
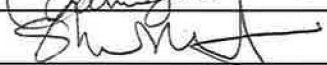



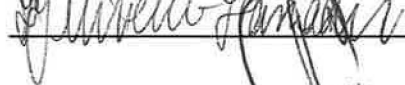
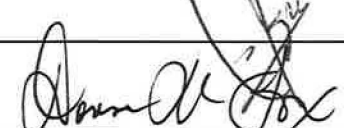
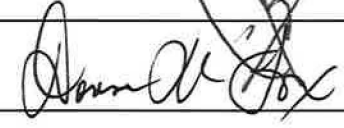
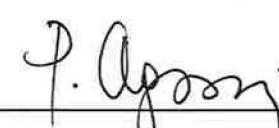


A FRAMEWORK FOR LOCALLY DRIVEN SEA LEVEL RISE POLICY AND  
ACTION

by

Adam T. Carpenter  
A Dissertation  
Submitted to the  
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of  
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of  
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Environmental Science and Public Policy

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A Framework for Locally Driven Sea Level Rise Policy and Action

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## **DEDICATION**

This is dedicated to my loving wife Marian, my wonderful child George, and my baby to be.

## **ACKNOWLEDGEMENTS**

I would like to thank my relatives, friends, and others who have helped support my education and this degree. My loving wife, Marian Carpenter, assisted with extensive proofreading and to help me find enough time for research and writing. My parents, Ann Carpenter and Craig Carpenter continuously encouraged me to keep moving forward, even when making progress was challenging. My committee members, Drs. Sklarew, deMonsabert, Jonas, Schopf, and Liner provided valuable support throughout the process. I would also like to thank the American Water Works Association for their tuition support during my research. Finally, I would also like to say thank you to all my other friends, family, and colleagues who encouraged me to pursue my education and have supported me along the way.

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## LIST OF ABBREVIATIONS

|                                                              |        |
|--------------------------------------------------------------|--------|
| Analytic Hierarchy Process.....                              | AHP    |
| Community Rating System (U.S.) .....                         | CRS    |
| Dynamic and Interactive Vulnerability Assessment (E.U.)..... | DIVA   |
| Environmental Protection Agency (U.S.) .....                 | EPA    |
| Federal Emergency Management Agency (U.S.) .....             | FEMA   |
| Greenhouse Gas .....                                         | GHG    |
| Intergovernmental Panel on Climate Change .....              | IPCC   |
| International Building Code.....                             | IBC    |
| International Code Council .....                             | ICC    |
| Light Information, Detection, and Ranging.....               | LIDAR  |
| Infiltration and Inflow .....                                | I&I    |
| Long Beach Island (New Jersey, U.S.).....                    | LBI    |
| National Climate Assessment (U.S.) .....                     | NCA    |
| National Flood Insurance Program .....                       | NFIP   |
| National Oceanic and Atmospheric Administration (U.S.) ..... | NOAA   |
| Sea Level Rise.....                                          | SLR    |
| U.S. Army Corps of Engineers .....                           | USACE  |
| U.S. Global Change Research Program.....                     | USGCRP |

## **ABSTRACT**

### **A FRAMEWORK FOR LOCALLY DRIVEN SEA LEVEL RISE POLICY AND ACTION**

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George Mason University, 2019

Dissertation Director: Dr. Dann Sklarew

Sea level rise (SLR) is a potentially devastating process for coastal communities, and many are not adequately prepared. Lacking perfect SLR information, communities must plan and prepare using imperfect information, subject to the needs and preferences of the community. This study identified public and local officials' preferences for SLR planning in coastal communities on the East Coast of the United States. A survey of over 500 individuals who live in, work in, or regularly visit coastal communities on the East Coast of the United States identified preferred components needed for planning, funding, and conflict resolution methods around SLR plans. Interviews with public officials on Long Beach Island, New Jersey addressed the utility of the survey results to address community needs to reduce SLR risks, protect key assets, and identify local protection priorities. Six key findings describe public preferences on what to include in a plan (such as prioritizing critical infrastructure), methods to reduce conflict (such as discussions with scientists) funding methods, and other components of a community-based sea level rise plan. This work will help communities to build SLR plans to meet their needs while breaking down policymaking barriers.



## CHAPTER ONE: INTRODUCTION

Sea level rise (SLR) is a very real and potentially disastrous phenomenon, although distant and abstract to many. Over the past century, global sea level has already risen by about 0.2 m (0.66 ft).<sup>138</sup> With a large and growing amount of the world's population living in coastal areas, a substantive percentage of the world's economic and human capital resides in proximity to oceans, seas, and ocean-influenced bays and other water bodies.<sup>95</sup> Baseline population estimates have over 10% of the world's population in low-lying coastal areas already subject to severe flooding, with many estimates having both the absolute population and percentage increasing.<sup>96</sup> Coastal communities also have increasing threats from climate change, adding to the overall risk.<sup>53</sup> Therefore, methods to assist communities in preparing for SLR are needed, including understanding of the perceptions and priorities of members of these communities involved in discussions around preparing for SLR. This chapter provides an overview of SLR risk, discusses the history and trends of sea level, introduces methods to address SLR, and describes the study design for the rest of this work.

Looking at one potential worst-case scenario, an eventual 5 m rise in sea level, it is estimated that nearly 670 million people worldwide would be displaced, nearly 9% of the Earth's population.<sup>143</sup> Although current projections do not call for such large increases in sea level over at least the next 90-100 years, there is evidence in the paleontological record that sea level has been this high as recently as about 115,000 years ago.<sup>31</sup> Under more likely scenarios in upcoming decades, the annual losses from flooding

damage could rise to over \$1 trillion per year worldwide by 2050 if adaptation measures are not taken, due to a combination of climate change and increasing coastal populations.<sup>51</sup> This estimate is over 160 times greater than present value of annual damage and could be catastrophic if communities are not adequately prepared.

Flooding in coastal communities can be caused by rain, tides, and storm surge, depending on the conditions. Although not a high risk on the East Coast of the United States, tsunamis driven by seismic events are another driver of highly destructive flooding.<sup>5</sup> SLR can amplify the impacts of all of these flooding drivers. Although impacts from SLR can come in many forms, two particularly vital concepts are inundation and coastal storm surge. Inundation refers to general flooding, which includes areas that previously were outside the tidal range but begin to be affected by high tides as well as that flood during heavy rain events.<sup>126,147</sup> Flooding can come from both heavy rain (storm water), which overflows drainage systems and nearby water bodies, and from rising tidal water. Inland flooding is caused primarily by overflow of inland drainage and water bodies. The highest yearly expected tide, commonly referred to as the King Tide, has been of considerable concern in the real estate community in light of SLR.<sup>123</sup> Storm surge refers to forceful, horizontal flow of water, primarily wind and current driven, from the ocean due to a hurricane or other powerful storm.<sup>147</sup> Storm surge is sometimes referred to as a “wall of water.” In this form, the force of the moving water can cause considerable damage beyond what slower forms of flooding cause.

Even for those not directly affected by SLR, the goods and services they rely upon could be. This includes agriculture, sanitation, and transportation where networks

can be interrupted, and supply lines cut off. Sometimes, this can occur well inland from the most direct impacts from storms. Therefore, SLR's associated impacts, such as groundwater salt intrusion, inundation, and increased storm surge potential present major risks both within and well beyond the coastal zone.

Since wastewater systems are generally not pressurized, they are vulnerable to infiltration and inflow (I&I) where water that does not belong in the system makes its way in through leaks, manhole covers, and other openings in the system.<sup>43</sup> The consequences of I&I include overflows of wastewater into the environment, backups in homes and businesses, and increased treatment costs. Some North Carolina coastal wastewater utilities modeled substantial potential impacts of various SLR scenarios, in some cases tripling baseline flows and exceeding maximum permitted treatment capacity.<sup>43</sup> SLR would exacerbate ongoing issues in these systems. Other areas such as Tangier Island, Virginia and Crisfield, Maryland report increasing difficulties maintaining current land against erosion.<sup>52,86</sup> Sea level rise would also exacerbate this land-loss issue.

Impacts from hurricane storm surge and other coastal events already cause substantial loss of life and property. For example, the four costliest hurricanes in the United States together caused at least \$365 billion in damage, including Katrina (2005) with \$125 billion in damage, Harvey (2017) with \$125 billion, Sandy (2012) with \$65 billion, and Irma (2017) with \$50 billion.<sup>8,94</sup> These studies did not include Hurricane Maria (2017) because it did not hit the mainland of the United States, although monetary damages seem to be between that of Harvey and Sandy. The 2018 hurricane season

included hurricanes Florence, which caused around \$25 billion of mostly coastal and inland flooding and Michael, which caused around \$25 billion of primarily wind damage.<sup>93</sup> Although not all the damage associated with these storms was caused by flooding and not all the damage took place on the coast, the extreme magnitude of these types of events shows the need for careful planning and risk reduction. SLR would worsen the impacts from future storms and disasters precisely when extensive and costly efforts are being made to recover from past events while reducing the risks of recurring damage from storms similar to past ones.

There are also non-disaster impacts such as ongoing and recurring salt water intrusion into drinking water aquifers and backup of salt water into wastewater systems.<sup>43</sup> The combination of new risks and worsening of current risks could lead to stranded investments (structures or infrastructure installed but no longer be usable), lost adaptation opportunities, a false sense of protection against future events, and other unintended consequences. Some areas, including low-lying islands where there is little opportunity to move to higher ground, are particularly vulnerable.<sup>26</sup> Understanding vulnerability is contingent on an understanding of SLR risk.

### **What is SLR Risk?**

Center to understanding of preparation for and recovery from extreme events is the concept of risk. The exact definition of risk varies from one profession to another and across different cultures.<sup>3</sup> One commonly used definition is that risk is exposure times consequence.

Exposure can be thought of numerically as the best estimate of likelihood of an undesirable event occurring over the time examined. Exposure can also be referred to as a probability. More likely events have a greater exposure. Consequence is the sum of damage, injury, and other impacts that will happen if the adverse event occurs, regardless of the likelihood. For example, the consequence of an aircraft accident is very high for the passengers even though the exposure is very low. Consequence can come in many forms, including but not limited to injury or loss of life, destroyed or damaged property, loss of historical or cultural sites, or forced changes to lifestyle. The most exposed locations are not necessarily those most at risk because the consequence may be greater in areas that are less exposed, and they are not the only places where there could be adverse impacts.

With an understanding of these concepts, SLR planning efforts can focus on reducing risk by addressing SLR-related impacts by both preventing them when possible (reducing exposure) and mitigating the damage when they do occur (reducing consequences). Both approaches reduce overall risk. Extreme events, such as the previously described storms, are an important part of overall risk, but are not the only consequences exacerbated by SLR. Actions that reduce exposure, consequence, or both necessarily mitigate overall risk. However, evaluating when and how much they have improved can be difficult, especially given that SLR exposure, such as increased flooding risk, changes over time. Risk reduction is not straightforward given such uncertainty.

There is not likely to be any set of actions that could completely eliminate the risk from these events. Although SLR is already established as an ongoing phenomenon, it

occurs at different rates in different places and with substantially different possible impacts, as described in reports such as those by the Intergovernmental Panel on Climate Change (IPCC) and the U.S. Global Change Research Program (USGCRP).<sup>62,56,138</sup>

Therefore, even if all human development was moved out of harm's way, however unlikely, there would continue to be impacts on natural features that people rely on for their economy, livelihood, recreation, and other benefits. However, SLR planning and adaptation actions are nevertheless likely to help in increase resiliency and reduce the risks from both extreme events and more common adverse occurrences. That is to say, careful preparation can help stave off the worst impacts. This is especially true in a changing climate, where some of these events will become more frequent and more severe over time.<sup>138</sup> Although establishing the need for SLR planning and actions may be straightforward, the assessment of potential changes, their likely impacts, and risk reduction strategies can be complex. There is considerable uncertainty associated with SLR impacts. Variations in topography, soil and sand types, and other local conditions mean that the same amount of SLR could result in dramatically different (larger and smaller) amounts of land erosion, inundation, and storm surge, resulting in different erosion ratios.<sup>115</sup> Likewise, which methods are likely to be effective, such as engineered barriers and development policies, will also vary depending on local conditions. In order to fully explore policy options, one must first examine the underlying driver of SLR, including its history.

## **Sea Level History and Trends**

Sea level has been directly measured for over 100 years.<sup>32</sup> Since then, sea level has already risen by about 0.2 m (0.66 ft) as a global average.<sup>138</sup>

The sea level record since the beginning of satellite observations in 1993 is considered especially precise, showing that between a third and half of the observed SLR since 1900 has taken place recently.<sup>137</sup> At the same time, the cause of specific shoreline changes can be very difficult to identify, meaning that additional inquiry is needed when examining any specific changes before attributing them to SLR alone.<sup>146</sup>

Although attributing shoreline changes and coastal impacts to specific causes is difficult, projecting possible impacts is necessary to develop risk reduction and adaptation actions. These actions include both technical and policy tools, which have different costs and benefits to consider. Engineered structures (sea walls, levies, building hardening, etc.), conservation and restoration of wetlands, relocation, building code modifications, insurance requirements, and numerous other tools are available to assist states, municipalities, and the public in reducing SLR risks.<sup>35</sup> Making difficult decisions on policies and actions to lessen these impacts can be extremely challenging since local government financial resources are often very limited.<sup>1</sup> Different groups will have different priorities. Some may be distrustful of data, models, and predictions that they do not understand or cannot themselves validate from their experiences. These difficulties can be compounded when outcomes are not clear (at least in the short term). Based upon greenhouse gas (GHG) emissions scenarios, model outputs, and other factors, many possible future scenarios can emerge from analysis. Some uncertainties, such as

uncertainty about future GHG emissions and whether models accurately reflect reality, can be reduced but cannot be completely eliminated.<sup>18,58,59</sup>

Despite these challenges, SLR adaptation is needed worldwide. In even the most optimistic GHG emissions scenarios, many people will be displaced globally and infrastructures and economies will be at risk.<sup>106</sup> Communities must overcome barriers to setting policies and taking robust, sustainable actions to plan successfully for, and take protective action related to SLR that considers these variables and satisfies stakeholders. To do so, their officials must find ways to make complex decisions while taking local priorities and preferences into account.

### **Methods to Assist with Complex Decisions**

There are many methods available to aid in making complex decisions. The Analytic Hierarchy Process (AHP), for example, dissects decision-making by defining a problem, structuring a decision based upon goals and objectives, weighing priorities through consensus or another structured process, and making a decision.<sup>121</sup> AHP, or a similar decision-making method, may be useful in structuring a framework for SLR risk reduction. Additionally, methods also exist to identify coastal vulnerability. A vulnerability or resilience index can take into account both physical and human parameters to help quantify conditions to form the basis for making decisions.<sup>2,105</sup> These are only a few methods that could potentially be used to prioritize alternatives and make decisions regarding SLR risk reduction.



## **Overview of Study Design**

While various methods to address SLR impacts have been developed, prioritizing and compiling input, priorities, and recommendations from potentially disparate groups is not straightforward. This work sought to build a better understanding of public, expert, and public officials (elected or appointed) viewpoints, priorities, and preferences, which could prove beneficial in this regard. It did so through the evaluation of expert information Chapter Two: Sea Level Rise Science and Policy, followed by collection and analysis of information from the public and public officials in a series of survey and interview instruments. These component studies are described in Chapter Three: Survey Development, Chapter Four: Public Survey Results, and Chapter Five: Public Officials Interviews.

In any given situation, there are likely to be viable alternatives that will be viewed as unacceptable or that carry excessive risks or costs for various stakeholders based upon advantages, limitations, costs, and potential barriers inherent within each alternative.<sup>80,90</sup> Although expert recommendations alone may generate technically viable alternatives to address SLR risks, input from the public and from public officials are required to ensure that options are socially appropriate, reflective of diverse opinions, locally relevant, and practically grounded.<sup>75,90–92</sup> Cultural concerns, areas of particular historic, economic, or environmental significance, and uncertainties over the necessary level of protection just some considerations that could be of public concern or important to officials. Given the limited resources that states, municipalities, and others involved in planning will likely have at their disposal, a framework to assist with planning could prove valuable to foster

a better understanding of local SLR priorities, especially in coastal communities on the East Coast of the United States, where this study focused.

### **Research Questions**

This work sought to better translate stakeholder input and data into actionable outcomes for local officials. In turn, this information is meant to help reduce SLR risks over time through improved planning. The primary questions addressed in this study were:

1. Is there a group of public priorities and preferences that need to be incorporated into a framework for effective SLR policymaking?
2. If so, what are those criteria, and do the groups studied differ in their opinions of what is required?
3. Can a framework be developed and applied that addresses the viewpoints of these groups and be considered useful for local SLR planning and policy processes?

To help answer these questions, this study developed key insights from several viewpoints on SLR planning, including a series of key findings that can be used to help develop and implement SLR plans, policies, and actions. This included examining the viewpoints of:

- Experts: Published works (preferably peer-reviewed) that demonstrate a specific expertise in sea level rise planning and adaptation measures. This information is contained within the literature review and used to inform the public survey and the public officials interviews.

- Public officials: Those who are elected (or appointed to a role commonly filled by an elected official) such as mayors and city councils or appropriate staff. In this study, officials from the six jurisdictions on Long Beach Island (LBI) in New Jersey (USA) were interviewed.
- Public: Individuals who live in, work in, or regularly visit coastal communities in U.S. Eastern Coastal states, who are neither public officials nor experts in this field.

Four components of this study provide this information. Each was designed to build upon of the knowledge learned in the previous component. First, an overview of SLR science and policy considerations, which constitute the “expert” portion of the study, is describe in Chapter Two: Sea Level Rise Science and Policy. Next, a survey development exercise (n=24) was designed to help gather a baseline of public thoughts on key components of SLR planning as described in Chapter Three: Survey Development. Third, a public survey delved deeper into Atlantic sates public viewpoints on sea level rise planning with a much larger study (n=503), as described in Chapter Four: Public Survey Results. Finally, public officials in six jurisdictions on LBI were interviewed to understand their current and planned SLR actions and to determine whether the findings of the public survey were applicable and potentially useful in those areas. LBI was selected because it is a barrier island likely at high risk for SLR impacts and was substantially impacted by Superstorm Sandy in 2012. Much of the island is within 1-2 m (3.3-6.6 ft) of sea level (as measured by the North American Datum of 1983).<sup>136</sup> Findings from these interviews are discussed in Chapter Five: Public Officials Interviews.

## **CHAPTER TWO: SEA LEVEL RISE SCIENCE AND POLICY**

Integrating local policies and perspectives on sea level rise requires a firm understanding of the physical processes driving SLR, both the anthropogenic and natural factors. Global average SLR is an important measurement that helps gauge the extent of potential impacts worldwide, but there is substantial local variability based on local factors impacting relative rise, differing vulnerabilities, and other considerations. The impact on any specific community will derive from a combination of the factors that make up local relative SLR including local land subsidence (or uplift), the increased probability and impact of storm surge events, and other SLR impacts, such as groundwater salt intrusion.<sup>43,67,76,78,137</sup> This chapter begins by discussing the science behind SLR with details of its key drivers, then describes SLR models and their limitations. A discussion of sea level rise policies including various viewpoints follows.

### **Sea Level Rise Science, History, Trends, and Projections**

Accurate, direct sea level measurements date back about 100 years.<sup>32</sup> Global satellite driven measurements began in 1993 and are considered highly precise, but the short record limits their usefulness to recent trend analysis.<sup>32</sup> Sea level history prior to these human records must be inferred from other evidence. An example of such a proxy measurement is that marine oxygen isotope records from sediments act as a surrogate for sea level through at least nine million years. Other stratigraphic studies have shown that 100 million years ago sea level was 200 m (656 ft) higher than today.<sup>32</sup> 50 million years ago, sea level was approximately 75 m (246 ft) higher than current levels.<sup>56</sup> Sea level was

approximately 6-9 m (19.7-29.5 ft) higher when the Earth's average temperature was 3-5 °C (5.4-9 °F) warmer than present during the last interglacial stage about 125,000 years ago.<sup>32</sup> This elevation could be an indication of the eventual SLR the Earth could experience with a similar level of warming. Due to an increase in land-based ice, sea level was nearly 120 m (394 ft) lower during the last ice age 20,000 years ago compared to today.<sup>56</sup>

There are at least two factors responsible for global sea level rise and at least three additional local and regional factors, each with different levels of uncertainty.<sup>62,144</sup> The global processes include thermal expansion and volumetric changes. The regional factors include land subsidence (or uplift), ocean circulation changes, and gravity impacts.

### **Thermal Sea Level Rise**

Thermal SLR (thermal expansion) is the result of a basic property of physics. With few exceptions, when substances are warm and contain more energy, they take up more physical space than when they are cool and contain less energy. The polar nature of water makes it an exception at certain temperatures (ice just below freezing takes up more space than the same number of molecules of water just above freezing), water above approximately 4 °C (39 °F) expands as it warms, at an accelerating rate until reaching boiling.<sup>47</sup> For example, water has lost over 4% of its density from 4 °C (39 °F) to just below boiling 100 °C (212 °F).<sup>36</sup> This difference is imperceptibly tiny for a small volume of water for modest temperature changes, but it is greatly amplified for a volume as large as the world's oceans. Because all the world's oceans are connected, thermal expansion may increase the global sea level by a substantial amount and it has increased

sea level considerably in past instances of global change.<sup>78</sup> However, the impacts of thermal expansion will not be uniform because there are many processes, such as weather patterns and ocean currents, that impact how water within the oceans is distributed around the globe. Although expansion via temperature is well understood, expected oceanic temperature changes and distribution can be modeled but are not known precisely, and therefore there is considerable uncertainty.<sup>128</sup>

### **Volumetric Sea Level Rise**

The second major contributor to SLR is volumetric rise based upon a net increase in the water within the oceans. Since the total amount of water on Earth is relatively constant over human timescales, a volumetric oceanic increase has to come from another existing water source. Glaciers, ice sheets, and other land-based ice are by far the largest deposits of surface water that do not contribute to sea level because they are not part of the ocean's water volume.<sup>81</sup> The melting of floating ice does not contribute to SLR because when frozen it displaces the same amount of water that it would contribute if melted. While all land-based ice can contribute to SLR, the ice sheets in West Antarctica and Greenland contain much more ice than any other possible sources.<sup>63,71</sup> If melted completely, these ice sheets plus other glaciers would raise sea level by at least 66 meters (217 feet).<sup>63</sup> Complete loss would likely take millennia even under extreme climate change conditions, but there is a great deal of uncertainty as to how rapidly and to what degree these ice sheets will react to atmospheric temperature change in plausible scenarios.<sup>116,128,138</sup> Higher air temperatures on the surface of ice sheets alone will not cause them to melt quickly, but there is evidence when water melts, it pools on top and

drills into the ice sheet's interior, accelerating breakup by exposing a much greater surface area to higher temperatures.<sup>137</sup> There have also been findings that instability and pooling water under glaciers near the grounding line, where an ice sheet transitions from solid ground to the ocean, can cause accelerated ice sheet loss.<sup>68,116</sup> Some experts believe melting ice sheets will have little impact on SLR over the next 50-100 years, while others believe they will contribute an enormous amount to SLR over that timeframe.<sup>31,68,116,118,125</sup> Uncertainty about ice sheet dynamics and how various events (such as the impacts of the loss of portions of sea-based ice sheets connected to land based ones) is one of the reasons for large possible ranges in SLR far into the future.<sup>76,117,124</sup> The other main reason is uncertainty about future net GHG emissions. Like thermal rise, volumetric increases will impact global oceanic levels, although other processes such as ocean currents will influence how that increase is distributed around the globe.<sup>138</sup>

### **Land Subsidence and Uplift**

Land subsidence and uplift are local to regional geologic processes mostly independent of climate change, and unrelated to changes in oceanic water itself.<sup>125</sup> Tectonic forces that cause land masses to rise and fall relative to the ocean, resulting in a relative sea level rise or fall even if the ocean level itself were to remain constant. Certain types of subsurface rock containing groundwater or certain fossil fuels are compressible, and long-term net extraction of these resources can cause or accelerate subsidence.<sup>146</sup> The amount of subsidence attributable to groundwater extraction is not entirely clear, although conservation measures to reduce the need for extraction slow these processes.

For reducing groundwater use, such measures are frequently used in water stressed areas, including the replacement of older water consuming devices with more efficient versions, and changing the pricing structure of treated water to reduce use.<sup>89</sup>

Because both subsidence and uplift are possible, some places will have a faster relative SLR than the global mean because the land is sinking, and others will experience slower relative SLR or even sea level fall if the land is rising. Although there is some variability (such as sudden shifts after large earthquakes), tectonic forces causing land subsidence and uplift are long-term processes, the speed of which is well known in many areas. Compression and tectonic forces are only a few of the causes of land elevation change, which also includes uplift “rebound” of land after being compressed by glaciers and subsidence for a variety of reasons.<sup>146</sup> Both past and present glaciers can contribute to future uplift, and like a see-saw, subsidence is now experienced in much of the East Coast of the United States.<sup>127</sup>

### **Ocean Circulation Patterns**

Changes in ocean circulation patterns can have an appreciable impact on where the water within the ocean is distributed. Well-described weather patterns such as El Niño, routinely temporarily redistribute heat in the ocean, impacting local sea level and the climate.<sup>138</sup> Although there is considerable uncertainty, climate change may alter the frequency, severity, and distribution of these types of weather patterns.<sup>137</sup> It could also cause changes to global ocean currents as the oceans warm and additional, less saline water from ice sheets is added. The impacts to sea level from an ocean current change are likely to be local to regional, although the changes in the patterns could be large enough



to have global implications. For example, much of the heat transfer that occurs in the ocean is part of what is known as the “global conveyor belt” which transports warmer, less saline water from the Pacific and Indian Oceans up through the Atlantic and ultimately up to close to Norway before cooling, sinking, and returning through the deep ocean.<sup>33</sup> This oceanographic pattern is complemented by a more shallow transfer that tends to be concentrated closer to coasts, known as Sverdrup circulation.<sup>110</sup> Changes in global and regional climate could impact both of these systems and redistribute pressure and density within the ocean, changing local sea levels.

### **Impacts of Gravity**

Sea level is influenced by gravity. On a recurring basis, the gravity from the moon and sun influences tides.<sup>66</sup> The current tide at the time of a major storm or other event can have a substantial impact on how storm surge and other impacts.<sup>101,149</sup> In addition to this recurring impact of gravity, because all mass (including water in the oceans) is attracted to other mass, and most strongly to the largest and closest masses, ice sheets have a measurable impact on gravity locally and regionally.<sup>67</sup> They are large enough to pull surrounding water closer to them (for example, in the areas around Greenland) which causes a higher sea level near the ice sheet, and a slightly lower sea level far away from the ice sheet. If a significant amount of the ice sheet’s mass is lost, this effect would be lessened, and sea level near the ice sheet would drop and sea level further away from the ice sheet would rise. Although the mechanics of gravity are well understood, how they apply to the distribution of sea level far away from ice sheets, and how this may change as the ice sheets reduce in size is still being explored. Therefore, how any particular area

may be impacted, and how important gravity will be compared to other sea level drivers, still has uncertainty.

### **Recent Sea Level Trends**

Recent trends indicate global sea level is increasing, and relative sea level is rising in most areas. Local rates of increase, or decrease, depend on specific factors such as local currents, land subsidence or uplift, and topographic variations. Increases in sea level due to the actual water in the ocean (momentarily setting aside the complication of land-based changes) is referred to as volumetric SLR.<sup>125</sup> Sea level changes due to circulation patterns, gravity, and other factors not related to water volume are known as dynamic SLR.<sup>132</sup> Although there is some variability based upon the sources and measurements used, a reasonably accepted estimate of average global SLR over the 20<sup>th</sup> century is  $1.7 \pm 0.5$  mm/year ( $0.067 \pm 0.02$  in/year).<sup>56</sup> Although this sounds very small, from 1900 to 2017, average global sea level rose 0.2 m (7.9 in) with about 0.07m (3 in) happening since 1993.<sup>137</sup>

When discussing SLR projections, there are several factors to consider: time period, base elevation at reference, assumptions for future GHG emissions, and the characteristics of the models being used. For example, one study focused on identifying the greatest physically plausible upper bound of SLR by 2100. That study reported an estimate of 2.25 m (7.38 ft) increase in sea level by 2100 when accounting for plausible worst-case scenarios and uncertainties.<sup>128</sup>

There are several key uncertainties concerning SLR projections. First, SLR is partially contingent on future GHG emissions, which are in turn based upon future human

policies and actions. There is no consensus on which GHG emissions scenario will become actualized or if emissions will be different than any of the modeled scenarios.<sup>62</sup> Second, there is considerable uncertainty associated with rates at which the Greenland and Antarctic ice sheets are likely to contribute to SLR, with some saying that past projections underestimate the overall contribution from the world's two largest masses of ice.<sup>118</sup>

The United States Fourth National Climate Assessment (NCA) projects a range of possible sea level rise scenarios ranging from with about 0.30-2.5 m (0.98-8.2 ft) through 2100 relative to a 2000 baseline.<sup>137</sup> The Intergovernmental Panel on Climate Change (IPCC) fifth assessment report provides several possible SLR ranges through 2100 with an overall range of 0.26 m-0.98 m (0.85 ft-3.21 ft) for 2081-2100 over the levels in 1986-2005.<sup>62</sup> The assessment report also notes that due to scientific advancement, confidence in the projections has increased in recent years and now projects them as “likely” (66%-100% probability). One study combined the IPCC methodology with the then-latest gauge, satellite, and other information to arrive at a single probabilistic 0.18 m (0.59 ft) lower bound, 0.48 m (1.57 ft) midpoint, and 0.82 m (2.69 ft) upper bound for SLR by 2100 over a baseline of 1990.<sup>56</sup> This study used a no greater than 2.5% probability of exceedance for the upper and lower bound, though many studies do not provide any probabilities.<sup>56</sup> Others have found that the contribution from Antarctica alone could be anywhere from about 0.2 m up to as much as 1 m by 2100.<sup>31,148</sup> Although there is no one correct or most accurate global SLR projection yet (and given uncertainties, there may never be), globally recognized publications, including the ones discussed above, are good

starting points for local discussions, especially if combined with specific local information. Because of the increasing amount of uncertainty with projections further forward in time, many assessments have been made through 2100, although SLR and its impacts are likely to start sooner and continue well beyond that year. Projecting forward beyond observed SLR requires understanding SLR models, which have both specific capabilities and limitations.

### **Sea Level Rise Models, Capabilities and Limitations**

SLR models have grown in sophistication and application in recent years. For example, discoveries related to ice sheet dynamics have led to the recent understanding that previous SLR projections may have been too low on average.<sup>32</sup> Additionally, modelers understand that some portions of climate models are more readily able to accurately project historical events, with temperature projections generally performing better than precipitation projections.<sup>112</sup> Some substantial limitations of modeling exist at high spatial resolutions and precise timescales.<sup>150</sup>

Models are also limited by the availability of precise data for some variables. For one, many studies have relied on light information, detection, and ranging (LIDAR) measurements from aircraft and satellites for heights above sea level. These are highly accurate but can lack sufficient resolution to conduct a thorough assessment of the most local impacts, such as block by block projections of flooding.<sup>9,30,108,150</sup> These impacts can be examined through other methods or estimated across communities. Such assessments should continue to assess more areas with greater resolution over time and can be combined with other information to help meet local needs.

In addition to uncertainty surrounding the overall extent of future SLR and the areas that would be inundated or at greater risk from storm surge or related events, the ways that shorelines react to changing conditions is often non-linear and can be difficult to predict. For example, one study used complex Bayesian modeling to predict shoreline changes due to a combination of relative SLR and factors such as coastal slope, mean wave height, erosion rates, and others.<sup>50</sup> Bayesian modeling “learns” likely outcomes based upon established and newly discovered relationships. This system predicted some changes well and predicted others poorly, and the actual changes identified in the shoreline were much more complex than what would be expected raising the sea level with an otherwise unaltered shoreline, much like filling a bathtub. This more complex response is likely to be especially prevalent for barrier islands and similar coastal features, as has been seen in North Carolina’s Outer Banks.<sup>88</sup> Therefore, the “bathtub” approach used in some studies to identify the areas likely to be impacted by SLR may be a good starting point to begin a conversation but it is not a complete answer for likely impacts.<sup>88,107</sup> The bathtub approach assumes that land is inundated in its current state with rising seas similar to a bathtub being filled with water, rather than processes like erosion and sedimentation changing the shoreline alongside the increased water level. For example, much of the New Jersey coast has a high erosion ratio, meaning that as much as 100-120 m (328-394 ft) of land horizontally could be lost for every 1 m of increase in vertical sea level.<sup>30</sup> This is one of the highest ratios in the Eastern United States. However, just because an assessment methodology, such as the bathtub approach, cannot

give a complete assessment does not invalidate it as useful for advancing understanding and beginning planning.

Finally, in addition to SLR-specific models, there are also risk assessment, mitigation, and adaptation models that seek to balance potential damage due to inundation, storm surge, and other hazards against the costs of reducing those risks through intentional community to regional scale adaptation. Some adaptation measures, such as wildlife impacts of artificial barriers, can also have negative consequences that need to be weighed against the benefits.<sup>65</sup> Using the Dynamic and Interactive Vulnerability Assessment (DIVA) tool in the European Union as an example, it is understood that the costs of adaptation in many instances will be much lower than the costs of damage from doing nothing.<sup>55</sup>

Although human impacts may be of the greatest immediate concern to many, SLR will ultimately have many non-human impacts, such as major losses to global biodiversity, if SLR advances far above current levels.<sup>81</sup> For example, some have focused on impacts to key species or ecosystems, such as manatees in Florida<sup>75</sup>, tidal marshes and wetlands<sup>20</sup>, impacts to fish<sup>74</sup>, or impacts to plant species.<sup>46</sup> Impacts on species, especially those that are endangered, threatened or may become so in the future, could pose additional challenges to adapting to sea level rise if the Endangered Species Act imposes federal requirements to protect species in ways that could limit communities options for adaptation. This is only one of many considerations for SLR policies.

### **Sea Level Rise Policies**

Communities have the opportunity to manage their risks from SLR through the use of policies such as elevation standards, development restrictions, and infrastructure hardening.<sup>35,55,84</sup> These policies come with both benefits and costs, requiring careful assessment. Although many communities have policies designed to protect against existing flooding, policies specific to SLR in the United States are not consistent, existing only in some jurisdictions.<sup>35</sup> Some state and local policies discourage development and limit municipal and state involvement (through mechanisms such as funding and permits) in areas at high risk for inundation or storm surge.<sup>48,84</sup> Few policies cover expected future risks in beyond current ones. There are some notable exceptions, including Maryland, California, and several major cities.<sup>21,48,98,120</sup> Key states discussed below are summarized in Table 1.

Table 1. Summary of states with SLR policies discussed

| <b>State</b>   | <b>Key Policy</b>                               |
|----------------|-------------------------------------------------|
| California     | State planning guidance to municipalities       |
| Maryland       | Strict limits on state involvement in SLR areas |
| North Carolina | Projections limited to 30 years in the future   |
| Virginia       | Executive order organizing state agencies       |

The State of Maryland has laid out 19 priority policy objectives and conservation program changes to redirect funds away from wildlife preservation areas and other locations that are expected to be lost to SLR in the near future.<sup>48</sup> These funds will instead

be spent on areas where conservation will best protect natural and artificial systems over time. New state facilities and projects receiving state subsidies will also be required to meet increased freeboard (elevation above expected floods) standards, meaning that most structures will need to be placed above or outside future projected flood areas, with a margin of safety. Once SLR advances beyond the current safety factor, the use of current flood lines as a base measurement for construction elevation standards will no longer protect structures as intended. These state policies will have a substantial impact on future state and state-subsidized operations, as well as on municipal operations receiving state funds, but influence from these policies on entirely private activities will be limited. Other policies, such as flood insurance requirements, will likely impact private activities to a greater extent.

California has also sought to identify coastal hazards associated with SLR. The state issued a draft state SLR policy guide in 2013 followed by final guidance in 2015.<sup>21</sup> This policy encourages municipalities to include sea level rise implications in their coastal development plans. It makes a strong delineation between existing development, where fewer adaptation options are available, and new development, where changes in design, location, or other factors can be made at relatively low costs. As part of this policy, coastal communities in different portions of the state are provided with anticipated SLR ranges and are encouraged to take steps to reduce risks associated with their entire potential SLR range.

Other states, like Virginia, have taken initial actions to start developing resilience plans that address SLR by directing state agencies to study the issue and develop action



plans.<sup>28</sup> These types of policies may not be appropriate everywhere, because each state and, to some extent, each locality has different legal frameworks and different political realities that affect meaningful SLR planning through a “top down” government approach. For example, politics have been a significant impediment to SLR planning in North Carolina. In 2011, draft versions of a bill (NC 819) would have preempted the use of local SLR projections with a single, uniform state policy.<sup>100</sup> The law, as initially written, would also have limited the sea level rise models such a state policy could be based upon to more-conservative assumptions that would project lower expected impacts, on average, than other models. Although the final version passed into law did not contain many of these provisions, this illustrated that political controversy can be a significant barrier to reaching consensus and developing community SLR plans. In 2015, the North Carolina Coastal Resources Commission Science Panel issued its final report after having determined the law allowed them to assess only 30 years in to the future, which reduces the assessed level of future SLR expected to accelerate later in the century.<sup>87,104</sup> Although SLR projections are only one part of developing a plan, communities could be very limited in their ability to respond if state projections minimize the perception of future impacts. Other states, such as Florida, New Jersey, and South Carolina, have encountered challenges in that there is little to mandate to take action on the state level and limited resources to provide assistance to coastal communities.<sup>84</sup>

Although not a guarantee for preventing political interference, nor a promise of complete acceptance, plans developed at the community level are likely to have substantial local support by their very nature, being developed and vetted by members of

that community. Therefore, one alternative or complement to prescriptive national or state SLR adaptation and planning measures is to understand local preferences, to create a framework flexible enough to fit different local requirements, and to encourage inclusiveness by building the plan from the local level.

There are several documented examples of local governments or communities on the East Coast of the United States completing their own SLR assessments and plans. New York City completed its assessment in 2015, projecting local SLR of up to 1.8 m (6 ft) by 2100.<sup>98</sup> Although much work remains to be done to adapt, the city now has much of the information necessary to start making detailed planning and adaptation decisions, as well as recommendations for actions detailed in the report. Miami, Florida convened a “Sea Level Rise Task Force” that reviewed relevant local studies and developed five major recommendations for the city in 2014, some of which are being implemented.<sup>119,120</sup> These cities are examples of pathways to move forward although it is likely that many smaller jurisdictions will not be able to conduct a study on the scale that these major metropolitan areas can.

### **Current Practices in Risk Reduction**

More common than specific and comprehensive SLR plans or policies are land development policies designed to either discourage development in current flood-prone areas (exposure reduction) or to impose building requirements to reduce flooding and storm surge damage to structures (consequence reduction). Several other forms of coastal risk reduction also exist. For example, most public infrastructure can either be hardened (built to withstand events with little to no damage) or relocated to lower risk areas (to

reduce the chances of being impacted), to lessen the chances of losing utilities, transportation, or other key services during an event. Local building codes may require the living areas of new homes to be above a certain height at which historical floods have taken place.<sup>61</sup> With such a design, areas below the designated flood level would be designed to allow flood water to pass through with minimal overall damage and without compromising the building's structure. Water would instead pass through flood vents, under the structure entirely, or through breakaway walls designed to prevent more serious damage.<sup>61</sup>

The 2012 International Building Code (IBC) instituted numerous flood related provisions, most of which have to do with elevating portions of a structure and reinforcing a building against physical flood damage (such as the pressure from storm surge).<sup>61</sup> Future editions of building codes generally build upon the successes of previous versions and address challenges encountered.

Provisions within current and future building codes may reduce both the exposure of and consequence to structures built since the provisions were put into place. However, but they do little for older structures, unless major modifications to the structures are made. Modifying an existing house or other building structurally can be very expensive, meaning that significant code updates to the existing portions of structures are rarely done outside of other improvements being made or as the result repairing damage when at least half of the value of the structure is replaced or repaired.<sup>61</sup>

Although building codes and other incentives for more resilient development in flood-prone areas may reduce the damage from an extreme weather event, they do

nothing to prevent said events. The benefits of such incentives thus may be skewed towards those who own or live in newer buildings. Updated codes should eventually cover many buildings while older or damaged buildings are slowly replaced, showing that while useful, they are limited in effectiveness across the community as a whole.

Despite being a successfully implemented “tool in the toolbox,” building codes have several potentially serious limitations. First, building to static height and hardening standards necessarily assumes stationarity, or overall unchanging sea-level conditions, that may no longer be appropriate in a changing climate. If codes assume that floods and storm surge will have the same average frequency, the same severity, and the same base flood elevation they have historically have, they may lose their effectiveness over time. Depending upon local conditions, SLR may cause the same severe weather events to cause more frequent and more damaging floods, increasing overall vulnerability and reducing the likelihood that codes and standards will be effective. Additionally, other factors at play, such as changing air circulation patterns, may result in more frequent and severe storms, in addition to SLR. This could result in both more vulnerability to flooding events and more frequent and more severe events such as hurricanes. These combined impacts would likely result in more frequent disruptions to normal life in coastal areas and more damage when disruptions do occur if the community has not taken measures to reduce these impacts considerably.

Another current method for mitigating risk to individuals and organizations is through insurance policies. Insurance limits an owner’s financial liability for repairs related to natural disasters. Because of the high level of risk to the insurance companies

involved in insuring against floods, standard homeowner's insurance policies usually do not cover flood damage.<sup>83</sup> Instead, the National Flood Insurance Program (NFIP), underwritten by the federal government and sold through private insurance companies, provides financial protection against floods in policies sold separately from homeowner's insurance.<sup>25</sup> While owning a policy issued through the NFIP is required for homes purchased with federally backed mortgages in certain flood zones and required by some private loans, it is voluntary for all others.<sup>25</sup> As of October 2018, there were approximately 5.1 million NFIP policies in place, covering a small fraction of all structures.<sup>41</sup>

Policies set by the NFIP are generally designed to incentivize homeowners and potential homeowners to build and purchase in less flood-prone areas and to take steps to minimize damage. First, flood insurance premiums for the same level of coverage are much lower outside flood zones.<sup>82</sup> Second, NFIP insurance policies strongly discourage the storage of valuable items below ground, as they will not pay to replace most possessions in below grade areas such as basements or crawlspaces.<sup>40</sup> There are also limits on types of finishing (such as drywall and flooring) and a limited selection of home components that are covered in below ground levels. A declaration guide given to purchasers of flood insurance indicates these limitations are meant primarily to limit NFIP's liabilities when floods occur, but they also serve to encourage risk reduction when building, rebuilding, renovating, and living in a flood prone location.<sup>40</sup>

As a government backed program, policies of the NFIP are also subject to political pressures. This has resulted in some policies being reversed, delayed, or

weakened because they were unpopular or politically untenable. For example, the 2012 Biggert-Waters Flood Insurance Reform Act was designed to help reduce the substantial deficits that the NFIP has been experiencing in recent years by making premiums more proportional to flooding risk.<sup>111</sup> However, some members of Congress almost immediately urged the Federal Emergency Management Agency (FEMA) to slow the implementation of the law because of the large premium increases that some homeowners were experiencing. As a result, many of the aspects of the 2012 Biggert-Waters reform were either repealed or modified to reduce the rate of increase in premiums.<sup>70</sup> Major events, such as hurricane Katrina in Louisiana in 2005 and the 2017 hurricanes in Texas, Florida, Puerto Rico, and the U.S. Virgin Islands, and the 2018 hurricanes in the Carolinas, Florida, and elsewhere have put the NFIP in considerable debt. In 2017, the NFIP nearly ran out of borrowing power to pay claims before Congress used general fund dollars to clear nearly \$15 billion in debt.<sup>29</sup> The program has since operated on a series of short-term extensions while longer-term changes are considered. These challenges could be compounded if flood maps are not regularly updated to incorporate changes in sea level and storm patterns that past mapping efforts did not have available.

A further limitation of the NFIP is that only those homes and businesses with mortgages or other loans on their properties are generally required to purchase flood insurance. Thus, many homes and businesses in flood-prone areas are uninsured, whether because of expense, lack of awareness, or some other reason.

Some communities work with FEMA through the NFIP to create community risk reduction plans that help to reduce premiums through a program called the Community

Rating System (CRS).<sup>39</sup> These communities can apply for hazard mitigation grants if they meet appropriate benefit/cost ratios to help reduce future damage.<sup>19</sup> Although flood insurance may encourage certain behaviors for those who buy into the system, and may provide extra benefits to communities participating in risk reduction plans, insurance is not a comprehensive program for flood management or SLR planning on its own.

Estimating the percentage of structures that are underinsured is not straightforward, as all properties have some amount of flood risk, but the risk is often not well known outside of existing or predicted flood zones. The 5.1 million flood insurance policies in place represent a small fraction of total structures in the United States, especially since over 1 million of these policies cover individual condominium units in multi-unit buildings.<sup>42</sup>

Other risk management efforts underway including modernizing older, potentially inaccurate flood maps.<sup>111</sup> Although updated FEMA flood maps are not incorporating SLR projections to create more detailed potential future flood zones at this time (and therefore NFIP policies will not reflect only past and not future SLR), some efforts combine updated mapping with future projections for a more in-depth picture for planning and educational purposes, such as the U.S. Global Change Research Program's maps for Superstorm Sandy recovery.<sup>139</sup> These efforts should provide valuable information and context for current programs, long-term planning, and decision-making. Despite this important context and needed information, maps alone do not assess the relative social importance and priority in the way that a community-driven plan can.

### **Expert Viewpoints**

Expert information clearly indicates the presence of recent and projected future SLR in most of the world.<sup>62,137</sup> It also indicates the need for substantial SLR planning and resources. One study found an estimated \$5.1 billion investment (in 1997 dollars, nearly \$8 billion in 2019) would be needed to protect land that would otherwise be completely lost in the United States to SLR under a 0.25 m (0.82 ft) rise by 2050.<sup>16</sup> However, this study does acknowledge that it has many limitations that overlook certain costs. For example, property values would decrease in areas close to land that would either be lost or need protection, which could exceed the direct costs by several times.<sup>16</sup> Studies have also made strides in assessing the potential impacts of SLR in numerous coastal areas, ranging in specificity from individual municipal assets<sup>107</sup> up to whole cities<sup>150</sup>, states<sup>30</sup>, regions, and even globally.<sup>6,51</sup> In coastal areas of California alone, it is estimated that \$100 billion in assets (homes, businesses, etc.) would likely be at risk by 2100.<sup>54</sup> This also represents over 480,000 residents, in addition to hundreds of pieces of critical infrastructure (those needed for the community to function, such as electricity, water, and transportation) indicating that direct costs alone are likely a substantial understatement of total economic impact. Assessments on the state, national, and global level serve a vital function in identifying at-risk infrastructure, potential costs and impacts, and other important background information.

Depending upon the level of detail within broad assessments, they may help identify potential local priorities through an assessment of risk reduction and adaptation costs, identifying which structures will be impacted first, and cascading links between



different assets. For example, a school could no longer be usable because of the loss of a road needed to access it. Such assessments may also identify “low hanging fruit” where strides can be made towards addressing priorities quickly and at minimal costs, as well as “no regrets” strategies where other benefits of the project would outweigh the costs even if future SLR did not take place.<sup>79</sup> However, such assessments based primarily on economics lack a potentially vital human component.

In an ideal world where costs were not a consideration and there were no unintended consequences, all possible protective measures would all be enacted for maximum resilience. Reality, however, dictates given limited resources, compromise is necessary even though it can be very difficult. Proven and theoretical community-based adaptation measures include early warning systems, integrated plans, structure hardening, and insurance mechanisms.<sup>147</sup> Although expert information is very helpful towards informing the scope of the issue, evidence upon which decisions can be made, and the range of options available to address concerns, it is only one factor informing SLR planning.

### **Public Viewpoints**

Public viewpoints form an important part of addressing sea level rise options. Several resources can inform our understanding of public perception of this issue. First, some SLR is closely related to climate change. Therefore, public viewpoints on SLR may reflect public viewpoints on climate change. It is not terribly uncommon for individuals to dismiss climate change as not real, despite overwhelming scientific evidence.<sup>62,137,138</sup>

Based on the divisive nature of how climate change is understood, one study identified “six Americas” of responses in the categories of alarmed, concerned, cautious, disengaged, doubtful, and dismissive.<sup>72</sup> Respondents were grouped into six major categories with respect to their opinions on climate change issues, in order to better explain the similarities and differences across the nation on how this issue is viewed. After these groups were first identified in 2009, by 2014 concerned (29%) and cautious (25%) were the most common responses, with only 8% being dismissive of climate change. By December 2018, the “alarmed” category had grown considerably to 29%, being second only to the concerned category at 30%.<sup>49</sup> This study also found that on average, more concerned groups felt that the benefits of taking action outweighed the costs, and the less concerned groups felt the opposite. Others have found that SLR is often seen in a similar worldview as climate change, and that some groups are willing to change their views when exposed to more information whereas others are not.<sup>3</sup>

Public perceptions of SLR may also be related to perceptions of extreme events, such as storm surge and flooding from hurricanes and strong storms. Unlike long-term climate trends, floods and other natural disasters are not subject to interpretation of their existence, with an average \$100 billion in damage from major disasters in the United States each year from 2014-2018.<sup>93</sup> The combination of association with climate change and association with disaster impacts confounds public opinions in such a way as to not be identical to either of the underlying concepts. Two public opinion polls run in Delaware in 2010 and 2014 found that SLR was not as important an issue for many people as water pollution, toxic waste, air quality, loss of forest habitat, declining fish and

wildlife populations, loss of marsh or wetlands, flooding, and climate change.<sup>34,114</sup>

Because of this low relative ranking, fostering engagement at the community level may be difficult, unless the public can make the connection between sea level rise planning and these other issues that are rated more highly.

Given the variability of public opinion on SLR, there is no single voice of the public in terms of SLR policy priorities.<sup>34,72,114</sup> For example, The Nature Conservancy describes potential impacts, such as “Most of the world’s coastal cities will experience a significant impact to their low-lying areas even if the most conservative sea level projections prove correct.”<sup>85</sup> They call for action and point to activities underway in a number of coastal cities. In a contrast, Taxpayers for Common Sense highlights on its website that the construction of sand dunes on coastal barrier islands may be temporarily effective but do not go far enough to protect property and should not be paid by for the federal taxpayer.<sup>131</sup> A community-based SLR planning model is unlikely to reach every member of the public. However, it would provide an opportunity for both established groups like these and other interested individuals to voice their opinions on decisions and to be included in the overall planning process. It would also ensure that societal needs and priorities are properly addressed, or at the very least fully discussed.

One study was built upon lessons learned by past efforts that have identified the need to explain the scientific basis of complex problems, in order to assure that the stakeholders are able meaningfully engage on the issues and make informed inputs to SLR decisions.<sup>3</sup> Making decisions is especially difficult when multiple stakeholders representing different interests cannot agree on priorities.<sup>92</sup>

SLR policy development is not likely to be a simple process. Uncertainty in flood risk alone (not even including changes due to SLR) has been shown to be difficult to communicate and in need of translation to terms more familiar to the public.<sup>37</sup>

### **Municipality/Governing Body Viewpoints**

Many municipalities in coastal areas are in difficult planning situations, because current economic and social interests must be balanced against long-term risk from SLR and extreme events. In a coastal barrier island such as Long Beach Island (LBI), businesses related to tourism (hotels, restaurants, beach themed shops, etc.) or catering to the needs of homeowners of second homes (real estate agencies, landscaping and home maintenance, builders, etc.) perform a very important role in the economy. Policies that negatively impact, or are perceived to negatively impact, these sectors in the short-term may be unpopular or politically untenable even if they are beneficial and cost saving over the long-term.

For a variety of reasons, including challenges with accepting recommendations developed elsewhere and the availability of local information not available elsewhere, solutions derived from the community may have a greater chance of success because of local stakeholder involvement.<sup>113</sup> Although there may be resistance from some portion of both officials and the public today, SLR planning and adaptation may become more widespread as conditions reach a “turning point” where previously disregarded scenarios become accepted as feasible outcomes.<sup>145</sup> A transition towards addressing long-term SLR risk could be accelerated as current risk reduction methods begin losing their

effectiveness and effects begin to be seen more frequently. This could allow the community to make progress even in environments where top-down approaches may not be feasible or may not meet the community's needs. Due to the benefits that many stakeholders see in public processes that involve their participation, a locally-driven plan may have considerable support, provided best practices are used in helping to build it.<sup>57,109,113</sup>

### **Rectifying Current Planning Process Omissions**

The studies examined above demonstrate methods for assessing vulnerabilities to SLR and determining the potential impacts and measures that can reduce these risks. However, they do not take the final step of providing a framework that can be locally adapted and instituted based upon local priorities.

One previous framework was published by The National Oceanographic and Atmospheric Administration (NOAA).<sup>35</sup> It considers economic assessment as a priority-setting approach. Although that framework is an excellent start, it specifically indicates that it does not include many considerations, such as culture and local priorities that may differ from what cost-benefit analysis alone would indicate.<sup>35</sup>

Another framework includes identifying SLR scenarios appropriate to the local level, which may serve as a key building block for additional framework development.<sup>73</sup> Yet another tool uses a checklist approach that walks the reader through where to find information on various SLR strategies, such as having a municipality master plan, updating building codes, and other adaptation measures.<sup>4</sup>

Various other methodologies are targeted more broadly at climate change issues but could potentially be targeted specifically at SLR. One suggests a hybrid approach between traditional risk management principles and co-adaptive management involving multiple stakeholders.<sup>77</sup> Alternatively, various policy instruments can be explored and weighted for issues such as challenges with governance and fairness prior to proposing specific adaptations.<sup>80</sup> Although no framework can provide all the answers, a goal of this work was to illustrate how to incorporate local priorities effectively into a SLR plan. Furthermore, this study recommends how to incorporate community values and priorities with existing expert information into a local plan of action. The following chapter will discuss the initial study that helped to develop these recommendations.

### **CHAPTER THREE: SURVEY DEVELOPMENT EXERCISE**

Between November 14 and November 30, 2016, the author conducted a small sample size survey designed gain an initial understanding of public priorities and preferences while assisting in the development and pretesting of questions for a subsequent larger public survey of SLR perspectives of individuals affiliated with coastal communities on the East Coast (IRBNet 966923-1). This study is referred to as the “survey development exercise” or “exercise.” The subsequent public study is described in Chapter Four: Public Survey Results. This chapter describes the goals, process, results, and implications of this exercise, which is also introduced in published work by the author.<sup>23</sup> The major storms and associated flooding in the 2017 and 2018 hurricane seasons took place after this survey development exercise was conducted. This chapter describes the characteristics of the survey development exercise, provides a summary of the coding process, coding results, and analysis of the text of the results, and finally describes the implications for the public survey described in the following chapter.

#### **Survey Development Background and Goals**

The primary purpose of this exercise was to gather information necessary to prepare the public survey described in Chapter Four: Public Survey Results. After attempting to develop potential default responses to several questions, it became clear that they were the perspectives of just one person (the author) and that a larger set of inputs would be necessary to assure that no major types of responses were overlooked or

omitted, which would introduce unnecessary bias into the public survey. In addition to the informed consent form, the questions asked in this exercise are shown in Table 2.

Table 2. Survey development exercise questions

| <b>Question Number</b> | <b>Question Name</b>        | <b>Question Text</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                      | Planning Factors            | Preparing for flooding, whether from sea level rise, significant storms, or other reasons is challenging. Please list any factors that you think are important for planning for sea level rise and future flooding in your community. As examples only, these could include the community better understanding the causes of flooding, looking for places at risk for flooding, and finding the least expensive ways to protect the community. Please list at least five important things to consider. |
| 2                      | Funding Mechanisms          | Preparing for flooding, especially related to future sea level rise, is likely to be expensive. Presuming that sources outside your community (such as federal and state funding) will not pay the entire cost, please list at least five other ways of paying for these activities. As examples, this could include a dedicated tax for upgrades, requiring property owners to install measures on their land, or cutting expenses in other programs.                                                 |
| 3                      | Conflict Resolution Options | Preparing for flooding, especially related to future sea level rise, has the potential for conflict. Please list at least five ways that could be used to address conflict in preparing for flooding and sea level rise. As examples, these could include holding public meetings or voting on protection strategies.                                                                                                                                                                                  |

In many ways, this exercise helped to develop the “lay of the land” or a topography of responses for these questions. Statistical representativeness was not necessary at this stage, recognizing that the intent was to prevent the accidental introduction of bias from the responses coming from the author’s opinions alone. The survey was designed to make sure that major categories of potential responses for several



questions were not overlooked. A sufficient number of “other voices” was appropriate for this purpose, regardless of statistical representativeness. Therefore, distribution of this survey could grow organically by starting with interested individuals known to the who were in the target study audience. This consisted of inviting the individuals that the author personally knew who live in, work in, or regularly visit a coastal community on the East Coast of the United States to complete the survey. As part of the invitation, every participant was asked to forward the invitation to others who might also be interested and are known to live in, work in, or regularly visit a coastal community on the East Coast of the United states, a form of snowball sampling. The combination of direct outreach and invitation by referral over the 16-day study period led to the 24 respondents. Potential respondents were asked to read the survey’s documentation and answer honestly. Therefore, although some respondents were previously known to the author (although this cannot be known for certain because the survey was anonymous), the exploratory nature of this exercise limited concerns about this sort of bias.

