Adapting to Sea Level Rise in the Coastal Zone

Law and Policy Considerations

ROUTLEDGE

Chad J. McGuire

Adapting to Sea Level Rise in the Coastal Zone

Law and Policy Considerations

Adapting to Sea Level Rise in the Coastal Zone

Law and Policy Considerations

Chad J. McGuire

Routledge
Taylor & Francis Group
NEW YORK AND LONDON

First published 2013 by Taylor & Francis

Published 2019 by Routledge
52 Vanderbilt Avenue, New York, NY 10017
2 Park Square, Milton Park, Abingdon, Oxon OX14 4RN

Routledge is an imprint of the Taylor & Francis Group, an informa business

Library of Congress Cataloging-in-Publication Data
McGuire, Chad J.
Adapting to sea level rise in the coastal zone : law and policy considerations / Chad J. McGuire.
pages cm.
Includes bibliographical references and index.
ISBN 978-1-4665-5980-6 (hardcover : alk. paper)
1. Sea level—Environmental aspects. 2. Coast changes. 3. Coastal zone management—Government policy. 4. Environmental policy. 5. Environmental law. I. Title.
GC89.M373 2013
363.34—dc23 2013003038

ISBN: 978-1-4665-5980-6 (hbk)
ISBN: 978-1-3150-9757-2 (ebk)

Typeset in AGaramondPro
by Apex CoVantage, LLC

Contents

About the Author

Chad J. McGuire is a professor of environmental policy within the Department of Public Policy at the University of Massachusetts, Dartmouth. He is also an attorney licensed to practice law in California, Nevada, and Massachusetts. His background is in environmental law and environmental science. Chad teaches, writes, and practices in the fields of environmental law, policy, sustainability, and dispute resolution. He has published more than 20 scholarly and applied articles on these topics over the past 10 years. He has worked on policy issues related to fisheries management, climate change, coastal management, and land use patterns. His expertise has been sought in both private and public forums, and he has served on committees for both nonprofit and government entities. He has more than 15 years of experience in the environmental management field. This book is based on his work in studying the problems that arise at the intersection of law and policy, in this case those problems that are directly related to coastal management planning necessitated by sea level rise.

In addition to this text, Professor McGuire is also the author of *Environmental Decision-Making in Context: A Toolbox*, published in 2012 by CRC Press, and part of the American Society for Public Administration's Series in Public Administration and Public Policy.

Chapter 1

Introduction

The coastal zone is a dynamic place, and this statement has been true throughout recorded human history. For as long as humans have been inhabiting coastal areas and recording what occurs in their environments, coastal zones have been defined through dynamic interactions. The area between land and sea shifts as the tides move landward and seaward. Coastal storms arrive at the shore, moving large amounts of sand in the process, sometimes eroding coastal areas and other times adding dry landmass to the coast. Humans have also influenced the contours of coastal areas through dredging and filling operations, intensifying these operations with the advent of technological innovations throughout history. More recently, humans have begun to defend against tide and sea by building walls and other barriers that attempt to limit the approach of the ocean into the land.

All the phenomena mentioned above reinforce the changing nature of coastal areas; as such, it should come as little surprise that coastal boundaries do not remain fixed in time and place but rather are in a state of constant flux. This text is not about the kinds of changes mentioned above; changes that have been observed as part of the *background conditions* of coastal areas. Rather, this text is focused on a more recent development: observed sea level rise. Over the past several decades, sea level rise has become a relatively constant phenomenon in most coastal regions around the globe. Scientific inquiry into the causes of sea level rise has placed human activities, specifically carbon emissions into our atmosphere, as a major cause of this observed phenomenon. By increasing the amount of carbon in our atmosphere, the Earth is warming and thus causing water held as ice to begin melting. As the water melts, it runs off into the Earth's oceans, causing sea level rise. In addition, warmer temperatures cause water molecules to heat up, leading to the thermal expansion of water. This thermal expansion of water in our oceans is also adding to observed sea level rise.

