property or facility and (b) subsequent decisions to maintain that property or facility. Whereas governments’ decisions to build or upgrade are immune, maintenance efforts carry liability just as they would for a private owner or operator.⁶⁹

The third guidepost to note is actually an exception to the upgrade/maintain distinction just discussed. It relates to a government’s duty to prevent or warn about dangerous conditions arising from a facility the government owns or operates. It applies if a government 1) creates a dangerous condition, which 2) is not readily apparent to whomever it injures, and 3) the

⁶³ *Commercial Carrier*, 371 So.2d at 1018: 1) Does the challenged act, omission, or decision necessarily involve a basic governmental policy, program, or objective? 2) Is the questioned act, omission, or decision essential to the realization or accomplishment of that policy, program, or objective, as opposed to one which would not change the course or direction of the policy, program, or objective? 3) Does the act, omission, or decision require the exercise of basic policy evaluation, judgment, and expertise on the part of the governmental agency involved? And 4) Does the governmental agency involved possess the requisite constitutional, statutory, or lawful authority and duty to do or make the challenged act, omission, or decision?

⁶⁴ *Cf.* *United States v. Varig Airlines*, 467 U.S. 797, 808 (1984) (describing basis for operational/planning distinction as follows: “The discretionary function exception . . . marks the boundary between Congress’ willingness to impose tort liability on the United States and its desire to protect certain governmental activities from exposure to suit by private individuals.”).

⁶⁵ *See* Theresa K. Bowley, *A Blanket of Immunity Will Not Keep Florida Dry: Proposed Adjustments to Florida’s Drainage Regulations and Sovereign Immunity Laws to Account for Climate Change Impacts*, 10 Fla. A&M U.L. Rev. 387, 403 (2015), <https://perma.cc/F7BY-VX83>.

⁶⁶ *Trianon Park Condo. Ass’n v. City of Hialeah*, 468 So. 2d 912, 919 (Fla. 1985).

⁶⁷ *Id.* at 921.

⁶⁸ *Id.*

⁶⁹ *Id.*; *see also* Thomas A. Sawaya, *Capital Improvements and Property Control Functions*, 6 Fla. Prac. Pers. Inj. & Wrongful Death Actions § 9:9 (2014).

government knew of the condition yet 4) failed to warn the public or avert the danger it created.⁷⁰ Thus, even if a government demonstrates that it merely maintained a facility rather than upgrading it, it can nonetheless be found liable if a plaintiff's injury arises from facts consistent with these four conditions. Florida courts have also restated this third principle more generally: "Where a defendant's conduct creates a foreseeable zone of risk, the law generally will recognize a duty placed upon defendant either to lessen the risk or see that sufficient precautions are taken to protect others from the harm."⁷¹

2.2.2 Takings—including via inverse condemnation

Takings law protects private property owners from government actions that fail to provide them with "just compensation" for the condemnation or appropriation of their real property or for regulation that deprives their real property of all or almost all of its use and economic value. In Florida, there are two sources of takings law: the Fifth Amendment to the U.S. Constitution and the Bert Harris Private Property Rights Protection Act.⁷² This subsection does not provide an extensive explanation of takings law in relation to SLR; such explanations are available from other sources,⁷³ and provide only limited value for discussions like this one of specific programmatic SLR adaptation efforts. Instead, this subsection covers two important points—one practical, one legal.

The practical point arises from takings law being complex, unpredictable in its application to particular cases, and the source of highly fact-specific legal disputes. These features have two important implications for localities. First, plaintiffs who feel strongly about their takings claim against the locality, or about their desire to remain where they are with all the services they have typically received, may bring a lawsuit even if the legal claim is tenuous. Second, fending off such claims will likely involve marshaling detailed factual information and expert testimony—expenses that a locality must incur even if it prevails in court unless the takings claim is so egregiously implausible that the court sees fit to award the locality attorneys' fees. In short: localities planning to undertake SLR adaptation measures should anticipate takings challenges.

The legal point relates to the decision in *Jordan v. St. Johns County*, a decision from Florida's Fifth District Court of Appeal.⁷⁴ That case dealt with the question of whether the

⁷⁰ Henry P. Trawick, Jr., *Modification of Planning Versus Operational Approach*, 4 Fla. Pl. & Pr. Forms § 37:3 (2015).

⁷¹ *Kaisner v. Kolb*, 543 So. 2d 732, 735 (Fla. 1989).

⁷² Fla. Stat. § 70.001.

⁷³ See, e.g., Siders, *supra* note 56, at 13–17; Michael Allen Wolf, *Strategies for Making Sea-Level Rise Adaptation Tools "Takings-Proof"*, 28 J. Land Use 157 (2013), <https://perma.cc/WVH8-QZLP>; see also David Dana, *Incentivizing Municipalities to Adapt to Climate Change: Takings Liability and FEMA Reform as Possible Solutions*, 43 B.C. Envtl. Aff. L. Rev. 281 (2016), <https://perma.cc/KB7M-V3WJ>; J. Peter Byrne & Kathryn A. Zyla, *Climate Exactions*, 75 Md. L. Rev. 758 (2016), <https://perma.cc/5NYY-YNZK>; Sean Hecht, *Taking Background Principles Seriously in the Context of Sea-Level Rise*, 39 Vt. L. Rev. 781 (2014-2015), <https://perma.cc/YE5F-2RQN>; Christopher Serkin, *Passive Takings: The State's Affirmative Duty to Protect Property*, 113 Mich. L. Rev. 345 (2014), <https://perma.cc/W3RU-XH9B>.

⁷⁴ 63 So. 3d 835 (Fla. 5th DCA 2011), *rev. declined*, 77 So. 3d 647 (Fla. 2011).

county had committed an inverse condemnation and a taking with its temporary moratorium on maintenance on a 1.6-mile stretch of the only road, “Old A1A,” that connected a housing subdivision on a barrier island to the mainland.⁷⁵ Due to repeated storms and persistent erosion, that maintenance threatened to devour the whole of the county’s annual transportation budget.⁷⁶ The court in that case agreed with the county that its temporary moratorium was rationally related to public safety and ruled that the moratorium did not amount to an inverse condemnation. The court also stated that Florida law does not give courts the authority to issue injunctions instructing perpetual performance of a duty. However, the court did not reject all of the plaintiff’s arguments. It declared that “the County has a duty to reasonably maintain Old A1A as long as it is a public road dedicated to public use,” and must ensure that the road provides “meaningful access.”⁷⁷ It did not further define “reasonably maintain” or “meaningful access,” and even stated that “[w]e do not hold that the County has the duty to maintain the road in a particular manner or at a particular level of accessibility.”⁷⁸ It also left open the possibility that a future claim for taking via inverse condemnation *could* prevail: “governmental inaction—in the face of an affirmative duty to act—can support a claim for inverse condemnation.”⁷⁹ Importantly, the court did not decide whether the county had actually fulfilled its duties or effectively abandoned the road, but remanded the case to the trial court to resolve the underlying factual disputes. Rather than continue the fight, the parties settled.

What does *Jordan v. St. Johns County* mean for Escambia? In addition to illustrating the likelihood of litigation arising from ad hoc deferrals or moratoria on maintenance for key roads and infrastructure, it also serves to highlight the value of addressing issues like prohibitively high maintenance costs in the context of the planning process. The *Jordan* decision took note of the fact that the county never formally voted to terminate road maintenance,⁸⁰ and hinted strongly to the parties that a formal decision to abandon the road would absolve the county of the duties on which the plaintiffs’ claims were based.⁸¹ Not only would addressing the issue legislatively have provided more legal cover, it would also been an opportunity to identify potential areas of compromise or settlement among the parties and to embody that compromise in a long-term plan for adapting (likely by eventually abandoning) both the road and barrier island.

⁷⁵ *Jordan*, 63 So. 3d at 837; see also *Rubano v. Dept. of Transp.*, 656 So.2d 1264, 1266-67 (Fla. 1995) (“A taking may occur when governmental action causes a lack of access to one’s property even when there is no physical appropriation of the property itself.”).

⁷⁶ *Ruppert & Grimm*, *supra* note 59, at 29 (“According to the county, the only feasible way to protect the road from the ‘ravages of the ocean’ was an expenditure by the county of more than \$13 million to elevate the height of the road by placing large amounts of sand along its entire length from the right-of-way down to the mean high-water mark. The county argued it would have to spend an additional \$5 to \$8 million every three to five years to maintain that protection. . . . more than the entire county budget for repair and maintenance of 800 miles of roads in the county.”).

⁷⁷ *Jordan*, 63 So. 3d at 838.

⁷⁸ *Id.*

⁷⁹ *Id.* at 839.

⁸⁰ *Id.* at 838.

⁸¹ *Id.*

Although *Jordan* dealt with a road, it is easy to imagine similar disputes over other types of infrastructure, such as electricity, stormwater, or wastewater. Thus Escambia County might consider more than one application of some or all of the language in a model ordinance proposed in response to *Jordan* by a group of Florida attorneys expert in adaptation and land use.⁸² That model ordinance creates a special category for roads like Old A1A: “any road categorized as ‘environmentally compromised’ under this ordinance shall be the subject of a requested design/maintenance exception.”⁸³ It provides thorough definitions of key terms, such as “environmentally challenging location” and “environmentally compromised local road segment,” which support decisions to reduce a given road segment’s level of service based on the cost of its upkeep relative to that of other local road segments. By making the relative cost of upkeep (rather than simple dollar-amounts) the threshold for level of service reduction, the approach taken by the model ordinance creates flexibility for a local government confronted with both budget constraints and multiple acute adaptation issues.

3. Vulnerabilities

This section discusses key findings from Dewberry’s Vulnerability Assessment regarding the nature and locations of Escambia County’s expected future vulnerabilities, and the particular assets that are likely to be put at risk. In addition to summarizing what Dewberry observed and what Preliminary Workshop participants raised, it highlights key features of the county’s vulnerabilities.