### **Survey Responses**

For all questions, respondents were asked to provide at least five factors, with the ability to include up to eight (no respondents provided more than six factors for any question). Although 24 respondents completed at least one question, only 22 respondents answered all three questions. The full list of responses (with pre-coding preparation applied as described in this section) is available in Appendix A: Survey Development Materials.

Question 1 (planning factors) had 121 responses to this question across 24 respondents (twenty-three respondents included five responses and one respondent included six). One response was invalid as it did not respond to the question (“I ran out of ideas”), leaving 120 valid responses to this question for analysis.

Question 2 (funding mechanisms) had 110 responses across 22 respondents (all twenty-two respondents included five responses each). One response was invalid (“NA”) leaving 109 valid responses to this question for analysis.

Finally, question 3 (conflict resolution options) had 110 responses across 22 respondents (each of the twenty-two respondents each gave five responses). There were three responses that were not coded. Two answered “NA.” One response stated “pistols at 50 yards,” which was unclear whether or not it was an attempt to answer the question. This left 107 valid responses to question 3 for analysis.

### **Preparation for Coding**

To allow for proper coding, a series of preparatory checks were completed on the data prior to running the analysis. For instance, in addition to basic spelling and readability corrections, abbreviations that could be clearly identified based upon their usage in context were spelled out to allow for a full analysis, such as “govt” being changed to “government” and “r” to “are” (when the context was clear). Each change was reviewed manually to assure meaning was not inadvertently altered.

In order to have an accurate text analysis, both the author and the computer need to be able to process individual words and sentences, several punctuation issues were identified and corrected to allow for this analysis. Examples of these corrections include:

- In instances where a respondent used a slash to indicate “and/or” such as “maintaining/creating” a space was added before and after the slash to allow both words to be counted in the resulting analysis.
- If a respondent included an ellipsis but did not place a space after it, such as “age....if ever” a space was included after to allow the following word to be counted.
- If a respondent connected two words together, such as not placing a space after a comma or a period, the space was added.

Within one respondent’s responses to question 1, suggestions were cross-referenced against each other. The relevant information from the referenced responses was added within brackets.

As a final pre-coding step, responses were reviewed to identify any that were not attempts to address the question. Five responses were removed for this reason (of 341, approximately 1.5%). This left a total of 336 responses amongst the three questions.

### **Coding Process**

Once pre-coding procedures were complete, qualitative open coding techniques were used to classify the responses into usable categories that could inform the respective main survey questions.<sup>129</sup> After labeling codes to each response, they were summarized using axial coding techniques.<sup>69</sup> Overall, the process included:

1. Reviewing each response carefully to help appreciate the diversity of responses.
2. Labeling each response with a category.

3. Labeling all responses with a category, then adding a subcategory during an additional review.
4. Twice reviewing all the categories, subcategories, and responses to assure consistent application across the data.

Coding is inherently subjective, in that the “bins” that any researcher creates for any given data are may not be identical to the bins that another researcher with similar knowledge would make, and probably very different than those that someone with little to no knowledge on the research subject would make. In this instance, all coding was completed by the author with the intent to provide the greatest internal consistency possible and the recognition that, despite all intentions, there is some degree of subjectivity in the process.

### **Coding Results**

For each question, a list of the most frequently mentioned categories (developed by aggregating individually coded suggestions) was developed. These categories, and the subcategories within them are shown in Appendix A: Survey Development Materials. These were compared to the draft public survey questions and proposed responses and modifications were made to the public survey to better incorporate the full range of likely common responses. A short summary of each major category is included below.

#### **Summary of Responses to Question 1: Planning Factors**

Question 1 asked respondents to describe planning factors important to developing a sea level rise plan within their communities. Table 3 shows the planning

factors described by the respondents from most frequent to least frequent, including the percentage across all 120 valid responses. This all of the tables for this study are adapted from and build upon the author's published work.<sup>23</sup> A description of each category is also included, along with additional analysis for commonly suggested factors.

Table 3. Planning factors coding results (survey development question 1)<sup>23</sup>

| <b>Category</b>       | <b>Responses</b> | <b>Percentage of responses (n=120)</b> | <b>Description</b>                                                                    |
|-----------------------|------------------|----------------------------------------|---------------------------------------------------------------------------------------|
| Mitigation Measures   | 34               | 28.3%                                  | Specific mitigation measures that can be built into plans                             |
| Information Resources | 25               | 20.8%                                  | Developing data and information to assist in planning                                 |
| Public Engagement     | 19               | 15.8%                                  | Planning ways to actively engage the community                                        |
| Policies              | 12               | 10.0%                                  | Setting regulations, codes, or other requirements or incentives                       |
| Research              | 12               | 10.0%                                  | Advancing methods to predict flooding, improve mitigation, or study other communities |
| Response Planning     | 11               | 9.2%                                   | Develop plans for post-incident response and recovery                                 |
| External Factors      | 7                | 5.8%                                   | Understanding how factors outside the community can have an impact                    |

*Mitigation Measures* was the most commonly suggested planning factor. These were generally specific improvements to mitigate the impacts of sea level rise and flooding identified by respondents, and included building/construction standards, built/engineered systems, and the incorporation of natural systems. Several responses

were relatively generic, such as “taking remedial action to avoid flooding” which could be categorized into this general subject but not into a specific subcategory. As the most discussed planning factor, incorporation of specific mitigation measures will probably be a priority in community-based sea level rise plans and was explored in the public survey.

*Information Resources* were the second most commonly suggested planning factor. These responses referred to various forms of information (whether currently available or that would need to be developed) that could help the community in conducting planning for SLR. Over 70% (18 of 25) responses in this category referred to some sort of risk mapping that would help to determine where impacts are likely. These types of resources could assist communities with identifying which action or actions make the most sense in their area. Other responses in the information resources category included: developing cost projections, information about impacts in general (separate from specific locations) and improving the disclosure of risk.

*Public Engagement* also appeared high on the list of frequently suggested factors. Although public engagement could take several forms, both in methods and in why it is important, in this context most respondents that mentioned public engagement (16 of 19) specifically mentioned education or awareness-building.

*Policies* generally referred to setting, revising, or removing policies focused on broader mitigation strategies (such as changes in land use or municipal budgeting to help address impacts) or in using incentives (such as insurance) to influence individual behavior. Policies include not just regulatory policies, but also laws, codes, standards, and public and private incentives that encourage or require protective actions. One

example mentioned of a policy driven by insurance is the pricing mechanism for federal flood insurance, which includes components of differences in premium depending on the flood zone of a structure, the protective measures in place, and to some extent, the community's overall readiness.

*Research, Response Planning, and External Factors* rounded out the remaining responses. *Research* focused on developing better information on how to predict flooding, ways to improve mitigation measures, and studying how other communities had handled these issues. *Response Planning* responses discussed warning systems to prepare communities for expected near-term impacts and preparing for temporary relocation (evacuation). Finally, *External Factors* responses discuss the need to plan for factors outside the direct or complete control of the community, such as changing patterns of storms or identifying ways to reduce global climate change overall.

There were also two responses that called for not taking action, either by not utilizing public funds to address SLR or by not interfering in other's decisions, regardless of the consequences.

## **Summary of Responses to Question 2: Funding Mechanisms**

Question 2 asked respondents to describe funding mechanisms to help develop and implement sea level rise plans in their communities. Table 4 shows funding mechanisms gleaned from the responses, starting with the most commonly suggested topics and including a percentage out of the 109 valid responses. A description of each category is included below, with additional discussion of the commonly suggested

funding mechanisms. Question 2's responses were more concentrated in the top categories than Question 1.

Table 4. Funding mechanisms coding results (survey development question 2)<sup>23</sup>

| <b>Category</b>          | <b>Responses</b> | <b>Percentage of responses (n=109)</b> | <b>Description</b>                                                                                               |
|--------------------------|------------------|----------------------------------------|------------------------------------------------------------------------------------------------------------------|
| Taxes                    | 46               | 42.2%                                  | Various forms of taxes (income, property, sales, etc.) to cover the costs.                                       |
| Regulatory Cost Shifting | 30               | 29.1%                                  | Shifting the costs to homes and businesses through regulatory requirements                                       |
| Loans                    | 8                | 7.3%                                   | Obtaining loans (such as issuing bonds) to pay for protective activities now and repay over time                 |
| Self-Funding             | 7                | 6.4%                                   | Encouraging homes and businesses to pay for protective activities voluntarily                                    |
| Allocation               | 5                | 4.6%                                   | Reprioritizing existing public resources to dedicate more towards protective activities                          |
| Cost-Avoidance           | 5                | 4.6%                                   | Finding places to reduce costs and using those savings to pay for protective measures.                           |
| Specific Measures        | 4                | 3.7%                                   | Specific measures to protect against flooding and SLR                                                            |
| Outside Assistance       | 4                | 3.7%                                   | Paying for protective activities through outside assistance (such as federal, state, and outside private grants) |



*Taxes* was the most commonly suggested category. With 46 responses, this category had a wide variety of possible types of taxes to fund these programs, such as property taxes, risk-based taxes (where those at greater risk contribute more), user fees or taxes, incentives to act, and other dedicated taxes (sales taxes, construction taxes, or others that were not specified). Two responses specifically stated that proceeds from taxes should not be used for sea level rise planning.

*Regulatory Cost Shifting* was the second most suggested category, having been suggested in 30 responses. Many of these responses indicated that regulations should be used to encourage or require mitigation, rather than to provide funding for mitigation directly. This category includes utilizing insurance requirements, regulations to require owners to protect their properties, regulations to change land use, implementation of building codes/standards, and the use of eminent domain to purchase and reduce risk to high-risk areas. One respondent specifically stated that there should not be regulations related to SLR.

*Loans and Self-Funding* were also commonly suggested. *Loans* refer to responses that indicated either governments taking out loans (or issuing bonds) or making loans available to businesses and individuals to implement mitigation measures. Loans can originate either from a municipality's own borrowing power through issuing bonds (if it is large enough and has a strong enough credit rating) or through specific federal and state programs such as FEMA hazard mitigation funds, state drinking water and clean water revolving loan funds, and similar mechanisms. Although no attempt was made in the question to separate out local, state, and federal sources of loan funding, some

respondents called out a desire for (and in some cases a desire against) state and federal funds as the source. *Self-Funding* refers to encouraging individuals and businesses to self-fund mitigation measures without necessarily having any specific requirements. In this case, the funding would come from individuals and businesses, and most likely be spent on measures designed to protect their own properties or small collections of properties through self-organized groups.

The remaining categories were *Allocation*, *Cost-Avoidance*, *Specific Measures*, and *Outside Assistance*. *Allocation* refers to repurposing or reprioritizing public funds currently spent on other issues to instead fund this issue (without necessarily increasing revenue). The *Cost-Avoidance* category includes finding ways to keep costs low to make funding them more attainable. *Specific Measures* refers to specific risk reduction activities (such as building physical barriers). It is unclear whether these were suggested as goals for items for which to find funding, if the question was not well understood for these responses, or for some other reason. *Outside assistance* refers to federal, state, non-profit, or other funding assistance coming from outside the community, such as grants or direct technical assistance coming from state, federal, or non-profit sources.

### **Summary of Responses to Question 3: Conflict Resolution Options**

Question 3 asked respondents to describe conflict resolution options that could be used to help prevent or resolve conflict in developing or implementing a community-based sea level rise plan.

Table 5 shows the most commonly suggested conflict resolution options, including a percentage of the 107 valid responses. The most important categories are then described, with additional discussion on the most commonly suggested options.

Table 5. Conflict resolution options coding results (survey development question 3)<sup>23</sup>

| <b>Category</b>      | <b>Responses</b> | <b>Percentage of responses (n=107)</b> | <b>Description</b>                                                                                                |
|----------------------|------------------|----------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| Public Engagement    | 67               | 62.6%                                  | Methods of working with the public at large (education, public meetings, etc.) to identify and overcome conflicts |
| Regulatory Methods   | 12               | 11.2%                                  | Use of regulatory methods to either reduce risks or improve risk disclosure                                       |
| Specific Measures    | 12               | 11.2%                                  | Specific methods of addressing flooding and sea level rise                                                        |
| Analytical Methods   | 7                | 6.5%                                   | Use of high quality information to help overcome conflicts                                                        |
| Incentive Methods    | 3                | 2.8%                                   | Use of incentives to reward those voluntarily providing protection                                                |
| Business Engagement  | 2                | 1.9%                                   | Working directly with businesses to improve protective actions                                                    |
| Legal Avenues        | 2                | 1.9%                                   | Resolving conflict through lawsuits and other legal measures                                                      |
| Political Engagement | 2                | 1.9%                                   | Working with politicians / political bodies to identify and resolve conflict                                      |

*Public Engagement* was the most frequently suggested conflict resolution option, with 67 of 107 (63%) of responses. There were eight subcategories within public engagement. Education (21 responses) focused on methods to inform the community about SLR risks, including the scientific basis, effective mitigation, and other aspects of the issue, by using improved knowledge as a basis to prevent and resolve conflict. Public meetings (18 responses) is a category that includes acknowledging and addressing conflicts openly and transparently in public meetings, workshops and similar activities. Collective action (8 responses) includes organizing the community to implement mitigation measures, such as using volunteers to build constructed physical barriers. Media outreach involved utilizing all forms of the media and press to involve the community and build engagement. Voting (6 responses) suggested addressing conflicts through votes. Three responses indicated public engagement (without being more specific), two discussed transparency, and one suggested mediation. Given most of the responses revolved around public engagement, this indicates a need for community champions (individuals, organizations, governments, or others) to help organize and facilitate engagement.

*Regulatory Methods* included zoning, disclosure rules and other required actions that reduce risk by setting common rules or inform all parties to the risk to make informed decisions. Several responses stated there should be specific new regulations and one specifically stated there should not be new regulations on existing uses. Most of these responses did not state how these methods would help prevent or resolve conflict, but in

general, regulatory processes can set baselines to reduce free-ridership (benefits for most or all with few bearing the expense).

*Specific Measures*, similar to as discussed in question 2, refers to specific risk reduction activities (such as instituting early warning systems). It is unclear whether these were suggested for the purposes of reducing conflict (since reduced risks would mean fewer potential conflicts), if the question was not well understood for these responses, or for some other reason.

The *Analytical Methods* category focused on resolving conflict through the use of high quality, thorough information, such as increasing the scientific basis for taking action or developing benefit-cost scenarios to assist with decision-making. This differs from public engagement in that these suggestions specifically focused on developing new information over using existing information.

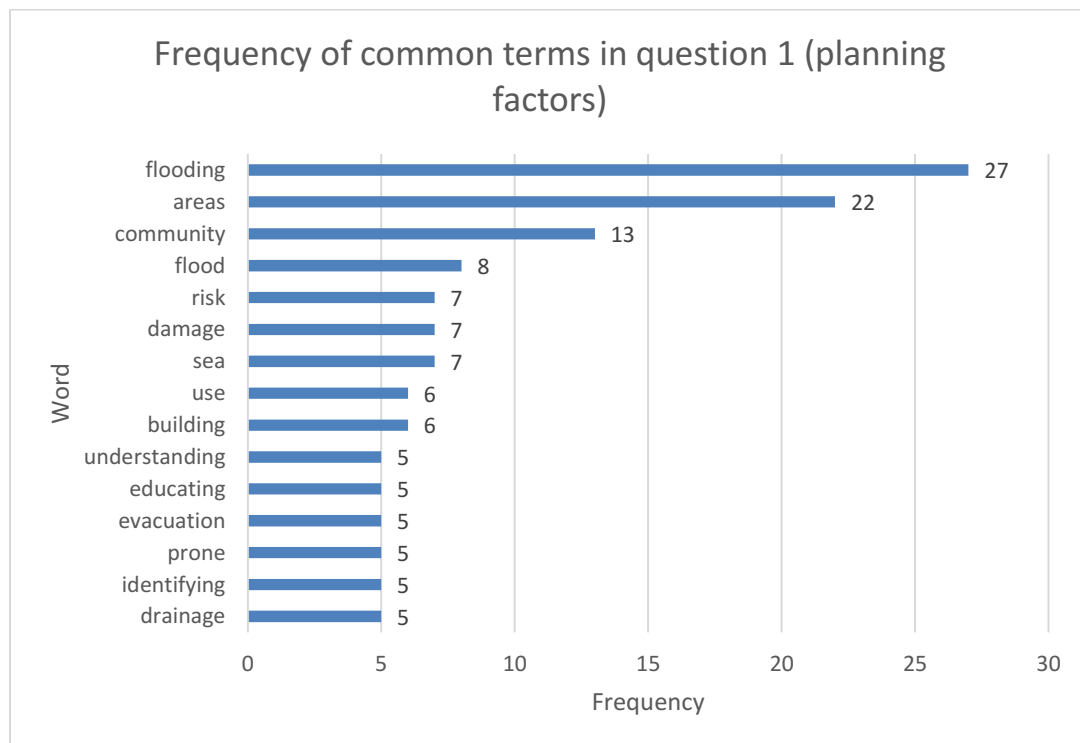
The remaining categories are *Incentive Methods*, *Business Engagement*, *Legal Avenues*, and *Political Engagement*. *Incentive Methods* include finding ways to reward those who are doing the most to improve mitigation and to take advantage of the options with the greatest funding support. *Business Engagement* involves working with the real estate community (agents and developers) to find ways to obtain buy-in and decrease risk. *Legal Avenues* refers to preparing for and engaging in (or defending against) lawsuits and other legal proceedings to resolve conflict. *Political Engagement* includes working with elected officials and having them work on ways to resolve conflict in work sessions or developing proposed plans as part of local campaigns.

### **Text Analysis**

Additional insight on the survey responses can be obtained through analyzing the full text of the responses for common words. Recognizing that this process demonstrates relative frequency of words only, the full text (after pre-coding preparation) was run through a word cloud generator to identify the most commonly seen words.<sup>102</sup> Common words that would not contribute substantively to the analysis (such as “and” and “the”) are removed automatically. Results were also analyzed using word counting utility to generate bar graphs of the most commonly seen words.<sup>44</sup> The word cloud for question 1 is shown in Figure 1 and the graph of common words is displayed in Figure 2.



Figure 1. Word cloud analysis for planning priorities responses (question 1)

Figure 2. Frequency of common terms in planning priorities responses (question 1)<sup>23</sup>

The words “flooding,” “areas,” and “community” are the most commonly seen in the text, with “flood,” “risk” and “prone” also prevalent. Given the strong emphasis the coding found for risk mapping (“areas”) and the cross-cutting nature of flooding across responses, these results help to reinforce the previous analysis. The presence of “risk” as a common word is somewhat surprising. Risk is a complex concept that is easily misunderstood. Because it is difficult to tell from individual responses whether respondents were correctly using the term, all analysis of “risk” in this respondent data presumes that the respondent is either referring to probability of the event occurring (incomplete definition), or the combination of probability of occurring plus the impact of that event (the actual definition), or the possibility of a severe consequence.

The word cloud for Question 2, showing common items found across those responses, is shown in Figure 3, with a frequency analysis of the commonly seen words shown in Figure 4.





Figure 3. Word cloud analysis for funding mechanisms responses (question 2)

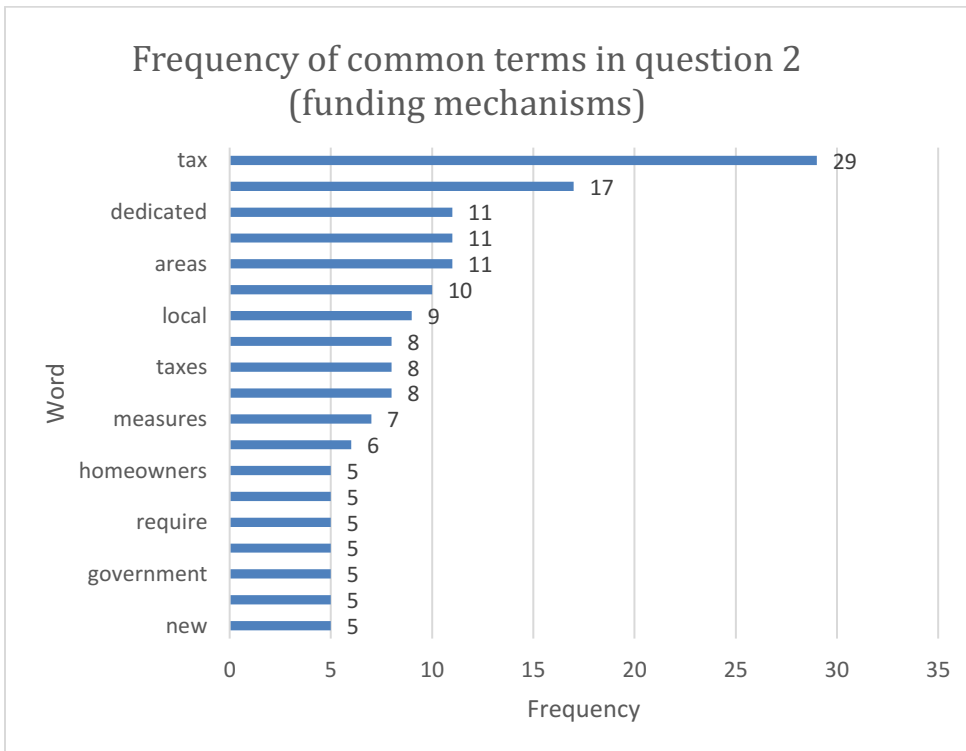


Figure 4. Frequency of common terms for funding mechanisms (question 2)<sup>23</sup>

“Tax” and “Taxes” are commonly seen in the word cloud, which is not surprising given the number of results that coded under the “taxes” category. “Property” is both a common subcategory (within property tax) and a cross-cutting topic that applies to many types of funding mechanisms. These results also appear to lend credibility to the previously discussed analysis.

The word cloud analysis for conflict resolution, which had a higher concentration of the most commonly seen words, can be seen in Figure 5 and a frequency analysis in Figure 6.

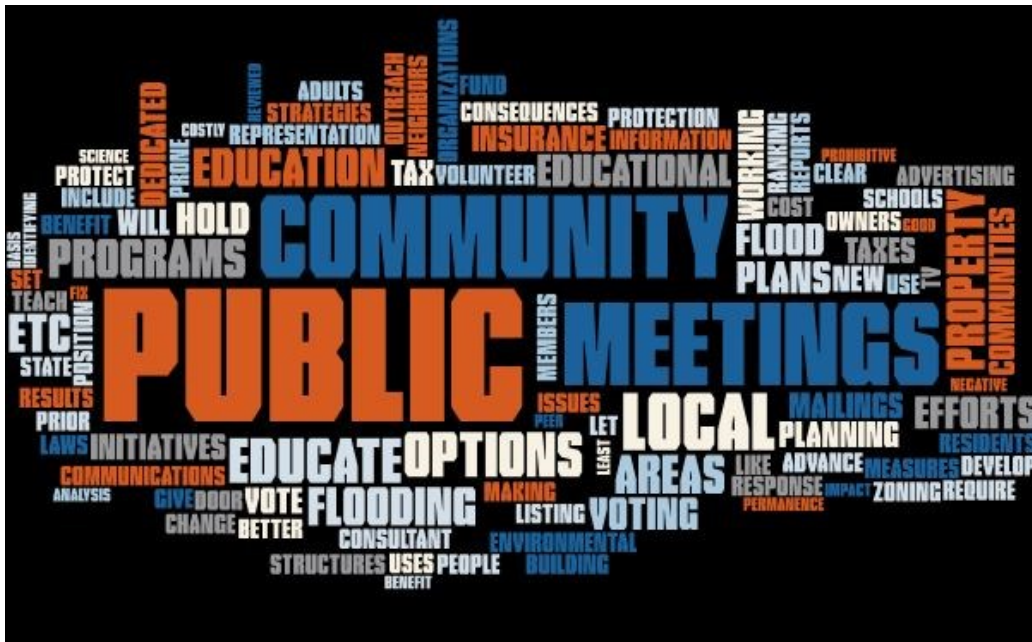


Figure 5. Word cloud analysis for conflict resolution options responses (question 3)

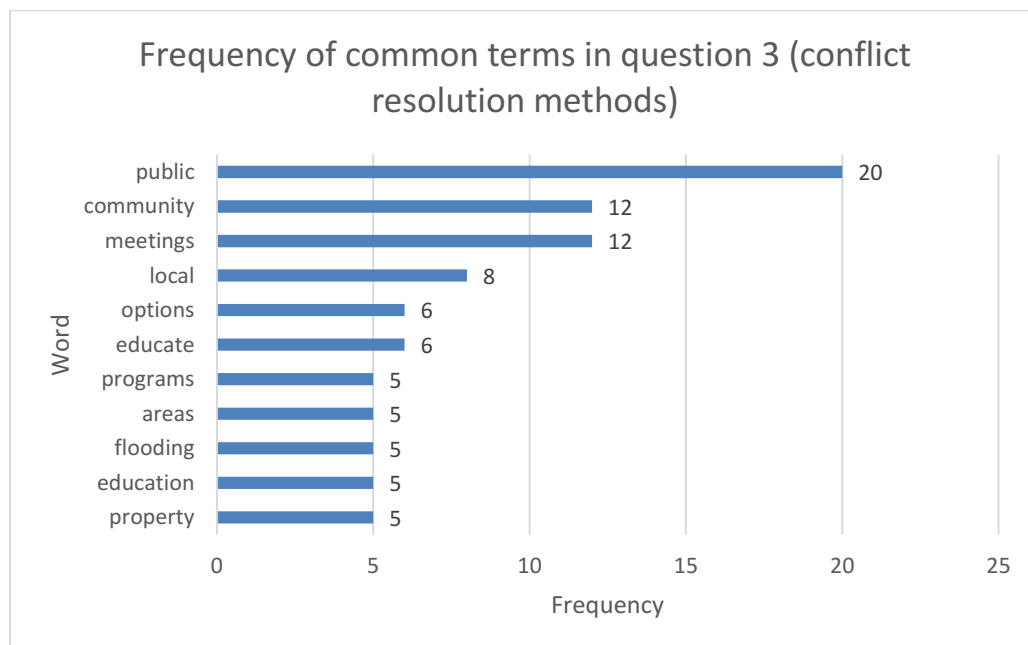


Figure 6. Frequency of common terms in conflict resolution options responses (question 3)<sup>23</sup>

The words “public,” “community,” and “meetings” dominate this analysis. Given the large number of responses that involved public meetings, and many categories that touched on the community for conflict resolution, this analysis also helps to increase credibility of the previously discussed analysis.

The high frequency of many words proposed to be used (and that ultimately were used) in the primary survey (flooding, community, tax, and others) validates their use as likely to be understood by survey respondents. This word frequency analysis informed the refining of the final questions of the primary survey.

### **Use of Examples within Questions**

Each question had several example responses embedded within. This was deemed necessary by the author to include in order to clarify the questions themselves and to help spur additional ideas. One potential outcome of a freeform question that does not provide any examples is that many potential respondents would not complete the survey because they did not understand the question. Therefore, including sample responses was necessary. The samples were drawn from what the author believed were obvious responses to each question.

- For question 1, there was one respondent who provided responses that included all three examples exactly. This same individual also provided two additional suggestions not in the examples. No other respondents used the exact phrasing of the examples, but some concepts align to concepts expressed many times.

- Within question 2, five responses used “dedicated tax” as provided in the example.

Two of these responses were specific types of dedicated taxes that were not provided

- in the example. One used the phrase “requiring property owners to install...” as provided in the example. Although the entire category “regulatory cost shifting” aligns with this response, most responses in this category were more specific than the example provided. Finally, one respondent used the phrase “cutting expenses” as provided in the question.
- For question 3, three respondents mentioned “voting” which was provided in an example. In one of these responses, several other items were also included. Six respondents mentioned public meetings, which was in the examples, two of them being more specific than what was provided.

Overall, although there were several responses (eight, provided the two more-specific “dedicated tax” responses to question 2 are not counted) that included the examples provided, they represent a low fraction (about 2.4%) of responses. Many other ideas were expressed that were not provided as examples.

### **Implications for Public Survey**

This study made many contributions for public survey and revealed additional findings. First, given the diversity of responses in this preliminary study, many questions included an “other” response to allow the expression of ideas beyond those previously imagined by the study’s author and this exercise.

There were several responses that were valid answers that stated that governments should not be involved in planning, that coastal residents who live in vulnerable areas should do so at their own risk, and that public/taxpayer funding should not be used for

SLR planning. An approach of minimal government intervention could be explored in depth in a future study. There is no way to follow-up with these respondents to gather more information (because no individual information was collected) to determine whether the respondents were advocating for a libertarian (minimal government involvement) approach or had some other motivation. Nonetheless, the presence of this type of response prompted an important check on the full survey questions and instructions. Throughout the design of the project, the concept of “community-based” or “locally driven” sea level rise planning was not meant to exclusively mean organized by governmental entities. Although communities could (and likely in many places will) use government entities to coordinate local sea level rise planning, there is no requirement to do so as many other entities and individuals could do the same comprehensive planning or portions of such planning, given sufficient motivation and resources. Therefore, all questions and instructions for the public survey were reviewed to make sure they did not state or imply that such planning will be done by government entities only. Failing to remove this potential bias could have caused some respondents to enter a mindset that is not focused on answering the questions but rather focused on their feelings about government entities, especially given that in recent years U.S. politics in general has been divisive. There may also be ways to further explore this phenomenon in future work by better differentiating among levels of government.

Another factor that could be important in understanding and analyzing the data is the concept of legitimacy. Even if proposed mitigation measures are effective and cost efficient, if they are not familiar to the community, they may be met with resistance

unless accompanied by outreach and education to help people better understand them.<sup>7,57</sup>

Building legitimacy requires building solid understanding and trust about proposed measures to allow them to be palatable to the community.

Additionally, a number of respondents answered questions 2 (funding) and 3 (conflict resolution) with specific actions for risk reduction, which were recorded as “specific measures.” These responses were valid, as they were neither protest responses nor obvious invalid responses such as “N/A.” However, they were nevertheless not very useful for answering the questions at hand. It is not clear if their inclusion was for the purposes of reducing future costs and conflict (for questions 2 and 3 respectively), because the question was not understood, or for some other reason. Some degree of not directly addressing the questions is probably unavoidable (if respondents do not read the directions, rush through, etc.), reducing the quality of the results. Therefore, the questions and instructions for the public survey were reviewed in detail for any potentially confusing phrases/concepts, and attempts were made to emphasize the differences among similar questions. This should help to maximize understanding.

Answers to question 1 fit into seven major categories (ranging from 7 to 34 responses) and a total of 28 subcategories. Given this broad diversity of responses, the corresponding question within the main survey allowed respondents to enter write-in responses. Since planning factors are perhaps the single most vital component of this entire process, every option, including “other,” in the public survey had a scale to assign importance, designed to allow for analysis of the relative importance of different factors.

However, as discussed in that section, relatively few participants included the scale in their write-in responses, complicating analysis.

Question 2 had eight primary categories, but the distribution was more weighted towards the two most commonly suggested categories (taxes at 46 responses and regulatory cost shifting at 30 responses) than the first question. Therefore, the corresponding public survey question was modified to permit greater granularity in the public survey's response options, including several subcategories of taxes (such as property taxes and risk-based taxes) and the choice to write-in other options for funding sources.

Question 3 had the least variety of all the questions, with 67 responses within "public engagement." Therefore, subcategories and an "other" option were included within the corresponding public survey question to allow for greater clarity.

### **Conclusions and Next Steps**

The findings from this survey development exercise were important and useful to enhancing the overall study and included several interesting results beyond the main analysis. For one, there were several responses that suggested government participation, intervention, and even funding was not wanted. This provides an opportunity for future research to assess whether individuals expressing these views are seeking strong non-governmental leadership on this issue or are wanting there to be no leadership in the issue (e.g., either dismissal of the problem or belief that it should be left up to individuals to address). Additionally, the almost overwhelming response of the "public engagement"



category as a method to address conflict means that engagement issues should be explored further in future research.

## **CHAPTER FOUR: PUBLIC SURVEY RESULTS**

From December 20 to December 22, 2017, a survey was conducted targeting adults who live in, work in, or regularly visit coastal communities in U.S. states bordering the Atlantic Ocean. This chapter describes this study in detail, including an overview of the study's design, results (both primary question and demographics), and discusses the key findings of the study.

### **Survey Design**

The geography studied was defined through the use of NOAA's List of Coastal Counties, using only the states that have at least one county that borders the Atlantic or a waterbody directly influenced by it (Connecticut, the District of Columbia, Delaware, Florida, Massachusetts, Maine, Maryland, North Carolina, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, South Carolina, and Virginia).<sup>99</sup> The survey covered topics surrounding sea level rise and flooding and was designed to help assess the following concepts from the perspective of members of eastern coastal communities:

- What factors should go into developing a community-based sea level rise plan?
- What services (and structures) within the community have the greatest priority for protection?
- What methods should be used to determine how much to fund planning and protection?
- How does the community resolve conflict around sea level rise planning and action?

## Survey Questions

A set of 26 questions were assessed to address these concepts:

1. Consent form
2. Do you live in, work in, or regularly visit a coastal community in the east coast of the United States?
3. Please state the importance of the following issues in your community.
4. In your community, how important are the following components in preparing for future flooding and sea level rise?
5. Are there any other components to preparing for future flooding and sea level rise that are important?
6. How vulnerable is your community to damage from the following hazards?
7. Please rate how high a priority protecting each of the following items in your community from flooding and future sea level rise should be.
8. Are there any other items in your community that should be priorities for protection?
9. Should preparing for future flooding and sea level rise be mostly private sector (and individual) responsibility, public sector (and government) responsibility or a mix of both?
10. How useful are the following methods in determining how much money should be spent protecting against floods and the effects of future sea level rise?
11. Are there any other methods to determine how much money should be spent protecting against floods and the effects of future sea level rise?
12. No type of protection is foolproof. Advanced protections are more complicated and expensive, while basic protections will fail more often. How strong should your community make its flooding and sea level rise protection?
13. How helpful are the following techniques in resolving potential conflict in developing a plan to protect against flooding from sea level rise in your community?
14. Are there any other techniques to resolve potential conflict in your community?

15. How appropriate are the following responses to protect against flooding and future sea level rise?
16. Are there any other responses to protect against flooding and future sea level rise in your community?
17. Please indicate your annual household income.
18. How much would you consider yourself an environmentalist?
19. Which of the following most closely matches your job title?
20. Please indicate your highest level of education completed.
21. Please specify your ethnicity.
22. What political party would you consider yourself most aligned with?
23. Was there any part of the survey you were confused about, or anything about flooding and sea level rise that the survey did not address but should have?
24. Additional information provided by survey company: Age group breakdown.
25. Additional information provided by survey company: Gender breakdown.
26. Additional information provided by survey company: Location breakdown.

### **Analysis Methods**

The responses were analyzed using a variety of techniques. Many of these questions solicited a Likert-type response (i.e., ordinal and non-continuous in nature). A rank of “5” does not indicate a response five times greater than a “1.” However, given a clearly marked scale, “5” is distinctly greater than “4” and so on. Given these limitations, there is considerable controversy surrounding the analysis of Likert-type data, and for this reason, both the selection of statistical tests and the interpretation of the results of such tests must be done carefully.<sup>10,22,27,130</sup> The analysis of medians and modes and non-parametric tests is not controversial, but the analysis of means and the use of parametric

tests is controversial. Some say that the use of means and parametric tests with sufficiently large samples (e.g., more than 20) is appropriate so long as the values were clearly labeled during the data collection, the items are related (scales for unrelated items cannot be directly compared) and the meaning of the result is carefully considered.<sup>22,130</sup> Others believe that even in large sample sizes, there are few situations where parametric analysis is appropriate and that analysis should focus on non-parametric tests to reduce controversy in the data.<sup>10,27</sup> This analysis incorporated facets of both approaches. It includes descriptive statistics (in addition to median and mode, mean and in some cases standard deviation were included, as is a percentage of responses in the top two categories), but the primary use of the means was to help summarize the frequency of the data among related questions. Using SPSS<sup>60</sup>, non-parametric tests were used to establish the potential relationships within the data. Independent Samples Kruskal-Wallis Test procedures, using a significance level of 0.05 for determining the impact of variations in demographics across the questions. This is a rank-based nonparametric test used to determine if there are statistically significant differences between two or more groups of an independent variable that are continuous or ordinal in nature. Through this test, the distribution of responses to questions were statically compared to determine whether the distribution was likely the same (varying by no more than chance would predict) or if the distribution was different based upon the answer to the key demographic. Only those relationships that were identified as significant within non-parametric tests and had large sample sizes were compared using parametric tests and were then considered significant

at  $p \leq 0.05$ . Although this methodology does not completely avoid these controversies, it does address the largest controversies by limiting the use of parametric tests.

### **Primary Questions**

#### **Question 1: Consent form**

The survey was approved by George Mason University's Institutional Review Board (Project Number 1668842-1), designed by the author, and executed by Survata, a third-party survey company. The first question was the IRB approved consent form, which respondents had to agree to in order to proceed with the rest of the survey.

Appendix B: Public Survey Materials contains additional information on the approval and on the materials used.

#### **Question 2: “Do you live in, work in, or regularly visit a coastal community in the east coast of the United States?”**

In this question, respondents self-identified whether they lived in, worked in, or regularly visited a coastal community in the east coast of the United States. 588 responses across 503 respondents, some had more than one applicable category. For example, one respondent could both live in and work in a coastal community. If a respondent chose “none of the above” they were not qualified for the survey, and their information was not retained by the survey system. Therefore, there are no recorded responses for that selection.

These selections within the screening questions were meant to all be equally valid for the purposes of participation in the survey, therefore the distribution within the acceptable answers does not validate or invalidate the results. It is of note, however, that

despite many respondents either living in or regularly visiting a coastal community, relatively few reported working in a coastal community. There are many plausible explanations for this, such as many seasonal residents (e.g., vacation properties), retirees, greater availability of jobs away from these coastal communities, or fewer workers in the respondent pool. Without additional information, it is not possible to determine exactly what the cause for this response was. Regardless, the results can be interpreted as including a substantial number of both residents (235) and regular visitors (284), but relatively few employees and business owners (69). This could warrant additional outreach to the business community when making use of the key findings to assure it is responsive to that population’s needs. This distribution of responses is provided in Figure 7.

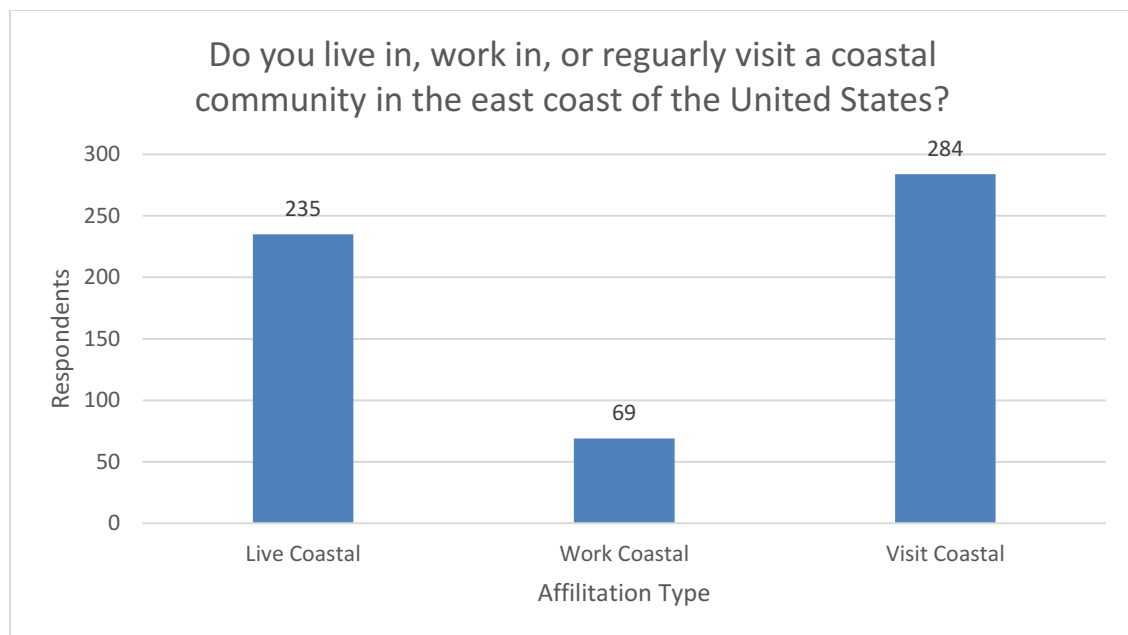


Figure 7. Responses on coastal community affiliation

Overall, there were 235 respondents who lived in coastal areas and 268 who do not. In order to understand whether or not those living in coastal communities have different views than those who do not, relationships were first screened using Mann-Whitney U (nonparametric) test, and the five relationships found to be significant were further tested using Independent Samples T-tests (for equality of means). These included portions of the issues (Q3), components (Q4), vulnerability (Q6), priorities (Q7), funding (Q11), conflict (Q13), and appropriate responses (Q15) questions. Across all of the sub-questions within these items, there were only five instances where responses were significantly different for residents than non-residents at a significance level of  $p \leq 0.05$  using both tests, reported below with Mann-Whitney first followed by the independent sample t-tests).

- Vulnerability: water surge damage from hurricanes and severe storms ( $p = .001$  /  $p < .001$ ), where residents believed they were more vulnerable (3.57) versus nonresidents (3.16).
- Vulnerability: repeated flooding from high tides ( $p = .001$  /  $p = .001$ ), where residents believed they were more vulnerable (3.10) compared to non-residents (2.70).
- Vulnerability: increased flooding if sea level rises in the future ( $p < .001$  /  $p < .001$ ). Residents believed they were more vulnerable (3.40) than non-residents (2.96).
- Priorities: electric power ( $p = 0.16$  /  $p = .012$ ), residents ranked the importance of prioritizing electric power for sea level rise plans (4.34) more than non-residents (4.13).



- Priorities: beaches and similar coastal areas ( $p=.008$  /  $p=.004$ ). Residents ranked beaches and coastal areas as higher priority (3.91) than non-residents (3.62)

Out of 65 items compared, only these five had a statistically significant difference, and the differences between residents and non-residents with another association with coastal communities are modest.

### **Question 3: “Please state the importance of the following issues in your community”**

In this question, respondents were asked to rate the importance of 10 different broad issues, on a scale of 1-5 as follows:

- 1 meaning “very unimportant”
- 2 meaning “somewhat unimportant”
- 3 meaning “neither important nor unimportant”
- 4 meaning “somewhat important”
- 5 meaning “very important”

These issues were meant to help gauge the relative importance of common issues (such as growing the economy) with planning for sea level rise.

In general, respondents rated all issues highly. The median for all issues was 4, and the mode was 5 for every issue except for “preparing for sea level rise” which had a mode of 4. Recognizing a large sample size (503 for every issue) and clear marking of the Likert scale, a mean and standard deviation could also be calculated for each response to further differentiate amongst them.<sup>130</sup> However, given the previously discussed controversies surrounding the analysis of Likert-type data, further analysis using parametric methods was done cautiously, with non-parametric tests used to establish most of the significant similarities and differences within the data. A percentage of those ranking the issue as either of the top two choices (4 and 5) is also shown in this table and

several subsequent ones to provide additional information on which issues were considered important (or very important) in an additional way to differentiate responses that are similar in median and mode other than through the use of mean. The summary of responses to question 3 are shown in Table 6.

Table 6. Key issues ranked by mean score

| <b>Issue</b>                                              | <b>Mean</b> | <b>Median</b> | <b>Mode</b> | <b>Standard Deviation</b> | <b>Number (Percent) Ranking 4 or 5</b> |
|-----------------------------------------------------------|-------------|---------------|-------------|---------------------------|----------------------------------------|
| Protecting the environment                                | 4.04        | 4             | 5           | 1.255                     | 381 (75.7%)                            |
| Maintaining roads and other transportation infrastructure | 4.04        | 4             | 5           | 1.220                     | 392 (77.9%)                            |
| Maintaining utilities and related infrastructure          | 4.01        | 4             | 5           | 1.200                     | 385 (76.5%)                            |
| Growing the economy                                       | 4.00        | 4             | 5           | 1.198                     | 375 (74.5%)                            |
| Protecting against future flooding                        | 3.99        | 4             | 5           | 1.248                     | 375 (74.5%)                            |
| Protecting property from natural disasters                | 3.99        | 4             | 5           | 1.242                     | 379 (75.3%)                            |
| Helping people with limited resources                     | 3.90        | 4             | 5           | 1.226                     | 368 (73.2%)                            |
| Reducing taxes                                            | 3.77        | 4             | 5           | 1.255                     | 331 (65.8%)                            |
| Preparing for sea level rise                              | 3.68        | 4             | 4           | 1.274                     | 329 (65.4%)                            |
| Preparing for climate change                              | 3.68        | 4             | 5           | 1.302                     | 318 (63.2%)                            |

First, the total difference between the highest ranked issue (protecting the environment) at 4.04, distribution shown in Figure 8 and the lowest ranked issue (preparing for climate change) at 3.68, distribution shown in Figure 9 is modest, differing by a maximum of 0.36 out of a maximum possible difference of 4. When examined by

median and mode, these two issues are indistinguishable, but looking at the percentage of respondents ranking either a 4 or a 5, the highest ranked by mean score had more than 12% of the respondents rank that issue highly than the lowest by mean score. This demonstrates that all of these issues are considered to be important by respondents, although to varying degrees that are challenging to measures.

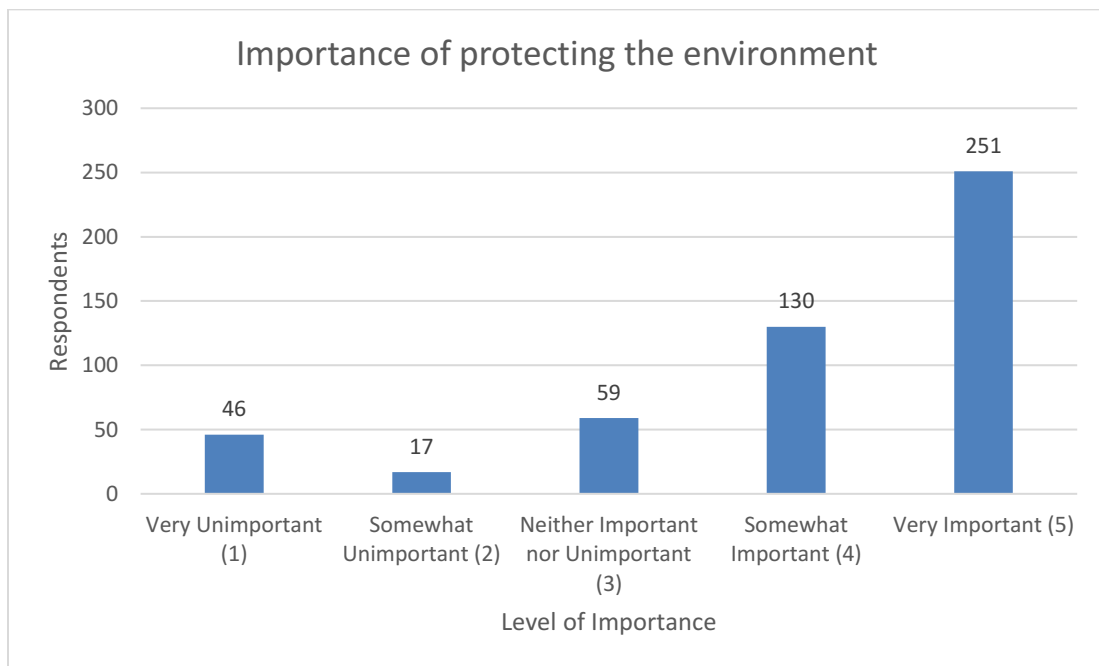


Figure 8. Distribution of responses to the issue "protecting the environment"

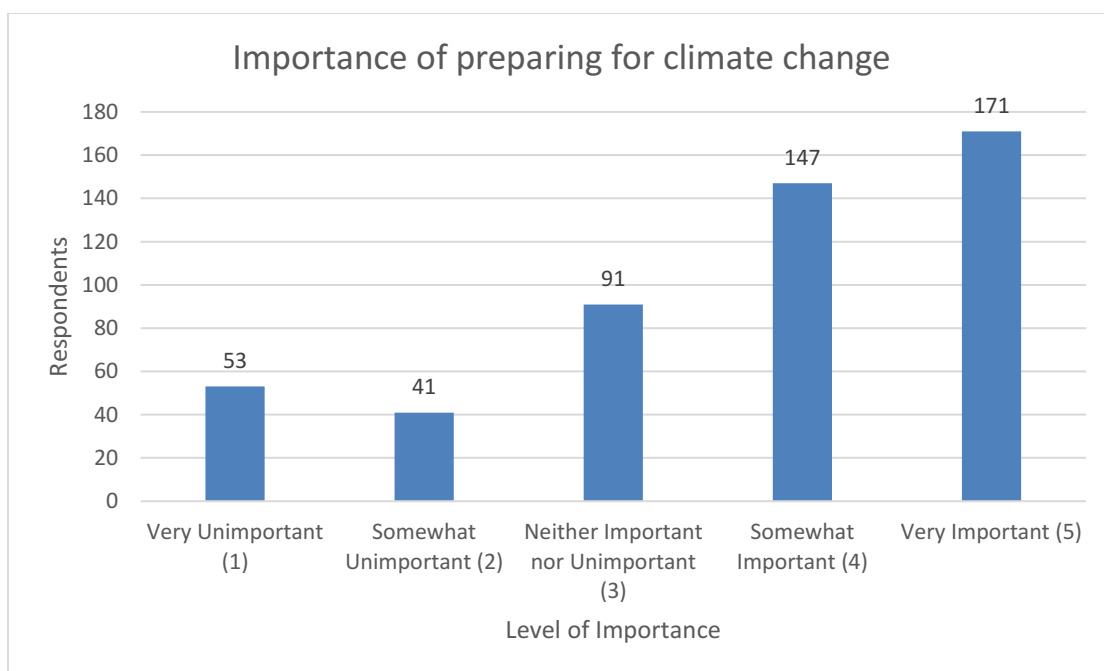


Figure 9. Distribution responses to the issue "preparing for climate change"

The standard deviation helps to measure the extent of variability. Although the difference in standard deviation was modest from the smallest (growing the economy at 1.198) to the largest (preparing for climate change at 1.302), with a maximum difference of 0.104, the relative difference amongst the standard deviations can be used as a proxy for generally how varied (and therefore how potentially controversial) opinions of importance about those issues are, although these are directional in nature rather than strictly numeric.

Since preparing a community-based sea level rise plan will include numerous components that have impacts on other items addressed in these issues, there may be some benefit to emphasizing the factors that benefit the highest ranked issues, such as actions that protect against sea level rise while also protecting the environment.

Conversely, when planning, potential pitfalls related to the lowest ranked and most variable issues could be considered early to mitigate them from being roadblocks.

For most questions, an analysis of which demographics have a meaningful impact on the results was conducted. This was done using Independent Samples Kruskal-Wallis Tests. As shown in Table 7, the distribution is likely the same across all options for gender for the importance of the “economy” as an issue, but likely different for the importance of “preparing for climate change” as an issue.

Although this test alone cannot determine in what way the responses were different (for example, what was different about the gender distributions for preparing for climate change), it can both prompt additional investigation if appropriate and also provides insights as to which differences in demographics are likely to have the greatest differences in opinions on these questions. This provides an opportunity for those conducting planning to proactively address differences in opinion across the most relevant demographics, customized to the needs of their community. Given that there are hundreds of question-demographic relationships contained within this data, it was possible to use this methodology to determine which demographics could influence which questions, only some of those relationships could be described in detail. For example, communities with active environmental communities may wish to prioritize planning processes with those groups on portions of SLR plans where that demographic plays a major role (as described in several of the below questions). Given the number of questions where gender and age play an important role in question responses, communities will probably want to incorporate a diverse set of participants in all

planning processes to capture these differences in opinions and prevent omitting relevant perspectives. The full “likely same” and “likely different” distributions for this question are shown in Table 7 with the “Likely different” ones highlighted for clarity. Values shown as “0.000” are those that are  $p < 0.001$ .

Table 7. Demographics influencing issues responses (statistically significant values at  $p \leq 0.05$  are highlighted and bold)

| Issues of Importance | Total "likely same" | Total "likely different" | Economy      | Preparing for Climate Change | Reducing taxes | Protecting property from natural disasters | Protecting the environment | transportation infrastructure | Utilities and related infrastructure | Helping people with limited resources | Protecting against future flooding | Preparing for sea level rise |
|----------------------|---------------------|--------------------------|--------------|------------------------------|----------------|--------------------------------------------|----------------------------|-------------------------------|--------------------------------------|---------------------------------------|------------------------------------|------------------------------|
| State                | 10                  | 0                        | 0.488        | 0.700                        | 0.359          | 0.916                                      | 0.941                      | 0.696                         | 0.785                                | 0.317                                 | 0.646                              | 0.808                        |
| Gender               | 5                   | 5                        | 0.244        | <b>0.007</b>                 | 0.506          | <b>0.030</b>                               | <b>0.000</b>               | 0.894                         | 0.803                                | <b>0.030</b>                          | <b>0.008</b>                       | 0.124                        |
| Age                  | 9                   | 1                        | 0.607        | 0.227                        | 0.115          | 0.327                                      | 0.207                      | <b>0.012</b>                  | 0.142                                | 0.108                                 | 0.284                              | 0.444                        |
| Live coastal         | 10                  | 0                        | 0.243        | 0.882                        | 0.626          | 0.869                                      | 0.115                      | 0.944                         | 0.560                                | 0.420                                 | 0.189                              | 0.202                        |
| Work coastal         | 9                   | 1                        | 0.282        | 0.187                        | 0.328          | 0.559                                      | 0.527                      | 0.058                         | 0.876                                | 0.447                                 | 0.672                              | <b>0.024</b>                 |
| Visit coastal        | 10                  | 0                        | 0.977        | 0.474                        | 0.280          | 0.876                                      | 0.145                      | 0.112                         | 0.957                                | 0.229                                 | 0.779                              | 0.784                        |
| Funding mixture      | 10                  | 0                        | 0.194        | 0.334                        | 0.112          | 0.237                                      | 0.512                      | 0.193                         | 0.728                                | 0.686                                 | 0.916                              | 0.928                        |
| Income               | 10                  | 0                        | 0.843        | 0.900                        | 0.940          | 0.961                                      | 0.982                      | 0.474                         | 0.673                                | 0.289                                 | 0.581                              | 0.775                        |
| Environmentalism     | 8                   | 2                        | 0.286        | <b>0.000</b>                 | 0.368          | 0.612                                      | <b>0.004</b>               | 0.913                         | 0.649                                | 0.060                                 | 0.631                              | 0.141                        |
| Education            | 7                   | 3                        | <b>0.029</b> | 0.335                        | <b>0.037</b>   | 0.255                                      | 0.151                      | <b>0.049</b>                  | 0.353                                | 0.335                                 | 0.388                              | 0.378                        |
| Ethnicity            | 9                   | 1                        | 0.569        | 0.867                        | 0.870          | 0.286                                      | 0.253                      | <b>0.047</b>                  | 0.557                                | 0.803                                 | 0.979                              | 0.737                        |
| Political party      | 8                   | 2                        | <b>0.039</b> | <b>0.000</b>                 | 0.072          | 0.989                                      | 0.666                      | 0.714                         | 0.692                                | 0.434                                 | 0.384                              | 0.184                        |

The demographic with the broadest potential influence of response distributions is gender, where five of ten questions have potentially different distributions. Education came in second with three questions, and level of environmentalist and political party each had two. Surprisingly, there were five demographics which did not have a measurable impact on any of the questions: the respondent's state, whether the respondent lived in a coastal community or regularly visits a coastal community, the funding mixture the respondent identified, or the respondent's income. The "funding mixture" is derived from the answer to Question 9 (as shown in Table 29), where respondents are asked where the responsibility and funding for sea level rise should originate from, whether in the public sector, private sector, or an equal mix of both.