Current sea level rise is different from the other phenomena mentioned above that cause changes to coastal areas. This currently observed sea level rise is a constant process that is occurring and, based on current best scientific estimates, will continue to occur for our foreseeable future. The question presented today is really neither about whether sea level rise is happening nor whether it will continue into the future, but rather how far sea levels will rise. This is an important question because the future extent of sea level rise defines what actions must be taken today in order to deal with the problem. For example, if the sea level only rises a few inches over the next 100 years, then there is little need to change current uses or expectations in most coastal regions around the globe. However, if sea level rises substantially—say 20 feet—over the next 100 years, then planning must occur immediately to alter the uses and expectations of coastal areas that will be impacted by such a rise in sea levels.

The current state of science contains a lot of uncertainty about how far sea levels will rise over the coming decades, and this uncertainty is problematic when considering planning options. There certainly is enough ice on Earth to raise sea levels by 20 feet (there is enough ice to raise average sea levels over 200 feet and more, which would be devastating). The question is not what is possible, but rather what is probable when contemplating planning for adaptation toward sea level rise. By knowing what is probable in terms of sea level rise, planners are better able to make decisions about how to plan for this anticipated rise. When information about future sea level rise is certain, the choices about what needs to be done today are clear. When the information about future sea level rise is uncertain, the choices about what should be done today are less clear. This brings us to the purpose of this text: to explain the causes of sea level rise, the policy options related to sea level rise planning, and finally to consider the legal implications of different policy directions.

It is important to note that this book is not about preventing sea level rise or mitigating its impacts. Rather, this text focuses on sea level rise as a given and discusses policy planning issues that arise when focusing solely on *adaptation* strategies to sea level rise. Thus, the key difficulty presented in this text surrounds making policy choices about how to adapt to *future* sea level rise when there is *uncertainty* about how high sea levels will rise in the future. If we knew the extent of sea level rise in the future, then it would be much easier to take action today with planning recommendations that limit the amount of harm caused to coastal areas in the future; for example, knowing sea level rise will inundate a coastal town in 10 years provides enough certainty to justify a policy that requires the retreat of that area within a 10-year period. However, the high degree of uncertainty over the extent of future sea level rise makes the task of planning today difficult. Not only is the task difficult in terms of anticipating future unknown events, but certain laws—including judicial interpretations of those laws—create even greater difficulties in limiting how coastal land is used without triggering a requirement that government pay citizens for planning that prohibits current uses of private land.

The goal of this text is to distill the science, policy, and legal issues surrounding sea level rise into a coherent set of principles that both identify important issues for

consideration, and then discuss those issues in light of current law and policy paradigms. By understanding how the current state of the law impacts policy choices, the hope is to provide those who are involved in studying or practicing coastal management a set of analytical tools to better understand the relationships between policy choices and legal frameworks impacting those choices. As shown in the text, the law often provides limitations on government actions, particularly foundational constitutional principles that cannot be easily overcome by simply passing a law or regulation that violates these foundational principles. Thus, understanding these legal limits on public planning for sea level rise is an important starting point in making informed policy choices. Once these limitations are understood, policy directions can be better mapped out. Sometimes the law will limit what seems like a superior set of policy choices for adaptation by making the decision untenable because of the financial consequences that might apply to such policy choices, as is the case with the Fifth Amendment of the United States Constitution's requirement that just compensation be paid for the taking of private property. Thus, policy directions that amount to a "taking" of private property, whether directly or indirectly, may require that the government pay full freight for the policy direction, and this legal requirement may make the policy choice inferior because of its costs even though it is superior in other measures. This is but one example of how legal frameworks can impact policy directions. The different impacts legal frameworks can have on policy choices are highlighted in greater detail throughout this text.