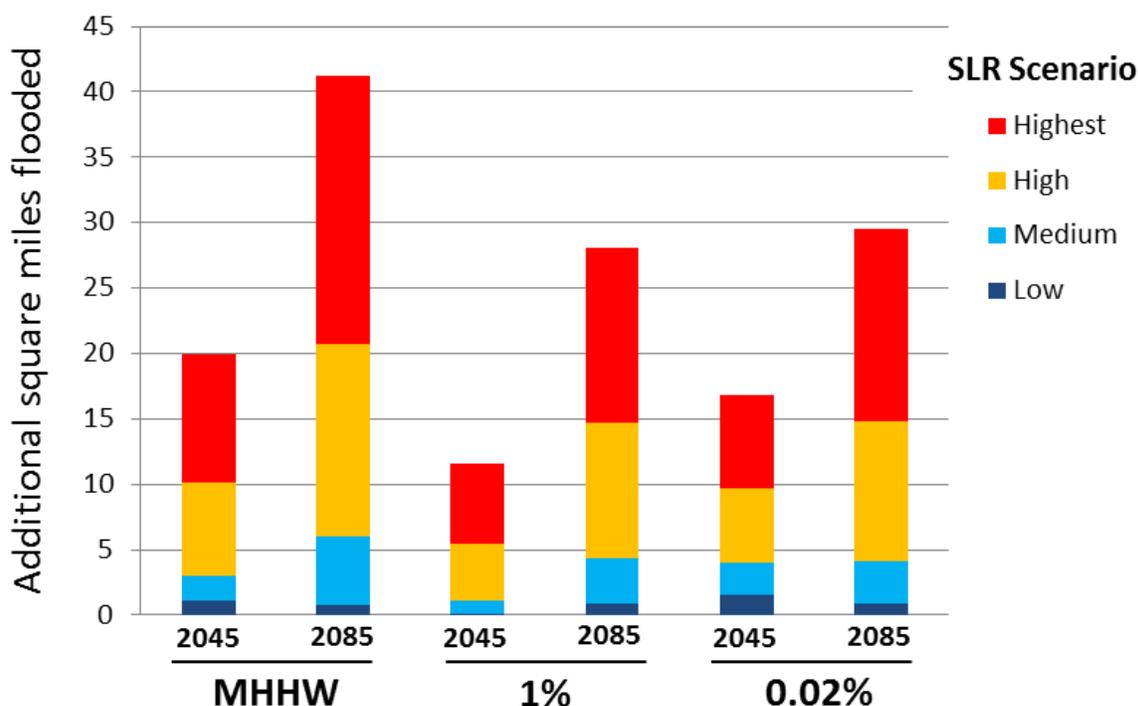
3.1 Flooding

The most important source of vulnerability for Escambia is flooding, whether as a result of tides driven higher or coastal storms made more powerful by SLR and other aspects of climate change. Figure 5, below, shows expected changes to the area within Escambia County that is vulnerable to flooding—that is, it does not show the size of area that is currently vulnerable, but only additions to that area.

⁸² Thomas Ruppert et al., *Environmentally Compromised Road Segments—A Model Ordinance*, <https://perma.cc/3RLM-DY7K> (last visited Jan. 6, 2017).

⁸³ *Id.* at para. 1.

Figure 5. Additional area vulnerable to tidal and storm-related flooding in different SLR scenarios



Two points grounded in the data shown in figure 5 deserve particular attention. The first is that the degree of growth in vulnerable areas is *highly* sensitive to levels of SLR. The Low and Medium SLR scenarios entail marginal increases, which are dwarfed by increases under the High and Highest scenarios. The second point amplifies the first: whereas expected changes from 2045 to 2085 under the Low and Medium scenarios are modest (and, in the case of a 500-year event, non-existent), under the High and Highest scenarios, the vulnerable area is expected to double for each type of flood event. These points deserve attention because they have a clear implication for the county: there appears to be substantial value in waiting for more information before authorizing development of areas that could be subject to flooding in a just few decades.⁸⁴ Using

⁸⁴ Economists sometimes refer to the value of waiting and thereby maintain the relative costs of pursuing different alternatives as “option value.” The notion was first developed in the context of finance (the holder of an option contract can buy or sell a particular asset at a particular price or time). Some have applied the approach used to estimate this value, called “real options analysis,” to coastal erosion under SLR scenarios. Ruben Jongejan et al.,

the jargon of adaptation, this argues for Escambia taking a precautionary and adaptive approach to planning and capital expenditure decisions. “Precautionary” means not making or permitting irreversible investments under uncertain conditions, and “adaptive” means deferring decisions about large and/or irreversible investments until better information becomes available. Thus, in practical terms, this sort of approach would mean maintaining restrictions on development and avoiding the installation of new infrastructure, facilities, or structures that could be put at risk before the end of their useful life, pending an indication of which SLR scenario Escambia County is actually facing.

A third notable point to highlight in figure 5, above, is that flooding vulnerabilities are concentrated in particular locations. The structures and infrastructure located there include: bridges, development in Pensacola Beach, undeveloped parcels in lower-lying topographies and the barrier islands, and parts of downtown Pensacola.

3.1.1 Bridges

According to Dewberry’s Vulnerability Assessment, the bridge by which U.S. 90 passes over the Escambia River is at risk for being made impassable by tidal flooding even under a Medium SLR scenario as early as 2045.⁸⁵ No other bridge in the county is projected to be at risk from tidal flooding by 2045, even under the Highest SLR scenario. However, Dewberry also projects that three other bridges would be at risk for impassability by 2085 under the Highest SLR scenario: U.S. 98 across Perdido Bay, State Route 399 between Gulf Breeze and Santa Rosa Island, and Quinette Road across Escambia River.⁸⁶

In addition to risks from tidal flooding, a number of bridges in the county are already at risk for impassability during 100- or 500-year flood events.

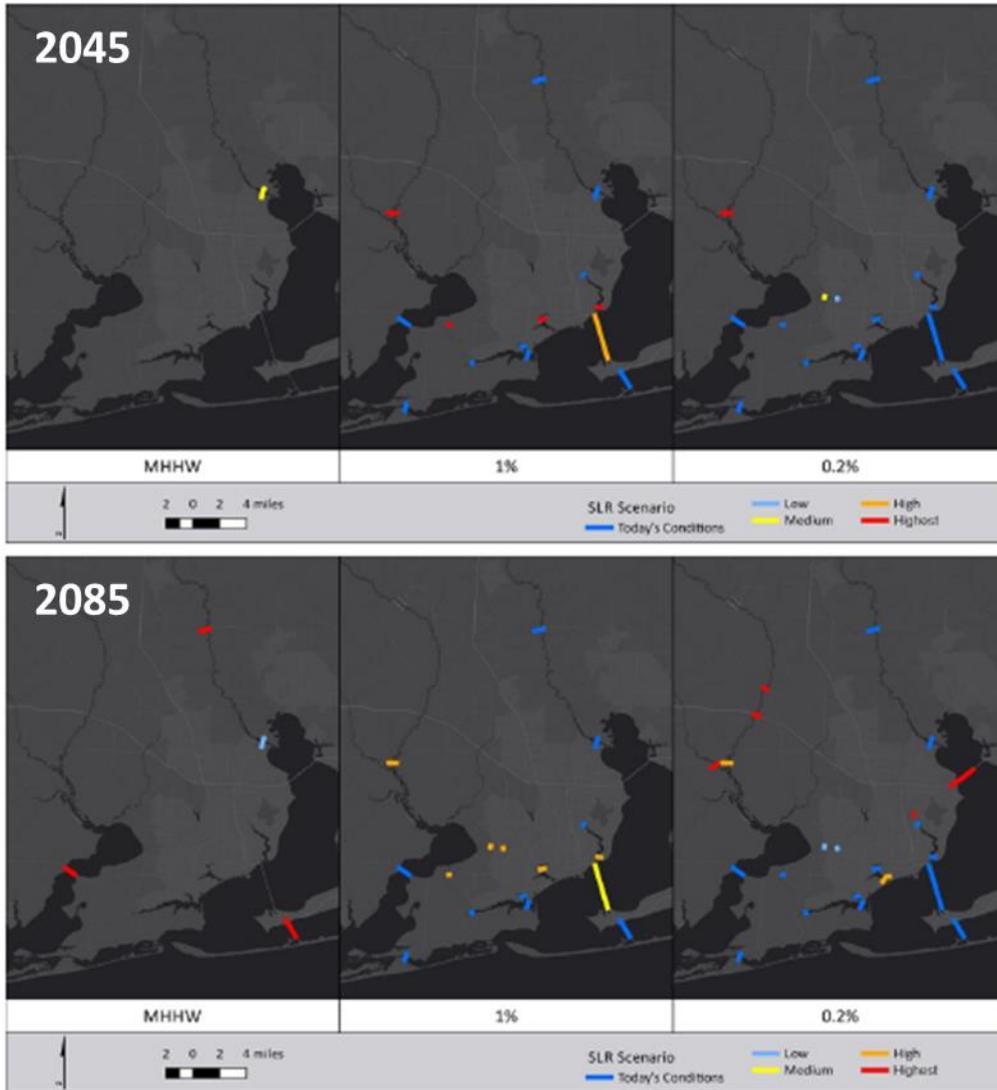
Figure 6, below, highlights bridges whose passability is likely to be impeded during different types of flood events in different SLR scenarios. The color used to mark each bridge indicates the least severe SLR scenario in which the bridge would become vulnerable (bridges not marked in a given event-and-scenario panel are not expected to be vulnerable in the corresponding circumstances).

Drawing the line on coastline recession risk, 122 *Ocean & Coastal Mgmt.* 87 (Mar. 2016), <https://perma.cc/826V-SQQZ> (concluding that existing development limits are needlessly stringent); Myung Jin Kim et al., *Real Options Analysis in Climate Change Adaptation Decision under Uncertainty* (May 2016), <https://perma.cc/SDF8-DE54> (describing process for estimating expected benefits of constructing large coastal defenses under different SLR scenarios).

⁸⁵ EC VA at 37.

⁸⁶ *Id.*

Figure 6. Bridges made impassable by flooding.