**Question 4: "In your community, how important are the following components in preparing for future flooding and sea level rise?"**

In question 4, respondents were presented with eight components that could potentially be part of a community-based sea level rise plan, ranking from 1 to 5 as follows:

- 1 meaning "very unimportant"
- 2 meaning "somewhat unimportant"
- 3 meaning "neither important nor unimportant"
- 4 meaning "somewhat important"
- 5 meaning "very important"

The intent of this question was to identify which components could be prioritized in instances where there is limited time or resources available, and to identify which components should always or nearly always be included, or possibly excluded, in the initial stages of planning. The median for six of the eight components was 4, with



“postponing change” having a lower median of 3 and “preparedness for events” having a higher median of 5. The descriptive statistics for this question are shown in Table 8.

Table 8. Sea level rise components ranked by mean score

| <b>Component</b>                                                                        | <b>Mean</b> | <b>Median</b> | <b>Mode</b> | <b>Standard Deviation</b> | <b>Number (Percent) Ranking 4 or 5</b> |
|-----------------------------------------------------------------------------------------|-------------|---------------|-------------|---------------------------|----------------------------------------|
| Preparing to respond and/or evacuate when flooding happens                              | 4.11        | 5             | 5           | 1.192                     | 392 (77.9%)                            |
| Implementing required policies to reduce future flood damage                            | 3.98        | 4             | 5           | 1.171                     | 369 (73.4%)                            |
| Developing maps and tools to learn where flooding will and won't likely cause damage    | 3.96        | 4             | 5           | 1.132                     | 369 (73.4%)                            |
| Educating the community on the causes of flooding and sea level rise                    | 3.88        | 4             | 5           | 1.209                     | 355 (70.6%)                            |
| Building physical barriers (sea walls, levies, dunes, etc.) to protect against flooding | 3.87        | 4             | 5           | 1.247                     | 357 (71.0%)                            |
| Calculating the most cost-effective places and things to protect                        | 3.85        | 4             | 5           | 1.182                     | 350 (69.6%)                            |
| Working in the community to implement voluntary protections                             | 3.82        | 4             | 4           | 1.123                     | 350 (69.6%)                            |
| Finding ways to postpone making changes until more research is done                     | 3.27        | 3             | 3           | 1.262                     | 218 (43.3%)                            |

“Working in the community to implement voluntary protections” is the only component with a mode of 4 and has a generally different distribution pattern than most of the rest of the responses (most of which had a mode of 5 and had higher means). As a whole, respondents felt that voluntary protections were less important (the mode of 4 corresponds with “somewhat important”) than most of the other responses that were

“very important.” Although the exact reason for this cannot be definitively identified from this information alone, one reasonable possibility to address during the development of local plans is the possibility that voluntary protections may have an important role, but that they would likely need to be paired with other, higher rated items to make a complete plan. The percentage ranking 4 or 5 provides additional differentiation of similarly ranked items. The distribution of this response is shown in Figure 10.

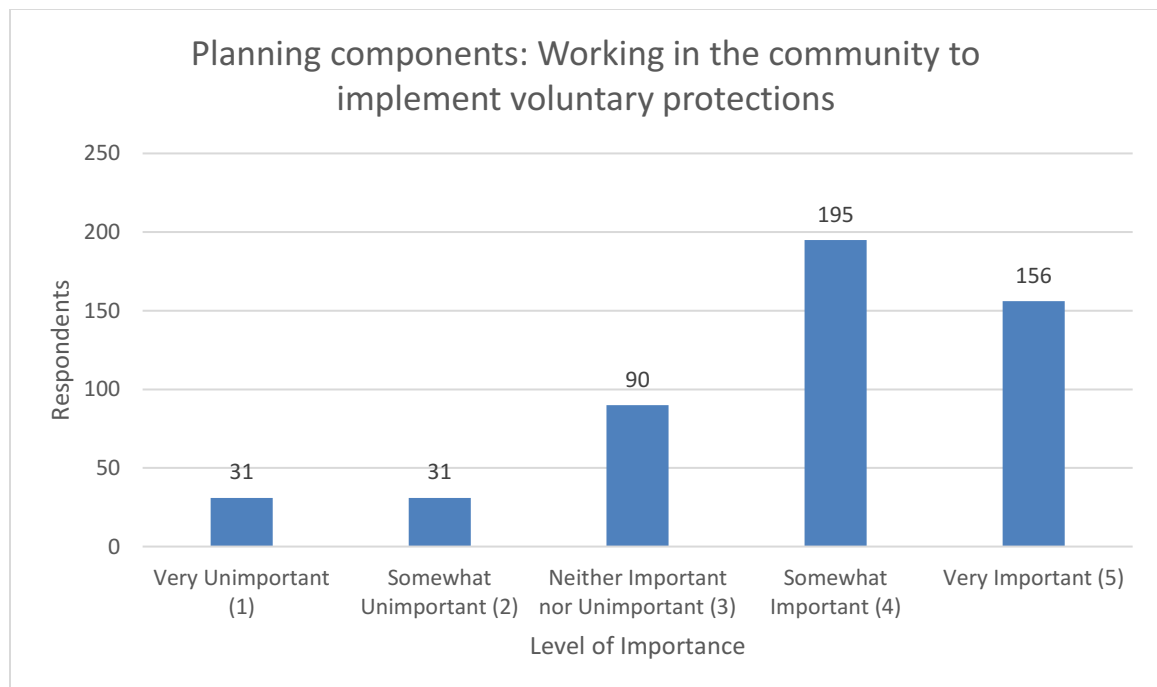


Figure 10. Distribution of responses to the planning component "voluntary protections"

“Finding ways to postpone making changes until more research is done” is the only component with a mode of 3, and also the only component with a median of 3. Also, at 3.27 it has the lowest mean by a considerable margin, being a statistically significant

difference by a non-parametric Wilcoxon Signed Rank Test ( $p < .001$ ) and significantly different by a parametric one-sample t-test ( $p < .001$ ) as seen in Table 9 ( $p < 0.001$  appears as 0.000).

Table 9. Comparison of highest and lowest ranked components responses. (statistically significant values at  $p \leq 0.05$  are highlighted and bold)

|                                     | t      | df  | Sig. (2-tailed) | Mean Difference | 95% Confidence Interval of the Difference |      |
|-------------------------------------|--------|-----|-----------------|-----------------|-------------------------------------------|------|
|                                     |        |     |                 |                 | Lower                                     |      |
| Components: preparedness for events | 77.329 | 502 | <b>.000</b>     | 4.111           | 4.01                                      | 4.22 |
| Components: postponing Change       | 58.148 | 502 | <b>.000</b>     | 3.272           | 3.16                                      | 3.38 |

In some political debates, popular press, and in decision making on all levels, waiting for improved research can be referenced to postpone making change in the present.<sup>103,122</sup> There can be value in postponing certain decisions if additional research results in fewer stranded assets (unnecessary expenditures on protections that were not needed or infrastructure that cannot be used because of changing conditions) or more tailored solutions that are more efficient.<sup>79</sup> At the same time, postponing action can result in increased damages if an event happens during the study period or can delay action indefinitely if research is not completed or is not acted upon later. These factors together can help to explain why this component was most often rated as “neither important nor

unimportant” and that all five options have many respondents. In developing community-based sea level rise policies, it is important to note that this is the least favored component (although still trending somewhat positive) while also being the most varied (highest standard deviation) across the entire set of options polled. The distribution for this question is shown in Figure 11.

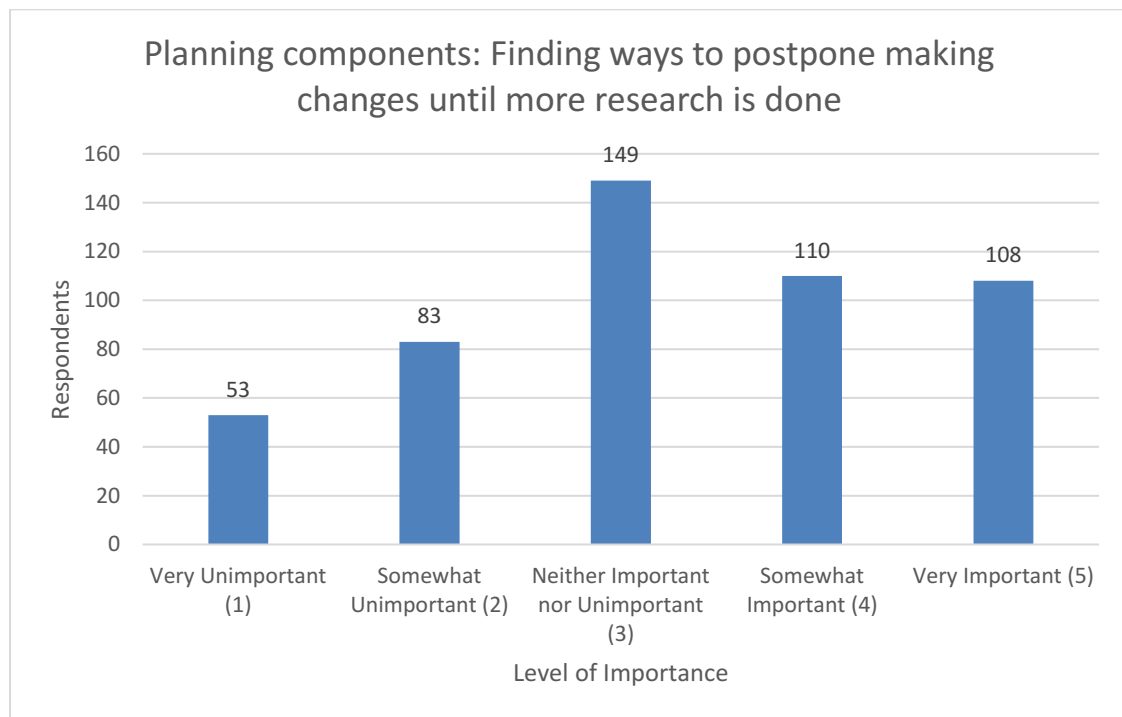


Figure 11. Distribution of responses to the planning component “postpone actions for research”

Finally, the response “Preparing to respond and/or evacuate when flooding happens” was rated the most important factor for inclusion in community-based sea level rise plans, scoring a mean of 4.11 (the only one above 4), and both a median and a mode

of 5. Being rated as the most important factor for community-based sea level rise plans, most likely plans should include provisions related to response and evacuation, or at least assure that such plans are in place prior to addressing other components. This could help to increase participation and investment in the planning process, given this measure's high popularity. However, there are many other components that are highly rated, and response and evacuation plans only reduce the impact of events and do not reduce their incidence or severity. Therefore, emergency planning can be paired with measures that are more preventative in nature to increase effectiveness. The distribution responses to this question is shown in Figure 12.

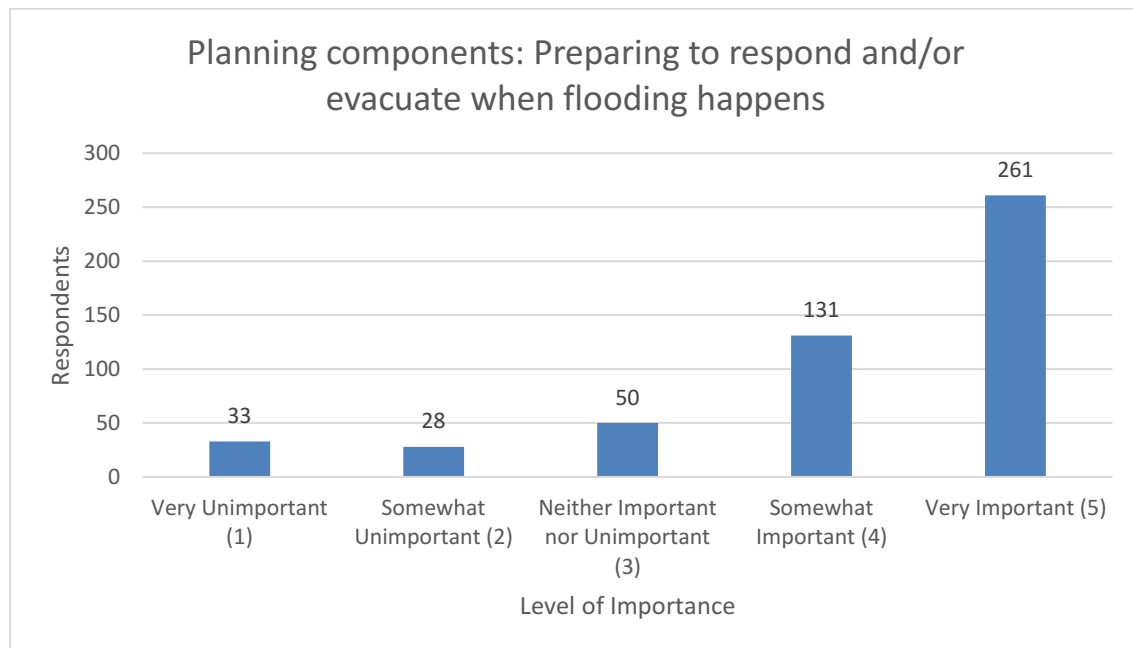


Figure 12. Distribution of responses to the planning component “preparing to respond and/or evacuate when flooding happens”

The demographics that are most likely to impact responses on this question are shown below in Table 10. For this question, gender had different distributions in six of eight sub-questions, being by far the most influential demographic. Level of environmentalist was the second most influential at three. Age and funding mixture (public versus private) each had one that was likely different. Factors such as education, ethnicity, political party, and income had minimal impact on the responses to these questions.

Table 10. Influence of demographics on planning components (statistically significant values at  $p \leq 0.05$  are highlighted and bold)

| Components      | Total "likely same" | Total "likely different" | Educating the community | Implementing required policies | Developing maps and tools | Calculating cost-effective protections | Voluntary protections | Constructed barriers | Postponing change | Preparedness for events |
|-----------------|---------------------|--------------------------|-------------------------|--------------------------------|---------------------------|----------------------------------------|-----------------------|----------------------|-------------------|-------------------------|
| State           | 8                   | 0                        | 0.433                   | 0.510                          | 0.813                     | 0.470                                  | 0.361                 | 0.611                | 0.761             | 0.504                   |
| Gender          | 2                   | 6                        | <b>0.027</b>            | <b>0.009</b>                   | <b>0.029</b>              | 0.175                                  | <b>0.001</b>          | <b>0.003</b>         | 0.576             | <b>0.009</b>            |
| Age             | 7                   | 1                        | 0.888                   | 0.725                          | 0.634                     | 0.407                                  | 0.871                 | 0.099                | 0.330             | <b>0.012</b>            |
| Live coastal    | 8                   | 0                        | 0.292                   | 0.823                          | 0.812                     | 0.082                                  | 0.454                 | 0.424                | 0.281             | 0.423                   |
| Work coastal    | 8                   | 0                        | 0.887                   | 0.177                          | 0.528                     | 0.570                                  | 0.211                 | 0.414                | 0.331             | 0.713                   |
| Visit coastal   | 8                   | 0                        | 0.176                   | 0.761                          | 0.879                     | 0.230                                  | 0.320                 | 0.845                | 0.376             | 0.694                   |
| Funding mixture | 7                   | 1                        | 0.160                   | 0.598                          | 0.352                     | 0.155                                  | 0.095                 | 0.583                | <b>0.022</b>      | 0.312                   |
| Income          | 8                   | 0                        | 0.956                   | 0.708                          | 0.931                     | 0.910                                  | 0.745                 | 0.734                | 0.925             | 0.499                   |
| Environmental   | 5                   | 3                        | <b>0.001</b>            | <b>0.024</b>                   | 0.273                     | 0.486                                  | <b>0.008</b>          | 0.178                | 0.058             | 0.235                   |
| Education       | 8                   | 0                        | 0.506                   | 0.962                          | 0.188                     | 0.297                                  | 0.549                 | 0.422                | 0.086             | 0.198                   |
| Ethnicity       | 8                   | 0                        | 0.961                   | 0.785                          | 0.957                     | 0.994                                  | 0.728                 | 0.891                | 0.411             | 0.683                   |
| Political party | 8                   | 0                        | 0.214                   | 0.347                          | 0.382                     | 0.910                                  | 0.362                 | 0.272                | 0.189             | 0.950                   |

**Question 5: “Are there any other components to preparing for future flooding and sea level rise that are important?”**

In this question, there were a total of 117 respondents who made an entry. Because the responses were open-ended, one respondent could identify more than one suggestion. In this instance, 21 of the 117 responses were statements that they did not have any additional suggestions or were unsure whether there were any additional components needed in local sea level rise plans. As the other 386 respondents did not provide any response to this question, either they did not have any suggestions or did not wish to share them, for a total of 407 (81%) of respondents not identifying any suggestions.

Of the 96 respondents who provided at least one suggestion, there were a total of 128 suggestions, with respondents providing anywhere from one to three suggestions each. Unfortunately, only 40 of the 128 suggestions contained a 1-5 ranking of importance, and there were several responses that appeared to have ordered lists (meaning that they listed several items in order) rather than 1-5 rankings denoting the importance of each one. Given the apparent confusion around providing a ranking, the 1-5 rankings within the write-in text could not be analyzed for any of the write-in questions. Although this is a key limitation of the write-in portion of the data, the text provided was still helpful for identifying common concepts and words. Additionally, eight of the 128 suggestions could not be coded, as responses such as “natural disasters” and “1 is caring about cars” did not provide sufficient information to point to a specific suggestion. The remaining 120 suggestions break down into the categories shown in Table 11.

Table 11. Write-in responses for other components for sea level rise planning

| <b>Coding Category</b>              | <b>Responses</b> | <b>Percentage of valid write-ins (n=120)</b> |
|-------------------------------------|------------------|----------------------------------------------|
| Education                           | 25               | 20.8%                                        |
| Planning Processes                  | 15               | 12.5%                                        |
| Emergency Response                  | 13               | 10.8%                                        |
| Specific Measures                   | 13               | 10.8%                                        |
| Stop High Risk Development          | 9                | 7.5%                                         |
| Personal Action Plan                | 8                | 6.7%                                         |
| Assistance for low-income persons   | 7                | 5.8%                                         |
| Planning for Emergency Food & Water | 6                | 5.0%                                         |
| Early Warning / Awareness           | 4                | 3.3%                                         |
| Political Issues                    | 4                | 3.3%                                         |
| Research                            | 4                | 3.3%                                         |
| Safety                              | 4                | 3.3%                                         |
| Insurance Issues                    | 3                | 2.5%                                         |
| Protecting Animals                  | 2                | 1.7%                                         |
| Legal Action                        | 1                | 0.8%                                         |
| Scientific Info                     | 1                | 0.8%                                         |
| Take No Action                      | 1                | 0.8%                                         |

Every idea is important, but responses that occur 5 or more times represent at least 1% of the entirety of survey respondents (whether they wrote in a response to this question or not), and therefore these items were examined in greater detail, for this write-in question and the other ones that follow. The percentage of valid write-ins in a larger percent because many respondents did not provide a write-in response. In some instances, additional discussion is provided when the response was notable.

“Education” was the topic most commonly suggested, both in this question and across all the write-in questions in total. Although the exact wording varied considerably with phrases like “Education about and required modifications... to reduce global



warming” and “it is very important to be educated on the matter if one is going to live near the shore,” the preference for education as a planning component for sea level rise was compelling. This is especially true given that education appeared in the list of options before the write-in, with nearly 70% of respondents indicating that education was somewhat important or very important. Education could come in many forms, including public school curricula on the science behind sea level rise, resources available at libraries, and many others.

“Planning Processes” was a catch-all for suggestions on process-based activities designed to assist with planning for flooding and sea level rise, as opposed to specific information resources or actions to assist with planning, which most other responses focused on. Examples include examination of costs, “evaluate plans,” and “creating climate change policies.”

“Specific Measures” refers to suggestions that were specific adaptation or mitigation actions, rather than suggestions for planning components as was requested. Although these responses, such as “using equipment to relocate beach sands into walls before hurricanes” or “making new bridges in this area...,” provide useful information for the study overall, they do not help with answering the planning question at hand because they do not refer to planning processes.

“Stop High Risk Development” is on the edge between a planning process and a specific mitigation measure. Examples include “the building heights in coastal areas need to be controlled to prevent building issues,” and “we need to stop encouraging/allowing people to build in flood zones, then use tax money to pay for flood damage.”

“Personal Action Plan” is the code for responses that discussed activities that individuals should take to prepare themselves for flooding or sea level rise. Examples include “call family, have food, have water, have insurance, have prayer,” and “sign up for flood warnings, buy insurance, flood bags, get community, help make a flood plan.” This could also be referred to as personal preparedness. In these responses, respondents made suggestions on what individuals or families should do, as opposed to collective community level planning.

“Assistance for Low-Income Persons” refers to responses that discuss the need to assist others in preparing for flooding and sea level rise, particularly those who have low-incomes or limited resources. Developing a methodology to build in assistance for those with fewer resources could be a vital factor within a planning process, as some recommendations and planning strategies may place burdens on low-income persons that they cannot overcome without additional assistance, meaning that planning should either help to avoid these types of burdens or address them when they do occur.

“Planning for Emergency Food and Water” was a specific subset of personal and community preparedness pointed out by several respondents on assuring that the community has food and water during an emergency. For specific flood events, this is an emergency response function, whereas for sea level rise, this could refer to infrastructure and other choices that provide resilience in the light of changing conditions. There is some potential overlap with the category “Personal Action Plan” for emergency preparedness, as some of the personal action plan responses included food or water as a portion, but in this case, several of the respondents discussed emergency food and water

in shelters and through governmental aid, rather than as a function of personal preparedness.

**Question 6: “How vulnerable is your community to damage from the following hazards?”**

The purpose of this question was to identify perceived vulnerability to various environmental hazards, ranked on a 1-5 scale as follows:

- 1 meaning “Not at all vulnerable”
- 2 meaning “somewhat vulnerable”
- 3 meaning “vulnerable”
- 4 meaning “highly vulnerable”
- 5 meaning “exceptionally vulnerable”

A low perceived vulnerability to a hazard could reduce the engagement received in a sea level rise planning process, and a high perceived vulnerability may help to catalyze both planning and action. This does not gauge actual vulnerability (which would require specific knowledge of the respondent’s community and objective measures of the community’s vulnerability, which were not part of this study). Rather, this question gauges the respondent’s perception of that vulnerability, whether or not that perception is accurate. The specific items assessed were vulnerability to the following four categories of hazards:

- Water surge damage from hurricanes and severe storms
- Repeated flooding from high tides
- Increased flooding if sea level rises in the future
- Other types of natural disasters

The descriptive statistics of these four perceptions are shown in Table 12. In this instance, both a high (ranked 4 or 5) and low (ranked 1 or 2) vulnerability categories are shown.

Table 12. Summary statistics for community vulnerability ranked by mean score

| <b>Vulnerability Type</b>                            | <b>Mean</b> | <b>Median</b> | <b>Mode</b> | <b>Standard Deviation</b> | <b>Number (Percent) Ranking 1 or 2</b> | <b>Number (Percent) Ranking 4 or 5</b> |
|------------------------------------------------------|-------------|---------------|-------------|---------------------------|----------------------------------------|----------------------------------------|
| Water surge damage from hurricanes and severe storms | 3.35        | 3             | 4           | 1.261                     | 137<br>(27.2%)                         | 248<br>(49.3%)                         |
| Increased flooding if sea level rises in the future  | 3.17        | 3             | 4           | 1.299                     | 254<br>(50.5%)                         | 223<br>(44.3%)                         |
| Other natural disasters                              | 3.12        | 3             | 3           | 1.082                     | 154<br>(30.6%)                         | 180<br>(35.8%)                         |
| Repeated flooding from high tides                    | 2.89        | 3             | 2           | 1.351                     | 220<br>(43.7%)                         | 187<br>(37.2%)                         |

All four perceptions have a median of 3, although the response distributions varied significantly (by related-samples Wilcoxon signed rank test,  $p < 0.001$ ) with differing modes, means, and standard deviations. In general, respondents believed they were the most vulnerable to current flooding from storms and hurricanes, less vulnerable to future flooding from sea level rise, and the least vulnerable to repeated flooding from high tides (although the unusual distribution for that question had two peaks at 2 and 4, giving it the highest standard deviation). Of these four perceptions, the distributions for “Water surge damage from hurricanes and severe storms” and “increased flooding if sea level rises in the future” were very similar and both perceived as “highly vulnerable” with the main difference being about 20 responses (about 4%) switching from “exceptionally vulnerable (5)” to current flooding to “not at all vulnerable (1)” to future flooding with

SLR, impacting the mean but not the median or mode. Since the mean and mode are not different, analysis using parametric tests is not appropriate in this instance. Instead, looking at the percentages that indicated low vulnerability (1 or 2) and those indicating high vulnerability (4 or 5) helps to provide additional clarity, in that more believe they are highly vulnerable to hurricanes/severe storms than minimally vulnerable, but for other hazards the distinction was much smaller, and in two cases more rated themselves as 1-2 than 3-4.

Perceptions of vulnerability varied considerably across several demographics. Both age and reported level of environmentalist impacted all four types of perceived vulnerability. Whether or not a respondent lived in, worked in, or regularly visited coastal communities also impacted the three vulnerability types about water (but not “other natural disasters”). State also made a difference for three of four. Gender, income, education, and political party all did not make a significant difference in perceived vulnerability, as shown in Table 13 ( $p < 0.001$  appears as 0.000). Given the large number of differences among many demographics, combined with the distribution of perceived risk overall, planners will probably need to first determine whether perceived risk varies locally as much as it does in this data. If it does, they may need to find ways to help those involved with planning processes “ground” their risk perceptions using data or other methods to make sure that the risks being addressed in the plan are appropriate to local conditions. This approach assumes likely risks have been assessed. If they have not, planners may need to conduct risk assessments concurrently with other planning processes to inform them.

Table 13. Influence of demographics on perceived vulnerability (statistically significant values at  $p \leq 0.05$  are highlighted and bold)

| Demographic impacting vulnerability | Total "likely same" | Total "likely different" | Water surge damage from hurricanes and severe storms | Repeated flooding from high tides | Increased flooding if sea level rises in the future | Other natural disasters |
|-------------------------------------|---------------------|--------------------------|------------------------------------------------------|-----------------------------------|-----------------------------------------------------|-------------------------|
| State                               | 1                   | 3                        | <b>0.025</b>                                         | <b>0.030</b>                      | 0.094                                               | <b>0.035</b>            |
| Gender                              | 4                   | 0                        | 0.098                                                | 0.085                             | 0.084                                               | 0.347                   |
| Age                                 | 0                   | 4                        | <b>0.004</b>                                         | <b>0.000</b>                      | <b>0.000</b>                                        | <b>0.005</b>            |
| Live coastal                        | 1                   | 3                        | <b>0.001</b>                                         | <b>0.001</b>                      | <b>0.000</b>                                        | 0.204                   |
| Work coastal                        | 1                   | 3                        | <b>0.015</b>                                         | <b>0.005</b>                      | <b>0.016</b>                                        | 0.195                   |
| Visit coastal                       | 1                   | 3                        | <b>0.004</b>                                         | <b>0.003</b>                      | <b>0.008</b>                                        | 0.316                   |
| Funding mixture                     | 3                   | 1                        | 0.294                                                | <b>0.020</b>                      | 0.244                                               | 0.068                   |
| Income                              | 4                   | 0                        | 0.943                                                | 0.971                             | 0.827                                               | 0.905                   |
| Environmentalism                    | 0                   | 4                        | <b>0.013</b>                                         | <b>0.000</b>                      | <b>0.000</b>                                        | <b>0.001</b>            |
| Education                           | 4                   | 0                        | 0.935                                                | 0.777                             | 0.665                                               | 0.641                   |
| Ethnicity                           | 3                   | 1                        | 0.135                                                | 0.186                             | <b>0.037</b>                                        | 0.394                   |
| Political party                     | 4                   | 0                        | 0.350                                                | 0.412                             | 0.259                                               | 0.371                   |

As mentioned above, perceptions of vulnerability varied across both level of environmentalism and age. 144 respondents rated their level of environmentalism as low (1 or 2 with 144 respondents) whereas 160 rated as high (4 or 5 with 160 respondents). In every instance, those with a high level of environmentalism perceived their vulnerability as higher than those with a low level of environmentalism, as shown in Table 14.

Table 14. Differences in assessment of vulnerability by level of environmentalism

| <b>Level of Environmentalism by measurement</b> | <b>Water surge damage from hurricanes and severe storms</b> | <b>Repeated flooding from high tides</b> | <b>Increased flooding if sea level rises in the future</b> | <b>Other natural disasters</b> |
|-------------------------------------------------|-------------------------------------------------------------|------------------------------------------|------------------------------------------------------------|--------------------------------|
| High Level of Environmentalism (Mean)           | 3.53                                                        | 3.20                                     | 3.41                                                       | 3.37                           |
| High Level of Environmentalism (% 4 or 5)       | 57.5%                                                       | 44.4%                                    | 52.5%                                                      | 45.6%                          |
| Low Level of Environmentalism (Mean)            | 3.06                                                        | 2.44                                     | 2.76                                                       | 2.86                           |
| Low Level of Environmentalism (% 4 or 5)        | 39.6%                                                       | 25.0%                                    | 29.2%                                                      | 25.7%                          |
| <b>Difference (Mean)</b>                        | <b>0.47</b>                                                 | <b>0.76</b>                              | <b>0.65</b>                                                | <b>0.51</b>                    |
| <b>Difference (% 4 or 5)</b>                    | <b>17.9%</b>                                                | <b>19.4%</b>                             | <b>23.3%</b>                                               | <b>19.9%</b>                   |

For age, there was no single linear correlation between age and perception of vulnerability. That is to say, perception of vulnerability does not increase or decrease consistently with increasing age. Most notably, respondents aged 65 and over rated three of four types of vulnerability (other than “water surge damage from hurricanes and severe storms”) lower than any other age group. The highest rated vulnerabilities were spread out over several age groups. Figure 13 shows each age group’s mean response compared to the overall means.

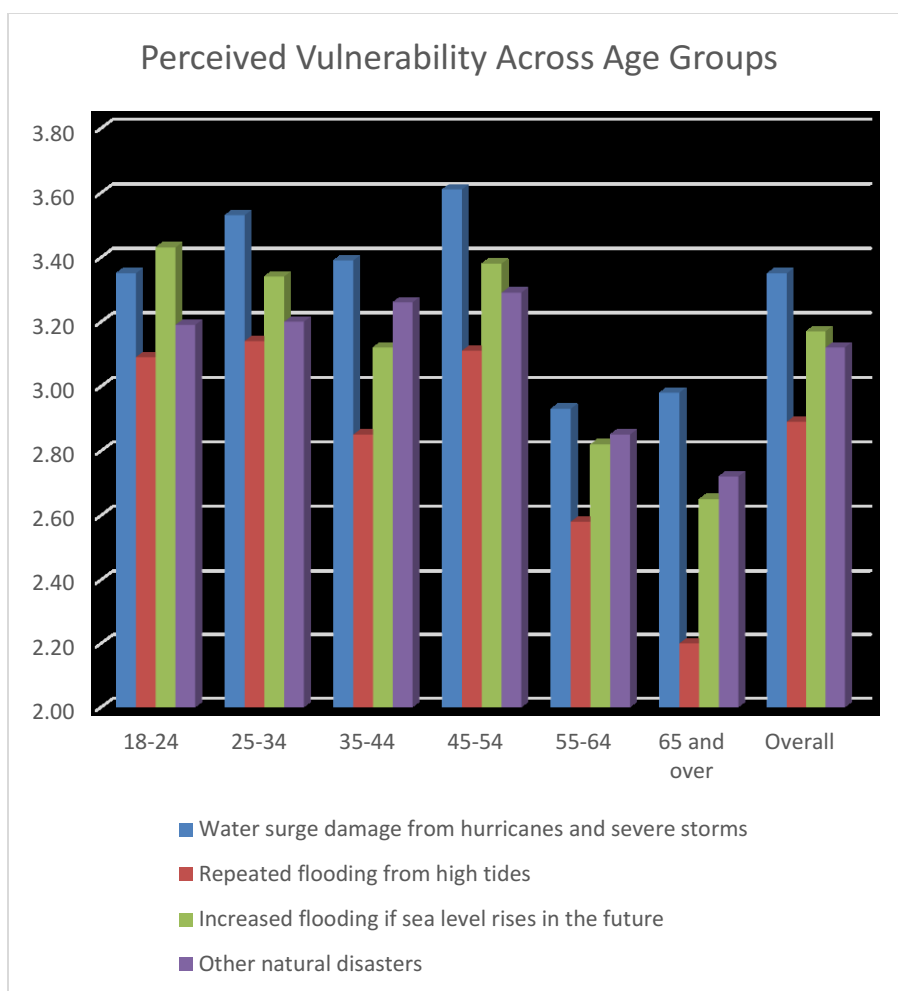


Figure 13. Perceived vulnerability across age groups by mean score

Looking from the perspective of those who ranked vulnerability in the highest two categories (% ranking as 4 or 5), similar patterns appear. This information is shown in Table 15.



Table 15. Perceived vulnerability by age (by percent ranking 4 or 5)

| Age            | Water surge damage from hurricanes and severe storms | Repeated flooding from high tides | Increased flooding if sea level rises in the future | Other natural disasters |
|----------------|------------------------------------------------------|-----------------------------------|-----------------------------------------------------|-------------------------|
| 18-24          | 51.3%                                                | 47.5%                             | 56.3%                                               | 33.8%                   |
| 25-34          | 54.9%                                                | 45.1%                             | 48.9%                                               | 38.3%                   |
| 35-44          | 50.0%                                                | 35.7%                             | 41.8%                                               | 42.9%                   |
| 45-54          | 58.3%                                                | 43.1%                             | 50.0%                                               | 43.1%                   |
| 55-64          | 34.5%                                                | 20.0%                             | 29.1%                                               | 27.3%                   |
| 65 and over    | 36.9%                                                | 18.5%                             | 30.8%                                               | 21.5%                   |
| <b>Overall</b> | 49.3%                                                | 37.2%                             | 44.3%                                               | 35.8%                   |

**Question 7: “Please rate how high a priority protecting each of the following items in your community from flooding and future sea level rise should be”**

In question 7, respondents rated how high of a priority the protection against flooding and sea level rise for fifteen different items should be, ranked on a scale of 1-5 as follows:

- 1 meaning “not at all a priority”
- 2 meaning “somewhat a priority”
- 3 meaning “a moderate priority”
- 4 meaning “a high priority”
- 5 meaning “an exceptionally high priority”

Assessing the relative strength and distribution of responses in this question can help guide the inclusion and relative priority of these and related components in drafting a community’s sea level rise plan. Table 16 shows the descriptive statistics for this question.

Table 16. Summary statistics for protection priorities

| <b>Priority for Protection</b>        | <b>Mean</b> | <b>Median</b> | <b>Mode</b> | <b>Std. Dev.</b> | <b>Number (Percent) Ranking 4 or 5</b> |
|---------------------------------------|-------------|---------------|-------------|------------------|----------------------------------------|
| Drinking water                        | 4.30        | 5             | 5           | 0.994            | 413 (82.1%)                            |
| Electric power                        | 4.23        | 5             | 5           | 0.957            | 399 (79.3%)                            |
| Roads and highways                    | 4.07        | 4             | 4           | 0.899            | 386 (76.7%)                            |
| Homes and residences                  | 4.07        | 4             | 5           | 1.020            | 380 (75.5%)                            |
| Sewer / wastewater                    | 3.97        | 4             | 5           | 1.085            | 352 (70.0%)                            |
| Government facilities                 | 3.90        | 4             | 5           | 1.042            | 343 (68.2%)                            |
| Natural gas / heating fuel            | 3.85        | 4             | 4           | 1.089            | 337 (67.0%)                            |
| Beaches and similar coastal amenities | 3.75        | 4             | 4           | 1.120            | 319 (63.4%)                            |
| Natural wetlands, wildlife areas      | 3.71        | 4             | 4           | 1.192            | 318 (63.2%)                            |
| Stormwater and green infrastructure   | 3.69        | 4             | 4           | 1.036            | 313 (62.2%)                            |
| Businesses, offices, shops            | 3.67        | 4             | 4           | 1.059            | 300 (59.6%)                            |
| Public transit                        | 3.62        | 4             | 4           | 1.180            | 296 (58.8%)                            |
| Places of cultural importance         | 3.47        | 4             | 3           | 1.076            | 254 (50.5%)                            |
| Parks and public spaces               | 3.43        | 3             | 3           | 1.120            | 241 (47.9%)                            |
| Houses of worship                     | 3.31        | 3             | 3           | 1.254            | 234 (46.5%)                            |

“Drinking water” and “electric power” were the only two priorities that had both a median and a mode of 5. They also had significantly higher means (electric power differed from roads and highways using related-samples Wilcoxon signed rank test,

$p < 0.001$ ), indicating they are considered by many to be high priorities for protection. Intuitively, virtually all residential, commercial, governmental and other pursuits rely on the functioning of these basic services. “Homes and residences,” “Sewer/wastewater,” and “government facilities” all also had modes of 5 (medians of 4). All of these services (and the homes/residences the services are meant to help) are also critical to a functioning society, and it is no surprise they rank highly as well. Although it was ranked lower by mode (4), “Roads and highways” had the third highest mean at 4.07. Drinking water, electric power, roads and highways, and homes and residences all had more than 75% of respondents rank them as either 4 or 5. Many others shared a median and a mode of 4, showing that many portions of the community are also considered high priorities for protection. Amongst the lowest (although with means still above 3 and means and modes of 3) were “Parks and public spaces” and “Houses of worship.” Although still indicated as important, these facilities (which provide services to the public but are not necessarily vital for the functioning of all other services) appear to be lower overall priorities for protection.

Some demographics play an important role in some priorities. Surprisingly, income, ethnicity, and gender do not appear to have much influence on any of the priorities, as shown in Table 17 ( $p < 0.001$  appears a 0.000).

Like many other questions, the reported level of environmentalism had a big impact on responses to protection priorities, influencing 9 of the 15 priorities. Preferred funding mixture (public versus private) influenced 7 of 15 priorities, and the respondent’s state influenced 4 of 15 priorities. Similar to the findings of several other factors, since

level of environmentalism is so pivotal in influencing the results, planners should consider bringing in members of this community (including different groups across various types of environmentalism to help bring in this entire demographic). The large number of differences based upon preferred funding mixture (public versus private) could potentially lead to polarization depending on whether the priorities were themselves public or private infrastructure and organizations, and planners could seek a balance of priorities that could include both publicly and privately funded solutions.

Table 17. Influence of demographics on protection priorities (statistically significant values at  $p \leq 0.05$  are highlighted and bold)

| Priorities       | Total "likely same" | Total "likely different" | Drinking water | Electric power | Natural gas / heating fuel | Sewer / wastewater | Stormwater and green infrastructure | Road and highways | Public transit | Places of cultural importance | Houses of worship | Homes and residences | Businesses, offices, shops | Government facilities | Parks and public spaces | Beaches and similar coastal areas | Natural wetlands, wildlife areas |
|------------------|---------------------|--------------------------|----------------|----------------|----------------------------|--------------------|-------------------------------------|-------------------|----------------|-------------------------------|-------------------|----------------------|----------------------------|-----------------------|-------------------------|-----------------------------------|----------------------------------|
| State            | 11                  | 4                        | 0.453          | 0.100          | 0.053                      | 0.207              | 0.160                               | 0.543             | <b>0.019</b>   | 0.208                         | 0.340             | 0.536                | <b>0.018</b>               | <b>0.035</b>          | <b>0.034</b>            | 0.139                             | 0.858                            |
| Gender           | 15                  | 0                        | 0.060          | 0.861          | 0.511                      | 0.104              | 0.671                               | 0.664             | 0.409          | 0.906                         | 0.712             | 0.172                | 0.495                      | 0.289                 | 0.645                   | 0.167                             | 0.320                            |
| Age              | 14                  | 1                        | 0.410          | 0.149          | 0.498                      | 0.284              | 0.440                               | 0.476             | <b>0.046</b>   | 0.676                         | 0.972             | 0.814                | 0.659                      | 0.786                 | 0.082                   | 0.920                             | 0.849                            |
| Live coastal     | 13                  | 2                        | 0.450          | <b>0.016</b>   | 0.103                      | 0.998              | 0.476                               | 0.151             | 0.980          | 0.391                         | 0.140             | 0.312                | 0.752                      | 0.379                 | 0.997                   | <b>0.008</b>                      | 0.836                            |
| Work coastal     | 12                  | 3                        | 0.059          | <b>0.014</b>   | 0.985                      | 0.378              | 0.247                               | 0.110             | 0.757          | <b>0.019</b>                  | <b>0.037</b>      | 0.117                | 0.112                      | 0.633                 | 0.059                   | 0.321                             | 0.239                            |
| Visit coastal    | 14                  | 1                        | 0.638          | <b>0.023</b>   | 0.204                      | 0.719              | 0.612                               | 0.292             | 0.947          | 0.443                         | 0.248             | 0.443                | 0.948                      | 0.165                 | 0.975                   | 0.196                             | 0.935                            |
| Funding mixture  | 8                   | 7                        | <b>0.011</b>   | 0.107          | 0.096                      | <b>0.003</b>       | 0.565                               | <b>0.011</b>      | 0.153          | <b>0.039</b>                  | <b>0.000</b>      | <b>0.005</b>         | 0.140                      | 0.060                 | <b>0.016</b>            | 0.363                             | 0.303                            |
| Income           | 15                  | 0                        | 0.792          | 0.987          | 0.948                      | 0.832              | 0.951                               | 0.999             | 0.977          | 0.918                         | 0.132             | 0.857                | 0.679                      | 0.931                 | 0.975                   | 0.691                             | 0.813                            |
| Environmentalism | 6                   | 9                        | 0.369          | 0.544          | <b>0.031</b>               | <b>0.011</b>       | <b>0.000</b>                        | 0.070             | <b>0.001</b>   | <b>0.000</b>                  | <b>0.008</b>      | 0.108                | <b>0.004</b>               | 0.075                 | <b>0.000</b>            | 0.071                             | <b>0.000</b>                     |
| Education        | 15                  | 0                        | 0.771          | 0.893          | 0.712                      | 0.929              | 0.497                               | 0.730             | 0.903          | 0.831                         | 0.717             | 0.826                | 0.876                      | 0.917                 | 0.770                   | 0.624                             | 0.686                            |
| Ethnicity        | 15                  | 0                        | 0.479          | 0.083          | 0.469                      | 0.879              | 0.743                               | 0.792             | 0.871          | 0.510                         | 0.775             | 0.635                | 0.776                      | 0.251                 | 0.854                   | 0.766                             | 0.666                            |
| Political party  | 14                  | 1                        | 0.664          | 0.915          | 0.576                      | 0.542              | 0.555                               | 0.840             | 0.333          | 0.698                         | <b>0.045</b>      | 0.616                | 0.392                      | 0.224                 | 0.082                   | 0.258                             | 0.391                            |

**Question 8: “Are there any other items in your community that should be priorities for protection?”**

This question inquired about specific types of places that should receive consideration in developing a community-based sea level rise plan. Seventy-three (73) respondents provided a write-in response to this question. Of those, 15 coded to “no others or not sure,” leaving 58 respondents with a total of 71 suggestions. All the 71 suggestions were able to be coded for the purposes of creating a summary. The summary of those responses is shown in Table 18, including the category, the number of responses fitting into that category, and the percentage of the responses that fell into that category.

Table 18. Write-in responses for other protection priorities

| <b>Coding Category</b>                  | <b>Responses</b> | <b>Percentage of valid responses (n =71)</b> |
|-----------------------------------------|------------------|----------------------------------------------|
| Medical Facilities / Hospitals          | 11               | 15.5%                                        |
| Educational Facilities / Schools        | 10               | 14.1%                                        |
| Animal Shelters / Zoos                  | 7                | 9.9%                                         |
| Personal Property                       | 4                | 5.6%                                         |
| Electric Infrastructure                 | 3                | 4.2%                                         |
| Homes / Housing                         | 3                | 4.2%                                         |
| Human Shelters                          | 3                | 4.2%                                         |
| People (not otherwise specified)        | 3                | 4.2%                                         |
| Security / Public Safety Infrastructure | 3                | 4.2%                                         |
| Water Infrastructure                    | 3                | 4.2%                                         |
| Boating Infrastructure / Boats          | 2                | 2.8%                                         |
| Environment (not otherwise specified)   | 2                | 2.8%                                         |
| Historic/Cultural Sites                 | 2                | 2.8%                                         |
| Natural Features (e.g., Wetlands)       | 2                | 2.8%                                         |
| Specific Locations                      | 2                | 2.8%                                         |
| All Critical Infrastructure             | 1                | 1.4%                                         |
| Community Centers                       | 1                | 1.4%                                         |
| Dams                                    | 1                | 1.4%                                         |
| Drainage / Storm Sewer                  | 1                | 1.4%                                         |
| Emergency Response Infrastructure       | 1                | 1.4%                                         |
| Houses of Worship                       | 1                | 1.4%                                         |
| Low-Lying Areas                         | 1                | 1.4%                                         |
| Marine Life                             | 1                | 1.4%                                         |
| People (children)                       | 1                | 1.4%                                         |
| People (homeless)                       | 1                | 1.4%                                         |
| Transportation Infrastructure           | 1                | 1.4%                                         |

Of particular note in these responses is that although there are many (25) categories, over half of them (16) represented one or two respondents. There was also a strong concentration of the top few items, as discussed in the following paragraphs.

“Medical Facilities / Hospitals” was the most commonly seen write-in with 11 instances. Medical facilities play an important role in communities during normal

conditions as well as a key response and recovery role after disaster situations. Their disruption could cause challenges throughout the community as chronic health conditions may not be properly treated and injuries and illnesses due to disasters may need to be taken to facilities outside the community.

“Educational Facilities / Schools” was the second most commonly suggested category with 10 instances, and refers to schools, universities, libraries, and other educational institutions. There are several reasons why respondents may have written in these facilities. For one, the proper functioning of educational institutions aids in the feeling of normalcy in a community. Schools may be one of the first things to close during an emergency and may be one of the last to start running again. If schools are not open, it is difficult for parents to return to work and difficult to keep school-aged children productively occupied. Although there is no reason to suspect that schools are more vulnerable to sea level rise and flooding than the community as a whole, they often represent one of the larger local public investments and therefore there is a great deal to lose financially if they are not properly protected. They could also be referring to keeping children safe during disasters or to the fact that some communities use schools as shelters (which would be unavailable if impacted) during disasters, although no responses specifically mentioned these two phenomena.

“Animal Shelters / Zoos” were also a common write-in response. Several respondents mentioned that animals may end up being left behind during an event because insufficient planning could mean that shelters are available only for people and not for their pets. Additionally, if animal shelters (those in operation all the time, not just



those activated only in an emergency) or zoos are vulnerable to flooding or sea level rise, the animals they house could be at risk and those services could be lost to the community. The relocation of zoological animals is a considerably more complex task than domestic animals, given the special care that such animals need.

**Question 9: “Should preparing for future flooding and sea level rise be mostly private sector (and individual) responsibility, public sector (and government) responsibility or a mix of both?”**

Question 9 contained only one part and asked whether the responsibility for preparing for future flooding and sea level rise should be entirely the responsibility of the private sector, entirely the public sector, or somewhere in the middle. Over 60% (303) respondents indicated it should be an equal mix of the public and private sectors, and nearly 23% (115) stated mostly public sector. Fewer than 10% (49) respondents stated it should be entirely private sector or entirely public sector. This strong focus on equal or near-equal responsibility speaks well to collaborative solutions involving both the public and private sector and avoiding “putting all the eggs in one basket” of pushing planning and actions in only one sector. Given the potentially fundamental difference in strategies that would be pursued under an extreme of responses versus the other, the answers to this question were analyzed in the same manner as a demographic in the analysis, to see whether responses to this question influenced the distribution of other questions. The full distribution of this question is shown in Figure 14.

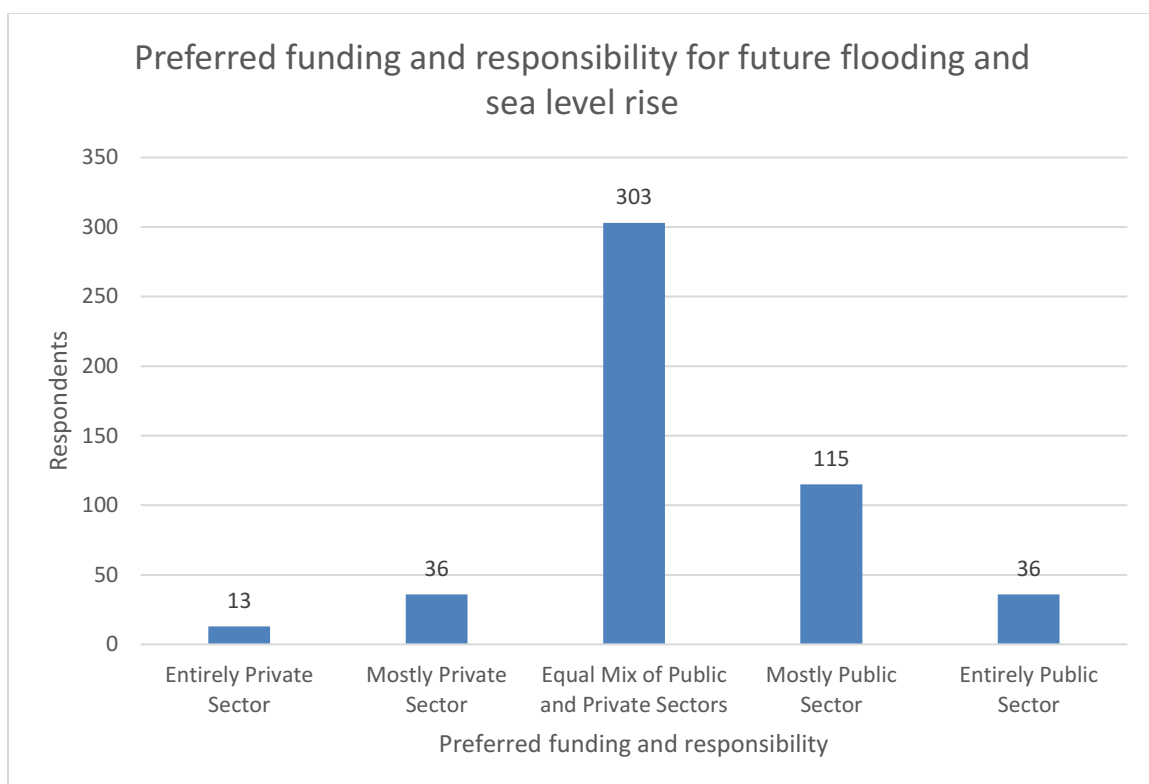


Figure 14. Distribution of responses on public and private responsibility for SLR and flooding

**Question 10: “How useful are the following methods in determining how much money should be spent protecting against floods and the effects of future sea level rise?”**

Question 10 asked respondents to rate the usefulness of several methods for determining how much to spend on preparing for flooding and sea level rise. The scale was as follows:

- 1 meaning “not at all useful”
- 2 meaning “somewhat useful”
- 3 meaning “useful”
- 4 meaning “highly useful
- 5 meaning “exceptionally useful”

The intent of this question is not to determine how much a community should spend on protection, as that will vary considerably by community across numerous factors, but rather to assess the methods of obtaining funding and setting spending amounts to help communities answer this question.

The methodologies surveyed include a mixture of choices that involve little to no financial impact on the community (no change, or use only state/federal funding), specific local funding sources (property, sales, income tax, etc.) and offsets and other methodologies to determine a strategy if the best one is not self-apparent.

Reflecting the diversity of funding mechanisms within the question, the responses were also varied, as shown in Table 19.

Table 19. Summary of responses to funding mechanisms

| <b>Funding Methodology</b>                                                                                            | <b>Mean</b> | <b>Median</b> | <b>Mode</b>  | <b>Standard Deviation</b> | <b>Number (Percent) Ranking 4 or 5</b> |
|-----------------------------------------------------------------------------------------------------------------------|-------------|---------------|--------------|---------------------------|----------------------------------------|
| Hold public meetings to identify highest priorities and vote on methods to pay for them                               | 3.64        | 4             | 4            | 1.101                     | 298 (59.2%)                            |
| Minimize the use of local taxes but utilize state/federal money when available                                        | 3.56        | 4             | 4            | 1.088                     | 275 (54.7%)                            |
| Encourage insurance companies to require upgrades on homes/businesses to reduce risks as a condition of insurance     | 3.41        | 3             | 3 & 4 (Tied) | 1.167                     | 248 (49.3%)                            |
| Set policies to encourage individuals / businesses to pay for their own protection to minimize local government costs | 3.27        | 3             | 4            | 1.211                     | 230 (45.7%)                            |
| Increase funding by raising local fees for beaches and other amenities                                                | 3.05        | 3             | 3            | 1.216                     | 189 (37.6%)                            |
| Use only money already used for protection (no change)                                                                | 2.96        | 3             | 3            | 1.297                     | 175 (34.8%)                            |
| Increase funding by raising local sales taxes                                                                         | 2.83        | 3             | 3            | 1.256                     | 161 (32.0%)                            |
| Increase funding by raising local property taxes                                                                      | 2.76        | 3             | 2            | 1.290                     | 149 (29.6%)                            |
| Increase funding by raising local income taxes                                                                        | 2.69        | 3             | 3            | 1.294                     | 137 (27.2%)                            |
| Increase funding for protection by cutting other local programs and services                                          | 2.62        | 3             | 1            | 1.396                     | 140 (27.8%)                            |

Although the medians for all the responses were either 3 or 4, the distribution and other statistics varied considerably. The top two by mean (public meetings and utilizing state/federal resources) were not significantly different ( $p=0.66$  using related-samples Wilcoxon signed rank test), but state/federal resources differed significantly from

insurance requirements with  $p=0.013$ . First, the following methods were less popular given their low means, modes, and percent ranking 4-5:

- “No change” had a mean of 2.96 and a mode of 3, showing a moderate interest but a wide distribution in a bimodal pattern, with the highest standard deviation (for example, 91 respondents ranked it as “1” and 73 as “5”). 34.8% of respondents ranked this as 4-5.
- “Cutting other local programs and services” to pay for protections was the least popular overall, with a mode of 1 (156 people rated it as such) and the lowest mean of 2.62. In this case, reviewing either the mean or median could lead to a false sense of acceptance, given that more respondents gave this the lowest possible score than any other selection, and only 27.8% of respondents ranked it as 4-5, fewer than half of the highest ranked options.
- All the tax options were also less popular, with means ranging from 2.69 to 2.83 and modes of either 2 or 3, with anywhere from 27.2-32% of respondents ranking them as 4 or 5.

Several methods were more popular, such as utilizing federal and state funds, using public meetings, and, to a lesser extent, insurance company requirements and encouraging self-pay. Although it is encouraging that some methodologies are considered acceptable, the responses to this question do pose challenges for communities looking to fund sea level rise planning and actions.

The techniques identified in later questions around conflict resolution may be necessary when addressing the issue of funding. This is because the methods that drive

specific revenue to address these challenges, either from new taxes or reduced spending elsewhere, were less popular than most other choices. Local use fees (such as fees to use beaches and other amenities) fared slightly better but were still less popular than the methodologies that do not specifically generate any new funding on their own. For example, public meetings and votes are ways to discuss the issues but do not themselves generate the needed funding. Encouraging self-pay may generate some protections but will probably be uneven and leave those least able to pay the most vulnerable. Self-pay also makes measures that benefit the entire community (instead of individuals or specific structures) more difficult to implement and may make protections costlier in aggregate. Insurance company requirements can be similar to self-pay, but the consequence of being unable to afford to install protections would likely be either losing insurance entirely or having the same insurance coverage become more expensive. This would make installing the protections even more challenging for those who cannot immediately afford them since it would be even more difficult to save to install protections due to the increased costs of insurance. Although more popular than most other choices, utilizing state and federal money may not be possible, as it is derived exclusively from decisions and factors made outside the local community.

These concerns do not mean that these measures will not be helpful. To the contrary, considerable progress could be made using the means that are popular while avoiding the ones that are not. However, the community needs to understand and accept the externalities, unintended consequences, and other pitfalls of decentralized or optional methods of protection before considering them as the primary methods of addressing this

issue. There could be significant consequences of implementing popular but potentially ineffective or inconsistent measures. The community could feel falsely assured or that preparedness could be considered a waste of time if the measures do not work.