This book has been divided into three main sections, each section divided into its own chapter, to clearly accomplish the goal identified above. The first section, Chapter 2, focuses on the science behind sea level rise. The goal of this chapter is to connect currently observed sea level rise with the science behind future predictions of how far sea level will rise, and also to provide the reader with some basic understanding of how different coastal features can influence the impact of sea level rise. Collectively, this information is meant to provide a foundation of knowledge about sea level rise dynamics, including the forces involved in its causes, as well as the forces and features that influence its impact on coastal areas. At the conclusion of Chapter 2, the reader should have a solid foundation of the basic factors that influence the processes and impacts of sea level rise on coastal areas. Armed with this information, the reader is ready to place policy choices into context.

Chapter 3 focuses on the policy options that are available in adapting to sea level rise. It begins with a section on understanding basic policy goals by discussing *net benefit* quantification methods (a way of rank ordering different adaptation approaches), as well as understanding the role and impact of *uncertainty* in developing and choosing between sea level rise policy approaches. After discussing these concepts, Chapter 3 focuses on the different kinds of adaptation approaches that may be taken in dealing with sea level rise. Three main categories of approaches are highlighted: (1) staying at the shore, (2) retreating from the shore, and (3) a mix of hybrid approaches that employs some measure of stay and retreat options. Finally, Chapter 3 concludes by considering adaptation approaches from economic, social,

and ecological viewpoints. Viewing approaches through these different lenses can alter the ways in which benefits and costs are calculated, thus altering a net benefit analysis. Understanding how different lenses can influence a determination of net benefits is an important part of identifying and choosing between policy directions even without considering the impact legal frameworks have on choosing between competing adaptation choices.

Chapter 4 summarizes the major legal considerations that influence adaptation choices toward sea level rise. Critical to this discussion is understanding the nature of property rights in land generally, and how these rights are viewed in combination with constitutional principles that protect private property rights (Fifth Amendment protections) and constitutional principles that empower state and local governments to protect citizens from known and reasonably understood dangers (Tenth Amendment police powers). The mix of constitutional powers and prohibitions provides the context from which policy planning that impacts private property rights begins; any policy that influences private property rights must be understood in relation to the powers and limitations placed on government in regulating land. This discussion of constitutional power interactions between the Fifth and Tenth Amendments to the U.S. Constitution provides a grounding point for this chapter. From this grounding point, the chapter discusses the legal issues from the *role* government takes in implementing policy directions. For example, when government acts in its regulatory capacity to develop and implement sea level rise adaptation policies, there is a greater chance that regulation may trigger a *regulatory taking* of private property rights when the policy results in limitations placed on the use of private property rights. Contrarily, if government adopts a policy direction that stems from a nonregulatory stance, then there is less chance the policy will implicate Fifth Amendment prohibitions on the taking of private property. The ways in which government may act outside its regulatory nature are discussed in some depth in this chapter offering policy makers the opportunity to understand how to develop adaptation policies that stand a better chance of avoiding legal frameworks like taking challenges.

Collectively, the three main chapters identified above are meant to provide a summary understanding of the law and policy considerations that impact coastal zone planning for sea level rise adaptation strategies. Each chapter introduces its major goals and, where appropriate, links those goals to the information provided in other chapters within the text. Although the text is meant to flow from start to finish, the chapters can be read out of sequence as references are made to other sections of text where appropriate. Because the text discusses three related disciplines (science, policy, and law), which each require significant depth for full understanding, the text does not serve as a comprehensive discussion on any one topic. The lack of depth in any one topic is necessitated in order to provide an understanding of the interactions between the science, law, and policy issues discussed. However, where appropriate, citations to primary materials with greater emphasis in each area are provided to allow the reader to gain additional insight and understanding where

they deem appropriate. With this limitation stated, the hope is that each reader will find important conceptual connections between the kinds of actions needed to be taken in coastal planning to help proactively deal with sea level rise both today and tomorrow. By connecting the kinds of choices available for sea level rise to the legal frameworks that limit policy planning, this text should serve as an important framework by which meaningful adaptation planning can occur.