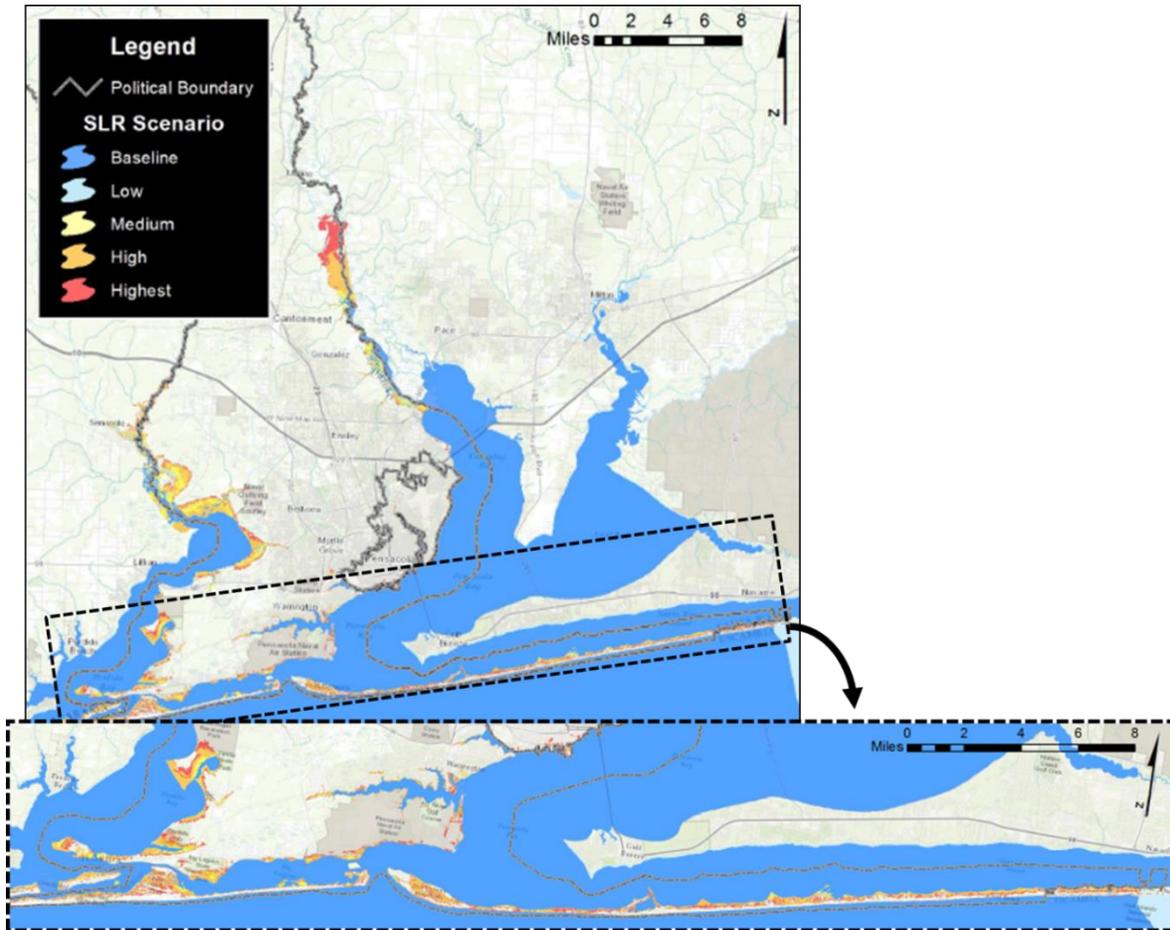
3.1.2 Flooding hotspots

As identified in Dewberry’s Vulnerability Assessment, particular coastal parcels and the barrier islands face changes not only to flooding levels but also to the presence of wave action under different SLR scenarios. Though stillwater flooding and wave action have broadly similar implications for planning, two critical differences distinguish them. The first has to do with the costs and effects of shoreline armoring; the second has to do with the ability of structures and facilities to withstand wave action as opposed to mere flooding. These are discussed further in section 5, below.

As figure 7 makes clear, the marked growth in the areas vulnerable to tidal flooding under a High or Highest SLR scenario is confined to particular segments of Escambia County, several of

which are partly undeveloped (like the land north and east of the junction of East Quintette Road and 95A North) or wholly undeveloped (like the Tarklin Bayou Preserve). Not all of these potentially vulnerable areas have gone undeveloped, however.

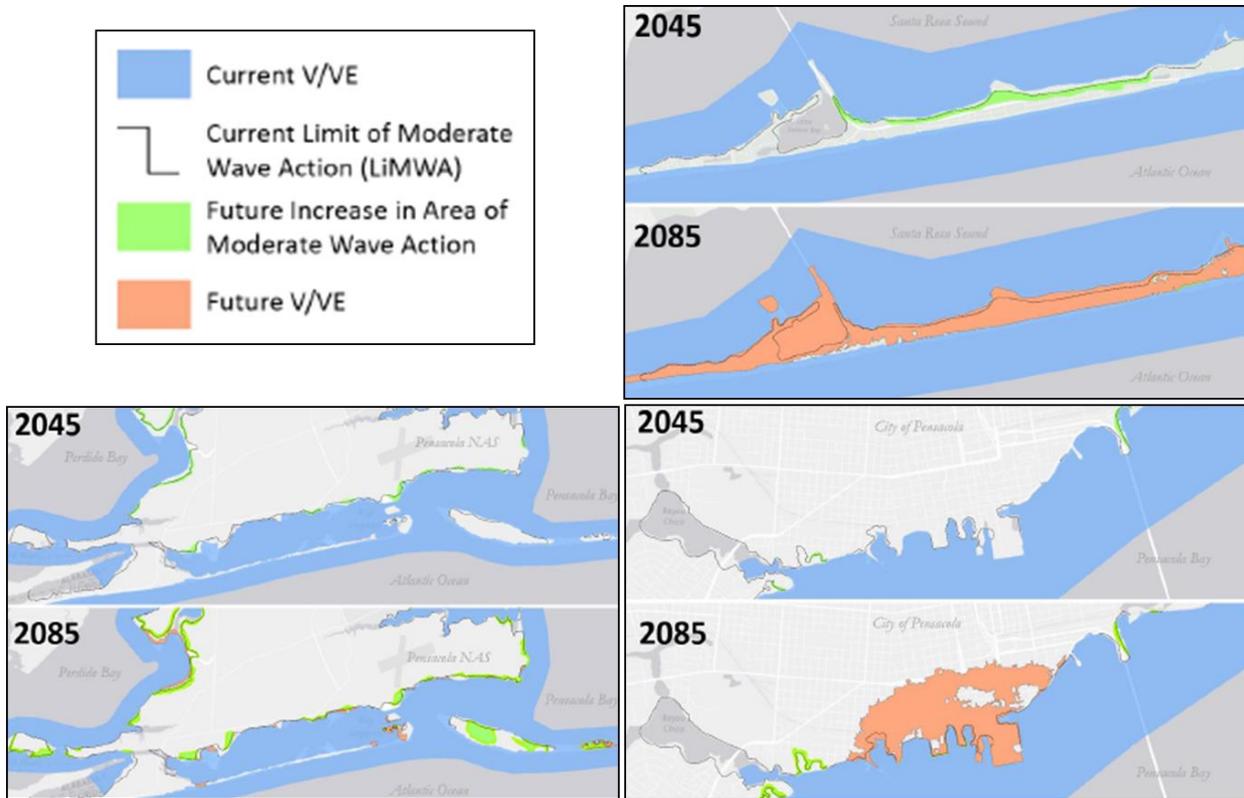
Figure 7. Extent of flooding due to MHHW in 2085 under different SLR scenarios.⁸⁷



Similarly, and to an even greater degree, expected changes in vulnerability to wave action are also concentrated in particular segments of Escambia County and Pensacola—most notably, the barrier islands and a large portion of downtown Pensacola’s waterfront. As figure 8, below, shows, these changes are expected to occur even in a Medium SLR scenario, which means that it would be prudent for the county to at least consider the possibility that these changes will emerge sooner.

⁸⁷ EC VA at 28–30.

Figure 8. Increased area subject to wave action under *Medium* SLR scenario: Pensacola Beach (top right), downtown Pensacola (bottom right), and the county’s southwest corner (bottom left).⁸⁸



The areas vulnerable to wave action feature diverse land uses, some of them intensive, which in turn call for very different adaptation measures. In all cases, however, plans for updated disaster preparedness and recovery should attend to the areas marked “Future V/VE” in figure 8 above, which are not currently subject to wave action but are expected to become so. Whereas in downtown Pensacola this might mean aggressive efforts to achieve greater accommodation of periodic inundation by revising building codes and increasing stormwater management system capacity, on barrier islands it might mean adopting a package of measures to avoid further development, to facilitate retreat and encourage accommodation by businesses and residents determined to stay, and to give greater priority to maintaining the islands’ function as a breakwater for the county’s coastline.

3.2 More frequent and severe precipitation

Dewberry’s downscaling of rainfall projections concludes ultimately that “[a]lthough the projected increases in rainfall may not appear all that large, they may still impact design criteria”

⁸⁸ EC VA at 30.

of the county’s stormwater management system.⁸⁹ Dewberry’s examination of the county’s stormwater management system also notes that the 1994 Escambia County Stormwater Master Plan—the source of design criteria for the existing system—characterizes rainfalls that currently occur four times annually on average (i.e., are 25% annual chance events) as 1% annual chance events. In sum, the NOAA Atlas 14 dataset suggests that the county gets more rain than its stormwater management systems design criteria would imply, and all projections for changes to regional rainfall anticipate even more frequent and more severe rainfall events in the coming years and decades.⁹⁰

Specific vulnerabilities associated with these features include both the county’s stormwater management system and that of Pensacola, as well as the county’s ability to comply with federal, state, and local water quality requirements.⁹¹ Two capacity-limiting features could spell trouble for the county’s obligation to maintain prescribed levels of service with respect to stormwater management. One is the size and state of pipes, ditches, and detention ponds, which are inadequate to their tasks by design and, and are further impeded—according to Preliminary Workshop participants—by a lack of adequate maintenance. The other is the elevation and state of coastal outfalls and spillways, which are the outermost ends of a gravity-driven system that relies entirely on relative elevation to disposition stormwater. Many of the county’s outfalls and spillways are low enough that they sometimes *receive* instead of expelling water.⁹² In addition to being low, 2009–15 survey data suggest a number of outfalls and spillways are also in disrepair.⁹³ Both of these conditions afflict a gravity-driven system in the same way: they prevent the rapid and unimpeded transfer of stormwater from land to ocean, which can in turn exacerbate or even cause flooding during precipitation events.

4. Local Context and Priorities

SLR is an urgent issue, but not an emergency. Unlike many of the coastal localities in Florida, which must scramble to deal with SLR-driven flooding and other climate change-related impacts in the near-term, Escambia County’s topography and its prudent past decisions about infrastructure and coastal development have put it in a good position to respond effectively to SLR vulnerabilities via *long-term* plans. Thus, although rising seas threaten Escambia County, its situation—in contrast to, say, Miami Beach—is not one that requires immediate measures to address SLR-related vulnerabilities like those noted above. The county’s ability to implement prudent long-term plans will be tested as development bumps up against areas that face foreseeable flood-related risks and create increasing amounts of impervious surface. The development of coastal and low-lying parcels and the reduction of stormwater infiltration

⁸⁹ EC VA at 47.

⁹⁰ *Id.* at 49.

⁹¹ These include not only standards specified by the federal Clean Water Act, but also the simple prohibition on the discharge of “untreated run-off directly into receiving waters” and on “new ‘direct’ discharge of untreated stormwater”. Escambia County Comprehensive Plan, Infrastructure Element, INF 3.1.9, at CP10:5.

⁹² EC VA at 51.

⁹³ *Id.* at 52.

capacity are both examples of maladaptive steps to be avoided, partly because of what they mean for future vulnerability to SLR-driven flooding impacts, and partly because they increase the county's risk of violating water quality restrictions.

Stormwater management requires intergovernmental coordination. The county's ability to steer away from maladaptations in its approach to stormwater management will necessarily rely in part on its collaboration with neighboring localities. Stormwater flows to Escambia from some of these, and from Escambia to others. Pensacola is foremost among them: in addition to facing significant stormwater management issues of its own, Pensacola is downstream of much of Escambia and thus highly sensitive to how Escambia channels stormwater. That sensitivity argues strongly for collaboration between the two localities both in terms of coordination and funding. Apart from Pensacola, Escambia's opportunities to address stormwater in collaboration with its neighbors relate chiefly to potential designations under EPA's National Estuary Program or other programmatic sources of funding and technical assistance for maintenance of coastal wetlands.