Reported level of environmentalism appeared to influence more responses to this question than any other demographic, with a different distribution of nine of ten sub-questions. To further explore the relationship between level of environmentalism and funding methods, an additional variable based on level of environmentalism category was defined, splitting the group into low (1-2), medium (3), and high (4-5). This allowed for the comparison of the high and low groups across the funding questions. One hundred forty-four (144) respondents were in the low category of environmentalism, and 160 were in the high level of environmentalism. The remaining 199 respondents were in the medium level and are excluded in the statistics below. Table 20 shows the Levene's test for equality of variances if that test is significant, followed by the resulting t-test ( $p < 0.001$  appears as 0.000).

Table 20. Preferred funding differences across low and high environmentalism  
(statistically significant values at  $p \leq 0.05$  are highlighted and bold)

| Type of Funding                                     | t-Test Type Performed       | F     | Sig. | t      | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval |       |
|-----------------------------------------------------|-----------------------------|-------|------|--------|-----------------|-----------------|-----------------------|-------------------------|-------|
|                                                     |                             |       |      |        |                 |                 |                       | Lower                   | Upper |
| Funding: no change                                  | Equal variances not assumed |       |      | -2.120 | <b>0.035</b>    | -.324           | .153                  | -.624                   | -.023 |
| Funding: encourage self-pay                         | Equal variances assumed     | 4.577 | .033 | -3.249 | <b>0.001</b>    | -.468           | .144                  | -.752                   | -.185 |
| Funding: cut other local programs and services      | Equal variances assumed     | 3.928 | .048 | -3.984 | <b>0.000</b>    | -.656           | .165                  | -.979                   | -.332 |
| Funding: utilize state/federal money when available | Equal variances not assumed |       |      | -3.605 | <b>0.000</b>    | -.460           | .128                  | -.711                   | -.209 |
| Funding: public meetings and votes                  | Equal variances assumed     | 4.645 | .032 | -3.821 | <b>0.000</b>    | -.488           | .128                  | -.739                   | -.236 |
| Funding: insurance company requirements             | Equal variances not assumed |       |      | -6.334 | <b>0.000</b>    | -.839           | .132                  | -1.100                  | -.578 |
| Funding: local property taxes                       | Equal variances not assumed |       |      | -5.882 | <b>0.000</b>    | -.856           | .145                  | -1.142                  | -.569 |
| Funding: local sales taxes                          | Equal variances not assumed |       |      | -6.645 | <b>0.000</b>    | -.911           | .137                  | -1.181                  | -.641 |
| Funding: local income taxes                         | Equal variances assumed     | 4.717 | .031 | -6.725 | <b>0.000</b>    | -.977           | .145                  | -1.263                  | -.691 |
| Funding: local fees for beaches and amenities       | Equal variances not assumed |       |      | -5.346 | <b>0.000</b>    | -.750           | .140                  | -1.026                  | -.474 |



In every instance, those who were in the low group of reported level of environmentalism (represented as 1) were less willing to use the funding mechanism than the high reported level of environmentalism (represented as 3). Surprisingly, this includes the “no change” option, which also statistically significant was the least strong relationship with the lowest overall difference in means between the two groups. This could reflect a desire to decrease funding, which was not explicitly included in any of the other choices. Those with a low level of reported environmentalism were less willing to consider any of the proposed funding mechanisms and may therefore be expressing a desire for less or no funding or other funding mechanisms not explored here.

Of other demographic factors beyond level of environmentalism, age had the second highest number, changing the distribution of six of ten, followed by preferred funding mixture (five of ten). Given the polarizing nature of funding, surprisingly, political party only made a difference for two types of taxes (local sales and local income taxes) plus local user fees (for beaches/amenities). Additionally, level of income only made a difference for encouraging self-pay, and not for any of the tax or fee sub-questions. The remaining relationships are summarized in Table 21 ( $p < 0.001$  appears as 0.000).

Table 21. Influence of demographics on funding methods (statistically significant values at  $p \leq 0.05$  are highlighted and bold)

| Funding         | Total "likely same" | Total "likely different" | No change    | Encourage self-pay | Cut other local programs and services | Utilize state/federal money | Public meetings and votes | Insurance company requirements | Local property taxes | Local sales taxes | Local income taxes | Local fees for beaches and amenities |
|-----------------|---------------------|--------------------------|--------------|--------------------|---------------------------------------|-----------------------------|---------------------------|--------------------------------|----------------------|-------------------|--------------------|--------------------------------------|
| State           | 8                   | 2                        | 0.060        | <b>0.027</b>       | 0.082                                 | 0.556                       | 0.058                     | 0.271                          | 0.097                | <b>0.003</b>      | 0.144              | 0.134                                |
| Gender          | 9                   | 1                        | 0.602        | 0.197              | 0.599                                 | 0.500                       | <b>0.004</b>              | 0.485                          | 0.195                | 0.570             | 0.626              | 0.941                                |
| Age             | 4                   | 6                        | <b>0.003</b> | 0.570              | <b>0.000</b>                          | 0.530                       | 0.163                     | <b>0.040</b>                   | <b>0.000</b>         | <b>0.001</b>      | <b>0.000</b>       | 0.213                                |
| Live coastal    | 10                  | 0                        | 0.397        | 0.603              | 0.350                                 | 0.446                       | 0.371                     | 0.826                          | 0.564                | 0.592             | 0.725              | 0.704                                |
| Work coastal    | 6                   | 4                        | 0.129        | 0.125              | <b>0.036</b>                          | 0.564                       | 0.791                     | 0.104                          | 0.100                | <b>0.025</b>      | <b>0.007</b>       | <b>0.032</b>                         |
| Visit coastal   | 10                  | 0                        | 0.568        | 0.949              | 0.585                                 | 0.678                       | 0.285                     | 0.818                          | 0.862                | 0.999             | 0.655              | 0.130                                |
| Funding mixture | 5                   | 5                        | <b>0.000</b> | 0.168              | <b>0.000</b>                          | 0.231                       | 0.727                     | 0.172                          | <b>0.001</b>         | <b>0.017</b>      | <b>0.007</b>       | 0.247                                |
| Income          | 9                   | 1                        | 0.499        | <b>0.046</b>       | 0.462                                 | 0.811                       | 0.976                     | 0.205                          | 0.830                | 0.985             | 0.647              | 0.327                                |
| Environmental   | 1                   | 9                        | 0.211        | <b>0.002</b>       | <b>0.001</b>                          | <b>0.002</b>                | <b>0.000</b>              | <b>0.000</b>                   | <b>0.000</b>         | <b>0.000</b>      | <b>0.000</b>       | <b>0.000</b>                         |
| Education       | 10                  | 0                        | 0.457        | 0.424              | 0.292                                 | 0.427                       | 0.996                     | 0.903                          | 0.550                | 0.752             | 0.393              | 0.738                                |
| Ethnicity       | 9                   | 1                        | 0.567        | 0.520              | 0.684                                 | 0.413                       | 0.648                     | 0.364                          | 0.056                | 0.555             | <b>0.014</b>       | 0.268                                |
| Political party | 7                   | 3                        | 0.389        | 0.661              | 0.064                                 | 0.328                       | 0.242                     | 0.166                          | 0.057                | <b>0.013</b>      | <b>0.032</b>       | <b>0.018</b>                         |

**Question 11: “Are there any other methods to determine how much money should be spent protecting against floods and the effects of future sea level rise?”**

This question inquired about additional methods to identify funding sources for flooding and sea level rise. 57 respondents entered a response to this write-in. Twenty-two (22) of those coded to “No Others or Not Sure,” leaving a total of 35 respondents with 41 suggestions. The most commonly seen words (with at least five mentions) are summarized in Figure 15.

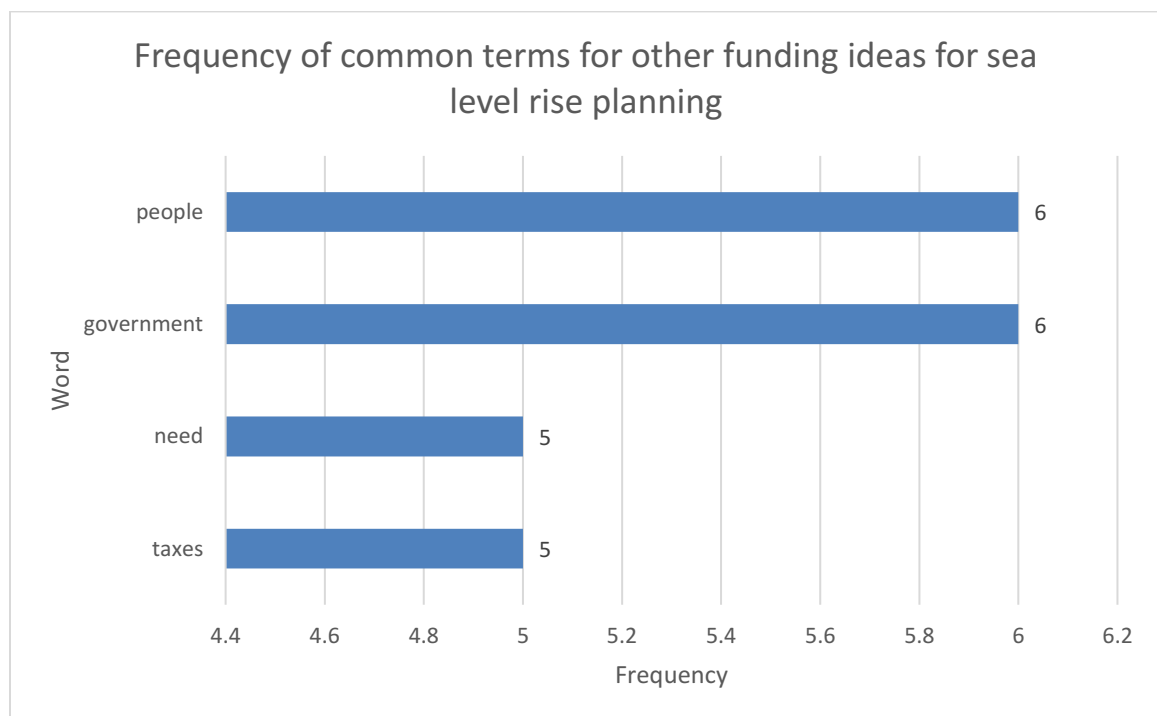


Figure 15. Frequency of common terms for other funding methods for sea level rise planning (question 11)

Unsurprisingly, “taxes” appears in the most commonly seen words. Although several forms of taxes were included in the related main question, there are both other

forms of taxes and taxes can be controversial subject. Given the involvement of both government and people in all funding mechanisms, their inclusion in the top words is also not surprising, as is the inclusion of “need” as it can appear in several contexts of things that are needed or not needed for funding. All the 41 suggestions received were able to be coded. The summary of these categorizations is shown in Table 22.

Table 22. Write-in responses for other funding sources

| <b>Responses</b>                                    | <b>Number</b> | <b>Percentage of valid write-ins (n=41)</b> |
|-----------------------------------------------------|---------------|---------------------------------------------|
| Governmental Action / Funding                       | 6             | 14.6%                                       |
| Improved Information                                | 6             | 14.6%                                       |
| Donations / Fundraising                             | 6             | 14.6%                                       |
| Education                                           | 3             | 7.3%                                        |
| Specific Measures                                   | 3             | 7.3%                                        |
| Non-governmental action                             | 2             | 4.9%                                        |
| Political Action                                    | 2             | 4.9%                                        |
| Reduce costs through reduced vulnerable development | 2             | 4.9%                                        |
| Avoid New Taxes                                     | 1             | 2.4%                                        |
| Energy Taxes                                        | 1             | 2.4%                                        |
| Funding based on location                           | 1             | 2.4%                                        |
| Funding to prevent damage                           | 1             | 2.4%                                        |
| Hazard based Insurance                              | 1             | 2.4%                                        |
| Hazard based Tax                                    | 1             | 2.4%                                        |
| Income Tax                                          | 1             | 2.4%                                        |
| Online Discussions                                  | 1             | 2.4%                                        |
| Prevention at all costs                             | 1             | 2.4%                                        |
| Renewable Energy                                    | 1             | 2.4%                                        |
| Research                                            | 1             | 2.4%                                        |

A key observation is that the suggestions for methods to determine funding were not consolidated, but rather 11 respondents had unique ideas and five more ideas were

mentioned by only two or three respondents. Some suggestions, such as income tax, already appeared in the previous question, and therefore did not need to be added as a write-in. Three write-in suggestions met the threshold of at least 5 responses (1% of survey respondents).

First, “Governmental Action / Funding” refers to write-in answers that are seeking some sort of governmental intervention. These suggestions were difficult to categorize because many of the responses stated that government should act or spend money but did not specify what the government’s source of funding would be. The main question responses that focused on various forms of taxes and fees (income tax, property tax, sales tax, user fees, etc.) were inherently “governmental action.” Therefore, it is unclear what is expected under these responses, other than perhaps additional governmental funding and action without additional taxes, which could be a challenge and likely not possible without cutting other services.

Second, “Improved Information” items are suggestions that indicated improving information would help to make funding decisions and best utilize available resources. Although it is not directly a funding strategy, it is a way to help direct funding and possibly bring attention to an issue to increase funding.

Third, “Donations / Fundraising” were respondents who suggested either soliciting donations or holding some sort of fundraising to pay for sea level rise protections. There certainly are many examples of areas where donations have paid to help solve complex problems (for example, public health nonprofits in fighting disease or social service nonprofits fighting hunger and poverty). It remains to be seen whether

fundraising and donations would be sufficiently large to make a dent in addressing these issues.

**Question 12: “No type of protection is foolproof. Advanced protections are more complicated and expensive, while basic protections will fail more often. How strong should your community make its flooding and sea level rise protection?”**

Question 12 was the most challenging to write, as providing too little information or too much information could be confusing to the respondents. The intention was to make the trade-off with costs and complexity known to respondents as they selected their strength of protections against minor and major flooding. In this instance, “strength” of a protection is measured by how often it is likely to fail, which can be an abstract concept. Therefore, the responses are provided in two different formats, with the following five options:

- Fails less than 10% of years (1 in 10 years average)
- Fails less than 2.5% of years (1 in 50 years average)
- Fails less than 1% of years (1 in 100 years average)
- Fails less than 0.2% of years (1 in 500 years average)
- Fails less than 0.1% of years (1 in 1000 years average)

The distribution of responses to “fails causing major flooding” were more protective on average (many more selected 1 in 100 years to 1 in 1,000 years and many fewer selected 1 in 10 to 1 in 50 years) than the distribution for “fails causing minor flooding,” as shown in Table 23.

Table 23. Distribution of responses on protection strength

| Potential Failure Rate                                   | Major Flooding |         | Minor Flooding |         |
|----------------------------------------------------------|----------------|---------|----------------|---------|
|                                                          | Total          | Percent | Total          | Percent |
| Fails less than 0.1% of years (1 in 1,000 years average) | 58             | 11.5%   | 35             | 7.0%    |
| Fails less than 0.2% of years (1 in 500 years average)   | 92             | 18.3%   | 61             | 12.1%   |
| Fails less than 1% of years (1 in 100 years average)     | 180            | 35.8%   | 168            | 33.4%   |
| Fails less than 2.5% of years (1 in 50 years average)    | 98             | 19.5%   | 126            | 25.0%   |
| Fails less than 10% of years (1 in 10 years average)     | 75             | 14.9%   | 113            | 22.5%   |

In both scenarios, the most common response was “Fails less than 1% of years (1 in 100 years average).” This is the middle option and happens to align with a terminology sometimes heard in both the popular press and through flood insurance (flood insurance maps are based mostly on the “100-year floodplain”). Dissecting why individuals are often looking for this level of protection could be a useful part of developing a local sea level rise plan, as this question will help to set expectations for many other portions of plan development and implementation. There is no “right answer” for how strong protection should be, but there are consequences for both extremes.

*For under protection:* If not sufficiently protected, a community may be lulled into a false sense of security that the installed measures will always work, even if certain events can overwhelm them, like what happened to the levy systems in New Orleans during Hurricane Katrina. Although likely to have cost less and had fewer unintended consequences, under protection puts the community at continued risk.

*For over protection:* Given too strong protections, it is possible a community will have spent time, money, and other resources on protections that will never be needed in the life span of said protection. Unintended consequences (such as environmental harm or wasted energy) will probably be larger in this situation, and the community could become jaded by the waste and not wish to make new protections in the future should they become needed. It is also possible that a community would never feel they were overprotected, because they would incur less damage than their poorly protected counterparts in the event of a serious event. Overall, determining the level of protection is an important balance between cost and resilience considering both risk tolerance and local preferences.

**Question 13: “How helpful are the following techniques in resolving potential conflict in developing a plan to protect against flooding from sea level rise in your community?”**

Question 13 asked respondents about how helpful they perceived eight different techniques to be to resolve conflict that may arise during the development of a community-based sea level rise plan, on a scale of 1 to 5 as follows:

- 1 meaning “not at all helpful”
- 2 meaning “somewhat helpful”
- 3 meaning “helpful”
- 4 meaning “very helpful”
- 5 meaning “exceptionally helpful”

Many of the activities to address sea level rise can be controversial, both because of tradeoffs with economic growth and other desirable factors and because of costs. Therefore, developing ways to recognize and address this conflict could be beneficial in



developing a local SLR plan. Responses were recorded on a scale from “Not at all helpful (1)” up to “Exceptionally helpful (5)” for eight techniques.

Overall, respondents were generally optimistic about the helpfulness of the various methods resolving conflict. The median for every response was 4, except for “optional measures” which was 3. Overall, most responses had similar distributions with a few exceptions. “Discuss with scientists” was the only response with a mode of 5 and had the second highest mean of 3.80, just behind “discuss with preparedness experts” at 3.85, as seen in Table 24.

Table 24. Summary of methods to resolving conflict by mean score

| <b>Conflict Resolution Methodology</b>                                                 | <b>Mean</b> | <b>Median</b> | <b>Mode</b> | <b>Std. Dev.</b> | <b>Number (Percent) Ranking 4 or 5</b> |
|----------------------------------------------------------------------------------------|-------------|---------------|-------------|------------------|----------------------------------------|
| Discuss with preparedness experts about ways to improve protection against floods      | 3.85        | 4             | 4           | 1.044            | 336 (66.8%)                            |
| Discuss with scientists about the chances and locations of future flooding             | 3.80        | 4             | 5           | 1.107            | 317 (63.0%)                            |
| Increase educational efforts through the media about the risks and impacts of flooding | 3.80        | 4             | 4           | 1.082            | 324 (64.4%)                            |
| Start with measures that have the greatest public support                              | 3.75        | 4             | 4           | 1.044            | 317 (63.0%)                            |
| Perform cost and benefit analysis on various ways to move forward                      | 3.70        | 4             | 4           | 1.012            | 303 (60.2%)                            |
| Hold public meetings to identify ways to resolve conflicts                             | 3.61        | 4             | 4           | 1.083            | 284 (56.5%)                            |
| Hold votes on options to resolve disputes                                              | 3.47        | 4             | 4           | 1.132            | 259 (51.5%)                            |
| Make some measures optional for individual homes and businesses                        | 3.34        | 3             | 3           | 1.200            | 238 (47.3%)                            |

Some methods of resolving conflict were not as popular as others. “Making some measures optional,” for example, had the lowest mean but also had a considerable number of responses at 4 and 5 (47.3%), making it potentially polarizing. Any consideration of making adaptation measures optional will have to be weighed against a duty to care responsibility because harm could come to those who were not involved in making the measure optional. For example, society does not allow anyone other than licensed architects and engineers to design buildings because making safety features like fire resistance optional could lead to injury or loss of life of someone not involved in designing the building. Holding votes to resolve conflict also seems to be controversial, although slightly less so. Voting also poses the particularly challenging question of who is and is not allowed to vote. Some coastal communities (including those studied in Chapter Five: Public Officials Interviews) may have large numbers of homes occupied only seasonally (who, therefore, are not permanent residents and generally not eligible to vote in elections) as well as homes that are short term rentals (where the owner lives elsewhere). Even determining who could be involved in those discussions and who gets to cast a vote for decisions could substantially change outcomes, as the needs and motivations of owner-occupied residences may be different than the owners of rentals or seasonal residences. Recognizing that communities may not all respond similarly to the same methods to resolve conflict, this information demonstrates a possible hierarchy of ways to address this conflict of starting with discussions with experts, adding on educational efforts, and beginning with options that have the greatest support before moving on to potentially more controversial ones. It is also important to note that in some

situations, some individuals may have no willingness to compromise and will not be trying to resolve their differences with others, in which case it is unlikely any conflict resolution methods are likely to work.

Overwhelmingly, the most influential demographic on conflict resolution was reported level of environmentalism. All eight sub-questions varied based upon this demographic. To better understand these relationships, the high-medium-low variable for environmentalism described in question 10 was used to compare high and low reported levels of environmentalism for these conflict resolution items, shown in Table 25 ( $p < 0.001$  appears as 0.000).

Table 25. Preferred conflict resolution methods across low and high environmentalism (statistically significant values at  $p \leq 0.05$  are highlighted and bold)

| Conflict Resolution Method                      | t-Test Type Performed       | F      | Sig. | t      | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference |       |
|-------------------------------------------------|-----------------------------|--------|------|--------|-----------------|-----------------|-----------------------|-------------------------------------------|-------|
|                                                 |                             |        |      |        |                 |                 |                       | Lower                                     | Upper |
| Conflict: hold public meetings                  | Equal variances not assumed |        |      | -3.810 | <b>0.000</b>    | -.483           | .127                  | -.733                                     | -.234 |
| Conflict: educational efforts through the media | Equal variances not assumed |        |      | -5.221 | <b>0.000</b>    | -.647           | .124                  | -.890                                     | -.403 |
| Conflict: discuss with preparedness experts     | Equal variances assumed     | 6.389  | .012 | -4.369 | <b>0.000</b>    | -.535           | .123                  | -.777                                     | -.294 |
| Conflict: discuss with scientists               | Equal variances assumed     | 7.602  | .006 | -5.310 | <b>0.000</b>    | -.663           | .125                  | -.909                                     | -.417 |
| Conflict: cost and benefit analysis             | Equal variances assumed     | 10.848 | .001 | -4.913 | <b>0.000</b>    | -.576           | .117                  | -.806                                     | -.345 |
| Conflict: hold votes                            | Equal variances not assumed |        |      | -3.151 | <b>0.002</b>    | -.415           | .132                  | -.674                                     | -.156 |
| Conflict: optional measures                     | Equal variances not assumed |        |      | -3.087 | <b>0.002</b>    | -.414           | .134                  | -.678                                     | -.150 |
| Conflict: start greatest support                | Equal variances not assumed |        |      | -2.332 | <b>0.020</b>    | -.287           | .123                  | -.529                                     | -.045 |

For every conflict resolution method, the respondents who rated themselves low on the scale of environmentalism felt that the conflict resolution method was on average less useful than the respondents who ranked themselves high on the environmentalism scale. This finding is potentially concerning because unlike the funding choices discussed

in question 10, the conflict resolution methods are not about determining an end-result, but rather are about finding ways to break down barriers when conflict does arise and find ways to keep moving forward. By not ranking any of the methods equally, these groups are demonstrating greater pessimism towards resolving conflict, and it may be difficult to overcome differences in opinion (in some cases people may not wish to overcome these differences). The reasons for this cannot be determined from this data alone. Aside from environmentalism, every other demographic influenced either one or no sub-questions, as shown in Table 26 ( $p < 0.001$  appears as 0.000).

Table 26. Influence of demographics on conflict resolution methods (statistically significant values at  $p \leq 0.05$  are highlighted and bold)

| Conflict Resolution | Total "likely same" | Total "likely different" | Hold public meetings | Educational efforts through the media | Discuss with preparedness experts | Discuss with scientists | Cost and benefit analysis | Hold votes   | Optional measures | Start with areas of greatest support |
|---------------------|---------------------|--------------------------|----------------------|---------------------------------------|-----------------------------------|-------------------------|---------------------------|--------------|-------------------|--------------------------------------|
| State               | 7                   | 1                        | 0.282                | 0.320                                 | 0.432                             | 0.232                   | 0.099                     | 0.097        | 0.263             | <b>0.043</b>                         |
| Gender              | 7                   | 1                        | 0.462                | 0.058                                 | <b>0.010</b>                      | 0.112                   | 0.120                     | 0.345        | 0.443             | 0.883                                |
| Age                 | 7                   | 1                        | 0.627                | 0.388                                 | 0.688                             | 0.175                   | <b>0.048</b>              | 0.197        | 0.054             | 0.188                                |
| Live coastal        | 8                   | 0                        | 0.437                | 0.212                                 | 0.271                             | 0.163                   | 0.945                     | 0.935        | 0.138             | 0.450                                |
| Work coastal        | 8                   | 0                        | 0.836                | 0.335                                 | 0.427                             | 0.726                   | 0.115                     | 0.307        | 0.118             | 0.897                                |
| Visit coastal       | 7                   | 1                        | 0.199                | 0.137                                 | 0.267                             | 0.535                   | 0.360                     | 0.393        | <b>0.021</b>      | 0.409                                |
| Funding mixture     | 7                   | 1                        | 0.077                | 0.630                                 | 0.378                             | 0.133                   | 0.320                     | 0.086        | <b>0.019</b>      | 0.135                                |
| Income              | 8                   | 0                        | 0.411                | 0.425                                 | 0.927                             | 0.588                   | 0.938                     | 0.417        | 0.400             | 0.844                                |
| Environmentalism    | 0                   | 8                        | <b>0.002</b>         | <b>0.000</b>                          | <b>0.000</b>                      | <b>0.000</b>            | <b>0.000</b>              | <b>0.010</b> | <b>0.000</b>      | <b>0.033</b>                         |
| Education           | 8                   | 0                        | 0.796                | 0.851                                 | 0.383                             | 0.649                   | 0.834                     | 0.258        | 0.759             | 0.903                                |
| Ethnicity           | 7                   | 1                        | 0.143                | 0.381                                 | 0.804                             | 0.085                   | 0.069                     | 0.108        | <b>0.003</b>      | 0.245                                |
| Political party     | 7                   | 1                        | 0.066                | 0.053                                 | 0.229                             | <b>0.026</b>            | 0.644                     | 0.249        | 0.369             | 0.862                                |

**Question 14: “Are there any other techniques to resolve potential conflict in your community?”**

Forty-five (45) respondents replied to this question. Of those, 15 stated that there were no additional methods for addressing conflict around sea level rise planning in their communities, or that they were unsure whether there were additional methods. There

were only two words, not counting non-substantive words, that were seen more than five times: “people” and “meetings” which were each seen six times.

Public meetings were already identified as popular options for conflict resolution, and meetings again appears in the most commonly seen words. There were 30 respondents who answered this question, containing a total of 31 write-in suggestions. All of these suggestions could be coded, and a summary of these responses are described in Table 27.

Table 27. Write-in responses for other methods to resolve conflict

| <b>Responses</b>           | <b>Number</b> | <b>Percentage of valid write-ins (n=31)</b> |
|----------------------------|---------------|---------------------------------------------|
| Community meetings         | 8             | 25.8%                                       |
| Education                  | 4             | 12.9%                                       |
| Increase awareness         | 2             | 6.5%                                        |
| Inter-personal discussions | 2             | 6.5%                                        |
| Mandatory measures         | 2             | 6.5%                                        |
| Online discussions         | 2             | 6.5%                                        |
| Assisting others           | 1             | 3.2%                                        |
| Corporate involvement      | 1             | 3.2%                                        |
| Financial incentives       | 1             | 3.2%                                        |
| Follow-through on promises | 1             | 3.2%                                        |
| Increase political will    | 1             | 3.2%                                        |
| Isolation                  | 1             | 3.2%                                        |
| Media                      | 1             | 3.2%                                        |
| Optional measures          | 1             | 3.2%                                        |
| Preparedness               | 1             | 3.2%                                        |
| User fees                  | 1             | 3.2%                                        |
| Voting                     | 1             | 3.2%                                        |

“Community meetings” was the most commonly provided response and referred to some sort of community gathering to resolve conflict. However, many of these

responses were almost identical to responses contained within the primary question. Showing up again in the write-in section reinforces its importance but does not otherwise add to the possible conflict resolution methods.

Although falling below the threshold of 1% of respondents, “education” as a conflict resolution method warrants discussion as the second most commonly suggested method. By writing in education as a response, these respondents likely believe that members of the community may need more information to decide and that knowing more will influence people towards some common goal. This may be true in some cases, but in others additional education may either be unwelcome or unhelpful.

**Question 15: “How appropriate are the following responses to protect against flooding and future sea level rise?”**

In this question, respondents were asked to rate the appropriateness of ten measures to protect against flooding and future sea level rise, on a scale of 1 to 5 as follows:

- 1 meaning “very inappropriate”
- 2 meaning “somewhat inappropriate”
- 3 meaning “neither appropriate nor inappropriate”
- 4 meaning “somewhat appropriate”
- 5 meaning “very appropriate”

A total of 10 different approaches were evaluated in this question, as discussed in Table 28.



Table 28. Summary of appropriateness of responses to flooding and SLR by mean score

| <b>Response for Gauging Appropriateness</b>                                         | <b>Mean</b> | <b>Median</b> | <b>Mode</b> | <b>Std. Dev.</b> | <b>Number (Percent) Ranking 4 or 5</b> |
|-------------------------------------------------------------------------------------|-------------|---------------|-------------|------------------|----------------------------------------|
| Develop and enhance early warning systems to notify residents about upcoming floods | 4.20        | 4             | 5           | 0.943            | 401 (79.7%)                            |
| Develop and enhance natural physical barriers (such as wetlands or sand dunes)      | 4.17        | 4             | 5           | 0.937            | 397 (78.9%)                            |
| Harden public infrastructure (roads, utilities, etc.) against damage                | 4.13        | 4             | 5           | 0.896            | 390 (77.5%)                            |
| Develop and enhance man-made physical barriers (sea walls, levies, etc.)            | 4.07        | 4             | 4           | 0.967            | 393 (78.1%)                            |
| Require new structures to be built at higher elevations                             | 4.07        | 4             | 5           | 0.970            | 382 (75.9%)                            |
| Prevent new development on the most vulnerable areas                                | 4.00        | 4             | 5           | 1.091            | 360 (71.6%)                            |
| Raise the elevation of existing structures                                          | 3.73        | 4             | 4           | 1.025            | 308 (61.2%)                            |
| Remove existing development from the most vulnerable areas over time                | 3.50        | 4             | 4           | 1.182            | 271 (53.9%)                            |
| Increase cost of insuring high-risk areas                                           | 3.42        | 3             | 3           | 1.183            | 247 (49.1%)                            |
| Don't provide assistance for areas at highest risk                                  | 2.52        | 2             | 1           | 1.419            | 140 (27.8%)                            |

Several responses were considered especially appropriate. Early warning systems rated the highest (or equal to other highly rated items) by all measures. Natural barriers, increasing elevations of new structures, hardening public infrastructure, preventing new development, and built/man-made barriers were all rated highly. Despite several responses in the survey development exercise that suggested excluding the highest risk areas from assistance, that response was less popular than most other choices, and with a mean of 2.5, a median of 2, a mode of 1, and only 27.8% of respondents ranking as 4-5, it

was the only measure clearly in the “inappropriate” category. However, increasing the cost of insurance did not fare well either, with both a median and a mode of 3 (and a slightly higher mean of 3.42) it fits best in the “neither appropriate nor inappropriate” category, although nearly half (49.1%) ranked it as 4-5.

Surprisingly, “remove existing development” is closer to the “appropriate” category, although only marginally so with a mean of 3.5 and a median and a mode of 4. This indicates that many individuals are willing to at least consider relocation of properties that are deemed to be too much risk, either after a significant event (by not rebuilding in the same location) or prior to an event if the loss is expected.

Unlike many of the other questions, level of environmentalism was not the strongest demographic influence. Instead the desired funding mixture (private versus public) influenced the most questions (at 7 of 10). Using a procedure like what was applied for environmentalism in questions 10 and 13, the preferred level of public and private funding and responsibility was split into three groups. The “private” group included the responses that indicated funding should be mostly or entirely from the private sector (49 respondents) and the “public” group was those that indicated funding should be mostly or entirely from the public sector (151 respondents). The remaining 303 respondents (which is 50% larger than the two other groups combined) indicated that funding should be an equal mix and were excluded from this analysis to show the impact of the two opposite ends of the spectrum. These comparisons are shown in Table 29.

Table 29. Preferred adaptation responses preferred funding mixture (statistically significant values at  $p \leq 0.05$  are highlighted and bold)

| Type of Response                                      | t-Test Type Performed       | F      | Sig. | t      | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference |       |
|-------------------------------------------------------|-----------------------------|--------|------|--------|-----------------|-----------------|-----------------------|-------------------------------------------|-------|
|                                                       |                             |        |      |        |                 |                 |                       | Lower                                     | Upper |
| Responses: natural barriers                           | Equal variances assumed     | 5.155  | .024 | -2.482 | <b>0.014</b>    | -.395           | .159                  | -.709                                     | -.081 |
| Responses: built barriers                             | Equal variances not assumed |        |      | -1.707 | 0.092           | -.310           | .182                  | -.672                                     | .052  |
| Responses: higher elevations new structures           | Equal variances not assumed |        |      | -1.333 | 0.187           | -.229           | .172                  | -.573                                     | .114  |
| Responses: raise the elevation of existing structures | Equal variances not assumed |        |      | .951   | 0.344           | .180            | .189                  | -.197                                     | .557  |
| Responses: harden public infrastructure               | Equal variances assumed     | 6.902  | .009 | -2.862 | <b>0.005</b>    | -.430           | .150                  | -.726                                     | -.134 |
| Responses: prevent new development                    | Equal variances not assumed |        |      | -1.098 | 0.276           | -.210           | .191                  | -.590                                     | .171  |
| Responses: remove existing development                | Equal variances not assumed |        |      | -.001  | 0.999           | .000            | .215                  | -.428                                     | .427  |
| Responses: exclude highest risk                       | Equal variances not assumed |        |      | 2.725  | <b>0.008</b>    | .627            | .230                  | .170                                      | 1.084 |
| Responses: increased cost of insurance                | Equal variances not assumed |        |      | 1.882  | 0.063           | .375            | .200                  | -.021                                     | .772  |
| Responses: early warning                              | Equal variances assumed     | 12.121 | .001 | -3.524 | <b>0.001</b>    | -.578           | .164                  | -.902                                     | -.255 |

Of the ten adaptation responses, a statistically significant difference between the public and private funding preferences can be seen in only four of them: natural barriers,

hardening public infrastructure, excluding areas of highest risk, and early warning systems. Those preferring public funding emphasized using natural barriers, hardening public infrastructure, and creating early warning systems. Those who preferred private funding expressed a desire to exclude areas at highest risk from public assistance. Given that a significant difference can be seen between these two groups in only four responses, instead of seven seen across all respondents (natural barriers was significantly different in this public-private analysis but not when analyzed across all groups), shows that the respondents who prefer equal funding have a substantial role in addressing this question.

In addition to the desired funding mixture, several other demographics were influential in the answers to this question, including gender (6 of 10), and a tie between age (5 of 10) and level of environmentalism (also 5 of 10), summarized in Table 30 ( $p < 0.001$  appears as 0.000).

Variations in opinions on these questions seem like a natural consequence of differences in desired funding mixture, as many of these response strategies are more well-suited to being publicly funded (such as hardening infrastructure or land use decisions) whereas others are much more suited to being either privately funded or a mixture (such as raising elevation of existing structures or increasing costs of insurance). Gaining consensus on what approaches to take may be challenging given that demographics that are well-represented in most communities (all genders and age groups, for example). This will make the need for education, finding common ground, and building an inclusive process especially important.

Table 30. Summary of demographic influences on responses (statistically significant values at  $p \leq 0.05$  are highlighted and bold)

| Responses       | Total "likely same" | Total "likely different" | Natural barriers | Built barriers | Higher elevations new structures | Raise elevation of existing structures | Harden public infrastructure | Prevent new development | Remove existing development | Exclude highest risk areas | Increased cost of insurance | Early warning |
|-----------------|---------------------|--------------------------|------------------|----------------|----------------------------------|----------------------------------------|------------------------------|-------------------------|-----------------------------|----------------------------|-----------------------------|---------------|
| State           | 10                  | 0                        | 0.136            | 0.115          | 0.388                            | 0.465                                  | 0.278                        | 0.615                   | 0.068                       | 0.185                      | 0.426                       | 0.425         |
| Gender          | 4                   | 6                        | <b>0.020</b>     | <b>0.006</b>   | <b>0.017</b>                     | <b>0.018</b>                           | 0.053                        | 0.220                   | 0.850                       | <b>0.003</b>               | 0.726                       | <b>0.001</b>  |
| Age             | 5                   | 5                        | <b>0.007</b>     | 0.141          | <b>0.002</b>                     | 0.828                                  | 0.373                        | <b>0.002</b>            | 0.181                       | <b>0.012</b>               | <b>0.019</b>                | 0.586         |
| Live coastal    | 10                  | 0                        | 0.500            | 0.466          | 0.403                            | 0.583                                  | 0.814                        | 0.718                   | 0.962                       | 0.526                      | 0.527                       | 0.419         |
| Work coastal    | 10                  | 0                        | 0.088            | 0.371          | 0.444                            | 0.836                                  | 0.483                        | 0.262                   | 0.997                       | 0.333                      | 0.323                       | 0.859         |
| Visit coastal   | 10                  | 0                        | 0.684            | 0.114          | 0.480                            | 0.550                                  | 0.989                        | 0.778                   | 0.899                       | 0.552                      | 0.943                       | 0.791         |
| Funding mixture | 3                   | 7                        | 0.062            | <b>0.047</b>   | <b>0.017</b>                     | <b>0.007</b>                           | <b>0.027</b>                 | 0.724                   | 0.291                       | <b>0.008</b>               | <b>0.007</b>                | <b>0.013</b>  |
| Income          | 10                  | 0                        | 0.704            | 0.643          | 0.770                            | 0.881                                  | 0.818                        | 0.776                   | 0.996                       | 0.689                      | 0.188                       | 0.993         |
| Environmental   | 5                   | 5                        | 0.314            | 0.140          | <b>0.001</b>                     | <b>0.001</b>                           | 0.124                        | <b>0.006</b>            | <b>0.000</b>                | 0.131                      | <b>0.001</b>                | 0.262         |
| Education       | 10                  | 0                        | 0.226            | 0.552          | 0.797                            | 0.173                                  | 0.677                        | 0.643                   | 0.962                       | 0.130                      | 0.414                       | 0.898         |
| Ethnicity       | 10                  | 0                        | 0.320            | 0.481          | 0.707                            | 0.696                                  | 0.893                        | 0.879                   | 0.263                       | 0.295                      | 0.728                       | 0.703         |
| Political party | 9                   | 1                        | 0.304            | 0.529          | <b>0.042</b>                     | 0.687                                  | 0.169                        | 0.894                   | 0.242                       | 0.347                      | 0.403                       | 0.237         |

**Question 16: “Are there any other responses to protect against flooding and future sea level rise in your community?”**

A total of 36 respondents replied to this question. Of those, 15 stated that there were no other responses for protecting against flooding and future sea level rise in their communities. Of the remaining 21 respondents, there were a total of 26 suggestions. No substantive words appeared more than five times, therefore, no frequency graph was generated. One suggestion of “drink more water” was unclear and could not be coded, leaving 25 suggestions for analysis as discussed in Table 31.

Table 31. Write-in responses for additional options for protection

| <b>Response</b>                | <b>Number</b> | <b>Percentage of valid write-ins (n=25)</b> |
|--------------------------------|---------------|---------------------------------------------|
| Improve Public Infrastructure  | 6             | 24.0%                                       |
| Emergency Response             | 4             | 16.0%                                       |
| Zoning / Building Restrictions | 3             | 12.0%                                       |
| Early Warning Systems          | 2             | 8.0%                                        |
| Education                      | 2             | 8.0%                                        |
| Improve private property       | 2             | 8.0%                                        |
| Physical Barriers              | 2             | 8.0%                                        |
| Assistance to Others           | 1             | 4.0%                                        |
| Do not rebuild                 | 1             | 4.0%                                        |
| Relocation                     | 1             | 4.0%                                        |
| Resource Conservation          | 1             | 4.0%                                        |
| Risk Disclosure                | 1             | 4.0%                                        |

“Improve public infrastructure” refers to several suggestions for making improvements to or modifications of public infrastructure to make it more resilient. This includes actions such as improving water, electric, natural gas, and other utilities, as well as roads, bridges, and other visible and hidden infrastructure.

Although below the line of 1% of respondents, “emergency response” warrants additional discussion. Emergency response is a challenging item to integrate with other protections, because it is fully reactive and not proactive like many of the other items. However, emergency response is also essentially a given, although the strategies for emergency response will vary over time and location. It is important that a focus on emergency response does not detract from preparatory actions as it could unnecessarily delay making difficult decisions to protect the community (reducing, but not eliminating, the need for emergency response).

### **Demographic Questions**

#### **Question 17: “Please indicate your annual household income”**

Respondents were asked to provide their annual household income, as expressed in one of eight categories, ranging from “under \$25,000” to “\$200,000 or more.”

Although household income is not the only indicator for wealth or affluence, it is one that is easily measured. The distribution of income of respondents is seen in Table 32.

Table 32. Respondent’s household income

| <b>Amount</b>          | <b>Frequency</b> | <b>Percentage</b> |
|------------------------|------------------|-------------------|
| \$200,000 or more      | 21               | 4.2%              |
| \$150,000 to \$199,999 | 20               | 4.0%              |
| \$100,000 to \$149,999 | 64               | 12.7%             |
| \$75,000 to \$99,999   | 79               | 15.7%             |
| \$50,000 to \$74,999   | 107              | 21.3%             |
| \$35,000 to \$49,999   | 79               | 15.7%             |
| \$25,000 to \$34,999   | 51               | 10.1%             |
| Less than \$25,000     | 66               | 13.1%             |
| <b>Total</b>           | <b>503</b>       | <b>100.0%</b>     |

There could be important differences across incomes in opinions over funding, priorities, conflict resolution, and other aspects of developing a community-based sea level rise plan, and therefore the relationship between income and other aspects of sea level rise planning can be informative in reaching and meeting the needs of different populations in any given coastal community.

**Question 18: “How much would you consider yourself an environmentalist?”**

Respondents were asked to rate how much they considered themselves to be environmentalists. Views on phenomena that revolve around human’s interaction with the environment and related activities such as development and utilization of natural features for protection could be influenced by how much someone considers themselves to be an environmentalist. The distribution of responses is seen in Table 33.

Table 33. Respondent’s self-rated environmentalism

| <b>Environmentalist</b> | <b>Frequency</b> | <b>Percent</b> |
|-------------------------|------------------|----------------|
| Exceptionally (5)       | 43               | 8.5%           |
| Highly (4)              | 117              | 23.3%          |
| Moderately (3)          | 199              | 39.6%          |
| Somewhat (2)            | 115              | 22.9%          |
| Not at all (1)          | 29               | 5.8%           |
| <b>Total</b>            | <b>503</b>       | <b>100.0%</b>  |

Responses to this question are clustered around “moderately (3)” with nearly 40% of responses, and nearly 86% of responses being between “somewhat (2)” and “highly (4).” In other words, most did not consider themselves to be on either extreme, but roughly equal amounts of people considered themselves a bit above or below



“moderately” and nearly 40% considered themselves to be right in the middle. Nearly 6% considered themselves to be “not at all” an environmentalist.

**Question 19: “Which of the following most closely matches your job title?”**

Respondents were asked to provide which job title most closely matched theirs from of a limited list of options (which also included options such as student and retired). The intent of this question was not to obtain a comprehensive list of every job that respondents held, but to determine if there were substantial differences in opinions based upon different job types. A summary of these responses is included in Table 34. This question was not used as a demographic for further demographic analysis (the “likely same / likely different” tables) because of the large number of job titles with a small number of responses, plus several responses within a later question that there were some job titles that were not available but should have been (such as not currently employed but not retired).

Table 34. Respondent's job titles

| <b>Job Title/Category</b>                    | <b>Frequency</b> | <b>Percentage</b> |
|----------------------------------------------|------------------|-------------------|
| President or Owner                           | 34               | 6.80%             |
| C-Level Executive (CIO, CTO, COO, CMO, etc.) | 16               | 3.20%             |
| Senior Vice President                        | 7                | 1.40%             |
| Vice President                               | 3                | 0.60%             |
| Director                                     | 15               | 3.00%             |
| Senior Manager                               | 14               | 2.80%             |
| Manager                                      | 82               | 16.30%            |
| Analyst/Associate                            | 87               | 17.30%            |
| Entry Level                                  | 64               | 12.70%            |
| Student                                      | 68               | 13.50%            |
| Retired                                      | 113              | 22.50%            |
| <b>Total</b>                                 | <b>503</b>       | <b>100.0%</b>     |

**Question 20: “Please indicate your highest level of education completed”**

Recognizing that opinions on many of the factors that go into sea level rise planning could be related to the respondent's level of education, respondents were asked to identify their highest level of education completed. Many of the concepts in sea level rise planning are complex and may be interpreted differently based upon education. The distribution of education is shown in Table 35 with comparisons to the national average from the American Community Survey.<sup>142</sup> The American Community Survey does not distinguish between a bachelor's degree and some graduate school (without a graduate degree), nor does it distinguish among types of graduate degrees, and therefore the data are not perfectly comparable.

Table 35. Respondent's levels of education

| <b>Level of Education</b>       | <b>Frequency</b> | <b>Percentage</b> | <b>National Percentage<sup>142</sup></b> | <b>Difference</b> |
|---------------------------------|------------------|-------------------|------------------------------------------|-------------------|
| 8th grade or less               | 1                | 0.2%              | 5.6%                                     | -5.4%             |
| Some high school                | 5                | 1.0%              | 7.4%                                     | -6.4%             |
| High school diploma             | 73               | 14.5%             | 27.5%                                    | -13.0%            |
| Some college                    | 159              | 31.6%             | 29.2%                                    | +2.4%             |
| Bachelor's degree               | 160              | 31.8%             | 18.8%                                    | +16.2%            |
| Some graduate school            | 21               | 4.2%              |                                          |                   |
| Master's degree                 | 56               | 11.1%             | 11.5%                                    | +4.6%             |
| Doctoral or Professional Degree | 25               | 5.0%              |                                          |                   |
| Decline to Answer               | 3                | 0.6%              | 0%                                       | +0.6%             |
| <b>Total</b>                    | <b>503</b>       | <b>100.0%</b>     | <b>100.0%</b>                            | <b>N/A</b>        |

The most frequent response is having a bachelor's degree, followed closely by "some college" and then "high school diploma." This distribution under-represents those with a high school diploma or less, and over-represents those with some college or more, compared to the national averages. Although the reason cannot be known for certain from this data, it is possible that those with higher levels of education had a greater ability to engage in the survey.

#### **Question 21: "Please specify your ethnicity"**

Respondents were asked to self-identify their ethnicity. Recognizing that ethnicity can play an important role (for a combination of many reasons) in attitudes and opinions towards many issues, including something like developing sea level rise plans. This information was collected so that any trends in responses across ethnicities could be analyzed. This information is shown in Table 36.

Table 36. Respondent's self-reported ethnicities

| <b>Ethnicity</b>                   | <b>Frequency</b> | <b>Percentage</b> |
|------------------------------------|------------------|-------------------|
| Asian / Pacific Islander           | 21               | 4.2%              |
| Black or African American          | 48               | 9.5%              |
| Decline to Answer                  | 4                | 0.8%              |
| Hispanic or Latino                 | 25               | 5.0%              |
| Multi-racial                       | 10               | 2.0%              |
| Native American or American Indian | 4                | 0.8%              |
| Other: Latino                      | 1                | 0.2%              |
| Other: Mixed races                 | 1                | 0.2%              |
| White or Caucasian                 | 389              | 77.3%             |
| <b>Total</b>                       | <b>503</b>       | <b>100.0%</b>     |

In addition to the pre-programmed choices, respondents could specify their ethnicity in their own words, and two chose to do so (one wrote “Latino,” and another wrote “Mixed races”) even though an equivalent responses were available (“Hispanic or Latino” and “Multi-racial,” respectively).

**Question 22: “What political party would you consider yourself most aligned with?”**

Recognizing that virtually all public decisions have a political component to them, and that many of the public officials who will be involved with sea level rise planning are elected and represent a political party or are appointed by someone who does, political party has an important role to play in understanding resident's thoughts on sea level rise policy and planning. The distribution of political parties is shown in Table 37.

Table 37. Respondent's self-identified political parties

| <b>Political Party</b>       | <b>Frequency</b> | <b>Percent</b> |
|------------------------------|------------------|----------------|
| Another party                | 23               | 4.6%           |
| Democratic                   | 214              | 42.5%          |
| Not affiliated (independent) | 142              | 28.2%          |
| Republican                   | 124              | 24.7%          |
| <b>Total</b>                 | <b>503</b>       | <b>100.0%</b>  |

Gallup polls taken since 2004 show a roughly 30-40-30 (Democrat-Independent-Republican) split on affiliation, although the exact numbers are constantly in flux.<sup>45</sup> The poll data taken shortly after this survey was conducted (January 2-6, 2018) shows a 32-44-22 (Democrat-Independent-Republican) affiliation, which suggests that the survey may overrepresent Democrats over Independents but did not substantially underrepresent Republicans. Therefore, survey responses slightly over-represent individuals affiliated with the Democratic party while modestly underrepresenting individuals who are either independent or affiliated with the Republican party. Regardless, a substantial number of respondents are aligned with the Democratic, Republican, and “Not Affiliated (independent)” viewpoints, allowing for analysis as to whether opinions on these questions vary across political parties.

**Question 23: “Was there any part of the survey you were confused about, or anything about flooding and sea level rise that the survey did not address but should have?”**

There were many respondents to this question that both indicated that there was no part of the survey they were confused about and also made another suggestion. Therefore, unlike many other write-in questions, answers such as “none” or “unsure” were treated like any other response for this question. There were 85 responses, which

included 42 instances of “none or unsure” and 43 other comments or suggestions, as described in Table 38.

Table 38. Write-in responses for survey concerns or suggestions

| <b>Response</b>       | <b>Number</b> |
|-----------------------|---------------|
| None or Unsure        | 42            |
| Favorable Remarks     | 17            |
| Subject Matter Issues | 11            |
| Survey Wording        | 7             |
| Write-in Issues       | 3             |
| Added Subjects        | 2             |
| Survey Assumptions    | 2             |
| Answer Corrections    | 1             |

“None or Unsure” is an affirmative statement that there was nothing that was confusing or various forms of “nothing comes to mind.” In this question, having a significant number of these responses reinforces that the questions were generally understandable and appropriate, although not perfect because of some other responses indicating concerns.

“Favorable Remarks” refers to statements that spontaneously indicated satisfaction with or enjoyment of the survey. This further demonstrates that there is interest and value in these concepts, although does not provide much additional insight.

“Subject Matter Issues” refers to responses that had some sort of concern related to the subject matter, but not necessarily related to the survey itself. For example, one respondent indicated that all new residents should receive a brochure on sea level rise

when they purchase property, and another stated that the U.S. Environmental Protection Agency (EPA) needs to be given more authority to help address this issue.

“Survey wording” refers to a handful of responses (slightly above the 1% threshold) that expressed concern over the wording of one or more questions. Those concerns were considered during the analysis of each of those questions.

**Question 24 (additional information provided by survey company): “Age group breakdown”**

All respondents to this survey were required to be age 18 or over. These can be compared with 2017 national statistics by age.<sup>141</sup> The breakdown of age group is shown in Table 39.

Table 39. Respondent’s age groups across respondents compared to national statistics

| Age Group    | Frequency  | Percent     | National <sup>141</sup> | National Percent (18+ only) | Difference |
|--------------|------------|-------------|-------------------------|-----------------------------|------------|
| 18 to 24     | 80         | 15.9%       | 30,616,469              | 12.1%                       | +3.8%      |
| 25 to 34     | 133        | 26.4%       | 45,342,672              | 18.0%                       | +8.4%      |
| 35 to 44     | 98         | 19.5%       | 40,875,370              | 16.2%                       | +3.3%      |
| 45 to 54     | 72         | 14.3%       | 42,374,952              | 16.8%                       | -2.5%      |
| 55 to 64     | 55         | 10.9%       | 41,995,658              | 16.7%                       | -5.8%      |
| 65 and over  | 65         | 12.9%       | 50,858,679              | 20.1%                       | -7.2%      |
| <b>Total</b> | <b>503</b> | <b>100%</b> | <b>252,063,800</b>      | <b>100%</b>                 | <b>N/A</b> |

With six age groups, and the lowest having nearly 11% of the respondents in it, the responses appear to be well distributed across ages. Compared to 2017 national totals, the survey pool over-represents the population 44 and under (especially for those 25-34), and the survey pool under-represents those 45 and older. Since age was an important

factor in the distribution of 29% of sub-questions (see Table 41 below), differences in perspectives from various age groups should be carefully considered during the development of SLR plans.

**Question 25 (additional information provided by survey company): “Gender breakdown”**

The respondents to this survey were weighted towards female, with 335 (66.6%) of respondents being female and 168 (33.4%) of respondents being male. In 2017, the national total (for persons aged 18+) in the United States was 122,786,239 (48.7%) male and 129,277,451 (51.3%) female.<sup>141</sup> With this imbalance in the respondent pool versus the national average, differences in responses that can be linked to gender are important to carefully consider. Gender was an important factor in 29% of sub-questions, as shown in Table 41 in the discussion below.

**Question 26 (additional information provided by survey company): “Location breakdown”**

The states represented by the respondents include Connecticut, the District of Columbia, Delaware, Florida, Massachusetts, Maine, North Carolina, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, South Carolina, and Virginia. Although the distribution of respondents across these states varies considerably, so do the coastal populations of these states. As respondents from Florida constitute over 20% of the responses and NY over 19%, these states may be over-represented, while states such as Maine, Delaware, New Hampshire, and Rhode Island may be underrepresented, as



shown in Table 40. New York and Florida are highly populous states, reducing the concern over this distribution.

Table 40. Respondent's locations across eastern coastal states

| <b>State</b> | <b>Frequency</b> | <b>Percent</b> |
|--------------|------------------|----------------|
| CT           | 16               | 3.2%           |
| DC           | 7                | 1.4%           |
| DE           | 2                | 0.4%           |
| FL           | 108              | 21.5%          |
| MA           | 34               | 6.8%           |
| MD           | 18               | 3.6%           |
| ME           | 6                | 1.2%           |
| NC           | 59               | 11.7%          |
| NH           | 9                | 1.8%           |
| NJ           | 41               | 8.2%           |
| NY           | 96               | 19.1%          |
| PA           | 42               | 8.3%           |
| RI           | 5                | 1.0%           |
| SC           | 29               | 5.8%           |
| VA           | 31               | 6.2%           |
| <b>Total</b> | <b>503</b>       | <b>100.0%</b>  |

### **Demographic Influences on Primary Questions**

Overall, the reported level of environmentalism influenced the largest number of sub-questions across the entire survey, a total of 62% of them. Desired funding mixture (public versus private) came in second at 34%, followed closely by gender and age, both at 29%. Whether someone lives in a coastal community or regularly visits a coastal community, income, education level, and ethnicity all influenced fewer than 10% of sub-questions, as summarized in Table 41.

Table 41. Overall influence of each demographic on survey sub-questions by question category

| <b>Overall Influence by Percentage</b> | <b>Vulnerability</b> | <b>Funding</b> | <b>Responses</b> | <b>Conflict Resolution</b> | <b>Priorities</b> | <b>Issues</b> | <b>Components</b> | <b>Total</b> |
|----------------------------------------|----------------------|----------------|------------------|----------------------------|-------------------|---------------|-------------------|--------------|
| Environmentalism                       | 100%                 | 90%            | 50%              | 100%                       | 60%               | 20%           | 38%               | <b>62%</b>   |
| Funding mixture                        | 25%                  | 50%            | 70%              | 13%                        | 47%               | 0%            | 13%               | <b>34%</b>   |
| Gender                                 | 0%                   | 10%            | 60%              | 13%                        | 0%                | 50%           | 75%               | <b>29%</b>   |
| Age                                    | 100%                 | 60%            | 50%              | 13%                        | 7%                | 10%           | 13%               | <b>29%</b>   |
| Work coastal                           | 75%                  | 40%            | 0%               | 0%                         | 20%               | 10%           | 0%                | <b>17%</b>   |
| State                                  | 75%                  | 20%            | 0%               | 13%                        | 27%               | 0%            | 0%                | <b>15%</b>   |
| Political party                        | 0%                   | 30%            | 10%              | 13%                        | 7%                | 20%           | 0%                | <b>12%</b>   |
| Live coastal                           | 75%                  | 0%             | 0%               | 0%                         | 13%               | 0%            | 0%                | <b>8%</b>    |
| Visit coastal                          | 75%                  | 0%             | 0%               | 13%                        | 7%                | 0%            | 0%                | <b>8%</b>    |
| Ethnicity                              | 25%                  | 10%            | 0%               | 13%                        | 0%                | 10%           | 0%                | <b>6%</b>    |
| Education                              | 0%                   | 0%             | 0%               | 0%                         | 0%                | 30%           | 0%                | <b>5%</b>    |
| Income                                 | 0%                   | 10%            | 0%               | 0%                         | 0%                | 0%            | 0%                | <b>2%</b>    |
| <b>Total</b>                           | <b>46%</b>           | <b>27%</b>     | <b>20%</b>       | <b>16%</b>                 | <b>16%</b>        | <b>13%</b>    | <b>11%</b>        | <b>19%</b>   |

This table is sorted vertically with the demographics of greatest influence at the top and sorted horizontally for the sub-questions most influenced by the largest number of demographics starting at the left. Therefore, the top left quadrant generally contains the items that are the most variable while the lower right quadrant generally contains the least variable items. Therefore, for example, the reported level of environmentalism, desired funding mixture, gender, and age all are of high influence. Likewise, vulnerability, funding, and adaptation responses were all likely to be influenced by many

different demographics. There are notable exceptions in this sorting, such as gender not having an apparent impact on perceived vulnerability, and education having a fairly strong influence on the ranking of other issues relative to sea level rise.