Chapter 2

Science behind Sea Level Rise

2.1 Introduction

Sea level rise is fundamentally a result of *chemical* and *physical* forces (Bryant 1997). While this statement is true, it does not provide an easy solution to the problems of sea level rise. Even so, without understanding the fundamental causes of sea level rise, we are less capable—and often wholly incapable—of making sound policy choices about how to act in response to sea level rise. The purpose of this chapter is to provide an overview of what science tells us about the potential causes and dynamics associated with sea level rise. A major goal in this chapter is to establish a foundation of the science behind sea level rise as a means of better understanding the connections between those scientific principles and the options we come up with as humans to respond to the impacts and effects of sea level rise. By understanding some of the scientific principles behind sea level rise, choices about policy directions can be made more meaningful and hopefully lead to better human decision making, the ultimate goal of this text.

The First Law of Thermodynamics, noting that energy is neither created nor destroyed, reminds us that no new water is being added to our Earth system; the same amount of water exists today as existed 50 years ago, suggesting that the phenomenon of sea level rise must be the result of causes beyond the addition of new water into the Earth system (Bertaianffy 1968). This chapter reviews the mechanisms behind sea level rise and discusses some of the geospatial (where things physically exist on Earth) considerations on how the physical characteristics of coastal areas impact sea level rise planning considerations.

Regarding causes of sea level rise, we have some understanding of the following potential contributors. Increasing temperatures are leading to a melting of water stored as ice. In addition, the increased heating of the oceans is causing sea water to expand (thermal expansion), further adding to sea level rise. Finally, human movement of water from largely stored underground sources (aquifers) may also be contributing to sea level rise as the water relocates to the oceans as part of the hydrologic cycle (Wada et al. 2012). The mix of warming and humans actively altering some of the normal sinks within the hydrologic cycle of water are providing feedback that is helping to drive sea level rise.

This chapter is divided into three main sections:

- Section 2.2, "Current Observations," aims to explore what we are seeing today in relation to sea level rise. The goal of this section is to help the reader understand some of the background science and observations that aid in our understanding of the dynamics behind sea level rise as an ongoing phenomenon. To aid in linking what we see today to a larger policy context, this section also begins to discuss the relevance of sea level rise in coastal management planning, particularly the question of *why* sea level rise deserves special consideration when thinking about coastal land use planning.
- Section 2.3, "Future Predictions," takes the information learned from Section 2.2 and asks two main questions in relation to that information. First, what is the potential for sea level rise in the future? Second, how does this impact land use planning within the coastal zone? The purpose of this section is to identify the importance of future predictions about sea level rise—essentially the importance of planning for the unknown by calculating the likelihood of future events—based on our current state of knowledge. The current state of knowledge about sea level rise serves as a foundation upon which future predictions about the extent of sea level rise are identified. Predictions about the future become the basis for planning efforts today and therefore are critical when making resource commitments; as such, the information relied upon when making such decisions is critically connected to our future actions. For example, the choice of whether or not to make infrastructure commitments in certain coastal areas is influenced by predictions about future sea level rise that are connected to our current state of knowledge. The choice to avoid infrastructure in a coastal area today will have an impact on the use of that area in the future. If the future prediction is unfounded, then the choice to avoid infrastructure can impact overall development and well-being today. Understanding the impact of future predictions on policy choices today is a key to understanding the risks involved in making planning decisions with less than perfect information. This relationship will be discussed in some detail within this section.

- Section 2.4, "Major Coastal Land Feature Considerations," explores the connections between the geography of different coastal areas and discusses the impact that local geographic conditions (spatial considerations) have on coastal planning. The simple calculus of rise over run (height over distance) is employed to add the dimension of geography as an important factor in coastal planning considerations. For example, a sea level rise of three-feet can have a substantial impact on an area where a three-foot rise in height can cover a very large distance of landmass, submerging that land in water. However, that very same three-foot rise in sea level can have little to no impact on an area where natural geography is mostly unaffected by the rise—for example, an area where the coastline is a bluff such as the White Cliffs of Dover in the south of England. Understanding basic geographic dimensions can have a significant impact on the overall planning process for dealing with sea level rise, and this section is devoted to connecting sea level rise planning to this important variable.