Shrinking Special Flood Hazard Areas (SFHAs). The county's far-sighted restrictions on development in flood-prone areas have relied heavily on the boundaries defined by FEMA's FIRMs⁹⁴ and on the state's guidance regarding what counties should consider to be the Coastal High Hazard Area (CHHA).⁹⁵ This makes prohibitions on development and requirements that at-risk structures be raised to BFE+3' susceptible to the revision of the CHHA by the state in 2006 and 2010, and the proposed revision of the SFHA by FEMA.⁹⁶ According to Preliminary Workshop participants, the county council and developers responded quickly to the CHHA revision and are eyeing areas for development that the preliminary FIRMs now exclude from the legacy SFHA. One proposal is for a business park, another for a nursing home—the latter presents an especially obvious risk vis-a-vis SLR-driven storm surge and flooding.⁹⁷

Habitat preservation. The geographic scope of legally imposed habitat preservation requirements is likely to shift landward as SLR pushes flora and fauna higher and farther from present shorelines—and into areas not presently subject to the restrictions that attend the presence of endangered species.

⁹⁴ See EC CP3:2, CP11:1.

⁹⁵ *Id.* at CP11:2–11:3. Before the Florida legislature adopted HB 1359 in 2006, state law defined the CHHA as the area covered by the evacuation zone for a Category 1 hurricane. See James F. Murley et al., Assessment of Redefining Florida's Coastal High Hazard Area 3 (Jan. 2008)<https://perma.cc/X78Q-PTEE> (providing comparison of old and new statutory language and criticizing revision as harmful to statewide coastal resilience). That change revised and shrunk the CHHA to be the area seaward of the extent of a Category 1 storm surge, as estimated by the NOAA SLOSH model. See Florida Statutes § 163.3178(2)(h).

⁹⁶ Northwest Florida Management District, Flood Information Portal: Escambia County, <http://portal.nwfwmdfloodmaps.com/map.aspx?cty=escambia> (Preliminary FIRM Issue Date: 1/27/2017).

⁹⁷ EC CP11:3 (“prohibit[ing] the location of new group homes, nursing homes, or other uses that have special evacuation requirements in the CHHA”).

5. Priority-setting, Policy Vehicles, and Potential Responses

Previous sections have described basic goals for adaptation, categories of adaptation measures, legal considerations for Florida localities looking to implement such measures, vulnerabilities particular to Escambia County, and features of the county’s community and economy that will likely enable, inform, and constrain ambitions for local adaptation. This section discusses priority setting, likely policy vehicles for implementing adaptation measures, the usefulness of budgetary baselines for determining whether measures are cost-effective, and potential responses to the vulnerabilities identified in section 3, keeping in mind the context discussed in section 4.

5.1 Priority-setting

Successful adaptation planning builds on the best available relevant information, aims to maximize adaptation-related benefits without committing irreversibly to incurring large costs (“no- or low-regrets”), gets stakeholders involved, and keeps them informed. Practically speaking, what does this mean?

First, adaptation planning involves evaluating not only how much it would cost to install or undertake a particular measure, but also what options that measure would foreclose and how it compares to alternative means of providing some or all of the same benefits.⁹⁸ Properly accounted for, the costs of a sea wall include not only the materials and labor involved in its installation, but also the costs of its future upkeep, the costs it imposes on adjacent properties, and the opportunity cost or lost chance to make some other use of the shoreline and of the money spent on the sea wall. In short, any evaluation of an adaptation measure is incomplete unless it considers that measure’s relative cost-effectiveness for its purpose and whether the measure will raise or lower the cost of likely future options for development or adaptation.

In addition, adaptation planning involves identifying both potential responses to vulnerabilities and stakeholders that will be affected by those responses. The STAPLEE factors described in section 1.4 should guide this step: Even if a given measure is unlikely to deprive anyone of economic value, will it nonetheless cut against a social tradition or preference? Even if a measure is likely to only affect a small handful of people or businesses, is it likely to generate extensive legal battles? Furthermore, even if a measure has the potential to be popular, such popularity is not guaranteed: planners might focus on identifying and evaluating an adaptation measure in terms of its aggregate costs, effects, legal viability, and administrative feasibility, but

⁹⁸ For a discussion of the value of making incremental investments in infrastructure or delaying irreversible investments, see Chi Truong & Stefan Trück, *It’s not now or never: Implications of investment timing and risk aversion on climate adaptation to extreme events*, 253 Eur. J. Operational Research 856 (Sept. 2016), <https://perma.cc/9XAE-YNRS>

lose sight of the need to craft outreach and prepare responses to questions from stakeholders in order to assure its political popularity.

Balancing all relevant considerations is much easier said than done, not least because the foregoing description assumes a linear progression of steps, rather than a nonlinear, sometimes redundant set of processes taking place at the same time. The inevitable complexity and messiness of identifying, analyzing, promoting, and implementing multiple adaptation measures while carrying on with other business favors an approach that brings adaptation efforts under a common analytical and political roof. Adaptation Action Areas (AAAs) lend themselves to this sort of administrative consolidation by providing a clearly delineated physical context and administrative and legal scope for whatever changes adaptation will entail.

5.2 Policy vehicles

The county's social, political, economic, administrative, and legal circumstances limit what can be done to adapt to SLR, and how it can be done. Three vehicles in particular could be well-suited to the task of navigating these circumstances while yet supporting implementation of measures discussed in the next subsection.

5.2.1 Pre- and post-disaster planning and recovery

Enduring a natural disaster may be bad, but failing to learn from one is worse. Natural disasters play a vital role in adaptation efforts: they signal the nature and potential dangers of future events, and they create a moment of decision for communities about whether and how to reconstitute what existed before disaster struck. By forcing a decision to invest in more or less vulnerable forms of recovery, disasters also scrape away the undue optimism that can cloud individuals' and communities' approach to valued but highly vulnerable places and structures. Of course, as a study examining 87 localities' disaster recovery plans concluded, "[p]oor-quality plans will not contribute to local ability to anticipate and adapt to dynamic conditions and to build back better."⁹⁹

For these reasons, and because including a disaster-trigger in a land use restriction can shield that restriction from takings claims,¹⁰⁰ disasters and post-disaster recovery feature prominently in adaptation literature. Recommendations for how to employ disaster scenarios (chiefly, coastal storms with accompanying flooding) in adaptation planning tend to include:

⁹⁹ Philip Berke et al., *Adaptive Planning for Disaster Recovery and Resiliency: An Evaluation of 87 Local Recovery Plans in Eight States*, 80 J. Am. Planning Ass'n 310, 320 (2014), <https://perma.cc/CC4H-PHA5>.

¹⁰⁰ See *Esposito v. S.C. Coastal Council*, 939 F.2d 165, 170 (4th Cir. 1991) (rejecting argument that statutory restrictions on post-disaster coastal redevelopment amounted to an unlawful taking), *cert. denied* 505 U.S. 1219 (1992)

- Restrict rebuilding of structures damaged by flooding that would be vulnerable to SLR or to future flooding, whether by simply prohibiting redevelopment, imposing design requirements, or imposing setbacks on affected properties;¹⁰¹
- Condition rebuilding on a prohibition against shoreline armoring, thereby ensuring that the land, even if developed, will act as a buffer in the next storm;¹⁰²
- Encourage dedication of conservation easements or pursue public acquisition of property repeatedly struck by floods or affected by SLR-driven flooding.¹⁰³

Existing language in Escambia County’s Coastal Management planning element would support recommendations like these.¹⁰⁴ An updated post-disaster recovery plan could accomplish several interwoven goals in support of adaptation efforts, including providing the public with information—as well as gathering information *from* the public—about local risks and options for mitigating those risks.

This argues for exploring whether to make a disaster of particular scale and scope the triggering event for significant alterations to land use restrictions, structural requirements, and infrastructure levels of service. Of course, adding community-altering triggers into a comprehensive plan is only politically feasible if key stakeholders agree to such a step—a fact that highlights the relationship between an ambitious plan for adaptive disaster recovery and the process involved in building broad support for potentially dramatic, post-disaster adaptation measures.¹⁰⁵

A further point about adaptation via pre- and post-disaster planning and recovery has to do with federal funding. Escambia’s Coastal Management planning element states that the county’s PDRP distinguishes between “redevelopment” and “repair.”¹⁰⁶ This distinction is an important factor to consider when exploring options for federal disaster recovery funding for adaptation efforts. While it is possible to read federal disaster recovery law as only supporting restoration of what existed before, that reading incorrectly excludes the option of using federal funds to adopt new designs that are better able to survive the next disaster—or, where appropriate, to undertake buyouts.¹⁰⁷

5.2.2 Making levels of service or capital expenditures contingent

¹⁰¹ See Siders, *surpa* note 56, at 85–86.

¹⁰² *Id.*

¹⁰³ See Georgetown Adaptation Toolkit, *supra* note 20, at 31–33.

¹⁰⁴ EC CP11:1, CP11:6–11:7 (COA 1.1.3 Flood Elevation; COA 1.4.2 Post-Disaster Redevelopment Plan; COA 1.4.4 Structure Damage Criteria).

¹⁰⁵ Carri Hulet et al., *Why Public Engagement Is Necessary to Enhance Local Readiness for Climate Adaptation*, in *Managing Climate Risks in Coastal Communities* 60–64 (Lawrence Susskind et al., eds. 2015) (discussing forms of public engagement and its indispensability to effective planning measures).

¹⁰⁶ EC CP11:6.

¹⁰⁷ Justin Gundlach & Channing Jones, *Integrating Climate Change Resilience Into HUD’s Disaster Recovery Program*, 46 *Envtl. L. Rep.* 10282 (Apr. 2016), <https://perma.cc/CQ4U-XJV7>.

The model ordinance discussed in section 2.2.2 above can serve localities facing prohibitively expensive infrastructure maintenance schedules by preventing legal challenge of the sort that led to the *Jordan v. St. Johns County* case. As noted in that section, the ordinance is drafted for roads, but could arguably be applied to components of stormwater or wastewater systems that are succumbing to increasing rates of sea-borne damage. The basic concept embodied in that model legislation is that service levels should be contingent on the cost-effectiveness of maintenance. Once the cost of maintaining a given component exceeds a threshold set by average maintenance costs for other similar components, the locality can staunch the flow of public funds to that repeatedly damaged component.

This concept need not be limited to the case of foregone maintenance that inspired Ruppert et al. to draft their model. It can also be applied to planning as well. For instance, recognizing the growing threat facing barrier island communities, Escambia County need not prevent redevelopment or investment through express restrictions, but it can make clear—ideally years or even decades in advance—that services relied upon by residents there will be provided only so long as the cost of their provision remains proportionate to average costs elsewhere in the county. This sort of signaling can help resolve social, political, economic, and legal problems that might stymie development restrictions aimed at a similar goal.