### **Key Findings from the Public Survey**

The following six key findings were derived from information contained within the survey results, developed from the major themes of the public survey. These key findings were developed from the public survey results and further informed by the survey development exercise to help create the public official interview questions, which are discussed in detail in Chapter Five: Public Officials Interviews. The key findings were developed using a combination of the highest and lowest ranked items in each section, with additional input from the corresponding write-in question and the survey development exercise (when applicable). The specific justification for each finding is discussed below along with the finding itself.

#### **Finding 1 on relative priority**

*Officials are likely to gain better engagement with the public if they make a strong connection between planning for sea level rise and other high priority issues like the environment, infrastructure/utilities, and the economy.*

As discussed earlier in this chapter and shown in Table 6, respondents placed preparing for sea level rise as a relatively low priority overall compared to other issues, such as roads, utilities, the economy, and the environment. Based upon the survey alone, there is no way to know for sure why respondents place a higher priority on these items, but one reasonable possibility is a desire to address issues that were more direct or

tangible to them. By finding ways to connect SLR planning to other issues, which rightly or wrongly are considered by much of the public to be a higher priority, the public will be able to better link what they already know and value with the sea level rise plan being developed, which potentially could help to advance planning and ultimately lead to stronger protections. Despite this lower ranking, the respondents still ranked preparing for sea level rise as important but did not support reducing support for other public programs to support SLR initiatives.

### **Finding 2 on planning components**

*Officials should consider building sea level rise plans that integrate response planning and preparedness with mandatory policies to reduce future damage. Maps and tools, educational resources, and voluntary protections were also popular, but inaction to wait for more research was not popular.*

As shown in Table 8, certain planning components were especially popular, including “preparing to respond and/or evacuate when flooding happens” (i.e., response planning and preparedness) and “implementing required policies to reduce future flood damage.” It is important to note that aside from “finding ways to postpone making changes until more research is done,” all components studied had a median and mode of at least 4 (somewhat important), meaning that including those items in local sea level rise plans would likely be well received by the public and therefore more likely to succeed. As discussed in key finding 5 below, as part of conflict resolution residents suggested talking with scientists and experts, meaning that their involvement would likely be welcome in this stage of development as well.

### **Finding 3 on protection priorities**

*Officials should consider the protection of essential utility and transportation services as some of the highest priorities for protection in sea level rise plans. Residents also rate the protection of individual home and of government facilities very highly.*

As shown in Table 16, drinking water and electric power were the highest ranked priorities for protection, both having a median and a mode of 5 (an exceptionally high priority). Road and highways, homes and residences, sewer/wastewater, and government facilities also ranked highly, as did several other utilities. One challenge in choosing priorities for officials may be that nearly everything ranks highly, and that many services are interconnected, making it difficult to focus only on certain items. Regardless, the very high rankings for drinking water and electric power especially may warrant special attention, with additional focus on other critical services that interact with them, such as wastewater.

### **Finding 4 on funding priorities**

*Funding may be one of the largest challenges of sea level rise planning. Officials should consider public meetings to discuss how to pay for priorities, should use state and federal funds when available, and should work with the insurance industry on risk reduction measures. Officials should avoid cutting other programs and should proceed cautiously with taxes.*

Holding public meetings was identified as the most popular way to determine what the highest priorities are and how to pay for them, as shown in Table 19. This also appears in finding 5 below on conflict resolution. This may be useful in some communities and pose a challenge in others if the preferred funding sources are not actually available. It is especially important to remember that a community's preferences

on funding may not necessarily line up with the intent of a funding source. For example, using state and federal money was one of the top ranked options, but because it is popular (presumably because it does not involve as much local investment, although the reasons cannot be directly derived from this data) does not mean that federal or state funds will be available for the community's needs in the timeline of when the community needs them. Additionally, in the various comments that government should not be directly involved, these same options could be used as a way to allocate risk amongst the public (to either take action or not), although this could be more challenging with items that are inherently public infrastructure.

#### **Finding 5 on conflict resolution**

*To help prevent and resolve conflict, officials should consider bringing in both preparedness experts and scientists familiar with flooding and sea level rise to talk with the community and use the media to help educate the community about this issue. Avoid making adaptation measures optional to avoid conflict.*

Contrary to some popular sentiment that scientific information and experts are distrusted, the results shown in Table 24 show that preparedness experts and scientists are trusted sources to talk with to help resolve conflict around sea level rise planning. There were also other popular methods that could be used if these two are not successful, such as educational efforts through the media and holding public meetings to find ways to resolve disputes. Of everything polled for, making some measures optional was considered the least acceptable, and therefore is less likely to be successful in helping to prevent or resolve conflict.

## **Finding 6 on adaptation responses**

*Public officials should consider a variety of adaptation responses. Early warning systems, natural and artificial barriers, and hardening infrastructure are among the items respondents generally found to be appropriate. Even some potentially controversial adaptations, such as preventing new development in vulnerable areas were generally viewed as appropriate. Officials should avoid cutting off assistance from high risk areas.*

As demonstrated in Table 28, there were many adaptation responses that with a median and/or mode of 4 or higher, meaning that they were considered appropriate or very appropriate. These included early warning systems, natural barriers, hardening infrastructure, man-made barriers, requirements for higher elevation of new structures, and even preventing new development on the most vulnerable areas. The only measure that clearly fell closer to “somewhat inappropriate” than “somewhat appropriate” was not providing assistance for areas at highest risk, which despite a mean of 2.52, had a mode of 1 (“very inappropriate”). In considering these various adaptation responses, officials can consider how responses may have co-benefits, such as how natural barriers might provide more fishing or recreation.

## **CHAPTER FIVE: PUBLIC OFFICIALS INTERVIEWS**

Building off the key findings of the public survey discussed in Chapter Four: Public Survey Results, a series of interviews with public officials was conducted from July 2 through July 9, 2018 (IRBNet 1257013-1). This chapter provides a context for sea level rise planning in these jurisdiction, summaries of the interviews with common themes from each identified, as well as a comparison of responses from the public survey and the public officials interviews.

### **Goals and Process**

There were several goals for these interviews of public officials. These goals included:

1. Understanding what the coastal jurisdictions had or had not done with regard to sea level rise planning and preparing for future flooding to date.
2. Discussing the barriers they have encountered and their future plans to address SLR.
3. Briefing them on the public survey results, including the six key findings.
4. Understanding how well the findings of the public survey align with the public officials understanding of their community and whether the findings would be useful in advancing sea level rise planning.

These interviews took place in the legal jurisdictions of Long Beach Island (LBI), New Jersey. There are six legal jurisdictions on the island, and at least one public official from each jurisdiction agreed to be interviewed. The interviews, of 30-45 minutes each,



took place with the mayor or a council member, and in one case both, according to the jurisdiction's preference. The respondents were given the opportunity for their jurisdiction and their title to be either identified or left anonymous. In each case, the respondents all agreed to have their jurisdictions and titles reported in the study. Additionally, to allow for more thorough notes and direct quotes, all allowed the interviews to be recorded. Per the approved research protocol, although detailed notes from the officials have been included in this summary (see Appendix C: Public Officials Interview Materials), all the copies of the recordings themselves were deleted after the completion of the study.

### **Local Context for Jurisdictions Interviewed**

Long Beach Island is an 18-mile-long island located on the coast of central New Jersey bordering the Atlantic Ocean. The island is half a mile wide or less throughout.<sup>97</sup>

There are six legal jurisdictions on the island, listed here from north to south:

1. Barnegat Light, NJ<sup>11</sup>
2. Harvey Cedars, NJ<sup>13</sup>
3. Long Beach Township, NJ<sup>133</sup>
4. Surf City, NJ<sup>15</sup>
5. Ship Bottom, NJ<sup>14</sup>
6. Beach Haven, NJ<sup>12</sup>

Figure 16 displays Long Beach Island (lower right) relative to neighboring portions of New Jersey.<sup>17</sup> Five of the jurisdictions appear on the map. Long Beach Township is non-contiguous and includes portions of the island between the other jurisdictions shown.

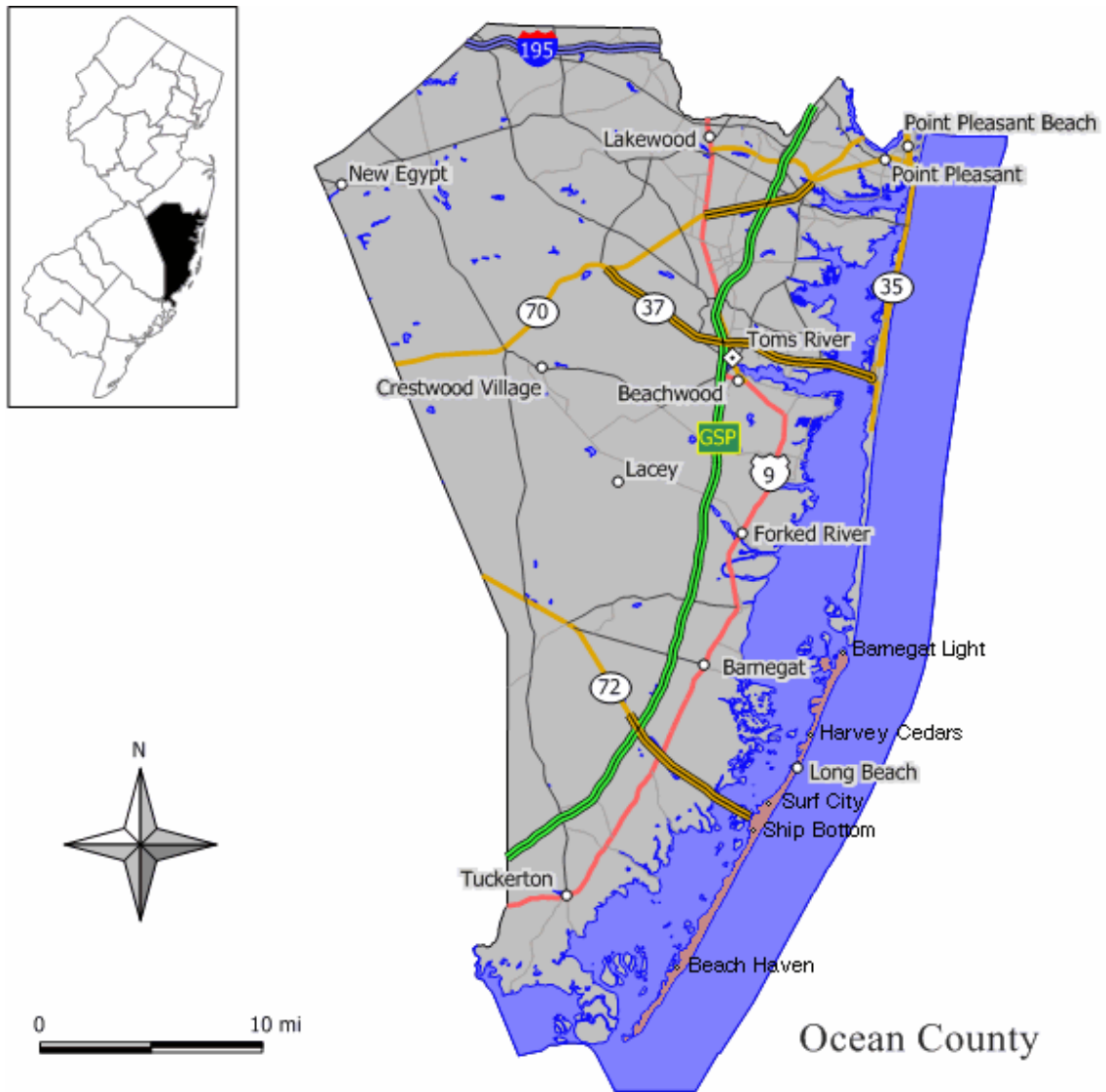


Figure 16. Map of Long Beach Island and surrounding areas in New Jersey.<sup>17</sup>  
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According to topographical maps of LBI, virtually all of the island, except for the sand dunes protecting the oceanfront side, is at an elevation less than 10 ft (3.05 m) above sea level.<sup>135</sup> Given the extensive road network and the responses to the interview questions (detailed below), it is also apparent that the island is highly developed, mostly with single-family homes and one to several story tall buildings for businesses.

### **Example Area Challenges**

Long Beach Island is no stranger to issues related to flooding, and, to a lesser extent, sea level rise. During Superstorm Sandy in 2012, several communities on the island experienced widespread damage.<sup>134</sup> The U.S. Army Corps of Engineers (USACE) has been building and maintaining sand dunes across the oceanside coastline of the island to help prepare for future storm surge as part of its Coastal Storm Risk Management program.<sup>140</sup> At the time of this writing, there was also an ongoing study on flooding from the bayside led by USACE, spurred by concerns over flooding caused by high tide events. Finally, the fact that the island is nearly flat and has large amounts of impervious surface, storm water drainage that leads to road flooding during heavy rainfall is also a challenge. During the week when the interviews took place, there was a storm that produced several inches of rain and caused considerable road flooding on portions of the island, with an example shown in Figure 17.



Figure 17. Image of street flooding on July 6, 2018 in Surf City, NJ (by author)

### **Overview of Completed Interviews**

Public officials from six jurisdictions were interviewed between July 2 and July 9, 2018. Seven public officials were included as Beach Haven elected to include both the mayor and a councilman, whereas the other five jurisdictions elected to have a single representative (either the mayor or a councilman) perform the interview. There were 35 questions in the interview, although many of them were reiterations of the same four questions across the six key findings (the draft key findings were referred to as “major findings” in this component study). The full list of questions and supplementary information that went along with them are provided in full in Appendix C: Public Officials Interview Materials. The six interviews conducted are shown in Table 42. Throughout the summaries of these interviews, the study’s total number of responses (n) is six except where noted otherwise.

Table 42. List of interviews with LBI officials conducted

| <b>Date</b> | <b>Jurisdiction</b>     | <b>Official(s)</b> |
|-------------|-------------------------|--------------------|
| 07/02/18    | Surf City, NJ           | Councilman         |
| 07/05/18    | Beach Haven, NJ         | Mayor, Councilman  |
| 07/06/18    | Long Beach Township, NJ | Mayor              |
| 07/09/18    | Harvey Cedars, NJ       | Mayor              |
| 07/09/18    | Barnegat Light, NJ      | Mayor              |
| 07/09/18    | Ship Bottom, NJ         | Councilman         |

### **Part 1 of 3: Summary of Current State of Sea Level Rise Planning and Barriers**

The interview questions consisted of three distinct parts. The first was an assessment of sea level rise planning, vulnerability, barriers, and other factors within the jurisdiction to help gain context on what planning and actions (if any) had already taken place. This section consisted of six questions, summarized below.

#### **Question 1: What is your role in sea level rise planning in your area?**

Of the six jurisdictions, the respondents either indicated that their roles were to work collaboratively with other groups such as the state, local groups, or government committees (three jurisdictions, including both public officials from Harvey Cedars) or that their roles included several positions in addition to their main office (three jurisdictions). These other roles included being part of the office of emergency management, part of the Community Rating System, local land use planning, and in most cases, several roles. The primary purpose of this question was to ascertain that the public official had a meaningful role in addressing these issues (all of which did) and to better understand the array of perspectives from these officials. The full list of reported roles is included in Appendix C: Public Officials Interview Materials.

#### **Question 2: Can you describe any sea level rise planning that has taken place in your area in recent years, including the process used to develop it? If little or none, elaborate on why not?**

All officials interviewed reported having at least some past planning for sea level rise in their jurisdictions. All six jurisdictions used this question to note one or several actions that they have taken, most of which have taken place since Superstorm Sandy in

2012. Table 43 provides a summary of the planning activities and actions that these jurisdictions chose to emphasize in the interview.

Table 43. Recent planning and actions in LBI jurisdictions.

| <b>Jurisdiction</b>     | <b>Key Recent Planning or Actions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Surf City, NJ           | <ol style="list-style-type: none"> <li>1. Part of Army Corps Dunes Project (pre-Sandy construction).</li> <li>2. Participating in Army Corps bayside flooding study.</li> <li>3. Participated in "Getting to Resilience" study with Jacques Cousteau and other jurisdictions.</li> <li>4. Raised several roads and storm drains during reconstruction and plan to continue.</li> </ol>                                                                                                                                                                                                                                               |
| Beach Haven, NJ         | <ol style="list-style-type: none"> <li>1. Part of Army Corps Dunes Project (post-Sandy construction).</li> <li>2. Participating in Army Corps bayside flooding study, have specifically noticed higher bay levels in recent years.</li> <li>3. Looking to reduce allowable impervious surface area to 65% on new construction.</li> <li>4. Responding to bayside flooding by looking to install backflow prevention and pumping on some storm drains.</li> <li>5. Looking to Ocean County to address Boulevard road flooding.</li> </ol>                                                                                             |
| Long Beach Township, NJ | <ol style="list-style-type: none"> <li>1. Passed ordinance after Superstorm Sandy raising bayside bulkhead heights for both repairs and new construction.</li> <li>2. Raised minimum building elevations to the new state standard (FEMA + 1 ft / 0.305 m).</li> <li>3. Looking to add four pumps to improve storm water drainage.</li> </ol>                                                                                                                                                                                                                                                                                        |
| Harvey Cedars, NJ       | <ol style="list-style-type: none"> <li>1. Part of Army Corps Dunes Project, noted as a key supporter (post-Sandy construction).</li> <li>2. Raised new and repaired bayside bulkheads to a minimum of 5 ft (1.5 m).</li> <li>3. Looking to raise the Boulevard by 12 in (0.305 m).</li> <li>4. Raised minimum new/renovated building elevation to a minimum of 20 in (0.509 m) above the crown of the road, looking to set this standard as above the road's desired elevation.</li> </ol>                                                                                                                                           |
| Barnegat Light, NJ      | <ol style="list-style-type: none"> <li>1. Considering raising minimum building elevations to 12 in (0.305 m) above crown of the road.</li> <li>2. Considering changing building elevations to be based off the Boulevard instead of the road in front of the property, as the Boulevard is the highest part of the borough.</li> </ol>                                                                                                                                                                                                                                                                                               |
| Ship Bottom, NJ         | <ol style="list-style-type: none"> <li>1. Requiring higher bulkheads and better storm drains for new construction.</li> <li>2. Raised crown on boulevard in portions about 16-18 in (0.41-0.46 m).</li> <li>3. Have completed SLR mapping for 1, 2, and 3 ft (0.31, 0.61, 0.91 m) rise for jurisdiction.</li> <li>4. Considering options for buy-outs or other actions on repetitive loss areas.</li> <li>5. In process of building a living shoreline after purchasing a now-underwater lot to reduce bayside flooding.</li> <li>6. Considering potential changes that may need to be made if SLR advances considerably.</li> </ol> |



Just because something was not emphasized in the interview does not mean that it is not present in that jurisdiction. For example, Surf City and Beach Haven emphasized the Army Corps dunes project as being especially important in their jurisdictions. However, that project stretches across almost all the oceanside coast of the island and across all six jurisdictions.<sup>140</sup> Even though the question specifically asked about sea level rise planning, only two jurisdictions specifically mentioned sea level rise (Beach Haven and Ship Bottom) in their responses to this question. The other four focused on measures taken to address current flooding, which could be useful in the light of sea level rise but may or may not be adequate depending on what is seen in the future and the priorities of the jurisdictions. Some adaptation measures, such as storm drain improvements, may not be effective in the future if sea level rise interferes with the pumping or backflow prevention devices, for example.

**Question 3: How vulnerable would you say your area is to flooding and future sea level rise?**

The respondents from each jurisdiction were asked to rate their perceived vulnerability to flooding and future sea level rise on a scale of 1-5 as follows:

- 1 meaning “not at all” vulnerable
- 2 meaning “somewhat” vulnerable
- 3 meaning “vulnerable”
- 4 meaning “highly” vulnerable
- 5 meaning “exceptionally” vulnerable

Understanding a jurisdiction’s perceived vulnerability provides contextual information for their responses to other questions, as well as a basis for comparison with

public opinions on vulnerability. The responses, including summary statistics, are included in Table 44.

Table 44. LBI officials perceived vulnerability to flooding/SLR.

| <b>Jurisdiction</b>                    | <b>Perceived Vulnerability</b> |
|----------------------------------------|--------------------------------|
| Surf City, NJ                          | (5) exceptionally              |
| Beach Haven, NJ                        | (4) highly                     |
| Long Beach Township, NJ                | (2) somewhat                   |
| Harvey Cedars, NJ                      | (4) highly                     |
| Barnegat Light, NJ                     | (2) somewhat                   |
| Ship Bottom, NJ                        | (5) exceptionally              |
| <b>Mean</b>                            | <b>3.66</b>                    |
| <b>Median</b>                          | <b>4</b>                       |
| <b>Mode</b>                            | <b>2, 4, 5 (tied)</b>          |
| <b>Number (Percent) Ranking 4 or 5</b> | <b>4 (66%)</b>                 |

There was considerable variability amongst the jurisdictions on perceived vulnerability to future flooding and sea level rise, ranging from 2 (somewhat vulnerable) to 5 (exceptionally vulnerable). With a median of 4 (highly vulnerable), it is clear that many of the jurisdictions see themselves as highly vulnerable to flooding and SLR and needing additional planning and actions to address that vulnerability. One of the jurisdictions that rated the vulnerability as relatively low (Long Beach Township) specifically stated that this applied for about 10 years, and that the vulnerability could go up in the future with either sea level rise or changes in storms.

**Question 4: How complete is the sea level rise plan in your area? (1-5, 1 being no plan, 5 being an advanced SLR plan)**

The respondents from each jurisdiction were asked to rate how complete of a sea level rise plan their area has, with a scale as follows:

- 1 meaning “no SLR plan”
- 2 meaning “minimal SLR plan”
- 3 meaning “partial SLR plan”
- 4 meaning “full SLR plan”
- 5 meaning “advanced SLR plan”

Jurisdictions self-identified this information, and there was no specific scale or example for them to compare themselves against. However, there is one measurement for which an external entity that evaluated their preparedness for currently expected floods, which is the Community Rating System. CRS is a voluntary rating system as part of the NFIP that evaluates a series of floodplain management and resilience factors within the jurisdiction to determine whether policyholders are entitled to a discount on flood insurance.<sup>39</sup> Although CRS does not specifically emphasize sea level rise, it can be used as a reasonable comparison for the community’s preparedness, and it is possible for communities to gain points in the system by addressing SLR concerns. FEMA assesses the information provided by communities to provide each of them a rating, from 1 (most prepared and biggest discount) to 10 (least prepared and no discount).<sup>38</sup> The responses for this question are summarized in Table 45, with both the jurisdiction’s self-reported level of SLR plan and their current CRS score.

Table 45. LBI officials reported completeness of local sea level rise plans.

| <b>Jurisdiction</b>     | <b>Reported level of SLR Plan (higher is more prepared)</b> | <b>CRS Score (lower is more prepared)</b> |
|-------------------------|-------------------------------------------------------------|-------------------------------------------|
| Surf City, NJ           | (3) Partial SLR plan                                        | 5                                         |
| Beach Haven, NJ         | (3) Partial SLR plan                                        | 5                                         |
| Long Beach Township, NJ | (4) Full SLR plan                                           | 5                                         |
| Harvey Cedars, NJ       | (4) Full SLR plan                                           | 8                                         |
| Barneгат Light, NJ      | (3) Partial SLR plan                                        | 8                                         |
| Ship Bottom, NJ         | (2) Minimal SLR plan                                        | 7                                         |
| <b>Mean</b>             | <b>3.16</b>                                                 | <b>6.33</b>                               |
| <b>Median</b>           | <b>3</b>                                                    | <b>5 &amp; 7 (tied)</b>                   |
| <b>Mode</b>             | <b>3</b>                                                    | <b>5</b>                                  |
| <b>Number (Percent)</b> |                                                             |                                           |
| <b>Ranking 4 or 5</b>   | <b>2 (33%)</b>                                              | <b>N/A</b>                                |

Every jurisdiction reported that they had at least a minimal sea level rise plan, with two reporting having a full sea level rise plan. However, none of the jurisdictions pointed to a plan specifically for sea level rise anywhere in any of the interviews. Instead, they pointed to a variety of other components, mostly individual adaptation measures that have been put into place or that are under consideration. This is validated by the CRS scores, which for any score better (lower) than 10 require the community to have documented specific measures designed to reduce flood risks, although from the score alone it is not possible to determine which measures were used. Several jurisdictions reported being involved in multi-jurisdiction studies, such as the Army Corps bayside flooding study underway at the time of this writing or the “Getting to Resilience” state-sponsored process.<sup>4</sup> For example, Long Beach Township has prepared a report based on this process laying out specific recommendations on the pathway towards resilience.<sup>64</sup> A few jurisdictions reported specific concerns surrounding sea level rise, although only

Ship Bottom specifically mentioned having developed maps and other resources specific to future sea level rise. In this, Ship Bottom specifically noted that many of the measures they are taking for addressing flooding today will probably not be effective should sea level rise in the future beyond a modest amount. Long Beach Township noted that they were only “somewhat” vulnerable in the previous question specifically because they felt they had a solid plan in place. Harvey Cedars and Beach Haven both mentioned their master plans as important tools. Although neither jurisdiction reported any specific sea level rise planning actions within those documents, master plans and other existing processes may be an alternate route for these and other jurisdictions if creating a stand-alone sea level rise plan is not locally feasible.

**Question 5: What barriers have you encountered in sea level rise planning to date?**

Respondents were asked to provide information about any barriers they have encountered in sea level rise planning. The reported barriers are described in Table 46.

Table 46. LBI officials reported barriers to sea level rise planning.

| <b>Jurisdiction</b>     | <b>Reported Barriers</b>                                                                                                                                                   |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Surf City, NJ           | 1. Bureaucratic, centered around state regulatory agencies<br>2. Funding / costs for projects, especially if not a close fit for a current grant programs                  |
| Beach Haven, NJ         | Funding /costs, especially capital costs                                                                                                                                   |
| Long Beach Township, NJ | Challenges with state regulatory agencies                                                                                                                                  |
| Harvey Cedars, NJ       | 1. Pushback from individual residents<br>2. Concerns from the environmental community<br>3. Apathy / not a top issue with residents when not in or recovering from a storm |
| Barnegat Light, NJ      | Resident's resistance to change, and unhappiness if forced to change                                                                                                       |
| Ship Bottom, NJ         | 1. Economic / Costs<br>2. Political / adaptations being oversold on effectiveness<br>3. Social (lack of acceptance)                                                        |

Although there was some variation in reported barriers, the costs (or some variation including funding and economic barriers) was the most commonly reported, appearing in three responses. Challenges with social acceptance or resistance to change was also seen in three responses, and difficulties with state regulators not adapting their rules to local community needs was also reported in two responses. Specific problems with grant mechanisms were also mentioned by both Ship Bottom and Surf City, who detailed challenges with the lack of sufficient funding in the FEMA program to assist with buy-outs of repetitive loss properties and with grant programs in general being too narrowly focused to meet local needs.

**Question 6: How important are the following issues on a scale 1-5 (1 being not at all important and 5 being exceptionally important)?**

Respondents were asked to provide the importance of ten general priorities on a scale of one to five. These priorities were the same as those provided in the public survey in order to identify whether these public officials were generally in alignment with the public survey results on prioritization of issues. The results are shown in Table 47.

Table 47. Importance of key issues to officials in six LBI jurisdictions.

| <b>Jurisdiction</b>                    | <b>Protecting the environment</b> | <b>Maintaining roads and other transportation infrastructure</b> | <b>Maintaining utilities and related infrastructure</b> | <b>Growing the economy</b> | <b>Protecting against future flooding</b> | <b>Protecting property from natural disasters</b> | <b>Helping people with limited resources</b> | <b>Reducing taxes</b> | <b>Preparing for sea level rise</b> | <b>Preparing for climate change</b> |
|----------------------------------------|-----------------------------------|------------------------------------------------------------------|---------------------------------------------------------|----------------------------|-------------------------------------------|---------------------------------------------------|----------------------------------------------|-----------------------|-------------------------------------|-------------------------------------|
| Surf City, NJ                          | 4                                 | 5                                                                | 5                                                       | 5                          | 4                                         | 5                                                 | 3                                            | 5                     | 3                                   | 2                                   |
| Beach Haven, NJ                        | 5                                 | 4                                                                | 5                                                       | 3                          | 5                                         | 4                                                 | 4                                            | 3                     | 3                                   | 3                                   |
| Long Beach Township, NJ                | 5                                 | 5                                                                | 5                                                       | 4                          | 5                                         | 5                                                 | 5                                            | 4                     | 4                                   | 4                                   |
| Harvey Cedars, NJ                      | 4                                 | 5                                                                | 5                                                       | 4                          | 5                                         | 5                                                 | 4                                            | 5                     | 4                                   | 4                                   |
| Barnegat Light, NJ                     | 2                                 | 5                                                                | 5                                                       | 4                          | 5                                         | 5                                                 | 5                                            | 3                     | 2                                   | 1                                   |
| Ship Bottom, NJ                        | 5                                 | 3                                                                | 3                                                       | 1                          | 5                                         | 4                                                 | 4                                            | 3                     | 5                                   | 5                                   |
| <b>Mean</b>                            | <b>4.17</b>                       | <b>4.50</b>                                                      | <b>4.67</b>                                             | <b>3.50</b>                | <b>4.83</b>                               | <b>4.67</b>                                       | <b>4.17</b>                                  | <b>3.83</b>           | <b>3.50</b>                         | <b>3.17</b>                         |
| <b>Median</b>                          | <b>4.5</b>                        | <b>5</b>                                                         | <b>5</b>                                                | <b>4</b>                   | <b>5</b>                                  | <b>5</b>                                          | <b>4</b>                                     | <b>3.5</b>            | <b>3.5</b>                          | <b>3.5</b>                          |
| <b>Mode</b>                            | <b>5</b>                          | <b>5</b>                                                         | <b>5</b>                                                | <b>4</b>                   | <b>5</b>                                  | <b>5</b>                                          | <b>4</b>                                     | <b>3</b>              | <b>3</b>                            | <b>4</b>                            |
| <b>Number / Percent Ranking 4 or 5</b> | <b>4<br/>66%</b>                  | <b>5<br/>83%</b>                                                 | <b>5<br/>83%</b>                                        | <b>4<br/>66%</b>           | <b>6<br/>100%</b>                         | <b>6<br/>100%</b>                                 | <b>5<br/>83%</b>                             | <b>3<br/>50%</b>      | <b>3<br/>50%</b>                    | <b>3<br/>50%</b>                    |

Most issues generally ranked as being important to very important, with some exceptions (such as preparing for climate change to the official in Barnegat Light and growing the economy to the official in Ship Bottom). Although several of the impacts of sea level rise (impacts to roads, protecting against future flooding, and others) ranked highly, preparing for sea level rise and climate change did not fare as well. The results are notably similar to the results obtained from the public survey as shown in Table 48, and reinforces major finding 1 of the public survey stressing the need to connect sea level rise to other high priority issues.

Table 48. Comparison of median scores for major issues by public and LBI officials

| <b>Issue</b>                                              | <b>Public</b> | <b>Public Officials</b> | <b>Difference</b> |
|-----------------------------------------------------------|---------------|-------------------------|-------------------|
| Protecting the environment                                | 4.00          | 4.50                    | +0.50             |
| Maintaining roads and other transportation infrastructure | 4.00          | 5.00                    | +1.00             |
| Maintaining utilities and related infrastructure          | 4.00          | 5.00                    | +1.00             |
| Growing the economy                                       | 4.00          | 4.00                    | 0.00              |
| Protecting against future flooding                        | 4.00          | 5.00                    | +1.00             |
| Protecting property from natural disasters                | 4.00          | 5.00                    | +1.00             |
| Helping people with limited resources                     | 4.00          | 4.00                    | 0.00              |
| Reducing taxes                                            | 4.00          | 3.50                    | -0.50             |
| Preparing for sea level rise                              | 4.00          | 3.50                    | -0.50             |
| Preparing for climate change                              | 4.00          | 3.50                    | -0.50             |

Because of the large difference in sample size (n=503 for the public and n=6 for officials), comparing means could be misleading because every public official response has substantial impact on the mean. Although this is still the case for comparing medians,



the impact is less pronounced. In the public category, every issue had a median of four, despite differences in mean and mode, whereas the medians for public officials ranged from 3.5 to 5. “Growing the economy” and “helping people with limited resources” had identical means for both groups. Five components were rated as more important and three were rated as less important by public officials compared to the public. Although this does show that priorities may not be perfectly aligned, it also shows that priorities of these two groups are also not widely different from one another.

### **Part 2 of 3: Review of Public Survey Key Findings**

In the second part of each interview, respondents were provided with the six draft key findings developed from the public survey. The exact wording of each of these draft key findings as discussed in the interviews is written in Appendix C: Public Officials Interview Materials, and are also included within the discussion for each one below. At the time the public officials interviews were conducted, the draft key findings were referred to as “major findings.” Therefore, that wording appears in the survey template and responses. For each of these six key (then “major”) findings, the same four questions were asked (where “X” is replaced with the major finding number).

- I believe Major Finding X is appropriate for sea level rise planning in my area
- I believe Major Finding X would help improve sea level rise planning in my area
- Please describe any way(s) in which Major Finding X would likely impact planning in my area
- Please feel free to make any other comments and/or elaborate on your previous responses

The first question helped gauge whether officials believed the major finding fit their local conditions, regardless of whether it would have any impact on planning. The

second question was designed to assess whether knowledge of this finding would be likely to help officials advance planning in their area. For both of these questions (and for the remaining questions on the same scale throughout this survey), the responses were on a scale of 1-5 as follows:

- 1 meaning “strongly disagree”
- 2 meaning “disagree”
- 3 meaning “neither agree nor disagree”
- 4 meaning “agree”
- 5 meaning “strongly agree”

The third question asked respondents to elaborate on any ways in which it might make a difference in planning. The last question was included to give respondents an opportunity to discuss any other thoughts they have about the finding that is not specifically requested in the other questions. In some cases, the respondents pivoted to talk about related items that are relevant to the discussion but are not precisely linked to the questions asked. These responses were recorded nevertheless, as the respondent’s decision to include them indicated they felt they were relevant to the discussion.

### **Discussion on Major Finding 1 on Relative Priority**

Major finding 1 states that “officials are likely to gain better engagement with the public if they make a strong connection between planning for sea level rise to other high priority issues like the environment, infrastructure/utilities, and the economy.” Interview respondents were provided a listing of how public survey respondents ranked these issues, showing sea level rise and climate change as the lowest priorities and the items stated above as some of the highest ones.

Respondents were asked several questions about this finding, including whether they believed this finding was appropriate in their area (question 7) and whether this finding would help to improve sea level rise planning in their area (question 8). Generally, respondents agreed strongly that this finding was appropriate to their jurisdictions. They generally also agreed that the finding would help to improve planning in their jurisdictions, although one response was neutral. The summaries of these responses are included in Table 49.

Table 49. LBI officials opinions on major finding 1 on relative priority

| <b>Jurisdiction</b>                        | <b>Appropriate to Area<br/>(n=5)</b>          | <b>Improve SLR Planning in<br/>Area (n=6)</b> |
|--------------------------------------------|-----------------------------------------------|-----------------------------------------------|
| Surf City, NJ                              | (5) Strongly Agree                            | (4) Agree                                     |
| Beach Haven, NJ                            | (5) Strongly Agree                            | (5) Strongly Agree                            |
| Long Beach Township,<br>NJ                 | (5) Strongly Agree                            | (3) Neither Agree nor<br>Disagree             |
| Harvey Cedars, NJ                          | (4) Agree                                     | (5) Strongly Agree                            |
| Barnegat Light, NJ                         | Unsure / Unable to<br>Answer                  | (4) Agree                                     |
| Ship Bottom, NJ                            | (5) Strongly Agree                            | (5) Strongly Agree                            |
| <b>Mean</b>                                | <b>4.8</b>                                    | <b>4.33</b>                                   |
| <b>Median</b>                              | <b>5</b>                                      | <b>4.5</b>                                    |
| <b>Mode</b>                                | <b>5</b>                                      | <b>5</b>                                      |
| <b>Number (Percent)<br/>Ranking 4 or 5</b> | <b>5 (100% those providing<br/>an answer)</b> | <b>5 (83%)</b>                                |

With regard to appropriateness, one respondent (Barnegat Light) was unsure and unable to answer the first question, elaborating that engagement on these issues is low. Therefore, the summary statistics for that question are based on the other five responses

only. With four out of five responses indicating a “strongly agree.” giving both a median and mode of the same, officials within LBI clearly identified this finding as appropriate with little disagreement. Even if engagement is low, the opportunity for officials to help the community through reasonable measures is likely high. For improving SLR planning, five of six agreed or strongly agreed that the finding would help improve planning, with one neither agreeing nor disagreeing that this finding would improve planning.

Respondents were further asked to elaborate on ways in which major finding 1 would likely impact planning in their jurisdictions (question 9). A summary of responses is included in Table 50.

Table 50. LBI officials reported possible planning improvements from major finding 1 on relative priority

| <b>Jurisdiction</b>     | <b>Possible Planning Improvements</b>                                                                                                                                                                                                                                        |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Surf City, NJ           | Much of this is already being done (for example, combining transportation planning with flood prevention)                                                                                                                                                                    |
| Beach Haven, NJ         | 1. Much of this is already being done<br>2. Public education has been a major challenge                                                                                                                                                                                      |
| Long Beach Township, NJ | May help in keeping people safe and protecting \$8.4 billion in building values                                                                                                                                                                                              |
| Harvey Cedars, NJ       | 1. Planning items have traditionally been very separate<br>2. Tying them together is a newer concept<br>3. Sometimes win-win, sometimes tradeoffs<br>4. Some groups not willing to compromise / integrate<br>5. Permitting structures often do not allow integrated planning |
| Barnegat Light, NJ      | Nothing specific                                                                                                                                                                                                                                                             |
| Ship Bottom, NJ         | All planning aspects will eventually need to revolve around sea level rise, or other items will eventually fail                                                                                                                                                              |

Two jurisdictions specifically mentioned that actions similar to the major finding were already being done, and a third alluded to this becoming a trend, lending credibility that tying together these high priority issues is important. Surprisingly, although almost every jurisdiction had responses to this question, none offered any concrete examples on how this might improve planning in the future, but rather focused on general concepts.

Question 10 was an opportunity for respondents to elaborate on their previous responses or to make any other comments about this major finding. Surf City stated that this finding was straightforward. Long Beach Township elaborated that they were not sure it would improve sea level rise planning because nobody knows exactly what is happening with regard to sea level rise. Beach Haven stated that public education and ordinances / integration into capital plans may be needed in the future. The full results from these and other jurisdictions are contained in Appendix C: Public Officials Interview Materials.

### **Discussion on Major Finding 2 on Planning Components**

Major finding 2 states that “officials should consider building sea level rise plans that integrate response planning and preparedness with mandatory policies to reduce future damage. Maps and tools, educational resources, and voluntary protections were also popular, but inaction to wait for more research was not popular.” Respondents were provided with a table showing how the public survey respondents ranked these and other potential components for sea level rise plans. They were then asked whether this finding was appropriate to their area (question 11) and whether it would help to improve sea level rise planning in their area (question 12), with the results discussed in Table 51.

Table 51. LBI officials opinions on major finding 2 on planning components

| <b>Jurisdiction</b>                        | <b>Appropriate to Area</b> | <b>Improve SLR Planning in Area</b> |
|--------------------------------------------|----------------------------|-------------------------------------|
| Surf City, NJ                              | (5) Strongly Agree         | (3) Neither Agree nor Disagree      |
| Beach Haven, NJ                            | (5) Strongly Agree         | (4) Agree                           |
| Long Beach Township, NJ                    | (5) Strongly Agree         | (5) Strongly Agree                  |
| Harvey Cedars, NJ                          | (5) Strongly Agree         | (4) Agree                           |
| Barnegat Light, NJ                         | (2) Disagree               | (3) Neither Agree nor Disagree      |
| Ship Bottom, NJ                            | (5) Strongly Agree         | (5) Strongly Agree                  |
| <b>Mean</b>                                | <b>4.5</b>                 | <b>4</b>                            |
| <b>Median</b>                              | <b>5</b>                   | <b>4</b>                            |
| <b>Mode</b>                                | <b>5</b>                   | <b>3, 4, 5 (three-way tie)</b>      |
| <b>Number (Percent)<br/>Ranking 4 or 5</b> | <b>5 (83%)</b>             | <b>4 (66%)</b>                      |

Five of the six jurisdictions stated that they strongly agreed that the major finding was appropriate to their area, with the last jurisdiction saying it was not (disagree), elaborating in a later question that many of these ideas were “difficult to impossible” to do in their jurisdiction. As for whether the finding would likely improve sea level rise planning, there was considerably more variability, with two jurisdictions each stating that they either “neither agree nor disagree,” “agree,” or “strongly agree.” When asked to elaborate on how this finding may impact planning (question 13), the responses were as shown in Table 52.

Table 52. LBI officials reported possible planning improvements from major finding 2 on planning components

| <b>Jurisdiction</b>     | <b>Possible Planning Improvements</b>                                                                                                                       |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Surf City, NJ           | Much of this is already being done, would be continued under processes such as the community's flood rating                                                 |
| Beach Haven, NJ         | Already working with others. This finding probably will not impact it, but could help accelerate it                                                         |
| Long Beach Township, NJ | The township is asking the county to raise the main highway (Long Beach Boulevard) by one foot, and Stockton college is doing a storm water management plan |
| Harvey Cedars, NJ       | Nothing beyond what we are already doing                                                                                                                    |
| Barnegat Light, NJ      | Nothing really                                                                                                                                              |
| Ship Bottom, NJ         | As long as the problem is identified and all are on board, it will be much easier to correct. If in denial, it will be difficult to address at all          |

In addition to one jurisdiction that said the finding would not likely lead to any changes, three additional jurisdictions mentioned that actions consistent with this finding already exist as a reason why it may not lead to any changes, and a fourth (Long Beach Township) mentioned a specific example of how they are working with others (in this case, with a local university to assist them in their storm water planning). When asked for any additional input on this finding, several responses stood out, as two expressed concerns over inaction related to research (Surf City and Ship Bottom), two mentioned emergency response challenges (Beach Haven with no high ground to store emergency vehicles and Long Beach Township with repeated road closures for flooding) and one (Barnegat Light) noted challenges doing anything proactively because 80-85% of homes are owned by non-residents who are not in the community very often.

### Discussion on Major Finding 3 on Protection Priorities

Major finding 3 states “officials should consider the protection of essential utility and transportation services as some of the highest priorities for protection in sea level rise plans. Residents also rate the protection of individuals homes and of government facilities very highly.” As with the other questions, respondents were shown supporting information including a table supporting this finding. When asked whether the finding was appropriate to their area (question 15) and whether it would help improve sea level rise planning in their area (question 16) the responses were as shown in Table 53.

Table 53. LBI officials opinions on major finding 3 on protection priorities

| <b>Jurisdiction</b>                        | <b>Appropriate to Area</b> | <b>Improve SLR Planning in Area</b> |
|--------------------------------------------|----------------------------|-------------------------------------|
| Surf City, NJ                              | (5) Strongly Agree         | (3) Neither Agree nor Disagree      |
| Beach Haven, NJ                            | (4) Agree                  | (4) Agree                           |
| Long Beach Township, NJ                    | (4) Agree                  | (5) Strongly Agree                  |
| Harvey Cedars, NJ                          | (5) Strongly Agree         | (5) Strongly Agree                  |
| Barnegat Light, NJ                         | (4) Agree                  | (4) Agree                           |
| Ship Bottom, NJ                            | (5) Strongly Agree         | (4) Agree                           |
| <b>Mean</b>                                | <b>4.5</b>                 | <b>4.16</b>                         |
| <b>Median</b>                              | <b>4.5</b>                 | <b>4</b>                            |
| <b>Mode</b>                                | <b>4 &amp; 5 (tied)</b>    | <b>4</b>                            |
| <b>Number (Percent)<br/>Ranking 4 or 5</b> | <b>6 (100%)</b>            | <b>5 (83%)</b>                      |

Agreement that this finding was locally appropriate was universal (100% of responses answering “agree” or “strongly agree”). Respondents also generally felt the finding would help improve planning, but Surf City rated it was “neither agree nor



disagree” while noting that they believe they are already largely taking actions in line with this finding. When asked to elaborate on how this may improve planning (question 17), the responses were as shown in Table 54.

Table 54. LBI officials reported possible planning improvements from major finding 3 on protection priorities.

| <b>Jurisdiction</b>     | <b>Possible Planning Improvements</b>                                                                                                                         |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Surf City, NJ           | Changes unlikely (already prioritizing these items)                                                                                                           |
| Beach Haven, NJ         | May help accelerate planning and funding of projects                                                                                                          |
| Long Beach Township, NJ | Each town has problems. Here, most of roadway from township to the closest hospital can get flooded during an event, blocking access                          |
|                         | (1) Individuals are mostly concerned about their own properties. Municipalities have to deal with everything else                                             |
| Harvey Cedars, NJ       | (2) Changes unlikely (already prioritizing these items)                                                                                                       |
| Barnegat Light, NJ      | Nothing specific                                                                                                                                              |
| Ship Bottom, NJ         | If using the tools already in place, everything within the jurisdiction will need to be elevated, which is not feasible. Therefore, need new tools and plans. |

Even though many jurisdictions believed this finding would help improve sea level rise planning, few had any specific ideas of what may change. Two jurisdictions specifically mentioned that changes were not likely because they were already prioritizing these elements. One mentioned that the finding may help accelerate actions but did not have specifics. Although not directly responding to the question, Ship Bottom’s answer that the tools currently in place will not work was an interesting statement. It shows a level of frustration that current methodologies will not likely address the concerns, because they would lead to the conclusion that everything needs to

be elevated, which would not be feasible to do. Few viable alternatives are currently available, as a dramatic step such as removing residences and allowing most of the town to be undeveloped to limit repetitive damage is not likely to be politically tenable.

When asked to add any additional thoughts or clarifications (question 18), several respondents had key points to add:

- Surf City mentioned that the importance of utilities became very clear during the aftermath of Superstorm Sandy when gas and electric were offline for several weeks
- Beach Haven mentioned that many local businesses, especially those on the main boulevard, are getting flooded on a routine basis, some annually, and that access to bayside homes is sometimes cut off.
- Long Beach Township also emphasized utilities, including their recent rebuilding of two water plants to withstand a 500-year flood (it was not immediately clear if the 500-year flood level was based on historical data or expected future floods). Harvey Cedars mentioned they have received a grant to elevate their water plant to the same level.
- Barnegat Light mentioned that water and sewer should be paired together as either one is not fully operational without the other. They also mentioned that they had developed a “critical facilities list” for prioritizing protection and response, and it includes many public and utility structures.
- Ship Bottom’s representative stated that he disagrees with the current direction of action because it does not address the problem. Actions such as buy-outs and converting some land to natural state is probably going to be needed. There has also

been pushback on regulations to try to control flooding, and residents all over the town want to be able to do to whatever they want, but also want flooding to be controlled with little to no cost involved.

#### **Discussion on Major Finding 4 on Funding Priorities**

Major finding 4 states “funding may be one of the largest challenges of sea level rise planning. Officials should consider public meetings to discuss how to pay for priorities, should use state and federal funds when available, and should work with the insurance industry on risk reduction measures. Officials should avoid cutting other programs and should proceed cautiously with taxes.” Respondents were provided with additional information including the corresponding table supporting this finding.

Responses to appropriateness (question 19) and whether it would help planning (question 20) are in Table 55.

Table 55. LBI officials opinions on major finding 4 on funding priorities

| <b>Jurisdiction</b>                        | <b>Appropriate to Area</b>     | <b>Improve SLR Planning in Area</b> |
|--------------------------------------------|--------------------------------|-------------------------------------|
| Surf City, NJ                              | (4) Agree                      | (4) Agree                           |
| Beach Haven, NJ                            | (3) Neither Agree nor Disagree | (2) Disagree                        |
| Long Beach Township, NJ                    | (2) Disagree                   | (2) Disagree                        |
| Harvey Cedars, NJ                          | (5) Strongly Agree             | (2) Disagree                        |
| Barnegat Light, NJ                         | (4) Agree                      | (2) Disagree                        |
| Ship Bottom, NJ                            | (4) Agree                      | (4) Agree                           |
| <b>Mean</b>                                | <b>3.83</b>                    | <b>2.66</b>                         |
| <b>Median</b>                              | <b>4</b>                       | <b>2</b>                            |
| <b>Mode</b>                                | <b>4</b>                       | <b>2</b>                            |
| <b>Number (Percent)<br/>Ranking 4 or 5</b> | <b>4 (66%)</b>                 | <b>2 (33%)</b>                      |

Responses to appropriateness ranged all the way from “disagree” to “strongly agree” although the summary statistics point to an average response at or slightly below “agree.” When asked about improving planning, most (four of six) respondents disagreed, and only two agreed, with several clarifying why this is the case in the rest of their answers.

When asked about ways it may or may not improve planning (question 21), respondents had a wide variety of responses, shown in Table 56.

Table 56. LBI officials reported possible planning improvements from major finding 4 on funding priorities.

| <b>Jurisdiction</b>     | <b>Possible Planning Improvements</b>                                                                                                                                                           |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Surf City, NJ           | (1) Pursuing state/federal funds as much as possible<br>(2) Using local funds to complement outside funding and in other minimal ways<br>(3) Finding is largely in line with current practice   |
| Beach Haven, NJ         | (1) State/federal funds are only viable option for long-term impacts<br>(2) Local funds make more sense for short-term impacts<br>(3) The finding probably will not change the current practice |
| Long Beach Township, NJ | The private sector needs to take over the National Flood Insurance Program in order to allow policyholders to set deductibles appropriately (and therefore reduce premium)                      |
| Harvey Cedars, NJ       | (1) Finding is discouraging - why plan if you cannot execute?<br>(2) State and federal funds will not always be available<br>(3) This finding may help planning become more realistic           |
| BarNEGAT Light, NJ      | (1) Nobody wants to spend the money to plan ahead collectively<br>(2) Many local businesses plan ahead, as there is a major fear of a "loss of the season"                                      |
| Ship Bottom, NJ         | If funding was available, could purchase repetitive loss homes and make open-space. Not currently socially acceptable here                                                                      |

Two respondents mentioned that they were pursuing state and federal funds, and two others mentioned that it sometimes or often is not available. Several respondents noted that the finding, or portions of it, was discouraging (Harvey Cedars) or that the actions that could come from it were not socially acceptable (Ship Bottom). Long Beach Township noted that the National Flood Insurance Program should be privatized in order to allow more policy options such as larger deductibles, which for the most part are not currently available.

When asked for any additional thoughts on this finding (question 22), the following most relevant responses were provided (a full account is provided in Appendix C: Public Officials Interview Materials):

- Surf City noted that the National Flood Insurance Program drives many adaptations already to keep policy rates down, and although that may not be exactly what respondents were thinking of when mentioning working with the insurance industry, it is functionally similar.
- Beach Haven mentioned that they are able to fund more adaptations because they have found cost-cutting measures across the town. Therefore, they were not exactly cutting other programs like what was unpopular but were rather spending more efficiently.
- Long Beach Township noted that all funding (local, state, and federal) ultimately comes from the same people, and expressed a desire for more self-funding using the analogy that residents of Nebraska should not pay for the costs of impacts of coastal flooding, nor should coastal residents pay for the costs of impacts of tornadoes in Nebraska. They also noted they have focused on user fees in recent years. Although not stated in the interview, this analogy potentially breaks down for certain types of installations, such as commercial ports, defense facilities, and others that may be physically located on the coast but serve many distant communities.
- Harvey Cedars noted that funding tends to be too targeted and focused on a “cookie cutter” approach. For example, the official believed that the design of the USACE installed dunes is the same all the way across New Jersey, largely independent of the

need. However, looking at the coastal management specifications for the Philadelphia District of the U.S. Army Corps of Engineers, the dune heights are the same across LBI but different in various other Portions of New Jersey.<sup>140</sup>

### **Discussion on Major Finding 5 on Conflict Resolution**

Major Finding 5 states “to help prevent and resolve conflict, officials should consider bringing in both preparedness experts and scientists familiar with flooding and sea level rise to talk with the community and use the media to help educate the community about the issue. Avoid making adaptation measures optional to avoid conflict.” Formatting and supplementary materials were similar to those of the other findings. The responses to appropriateness (question 23) and potential planning improvement (question 24) are included in Table 57.

Table 57. LBI officials opinions on major finding 5 on conflict resolution

| <b>Jurisdiction</b>                        | <b>Appropriate to Area</b>     | <b>Improve SLR Planning in Area</b> |
|--------------------------------------------|--------------------------------|-------------------------------------|
| Surf City, NJ                              | (3) Neither Agree nor Disagree | (3) Neither Agree nor Disagree      |
| Beach Haven, NJ                            | (5) Strongly Agree             | (5) Strongly Agree                  |
| Long Beach Township, NJ                    | (4) Agree                      | (3) Neither Agree nor Disagree      |
| Harvey Cedars, NJ                          | (4) Agree                      | (4) Agree                           |
| Barnegat Light, NJ                         | (4) Agree                      | (4) Agree                           |
| Ship Bottom, NJ                            | (5) Strongly Agree             | (5) Strongly Agree                  |
| <b>Mean</b>                                | <b>4.16</b>                    | <b>4</b>                            |
| <b>Median</b>                              | <b>4</b>                       | <b>4</b>                            |
| <b>Mode</b>                                | <b>4</b>                       | <b>3, 4, 5 (three-way tie)</b>      |
| <b>Number (Percent)<br/>Ranking 4 or 5</b> | <b>5 (83%)</b>                 | <b>4 (66%)</b>                      |

In this instance respondents generally agreed that the finding was appropriate to their area, except for Surf City which was neutral as they stated they have had experts come and give lectures, and do not believe additional activity in that area would make a difference. It is possible that even if expert opinions may not change public perceptions much, they may result in additional ideas on how to protect the community. Long Beach Township's neutral response to potential planning improvement is explained by their response to question 26, where they state that reaching the public is exceptionally difficult as a public meeting may have only eight participants (out of 9,000 properties) and few want to provide email addresses for updates and few read the newspaper. Respondents were also asked to provide any details on how major finding 5 might improve sea level rise planning, with those responses discussed in Table 58.



Table 58. LBI officials possible planning improvements from major finding 5 on conflict resolution

| <b>Jurisdiction</b>     | <b>Possible Planning Improvements</b>                                                                                                                                                                                                                                                                                                                                         |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Surf City, NJ           | (1) Increased elevation already mandatory for new builds, but controversy over adjusting height limits so elevated houses would not be taller than non-elevated ones<br>(2) Education/experts may be challenging in a seasonal economy, where many are present on the island only a few weeks per year. Year-round population of 1,100, but at least 28,000 visit each summer |
| Beach Haven, NJ         | Educating the community is important, but not clear what would change                                                                                                                                                                                                                                                                                                         |
| Long Beach Township, NJ | (1) Need better information on causes of flooding and SLR, with local relevance<br>(2) Difficult to find experts with local knowledge<br>(3) Local factors also important - sinking land and sand that easily migrates                                                                                                                                                        |
| Harvey Cedars, NJ       | (1) More people on board help with ideas<br>(2) Finding will more likely help with implementation than planning                                                                                                                                                                                                                                                               |
| Barneгат Light, NJ      | This might be politically helpful, was opposed in re-election because of conflict on post-Sandy recovery when large boat owners were prioritized for return to clean up diesel fuel                                                                                                                                                                                           |
| Ship Bottom, NJ         | (1) Scientists need to be on board with what needs to be done, to support government action<br>(2) Scientific basis is an important tool                                                                                                                                                                                                                                      |

Several jurisdictions expressed concern over increasing discussion with experts, which were the top two options in the public survey. Long Beach Township indicated that it is difficult to find experts with local knowledge, as they may have general knowledge of the issue, but they do not know how it will impact this area specifically. Surf City's official expressed concern about the use of experts because the seasonal population cannot be reached through experts because they are not on the island most of the year. Beach Haven thought education was important but said it was not clear what

would change because of it. Ship Bottom stated that scientists need to be more specific on what needs to be done, in order to support action by government. Several jurisdictions stated they have seen some controversy around flooding responses.