In summary, this first primary chapter is meant to provide the reader with an understanding of our current state of knowledge about sea level rise, and then relate that current state of knowledge to the process involved in making future plans about how we utilize our coastal regions. The connection between our current state of knowledge and the assumptions derived from that knowledge are emphasized as we consider the future predictions of sea level rise. Also, the geographic conditions of the coastal area in question help us place those predictions into context regarding how we think about impacts to coastal areas that geography will influence—either emphasizing or mitigating—those impacts. This preliminary understanding of the scientific principles behind sea level rise will then be used as a backdrop for the exploration of subsequent chapters in this text, particularly the policy options available to deal with sea level rise as well as the important legal considerations that influence potential policy directions.

2.2 Current Observations

Sea level rise is a phenomenon that is being observed all over the globe (IPCC 2007). Logical questions that follow from the current observation of sea level rise include: what is causing this observed rise in sea level; how much is sea level going to rise; what is the impact of sea level rise today and in the future; and finally, what, if anything, should we do about sea level rise? This section focuses on what we see today in terms of sea level rise. Subsequent sections get into the questions of future predictions and the impact of the particular geographic features of coastal areas. Before discussing the question of what is being currently observed, this section explores the question of why we care about sea level rise in relation to coastal planning in the first place—in particular, what role does sea level rise have in our discussion of coastal planning?

2.2.1 Why Is Sea Level Rise Something That Must Be Considered in Coastal Land Use Planning?

Coastal land use planning is a particular subset of land use planning generally. To understand coastal land use planning, including its purposes and goals, one must understand the purposes of land use planning generally, and then consider the particular conditions that occur in coastal areas that differentiate them from general land use planning considerations. In this review, one will find that coastal areas present a dynamic interaction between land and sea that is not normally encountered inland. This dynamic interaction has the ability to change boundaries between the land and sea interface, and also influence the impacts that forces of the sea have on human development at the nearshore.* Once a framework for understanding the unique circumstances presented in the coastal region is understood, the presentation of current observations relative to sea level rise will make more sense; this is particularly true as we move into the sections of this text that discuss policy options and legal considerations.

Traditional land use planning tends to focus on an orderly kind of planning surrounding human uses separated into different contexts based on a combination of preexisting uses and practical considerations (Randolph 2004). For example, planning for an already developed area may include considering how the land is currently being put to use and making determinations based on those existing uses; areas where industrial processes currently take place may continue to allow for industrial processes while residential uses may be restricted in this area to protect human welfare. Conversely, undeveloped areas allow for more planning options, and choices about development can be based on a broader set of considerations. Areas with superior views or located close to recreational opportunities may be best suited for residential development because of the demand for these kinds of natural attributes in residential living. Areas with less aesthetic attributes may be better suited for commercial or industrial purposes, depending on location, proximity to highways, and similar considerations.

One aspect of land use planning that is assumed to be consistent over time is the relative boundaries of land; this is one assumption that differs between traditional land use planning and coastal zone planning, particularly in areas where the coastal zone is subject to dynamic forces that can alter the boundaries between land and water. Unlike inland areas where boundaries are relatively stable, coastal zones contain a shifting boundary between the land–sea interface. A representation of this shifting boundary is identified in Figure 2.1.

As you can see from Figure 2.1, the boundaries between land and sea are based on the precise location where the land meets the water, which itself is constantly changing under natural forces of gravity, particularly the relative influence of

* The term "nearshore" here is being used to identify the area of dry land that is in close proximity to the waterline creating a demarcation between land and sea.