Similarly, the county could require capital expenditures to meet a cost-effectiveness threshold to proceed. Phrased as a Policy in the Coastal Management element—which currently sets limits on spending in Coastal High Hazard Areas¹⁰⁸—this might read as follows:

Capital spending shall only be provided for the repair or upkeep of infrastructure components repeatedly damaged, degraded, or routinely impaired as a result of SLR’s impacts, such as nuisance flooding, after considering alternative design standards and determining that design changes would not yield net savings over the useful life of the component or components.

The University of Florida Conservation Clinic offers two similar but harder-hitting approaches:

Policy 1.3.2: No capital improvements within the vulnerable area shall be financed or constructed without having first been reviewed to determine the extent to which the proposed improvement is sea-level rise-ready, taking into account the sea-level rise adaptation zone in which it is located, and whether it will contribute to additional development within the vulnerable area.

Policy 4.1.1: Within [the most vulnerable areas], the City/County shall eliminate new investment in public infrastructure likely to be subject to the impacts of sea level rise within the planning horizon.

¹⁰⁸ EC CP11:2–11:3 (COA 1.2.2 Expenditure Limits).

5.2.3 Adaptation Action Areas

AAAs are a flexible means of designating the physical area(s) where measures like those just described would apply. AAAs make it possible to change important policies without rewriting zoning decisions and other plan language. They also serve an important educational, social, and political function because their basic logic is transparent to stakeholders: because SLR, which is expected to increase in predictable increments, causes flooding in a given area, that area is exceptional and will receive different policy treatment. This is not to say that AAAs simply make political challenges go away. However, they can help to inoculate adaptation measures against objections that the resulting costs and services would be allocated unfairly, and they can provide a stable foundation for any number or combination of adaptation policies.

In addition, because AAAs can be designated using objective *and dynamic* criteria, such as the frequency of flooding to a particular height, they can remove controversy from questions about the boundaries within which particular policies should apply and when to change those boundaries. Should the county decide on designating AAAs in this way, it should schedule a periodic update of AAA boundaries using a standard methodology.

Participants in the Preliminary Workshop said that overlay zones had worked well for several purposes but indicated concern about receptivity to adoption of one or more AAAs by Escambia’s Board of Commissioners and the wider public. To avoid a proposal that appears to be yet another independent source of restrictions on development, the county might consider adopting an AAA as part of a redefinition of the CHHA that incorporates expectations about SLR. That is, the criteria for the boundary of the CHHA could expressly include periodic updates based on new data and the AAA could serve as a sort of vanguard of the CHHA—a boundary based on where the CHHA is expected to fall in 15 or 30 years. Importantly, SB 1094 has provided Escambia with a valid legal reason to undertake precisely this sort of change: it requires localities to include a redevelopment component in their coastal management planning element that addresses flood risk arising from SLR, *and* encourages localities to “eliminate” development that foreseeable flooding impacts makes “inappropriate and unsafe.”

5.3 Budgets and baselines

Preliminary Workshop participants emphasized that programs or projects oriented to adaptation goals would be received well by county commissioners and the public so long as the need for those measures and their benefits were plainly apparent. In practical terms, this means that proposed measures require analytical support that conveys their expected costs, benefits, and/or effectiveness relative to possible alternatives.¹⁰⁹ Several tools are available to help

¹⁰⁹ For an example of a study of the costs and benefits of measures that improve CRA scores, see Wesley E. Highfield & Samuel D. Brody, *Evaluating the Effectiveness of Local Mitigation Activities in Reducing Flood Losses*, 14 *Natural Hazards Rev.* 229 (2013), <https://perma.cc/EVH7-K33J> (finding that freeboard requirements SFHA as well as other structural responses, such as well-designed berms, most effectively reduced flood losses in CRA-participating communities).

generate that sort of analysis—FEMA has developed one for download,¹¹⁰ the University of Southern Maine has developed another¹¹¹—and a number of published reports provide examples of those tools’ application.¹¹²

Arguably the most critical feature of an analysis that justifies investments in one or more adaptation measures—or measures that happen to have adaptive co-benefits—is the estimation of the costs of doing nothing. *Costs of Doing Nothing*, an aptly named report about the costs that flooding (with and without SLR) will visit on Hampton Roads, Virginia foregrounds this feature.¹¹³ While Escambia County’s circumstances are not as dire as those of Hampton Roads, Annapolis, or Miami Beach, Dewberry’s Vulnerability Assessment makes clear that parts of Escambia face material flooding risks. For Pensacola Beach, Perdido Key, and segments of the county’s stormwater management system, the costs of doing nothing are likely quite high. As for areas potentially relieved of BFE+3’ restrictions as a result of FEMA’s planned FIRM revision, decisions to develop in spite of future flood risks can and should be counted as a form of cost of doing nothing.

The sort of adaptation-oriented analysis described here is not wholly new to the county: Escambia’s Local Mitigation Strategy (LMS) discusses how to apply cost-benefit analysis for the similar purpose of selecting projects for consideration by FEMA for possible hazard mitigation grant funding.¹¹⁴ For adaptation measures, as for LMS projects, “costs” include capital and labor required to develop and maintain a program or project, and “the ‘benefit’ of the initiative is the ‘costs avoided’ over its useful life.”¹¹⁵ Construing that benefit requires first estimating the costs of doing nothing, discussed above, and then comparing those estimated costs to estimates of the costs expected to result from the initiative.¹¹⁶

¹¹⁰ FEMA, Benefit-Cost Analysis, <https://www.fema.gov/benefit-cost-analysis>, (last updated Jan. 20, 2017) (providing access to tool and instructions for its use).

¹¹¹ Blue Marble Geographics, Coastal Adaptation to Sea Level Rise Tool (COAST), <http://www.bluemarblegeo.com/products/COAST.php> (last visited Feb. 7, 2017).

¹¹² See, e.g., Will Cooper et al., *Climate Change Adaptation Case Study: Benefit-Cost Analysis of Coastal Flooding Hazard Mitigation*, 3 J. Ocean & Coastal Econ., Nov. 2016, <https://perma.cc/4A9V-LK7B> (applying FEMA benefit-cost rubric in New Jersey following Superstorm Sandy); Jason Liechty, Planning for Sea Level Rise: Modeling Costs and Benefits for Coastal Broward County (May 2015), <https://perma.cc/5LR2-NA53>; Jonathan T. Lockman, Benefit Cost Analysis for Adaptation to Sea Level Rise and Storm Surge in Catskill, NY: Use of the COAST Approach to Evaluate Elevations, Flood Proofing, Flood Walls, and Strategic Relocations, (Aug. 2014) <https://perma.cc/B2RC-B4H8>.

¹¹³ George Van Houtven et al., Costs of Doing Nothing: Economic Consequences of Not Adapting to Sea Level Rise in the Hampton Roads Region; Final Report (Nov. 2016), <https://perma.cc/26LG-CSW8> (applying model developed in P. Kirshen et al., *Simplified method for scenario-based risk assessment adaptation planning in the coastal zone*, 113 Climatic Change 919 (2012) <https://perma.cc/3KRZ-BB6T>); see also Don M. Bain, Quantifying the Economic Impacts of Adaptation Action vs. Non-Action 37–38 (Annapolis Charette: Weather It Together, Apr. 2016), <https://perma.cc/K4QY-XY6B> (listing expected costs of inaction).

¹¹⁴ Escambia County Local Mitigation Strategy Plan 170 (2015), <https://perma.cc/FSC2-FCMN>.

¹¹⁵ *Id.*

¹¹⁶ FEMA made use of rare circumstances in 2013 in Colorado to conduct an empirical version of this sort of study. Sudden, heavy, and persistent downpours in Colorado’s front range had caused destructive flooding in dozens of counties. Those that had adopted more stringent flood-related regulations, such as freeboard requirements and

These analytic approaches estimate social costs and social benefits, but do not necessarily generate estimates of how those costs and benefits would be distributed. A report issued following Southern Monterey Bay, California did so in a recent adaptation scenario planning exercise provides an example of an adaptation cost-benefit study that also considered the distribution of costs and benefits.¹¹⁷ A pair of authors developed an even more focused approach for estimating what they called property owners’ fair share of the value of hurricane risk mitigation spending.¹¹⁸

5.3 Potential responses to vulnerabilities

The following potential responses to vulnerabilities identified by Dewberry could be implemented independent of one another or in any number of combinations. In several instances, combinations would likely increase individual responses’ effectiveness while reducing their cost.

5.3.1 Flood maps and freeboard

FEMA’s revised preliminary FIRMs for Escambia County were published on January 27, 2017 and are not yet final (FEMA uses the term “effective”). Barring revision, they are currently scheduled to become effective on February 16, 2018.¹¹⁹ FEMA has not yet scheduled a timeline or deadlines for appeal of the preliminary FIRMs.¹²⁰ Escambia should consider requesting that FEMA revise preliminary FIRMs because they appear to understate the flood risks attending a 1% annual chance flood event.¹²¹ FIRMs are derived from a statistically random selection of past storm and flood data and FEMA is generally receptive to requests that FIRMs reflect data addition to those initially selected for a preliminary FIRM. FEMA is also not averse to expanding flood zones relative to those mapped in a preliminary FIRM.

Escambia should examine how the resulting changes the preliminary FIRMs published on January 27, 2017 would be translated by local ordinances and planning documents into changes to land use and development restrictions.¹²² If a particular aspect of the FIRM revision appears

development restrictions, avoided much of the destruction seen where regulations were less stringent. Because—apart from their flood regulations—these counties were similar and had experienced similar rainfall and flooding levels in 2013, FEMA was able to derive precise estimates of the value of particular regulations using empirical data. FEMA, Reducing Losses through Higher Regulatory Standards: 2013 Colorado Floods Case Study, FEMA-DR-4145-CO (Mar. 2015), <https://perma.cc/UA73-XUNG>.

¹¹⁷ Kelly L. Leo et al., The Nature Conservancy, Economic Impacts of Climate Adaptation Strategies for Southern Monterey Bay (Mar. 2016), <https://perma.cc/PRB7-5MTF> (pages 47 through 52 summarize and list data sources and calculations undertaken).

¹¹⁸ Robert E. Deyle and Richard A. Smith et al., The Costs of Hurricane Emergency Management Services: A Risk-Based Method for Calculating Property Owners’ Fair Share, <https://perma.cc/Z6E3-TYZF>.

¹¹⁹ Feb. 8, 2017 email from FEMA map specialist re “FMIX Inquiry #2386654 - [FMS] - query about schedule for Escambia FIRMs” to Justin Gundlach.

¹²⁰ *Id.*

¹²¹ FEMA cannot revise its preliminary FIRM based on Dewberry’s Vulnerability Assessment.