When asked for any additional information (question 26), there were several relevant responses:

- Beach Haven noted that they have brought in various experts and groups on other issues, and that there is interest for doing so on this one.
- As noted above, Long Beach Township stated concern over reaching the community with any kind of information.
- Barnegat Light noted that experts can be wrong. For example, one had told them that sand dunes would wash away, but in this area, they actually have been growing larger. Incorrect predictions can cause mistrust, and local knowledge is key. They also noted there was a lot of conflict that arose from people who decided not to evacuate during the mandatory evacuation order for Sandy as they were not allowed to leave the island for a while after.
- Ship Bottom noted that many are avoiding taking any measures now, more than just making them optional.

### **Discussion on Major Finding 6 on Adaptation Responses**

The last major finding discussed with respondents was major finding 6, which states “public officials should consider a variety of adaptation responses. Early warning systems, natural and artificial barriers, and hardening infrastructure are among the items respondents generally found to be appropriate. Even some potentially controversial

adaptations, such as preventing new development in vulnerable areas were generally viewed as appropriate. Officials should avoid cutting of assistance from high risk areas.”

The table and supporting information provided indicated that that the public survey asked about how appropriate or inappropriate the responses were, not whether they were the best technical choices. The public official interview responses to the appropriateness of this finding (question 28) and whether it would improve planning (question 29) are shown in Table 59.

Table 59. LBI officials opinions on major finding 6 on adaptation responses

| <b>Jurisdiction</b>                        | <b>Appropriate to Area</b> | <b>Improve SLR Planning in Area</b> |
|--------------------------------------------|----------------------------|-------------------------------------|
| Surf City, NJ                              | (5) Strongly Agree         | (3) Neither Agree nor Disagree      |
| Beach Haven, NJ                            | (5) Strongly Agree         | (4) Agree                           |
| Long Beach Township, NJ                    | (5) Strongly Agree         | (5) Strongly Agree                  |
| Harvey Cedars, NJ                          | (4) Agree                  | (4) Agree                           |
| Barnegat Light, NJ                         | (5) Strongly Agree         | (5) Strongly Agree                  |
| Ship Bottom, NJ                            | (4) Agree                  | (4) Agree                           |
| <b>Mean</b>                                | <b>4.67</b>                | <b>4.16</b>                         |
| <b>Median</b>                              | <b>5</b>                   | <b>4</b>                            |
| <b>Mode</b>                                | <b>5</b>                   | <b>4</b>                            |
| <b>Number (Percent)<br/>Ranking 4 or 5</b> | <b>6 (100%)</b>            | <b>5 (83%)</b>                      |

Four of six strongly agreed that this finding was appropriate in their area, with the other two agreeing, showing local relevance. Five of six agreed or strongly agreed that it would help improve planning, with one (Surf City) being neutral, stating that these responses are already being considered and therefore it would not change planning.

When asked for details on how this finding would likely change planning, the respondents provided the information provided in Table 60.

Table 60. LBI officials reported possible planning improvements from major finding 6 on adaptation responses.

| <b>Jurisdiction</b>     | <b>Possible Planning Improvements</b>                                                                                                                                                                                                                                                              |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Surf City, NJ           | These priorities are already what is done here                                                                                                                                                                                                                                                     |
| Beach Haven, NJ         | (1) Currently trying to pass a "green acres" bill to set aside some land for flood control, but has already been voted down twice<br>(2) Land that most thought was not developable has been developed in recent years<br>(3) Higher building elevations are already required for new construction |
| Long Beach Township, NJ | (1) Public only pushes back when they do not like a new ordinance, and rarely can get consensus<br>(2) Most do not provide feedback on a change until they personally have to do (or not do) something                                                                                             |
| Harvey Cedars, NJ       | This finding might help make a wider general scope of planning                                                                                                                                                                                                                                     |
| Barnegat Light, NJ      | (1) Preventing new development is difficult. Hard to pass a new law or too controversial to try<br>(2) Working with insurance is outside the town's jurisdiction                                                                                                                                   |
| Ship Bottom, NJ         | If these measures were being taken, it might slow down the damage considerably. Instead, actions are speeding it up                                                                                                                                                                                |

Most of the responses were not direct about how planning would change, but rather discussed barriers that make adaptations difficult. Beach Haven discussed a bill to set aside land for flood control that has failed twice and is now up for a third vote, as well as frustration over developments that they believe were on land that could not be developed. Others also expressed difficulty with passing ordinances or frustration over

lack of action being taken. The only comment directly focused on planning improvements came from Harvey Cedars, and indicated that this finding may help widen the scope of planning.

Respondents were also asked to elaborate or provide additional information with regard to this finding (question 30), with the following responses:

- Surf City felt early warning was especially important, because until the new bridge is built in 2020, there is only one way off the island. Even when the second bridge opens, while there will be more capacity, evacuation would still take a long time.
- Beach Haven stated that many of these actions were underway or under consideration already.
- Long Beach Township stated they would like to see a consensus on what is happening (and what to do about it). They said that reading “100 different opinions” is challenging.
- Harvey Cedars stated that they successfully used social media and other warning tools around Sandy and will be ready for future incidents.
- Barnegat Light expressed concerns over flood insurance. The rates are high in the town because little mitigation has taken place, but the problem is not as bad as in other jurisdictions, which should be taken into account.
- Ship Bottom stated that with funding and resources many more measures could be completed. Some current responses are crude because the town does not feel it is supported and needs more public involvement to get that support.

### **Part 3 of 3: Impact of the Public Survey's Information on Planning**

The third and final section of the study was a series of questions that asked about the six major findings collectively and several related questions. This was included to gain a better understanding of what the respondents felt about the findings and study overall.

Question 31 asked whether the respondents found the major findings to be informative about public perceptions of sea level rise. This was included because, regardless of their opinions on whether the findings were locally appropriate or would help with planning, they may or may not have found them to be informative. Question 32 asked whether these findings would “help my area improve its processes around planning for sea level rise” and was meant to see if respondents felt it would be helpful from a procedural point of view. Question 33 asked a similar but slightly different question, in asking whether these findings will “help me advance planning for sea level rise.” As opposed to the procedural nature of question 32, this was meant to be more results-based. The findings from these three questions are presented in Table 61.

Table 61. LBI officials responses to public survey findings

| <b>Jurisdiction</b>                        | <b>Informative</b>      | <b>Improve Processes</b> | <b>Advance Planning</b>        |
|--------------------------------------------|-------------------------|--------------------------|--------------------------------|
| Surf City, NJ                              | (4) Agree               | (4) Agree                | (3) Neither Agree nor Disagree |
| Beach Haven, NJ                            | (4) Agree               | (4) Agree                | (4) Agree                      |
| Long Beach Township, NJ                    | (5) Strongly Agree      | (4) Agree                | (4) Agree                      |
| Harvey Cedars, NJ                          | (4) Agree               | (4) Agree                | (4) Agree                      |
| Barnegat Light, NJ                         | (5) Strongly Agree      | (4) Agree                | (4) Agree                      |
| Ship Bottom, NJ                            | (5) Strongly Agree      | (5) Strongly Agree       | (5) Strongly Agree             |
| <b>Mean</b>                                | <b>4.5</b>              | <b>4.17</b>              | <b>4</b>                       |
| <b>Median</b>                              | <b>4.5</b>              | <b>4</b>                 | <b>4</b>                       |
| <b>Mode</b>                                | <b>4 &amp; 5 (tied)</b> | <b>4</b>                 | <b>4</b>                       |
| <b>Number (Percent)<br/>Ranking 4 or 5</b> | <b>6 (100%)</b>         | <b>6 (100%)</b>          | <b>5 (83%)</b>                 |

No respondents disagreed with any of these three statements, and only one was neutral. Surf City stated it neither agreed nor disagreed that the findings would help them advance planning. Respondents felt especially strongly that the findings were informative, with a median of 4.5.

Question 34 asked respondents if there was any additional information that this study could have provided that would have useful. This was an opportunity to better understand any related topics that officials were concerned about, as well as inform future research. These suggestions are detailed in Table 62.

Table 62. LBI officials reported additional public opinion factors that could be useful for SLR planning.

| <b>Jurisdiction</b>     | <b>Additional Items That Would be Useful</b>                                                                                                                                                                                                    |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Surf City, NJ           | Need more information about what major funders think of these findings                                                                                                                                                                          |
| Beach Haven, NJ         | (1) Studies needed on the effectiveness of adaptation measures<br>(2) Study's report should indicate how respondents were chosen<br>(3) Information on if respondents felt EPA and others in the federal government were fulfilling their roles |
| Long Beach Township, NJ | (1) A stronger scientific consensus on exactly what is expected to happen and where is needed.<br>(2) Need to include public officials on recommendations on how to address these issues                                                        |
| Harvey Cedars, NJ       | Are increased flooding anomalies because we are paying closer attention since Sandy, or has something changed?                                                                                                                                  |
| Barnegat Light, NJ      | In different towns, everyone will think differently                                                                                                                                                                                             |
| Ship Bottom, NJ         | Nothing additional                                                                                                                                                                                                                              |

Only a few of the suggestions could potentially have been asked in the public survey, such as what the respondents felt about EPA and other federal agencies. A study about other funders or whether recent anomalies are because of more frequent observations or a real change are entirely feasible, but outside the scope of this study.

The interview's final question (35) asked for respondents to elaborate on any ways that the information from the study would likely alter (or not alter) sea level rise planning for their area. Several respondents also took this last question as an opportunity provide any other information they felt was relevant but had not been covered earlier in the interview.

- Surf City felt a stronger consensus of what specifically to plan for is needed, especially when outliers generally get the most attention in the media.



- Beach Haven felt it is having to make decisions on this issue in too much isolation, and needs to form better connections across towns, states, etc.
- Long Beach Township was surprised that no scientist has ever called asking for data about beach replenishment, road flooding rates, etc. and questioned where they get their data given that this has never happened. They also stated that the state often does not take local considerations into account, and that after Sandy, FEMA did a poor job helping.
- Harvey Cedars stated they were not sure what exactly would change, but they remain concerned about funding. They need to partner with the county and state to get into bigger studies, since small towns are often not accounted for otherwise.
- Barnegat Light thinks they will move forward raising the base elevation for garages (already raised for living spaces).
- Ship Bottom emphasized being careful about the difference between sea level rise and flooding, with sea level rise being a cause and flooding being an effect. This distinction is important in planning.

These interviews with public officials provide additional information about the challenges that coastal communities are facing with regard to sea level rise planning and the actions being taken to help address them. Despite this additional information and insight, these interviews are a small sample of six out of hundreds of coastal communities on the East Coast. These six communities were hardly homogeneous, as they expressed a wide range of concerns, past actions, and future priorities, they are common to a single

barrier island within one state and therefore may not represent all coastal communities. Recognizing these limitations paves the way for future work in other jurisdictions.

### **Key Findings of Public Official Interviews**

A summary of the public official ratings of each of the public survey’s major (key) findings is shown in Table 63. The sample size of each input in n=6 except for “appropriate to area” for finding 1, which is n=5 because one respondent (Barnegat Light) declined to answer that question.

Table 63. Overall public official opinions of major findings by mean score

| <b>Appropriate to Area</b> | <b>Improve SLR planning</b> | <b>Major Finding</b>              |
|----------------------------|-----------------------------|-----------------------------------|
| 4.80                       | 4.33                        | Relative priorities (finding 1)   |
| 4.50                       | 4.00                        | Planning components (finding 2)   |
| 4.50                       | 4.16                        | Protection priorities (finding 3) |
| 3.83                       | 2.66                        | Funding priorities (finding 4)    |
| 4.16                       | 4.00                        | Conflict resolution (finding 5)   |
| 4.67                       | 4.16                        | Adaptation responses (finding 6)  |
| <b>4.41</b>                | <b>3.89</b>                 | <b>Overall across findings</b>    |

The public official respondents generally had favorable views that the major findings were both appropriate to their area and would help to improve sea level rise planning. The outlier to this observation is with major finding 4 on funding priorities. In this case, the respondents generally (but not exclusively) found it to be appropriate to the area, but generally did not believe it would help sea level rise planning, because of the challenges with obtaining federal and state funds and over discouragement that the public

survey generally did not favor local sources of funding. As previously discussed in Table 61, the public official respondents also generally found that the draft key (major) findings were informative, would help improve local processes, and would help to advance SLR planning. Therefore, the key findings, when combined with local knowledge and processes to develop specifics based on the principles, can help to form the basis of local sea level rise plans.

## **CHAPTER SIX: CONCLUSIONS AND NEXT STEPS**

The three activities (survey development exercise, public survey, and public official interviews) of this study interweave to paint a challenging picture of sea level rise planning for coastal communities, but with some reasons for optimism. This chapter describes cumulative conclusions of these three studies and lays out additional opportunities for future study. Of the six jurisdictions interviewed in the public officials study, most had taken a handful of actions to address current flooding and to at least partially address sea level rise, and although they self-reported having complete SLR plans, none presented evidence of a comprehensive plan and only one presented evidence of a detailed assessment of future impacts across various SLR scenarios. Within both the survey development exercise and the public survey, respondents ranked sea level rise planning and addressing climate change as important, but less so than other priorities, but also identified several planning factors, funding methods, and methods to resolve conflict that could be helpful in addressing the impacts of SLR. The current status of planning within LBI jurisdictions seems reflective of these public priorities in that other issues appear to be higher priority in the jurisdictions studied.

There is little doubt that there is no single pathway towards making a sea level rise plan. In many communities, including all the municipalities whose interviews are discussed in Chapter Five: Public Officials Interviews, there was no evidence of a current or future sea level rise plan except Ship Bottom, where the council member stated that the

borough should make one but does not currently have plans to do so. This is in direct contradiction to the responses of several public officials who mostly stated that they believed they had a full plan or a partial plan. The actions and plans actually described by these officials were almost exclusively related to current flooding rather than increased future flooding due to sea level rise. These activities are important for many reasons, including protecting life and property against already-expected events, although they do not alone constitute a SLR plan. Although none of these communities appear to have a dedicated sea level rise plan, they have nevertheless taken some steps towards adaptation, using a variety of policies and processes related to transportation plans, building codes, utilities, and others. Therefore, it appears that for some communities, it may not be a sea level rise plan that needs to be developed, but rather the integration of sea level rise concerns into other plans and processes. Study of the benefits of mainstreaming SLR planning into existing policies and processes versus the development of stand-alone SLR plans is an opportunity for future work. Regardless, in these six communities, none of the public officials interviewed identified any measures that were specifically designed to address the ever-changing nature of sea level rise risks, but rather focused on existing hazards with limited analysis of future impacts. The key findings from this study could help enhance the development of SLR plans (whether freestanding or integrated into other processes) in LBI, across the East Coast, and potentially elsewhere.

### **Research Question Insights**

Despite these challenges, the public official interviews revealed that coastal communities are concerned and are engaging in activities to address at least current flood

risk, and the key findings developed from the survey development exercise and subsequent public survey were demonstrated to be potentially informative and useful to officials. Therefore, returning to the research questions first posed in Chapter One: Introduction, the following observations can be made about each:

*1. Is there a group of public priorities and preferences that need to be incorporated into a framework for effective SLR policymaking?*

Based on the diversity of opinions expressed in both the public survey and the public official interviews, it does appear that there are criteria that need to be incorporated into SLR policymaking. However, it does not appear that there is one exclusive group of said criteria for SLR policymaking. Rather, there are common themes that are present across these groups that would be beneficial for inclusion in plans specific to SLR or incorporated into other frameworks such as transportation plans and city master plans. These include the items discussed in the six key findings from the public survey and tested in the public official interviews.

*2. If so, what are those criteria, and do the groups studied differ in their opinions of what is required?*

As discussed in Chapter Four: Public Survey Results, the public generally prioritized the consequences of sea level rise and climate change, while putting less emphasis on SLR and climate change themselves. This consequence-oriented approach was also reflected in the public official interviews, with most emphasizing road flooding or other specific impacts and measures instead of the issue or plans to address it holistically. Although this is not surprising, it does lead to challenges in building

engagement and moving both plans and actions forward. Ultimately, the criteria to be included in a sea level rise plan, or items to be integrated into other plans and processes, ideally will be comprehensive and include the items identified in the six key findings:

1. **Relative Priority:** Officials are likely to gain better engagement with the public if they make a strong connection between planning for sea level rise and other high priority issues like the environment, infrastructure/utilities, and the economy.
2. **Planning Components:** Officials should consider building sea level rise plans that integrate response planning and preparedness with mandatory policies to reduce future damage. Maps and tools, educational resources, and voluntary protections were also popular, but inaction to wait for more research was not popular.
3. **Protection Priorities:** Officials should consider the protection of essential utility and transportation services as some of the highest priorities for protection in sea level rise plans. Residents also rate the protection of individual home and of government facilities very highly.
4. **Funding Priorities:** Funding may be one of the largest challenges of sea level rise planning. Officials should consider public meetings to discuss how to pay for priorities, should use state and federal funds when available, and should work with the insurance industry on risk reduction measures. Officials should avoid cutting other programs and should proceed cautiously with taxes.
5. **Conflict Resolution:** To help prevent and resolve conflict, officials should consider bringing in both preparedness experts and scientists familiar with flooding and sea level rise to talk with the community and use the media to help educate the community about this issue. Avoid making adaptation measures optional to avoid conflict.
6. **Adaptation Responses:** Public officials should consider a variety of adaptation responses. Early warning systems, natural and artificial barriers, and hardening infrastructure are among the items respondents generally found to be appropriate. Even some potentially controversial adaptations, such as preventing new development in vulnerable areas were generally viewed as appropriate. Officials should avoid cutting off assistance from high risk areas.

Given the limited resources and competing priorities as seen in both the public survey and public official interviews, getting to this ideal may be challenging for many

communities. This speaks to a theoretical benefit to mainstreaming of SLR planning into other policies and practices (master plans, land use plans, building codes, etc.) rather than as distinct processes.

3. *Can a framework be developed and applied that addresses the viewpoints of these groups and be considered useful for local SLR planning and policy processes?*

The six key findings identified through the public survey were considered by public officials to be informative, five of which were believed to be helpful in improving planning processes and advancing future planning (key finding four on funding priorities was found to not be helpful by some). Therefore, developing or refining planning processes around the key findings could be a way to become better prepared and gain better public engagement, while satisfying public officials needs. Given that each municipality interviewed described different existing processes and pathways forward (despite many similarities of the jurisdictions), there is not likely to be a single way to complete a local plan or achieve the desired level of protection but building a process that incorporates the key findings could nevertheless be a useful exercise in moving towards that goal.

The six key findings were derived from the priorities and preferences expressed across the public survey as a whole. Contained within those overall priorities and preferences similarities and differences across different demographic groups. Some demographics had surprisingly little impact on priorities and preferences, such as income and level of education. This suggests that although representation of all groups is important, public officials may see more agreement across individuals and groups



representing different segments of these demographics and may need to spend more time understanding how needs vary across other demographics. The self-reported level of environmentalism stood out as impacting the distribution of considerably more sub-questions than any other demographic. Different preferred “funding mixture,” which was derived from the question about whether paying for SLR planning and action should be mostly public, mostly private, or an equal mix of both was the second most influential demographic, followed by gender and age. Public officials may find the greatest diversity of opinions on priorities and preferences looking across these and other influential demographics and may be able to make progress more efficiently by fully engaging these groups early in the development of any plan or planning process. Future work could help to better understand why various demographics have relatively greater or lesser influence on SLR planning priorities and preferences. Such study could help to increase understanding of motivations for action and inaction within communities on this issue.

Another factor that came up repeatedly throughout the public officials interviews but was not directly studied was the impact of seasonal, short-term, and otherwise transient populations on decision-making. Several LBI jurisdictions specifically noted the challenges of communication and engagement surrounding the substantial portion of part-year residents due to vacation homes, seasonal homes, and short-term rentals. Although there are likely many communities where these are a small portion of the community, there are also likely to be many that share this issue. Generally, part-year residents are able to vote in local elections only if they claim residency, and therefore many may feel

they are not adequately represented by local officials. Part-year residents may also not experience the challenges of coastal flooding and SLR until after full-time residents simply because they are not in the community as frequently. Additional study of the challenges and solutions around engagement of part-year residents is a topic for future work.

Finally, the relatively “appropriate” ranking of most adaptation responses in the public survey, even most of those that were expected to be controversial, disrupts the political narrative that many adaptation measures are too controversial to consider. Although actually working through the costs and benefits of adaptation measures may result in some of them being removed from consideration, officials can consider a wide range of these measures in SLR policymaking, and by extension, potentially in adaptation planning for other climate risks. This could help to spur action, where appropriate, of officials currently hesitant to begin or enhance the exploration of SLR and other climate risk adaptation.

### **Future Work and Next Steps**

There are several key limitations to this study that can be addressed in future work. First, the public official interviews all discussed jurisdictions within one barrier island in a single state, which is both a strength and a limitation to the design. The strength of interviewing neighboring jurisdictions across the same island eliminated many complicating factors, since they all experience similar weather, are subject to the same state and county regulations, and have similar past experiences. If the public officials on a

single island struggle to agree on actions to take, it will likely be especially difficult for areas across the East Coast to agree on actions.

Many of the issues and challenges seen within LBI are likely to be seen in other coastal communities. However, it is a key limitation that information from a larger cross-section of these communities would be necessary to uncover additional perspectives that may not have been present within the LBI jurisdictions. Expanding this understanding to other areas within New Jersey as well as to additional states and to areas outside of the East Coast of the United States are all topics for future work. Additional insights could be gained by gathering similar information from other areas throughout the country and around the world, recognizing that the environmental, social, and political factors will also likely be different. This could be especially useful if conducted in states that have taken a leadership role in one or more aspects of sea level rise planning, such as Maryland and California, which could help to identify whether or not those state policies have had an appreciable impact on local decision making.

There are many future actions that can further develop sea level rise planning. Such actions will take multiple paths. First, projections on where and when sea level rise will take place and its severity will continue to come into sharper focus as data and methods continue to improve. There will always be uncertainty since there are limits to predicting future emissions and in understanding complex natural systems. Even with improved projections, additional work is needed to assess specific methods to address

risk and resilience to flooding and SLR within communities, develop plans, and implement protective measures.

Second, the key findings were derived by responses from the public and validated as *potentially* useful by the LBI officials based on exposure to the key findings in an interview setting. A logical next step to this work would be to take the key findings and assist one or several communities (whether on LBI or elsewhere on the East Coast) in applying them and documenting actual (or lack of actual) benefit for planning and preparedness. Although doing so may pose a number of challenges, such as finding communities willing to participate and challenges with understanding the baseline before implementing the key findings, such a study would bridge the gap between potential benefit and actual benefit and either further validate the usefulness of the key findings or demonstrate the need for refinement and revision.

Third, future work could help to better bridge the connection between improvements to sea level rise planning and other forms of adaptation to climate and environmental change. Even communities whose primary climate risk is sea level rise may benefit by broadening the discussion to include other risks such as drought, temperature changes, vector-borne illness and others. Priorities and preferences may or may not align across the public and public officials to incorporate all or most hazards simultaneously.

Municipal and private sector views on risk tolerance, priorities, and planning will almost certainly evolve over time, requiring an iterative process to continue to make

progress towards protecting vulnerable communities on the East Coast from sea level rise. Findings of this study can help both public officials and engaged members of the public take the first or next steps towards protecting their communities on this long journey towards resilience.

## **APPENDIX A: SURVEY DEVELOPMENT MATERIALS**

This appendix contains supplemental materials for the survey development exercise (survey 1), including the original questions, compliance information, and the full tables of coded responses, which are summarized but not presented in full in Chapter Three: Survey Development.

The George Mason University Institutional Review Board reviewed this survey and provided the author with a “determination of exempt status” for under exemption category #2 on October 10, 2016. The study number was IRBNet 966923-1. All respondents were presented electronically with the IRB approved consent form and were required to agree with the information provided in order to proceed with answering the survey. The approval letter is shown in Figure 18, the consent form in Figure 19, and the recruitment letter in Figure 20 (page 1), Figure 21 (page 2), and Figure 22 (page 3).



Office of Research Integrity and Assurance

Research Hall, 4400 University Drive, MS 6D5, Fairfax, Virginia 22030  
Phone: 703-993-5445; Fax: 703-993-9590

DATE: October 10, 2016

TO: Robert Jonas, Ph.D.  
FROM: George Mason University IRB

Project Title: [966923-1] Identifying planning factors for local sea level rise planning

SUBMISSION TYPE: New Project

ACTION: DETERMINATION OF EXEMPT STATUS  
DECISION DATE: October 10, 2016

REVIEW CATEGORY: Exemption category #2

Thank you for your submission of New Project materials for this project. The Office of Research Integrity & Assurance (ORIA) has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations.

Please remember that all research must be conducted as described in the submitted materials.

Please note that any revision to previously approved materials must be submitted to the ORIA prior to initiation. Please use the appropriate revision forms for this procedure.

If you have any questions, please contact Katie Brooks at (703) 993-4121 or [kbrook14@gmu.edu](mailto:kbrook14@gmu.edu). Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within George Mason University IRB's records.

Figure 18. Survey development approval letter

**INFORMED CONSENT FORM – Please print or save a copy of this page for your records**

**RESEARCH PROCEDURES**

This research is being conducted to help identify priorities in local sea level rise planning in coastal communities in the eastern United States, and is open to adults who live in, work in, regularly visit, or are otherwise connected to these coastal communities. This survey will be used to help set the context of the remaining research and will assist in developing future surveys. If you agree to participate, you confirm that you are affiliated in some way with an east coast coastal community and you will be asked to answer several open-ended questions about your opinions on planning for sea level rise and flooding. The survey should take less than five minutes to complete.

**RISKS**

There are no foreseeable risks for participating in this research.

**BENEFITS**

There are no benefits to you as a participant other than to further research in sea level rise planning.

**CONFIDENTIALITY**

The data in this study will be confidential. This is an anonymous survey: names and other personal identifiers will not be collected. While it is understood that no computer transmission can be perfectly secure, reasonable efforts will be made to protect the confidentiality of your transmission.

**PARTICIPATION**

Your participation is voluntary, and you may withdraw from the study at any time and for any reason. If you decide not to participate or if you withdraw from the study, there is no penalty or loss of benefits to which you are otherwise entitled. There are no costs to you or any other party.

**CONTACT**

This research is being conducted by Adam Carpenter, a student at George Mason University in the Environmental Science and Policy department. He may be reached at 703-957-8823 for questions or to report a research-related problem, and his faculty advisor Dr. Robert Jonas can be reached at 703-993-1030. You may contact the George Mason University Office of Research Integrity & Assurance at 703-993-4121 if you have questions or comments regarding your rights as a participant in the research.

This research has been reviewed according to George Mason University procedures governing your participation in this research.

**CONSENT**

I have read this form, all of my questions have been answered by the research staff, and by continuing, I agree to participate in this study.



Project Number: 966923-1

**IRB: For Official Use Only**

Page 1 of 1

Figure 19. Survey development consent form



**Email Outreach:**

Dear [Potential Participant's Name or Group Name]:

My name is Adam Carpenter and I am a Ph.D. student at George Mason University in the Environmental Science and Policy department. I am researching community-based planning for sea level rise and flooding.

As part of this research I am developing a comprehensive survey that will seek to have several hundred responses. In order to assure that the questions and suggested responses for this upcoming survey are based upon substantial input and not just the researcher's own opinions, I am reaching out to individuals and groups who may be interested in providing their opinions on the top priorities for sea level rise / flooding planning and on a few related questions. This study will help to assure that the upcoming comprehensive survey is not biased towards the selections that I as the study's author believes to be the most important, but rather based upon a broader, more balanced list. Additionally, this survey's data could also assist in directing the remainder of the project and provide additional information for the overall analysis and conclusions.

This is a voluntary and anonymous survey for adults who live, work, or regularly visit or are otherwise affiliated with coastal communities in the east coast of the United States. There are three questions, which should in total take less than five minutes to complete. No personal information will be collected in this survey.

This study has been approved by George Mason University's Institutional Review Board (IRBNet number 966923-1). If you are interested in participating, please go to [Survey Link] to review the consent form and answer the questions. If there are any other groups or individuals that you believe may be interested in this survey, I would appreciate if you could let me know. I can be reached at 703-957-8823 or [acarp8@masonlive.gmu.edu](mailto:acarp8@masonlive.gmu.edu) and my faculty Advisor, Dr. Robert Jonas can be reached at 703-993-1030. Thank you for your assistance in this project!

Figure 20. Survey development recruitment letter page 1

**Electronic Bulletin Board / Social Media Outreach:**

Dear Members of [Name of group]:

My name is Adam Carpenter and I am a Ph.D. student at George Mason University in the Environmental Science and Policy department. I am researching community-based planning for sea level rise and flooding.

As part of this research I am developing a comprehensive survey that will seek to have several hundred responses. In order to assure that the questions and suggested responses for this upcoming survey are based upon substantial input and not just the researcher's own opinions, I am reaching out to individuals and groups who may be interested in providing their opinions on the top priorities for sea level rise / flooding planning and on a few related questions. This study will help to assure that the upcoming comprehensive survey is not biased towards the selections that I as the study's author believes to be the most important, but rather based upon a broader, more balanced list. Additionally, this survey's data could also assist in directing the remainder of the project and provide additional information for the overall analysis and conclusions.

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Figure 21. Survey development recruitment letter page 2

**Printed Outreach (in case anyone requests it):**

Dear Potential Survey Participant:

My name is Adam Carpenter and I am a Ph.D. student at George Mason University in the Environmental Science and Policy department. I am researching community-based planning for sea level rise and flooding.

As part of this research I am developing a comprehensive survey that will seek to have several hundred responses. In order to assure that the questions and suggested responses for this upcoming survey are based upon substantial input and not just the researcher's own opinions, I am reaching out to individuals and groups who may be interested in providing their opinions on the top priorities for sea level rise / flooding planning and on a few related questions. This study will help to assure that the upcoming comprehensive survey is not biased towards the selections that I as the study's author believes to be the most important, but rather based upon a broader, more balanced list. Additionally, this survey's data could also assist in directing the remainder of the project and provide additional information for the overall analysis and conclusions.

This is a voluntary and anonymous survey for adults who live, work, or regularly visit or are otherwise affiliated with coastal communities in the east coast of the United States. There are three questions, which should in total take less than five minutes to complete. No personal information will be collected in this survey.

This study has been approved by George Mason University's Institutional Review Board (IRBNet number 966923-1). If you are interested in participating, please go to [\[Survey Link\]](#) to review the consent form and answer the questions. If there are any other groups or individuals that you believe may be interested in this survey, I would appreciate if you could let me know. I can be reached at 703-957-8823 or [acarp8@masonlive.gmu.edu](mailto:acarp8@masonlive.gmu.edu) and my faculty Advisor, Dr. Robert Jonas can be reached at 703-993-1030. Thank you for your assistance in this project!

Figure 22. Survey development recruitment letter page 3

### **Survey Development Coding Tables**

The following tables provide the full coding results from the survey development exercise. Table 64 shows the planning factors categories and subcategories (question 1). Table 65 includes the categories and subcategories for funding considerations (question 2). Finally, Table 66 displays the conflict resolution categories and subcategories (question 3).

Table 64. Planning factors (question 1) coding results summary<sup>23</sup>

| # Responses | Primary Category      | # Responses | Subcategory            |
|-------------|-----------------------|-------------|------------------------|
| 34          | Mitigation Measures   | 12          | Built Systems          |
|             |                       | 8           | Not Specified          |
|             |                       | 6           | Natural Barriers       |
|             |                       | 5           | Building Standards     |
|             |                       | 2           | Natural Systems        |
|             |                       | 1           | Permanent Relocation   |
| 25          | Information Resources | 18          | Risk Mapping           |
|             |                       | 4           | Cost Projections       |
|             |                       | 2           | Impact Information     |
|             |                       | 1           | Risk Disclosure        |
| 19          | Public Engagement     | 16          | Education              |
|             |                       | 2           | Decision-making        |
|             |                       | 1           | Advocacy               |
| 12          | Policies              | 6           | Land Use               |
|             |                       | 3           | Insurance              |
|             |                       | 2           | Budgeting              |
|             |                       | 1           | Not Specified          |
| 12          | Research              | 4           | Flooding Prediction    |
|             |                       | 3           | Long-term Impacts      |
|             |                       | 2           | New Building Standards |
|             |                       | 1           | Comparative Study      |
|             |                       | 1           | Natural Systems        |
|             |                       | 1           | New Response Measures  |
| 11          | Response Planning     | 7           | Temporary Relocation   |
|             |                       | 4           | Warning Systems        |
| 7           | External Factors      | 3           | Climate Change         |
|             |                       | 3           | Climate Mitigation     |
|             |                       | 1           | Extreme Events         |

Table 65. Funding mechanisms (question 2) coding results summary<sup>23</sup>

| # Responses | Primary Category         | # Responses | Subcategory               |
|-------------|--------------------------|-------------|---------------------------|
| 46          | Taxes                    | 9           | Property Tax              |
|             |                          | 9           | Risk-based Tax            |
|             |                          | 7           | User Fees / Taxes         |
|             |                          | 6           | Tax Incentives            |
|             |                          | 5           | Dedicated (Not Specified) |
|             |                          | 5           | Sales Tax                 |
|             |                          | 2           | Construction Tax          |
|             |                          | 2           | No Taxes                  |
|             |                          | 1           | Not Specified             |
| 30          | Regulatory Cost Shifting | 10          | Insurance Requirements    |
|             |                          | 7           | Owner Mitigation          |
|             |                          | 6           | Land Use                  |
|             |                          | 4           | Building Standards        |
|             |                          | 2           | Eminent Domain            |
|             |                          | 1           | No Regulations            |
| 8           | Loans                    | 5           | Bond issuance             |
|             |                          |             | Loans to                  |
|             |                          | 3           | individuals/businesses    |
| 7           | Self-Funding             | 5           | Owner Responsibility      |
|             |                          | 2           | Local Cost Sharing        |
| 5           | Allocation               | 4           | Modify Existing Budget    |
|             |                          | 1           | Reserve Funds             |
| 5           | Cost-Avoidance           | 3           | Reduce Other Expenses     |
|             |                          | 1           | No Funding                |
|             |                          | 1           | Reduce Labor Costs        |
| 4           | Specific Measures        | 3           | Mitigation                |
|             |                          | 1           | Recycling                 |
| 4           | Outside Assistance       | 2           | State / Federal Funds     |
|             |                          | 2           | Non-profit Funds          |

Table 66. Conflict resolution options (question 3) coding results summary<sup>23</sup>

| #<br>Responses | Primary Category     | #<br>Responses                         | Subcategory                                                                                                                                         |
|----------------|----------------------|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| 67             | Public Engagement    | 21<br>18<br>8<br>8<br>6<br>3<br>2<br>1 | Education<br>Public Meetings<br>Collective Action<br>Media Outreach<br>Voting<br>Planning (Not Specified)<br>Disclosure / Transparency<br>Mediation |
| 12             | Regulatory Methods   | 4<br>4<br>3<br>1                       | Disclosure / Transparency<br>Zoning<br>Additional Regulation<br>Exempt Existing                                                                     |
| 12             | Specific Measures    | 3<br>2<br>2<br>1<br>1<br>1<br>1<br>1   | Emergency Response<br>Taxes<br>Zoning<br>Building Standards<br>Insurance<br>No Action<br>Not Specified<br>Recovery Funds                            |
| 7              | Analytical Methods   | 5<br>2                                 | Cost-Benefit Analysis<br>Scientific Basis                                                                                                           |
| 3              | Incentive Methods    | 2<br>1                                 | Public Recognition<br>Funding                                                                                                                       |
| 2              | Business Engagement  | 2                                      | Real Estate Community                                                                                                                               |
| 2              | Legal Avenues        | 2                                      | Legal Actions                                                                                                                                       |
| 2              | Political Engagement | 1<br>1                                 | Campaign Issues<br>Collective Action                                                                                                                |

### **Survey Development Results**

The following tables provide the full results (responses and coding results) from the survey development exercise. The responses are provided in alphabetical order and are unedited except for the changes made to allow for processing and readability as discussed in the Preparation for Coding section of Chapter Three: Survey Development. Table 67 shows the planning factors full responses and coding results (question 1). Table 68 includes full responses and coding results about funding mechanisms (question 2). Finally, Table 69 provides the coding results and full responses about conflict resolution methodologies (question 3).



Table 67. Planning factors (question 1) full coded results<sup>23</sup>

| Category              | Subcategory        | Full Response with coding preparation applied                                                                                                    |
|-----------------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| External Factors      | Climate Change     | Global warming                                                                                                                                   |
| External Factors      | Climate Change     | Weather pattern changing sea currents                                                                                                            |
| External Factors      | Climate Change     | When will the next ice age start.... if ever                                                                                                     |
| External Factors      | Climate Mitigation | Develop incentives to minimize auto use and other activities to reduce carbon emissions that contribute to sea ice melt                          |
| External Factors      | Climate Mitigation | Steps to contain global warming                                                                                                                  |
| External Factors      | Climate Mitigation | Incentivize overall sustainability initiatives - solar, wind power                                                                               |
| External Factors      | Extreme Events     | Increased hurricane frequency / severity                                                                                                         |
| Information Resources | Cost Projections   | Future cost of water containment adjacent to flood prone areas                                                                                   |
| Information Resources | Cost Projections   | Identifying cost-effective solutions                                                                                                             |
| Information Resources | Cost Projections   | Finding the least expensive ways to prevent flooding                                                                                             |
| Information Resources | Cost Projections   | Finding cost effective solutions                                                                                                                 |
| Information Resources | Impact Information | Clear data outlining potential impacts                                                                                                           |
| Information Resources | Impact Information | Use [Understand the Location impact of flooding] to project where damage will be the heaviest                                                    |
| Information Resources | Risk Disclosure    | Requiring sellers of flood-prone property to make full disclosure before transfer                                                                |
| Information Resources | Risk Mapping       | Locations of houses / buildings                                                                                                                  |
| Information Resources | Risk Mapping       | Designation of areas likely to be impacted                                                                                                       |
| Information Resources | Risk Mapping       | Predicting areas most likely prone to flooding                                                                                                   |
| Information Resources | Risk Mapping       | Accurate mapping of neighborhood terrain above or below current sea level                                                                        |
| Information Resources | Risk Mapping       | Understand the Location impact of flooding...where it will take place first                                                                      |
| Information Resources | Risk Mapping       | Conducting a risk assessment, including identification of at-risk areas, at-risk populations, and critical infrastructure vulnerable to flooding |
| Information Resources | Risk Mapping       | Accurate prediction of at-risk areas                                                                                                             |
| Information Resources | Risk Mapping       | Tides, in particular king tides and how they affect coastal areas                                                                                |
| Information Resources | Risk Mapping       | Seeking out locations where flooding may arise                                                                                                   |

| Category              | Subcategory        | Full Response with coding preparation applied                                                                                           |
|-----------------------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Information Resources | Risk Mapping       | Identifying particularly flood-prone areas                                                                                              |
| Information Resources | Risk Mapping       | Identifying areas at greatest risk                                                                                                      |
| Information Resources | Risk Mapping       | Focus on most at risk population / locations to establish priorities for action                                                         |
| Information Resources | Risk Mapping       | Looking for places at risk of flooding                                                                                                  |
| Information Resources | Risk Mapping       | Identification of existing land uses in areas in danger                                                                                 |
| Information Resources | Risk Mapping       | Pay particular attention to roads when identifying areas prone to flooding                                                              |
| Information Resources | Risk Mapping       | Identify areas that will inevitably be hard hit                                                                                         |
| Information Resources | Risk Mapping       | Density of people at or near beach increasing                                                                                           |
| Information Resources | Risk Mapping       | Environmental impacts of flooding                                                                                                       |
| Mitigation Measures   | Building Standards | Freeboard under building first floor in flood prone areas                                                                               |
| Mitigation Measures   | Building Standards | Ensure that houses and / or buildings are built on stilts                                                                               |
| Mitigation Measures   | Building Standards | Improve and modify building codes to allow for more resistant structures e.g. Elevations, height restrictions, under house parking etc. |
| Mitigation Measures   | Building Standards | Construction on stilts in coastal areas                                                                                                 |
| Mitigation Measures   | Building Standards | Enforce building codes and zoning codes that disallow construction in floodable areas                                                   |
| Mitigation Measures   | Built Systems      | Ensure that existing drainage is working & well maintained                                                                              |
| Mitigation Measures   | Built Systems      | Drainage development                                                                                                                    |
| Mitigation Measures   | Built Systems      | Maintaining / creating drainage ditches                                                                                                 |
| Mitigation Measures   | Built Systems      | Sea walls (although prohibited in most areas)                                                                                           |
| Mitigation Measures   | Built Systems      | Install flap gates on drain outfalls to prevent back flow at high tides                                                                 |
| Mitigation Measures   | Built Systems      | Mitigation (rerouting, dams, hurricane wall -New Bedford, MA)                                                                           |
| Mitigation Measures   | Built Systems      | Maintaining / creating storm drains                                                                                                     |
| Mitigation Measures   | Built Systems      | Identify areas prone to flooding and add additional drainage                                                                            |
| Mitigation Measures   | Built Systems      | Undertaking structural improvements to prevent or lessen damage caused by flooding                                                      |
| Mitigation Measures   | Built Systems      | Boats legally should be secured.                                                                                                        |
| Mitigation Measures   | Built Systems      | Determining levels of seas walls needed                                                                                                 |

| Category            | Subcategory          | Full Response with coding preparation applied                                                             |
|---------------------|----------------------|-----------------------------------------------------------------------------------------------------------|
| Mitigation Measures | Built Systems        | Installing underground holding areas where run-off can be held and slowly reabsorbed                      |
| Mitigation Measures | Natural Barriers     | Maintaining / creating dunes                                                                              |
| Mitigation Measures | Natural Barriers     | Beach refurbishing                                                                                        |
| Mitigation Measures | Natural Barriers     | Artificial modification of natural barriers                                                               |
| Mitigation Measures | Natural Barriers     | Reinforcing foundations and buffering for new dunes                                                       |
| Mitigation Measures | Natural Barriers     | Planting to protecting erosion (sea grapes- sea oats- etc.                                                |
| Mitigation Measures | Natural Barriers     | Artificial reefs                                                                                          |
| Mitigation Measures | Natural Systems      | Creation of "green" areas where the water can be absorbed                                                 |
| Mitigation Measures | Natural Systems      | Use of materials that promote surface drainage                                                            |
| Mitigation Measures | Not Specified        | Taking remedial action to avoid flooding                                                                  |
| Mitigation Measures | Not Specified        | Plan for protecting communities from impacts                                                              |
| Mitigation Measures | Not Specified        | Permanence of any solution                                                                                |
| Mitigation Measures | Not Specified        | Use [project where damage will be the heaviest] to mitigate the damage                                    |
| Mitigation Measures | Not Specified        | Take appropriate action regardless of cost                                                                |
| Mitigation Measures | Not Specified        | Use [understanding locations] and [areas of greatest impacts] to try to put in preventative measures.     |
| Mitigation Measures | Not Specified        | Limiting activities known to increase flooding risks                                                      |
| Mitigation Measures | Not Specified        | Publish - distribute Government available funding, grants, support for implementing mitigation approaches |
| Mitigation Measures | Permanent Relocation | Re-location of facilities                                                                                 |
| Policies            | Budgeting            | budgeting for prevention and mitigation, when possible/applicable                                         |
| Policies            | Budgeting            | Do not invest tax dollars in efforts to prevent flooding that will benefit few people                     |
| Policies            | Insurance            | Establishing policy for home insurance                                                                    |
| Policies            | Insurance            | flood insurance that is attainable and reasonable                                                         |
| Policies            | Insurance            | Allowing adults to make ill-advised decisions to build in flood-prone areas but not provide insurance     |
| Policies            | Land Use             | Zoning for housing taking into account risks of flooding                                                  |
| Policies            | Land Use             | Future building too close to flood line                                                                   |
| Policies            | Land Use             | Setting economic incentives to avoid building in danger areas                                             |
| Policies            | Land Use             | Push for laws restricting building close to coasts, riverways that are affected                           |
| Policies            | Land Use             | Restrict the use of impervious surfaces (driveways, patios, sidewalks, etc.                               |

| Category          | Subcategory         | Full Response with coding preparation applied                                                             |
|-------------------|---------------------|-----------------------------------------------------------------------------------------------------------|
| Policies          | Land Use            | Preventing development in areas at risk for flooding                                                      |
| Policies          | Not Specified       | Consider ways to enforce policies aimed at countering flooding                                            |
| Public Engagement | Advocacy            | Identifying individuals in the community who will advocate for the solutions                              |
| Public Engagement | Decision-making     | Developing consensus in the community about best methods to avoid damage                                  |
| Public Engagement | Decision-making     | Triage decisions as to what should and should not be done                                                 |
| Public Engagement | Education           | Educating the public regarding causes of flooding                                                         |
| Public Engagement | Education           | Community education                                                                                       |
| Public Engagement | Education           | Community better understanding causes of flooding                                                         |
| Public Engagement | Education           | Educating the community                                                                                   |
| Public Engagement | Education           | Community education to on risk to build knowledge and support for change needed                           |
| Public Engagement | Education           | Educating community about this                                                                            |
| Public Engagement | Education           | Educating the public on the causes of climate change                                                      |
| Public Engagement | Education           | Community outreach to spread the message                                                                  |
| Public Engagement | Education           | Ensuring the community is aware of the risks of flooding                                                  |
| Public Engagement | Education           | Publish -distribute proven cost-beneficial mitigation approaches                                          |
| Public Engagement | Education           | How to address the naysayers who oppose climate change projections                                        |
| Public Engagement | Education           | Educating the public regarding the hazards of flooding                                                    |
| Public Engagement | Education           | Communication and education for community                                                                 |
| Public Engagement | Education           | Engaging entire community in educational programs re flooding                                             |
| Public Engagement | Education           | Those living on the water should attend discussions about what supplies to keep and preventative measures |
| Public Engagement | Education           | How to educate the community on the interconnectivity of [location, severity, and mitigation]             |
| Research          | Comparative Study   | Reviewing actions of other similar communities                                                            |
| Research          | Flooding Prediction | Better understanding the causes of flooding                                                               |
| Research          | Flooding Prediction | Improving the prediction of flooding events                                                               |
| Research          | Flooding Prediction | Affect of reductions of permeable land                                                                    |
| Research          | Flooding Prediction | Run off from flooding in areas that normally don't flood                                                  |
| Research          | Long-term Impacts   | Erosion, whether it be beaches or marshes                                                                 |

| <b>Category</b>   | <b>Subcategory</b>     | <b>Full Response with coding preparation applied</b>                                                                            |
|-------------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Research          | Long-term Impacts      | Better understanding of the affects of subsidence on existing coastal terrain                                                   |
| Research          | Long-term Impacts      | Understanding the risk of sea level rise vs temporary flooding                                                                  |
| Research          | Natural Systems        | Beach erosion increasing. Loss of beach                                                                                         |
| Research          | New Building Standards | Government sponsored research and marketing of construction-property fortification techniques that minimize future flood damage |
| Research          | New Building Standards | Developmental standards that would lessen damage caused by flooding                                                             |
| Research          | New Response Measures  | Understanding ways to counteract flooding                                                                                       |
| Response Planning | Temporary Relocation   | Evacuation plans                                                                                                                |
| Response Planning | Temporary Relocation   | People must be aware that they must evacuate during significant storms                                                          |
| Response Planning | Temporary Relocation   | Clearly marking evacuation routes                                                                                               |
| Response Planning | Temporary Relocation   | Development of effective evacuation routes and plans                                                                            |
| Response Planning | Temporary Relocation   | Designated shelters                                                                                                             |
| Response Planning | Temporary Relocation   | Preparing a response plan to flooding, including (but not limited to) evacuation route, shelters, etc.                          |
| Response Planning | Temporary Relocation   | Establish evacuation plans                                                                                                      |

Table 68. Funding mechanisms (question 2) full coded results<sup>23</sup>

| Category                 | Subcategory                     | Full Response with coding preparation applied                                                                              |
|--------------------------|---------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Allocation               | Modify Existing Budget          | Make flood prevention a major priority within existing budget levels                                                       |
| Allocation               | Modify Existing Budget          | Set asides of funds from other areas (e.g., entertainment taxes)                                                           |
| Allocation               | Modify Existing Budget          | Redirect money going to less vital causes                                                                                  |
| Allocation               | Modify Existing Budget          | Rearranging of budgetary priorities                                                                                        |
| Allocation               | Reserve Funds                   | Dedicated "emergency" funds                                                                                                |
| Cost-Avoidance           | No Funding                      | No funding is an option                                                                                                    |
| Cost-Avoidance           | Reduce Labor Costs              | Subsidize labor costs with volunteer efforts or with prison / community service teams                                      |
| Cost-Avoidance           | Reduce Other Expenses           | Cutting expenses                                                                                                           |
| Cost-Avoidance           | Reduce Other Expenses           | Balance the budget; cut other expenses                                                                                     |
| Cost-Avoidance           | Reduce Other Expenses           | Reducing expenses in other areas, for example our area spends as much on administration in the school district as teachers |
| Loans                    | Bond issuance                   | Local communities selling bonds like they might to build a school                                                          |
| Loans                    | Bond issuance                   | Raise funds via bond issue or bank debt                                                                                    |
| Loans                    | Bond issuance                   | Bonds                                                                                                                      |
| Loans                    | Bond issuance                   | Bonds                                                                                                                      |
| Loans                    | Bond issuance                   | Bond initiative                                                                                                            |
| Loans                    | Loans to individuals/businesses | Low or no interest local, state or federal loans                                                                           |
| Loans                    | Loans to individuals/businesses | Local government financing with owners repaying over 10 years (amortized payment)                                          |
| Loans                    | Loans to individuals/businesses | Personal loan at financial institution                                                                                     |
| Outside Assistance       | Non-profit Funds                | Funding by non-profit environmental groups                                                                                 |
| Outside Assistance       | Non-profit Funds                | Donations from charities such as the American Red Cross                                                                    |
| Outside Assistance       | State / Federal Funds           | Lobbying legislatures and government agencies for financial assistance                                                     |
| Outside Assistance       | State / Federal Funds           | Use federal and state funding to the maximum extent                                                                        |
| Regulatory Cost Shifting | Building Standards              | Incorporating relevant measures into new construction requirements                                                         |
| Regulatory Cost Shifting | Building Standards              | Require improvements to be paid for by residential owners who insist on building close to shore                            |
| Regulatory Cost Shifting | Building Standards              | Building requirements that would minimize flooding damage                                                                  |

| <b>Category</b>          | <b>Subcategory</b>     | <b>Full Response with coding preparation applied</b>                                                                                         |
|--------------------------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Regulatory Cost Shifting | Building Standards     | Local ordinances to force sound construction                                                                                                 |
| Regulatory Cost Shifting | Eminent Domain         | Eminent Domain takings of properties in danger                                                                                               |
| Regulatory Cost Shifting | Eminent Domain         | Use dollars to buy out owners where it makes no sense to rebuild                                                                             |
| Regulatory Cost Shifting | Insurance Requirements | Flood insurance is mandatory                                                                                                                 |
| Regulatory Cost Shifting | Insurance Requirements | Docks currently can't be insured in Florida, this should be changed                                                                          |
| Regulatory Cost Shifting | Insurance Requirements | Mandatory federal insurance programs to pay for losses                                                                                       |
| Regulatory Cost Shifting | Insurance Requirements | Reducing government contribution to flood insurance                                                                                          |
| Regulatory Cost Shifting | Insurance Requirements | Money should be kept in escrow for flooding for those homes and buildings likely to be effected                                              |
| Regulatory Cost Shifting | Insurance Requirements | Require all property owners in flood zone to purchase private flood insurance                                                                |
| Regulatory Cost Shifting | Insurance Requirements | The government should not act an insurer.                                                                                                    |
| Regulatory Cost Shifting | Insurance Requirements | Require flood insurance                                                                                                                      |
| Regulatory Cost Shifting | Insurance Requirements | Require a level of insurance that will pay the entire cost                                                                                   |
| Regulatory Cost Shifting | Insurance Requirements | Insurance premium reduction incentives                                                                                                       |
| Regulatory Cost Shifting | Land Use               | Zoning laws that prohibit building in flood zones                                                                                            |
| Regulatory Cost Shifting | Land Use               | Reestablish new flood zones based on expected flooding levels                                                                                |
| Regulatory Cost Shifting | Land Use               | Zoning / building restrictions                                                                                                               |
| Regulatory Cost Shifting | Land Use               | Consider whether rebuilding makes sense in certain areas                                                                                     |
| Regulatory Cost Shifting | Land Use               | Local zoning ordinances                                                                                                                      |
| Regulatory Cost Shifting | Land Use               | Don't expect to build a dike to hold back the seas, like in Holland. Prepare for a new coastline. Prohibit building where it makes no sense. |
| Regulatory Cost Shifting | No Regulations         | It is not the government's job to maintain a coastline.                                                                                      |
| Regulatory Cost Shifting | Owner Mitigation       | Property specific mitigation requirements                                                                                                    |
| Regulatory Cost Shifting | Owner Mitigation       | Fine property owners who fail to install reasonable countermeasures                                                                          |
| Regulatory Cost Shifting | Owner Mitigation       | Require home owners to act to remediate potential flooding                                                                                   |

| Category                 | Subcategory               | Full Response with coding preparation applied                                                        |
|--------------------------|---------------------------|------------------------------------------------------------------------------------------------------|
| Regulatory Cost Shifting | Owner Mitigation          | Requiring drainage improvements                                                                      |
| Regulatory Cost Shifting | Owner Mitigation          | Requiring property owners to install measures                                                        |
| Regulatory Cost Shifting | Owner Mitigation          | Requiring owner mitigation improvements                                                              |
| Regulatory Cost Shifting | Owner Mitigation          | Landowner mandates                                                                                   |
| Self-Funding             | Local Cost Sharing        | Home owners association (sharing costs)                                                              |
| Self-Funding             | Local Cost Sharing        | Fundraise                                                                                            |
| Self-Funding             | Owner Responsibility      | This is a property owner responsibility                                                              |
| Self-Funding             | Owner Responsibility      | Self funding                                                                                         |
| Self-Funding             | Owner Responsibility      | Homeowners may end up paying some amount for flooding on their own property                          |
| Self-Funding             | Owner Responsibility      | Property owners should bear all the risk of sea rise                                                 |
| Self-Funding             | Owner Responsibility      | Mandatory requirement that home owner pay if they want to build or rebuild                           |
| Specific Measures        | Mitigation                | Planting sea oats on dunes                                                                           |
| Specific Measures        | Mitigation                | Sand fences to slow wind and cause sand to drop                                                      |
| Specific Measures        | Mitigation                | Underground utilities                                                                                |
| Specific Measures        | Recycling                 | Creating ways to store / utilize flood waters for irrigation and other needs                         |
| Taxes                    | Construction Tax          | Tax on new construction                                                                              |
| Taxes                    | Construction Tax          | Assessments on new development in the area                                                           |
| Taxes                    | Dedicated (Not Specified) | Dedicated tax                                                                                        |
| Taxes                    | Dedicated (Not Specified) | Dedicated tax for upgrades                                                                           |
| Taxes                    | Dedicated (Not Specified) | Dedicated tax                                                                                        |
| Taxes                    | Dedicated (Not Specified) | Dedicated tax                                                                                        |
| Taxes                    | Dedicated (Not Specified) | Use specific, project related taxes as last resort. Such funds should not be for general budget use. |
| Taxes                    | No Taxes                  | This is not a taxpayer responsibility                                                                |
| Taxes                    | No Taxes                  | Tax money should not be used to protect people's shore houses                                        |
| Taxes                    | Not Specified             | People on the water are already heavily taxed so this might be decreased if measures are taken       |
| Taxes                    | Property Tax              | Assessments for those living in gated communities                                                    |
| Taxes                    | Property Tax              | Dedicated tax on homeowners                                                                          |
| Taxes                    | Property Tax              | Dedicated tax on ocean front property                                                                |



| <b>Category</b> | <b>Subcategory</b> | <b>Full Response with coding preparation applied</b>                                            |
|-----------------|--------------------|-------------------------------------------------------------------------------------------------|
| Taxes           | Property Tax       | Requiring property owners to pay tax                                                            |
| Taxes           | Property Tax       | Tax on insurance for these properties                                                           |
| Taxes           | Property Tax       | Surcharges on sale of property to fund community initiatives                                    |
| Taxes           | Property Tax       | Dedicated local property tax assessment                                                         |
| Taxes           | Property Tax       | Increase overall property taxes                                                                 |
| Taxes           | Property Tax       | Tax based on property value for those in coastal areas, floodplains, or areas prone to flooding |
| Taxes           | Risk-based Tax     | Assessment of taxes on properties most likely to need protection from flooding                  |
| Taxes           | Risk-based Tax     | Tax for facilities in a flood zone                                                              |
| Taxes           | Risk-based Tax     | Variable local tax for living in a 100 or 25 year floodplain, etc.                              |
| Taxes           | Risk-based Tax     | Increase property taxes for property in at-risk areas                                           |
| Taxes           | Risk-based Tax     | A small property tax for those in affected areas                                                |
| Taxes           | Risk-based Tax     | Tax on those homeowners' who do not install anti-flooding measures                              |
| Taxes           | Risk-based Tax     | Property assessment on communities where there be increased flooding risks                      |
| Taxes           | Risk-based Tax     | Tax on towns and communities in flood-prone areas                                               |
| Taxes           | Risk-based Tax     | Tax any projects that build on threatened areas                                                 |
| Taxes           | Sales Tax          | Currently 1 cent sales tax for beach renourishment                                              |
| Taxes           | Sales Tax          | Dedicated local, hotel, motel and home rental taxes                                             |
| Taxes           | Sales Tax          | Dedicated Local business sales taxes                                                            |
| Taxes           | Sales Tax          | Meal tax in coastal areas                                                                       |
| Taxes           | Sales Tax          | Impose higher taxes on cigarettes, gas, alcohol                                                 |
| Taxes           | Tax Incentives     | Providing tax incentives to private businesses / homeowners for implementing relevant measures  |
| Taxes           | Tax Incentives     | Tax credit for homeowners' who install anti-flooding measures                                   |
| Taxes           | Tax Incentives     | Incentives to encourage sustainability measure that cut carbon dioxide                          |
| Taxes           | Tax Incentives     | Providing tax incentives for "Leed" construction                                                |
| Taxes           | Tax Incentives     | Tax credits for individuals that pay for upgrades                                               |

| <b>Category</b> | <b>Subcategory</b> | <b>Full Response with coding preparation applied</b>                                   |
|-----------------|--------------------|----------------------------------------------------------------------------------------|
| Taxes           | Tax Incentives     | Smaller tax for facilities adjacent to a flood zone                                    |
| Taxes           | User Fees / Taxes  | Road use tax in coastal areas                                                          |
| Taxes           | User Fees / Taxes  | Fee, like the bag fee                                                                  |
| Taxes           | User Fees / Taxes  | Emissions tax                                                                          |
| Taxes           | User Fees / Taxes  | Increased charge to use the beach or for beach parking                                 |
| Taxes           | User Fees / Taxes  | Tax on tourists                                                                        |
| Taxes           | User Fees / Taxes  | Communities could out on functions and charge a fee which could be put into an account |
| Taxes           | User Fees / Taxes  | Higher bag tax, with proceeds dedicated to environmental protection measures           |