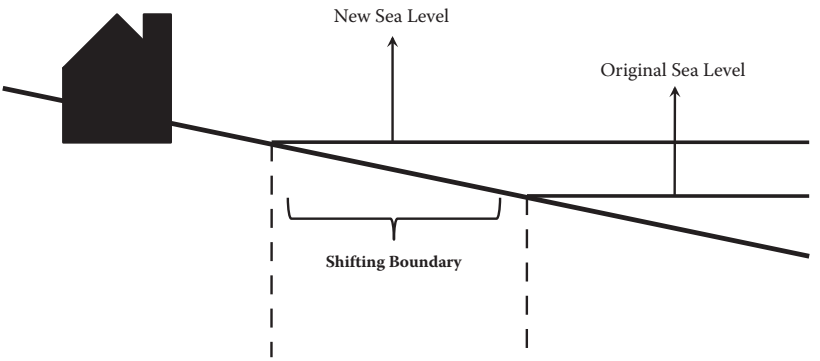

Figure 2.1 A representation of a shifting boundary between the land–sea interface.

the moon's gravitational influence over large bodies of water such as our oceans (Schlesinger 1997). Tidal shifts can alter the boundary between land and water, sometimes substantially in certain areas like the Bay of Fundy in Canada. We can refer to these cyclical changes in the land–sea interface along the coast from an average "high tide" to an average "low tide" as *tidal variation.*[*]

Tidal variations are a normal part of the boundary changes between the land and sea. Tidal variations also provide some evidence of the special land use planning considerations that occur at the coast. The traditional method of defining the "set" line between the land and ocean is to establish a *baseline* that demarks the relative position between land and water for planning purposes.[†] Baselines are generally established by taking the average of the water line at a particular extent of tidal variation. For example, one can average out the mean high and low tides at a particular coastal location, and the baseline can be established as the average high or low tide mark at that particular location. Many legal standards internationally have adopted either the *mean high water mark* (meaning the average high tide water line of a given location) or the *mean low water mark* (the average low tide water line) as the basis for defining the official boundary between land and sea for land use planning purposes (Kalo et al. 2007).

The drawing of "official" baselines attempts to rationalize coastal land use planning by creating set boundaries so that the assumption of fixed boundaries adopted

[*] *Tidal variation* refers to the variation at a coastal point between the average high and low tides that are observed on a recurring basis. Influences such as moon phases and relative position of the Earth to celestial bodies can further impact the range of high to low tides, often referred to as *neap* and *spring* tides, respectively.

[†] It should be noted that the baseline is somewhat of an arbitrary construct, meaning that it aims to present a stable, nonchanging demarcation between the land and sea. However, the relative boundary between land and sea is constantly changing based on forces of gravity (and other factors) as described as the *tidal variation* above.

in general land use planning can be applied to the coast. It is understood that these boundaries are relative and fluctuations between the land and sea barrier occur regularly. However, an acknowledgment of natural fluctuations is bounded by the assumption that there is an upper limit between the highest of high tides and the lowest of low tides in a particular location. What is generally not acknowledged in the establishment of baselines is that other forces can irrevocably alter the historical baselines.

Coastal areas can be altered based on two primary considerations: (1) the background structure of the coast itself (discussed in a later section of this chapter), and (2) the environmental conditions impacting the coast. Land–sea boundaries can be impacted, sometimes irreversibly, by environmental conditions. Obvious examples include hurricanes or similar storms of significant energy intensity that shift sandy coastal areas to such a degree that the baselines between sea and land move substantially inland or seaward, depending on the impacts of the storm. Other examples are less discrete, taking place over longer periods of time. For example, erosion of certain types of coastal features (such as sandstone) can slowly remove land features at the coast, changing the land–sea boundary by impacting relative elevation of the nearshore. Also, the filling of submerged lands in one area—for example, the filling of coastal inlets and tributaries—can impact local shorelines by preventing the inflow of water into bays and estuaries, causing localized sea levels to rise in immediately adjacent areas (Philander 2008).