¹²² See, e.g., Ordinance number 10-07, § 2, 4-12-10, *codified at* § 8-428 of the St. Augustine code (defining Coastal High Hazard Areas in terms of FEMA-designated flood zones and imposing requirements on construction or substantial improvements to structures there); St. Augustine Comprehensive Plan, Capital Improvements Element

likely to invite maladaptive development by residents or business owners, the county could consider options for maintaining at least some of the restrictions by other means. For instance, designating one or more AAAs using Dewberry’s mapping of flood risks would provide a valid, transparent, and logically and legally defensible basis for restricting development in what are no longer Special Flood Hazard Areas but nonetheless remain areas susceptible to various types of flood events. Timing would be critical to such a step: signaling as early as possible that restrictions will not in fact be lifted in 2018 could help avoid upset and uncertainty among stakeholders.

Escambia County imposes a freeboard requirement in addition to BFE.¹²³ In anticipation of SLR causing flood zones to creep inland, the county should also consider imposing requirements of graduated stringency for new or renovated structures based on the vulnerability of their location to 1% annual chance floods in 30 years (i.e., roughly 2045) under the High or Highest SLR scenarios described in Dewberry’s Vulnerability Assessment. Thus, for instance, whereas new or substantially improved structures located in the current A zone on county FIRMs must add 3 feet of freeboard, those in the area *projected* to fall in that zone after 1 foot of SLR could be required to build to BFE+2’, and those in the area projected to fall within that zone after 2 feet of SLR could be required to build to BFE with no additional freeboard requirement. Importantly, such restrictions would affect a relatively small fraction of the county (see figure 9 below).¹²⁴

(“Objective 2. The City of St. Augustine will limit capital expenditures that subsidize development in coastal high hazard areas, but will place no limitation on expenditures in those areas that enhance or restore natural resources.”).

¹²³ EC CP11:1.

¹²⁴ EC VA at 16 (“Minimal increases in the 1% annual chance floodplain are apparent in 2045. Exceptions are: small increases to the High and Highest scenarios along the floodplain boundary in Perdido Bay, from Halcyon Shores north to Saufley Estates; downtown Pensacola between S. Pace Blvd and S. 9th Ave. On the Escambia River, increases are apparent just south of Melino.”).

Figure 9. Projections of 1% annual chance event in 2045 under different SLR scenarios. “Baseline” scenario (marked by dark blue rim) identifies current extent of 1% flood zone.



This would make it more expensive to build or improve structures in the small number of vulnerable locations not already encompassed by the CHHA, which would alert everyone considering such development to the expected future risks—and thus the likely costs—of investing in immovable and flood-susceptible assets. It would also substitute partly for restrictions that would be eased should FEMA’s recently released preliminary FIRMs be made effective with no changes.

A further measure that would better align the county’s approach to floodplain management with SLR adaptation goals would be revision of the 1-year duration currently used to calculate cumulative substantial damage or improvement to properties in a floodplain. Expanding that duration to three or five years would prevent residents from avoiding the purpose of the policy, namely to prevent the rebuilding of or further investment in maladapted structures.

Reaction to all of the foregoing proposals is likely to be unenthusiastic, given that they would prevent largely unrestricted development on affordable parcels that are not heavily developed. The reply to such reaction can draw legal support from SB 1094 (discussed in section 2.1.2 above) and factual support from empirical evidence of persistent and growing flood risks. Much of that evidence can be drawn from Dewberry’s Vulnerability Assessment and the data

underlying its projections. More general evidence is available from findings published by FEMA about flood risks elsewhere. In particular, the 2013 floods in Colorado provide an object lesson in the increasing volatility of weather patterns, and the dangerous implications of that volatility for people living in or near flood zones. In the case of the Colorado counties hit with cloudburst storms and flooding in 2013, “There was a high percentage of [post-disaster assistance funding] applicants outside the SFHA, which indicates that properties located outside the SFHA are still at risk for flooding.”¹²⁵

In addition to these direct responses to the prospect of revised FIRMS, the county might also consider indirect responses that inform property owners about SLR-related risks. Consider these four examples:

1. The county could require that property purchasers and/or developers be given full information about the expected future levels of SLR, as projected in Dewberry’s Vulnerability Assessment, and the impacts of SLR on levels of service for infrastructure serving the property, as determined by the appropriate county departments.

2. The county might also require that any development or redevelopment be preceded by an environmental impact analysis (i) the time horizon for which aligns with the expected life of the new structures or facilities, and (ii) that adopts the SLR projections in Dewberry’s Vulnerability Assessment.

3. Rather than imposing requirements on private property owners or developers, the county could conduct a review of the sufficiency of existing shoreline stabilization measures vis-à-vis the SLR projections in Dewberry’s Vulnerability Assessment. The University of Florida Conservation Clinic has drafted model language that would provide for such a review:

Policy 2.1.2: Based on projected rates of sea level rise within the sea-level rise planning horizon the City/County shall inventory all existing shoreline stabilization structures and determine their capacity to maintain functionality throughout the SLR planning horizon.¹²⁶

4. If this sort of review seems politically feasible and likely to both provide the county and individual property owners and developers with useful information, the county might consider a similar but more extensive review of planned and existing infrastructure and development or redevelopment proximate to shorelines. Here again, the U of F Conservation Clinic’s model language could be useful:

¹²⁵ FEMA, Colorado study, *supra* note 116, at 4-3 (indicating that in three of the hardest-hit counties, large percentages of NFIP claims were made by property owners located outside the SFHA: in Boulder, 55% of applications came from addresses in the SFHA and 45% from outside; in Larimer, it was also 57% and 43%; in Weld it was 73% and 27%).

¹²⁶ Macangdang & Newmons, *supra* note 45.

Policy 1.3.1: The City/County shall inventory all existing and planned infrastructure and land development within the vulnerable area for its capacity to accommodate projected sea-level rise over the life expectancy of the infrastructure and development.¹²⁷

5.3.2 Coastal management

A suite of coordinated measures could preserve natural coastal buffers against storm surges and ensure the wellbeing of populations and assets located on the barrier islands and vulnerable parts of the coast. Measures discussed in the previous subsection would serve near-term goals like maintaining barrier islands, discouraging new development, and encouraging SLR accommodations (e.g., locating electrical equipment and other machinery above BFE) on the part of current property owners and businesses. Over the longer term, specific measures should come to include more forceful encouragements to residents and businesses to move out of harm's way. Buyouts targeted at the most vulnerable properties would be one direct, if potentially expensive, option. Creating a transferrable development rights (TDR) scheme that links Pensacola or some other relatively dense area of development to vulnerable coastal properties would channel private dollars toward the project of retreat while also fostering more intensive inland development¹²⁸—consistent with the anti-sprawl provisions of the county's future land use planning element.¹²⁹ This scheme would resemble Lee County's Greater Pine Island TDR program, which aims to encourage island residents to leave the island and to increase urban density elsewhere in the county.¹³⁰ A third measure would involve educating residents about the tax advantages and environmental and resiliency benefits of turning their properties into conservation easements. As with a TDR scheme, but with less involvement by the county and Pensacola governments, informing residents about how to create conservation easements and the beneficial role undeveloped parcels of barrier islands would likely play for the county as a whole might entice some number of property owners at least to forego developing their property further. It could also lay the groundwork for a land trust that accumulated parcels on the barrier islands and managed them collectively.

¹²⁷ *Id.*

¹²⁸ TDR schemes vary in their details, but are broadly similar: parties seeking to develop properties in a relatively dense area and to a degree that exceeds existing limits on density (the "target area") are invited to purchase the right to do so from parties that own property vulnerable to erosion and coastal storms (the "sending area"). Sellers, after being bought out, can put the proceeds toward a residence in a less vulnerable area. No public funds are involved, apart from those required to administer the program. For a clear-eyed description of TDRs in Florida, see University of Florida Conservation Law Clinic, Transferable Development Rights and Density Transfers, <https://perma.cc/48SE-VHY8> (last visited Feb. 9, 2017) (noting that TDR programs can be cumbersome and unworkable, but also highlighting success of Collier County program); see also Collier County, Florida, Code of Ordinances, art. III, § 146-65(h), <https://perma.cc/N2QX-U63Y>.

¹²⁹ EC CP7:2.

¹³⁰ See Lee County, Transfer of Development Rights (TDR) Program, <http://www.leegov.com/dcd/planning/tdr> (describing program and linking to maps of "sending" and "receiving" areas); see also Lee County Admin. Code 13-5, <https://perma.cc/NP6J-Z9BE> (last amended Apr. 5, 2016).

An important caveat about the combination of measures just described is that near-term investments in structures and property, including for the purpose of accommodation, could make subsequent efforts to encourage retreat more expensive and difficult. Thus any program aimed at the gradual displacement of people and structures should take care not to encourage them to invest heavily in their properties with the expectation of recouping that investment through later sale.

5.3.3 Bridges

In relation to new development, precaution and adaptive decisionmaking argue for waiting for further information before investing in structures and supporting infrastructure on what might become floodplain by 2085 or even 2045. In relation to bridges, the same principles argue for pinpointing when in the next 30 or 60 years the county’s bridges—and the four bridges potentially at risk for tidal flooding in particular—are likely to require substantial repair or replacement and analyzing the likely costs and benefits of redesigning those bridges at those times. The goal of such an analysis would be twofold: determine whether it would be more cost-effective to increase the clearance of those bridges than to leave them as-is; and determine when such a change would be worthwhile. This latter determination hinges both on the amortization schedules of different bridges and on what more will be known about the SLR scenario Escambia faces when particular bridges approach the end of their useful lives. If, for instance, the U.S. 98 bridge across Perdido Bay is scheduled for full restoration in 2050, then it makes sense not to analyze the costs and benefits of raising that bridge until at least 2040, by which time the county will know much more about the SLR scenario it should expect in 2085. On the other hand, if that bridge is scheduled for full restoration in 2040, then it could be worth exploring now how the costs of redesign balance against the value of having a fully operational bridge even during king tides or 1% annual chance storm events.

5.3.4 Stormwater management

Escambia’s wastewater management system is not invulnerable to SLR-driven impacts, but it is also well-adapted to those impacts, thanks in large part to upgrades made after Hurricane Ivan struck in 2004.¹³¹ As noted in section 3.2, above, however, Escambia’s stormwater management system is vulnerable and not well adapted to increasingly severe rainfalls and other SLR-driven impacts. Dewberry’s Vulnerability Assessment records and Preliminary Workshop participants explained that this vulnerability owes to several factors:

- the system’s under-capacity design;
- the age of system components; and

¹³¹ See, e.g., Emerald Coast Utilities Authority, Wastewater Services, <https://perma.cc/7XFL-7VRX> (last visited Feb. 9, 2017) (“The [Central Water Reclamation Facility] CWRP was funded in large part through grants from the Federal Emergency Management Agency (FEMA) and other federal sources, the State of Florida, Escambia County and the City of Pensacola. Several local firms, employing hundreds of Northwest Florida employees, participated in the design and construction of the facility, three major lift stations and 25 miles of pipeline.”).