Table 69. Conflict resolution options (question 3) full coded results<sup>23</sup>

| Category             | Subcategory               | Full Response with coding preparation applied                                                                                                          |
|----------------------|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Analytical Methods   | Cost-Benefit Analysis     | Cost - Benefit Analysis                                                                                                                                |
| Analytical Methods   | Cost-Benefit Analysis     | Ranking options by cost                                                                                                                                |
| Analytical Methods   | Cost-Benefit Analysis     | Position that has the least negative impact on local residents and property owners                                                                     |
| Analytical Methods   | Cost-Benefit Analysis     | Ranking options by permanence of fix                                                                                                                   |
| Analytical Methods   | Cost-Benefit Analysis     | Identifying prohibitive (costly) options                                                                                                               |
| Analytical Methods   | Scientific Basis          | Use good, peer reviewed science as basis for decisions                                                                                                 |
| Analytical Methods   | Scientific Basis          | Ensure all communications are data-driven and unbiased                                                                                                 |
| Business Engagement  | Real Estate Community     | Working with realtors and developers                                                                                                                   |
| Business Engagement  | Real Estate Community     | Working with local development communities                                                                                                             |
| Incentive Methods    | Funding                   | Position that has the most funding support                                                                                                             |
| Incentive Methods    | Public Recognition        | Rewarding those companies in the private sector for environmental initiatives                                                                          |
| Incentive Methods    | Public Recognition        | Recognize the efforts of communities that create programs to address these issues                                                                      |
| Legal Avenues        | Legal Actions             | Municipalities prepare to defend homeowner and business lawsuits                                                                                       |
| Legal Avenues        | Legal Actions             | Lawyers or other representation                                                                                                                        |
| Political Engagement | Campaign Issues           | Have local candidates develop focused plans in connection with their candidacies                                                                       |
| Political Engagement | Collective Action         | Work sessions with members of local governing body                                                                                                     |
| Public Engagement    | Collective Action         | Establish a local committee with very broad property owner representation                                                                              |
| Public Engagement    | Collective Action         | Volunteer organizations like the MRC or CERT where community members learn both about emergency response and about the cultural diversity of neighbors |
| Public Engagement    | Collective Action         | Canvassing door to door                                                                                                                                |
| Public Engagement    | Collective Action         | Tours / visits to imperiled areas                                                                                                                      |
| Public Engagement    | Collective Action         | Working with community organizations                                                                                                                   |
| Public Engagement    | Collective Action         | Making known how their neighbors are doing and how they could be disagreeing                                                                           |
| Public Engagement    | Collective Action         | Involve equal parts political, academic, and corporate entities coalesced around a single message                                                      |
| Public Engagement    | Collective Action         | Organize volunteer days to plant sea grass, etc.                                                                                                       |
| Public Engagement    | Disclosure / Transparency | Listing alternatives ( results of not responding )                                                                                                     |

| Category          | Subcategory               | Full Response with coding preparation applied                                                                                   |
|-------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Public Engagement | Disclosure / Transparency | Making public consultant reports on options                                                                                     |
| Public Engagement | Education                 | Community outreach education programs                                                                                           |
| Public Engagement | Education                 | Educate the public on ways these efforts will benefit the individual and the community                                          |
| Public Engagement | Education                 | Education in schools                                                                                                            |
| Public Engagement | Education                 | Community education                                                                                                             |
| Public Engagement | Education                 | Educational efforts by local and state governments                                                                              |
| Public Engagement | Education                 | Educate the public on the risks to them, individually of not taking these measures                                              |
| Public Engagement | Education                 | Educating about consequences                                                                                                    |
| Public Engagement | Education                 | Post internet information                                                                                                       |
| Public Engagement | Education                 | Local educational programs                                                                                                      |
| Public Engagement | Education                 | Teach mitigation methods, not just doom and gloom                                                                               |
| Public Engagement | Education                 | Educational efforts by non-profit environmental groups                                                                          |
| Public Engagement | Education                 | Community oriented written communications                                                                                       |
| Public Engagement | Education                 | Prior outline of what will happen after flooding                                                                                |
| Public Engagement | Education                 | Those that have been impacted by flooding should give lectures and educate                                                      |
| Public Engagement | Education                 | Include information with property tax mailings                                                                                  |
| Public Engagement | Education                 | Creating program for students which teach them how to contribute to the resolution of this problem and the benefits of doing so |
| Public Engagement | Education                 | Curriculum in public schools                                                                                                    |
| Public Engagement | Education                 | Better educate school children to need to plan for eventual flooding                                                            |
| Public Engagement | Education                 | Examples of how past situations have been responded to and results                                                              |
| Public Engagement | Education                 | State-sponsored educational programs                                                                                            |
| Public Engagement | Education                 | Educate community on protection strategies that have worked elsewhere, even though controversial at the time                    |
| Public Engagement | Media Outreach            | Dedicated social media sites                                                                                                    |
| Public Engagement | Media Outreach            | Communicate frequently to all property owners (mailings, emails, etc.)                                                          |
| Public Engagement | Media Outreach            | Radio advertising                                                                                                               |
| Public Engagement | Media Outreach            | TV advertising / programs                                                                                                       |
| Public Engagement | Media Outreach            | Public service announcements                                                                                                    |
| Public Engagement | Media Outreach            | Sending mailings to residents                                                                                                   |
| Public Engagement | Media Outreach            | TV ads                                                                                                                          |

| Category           | Subcategory               | Full Response with coding preparation applied                                         |
|--------------------|---------------------------|---------------------------------------------------------------------------------------|
| Public Engagement  | Media Outreach            | Documentary films                                                                     |
| Public Engagement  | Mediation                 | 3rd party, independent mediators                                                      |
| Public Engagement  | Planning (not specified)  | Pre-planning and advanced agreement                                                   |
| Public Engagement  | Planning (not specified)  | Public prioritizing of options                                                        |
| Public Engagement  | Planning (not specified)  | Develop plans well in advance                                                         |
| Public Engagement  | Public Meetings           | Hold meetings                                                                         |
| Public Engagement  | Public Meetings           | Public meetings are critical                                                          |
| Public Engagement  | Public Meetings           | Public meetings to educate public                                                     |
| Public Engagement  | Public Meetings           | Public meetings                                                                       |
| Public Engagement  | Public Meetings           | Public education meetings                                                             |
| Public Engagement  | Public Meetings           | Public meetings                                                                       |
| Public Engagement  | Public Meetings           | Holding public meetings                                                               |
| Public Engagement  | Public Meetings           | Public meetings                                                                       |
| Public Engagement  | Public Meetings           | Public education through meetings                                                     |
| Public Engagement  | Public Meetings           | Public listing of options                                                             |
| Public Engagement  | Public Meetings           | Public planning meetings                                                              |
| Public Engagement  | Public Meetings           | Local community discussion and vote                                                   |
| Public Engagement  | Public Meetings           | Hold community outreach events in public places to ease discourse                     |
| Public Engagement  | Public Meetings           | Hold community meetings with concentration on areas where flooding likely to occur    |
| Public Engagement  | Public Meetings           | Participatory, public forums to discuss issues                                        |
| Public Engagement  | Public Meetings           | Public hearings on consultant reports                                                 |
| Public Engagement  | Public Meetings           | Each community should select an officer and a yearly convention                       |
| Public Engagement  | Public Meetings           | Hold town hall meetings for folks to congregate, ask questions, and propose new ideas |
| Public Engagement  | Voting                    | Voting on protection strategies                                                       |
| Public Engagement  | Voting                    | Voting                                                                                |
| Public Engagement  | Voting                    | Voting                                                                                |
| Public Engagement  | Voting                    | Ballot initiatives                                                                    |
| Public Engagement  | Voting                    | Vote on dedicated taxes up or down                                                    |
| Public Engagement  | Voting                    | Vote on dedicated taxes - give 3 or 4 choices                                         |
| Regulatory Methods | Additional Regulation     | Enact federal legislation                                                             |
| Regulatory Methods | Additional Regulation     | There should be direct consequences for those who do not vacate, etc.                 |
| Regulatory Methods | Additional Regulation     | Change laws to better protect environment/people                                      |
| Regulatory Methods | Disclosure / Transparency | Rules should not leave any room for interpretation                                    |

| Category           | Subcategory               | Full Response with coding preparation applied                                                                                                                                                   |
|--------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Regulatory Methods | Disclosure / Transparency | Require full disclosure                                                                                                                                                                         |
| Regulatory Methods | Disclosure / Transparency | Include info with annual insurance policies                                                                                                                                                     |
| Regulatory Methods | Disclosure / Transparency | Government transparency when changing policy, voting, etc. on items like changes in taxes, response plans, etc.                                                                                 |
| Regulatory Methods | Exempt Existing           | Grandfather existing uses                                                                                                                                                                       |
| Regulatory Methods | Zoning                    | Clear regulations and zoning                                                                                                                                                                    |
| Regulatory Methods | Zoning                    | Make coastal planning mandatory for all looking to build within flood zone                                                                                                                      |
| Regulatory Methods | Zoning                    | Don't encourage people to buy property in flood-prone areas                                                                                                                                     |
| Regulatory Methods | Zoning                    | Building should not be allowed to close to water's edge and landfill should not be permitted                                                                                                    |
| Specific Measures  | Building Standards        | Require all structures to have habitual area above flood prone areas                                                                                                                            |
| Specific Measures  | Emergency Response        | Clear evacuation plans                                                                                                                                                                          |
| Specific Measures  | Emergency Response        | Backup communication systems                                                                                                                                                                    |
| Specific Measures  | Emergency Response        | Use a triage model set up prior to flooding                                                                                                                                                     |
| Specific Measures  | Insurance                 | Mandate insurance or a new form of insurance                                                                                                                                                    |
| Specific Measures  | No Action                 | Let adults be adults                                                                                                                                                                            |
| Specific Measures  | Not Specified             | Executive initiatives                                                                                                                                                                           |
| Specific Measures  | Recovery Funds            | Designated disaster fund                                                                                                                                                                        |
| Specific Measures  | Taxes                     | Don't spend tax money for the benefit of a few                                                                                                                                                  |
| Specific Measures  | Taxes                     | Let communities set tax rate to fund measures to be taken in advance, with an expectation that that is what will be done and that is the extent that the community is willing to protect itself |
| Specific Measures  | Zoning                    | Change zoning laws to not allow building / rebuilding structures in flood predicted areas                                                                                                       |
| Specific Measures  | Zoning                    | Prohibit new uses                                                                                                                                                                               |

## **APPENDIX B: PUBLIC SURVEY MATERIALS**

This appendix contains supplemental materials for the public survey, including compliance information, and additional details including the full list of write-ins for the open-ended questions. This information is summarized, but not provided in full, in Chapter Four: Public Survey Results.

The George Mason University Institutional Review Board reviewed this survey and provided the author with a “determination of exempt status” for under exemption category #2 on December 20, 2017. The study number was IRBNet 1168842-1. All respondents were presented electronically with the IRB approved consent form and were required to agree with the information provided in order to proceed to the survey. The approval letter is shown in Figure 23, the consent form in Figure 24. Due to the distribution method of this survey, there is no separate recruitment letter (the consent form instead fulfills that purpose).



Office of Research Development, Integrity, and Assurance

Research Hall, 4400 University Drive, MS 6D5, Fairfax, Virginia 22030  
Phone: 703-993-5445; Fax: 703-993-9590

DATE: December 20, 2017

TO: Robert Jonas, PhD  
FROM: George Mason University IRB

Project Title: [1168842-1] Priorities and preferences in developing community-based sea level rise plans in eastern coastal states

SUBMISSION TYPE: New Project

ACTION: DETERMINATION OF EXEMPT STATUS  
DECISION DATE: December 20, 2017

REVIEW CATEGORY: Exemption category #2

Thank you for your submission of New Project materials for this project. The Institutional Review Board (IRB) Office has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations.

Please remember that all research must be conducted as described in the submitted materials.

Please note that any revision to previously approved materials must be submitted to the IRB office prior to initiation. Please use the appropriate revision forms for this procedure.

If you have any questions, please contact Karen Motsinger at 703-993-4208 or [kmotsing@gmu.edu](mailto:kmotsing@gmu.edu). Please include your project title and reference number in all correspondence with this committee.

Please note that all research records must be retained for a minimum of five years, or as described in your submission, after the completion of the project.

Please note that department or other approvals may also be required to conduct your research.

GMU IRB Standard Operating Procedures can be found here: [http://oria.gmu.edu/1031-2/?\\_ga=1.12722615.1443740248.1411130601](http://oria.gmu.edu/1031-2/?_ga=1.12722615.1443740248.1411130601)

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within George Mason University IRB's records.

Figure 23. Public survey approval letter



**INFORMED CONSENT FORM – Please print or save a copy of this page for your records**

**RESEARCH PROCEDURES**

This research is being conducted to help identify priorities in local sea level rise planning in coastal communities in the eastern United States, and is open to adults who live in, work in, regularly visit, or are otherwise connected to these coastal communities. If you agree to participate, you will be asked to answer questions about your opinions on planning for sea level rise and flooding. No personally identifiable information is collected, although some non-identifiable demographic information is. The survey should take approximately 10 minutes to complete.

**RISKS**

There are no foreseeable risks for participating in this research.

**BENEFITS**

There are no benefits to you as a participant other than to further research in this subject.

**CONFIDENTIALITY**

is an anonymous survey; names and other personal identifiers will not be collected. While it is understood that no computer transmission can be perfectly secure, reasonable efforts will be made to protect the confidentiality of your transmission.

**PARTICIPATION**

Your participation is voluntary, and you may withdraw from the study at any time and for any reason. If you decide not to participate or if you withdraw from the study, there is no penalty or loss of benefits to which you are otherwise entitled. There are no costs to you or any other party. Compensation for participating in the study is determined by the survey company and may include points, rewards, or monetary compensation.

**CONTACT**

This research is being conducted by Adam Carpenter, a student at George Mason University in the Environmental Science and Policy department. He may be reached at 703-957-8823 for questions or to report a research-related problem, and his faculty advisor Dr. Robert Jonas can be reached at 703-993-1030. You may contact the George Mason University Institutional Review Board Office at 703-993-4121 if you have questions or comments regarding your rights as a participant in the research.

This research has been reviewed according to George Mason University procedures governing your participation in this research and has been assigned the study number 1168842-1.

**CONSENT**

I have read this form, all of my questions have been answered by the research staff, and by continuing, I agree to participate in this study.



Project Number: 1168842-1

**IRB: For Official Use Only**

Page 1 of 1

Figure 24. Public survey consent form

### **Data Availability and Write-In Responses**

The full data set for the public survey is available on OpenICPSR under project 108312.<sup>24</sup> The following data tables contain the full results of write-in responses. They are unedited except correcting obvious spelling mistakes / typos, changing abbreviations to full words for clarity, and fixing capitalization of the first character for readability. The responses have been alphabetized. The tables discuss the write-in question responses as follows:

- Table 70 provides the write-in responses for planning factors (question 5)
- Table 71 shows the responses for additional protection priorities (question 8)
- Table 72 displays the responses for funding consideration (question 11)
- Table 73 provides the responses for conflict resolution methods (question 14)
- Table 74 shows the write-in responses for adaptation options (question 16)
- Table 75 shows respondent feedback about the survey itself (question 23)

Table 70. Write-in responses for additional planning factors (question 5)

|                                                                                                                                                                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Question 5 - Are there any other components to preparing for future flooding and sea level rise that are important? (Please state and rate 1-5. If none, select N/A)</b>                                               |
| 1 -- A place for evacuees to easily go to that will provide temporary comfort, food, water, shelter ... etc.<br>1 -- Emergency transportation service for those who without vehicles and who need medical assistance.     |
| 1 Cost 2 research 3 time                                                                                                                                                                                                  |
| 1 Educating younger adults on how to handle flooding 2 Not trying to play a hero but be assertive<br>3 always stay safe 4 be very alert and communicate well with others 5 just Learn to stay away from deadly situations |
| 1 Food and water 2 maps 3 location destination 4 Power source 5 Phone source.                                                                                                                                             |
| 1 Is caring about cars and 5 is prepping food.                                                                                                                                                                            |
| 1 There is none 5 there is constant threat of flooding in our area especially during a hurricane                                                                                                                          |
| 1. Call family 2. have food 3. have water 4. have insurance 5. have prayer                                                                                                                                                |
| 1. Education 2. Impeach Trump                                                                                                                                                                                             |
| 1. Education about and required modifications (solar and wind generated electricity) to reduce global warming.                                                                                                            |
| 1. Flood insurance 2. don't make houses in flood zones 3. sue builders who do 4. pay money to victims of builders 5. throw the criminals in jail                                                                          |
| 1. Making people understand that coastal communities will flood regardless of human intervention. 2. Building homes further away from coast and higher up.                                                                |
| 1. One important item is to let people know where to get help and assistance in case of a flood. Was very important to me when I lost everything I owned in the Agnes Flood of 1972.                                      |
| 1. Studying environment 2. Come up with a plan 3. Evaluate all plans 4. Educate and choose plans. 5. Evaluate plans                                                                                                       |
| 1. Teaching people that this is happening 2. having town meetings 3. social media awareness 4. allowing schools to teach this to young adults 5. finding ways to prevent it from occurring sooner than expected           |
| 1 Sign up for flood warnings 2 buy insurance 3 flood bags 4 get community help 5 make a flood plan                                                                                                                        |
| 5 Flooding is important because it can be damaging to the infrastructure of human interaction                                                                                                                             |
| 5 Need to stop encouraging/allowing people to build in flood zones, then using tax money to pay for flood damage,                                                                                                         |
| 5 People need to be informed more of what they can do to protect themselves 4 government needs to help the lower income people and provide for help                                                                       |
| 5- The building heights in coastal areas need to be controlled to prevent building issues and damages along the beaches.                                                                                                  |
| 5 Would be to stop building where it is already an issue.                                                                                                                                                                 |
| 5. Even if it rains the main road is gone under water.                                                                                                                                                                    |
| 5. Funding for potential disaster to homes, boats, etc...                                                                                                                                                                 |
| 5-Making all aware of what precautions are necessary                                                                                                                                                                      |
| Better drainage                                                                                                                                                                                                           |
| Builders need to research the issue of runoff                                                                                                                                                                             |
| Building houses above sea level - 5 Developing emergency protocols- 4                                                                                                                                                     |
| Creating climate change policies                                                                                                                                                                                          |
| Don't know                                                                                                                                                                                                                |
| Educating the citizens who are in flood zones on ways to protect their homes and evacuate if necessary                                                                                                                    |

|                                                                                                                                                                                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Question 5 - Are there any other components to preparing for future flooding and sea level rise that are important? (Please state and rate 1-5. If none, select N/A)</b>          |
| Educating the public about mandatory evacuation procedures 5                                                                                                                         |
| Educating those who would move to these endangered areas.                                                                                                                            |
| Education about climate change                                                                                                                                                       |
| Elevating homes in low-lying areas and requiring new buildings be elevated with staircases to reach the first floor.                                                                 |
| Emergency routes 3                                                                                                                                                                   |
| Evacuation policies. Rate:5                                                                                                                                                          |
| Evacuation routes                                                                                                                                                                    |
| Every aspect and component of preparing is important. 5 Very important                                                                                                               |
| Expense is very much debated 5                                                                                                                                                       |
| Figuring out what government aid we could get in case of a severe flood.                                                                                                             |
| Flooding in the future                                                                                                                                                               |
| Food preparation in case of emergencies.                                                                                                                                             |
| For preparing for future flooding and sea level rise, the community is attempting to build more buildings nearby with material to withstand rough weather, especially flooding.      |
| Funding                                                                                                                                                                              |
| Future flooding can be avoided if some basic work in the sea                                                                                                                         |
| Getting our republican legislative bodies to admit it is real 5                                                                                                                      |
| Getting the Republican party to understand the scientific causes of sea flooding and the associated costs involved. 5                                                                |
| Giving the locals knowledge on what and what not to do 5                                                                                                                             |
| Have to make sure you're prepared                                                                                                                                                    |
| Help get people ready 5                                                                                                                                                              |
| Helping lower-income people in flood zones fund the necessary preparations to protect their homes                                                                                    |
| Housing for displace victims after a disaster happen .5                                                                                                                              |
| I am not sure other than education                                                                                                                                                   |
| I think that the most important thing is awareness. Keep informed when storms are heading toward your geo location                                                                   |
| Identifying routes for emergency evacuations                                                                                                                                         |
| Informing citizens of safe havens during a natural disaster. Putting up barriers to prevent flooding in low areas Creating response teams to be activated whenever needed            |
| Insurance know how                                                                                                                                                                   |
| It is very important to be educated on the matter if one is going to live near the shore. Their houses can be destroyed and they could lose everything they owned. Education is a 5. |
| Making new bridges in this area make new ways and roads to avoid traffic                                                                                                             |
| Making sure everything is structurally sound                                                                                                                                         |
| Making sure new home construction protects against flooding                                                                                                                          |
| Making sure those who can't evacuate by themselves have help - 5                                                                                                                     |
| Measuring how far homes need to be moved, or walls built 5                                                                                                                           |

|                                                                                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Question 5 - Are there any other components to preparing for future flooding and sea level rise that are important? (Please state and rate 1-5. If none, select N/A)</b>                                |
| More emergency shelters                                                                                                                                                                                    |
| Must get ready to move                                                                                                                                                                                     |
| N/A                                                                                                                                                                                                        |
| N/A                                                                                                                                                                                                        |
| N/A                                                                                                                                                                                                        |
| N/A                                                                                                                                                                                                        |
| N/A                                                                                                                                                                                                        |
| N/A                                                                                                                                                                                                        |
| N/A                                                                                                                                                                                                        |
| N/A                                                                                                                                                                                                        |
| N/A                                                                                                                                                                                                        |
| NA                                                                                                                                                                                                         |
| NA                                                                                                                                                                                                         |
| NA                                                                                                                                                                                                         |
| NA                                                                                                                                                                                                         |
| Natural disasters                                                                                                                                                                                          |
| No                                                                                                                                                                                                         |
| No                                                                                                                                                                                                         |
| No longer Rebuilding in flood zones 1                                                                                                                                                                      |
| NONE                                                                                                                                                                                                       |
| None                                                                                                                                                                                                       |
| None                                                                                                                                                                                                       |
| Nope                                                                                                                                                                                                       |
| NOT SURE                                                                                                                                                                                                   |
| One of the most important is having people aware of what to do and where to go, to be prepared                                                                                                             |
| People believing or not                                                                                                                                                                                    |
| People need to be educated 5 Evidence needs to be produced 5                                                                                                                                               |
| Persuasion campaigns within coastal communities has been very effective, conveying the impacts of sea level rise to non-coastal communities is the national barrier to policy changes. 5                   |
| Planned shelters                                                                                                                                                                                           |
| Preparing an evacuation plan rate:4                                                                                                                                                                        |
| Preparing residents in case of flooding emergencies- 2                                                                                                                                                     |
| providing info on getting proper flood insurance                                                                                                                                                           |
| Public awareness 5 Science behind climate change 5                                                                                                                                                         |
| Putting up barriers 5                                                                                                                                                                                      |
| Rating: 5: Protecting and maintaining natural flood and SLR (Sea Level Rise) deterrents and barriers such as wetlands. When there are wetlands to sequester the additional water from floods and SLR, then |

|                                                                                                                                                                                                                                                                                                           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Question 5 - Are there any other components to preparing for future flooding and sea level rise that are important? (Please state and rate 1-5. If none, select N/A)</b>                                                                                                                               |
| there is less damage to property and people, and there is less SLR and flooding. Rating: 5: Keeping additional development to a minimum in order to preserve what wetlands and natural SLR barriers remain.                                                                                               |
| Reducing carbon emissions 5                                                                                                                                                                                                                                                                               |
| Relocating hazardous materials 3                                                                                                                                                                                                                                                                          |
| Repairing damage that has already happened from Hurricane Irma- 5                                                                                                                                                                                                                                         |
| Safety is the biggest concern                                                                                                                                                                                                                                                                             |
| Sea level rise will eventually impact people living at the water                                                                                                                                                                                                                                          |
| Staying informed about future weather conditions. Seeing if need to travel away from the beach!                                                                                                                                                                                                           |
| Stop development in flood prone areas. 1 Find ways for commuters to get home when flooding closes many streets. 2 Improve drainage to prevent so many road closures 3 Consider delay of school during high tide and flooding 4 Help the people who have lost their homes more than once due to flooding 5 |
| Stop filling in wetlands!!! There used to be regulations against this, but, now, apparently if you have enough money you can build wherever you like.                                                                                                                                                     |
| Teaching it in the schools beginning in elementary school, 4                                                                                                                                                                                                                                              |
| That is very important and it's a 9                                                                                                                                                                                                                                                                       |
| That they urge people to take this seriously. I think many people who were not directly effected can go on with their daily lives and just block out what the obvious is becoming. Even those who were, we are just not use to living in an environment where there is an imminent life altering threat.  |
| The basement flooding                                                                                                                                                                                                                                                                                     |
| To get the supplies                                                                                                                                                                                                                                                                                       |
| Using equipment to relocate beach sands into walls before hurricanes to reduce sea coastal damages to minimize flooding.                                                                                                                                                                                  |
| We always need to be ready                                                                                                                                                                                                                                                                                |
| We must prepare ourselves for the fact that ocean levels may not rise and it's all part of liberal media                                                                                                                                                                                                  |
| Wildlife habitat protections                                                                                                                                                                                                                                                                              |
| Working with local nonprofits to ensure there are/will be "boots on the ground"                                                                                                                                                                                                                           |
| Yes u should have insurance                                                                                                                                                                                                                                                                               |
| Yes. Animal life and sea walls                                                                                                                                                                                                                                                                            |

Table 71. Write-in responses for additional protection priorities (question 8)

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Question 8 - Are there any other items in your community that should be priorities for protection? (Please state and rate 1-5. If none, select N/A)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 1. Raft 2. goggles 3. plane ticket 4. health insurance 5. batteries                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 1Hospital 2churches 3areas in low places                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 2. Neighborhood watch program                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 5 Checking that all safety matters are working and in place                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 5 Protecting dam's that have been exceptional vulnerable.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 5 Reservoirs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 5 Schools                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 5- Street flooding during heavy rain is an ongoing issue where cars are being damaged because the street drainage system is inadequate and needs to be upgraded. This doesn't just occur during hurricanes, but when there is heavy rain.                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 5. Homes, Cars, Personal Items, Flooding Inside Homes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Animal shelter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Animal shelter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Animal shelters                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Animal Shelters and Zoos - 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Animals shelters                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Boat docks. Rate:4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Boats must be protected                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Community centers 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Educational Institutions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Emergency assistance availability                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Everything is important but I would think those infrastructures that are going to keep society and government moving along even through chaotic moments of disasters. Home bases, nerve centers, water, gas and electric, gas stations, food pantries, hospitals. Even schools. I think it is important to get children back in school as soon as possible to keep them in a normal state of activity, even if classes are not scheduled as normal but to get them in and talking as a group and one on one counselling. If your a parent in a disaster sometimes constant attention and reassurance and support to children are overlooked and they can not be as attentive as they would like. |
| Highways and side roads                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Historic and cultural sites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Historic Sites- 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Homeless people. 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Homes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Homes and humans are key priority in my eyes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Hospitals                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Hospitals 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Hospitals, nursing homes, animal shelters, 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Houses are a 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

|                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Question 8 - Are there any other items in your community that should be priorities for protection? (Please state and rate 1-5. If none, select N/A)</b>                                      |
| I don't know                                                                                                                                                                                    |
| I listed wetlands as not a priority because this is what they should be for.....to handle the water that comes in from rain, tides, or storms. They are nature's way of protecting other lands. |
| Making sure water is good                                                                                                                                                                       |
| Marine life 4                                                                                                                                                                                   |
| Medical facilities 5                                                                                                                                                                            |
| N/A                                                                                                                                                                                             |
| N/A                                                                                                                                                                                             |
| N/A                                                                                                                                                                                             |
| N/A                                                                                                                                                                                             |
| N/A                                                                                                                                                                                             |
| NA                                                                                                                                                                                              |
| NA                                                                                                                                                                                              |
| Natural wetlands which would lower our risk moderately 5                                                                                                                                        |
| Neighbors                                                                                                                                                                                       |
| No                                                                                                                                                                                              |
| No                                                                                                                                                                                              |
| No                                                                                                                                                                                              |
| No                                                                                                                                                                                              |
| None                                                                                                                                                                                            |
| None                                                                                                                                                                                            |
| NOT SURE                                                                                                                                                                                        |
| Nursing homes                                                                                                                                                                                   |
| People                                                                                                                                                                                          |
| Persons personal property                                                                                                                                                                       |
| Pirates deck the local bar                                                                                                                                                                      |
| Pollution out of the water                                                                                                                                                                      |
| Protecting the environment                                                                                                                                                                      |
| Public hospitals                                                                                                                                                                                |
| Public shelter                                                                                                                                                                                  |
| Rating 4: Schools and Libraries, and other public education buildings. Rating 5: Hospitals Rating 5: Shelters (human and animal)                                                                |
| Schools                                                                                                                                                                                         |
| Schools=3                                                                                                                                                                                       |
| Security cameras in downtown                                                                                                                                                                    |
| Senior care centers and communities. 4 Schools 4                                                                                                                                                |
| Senior living residences                                                                                                                                                                        |



|                                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Question 8 - Are there any other items in your community that should be priorities for protection? (Please state and rate 1-5. If none, select N/A)</b> |
| Shelters and schools                                                                                                                                       |
| Solar and wind turbine grid protection                                                                                                                     |
| The data company risk high protection                                                                                                                      |
| The library is at 3                                                                                                                                        |
| The school system rate:5                                                                                                                                   |
| Town electric supply                                                                                                                                       |
| Valuables in home                                                                                                                                          |
| Yes and that's kids & 10                                                                                                                                   |

Table 72. Write-in responses for funding considerations (question 11)

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Question 11 - Are there any other methods to determine how much money should be spent protecting against floods and the effects of future sea level rise? (Please state and rate 1-5. If none, select N/A)</b>                                                                                                                                                                                                                                                  |
| 1 Communities should have funding for natural disaster 2 volunteers should be in place 3 Discuss methods on how to protect each community 4 stay safe always 5 shelters also should be in place                                                                                                                                                                                                                                                                    |
| 1. Batteries                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 5 A continuous meeting of keeping calculations at the needed cost                                                                                                                                                                                                                                                                                                                                                                                                  |
| 5 Encourage people to move back away from shorelines.                                                                                                                                                                                                                                                                                                                                                                                                              |
| 5- The governor and local mayors need to inform Florida residents of these issues and communicate more with the residents about planning to implement solutions if they want to live in Florida. This is for the future so that everyone can benefit from these necessary improvements.                                                                                                                                                                            |
| 5. Having the government actually making the efforts, and not just standing in front of a podium on TV saying what they will do but not following through. Essentially the government putting aside the money and keeping it there for future reference if need be.                                                                                                                                                                                                |
| 5. STOP Building in flood zones/ and stop concreting everything                                                                                                                                                                                                                                                                                                                                                                                                    |
| Cut back on government officials perks and other lavish spending expenditures                                                                                                                                                                                                                                                                                                                                                                                      |
| Don't know                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Encourage residents to vote for politicians (local, state, and federal), who understand and agree with the science of climate change, and who want to do something about it, and who will support measures to increase local, state, and federal funding to mitigate the risk and damage climate change and Sea Level Rise pose to coastal and inland communities. You can't expect anything useful to be done if you don't have the right change-makers in power. |
| Enough to prevent damage                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Fundraisers                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Future predictions                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Hey I don't have the answers, but in time of need everything helps                                                                                                                                                                                                                                                                                                                                                                                                 |
| How many times the flooding will happen 5                                                                                                                                                                                                                                                                                                                                                                                                                          |
| I am not sure                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| I am sure there are but nothing is coming to mind at the moment                                                                                                                                                                                                                                                                                                                                                                                                    |
| If people quit building in flood prone areas, and wetlands stop being filled in, there shouldn't have to be money spent for this.                                                                                                                                                                                                                                                                                                                                  |
| Income of private people 2                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Increase taxes on conventional energy usage.                                                                                                                                                                                                                                                                                                                                                                                                                       |
| It's Florida. Every roof on every home and business should have solar panels 5                                                                                                                                                                                                                                                                                                                                                                                     |
| Keep the government out of it, they are incompetent and aren't held accountable. Teach people to fish, not make them dependent                                                                                                                                                                                                                                                                                                                                     |
| Local Fundraisers                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Make better the education                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Market Analysis                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Money should be routed from other things that don't need the funding                                                                                                                                                                                                                                                                                                                                                                                               |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

|                                                                                                                                                                                                                                                                                                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Question 11 - Are there any other methods to determine how much money should be spent protecting against floods and the effects of future sea level rise? (Please state and rate 1-5. If none, select N/A)</b>                                                                                       |
| N/A                                                                                                                                                                                                                                                                                                     |
| N/A                                                                                                                                                                                                                                                                                                     |
| N/A                                                                                                                                                                                                                                                                                                     |
| N/A                                                                                                                                                                                                                                                                                                     |
| NA                                                                                                                                                                                                                                                                                                      |
| NA                                                                                                                                                                                                                                                                                                      |
| NA                                                                                                                                                                                                                                                                                                      |
| No                                                                                                                                                                                                                                                                                                      |
| No                                                                                                                                                                                                                                                                                                      |
| No                                                                                                                                                                                                                                                                                                      |
| No. Rate:5                                                                                                                                                                                                                                                                                              |
| None                                                                                                                                                                                                                                                                                                    |
| None                                                                                                                                                                                                                                                                                                    |
| None                                                                                                                                                                                                                                                                                                    |
| None that I can think of that weren't already talked about in the previous question.                                                                                                                                                                                                                    |
| Nope                                                                                                                                                                                                                                                                                                    |
| Online discourse 5                                                                                                                                                                                                                                                                                      |
| Outsourced information                                                                                                                                                                                                                                                                                  |
| People should protest or make donations to help & 9                                                                                                                                                                                                                                                     |
| PREVENT THEM ANYWAY 55555                                                                                                                                                                                                                                                                               |
| Progressive income taxes and hazard based property taxes and insurance 5                                                                                                                                                                                                                                |
| Property taxes are high here, so I don't think that's a good idea.                                                                                                                                                                                                                                      |
| See what other communities spend                                                                                                                                                                                                                                                                        |
| Set up donations, fundraisers and funds to pay for this 5                                                                                                                                                                                                                                               |
| The government should be funding this                                                                                                                                                                                                                                                                   |
| The location itself and how vulnerable it is                                                                                                                                                                                                                                                            |
| There could be donations but I do not think raising taxes are necessary                                                                                                                                                                                                                                 |
| There needs to be investment by corporations. We are already taxed beyond our means and the government has over 1 billion debt and climbing. We need to manage our money better and stop wasting it. People are also becoming more and more ignorant and non-caring about their environment and health. |
| Update FEMA testing of flood zones                                                                                                                                                                                                                                                                      |

Table 73. Write-in responses for conflict resolution methods (question 14)

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Question 14 - Are there any other techniques to resolve potential conflict in your community? (Please state and rate 1-5. If none, select N/A)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 1. Talk to neighbors                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 1 Stay away from people 2become a lonely 3be passive 4don't bother people 5show compassion toward everyone                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 5 Community meetings on a regular basis with experienced guest speakers.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 5 Having all members at meetings as a requirement so everyone's on the same page                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 5- Provide monthly Fee for Beach Coast Flooding Fund.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 5. Make sure the local community leaders, actually follow through in saying what they are going to do. Enough talk, more action.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| A town hall before the event 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Can't think of any                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Change building and zoning codes to prevent re-building with the same flaws that now exist. 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Community discussions period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Dialog                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Education and preparation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Getting homeless people off the ground                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Give the community the option to join in one everything involved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Have a ski boat ready to go                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Have consistent town meetings to talk about what is happening rate:4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| I think there should be mandatory meetings at least for coastal towns for home and business owners on what they can do to help support protection. If there is not a good excuse to attend the meeting you should be given a fine. I think so many people just do not care unless it happens. I live in a small town where people have not even grasped the effects of not recycling. I still can not fathom how people are not concerned about where all this trash goes, especially in small town. If we can't even recycle how are we going to do everything else ? maybe to some that is extreme but it shows the laziness on the part of a lot of human beings. |
| I'm not schooled well enough to answer but nothing will happen without political will 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Just keep overall awareness!!!                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Just to look around and be aware of potential problems                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Making climate change known                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| More meetings to talk about the issue                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| NA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

|                                                                                                                                                           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Question 14 - Are there any other techniques to resolve potential conflict in your community?<br/>(Please state and rate 1-5. If none, select N/A)</b> |
| No                                                                                                                                                        |
| No.                                                                                                                                                       |
| None                                                                                                                                                      |
| None come to mind                                                                                                                                         |
| None that I can think of right now that weren't already mentioned in the previous question.                                                               |
| Not that I am aware of that aren't being currently used.                                                                                                  |
| Offer discounts on taxes and insurance if owners comply with additional safety                                                                            |
| Online campaigns 3                                                                                                                                        |
| Online discourse 4                                                                                                                                        |
| Public private partnerships 5                                                                                                                             |
| Rating 5: Education, including political and science education, is key.                                                                                   |
| Televising these meetings so that those who cannot attend, could watch at home                                                                            |
| The public must be educated by experts/scientist and heed their recommendations.                                                                          |
| Voting                                                                                                                                                    |
| We are disconnected and live in a populated area so the news is the best way.                                                                             |

Table 74. Write-in responses for additional adaptation options (question 16)

| <b>Question 16 - Are there any other responses to protect against flooding and future sea level rise in your community? (Please state and rate 1-5. If none, select N/A)</b> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Do not rebuild structures that are taken by the sea.                                                                                                                      |
| 1. Put pets in shelter                                                                                                                                                       |
| 1 More sand in the beaches 2 early detection 3 build levies                                                                                                                  |
| 5 -- Education. Progressively keeping up with climate change.                                                                                                                |
| 5 Help others                                                                                                                                                                |
| Add more sand to the beaches. Rate: 5                                                                                                                                        |
| Can't think of any                                                                                                                                                           |
| Drainage must be good                                                                                                                                                        |
| Drink more water                                                                                                                                                             |
| Have a set up in fire departments to help any event 3                                                                                                                        |
| Helping to provide both green space for community protection against                                                                                                         |
| Just stop more development. 40 homes were approved to be built in a high flood zone.                                                                                         |
| Just the tv warning system                                                                                                                                                   |
| Man made floodplains 5                                                                                                                                                       |
| Move more public buildings, hospitals, etc. from downtown to outlying, higher areas.                                                                                         |
| My area in Daytona Beach is very prepared over many years!!                                                                                                                  |
| N/A                                                                                                                                                                          |
| N/A                                                                                                                                                                          |
| N/A                                                                                                                                                                          |
| N/A                                                                                                                                                                          |
| N/A                                                                                                                                                                          |
| NA                                                                                                                                                                           |
| No                                                                                                                                                                           |
| No                                                                                                                                                                           |
| No                                                                                                                                                                           |
| No others reasons                                                                                                                                                            |
| None come to mind                                                                                                                                                            |
| None. I find out from Facebook                                                                                                                                               |
| Not at this moment                                                                                                                                                           |
| Not that i am aware of that are not being currently utilized.                                                                                                                |
| Pass ordinances against development in high-risk areas, or areas that are important for wildlife                                                                             |
| People get flooded and then they fix their houses until the next flood with no other change done - ridiculous.                                                               |
| Plant more low rising trees, shrubs                                                                                                                                          |
| Rating 4: set up shelters for evacuees, including shelters that accept pets.                                                                                                 |

|                                                                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Question 16 - Are there any other responses to protect against flooding and future sea level rise in your community? (Please state and rate 1-5. If none, select N/A)</b> |
| Scientific outreach 5                                                                                                                                                        |
| Telling people the elevation of the area they live in so they know the flood risks in their neighborhood                                                                     |
| Waterproof houses and cars.                                                                                                                                                  |
| We can raise the level of elevations                                                                                                                                         |
| Yes and stop using water and wasting & 9                                                                                                                                     |

Table 75. Write-in responses for survey feedback (question 23)

| <b>Question 23 - Was there any part of the survey you were confused about, or anything about flooding and sea level rise that the survey did not address but should have? (If none, select N/A)</b> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A bit on categorizing flood situations                                                                                                                                                              |
| A visual of a flood map might have helped some. I wasn't quite sure in the open-ended questions whether you wanted me to number it or not.                                                          |
| Areas not near rivers or the ocean but are near reservoirs                                                                                                                                          |
| Electing candidates who use science based policies regarding climate change                                                                                                                         |
| Every question contained the phrase sea level rising                                                                                                                                                |
| Everything worked quite well, thanks!                                                                                                                                                               |
| Fail flooding                                                                                                                                                                                       |
| I am not very actively involved in the community that I was thinking about so it was difficult to answer some of the questions                                                                      |
| I believe I understood the survey and questions.                                                                                                                                                    |
| I feel that someone who isn't as informed with the ways of preventing flooding will have a bit of a hard time knowing what procedures would help their communities.                                 |
| I have to say I thoroughly enjoyed this survey, specifically the topic.                                                                                                                             |
| I LIVE IN A TOURIST TOWN.....THE ECONOMY IS DRIVEN BY THE GULF.....TOWNSFOLK JUST DEAL WITH THE FLOODING....                                                                                        |
| I put my first set of responses in the wrong order. Stop development should be a 5.                                                                                                                 |
| I think there was very good coverage of the entire idea.                                                                                                                                            |
| I was a little unsure if the phrasing of the question indicated how much of a priority the choices already were in my community, or how much i thought they SHOULD be.                              |
| I was flooded in 2010 in RI and lost everything. FEMA was useless. I had only rental insurance. Now I have flood insurance.!!!!                                                                     |
| I wasn't sure about the 1-5                                                                                                                                                                         |
| It was a given in this instrument that sea level rise is coming. Not all of us agree with this premise for the near future.                                                                         |
| It was fun                                                                                                                                                                                          |
| It's an issue that really needs to stop being politicized, actionable plans need to be implemented quickly.                                                                                         |
| My hometown is 25 miles inland from the ocean, so the only concern would be flooding from extremely heavy rains                                                                                     |
| N/A                                                                                                                                                                                                 |
| NA                                                                                                                                                                                                  |
| NA                                                                                                                                                                                                  |
| NA                                                                                                                                                                                                  |
| NA                                                                                                                                                                                                  |
| No                                                                                                                                                                                                  |
| No                                                                                                                                                                                                  |
| No                                                                                                                                                                                                  |
| No                                                                                                                                                                                                  |
| No                                                                                                                                                                                                  |



|                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Question 23 - Was there any part of the survey you were confused about, or anything about flooding and sea level rise that the survey did not address but should have? (If none, select N/A)</b>                                                                                                                                         |
| No                                                                                                                                                                                                                                                                                                                                          |
| No                                                                                                                                                                                                                                                                                                                                          |
| NO                                                                                                                                                                                                                                                                                                                                          |
| No                                                                                                                                                                                                                                                                                                                                          |
| No                                                                                                                                                                                                                                                                                                                                          |
| No                                                                                                                                                                                                                                                                                                                                          |
| No everything was good                                                                                                                                                                                                                                                                                                                      |
| No everything was perfect                                                                                                                                                                                                                                                                                                                   |
| No it was easy to answer                                                                                                                                                                                                                                                                                                                    |
| No its was every good survey I believe people will enjoy it                                                                                                                                                                                                                                                                                 |
| No none at all.                                                                                                                                                                                                                                                                                                                             |
| No not at all was very good                                                                                                                                                                                                                                                                                                                 |
| No quite comprehensive but unhelpful. The EPA is emasculated and the government has abrogated it's responsibility                                                                                                                                                                                                                           |
| No was a great informative survey. Thanks                                                                                                                                                                                                                                                                                                   |
| No, it was a good survey.                                                                                                                                                                                                                                                                                                                   |
| No, thanks                                                                                                                                                                                                                                                                                                                                  |
| No, the survey was really well done and easy to answer. It's just that my particular community is away from the coast so the only time there's ever a problem with water is when there's been a lot of rain and the roads crack and the ditches rise because leaves are blocking the pipes.                                                 |
| No. I enjoyed it.                                                                                                                                                                                                                                                                                                                           |
| None                                                                                                                                                                                                                                                                                                                                        |
| NONE                                                                                                                                                                                                                                                                                                                                        |
| None thank you                                                                                                                                                                                                                                                                                                                              |
| None, but survey was very interesting and needed a great amount of concentration in order to understand the exact questions.                                                                                                                                                                                                                |
| None. Great survey with wonderfully formatted questions and selections.                                                                                                                                                                                                                                                                     |
| Nope                                                                                                                                                                                                                                                                                                                                        |
| Not at all, simple                                                                                                                                                                                                                                                                                                                          |
| Nothing I was confused about.                                                                                                                                                                                                                                                                                                               |
| Nothing was confusing.                                                                                                                                                                                                                                                                                                                      |
| One of the questions I did not understand                                                                                                                                                                                                                                                                                                   |
| Some question could have been worded more simply.                                                                                                                                                                                                                                                                                           |
| The employment question needs an option for people who aren't currently employed but aren't retired                                                                                                                                                                                                                                         |
| The safety of schools and hospitals. As well as the importance of people's animals to them. A lot of people will stay in dangerous homes because they cannot bring their pets with them to shelters during floods. Also, it would have been nice had there been more connection between SLR and Climate Change, as they are so intertwined. |

|                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Question 23 - Was there any part of the survey you were confused about, or anything about flooding and sea level rise that the survey did not address but should have? (If none, select N/A)</b>                                                                                                                                                                       |
| The section that looked like this and just asked to rate other ideas that might help, this was confusing because how do you rate your own idea                                                                                                                                                                                                                            |
| The survey was not at all confusing.                                                                                                                                                                                                                                                                                                                                      |
| The survey was very well worded!                                                                                                                                                                                                                                                                                                                                          |
| There was nothing I was confused about. My very strong feeling is that if people stop building on wetlands and very low lying areas, a lot of the problems we have experience in recent years will stop. Climate change will always be with us in one direction or another, and sea levels will rise and fall, so people should learn to build in less flood prone areas. |
| This needs to be in a local brochure for awareness. Many new residents come here with no understanding on sea level rise.                                                                                                                                                                                                                                                 |
| This was a good and thoughtful survey.                                                                                                                                                                                                                                                                                                                                    |
| Very good topic!!!                                                                                                                                                                                                                                                                                                                                                        |
| Very interesting selection of options for these questions!                                                                                                                                                                                                                                                                                                                |
| Was not confused about anything, was interesting and different                                                                                                                                                                                                                                                                                                            |
| You pretty much addressed all of my concerns and ideas regarding the rising sea level.                                                                                                                                                                                                                                                                                    |

## **APPENDIX C: PUBLIC OFFICIALS INTERVIEW MATERIALS**

This appendix contains supplemental materials for the public officials interviews, including compliance information. Additional details are also included, including a copy of the full interview instrument and full notes from each interview. This information is summarized, but not provided in full, in Chapter Five: Public Officials Interviews.

The George Mason University Institutional Review Board reviewed this project and provided the author with a “determination of exempt status” for under exemption category #2 on June 19, 2018. The study number was IRBNet 1257013-1. All respondents were presented with a paper copy of the IRB approved consent form and were also provided with a verbal summary of its contents before being asked to consent with proceeding with the interview. The approval letter is shown in Figure 25, the consent form in Figure 26 (page 1) and Figure 27 (page 2), and the recruitment letter in Figure 28.



Office of Research Development, Integrity, and Assurance

Research Hall, 4400 University Drive, MS 6D5, Fairfax, Virginia 22030  
Phone: 703-993-5445; Fax: 703-993-9590

DATE: June 19, 2018

TO: Robert Jonas, Ph.D.  
FROM: George Mason University IRB

Project Title: [1257013-1] Local public officials perspectives on community-based sea level rise planning

SUBMISSION TYPE: New Project

ACTION: DETERMINATION OF EXEMPT STATUS  
DECISION DATE: June 19, 2018

REVIEW CATEGORY: Exemption category #2

Thank you for your submission of New Project materials for this project. The Institutional Review Board (IRB) Office has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations.

Please remember that all research must be conducted as described in the submitted materials.

Please note that any revision to previously approved materials must be submitted to the IRB office prior to initiation. Please use the appropriate revision forms for this procedure.

If you have any questions, please contact Bess Dieffenbach at 703-993-5593 or [edieffen@gmu.edu](mailto:edieffen@gmu.edu). Please include your project title and reference number in all correspondence with this committee.

Please note that all research records must be retained for a minimum of five years, or as described in your submission, after the completion of the project.

Please note that department or other approvals may also be required to conduct your research.

GMU IRB Standard Operating Procedures can be found here: [http://oria.gmu.edu/1031-2/?\\_ga=1.12722615.1443740248.1411130601](http://oria.gmu.edu/1031-2/?_ga=1.12722615.1443740248.1411130601)

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within George Mason University IRB's records.

Figure 25. Public officials interviews approval letter

## **INFORMED CONSENT FORM**

### **RESEARCH PROCEDURES**

This research is being conducted to help identify and validate priorities in local sea level rise planning in coastal communities in the eastern United States and demonstrate the usefulness or lack of usefulness of priorities previously identified from a survey of members of the public. This survey is targeted to public officials with responsibility for sea level rise planning. If you agree to participate, you will be interviewed and asked to answer questions about your opinions on planning for sea level rise and flooding in your jurisdiction and shown information from past research and asked for your opinions. Unless you request them not to be collected (see “confidentiality” below), your jurisdiction and title will be associated with your responses, which means you could be identified from the results. The interview is expected to take 30 minutes or less to complete.

With your permission, the interview will be recorded to assure the accuracy of the results. After the data within the recording has been fully analyzed and the necessary data obtained, the recording itself will be deleted. The interview will not be recorded if you do not wish for it to be.

### **RISKS**

There are no foreseeable risks for participating in this research.

### **BENEFITS**

There are no benefits to you as a participant other than to further research in this subject. Your jurisdiction may benefit from advancement of the subject of sea level rise planning.

### **CONFIDENTIALITY**

Your job title and jurisdiction will be recorded in the survey results, unless you ask for them not to be, in which case a generic substitution will be made (for example, instead of using the format “Mayor of Chicago” the result would be recorded as “Public Official of Jurisdiction A”). It is possible that your answers to other questions within the survey could allow individuals to reasonably guess what jurisdiction is being discussed and/or what public official is providing the answers. While it is understood that no method of storing data can be perfectly secure, reasonable efforts will be made to protect the confidentiality of your information. The results of the study will be published.

### **PARTICIPATION**

Your participation is voluntary, and you may withdraw from the study at any time and for any reason. If you decide not to participate or if you withdraw from the study, there is no penalty or loss of benefits to which you are otherwise entitled. There are no costs to you or any other party. There is no compensation for participating in this study.

Figure 26. Public officials interviews consent form page 1

**CONTACT**

This research is being conducted by Adam Carpenter, a student at George Mason University in the Environmental Science and Policy department. He may be reached at 703-957-8823 for questions or to report a research-related problem, and his faculty advisor Dr. Robert Jonas can be reached at 703-993-1030. You may contact the George Mason University Institutional Review Board Office at 703-993-4121 if you have questions or comments regarding your rights as a participant in the research.

This research has been reviewed according to George Mason University procedures governing your participation in this research and has been assigned the study number 1257013-1.

**CONSENT**

I have read this form, all of my questions have been answered by the research staff, and by continuing with the interview, I agree to participate in this study.

Figure 27. Public officials interviews consent form page 2

**Email Outreach (if unable to reach by email, the potential participant will be called and this information provided by phone, with a printed follow-up if requested):**

Dear [Public Official's Name / Title, or assistant]:

My name is Adam Carpenter and I am a Ph.D. student at George Mason University in the Environmental Science and Policy department. I am researching community-based planning for sea level rise and flooding. I've also a frequent visitor to Long Beach Island for nearly ten years and hope to meet with you or another public official in your jurisdiction.

The research centers around finding what factors (items to include in a plan, how to resolve conflict, what adaptation options are acceptable, and others) are most important to coastal communities to make plans to prepare for future flooding and sea level rise under the assumption that the state and federal governments may provide some assistance, but that the lion's share of work will be on the local level.

I would like to request a short interview with the mayor or whomever is responsible for preparation for flooding and sea level rise, to discuss this research and gain valuable insights on whether the findings are or are not likely to be helpful to public officials. Should the mayor not be available, any other appropriate public official who would be available, such as a public works director, a council member, or a land use planning official who could talk in his or her official capacity about this issue would be great to talk to. I am making this same request for each jurisdiction on LBI.

In this short interview, I would like to discuss the following:

1. What actions, if any, has your jurisdiction taken to examine and prepare for future sea level rise? I'll ask a few questions about planned actions, funding sources, and perceived barriers to making progress, to help compare those results to a previous study conducted of coastal residents across the East Coast.
2. I'll provide some information from my research up to this point, and get any thoughts on how it may be (or may not be) useful for future planning efforts for flooding and sea level rise. That will help assess the overall approach.