Environmental conditions can impact boundaries between the water and land. When environmental conditions change, they have the potential to change the underlying conditions upon which human decisions are made, and this is certainly true of the assumptions that go into establishing baseline boundaries between land and sea. Science plays a critical role in helping us understand how environmental conditions might impact our assumptions about land–sea boundaries, and this is particularly true when we consider the phenomenon of sea level rise as an environmental condition that is driving long-term changes in coastal boundary lines.

Sea level rise is being observed all over the Earth and it is having a disproportionate impact on coastal areas (IPCC 2007). As an environmental phenomenon, sea level rise has a variety of causes, many of which identify humans as a cause for the conditions that are leading to sea level rise. The causes and impacts of sea level rise are discussed in some detail in Section 2.2.2. Here we discuss the importance of sea level rise as something that must be considered in coastal land use planning. The main reason is that sea level rise brings with it a variety of factors that go beyond other environmental causes of changes to coastal boundaries. Importantly, the kinds of changes brought about through sea level rise at the coast can have the kind of impact and duration that make them permanent. As such, changes in coastal boundaries brought about by sea level rise require planning decisions that precede the changes; otherwise, coastal land use planning will devolve to a

reactionary set of disaster response scenarios—not the best outcome when we think about the purpose behind planning for human interactions with land.*

As noted earlier, coastal boundary lines are ever changing, undulating landward and then seaward as the tides are influenced through gravitational forces of, primarily, the moon and sun. In addition, storms and other environmental factors (such as erosion) influence the boundary of land and sea, sometimes changing these boundaries in permanent ways.† However, current observed sea level rise is not the kind of environmental factor or natural background condition on which assumptions about coastal development generally rely. Instead, sea level rise represents a phenomenon that is unique to the current time frame in which human beings have flourished for the past 5,000 years and certainly unique to the current assumptions that define our law and regulatory regime related to land use planning, these legal assumptions being defined over the past several centuries to millennia in most cases. In this way, sea level rise represents a new problem that sometimes requires new ways of dealing with this problem at the coastal planning level of government interaction.

Sea level rise must be considered in coastal planning because it represents the greatest potential for change from the conditions we currently expect to find at the coast. From an impact standpoint, sea level rise presents new risks to coastal areas that go beyond the historical factors managers have dealt with in the past regarding coastal land use planning, development, and management. There are new *categories* of risk associated with sea level rise, including the continuous march of water inland over coastal areas now and for the foreseeable future. In addition, there are new *magnitudes* of risk as sea level rise represents, in part, a condition brought on by a warming planet.

The warming of the Earth including its oceans, increases the number and intensity of storms; coastal areas will experience storm impacts unlike those seen in the past. In addition, a warming planet presents powerful feedback in terms of energy dispersal that can impact coastal areas. For example, warm water melts ice sheets, thus increasing the amount of water flowing into our seas. In addition, warm water undergoes thermal expansion, which exacerbates sea level rise by causing the existing volume of ocean water to expand as it warms. The melting of sea ice exposes ground below the ice that is much darker than the ice itself; the reflective albedo effect of the ice is diminished and the darker ground underneath absorbs sunlight, thus reinforcing the warming effect on the Earth. Finally, a warming planet thaws permafrost areas of the Earth, releasing methane and other compounds into the

* Planning inherently suggests a proactive approach by humans to potential scenarios so the negative impacts of those scenarios can be mitigated (and hopefully often prevented) to the extent practicable. Planning that does not proactively respond to the potential impacts of sea level rise cannot rationally conclude to be meeting the essence of its "planning" goals.

† The term "permanent" here has a relative meaning, referring to a time period that may seem permanent relative to human beings, say, decades to centuries. However, the forces that alter coastline boundaries from a geological viewpoint (epochs, eras, eons) may seem impermanent in comparison to the shortened time frame of the human being's lens of perspective.