- widespread disrepair that has resulted from an unsystematic and complaint-driven approach to enforcement of requirements for detention ponds and conveyances relied upon for drainage.

The possible responses to system vulnerabilities discussed below would address one or more of these factors. Because the problem of paying for those responses is integral to undertaking them, options for gathering and directing revenue toward those responses is discussed below as well.

Low impact development a.k.a. green infrastructure. As the county has recognized and communicated to its residents and businesses, progress toward stormwater management goals in current and foreseeable future circumstances can be served by installing various forms of low impact development (LID) or green infrastructure (GI) on public property and by encouraging similar installations on private property.¹³² The county’s Low Impact Design Best Management Practices Manual—whose contents the county has put online and further publicized through free workshops conducted in August 2016—provides a thoroughgoing list of approaches to stormwater management that improve on water quantity and quality impacts of traditional system design by imitating or employing natural processes.¹³³ That Manual’s appendices even provide detailed technical information for use by any residents or businesses seeking to assess whether and how LID/GI would enable compliance with various regulatory requirements imposed by the state and the Northwest Florida Water Management District for “the rainiest region in Florida.”¹³⁴ Furthermore, the county’s Central Office Complex, located at 3363 Park Place, embodies LID/GI in the form of a green roof and permeable pavers, as well as data collection tools that allow building managers to track aspects of the building’s performance likely to be improved by those components.

Much as installing LID/GI can take pressure off of hard stormwater system components, LID/GI installation *outside* of areas subject to flooding risks can help mitigate those risks by reducing the amount of stormwater flowing into them from other areas. The most important implication of this point for the county is that Pensacola, which is on the receiving end of a substantial volume of county stormwater runoff, has good reason to provide administrative and financial support to the county for LID/GI promotion efforts. Pensacola’s recent discovery that it is home to \$28-53 million worth of projects to mitigate its flood vulnerability suggests that it has strong motives to mitigate that vulnerability by all possible means, including by supporting county efforts.

Upgrades and upkeep for “grey” system components. While installing LID/GI features upstream can take pressure off of the “grey” components—grates, culverts, pipes, and outfalls—of Escambia’s stormwater management system, it cannot fully supplant those components, which

¹³² See Escambia County Low Impact Design Manual (Sept. 2016), <https://perma.cc/H235-MBLK>.

¹³³ *Id.* at 17–20, 23–25 (discussing water quality improvements and runoff reduction available from LID/GI, as well as indirect benefits like improved energy efficiency and traffic calming).

¹³⁴ *Id.* at 9.

are currently inadequate to their task and are certain to become less adequate as rainfall increases and sea levels rise. Therefore, in complement to a LID/GI campaign, the county should make targeted upgrades to the grey components through which stormwater flows. The selection of particular locations and components for upgrade should take several factors into account, including: the current performance of the system in a given area versus level of service required for that area; the remaining useful life of the existing components or their replacements; and opportunities to couple replacement of old or worn components with redesign of that system branch to meet current or prospective capacity requirements. To justify upgrades, the county should consider revising existing budgets to more accurately reflect the relationship between system performance and component upkeep. This particular version of the cost of doing nothing could provide the basis for cost-effectiveness comparisons between options for upgrade and upkeep.

Maintenance and enforcement. Preliminary Workshop participants explained that enforcement of requirements for retention/detention culvert and pond maintenance tends to respond to complaints rather than following a fixed schedule of systematic inspections. The result is a haphazard and partial pattern of upkeep that reduces system capacity in ways that are palpable but often are not traced to their causes. This problem is a good candidate for the sort of budgeting tactics discussed above: the county should explore how it might estimate the costs this approach *imposes* on stormwater maintenance budget line items, possibly by conducting a pilot program involving regular inspections of a particular area and comparing the resulting costs and outcomes to system averages. Such a comparison might reveal that money could be saved—or just that no extra money need be spent—if the county makes enforcement proactive.

Paying for these things. The county's drainage impact fee of \$0.05/ft² generates little revenue for the county and creates little incentive for private property owners to avoid it by limiting the amount of impervious surface on their properties. Alternatives to the current fee include:

1. a higher drainage impact fee;
2. a stormwater impact fee to be paid by an expanded category of property owners (for instance, anyone undertaking *any* construction on their property for which a permit is required);
3. a stormwater utility fee that individual property owners can be reduce by installing LID; and/or
4. an increase to the local option tax specifically for the purpose of paying for green and grey stormwater infrastructure improvements.

The first option is likely the most politically palatable but also the least likely to meet the county's fiscal needs. The political cost of replacing the current impact fee with either the second or the third option is likely to be similar, but the third option is likely to yield a larger and more stable revenue stream than the second. The fourth option avoids meddling with the current fee

but would yield revenues that can only be deployed via capital expenditures and so would be unavailable for a large subset of the expenses involved in maintaining the stormwater system improvements discussed above. So how to decide?

A feasibility-plus-cost-benefit study that examines how each of these options might be implemented would be the best means both of comparing them and of identifying an optimal level and incidence of a fee/tax. Designing such a study to get at more than just the optimal level and incidence of a fee would add significantly to its usefulness. Ideally, it would do the following:

- specify the incidence not just of the current drainage impact fee but of all taxes and fees that contribute to stormwater system upkeep;
- estimate the benefits accruing from system upkeep to those who do and do not pay those taxes and fees (ideally, it would allow for easy comparison of costs, benefits, and their incidences easy);
- include *expected* costs from foreseeable failure rates and replacement costs for system components whose age or capacity or both make them insufficient to guarantee the level of service required in the area they serve. Furthermore, if possible, anticipate the incidence of fees and taxes that would be used to pay for those expected costs;
- include *potential* benefits from improvements to system upkeep that are not currently being realized;
- use a time horizon long enough to anticipate expected changes to system performance and needs as a result of increasing rainfall volumes and SLR-driven flooding impacts.

In addition to comparing the current state of affairs to possible alternatives, a study of this sort could make clear how higher fees could be cost-beneficial to residents and businesses, and also that alternative fee structures can more fairly align the burden of the fee with the benefit of system upkeep. This information could provide valuable rebuttals to suggestions that higher fees are necessarily wasteful or unfair.

Conclusion

This Strategic Adaptation Report serves several purposes. It describes key features of the policy and legal frameworks that underlie adaptation efforts in Florida. Drawing on Dewberry's Vulnerability Assessment and the discussion at the October 26, 2016 Preliminary Workshop in Escambia County, it provides an overview of vulnerabilities and circumstances relevant to any effort to address those vulnerabilities. Finally, in addition to these descriptions, it provides suggestions for potential use by decisionmakers seeking to develop and implement adaptation measures. Those suggestions draw on inputs from county officials, and on local and statewide efforts in Florida to identify opportunities to apply legal and policy tools to adaptation goals.

Appendix A: Methodology, Lessons Learned, and Recommendations

This appendix contains three sections related to Task 2 of the pilot phase of the Community Resiliency Initiative, performed by the Sabin Center for Climate Change Law at Columbia Law School (“Sabin Center”). The first section describes the Sabin Center’s methodology for developing an Adaptation Plan for the Escambia County. The second section describes lessons learned in the course of carrying out Task 2. The third section sets forth recommendations for the Florida Department of Economic Opportunity (“DEO”) as it decides whether and how to shift from the pilot phase to fuller implementation of the Community Resiliency Initiative.

1. Methodology

While Dewberry Consultants LLC (“Dewberry”) conducted Task 1, the Sabin Center conducted preliminary research into adaptation law and policy generally, adaptation law and policy as implemented by Florida localities, and Florida law related to comprehensive planning, climate change adaptation, takings, and municipal liability.

In advance of the October 2016 Preliminary Workshop, the Sabin Center reviewed Dewberry’s Vulnerability Assessment for Escambia, as well as Escambia’s comprehensive plan elements and various reports and documents that described its economic profile and recent hazard mitigation and/or disaster recovery efforts. This review informed the presentation the Sabin Center developed for the Preliminary Workshop, as well as its structuring of the discussion conducted at that Workshop.

The Sabin Center’s presentation to Preliminary Workshop participants, which covered adaptation policy and relevant areas of Florida law, provided the basis for a facilitated discussion of potential responses to the vulnerabilities identified by Dewberry’s Vulnerability Assessment and described in further detail by participants.

Following the Preliminary Workshop, the Sabin Center provided a summary document to participants (attached as Appendix B to the Adaptation Plan) and conducted further research into areas that local officials at the Preliminary Workshop characterized as especially important for Escambia. This research examined the academic literature and federal, state, and local governmental agency reports for discussions of those areas of consideration. It sought in particular to locate descriptions of how other jurisdictions had dealt with similar circumstances and issues. Using the original research and analysis conducted in advance of the Preliminary Workshop, details and insights collected from local officials during the Preliminary Workshop, and the articles and reports located through supplemental research, the Sabin Center developed Escambia’s draft Adaptation Plan and sought local officials’ feedback on that Plan.

2. Lessons Learned

The following observations and insights are based on the experience of gathering information about and developing Adaptation Plans for three Florida localities, including

Escambia. They could be useful for future adaptation planning efforts by other Florida localities and/or DEO.

Coordination among project team members. Project team members from DEO, Dewberry, and the Sabin Center each had distinct perspectives and unique resources available to them. Coordination among team members with legal, engineering, and policy expertise is important for aligning approaches so as to achieve the project’s overarching goals.

Coordination among stakeholders. The City of Pensacola and third parties, including the Nature Conservancy, participated in the pilot project conducted in Escambia. Their participation was helpful insofar as it highlighted important considerations and example of problems and solutions that transcended county boundaries. However, their participation also made clear that because localities interact so extensively in ways that are important to adaptation, the project—not only in Escambia but elsewhere in Florida as well—might achieve more cost-effective results using a regional approach.

Scoping. The scope of issues relevant to a locality’s options and goals for adaptation can be extremely wide. Similarly, it is possible to delve in great depth into particular issues—whether they are programmatic, procedural, legal, engineering, or other. Escambia’s Adaptation Plan reflects an iterative process, which began with a kickoff call, continued with the Preliminary Workshop and follow-up documentation of that Workshop’s discussion, and wrapped up with feedback from Escambia on the draft Adaptation Plan. However, given the breadth and depth of possible approaches to adaptation, additional iterative steps might have been helpful to refine the scope of the Adaptation Plan. Additional iterative steps in subsequent efforts should include: two questionnaires, one sent before the Workshop to ask participants about their goals and expectations for the Workshop and the project as a whole, and another sent after the Workshop to ask participants about how they and/or their departments would like to make use of the Adaptation Plan.