I plan to be at LBI from June 30 through July 14, and could accommodate any time on any day (including both weekdays and weekends) during those times, anywhere on or near LBI. In order to make the best use of the interview, my preference would be to record it so I can create detailed notes after, but this would only be with permission. I will be able to provide more detailed information on this and the entire study before the interview.

If there are no dates within that time frame that work, I would also be happy to perform the interview by phone. Recognizing the possibility that emails can get lost, I will try calling in a few days if I do not receive any reply.

This study has been approved by George Mason University's Institutional Review Board (IRBNet number 1257013-1). I can be reached at 703-957-8823 or [acarp8@masonlive.gmu.edu](mailto:acarp8@masonlive.gmu.edu) and should you have any questions or concerns that I cannot address my faculty Advisor Dr. Robert Jonas can be reached at 703-993-1030. I greatly appreciate your willingness to consider participating in this research.

Sincerely,

Adam Carpenter  
703-957-8823  
Ph.D. Candidate in Environmental Policy  
George Mason University



Project Number: 1257013-1

**IRB: For Official Use Only**

Page 1 of 1

Figure 28. Public officials interviews recruitment letter

## **Interview Instrument**

The following contains the interview instrument used for this portion of the study. Note that the table numbers here are different than they appeared in the original (each table was labeled with the same number as their corresponding major finding) due to integration into this document. For brevity, page breaks between each section and other formatting adjustments have been made, meaning the original appeared slightly different. Additionally, at the time this component study was conducted, the public survey draft key findings were referred to as “major findings” on an interim basis. Therefore, they appear as such throughout the interview instrument and interview responses.

### **Public Officials Interview Questions and information, summer 2018 (IRBNet 1257013-1)**

**Adam T. Carpenter**

**George Mason University Ph.D. Candidate**

Date of Interview: \_\_\_\_\_

Jurisdiction of Interview: \_\_\_\_\_

Public Official's Title: \_\_\_\_\_

(If requested, a generic jurisdiction and title will be substituted here to reduce the chances of the public official being identified based on the study results)

### **Part 1 of 3: Summary of current state of sea level rise planning and barriers**

In this portion, the public officials being interviewed are asked to provide information about any current planning for sea level rise in their jurisdictions / geographic areas and to discuss some barriers to planning that they've seen to date.

1. What is your role in sea level rise planning in your area?
2. Can you describe any sea level rise planning that has taken place in your area in recent years, including the process used to develop it? If little or none, elaborate on



why not?

3. How vulnerable would you say your area is to flooding and future sea level rise?

(1) Not at all (2) somewhat (3) vulnerable (4) highly (5) exceptionally

4. How complete is the sea level rise plan for your area? (1-5, 1 being no plan, 5 being an advanced SLR plan)

(1) No SLR plan (2) Minimal SLR plan (3) Partial SLR plan (4) Full SLR plan (5) Advanced SLR plan

5. What barriers have you encountered in sea level rise planning to date?

6. How important are the following issues on a scale of 1-5 (1 being not at all important and 5 being exceptionally important)?

- Protecting the environment \_\_\_\_\_
- Maintaining roads and other transportation infrastructure \_\_\_\_\_
- Maintaining utilities and related infrastructure \_\_\_\_\_
- Growing the economy \_\_\_\_\_
- Protecting against future flooding \_\_\_\_\_
- Protecting property from natural disasters \_\_\_\_\_
- Helping people with limited resources \_\_\_\_\_
- Reducing taxes \_\_\_\_\_
- Preparing for sea level rise \_\_\_\_\_
- Preparing for climate change \_\_\_\_\_

## Part 2 of 3: Review of Major Findings

Please review the following findings and answer the following questions. These are derived from a 503-person survey of individuals who live in, work in, and/or frequently visit coastal communities on the East Coast of the United States.

In this survey, respondents were asked questions about several concepts surrounding planning for sea level rise and flooding. On the following pages, the most relevant information from this survey is summarized, specifically six major findings. For each finding, there is a description of the finding, additional supporting information, and four questions, two which ask for a ranking of 1-5 (with 5 being best and 1 being worst) and two which are open-ended.

**Major Finding 1 on Relative Priority: Officials are likely to better gain engagement with the public if they make a strong connection between planning for sea level rise to other high priority issues like the environment, infrastructure/utilities, and the economy.**

**Additional information:** Respondents rated preparing for sea level rise as 9<sup>th</sup> out of 10 major issues, but ranked protecting the environment, maintaining transportation infrastructure, maintaining utilities, and growing the economy as their top four issues, as shown in the table below:

Table 76. Key issues ranked by mean score (n = 503)

| Mean | Median | Mode | Standard Deviation | Issue                                                     |
|------|--------|------|--------------------|-----------------------------------------------------------|
| 4.04 | 4      | 5    | 1.255              | Protecting the environment                                |
| 4.04 | 4      | 5    | 1.220              | Maintaining roads and other transportation infrastructure |
| 4.01 | 4      | 5    | 1.200              | Maintaining utilities and related infrastructure          |
| 4.00 | 4      | 5    | 1.198              | Growing the economy                                       |
| 3.99 | 4      | 5    | 1.248              | Protecting against future flooding                        |
| 3.99 | 4      | 5    | 1.242              | Protecting property from natural disasters                |
| 3.90 | 4      | 5    | 1.226              | Helping people with limited resources                     |
| 3.77 | 4      | 5    | 1.255              | Reducing taxes                                            |
| 3.68 | 4      | 4    | 1.274              | Preparing for sea level rise                              |
| 3.68 | 4      | 5    | 1.302              | Preparing for climate change                              |

Additionally, gender impacts the most response distributions (5 of 10), followed by level of education (3 of 10). Assuring diversity in these (as well as other) demographics may be essential to assure solid planning.

7. I believe Major Finding 1 *is appropriate* for sea level rise planning in my area?

(1) Strongly Disagree (2) Disagree (3) Neither Agree nor Disagree (4) Agree (5) Strongly Agree

8. I believe Major Finding 1 *would help improve* sea level rise planning in my area?

(1) Strongly Disagree (2) Disagree (3) Neither Agree nor Disagree (4) Agree (5) Strongly Agree

9. Please describe any way(s) in which Major Finding 1 would likely impact planning in my area:

10. Please feel free to make any other comments and/or elaborate on your previous responses:

**Major Finding 2 on Planning Components: Officials should consider building sea level rise plans that integrate response planning and preparedness with mandatory policies to reduce future damage. Maps and tools, educational resources, and voluntary protections were also popular, but inaction to wait for more research was not popular.**

**Additional information:** In the 503-person survey, respondents were asked to rate the importance of various components that could be part of a sea level rise plan. Although most of the responses generally ranked high (all but one had a mean above 3.8 on a scale of 1-5 and a mean and mode of at least 4), the distribution of responses is shown in the table below. The most influential demographics in this question were gender (influencing the distribution of 6 of 8 response distributions) and the reported level of environmentalism (influencing 3 of 8 response distributions).

Table 77. Planning components ranked by mean (n = 503)

| Mean | Median | Mode | Standard Deviation | Component                                                                               |
|------|--------|------|--------------------|-----------------------------------------------------------------------------------------|
| 4.11 | 5      | 5    | 1.192              | Preparing to respond and/or evacuate when flooding happens                              |
| 3.98 | 4      | 5    | 1.171              | Implementing required policies to reduce future flood damage                            |
| 3.96 | 4      | 5    | 1.132              | Developing maps and tools to learn where flooding will and won't likely cause damage    |
| 3.88 | 4      | 5    | 1.209              | Educating the community on the causes of flooding and sea level rise                    |
| 3.87 | 4      | 5    | 1.247              | Building physical barriers (sea walls, levies, dunes, etc.) to protect against flooding |
| 3.85 | 4      | 5    | 1.182              | Calculating the most cost-effective places and things to protect                        |
| 3.82 | 4      | 4    | 1.123              | Working in the community to implement voluntary protections                             |
| 3.27 | 3      | 3    | 1.262              | Finding ways to postpone making changes until more research is done                     |

11. I believe Major Finding 2 *is appropriate* for sea level rise planning in my area.

(1) Strongly Disagree (2) Disagree (3) Neither Agree nor Disagree (4) Agree (5) Strongly Agree

12. I believe Major Finding 2 *would help improve* sea level rise planning in my area.

(1) Strongly Disagree (2) Disagree (3) Neither Agree nor Disagree (4) Agree (5) Strongly Agree

13. Please describe any way(s) in which Major Finding 2 would likely impact planning in my area:

14. Please feel free to make any other comments and/or elaborate on your previous responses:

**Major Finding 3 on Protection Priorities: Officials should consider the protection of essential utility and transportation services as some of the highest priorities for protection in sea level rise plans. Residents also rate the protection of individual homes and of government facilities very highly.**

**Additional information:** 503 respondents were given numerous potential priorities for protection against damage from flooding and sea level rise to rank in importance on a scale of 1 to 5. Among those options were utilities, beaches, residences, and others, as shown in the table below. Respondents were also given the chance to write-in other priorities, with the two most common write-ins being schools and medical facilities. The most important demographic in influencing protection priorities was reported level of environmentalism, changing the distribution of 9 of 15 categories.

Table 78. Protection priorities ranked by mean (n = 503)

| Mean | Median | Mode | Std. Dev. | Priority for Protection               |
|------|--------|------|-----------|---------------------------------------|
| 4.30 | 5      | 5    | 0.994     | Drinking water                        |
| 4.23 | 5      | 5    | 0.957     | Electric power                        |
| 4.07 | 4      | 4    | 0.899     | Roads and highways                    |
| 4.07 | 4      | 5    | 1.020     | Homes and residences                  |
| 3.97 | 4      | 5    | 1.085     | Sewer / wastewater                    |
| 3.90 | 4      | 5    | 1.042     | Government facilities                 |
| 3.85 | 4      | 4    | 1.089     | Natural gas / heating fuel            |
| 3.75 | 4      | 4    | 1.120     | Beaches and similar coastal amenities |
| 3.71 | 4      | 4    | 1.192     | Natural wetlands, wildlife areas      |
| 3.69 | 4      | 4    | 1.036     | Stormwater and green infrastructure   |
| 3.67 | 4      | 4    | 1.059     | Businesses, offices, shops            |
| 3.62 | 4      | 4    | 1.180     | Public transit                        |
| 3.47 | 4      | 3    | 1.076     | Places of cultural importance         |
| 3.43 | 3      | 3    | 1.120     | Parks and public spaces               |
| 3.31 | 3      | 3    | 1.254     | Houses of worship                     |

15. I believe Major Finding 3 is *appropriate* for sea level rise planning in my area.

(1) Strongly Disagree (2) Disagree (3) Neither Agree nor Disagree (4) Agree (5) Strongly Agree

16. I believe Major Finding 3 *would help improve* sea level rise planning in my area.

(1) Strongly Disagree (2) Disagree (3) Neither Agree nor Disagree (4) Agree (5) Strongly Agree

17. Please describe any way(s) in which Major Finding 3 would likely impact planning in my area:

18. Please feel free to make any other comments and/or elaborate on your previous responses:

**Major Finding 4 on Funding Priorities: Funding may be one of the largest challenges of sea level rise planning. Officials should consider public meetings to discuss how to pay for priorities, should use state and federal funds when available, and should work with the insurance industry on risk reduction measures. Officials should avoid cutting other programs and should proceed cautiously with taxes.**

**Additional information:** 503 eastern coastal residents were asked about how to decide how much to spend on sea level rise planning (and implementation of those plans). This question did not try to address how much should be spent, since that will vary by community. The most influential demographics were the reported level of environmentalism (influenced 9 of 10 responses) and age (influenced 6 of 10 responses):

Table 79. Funding methodologies ranked by mean (n = 503)

| Mean | Median | Mode         | Standard Deviation | Funding Methodology                                                                                                   |
|------|--------|--------------|--------------------|-----------------------------------------------------------------------------------------------------------------------|
| 3.64 | 4      | 4            | 1.101              | Hold public meetings to identify highest priorities and vote on methods to pay for them                               |
| 3.56 | 4      | 4            | 1.088              | Minimize the use of local taxes but utilize state/federal money when available                                        |
| 3.41 | 3      | 3 & 4 (Tied) | 1.167              | Encourage insurance companies to require upgrades on homes/businesses to reduce risks as a condition of insurance     |
| 3.27 | 3      | 4            | 1.211              | Set policies to encourage individuals / businesses to pay for their own protection to minimize local government costs |
| 3.05 | 3      | 3            | 1.216              | Increase funding by raising local fees for beaches and other amenities                                                |

| Mean | Median | Mode | Standard Deviation | Funding Methodology                                                          |
|------|--------|------|--------------------|------------------------------------------------------------------------------|
| 2.96 | 3      | 3    | 1.297              | Use only money already used for protection (no change)                       |
| 2.83 | 3      | 3    | 1.256              | Increase funding by raising local sales taxes                                |
| 2.76 | 3      | 2    | 1.290              | Increase funding by raising local property taxes                             |
| 2.69 | 3      | 3    | 1.294              | Increase funding by raising local income taxes                               |
| 2.62 | 3      | 1    | 1.396              | Increase funding for protection by cutting other local programs and services |

19. I believe Major Finding 4 *is appropriate* for sea level rise planning in my area.

(1) Strongly Disagree (2) Disagree (3) Neither Agree nor Disagree (4) Agree (5) Strongly Agree

20. I believe Major Finding 4 *would help improve* sea level rise planning in my area

(1) Strongly Disagree (2) Disagree (3) Neither Agree nor Disagree (4) Agree (5) Strongly Agree

21. Please describe any way(s) in which Major Finding 4 would likely impact planning in my area:

22. Please feel free to make any other comments and/or elaborate on your previous responses:

**Major Finding 5 on Conflict Resolution: To help prevent and resolve conflict, officials should consider bringing in both preparedness experts and scientists familiar with flooding and sea level rise to talk with the community, and use the media to help educate the community about this issue. Avoid making adaptation measures optional to avoid conflict.**

**Additional information:** Overwhelmingly, the most influential demographic in this question is the self-reported level of environmentalism, influencing all eight answers. Every other demographic influenced either one or zero answers.

Table 80. Conflict resolution options ranked by mean (n = 503)

| Mean | Median | Mode | Std. Dev. | Conflict Resolution Methodology                                                   |
|------|--------|------|-----------|-----------------------------------------------------------------------------------|
| 3.85 | 4      | 4    | 1.044     | Discuss with preparedness experts about ways to improve protection against floods |

| Mean | Median | Mode | Std. Dev. | Conflict Resolution Methodology                                                        |
|------|--------|------|-----------|----------------------------------------------------------------------------------------|
| 3.80 | 4      | 5    | 1.107     | Discuss with scientists about the chances and locations of future flooding             |
| 3.80 | 4      | 4    | 1.082     | Increase educational efforts through the media about the risks and impacts of flooding |
| 3.75 | 4      | 4    | 1.044     | Start with measures that have the greatest public support                              |
| 3.70 | 4      | 4    | 1.012     | Perform cost and benefit analysis on various ways to move forward                      |
| 3.61 | 4      | 4    | 1.083     | Hold public meetings to identify ways to resolve conflicts                             |
| 3.47 | 4      | 4    | 1.132     | Hold votes on options to resolve disputes                                              |
| 3.34 | 3      | 3    | 1.200     | Make some measures optional for individual homes and businesses                        |

23. I believe Major Finding 5 *is appropriate* to sea level rise planning in my area.

(1) Strongly Disagree (2) Disagree (3) Neither Agree nor Disagree (4) Agree (5) Strongly Agree

24. I believe Major Finding 5 *would help improve* sea level rise planning in my area.

(1) Strongly Disagree (2) Disagree (3) Neither Agree nor Disagree (4) Agree (5) Strongly Agree

25. Please describe any way(s) in which Major Finding 5 would likely impact planning in my area:

26. Please feel free to make any other comments and/or elaborate on your previous responses:

**Major Finding 6 on adaptation responses: Public officials should consider a variety of adaptation responses. Early warning systems, natural and artificial barriers, and hardening infrastructure are among the items respondents generally found to be appropriate. Even some potentially controversial adaptations, such as preventing new development in vulnerable areas were generally viewed as appropriate. Officials should avoid cutting off assistance from high risk areas**

**Additional information:** Respondents were asked to rate the appropriateness of ten different adaptation responses on a scale of 1 (very inappropriate) to 5 (very appropriate), where a 3 is neither appropriate nor inappropriate. The most influential demographic is

what funding mixture the respondent preferred (public versus private), influencing 7 of 10 questions, followed by gender (6 of 10).

Table 81. Appropriateness of adaptation responses ranked by mean (n = 503)

| Mean | Median | Mode | Std.<br>Dev. | Response for Gauging Appropriateness                                                |
|------|--------|------|--------------|-------------------------------------------------------------------------------------|
| 4.20 | 4      | 5    | 0.943        | Develop and enhance early warning systems to notify residents about upcoming floods |
| 4.17 | 4      | 5    | 0.937        | Develop and enhance natural physical barriers (such as wetlands or sand dunes)      |
| 4.13 | 4      | 5    | 0.896        | Harden public infrastructure (roads, utilities, etc.) against damage                |
| 4.07 | 4      | 4    | 0.967        | Develop and enhance man-made physical barriers (sea walls, levies, etc.)            |
| 4.07 | 4      | 5    | 0.970        | Require new structures to be built at higher elevations                             |
| 4.00 | 4      | 5    | 1.091        | Prevent new development on the most vulnerable areas                                |
| 3.73 | 4      | 4    | 1.025        | Raise the elevation of existing structures                                          |
| 3.50 | 4      | 4    | 1.182        | Remove existing development from the most vulnerable areas over time                |
| 3.42 | 3      | 3    | 1.183        | Increase cost of insuring high-risk areas                                           |
| 2.52 | 2      | 1    | 1.419        | Don't provide assistance for areas at highest risk                                  |

27. I believe Major Finding 6 *is appropriate* to sea level rise planning in my area.

(1) Strongly Disagree (2) Disagree (3) Neither Agree nor Disagree (4) Agree (5) Strongly Agree

28. I believe Major Finding 6 *would help improve* sea level rise planning in my area.

(1) Strongly Disagree (2) Disagree (3) Neither Agree nor Disagree (4) Agree (5) Strongly Agree

29. Please describe any way(s) in which Major Finding 6 would likely impact planning in my area:

30. Please feel free to make any other comments and/or elaborate on your previous responses:



### **Part 3 of 3: Impact of the study's information**

In this portion, please elaborate on the following questions, based upon the major findings just reviewed.

31. The major findings from this study are *informative* about public perceptions of sea level rise planning

(1) Strongly Disagree (2) Disagree (3) Neither Agree nor Disagree (4) Agree (5) Strongly Agree

32. The major findings from this study will help my area improve its processes around planning for sea level rise

(1) Strongly Disagree (2) Disagree (3) Neither Agree nor Disagree (4) Agree (5) Strongly Agree

33. These findings will help me advance planning for sea level rise

(1) Strongly Disagree (2) Disagree (3) Neither Agree nor Disagree (4) Agree (5) Strongly Agree

34. What additional information from this study do you think would be necessary to make it more useful?

35. Please elaborate on any ways information from this study is likely to (or not likely to) alter sea level rise planning in your area.

### **Interview Responses**

The following contains the interview responses from the six completed interviews. The questions responses have been condensed from their original formatting (see above for the full questions) but do contain the full text documented from each interview. These are not transcripts, but rather the key points that each public official emphasized. The interviews are presented in the order in which they were conducted.

#### **Interview 1: Councilman of Surf City, NJ on 07/02/2018**

#### **Part 1 of 3: Summary of current state of sea level rise planning and barriers**

1. Role in SLR planning:

As a councilman, he is responsible for the following activities: beach replenishment, environmental & public issues committee, the fair captain, and member of the land use board, all of which are related. The biggest component that he is not involved in impacted by this issue is with streets and roads.

2. Planning to date:

There are several projects underway that should help reduce flooding. Most specifically, the U.S. Army Corps of Engineers “Coastal Storm Damage Reduction Project,” which includes oceanside sand dunes (but also other activities). USACE is funded by and runs through Congress, meaning that although Surf City is involved, the Corps does most of the activity. Surf City was the only Long Beach Island jurisdiction to have completed installation before Superstorm Sandy in 2012 (except for a few blocks where much of the city’s damage was).

Right now, the Corps is conducting a 3 year study on what could/should be done on the bayside. Surf City has noticed increasing repetitive flooding due to recurring high tides and with major rainstorms. Some of this may be due to sea level rise, some to increased storm intensity, and some due to an enormous amount of sand that was washed from the ocean side of the island to the bayside of the island during Sandy.

Surf City also participated in the “Getting to Resilience” study with Jacques Cousteau and other partners.

Finally, during repaving and reconstruction recently of several roads, they were raised (and the storm drains were raised) by several inches to decrease flooding. As funds are available, the city intends to continue this on additional roads in the future.

3. How vulnerable: (5) exceptionally.

Comment: Virtually all of Surf City is within a few feet of sea level, and much of it is at or below.

4. SLR Plan status: (3) Partial SLR plan.

Comment: Although many actions have taken place, there is no comprehensive plan within the jurisdiction for what could/should be done next, nor a specific process for getting to such a plan.

5. Barriers to SLR planning:

Bureaucratic. For example, certain responsibilities have recently changed from the state’s Department of Environmental Protection to the state’s Department of Transportation.

The associated costs / funding for implementing fixes and taking proactive actions, especially if needs of the area are not the same as what the funders are looking to fund. For example, the federal agencies tend to be interested almost exclusively in very large projects.

6. Importance of issues:

|                                                             |   |
|-------------------------------------------------------------|---|
| - Protecting the environment                                | 4 |
| - Maintaining roads and other transportation infrastructure | 5 |
| - Maintaining utilities and related infrastructure          | 5 |
| - Growing the economy                                       | 5 |
| - Protecting against future flooding                        | 4 |
| - Protecting property from natural disasters                | 5 |
| - Helping people with limited resources                     | 3 |
| - Reducing taxes                                            | 5 |
| - Preparing for sea level rise                              | 3 |
| - Preparing for climate change                              | 2 |

**Part 2 of 3: Review of Major Findings**

Major Finding 1: Relative Priority

7. Appropriateness: (5) Strongly Agree

8. Would help planning: (4) Agree

9. Ways may impact planning:

A lot of this activity is already being done. For example, where maintaining transportation infrastructure is incorporated with planning for flooding by raising the road and the storm drain by several inches.

10. Other comments: These findings seem pretty straightforward.

Major Finding 2: Planning Components

11. Appropriateness: (5) Strongly Agree

12. Would help planning: (3) Neither Agree nor Disagree

Comment: It would not change much because much of it is already being done.

13. Ways may impact planning:

Much of this finding would be continued as part of ongoing processes, such as the community's flood insurance rating.

14. Other comments:

Many residents have expressed a similar concern with the length of the USACE Bay study and would like to start taking action now.

### Major Finding 3: Protection Priorities

15. Appropriateness: (5) Strongly Agree

16. Would help planning: (3) Neither Agree nor Disagree

Comment: already largely doing these items.

17. Ways may impact planning:

It is not likely to change much, but only because already prioritizing these items.

18. Other comments:

The importance of utilities was very clear during the aftermath of Sandy, where water and wastewater were in service for most of the time, but gas and electric were offline in most places for several weeks.

### Major Finding 4: Funding Priorities

19. Appropriateness: (4) Agree

20. Would help planning: (4) Agree

21. Ways may impact planning:

Currently pursuing state and federal funding to the greatest extent possible, and using local taxes in a minimal way. They have used local funding as they have received grants to complement it, for example. These findings are largely in line with current practice.

22. Other comments:

Although possibly not in the same manner that the survey respondents thought, the National Flood Insurance Program drives many of the mitigation measures already through their policies.

### Major Finding 5: Conflict Resolution

23. Appropriateness: (3) Neither Agree nor Disagree

Comment: Experts on both preparedness and climate come to town and give lectures, etc. Adding more would not necessarily add anything to the discussion.

24. Would help planning: (3) Neither Agree nor Disagree)

25. Ways may impact planning:

First, measures (such as new construction elevations) are already mandatory. One controversial item was adjusting the maximum height so that an elevated house could not be taller overall than the non-elevated ones. Given the seasonal economy (which is only a few months each year) many who could benefit from education or experts will not be here more than a few weeks. Census puts the population at 1,100, but a more common

summer population is 8,900, with at least 28,000 people cycling through during the year. Newer owners often are unaware of the challenges and are hard to reach.

26. Other comments: See the previous question.

**Major Finding 6: Adaptation Responses**

27. Appropriateness: (5) Strongly Agree

28. Would help planning: (3) Neither Agree nor Disagree

29. Ways may impact planning:

Probably very little, because these priorities are largely what is already done in this area.

30. Other comments:

Early warning is especially important in this area, because until 2020 there is only one way off the island, and after 2020, there will be two adjacent bridges (more capacity) but evacuation could still take quite a while.

**Part 3 of 3: Impact of the study's information**

31. Findings informative: (4) Agree

32. Findings help processes: (4) Agree

33. Findings advance SLR planning: (3) Neither Agree nor Disagree

34. Additional useful information:

Would need to know more about the perception of all the major funders, such as what do they think about these findings and how would they influence what they are willing to help pay for?

35. Additional info on planning impacts:

With regard to sea level rise science itself, a more thorough understanding on consensus on what to plan for. This is especially important given the attention that outliers are likely to get in the media.

**Interview 2: Mayor (1) and Councilman (2) of Beach Haven, NJ on 07/05/2018**

**Part 1 of 3: Summary of current state of sea level rise planning and barriers**

1. Role in SLR planning:

Councilman: Investigated what other communities, both on island and elsewhere, are doing about these issues. Looked into research taking place at Rutgers and several other colleges in the area.

Mayor: A former professor who works with other jurisdictions, hired Stockton University to piggyback on a study underway for Long Beach Township to better understand flooding and SLR issues in this area.

2. Planning to date:

There has definitely been a rise in sea level already, although many people do not want to believe it. Additionally, the area is seeing more Nor'easters. This is largely an education issue with some other public officials. In the town's new master plan, currently looking to reduce impervious surface area allowed to a maximum of 65% of any lot, plus encouraging permeable pavers. However, this mostly addresses storms rather than sea level rise.

One of the efforts has been to try to get more attention to the boulevard (the main road across the island), which is managed not by the municipalities but by Ocean County. The freeholders (the county representatives) generally understand the issues, but need more data to participate in grants, etc. Trying to follow the lead of Ocean City and elsewhere.

Additionally, Beach Haven has seen a rise in level of the bay, making storm drains less effective, and sometimes completely ineffective. Currently, there is a plan to add backflow prevention to some storm drains and then pump the water over bulkheads. This would help to address nuisance flooding and adapt to the higher bay levels seen. At least some portion of the main roads have been shut down at least 40 times since Superstorm Sandy in neighboring Long Beach Township, which has impacted Beach Haven.

22 ft (6.7 m) dunes installed by the Army Corps of Engineers will help for the next storm surge.

Has met with other towns to discuss these issues. Currently, are concerned about the four year bayside study underway by USACE because of the lack of involvement by the municipalities.

A positive recent development is that the state department of environmental protection (DEP) has made it easier to clean out storm drains without as much permitting and other requirements, allowing for faster response.

3. How vulnerable: (4) Highly

4. SLR Plan status: (3) Partial SLR plan

5. Barriers to SLR planning:

Funding / money has been the largest barrier. There is currently a major priority to get capital investment for the storm drain upgrades.

6. Importance of issues:

- |                                                             |   |
|-------------------------------------------------------------|---|
| - Protecting the environment                                | 5 |
| - Maintaining roads and other transportation infrastructure | 4 |
| - Maintaining utilities and related infrastructure          | 5 |
| - Growing the economy                                       | 3 |
| - Protecting against future flooding                        | 5 |
| - Protecting property from natural disasters                | 4 |
| - Helping people with limited resources                     | 4 |
| - Reducing taxes                                            | 3 |
| - Preparing for sea level rise                              | 3 |
| - Preparing for climate change                              | 3 |

Comments on this question:

- Utilities: Storm drains are an especially strong portion of utilities.
- Protecting against flooding: Especially the boulevard and houses with repetitive flooding.
- Limited Resources: affordable housing is an important priority.
- Reducing taxes: The city has a good financial strategy / outcomes in recent years. The surplus has grown in recent years allowing for more self-funding. Therefore, managing taxes is important, but not necessarily reducing them.
- Sea level rise & climate change: Noted that they are a small municipality that cannot prepare for these global issues on its own. Need state/federal help to address issues of this scale.

## **Part 2 of 3: Review of Major Findings**

### **Major Finding 1: Relative Priority**

7. Appropriateness: (5) Strongly Agree

8. Would help planning: (5) Strongly Agree

9. Ways may impact planning:

Beach Haven is doing most of this now, recognizing the need. Before Sandy, did not do much planning in this regard, but much more since then. Education with the public has been a major issue. There are many questions on what can be done, both over the short-term and the long-term.

10. Other comments:

The town is very sensitive to issues like getting rid of single use bags and finding ways to connect various issues to each other. Need more education of the public as well as ordinances / capital plans.

Major Finding 2: Planning Components

11. Appropriateness: (5) Strongly Agree

12. Would help planning: (4) Agree

13. Ways may impact planning:

Beach Haven is already working with others on the island. This finding probably will not impact it, but it could help to accelerate it.

14. Other comments:

Currently, the town is finding that emergency vehicles and response is being impacted by flooding. They would like to find a higher place for vehicle storage, but have not found anything yet.

Major Finding 3: Protection Priorities

15. Appropriateness: (4) Agree

16. Would help planning: (4) Agree

17. Ways may impact planning:

This might help to accelerate planning and funding of projects.

18. Other comments:

Flooding of the boulevard is impacting businesses. They have to continually reinvest to stay open. Some business owners have flooding on a routine basis, many annually. In the fall, business owners often put out sandbags in front of entrances. Flooding is also impacting the ability to get to bayside homes.

Major Finding 4: Funding Priorities

19. Appropriateness: (3) Neither Agree nor Disagree

20. Would help planning: (2) Disagree

21. Ways may impact planning:

Federal and state funds are the only viable option for long-term impacts, but local resources make more sense for short-term items. This finding would probably not make much difference in this municipality.

22. Other comments:



The town has developed a surplus, and have found cost-cutting measures like encouraging businesses to run their own trash removal.

Major Finding 5: Conflict Resolution

23. Appropriateness: (5) Strongly Agree

24. Would help planning: (5) Strongly Agree

25. Ways may impact planning:

Educating the community is important, although it is not immediately clear what would change.

26. Other comments:

The town has brought groups in on similar issues, and there is interest in the community.

Major Finding 6: Adaptation Responses

27. Appropriateness: (5) Strongly Agree

28. Would help planning: (4) Agree

29. Ways may impact planning:

Currently trying to pass a “green acres” bill, which is on its third attempt, which could protect some land to help protect against flooding and prevent development of structures that would be highly vulnerable. However, a great deal of land that is already developed was thought to have been “undevelopable” but still managed to get permits from the state, etc. Higher building elevation requirements have already been put in place.

30. Other comments:

A lot of what is described above is already being done here.

**Part 3 of 3: Impact of the study’s information**

31. Findings informative: (4) Agree

32. Findings help processes: (4) Agree

33. Findings advance SLR planning: (4) Agree

34. Additional useful information:

Many studies are needed on the effectiveness of measures. Ocean City was much worse than the current situation in Beach Haven, and there have been many pessimistic articles.

Also, how were the respondents picked?

Information on how the respondents felt about EPA / other feds fulfilling their roles with regard to flooding and SLR would have been helpful.

35. Additional info on planning impacts:  
Beach Haven feels somewhat alone. It could help to have better connections across towns, states, etc. The feds are not doing much to help.

### **Interview 3: Mayor of Long Beach Township, NJ on 07/06/2018**

#### **Part 1 of 3: Summary of current state of sea level rise planning and barriers**

##### **1. Role in SLR planning:**

The mayor is also the head of emergency management, public safety, and building/zoning in Long Beach Township

##### **2. Planning to date:**

- The township passed an ordinance after Superstorm Sandy raising the bulkhead heights on the bayside, both for repairs and for new construction.
- Have increased new building elevations to those required by FEMA plus 1 foot, which is the new state standard.
- Sought funding to install four pumps to improve drainage from stormwater

##### **3. How vulnerable: (2) Somewhat**

Comment: Somewhat vulnerable for the next 10 years or so, but less clear further out. Already doing a lot that helps to address vulnerability or the current number would be higher.

##### **4. SLR Plan status: (4) Full SLR plan**

##### **5. Barriers to SLR planning:**

The state Department of Environmental Protection has been one of the biggest barriers. Serious issues with permitting including some that are “stupidity.” The state DEP does not acknowledge home rule.

##### **6. Importance of issues:**

- |                                                             |   |
|-------------------------------------------------------------|---|
| - Protecting the environment                                | 5 |
| - Maintaining roads and other transportation infrastructure | 5 |
| - Maintaining utilities and related infrastructure          | 5 |
| - Growing the economy                                       | 4 |
| - Protecting against future flooding                        | 5 |
| - Protecting property from natural disasters                | 5 |
| - Helping people with limited resources                     | 5 |

- Reducing taxes 4
- Preparing for sea level rise 4
- Preparing for climate change 4

## **Part 2 of 3: Review of Major Findings**

### **Major Finding 1: Relative Priority**

7. Appropriateness: (5) Strongly Agree
8. Would help planning: (3) Neither Agree nor Disagree
9. Ways may impact planning:

Yes, this would help in making sure that everyone is safe, and helping to protect the \$8.4 billion in building values within the township.

10. Other comments:

Nobody knows exactly what is currently happening with sea level rise and future flooding. No finding is gospel.

### **Major Finding 2: Planning Components**

11. Appropriateness: (5) Strongly Agree
12. Would help planning: (5) Strongly Agree

13. Ways may impact planning:

The main highway (Long Beach Boulevard) is county owned. The township is asking the county to raise it by 1 foot to decrease flooding. Stockton college is doing a storm water management plan, and one section of the road has already been raised.

14. Other comments:

Trying to prevent traffic diversions. If the boulevard is closed, need to direct traffic through side streets, which themselves can also become flooded. Have been keeping a record of the diversions and provided that information to both the county and the media.

### **Major Finding 3: Protection Priorities**

15. Appropriateness: (4) Agree
16. Would help planning: (5) Strongly Agree

17. Ways may impact planning:

Every town has its own problem areas. In this one, it is 15 miles to the closest hospital by ambulance, which is a big challenge because much of that distance could be flooded during a major event.

18. Other comments:

Utilities are “prime.” Have rebuilt two water plants in the township to withstand a 500-year flood.

Major Finding 4: Funding Priorities

19. Appropriateness: (2) Disagree

20. Would help planning: (2) Disagree

21. Ways may impact planning:

The largest thing is that private industry should set flood insurance rates rather than the National Flood Insurance Program. NFIP at present will not allow policyholders to set deductibles appropriately. For example, a flood policy may cost “X” at a \$1,000 deductible, but “half of X” at a \$10,000 deductible. Right now, NFIP does not let the policyholder decide what makes sense to them.

22. Other comments:

- Ultimately, local, state and federal funds all come from the same people. Why should someone in Nebraska pay for coastal flooding, or a coastal resident pay for tornadoes in Nebraska?
- The township is a strong believer in user fees / use taxes that are appropriate.
- FMEA / federal funds make sense for catastrophes, but local/state better for everything else.

Major Finding 5: Conflict Resolution

23. Appropriateness: (4) Agree

24. Would help planning: (3) Neither Agree nor Disagree

25. Ways may impact planning:

One problem is that we have not identified all the causes of flooding and sea level rise, and that each area has its own problems. There is also a lot of difficulty finding experts that have local knowledge, as they may know generally about an issue, but they do not know how it impacts this area. Additionally, we have the challenges of the fact that some land is sinking, regardless of the ocean. Finally, we have very fine sand that migrates and requires replenishment.

26. Other comments:

The biggest problem is education. There are about 9,000 properties in Long Beach Township, but a town meeting may only get eight participants. How do we inform them?

It is hard to get emails from people, and few of them read the newspaper. It is hard to get data to taxpayers.

**Major Finding 6: Adaptation Responses**

27. Appropriateness: (5) Strongly Agree

28. Would help planning: (5) Strongly Agree

29. Ways may impact planning:

One of the biggest problems is education. When changing ordinances, the public only pushes back when they do not like it. In many cases, will never get a consensus. Often you only get feedback when they have to make a change of some kind.

30. Other comments:

Would love to see a consensus on what is happening, and therefore what to do about it. Reading 100 different opinions is a challenge.

**Part 3 of 3: Impact of the study's information**

31. Findings informative: (5) Strongly Agree

32. Findings help processes: (4) Agree

33. Findings advance SLR planning: (4) Agree

34. Additional useful information:

A stronger scientific consensus on exactly what is expected to happen and where is needed. Need to include public officials on what to do about the various issues.

35. Additional info on planning impacts:

With all the data out there about flooding and sea level rise, why has no scientist ever called for the township's input, given the data they have on replenishment rates, frequency of flooding, etc. Where are the scientists getting their information from since they are not asking? There are 12 miles of beach in Long Beach Township, one of the longest in the state, but nobody has ever asked for their data. During the rebuild after Sandy, FEMA asked poor questions, and never asked for solutions (only told them). Many of DEP's processes do not take local considerations into account. Former Governor Christie's Barnegat Bay Initiative was put together without any input from the localities.

**Interview 4: Mayor of Harvey Cedars, NJ on 07/09/2018**

**Part 1 of 3: Summary of current state of sea level rise planning and barriers**

1. Role in SLR planning:

When there is a problem with flooding, works with commissions and the county and/or state (depending on the issue) and works on the town's master plan.

2. Planning to date:

Harvey Cedars was instrumental in the development of the beach dunes project by the Army Corps of Engineers. Recently, the challenge has been with back bay flooding. After Sandy, looking at where the high tides are, they have been raising elevations across the back bay. New and repaired bulkheads have to be at a 5-foot elevation to reduce flooding. Although Harvey Cedars is fortunate to be up higher than some other LBI communities, ultimately some portions of the island will need to be raised. Looking to raise the boulevard by 1 foot. Additionally, with each major renovation/rebuild of structures, the new elevation minimum is 20 inches above the crown of the road. Looking to set this to 20 inches above the desired elevation of the road, since the road will probably be raised by slightly different amounts until well into the future when it has been completely redone.

3. How vulnerable: (4) Highly

4. SLR Plan status: (4) Full SLR plan

Comment: Doing well, but there is always room for improvement

5. Barriers to SLR planning:

Pushback from owners/residents on the individual level is the most common barrier. Adaptations to reduce damage make sense until it is your property and you have to do something different or spend your money. There are also some property ends without bulkheads, raising another challenge. Finally, there is a conflict with the environmental community because some ends without bulkheads are used by turtles for nesting, so they are important environmentally but a risk to structures.

Finally, when not in a storm (or recovering from a recent storm) this issue seems to disappear from people's minds. Many owners do not even see the storms or the cleanup after because they are not present most of the time. There is a need for much more public advertisement and much more public involvement in other ways.

6. Importance of issues:

- |                                                             |   |
|-------------------------------------------------------------|---|
| - Protecting the environment                                | 4 |
| - Maintaining roads and other transportation infrastructure | 5 |
| - Maintaining utilities and related infrastructure          | 5 |
| - Growing the economy                                       | 4 |
| - Protecting against future flooding                        | 5 |
| - Protecting property from natural disasters                | 5 |
| - Helping people with limited resources                     | 4 |

- Reducing taxes 5
- Preparing for sea level rise 4
- Preparing for climate change 4

## **Part 2 of 3: Review of Major Findings**

### **Major Finding 1: Relative Priority**

7. Appropriateness: (4) Agree
8. Would help planning: (5) Strongly Agree

#### 9. Ways may impact planning:

Usually items are very separate, despite the idea of integrating them. Trying to tie everything together is a newer concept. There are also tradeoffs, sometimes it is a win-win, sometimes it is not and there are tradeoffs between different priorities.

Environmental people will not budge on many issues, which makes it difficult to have a common-sense conversation. Permitting issues are also a challenge, making it difficult to get to priorities. For example, challenges getting permission for dredging and in placing the dredge material.

#### 10. Other comments:

Common sense often does not play a role here. It is difficult to tie issues together when each is an established item and is singularly focused.

### **Major Finding 2: Planning Components**

11. Appropriateness: (5) Strongly Agree
12. Would help planning: (4) Agree

#### 13. Ways may impact planning:

Nothing beyond what we are already doing.

#### 14. Other comments: None

### **Major Finding 3: Protection Priorities**

15. Appropriateness: (5) Strongly Agree
16. Would help planning: (5) Strongly Agree

#### 17. Ways may impact planning:

Individuals are most concerned about their properties, we (the municipality) as to deal with everything else. Nothing would likely be different, but agree with the finding because it has helped up to this point.

18. Other comments:

Recently received a grant to raising the elevation of a water plant to the 500-year flood elevation.

Major Finding 4: Funding Priorities

19. Appropriateness: (5) Strongly Agree

20. Would help planning: (2) Disagree

21. Ways may impact planning:

This finding is discouraging. Why spend time on something that is not happening? What good is planning if you cannot execute it? State and federal funds will not always be available. Hopefully this comment will help to make planning more realistic.

22. Other comments:

Towns cannot afford everything. Plans can be great on paper, but are not always realistic to the available resources. Funding also tends to be too targeted, with many funding programs being too “cookie cutter” in their approach. The dunes, for example, do not need to be designed the same way for everyone. Right now, they are essentially the same from Cape May, NJ all the way to New York Harbor, including LBI.

Major Finding 5: Conflict Resolution

23. Appropriateness: (4) Agree

24. Would help planning: (4) Agree

25. Ways may impact planning:

Getting more people involved helps with ideas. It would likely help with implementation more than with planning.

26. Other comments: No additional comments

Major Finding 6: Adaptation Responses

27. Appropriateness: (4) Agree

28. Would help planning: (4) Agree

29. Ways may impact planning:

It might help make a wider general scope of planning

30. Other comments:



Social media and other communications / warning tools were used around Sandy and are ready for future incidents. When Sandy hit, people wanted to know more.

### **Part 3 of 3: Impact of the study's information**

31. Findings informative: (4) Agree

32. Findings help processes: (4) Agree

33. Findings advance SLR planning: (4) Agree

34. Additional useful information:

Where is the study going to go? What is going to come out of this? One challenge is since Sandy, there have been many more anomalies in flooding. More blow-out tides than before. Is it that we are seeing them more because we are paying closer attention, or are they actually happening more? There have also been many more road closures recently, are the channels closing up?

35. Additional info on planning impacts:

Nothing else specifically, but always worried about funding. Home rule is big in New Jersey. Need to get into bigger studies with the state and county, as those studies do not always take into account small community needs. Sometimes small towns do some odd things that are not accounted for in the studies.

### **Interview 5: Mayor of Barnegat Light, NJ on 07/09/2018**

#### **Part 1 of 3: Summary of current state of sea level rise planning and barriers**

1. Role in SLR planning:

LBI has a hazard mitigation plan, has held meetings with experts. Have plans for different categories of storms, and were part of the "barrier island assessment" and are part of an ongoing flooding study. However, a lot of this is "keeping fingers crossed" and addressing flooding as much as possible through local knowledge. Because Barnegat has the inlet/outlet, most flooding runs right out through it.

2. Planning to date:

Do not have a problem with flooding for the most part. Have been talking about raising height restrictions to allow minimum elevations of 12" above the crown of the road. Right now, the elevation requirements are off of the road in front of the house, but are considering changing it to 12" above the crown of the Boulevard, which is the highest part of the island in most places, and is about 6.6ft above sea level. However, these restrictions are likely to cause challenges with conflicts among neighbors.

3. How vulnerable: (2) Somewhat

4. SLR Plan status: (3) Partial SLR plan
5. Barriers to SLR planning:  
Nobody wants to change. If they are forced to change, they are unhappy.
6. Importance of issues:
 

|                                                             |   |
|-------------------------------------------------------------|---|
| - Protecting the environment                                | 2 |
| - Maintaining roads and other transportation infrastructure | 5 |
| - Maintaining utilities and related infrastructure          | 5 |
| - Growing the economy                                       | 4 |
| - Protecting against future flooding                        | 5 |
| - Protecting property from natural disasters                | 5 |
| - Helping people with limited resources                     | 5 |
| - Reducing taxes                                            | 3 |
| - Preparing for sea level rise                              | 2 |
| - Preparing for climate change                              | 1 |

Comments:

- Environment: If flooded, nothing to protect. Also, not much that is natural still present.
- Roads: Down the island, what they do or do not do makes a huge difference since it can cut off the town from the rest of the world.
- Utilities: Losing sewage means we are all out of business.
- Future flooding: Protecting the sand dunes.
- Reducing taxes: Taxes have been maintained for about 20 years.
- Climate change: Concerned about offshore areas that may be leased for wind farms, often to foreign entities. Concerned about local impacts to fishing and navigation. May be difficult to see pilings in fog, and insurers may not allow travel through those areas to reduce risk. Probably will not be able to fish at all between turbines, even if the wind farm operator says it is okay. Trying to stop them from being built in areas where local fishermen work.

## Part 2 of 3: Review of Major Findings

### Major Finding 1: Relative Priority

7. Appropriateness: Not Sure / Unable to answer this question
8. Would help planning: (4) Agree

9. Ways may impact planning: Nothing Specific

10. Other comments:

Barnegat Light is the highest area on the island. There has barely been any flooding on this part of the island. The challenges are mostly down island, with other challenges impacting this jurisdiction.

#### Major Finding 2: Planning Components

11. Appropriateness: (2) Disagree

12. Would help planning: (3) Neither Agree nor Disagree

13. Ways may impact planning: Nothing really

14. Other comments:

A lot of this is difficult or impossible to do here. Dunes is the biggest one that has been done. Educating the community is extremely hard. 100 people in a room will all have different ideas. Of about 1,000 homes, 80-85% do not live here. There are about 575 full time residents, and many people really do not care because they are not in the community very often. After Sandy, for example, many never got their boats back or even looked for them because they had insurance to replace them.

#### Major Finding 3: Protection Priorities

15. Appropriateness: (4) Agree

16. Would help planning: (4) Agree

17. Ways may impact planning: Nothing Specific

18. Other comments:

Drinking water and wastewater/sewer should probably be paired together, as one is not fully operational without the other.

There is a list of critical facilities in the town to prioritize for protection and response, including the town hall, the first aid squad /fire department, the utility system, the emergency operations center, the post office, water wells, public dock, and the Zion church (refuge of last resort).

#### Major Finding 4: Funding Priorities

19. Appropriateness: (4) Agree

20. Would help planning: (2) Disagree

21. Ways may impact planning:

Nobody wants to spend money planning ahead. Personally, the mayor's business plans ahead, as do many other local businesses. There is a major fear of "loss of the season" because for many businesses here, a few months is almost the entire years' worth of business. There is also a major concern about fires.

22. Other comments:

In a recent mayor's meeting there was a discussion about how on Ship Bottom cannot get through when floods are happening. The County (who owns the main road) is not willing to help. Finally planning to put in storm water pumps around the flooding areas.

For Question 20, need to spend money to do this. Some areas get a lot of hurricanes, others get a lot of surge. Here, the more common problem is Nor'easters. Many residents do not care except for their own property. Right now, you cannot sit on the beach in high tides in some places. There are also endangered species (piping plovers) in some areas, restricting access.

Major Finding 5: Conflict Resolution

23. Appropriateness: (4) Agree

24. Would help planning: (4) Agree

25. Ways may impact planning:

This finding might be politically helpful. People ran against the mayor after Sandy because they were not allowed to come back on the island immediately after the disaster while emergency repairs were taking place. The mayor to give out passes to certain people to come pump out diesel fuel from large boats, etc.

26. Other comments:

Experts can be wrong. One expert said exactly the opposite of what happened with the dunes (said they would wash away, instead sand has been accumulating on some of them). Local knowledge is important, here is not the same as everywhere else.

There was also major conflict because people who chose not to leave during Sandy were not allowed to leave for a while after because the road was inaccessible.

Major Finding 6: Adaptation Responses

27. Appropriateness: (5) Strongly Agree

28. Would help planning: (5) Strongly Agree)

29. Ways may impact planning:

Preventing development in new areas is difficult. New laws are often either too hard to get passed or too controversial. Working with insurance is outside the town's jurisdiction.

30. Other comments:

Challenges: if you build in a high-risk area and you know it at the time, you should take responsibility for it. However, there have not been any repetitive loss areas in Barnegat Light to date, so have not had to face that issue yet. Flood insurance rates are high because the jurisdiction has not done as much mitigation as some other jurisdictions. However, this is because the problem is not as bad here, and the flood insurance program should take that into account.

**Part 3 of 3: Impact of the study's information**

31. Findings informative: (5) Strongly Agree

32. Findings help processes: (4) Agree

33. Findings advance SLR planning: (4) Agree

34. Additional useful information:

Nobody agrees on anything. In different towns, everyone will think differently.

35. Additional info on planning impacts:

Need to raise base elevation for garages. Already have it for living space.

**Interview 6: Councilman of Ship Bottom, NJ on 07/09/2018**

**Part 1 of 3: Summary of current state of sea level rise planning and barriers**

1. Role in SLR planning:

In addition to being a councilman, also the Office of Emergency Management Coordinator, on the Community Rating System (for NFIP) board, part of the island planning system, the flood mitigation team and “a million others.”

2. Planning to date:

It is important to recognize that there are two related but distinct phenomenon taking place. Flooding and sea level rise are related but not the same. Not a regulated system, and goals and expectations are different across different jurisdictions.

For sea level rise, there definitely is a problem and there is a growing awareness of it, but at present, there is no plan. More people are starting to talk about it, but it is still a “dirty word” amongst many groups.

For flooding, many are in denial about SLR, but flooding is more straightforward because people can see it and experience it now. If the bay was 6 feet lower than it is today, there would be no existing regular flooding. SLR is either directly the cause or contributes to it.

Some people are constantly complaining about the boulevard and street ends being flooded.

Concerns:

- “The old LBI” was lots of bungalows rather than big houses, and there were lots of dunes all over. Now, there is lots of flooding, sometimes even at low tide, because the area has become a “concrete jungle.” Many more gallons of water for the same events needs to find somewhere to go because there is less open space
- If a category 3 hurricane were to ever hit Ship Bottom directly, the entire town would be flooded from the bayside, regardless of the ocean side dunes. This would also cut off access to the rest of the island because the causeway would be inaccessible until the water receded.

Past actions:

- Require higher bulkheads and better storm drains for new construction
- Raised crown on boulevard, but that just pushes the water somewhere else (even if it does keep the road open). 16-18” higher elevation
- Potential SLR mapping has taken place for Ship Bottom. The findings were extremely distressing.
  - o By 2035 (1-foot rise) some parcels will be underwater all the time, especially around 28<sup>th</sup> street. There will be many bulkheads that will be below the water level during high tide, even if they look good now.
  - o By 2060 (2-foot rise) Access to much of the town would be very difficult because many roads would be underwater all the time. There would be at least one “island within an island” cut off from all directions.
  - o By 2085 (3-foot rise) most of the town would be gone, including most roads and access to most non-flooded lots. Access to the bridge / causeway would also be impossible without major modifications.

Future actions:

- Time to start thinking about repetitive loss areas and buying them out to allow absorption of flooding on those lots instead of across occupied ones
- Most traditional flood mitigation will not be effective as sea level rises. This is a global issue. Has not been addressed here due to challenges, but ultimately it comes down to “instead of building, should be bulldozing”
- Likely the need will be a lifestyle change. Need to think about this issue globally, but what to do locally? Most likely it will be buying up property to slow down the impacts.
- What can we do to make it better? Need to “do the outside of the puzzle” first. Right now, we are letting politics dictate what is done and that will be harmful over the long-term. Ship Bottom just purchased a lot that is almost entirely under water. There was a house there in the 1970s, but only the back of the lot was a

shoreline. The front was completely gone. Plan to put a living shoreline there, which will help a little.

3. How vulnerable: (5) Exceptionally

4. SLR Plan status: (2) Minimal SLR plan

5. Barriers to SLR planning:

Backflow preventing on storm drains are being touted as an answer to many of these problems. They will help in the short-term, but depending on what kind you get, they activate at different pressures. The more the bay rises, the more back pressure you will get, and the less storm water will drain through them. The only other option is to go to a pumped system, which will probably need to be run all the time once SLR reaches a certain point.

The barriers are essentially economic, political, and social. People just do not want to accept this.

Another problem is “hairbrained” ideas coming from governors. One is for floodgates to be put across the inlets to the bay, blocking it when a storm comes. This may help against storms but would only help against SLR if they were permanently closed. A measure like this shows that we can be some of our worst enemies.

6. Importance of issues:

|                                                             |   |
|-------------------------------------------------------------|---|
| - Protecting the environment                                | 5 |
| - Maintaining roads and other transportation infrastructure | 3 |
| - Maintaining utilities and related infrastructure          | 3 |
| - Growing the economy                                       | 1 |
| - Protecting against future flooding                        | 5 |
| - Protecting property from natural disasters                | 4 |
| - Helping people with limited resources                     | 4 |
| - Reducing taxes                                            | 3 |
| - Preparing for sea level rise                              | 5 |
| - Preparing for climate change                              | 5 |

Comments:

- Environment: This helps address the rest of the issues.
- Economy: The drive for growth is part of the problem (this represents the interviewee’s opinion only).

- Reducing Taxes: the drive to control taxes is also part of the problem, because we are not investing enough in this issue. There is a social / political / economic problem here.
- For SLR and Climate change: The sooner we acknowledge these issues and take action, the better off we will all be.

## **Part 2 of 3: Review of Major Findings**

### **Major Finding 1: Relative Priority**

7. Appropriateness: (5) Strongly Agree
8. Would help planning: (5) Strongly Agree
9. Ways may impact planning:

All planning aspects need to revolve around sea level rise. If not, everything else will eventually fail. This was not done in the past and it has caused problems.

10. Other comments:

If we do not deal with this issue, everything else is unimportant. Politicians are often part of the problem. In many ways, are already digging out of a whole due to past inaction.

### **Major Finding 2: Planning Components**

11. Appropriateness: (5) Strongly Agree
12. Would help planning: (5) Strongly Agree
13. Ways may impact planning:

As long as the problem is identified and all are on board, it will be much easier to correct. If in denial, it will be difficult to address at all.

14. Other comments:

If 30 years ago, did not wait for more research (as is what happened) would be much better off. The big question is, it is too late to correct these problems?

### **Major Finding 3: Protection Priorities**

15. Appropriateness: (5) Strongly Agree
16. Would help planning: (4) Agree
17. Ways may impact planning:

We are currently planning using the tools that are already in place. With that framework, everything everywhere within the jurisdiction will need to be elevated. That just is not feasible, and we will need a new strategy.



18. Other comments:

Do not agree with the current direction as it does not correct the problem. Probably need to start doing away with some houses through buy-outs. Some will say “do everything” because of their major home investment, but may ultimately be adding to the long-term problems. There has also been lots of pushback on regulations; people want to do anything they want. When that attitude is everywhere, there is a big problem.

Major Finding 4: Funding Priorities

19. Appropriateness: (4) Agree

20. Would help planning: (4) Agree

21. Ways may impact planning:

If funding was available, could purchase repetitive loss homes. FEMA funding for buy-outs is minimal, and the idea of doing that is not socially accepted here because the bought-out property is required to be open space permanently. That is not something people here are okay with.

22. Other comments:

This is important. Small towns cannot function without outside funding.

Major Finding 5: Conflict Resolution

23. Appropriateness: (5) Strongly Agree

24. Would help planning: (5) Strongly Agree

25. Ways may impact planning:

If more scientists were on board on what would need to be done, it would be easier for government planners to be out there saying the same thing. The scientific basis is an important tool.

26. Other comments:

Avoiding taking measures is happening now, unfortunately it is largely avoiding taking any measures, not just making them optional.

Major Finding 6: Adaptation Responses

27. Appropriateness: (5) Strongly Agree

28. Would help planning: (5) Strongly Agree

29. Ways may impact planning:

If these measures were being done up and down the island, you might slow down the process considerably. Instead, the actions being taken are accelerating it.

30. Other comments:

With funding and resources, many more measures could be done. Some measures being done are “crude” because the town feels like it is on its own. Need more resources to do more. People need to start showing up and asking for the town, state, feds, etc. to do more.

**Part 3 of 3: Impact of the study’s information**

31. Findings informative: (5) Strongly Agree

32. Findings help processes: (5) Strongly Agree

33. Findings advance SLR planning: (5) Strongly Agree

34. Additional useful information: Nothing else specifically

35. Additional info on planning impacts:

Be careful about the difference between sea level rise and flooding. The effects versus the causes are important for planning.

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