A lack of urgency might have given local officials the wrong idea. As the Adaptation Plan for Escambia says, that county’s vulnerabilities to sea level rise make adaptation important but not so urgent that it could be described as an emergency. This lack of urgency might explain why relatively few officials participated in the Preliminary Workshop. However, as the Adaptation Plan also says, Escambia is in the somewhat enviable position of being able to make its medium- and long-term plans for the future more adaptive in a way that can avoid stranding assets that have not yet fully depreciated.

Gathering information. Plan elements, ordinances, and some locality-specific reports were publically available. However, details about important features of Escambia’s adaptation profile and political and regulatory decision making processes could only be gathered from local officials. While the Preliminary Workshop served as a good means of identifying and collecting

much of that information, future adaptation planning efforts would be aided by the collection of a standard set of documents relating to:

- Escambia’s budgeting process,
- Escambia’s recent experiences with disaster planning, mitigation, and recovery, and with federally-funded programs relating to land use and water quality more generally, and
- Examples of adaptation planning reports or materials developed by other localities that Escambia officials have found to be informative and/or worth imitating in part or as a whole.

Framing the nature of adaptation planning. Escambia local officials seemed open to the view that adaptation planning is not a temporary intervention in the normal course of business, but rather is the first instance of an approach to land use and capital investment planning that entails permanent changes relative to past practice. As discussed in the Adaptation Plan, the most basic and important aspect of adaptation is to recognize that the coastlines and climate of the future will not only depart from those of the past but will continue to change—and so will require coastal localities to adapt continuously. This point should be conveyed early in the process and reinforced at each stage. Doing so will help participants to make the best possible use of the time with and access to experts, chiefly by shaping the Vulnerability Assessment and Adaptation Plan generated in the course of the project to be maximally useful for Escambia’s purposes.

Opportunities for outside financing. More than any other locality that participated in the pilot project, Escambia was eager to know about possible sources of financing from the state, federal government, or privately-run grant programs. This interest reflected past success with seeking grant funding for projects focused on water quality outcomes, as well as limited options for tapping new sources of local funding or increasing existing local funding streams.

3. Recommendations for DEO

Localities are well positioned to identify the vulnerabilities to which adaptation is necessary. They are also uniquely well-informed about how best to set priorities for addressing those vulnerabilities. However, leadership from a statewide authority like DEO, the Department of Environmental Protection, or the Department of Transportation is critical to the success of adaptation to sea level rise in Florida. Statewide leadership can facilitate coordinated and potentially synergistic efforts among multiple localities. It can take pressure off of local officials who might otherwise face insurmountable political hurdles. And it can help make useful information, expertise, and funding accessible to those in need of it in a way that individual localities generally cannot do. This leadership role is even more critical now, as the federal government agencies that have served these centralizing roles to date are being directed away from further engagement. Consistent with these essential objectives, DEO should:

- Create an online database that shares the experiences of Florida localities already engaged in adaptation planning and implementation. In contrast to databases maintained by the Georgetown Climate Center and the Climate Adaptation Knowledge Exchange,¹ a Florida-specific database would provide Florida localities with a manageable volume of resources, all of which reflect efforts to contend with similar challenges in the same legal and policy context. DEO might consider collaborating with the Southeast Florida Regional Climate Compact in this effort, as the Compact has already established a database of this sort.²
- Create a web portal that makes available technical information such as building codes, stormwater and wastewater equipment specifications, and disaster mitigation plans that have been shown to be especially effective in the face of rising seas and strengthening storms. Locating resources (or even just links to resources) like these in one place in an organized way would facilitate not just access but also comparisons of technical approaches across jurisdictions.

¹ Climate Adaptation Knowledge Exchange, <http://www.cakex.org/>; Georgetown Climate Center, State and Local Adaptation Plans, <http://www.georgetownclimate.org/adaptation/plans.html>.

² Southeast Florida Regional Climate Change Compact, RCAP Database, <http://rcap.southeastfloridaclimatecompact.org/>.

Appendix B: Preliminary Workshop Summary
Coastal Resiliency Initiative, Preliminary Workshop
Escambia County, Florida | October 26, 2016

Summary

The Preliminary Workshop conducted on October 26, 2016 served several interwoven objectives, including:

1. Developing a common framework for understanding physical and policy options for adapting to sea level rise (SLR);
2. Characterizing particular adaptation issues in terms of their urgency, scale (physical and budgetary), relevance to particular constituencies, and ease or difficulty of address;
3. Identifying strategies suitable for addressing particular adaptation issues, either on their own or in concert with parallel programmatic efforts.

This summary organizes items covered during the Workshop in terms of those four objectives. It also notes several preliminary decisions taken, based in part on discussion of those items.

Framework for policy options

Responses to vulnerabilities resulting from SLR involves either (1) protecting current land uses and patterns of activity in vulnerable areas (protect), (2) reducing vulnerabilities by modifying those uses and patterns (accommodate), or steering clear of vulnerabilities by (3) moving existing people and structures (retreat) or (4) deciding against development (avoid). Implementing these approaches cost-effectively involves steering private decisions, as well as grounding decisions about the location and design of infrastructure in the best available information about future circumstances—topography, weather, and fiscal constraints, among others. Imposing restrictions on development can create legal risk for a locality. So too can the use of infrastructure funding to encourage accommodation, avoidance, or retreat from vulnerable locations. However, legal risks will increasingly also attend failures to do so.

Adaptation issues and responsive strategies

The Workshop’s “structured discussion” segments considered adaptation issues and responsive strategies. The main issue areas covered were: coastal management; disaster recovery; stormwater management; and the related tasks of budgeting, maintaining revenues, and justifying adaptation planning measures to elected officials and the public. The following table, which is organized by issue area, lists key points from the participants’ discussion. It is not an exhaustive record of that discussion. The arrows in the right column indicate that the paragraph relates to the issue at left.

<i>Issue area</i>	<i>Issues identified</i>	<i>Responsive strategies discussed</i>
Coastal management	- Recent changes to FEMA flood maps and to state CHHA invite	➔ Assess whether an Adaptation Action Area or coastal overlay zone that maps onto hurricane

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<p>Coastal management (continued)</p>	<p>development in vulnerable coastal areas</p>	<p>evacuation zones would be more likely to provide a politically and practically feasible basis for restricting development in newly unregulated areas</p>
	<p>- Neighboring counties are working with Escambia to seek participation in a new EPA estuary initiative</p>	<p>➔ Participation would be useful for several reasons; data gathered for the purpose of applying might also be useful to support other local or inter-county resilience initiatives</p>
<p>Flood mapping and disaster recovery</p>	<p>- FEMA’s proposed revision to county flood insurance rate maps (FIRMs) would <i>reduce</i> the extent of flood zones and thereby undermine the existing BFE +3’ requirements that have caused some property owners to elevate their residences or businesses</p>	<p>➔ Request reconsideration by FEMA. FIRM mapping builds on data from randomly selected past flood events; reconsideration can therefore easily prompt revision/correction to inappropriately rosy maps – and FEMA is always open to making flood zones bigger; at a minimum, ask FEMA to revise its assumption about beach nourishment</p>
	<p>- CHHA revision prompted revision of comprehensive plan in a way that opened up high-risk areas to development</p>	<p>➔ Identify credible externally-developed information about flood risks—possibly Dewberry’s reading of NOAA and Army Corps data?— for inclusion in materials presented to council members in support of proposed plan revisions that steer development away from vulnerable areas; Draw on SB 1094 language to support stepwise restrictions on development in zones designated as vulnerable to flooding for hurricane Categories 1 through 5; Explore what data, evidence would be needed to persuade council members to accept plan documents that extend timeframe for cumulative substantial</p>

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		damage/improvement beyond 1 year ¹
Stormwater management	- Many pipes and other system components throughout the country are well beyond their design life	➔ Update drainage inventory to indicate features and status of pipes in use
Stormwater management (continued)	- Current budgets don't reflect/anticipate costs of replacing old components	➔ Revise or supplement budgeting documents with several numbers: expected failure rates, estimated costs of failures, costs of replacement (in combination, these will provide a framework for periodic cost-benefit analyses)
	- Current system relies on detention ponds, many of which are not well maintained; maintenance efforts are often complaint-driven	➔ Consider commissioning cost-benefit analysis of increments of increased spending on maintenance (and thereby incrementally greater avoidance of flood damage during rain events)
	- Current development impact fee of \$0.05/ft ² impervious surface is a one-off charge; annual stormwater fee would likely be unpopular	➔ Explore options for increasing impact fee and creating partial or full exemptions for installation of green infrastructure; Explore options for replacing impact fee it with stormwater fee; one option would be to phase out old fee and phase in new fee over 1-3 years to allow for installation of green infrastructure by property owners eager to avoid the new fee; Any effort to enact a stormwater fee should be coupled with information about green infrastructure—use data gathered from county govt building's green

¹ See, e.g., FEMA, *Reducing Losses through Higher Regulatory Standards Best Practices and Cost-Effective Strategies Report*, FEMA-DR-4145-CO (Mar. 2015), <http://bit.ly/2flq0p6>.

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		<p>roof to characterize performance of such installations to the county board and to the public; Use a modified version of Pensacola’s stormwater fee viability assessment model to derive a rough estimate of what fee levels would be for the county</p>
<p>Budgeting for and justifying adaptation measures</p>	<p>- [see points above about stormwater management system and fee]</p>	<p>➔ Present board with integrated results of one or more analyses that capture costs and benefits of old pipe replacement (or failure to replace), installation of green infrastructure on public property and in public rights of way, replacement of impact fee with stormwater fee, and that notes prohibition on use of local option sales tax for non-capital spending</p>
<p>Budgeting etc. (continued)</p>	<p>- [see points above about FEMA map revision and CHHA change]</p>	<p>(e.g., maintenance of green infrastructure); Whenever possible, seek federal involvement in a project so that National Environmental Policy Act requirements apply—they now include guidance re consideration for climate change-related risks, such as sea level rise</p>
	<p>- Pensacola’s 2014 modeling exercise revealed vulnerability to flooding and called for \$28-58M in spending to address it</p>	<p>➔ Identify risk factors for Pensacola that arise in Escambia County and seek support from Pensacola for projects that would yield benefits in both places</p>

Decisions

- Should the work product submitted to Escambia County be a free-standing document that identifies and analyzes a range of adaptation options? or should it be broken into components intended for specific uses in some planning Elements but not others?
Preliminary answer: freestanding document whose components can easily be broken out.
- How should priorities be set for choosing among adaptation strategies?

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Preliminary answer: selection criteria include feasibility, cost, prospective benefits (and/or avoided costs).

- What adaptation issues, options and strategies should take priority?

Preliminary answer: restoration of restrictions on development in flood zones to offset changes in FEMA maps, CHHA; maintenance of and upgrades to wastewater management system

- Are legislative changes necessary to enable or support preferred strategies?

Preliminary answer: Legislative approval from the board will be necessary to implement some but not all strategies. No new state-level legislation seems to be required.