Sea-Level Rise and Floodplain Management in California:

Understanding Information Needs, Challenges and Opportunities

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ABOUT THIS DOCUMENT

This report presents the findings from a Science Needs Assessment conducted by the California Ocean Science Trust. This needs assessment was conducted in support of a project funded by the NOAA Coastal and Ocean Climate Applications program led by the California Department of Water Resources, the Scripps Institution of Oceanography, and the Ocean Science Trust. The project aims to develop information and guidance products for coastal planning and management that incorporate new sea-level rise and coastal flood zone information. The Ocean Science Trust would like to acknowledge the time and thoughtful input of the individuals interviewed for this needs assessment.

ABOUT THE OCEAN SCIENCE TRUST

The Ocean Science Trust is a non-profit organization based in Oakland, California. Guided by the belief that science is an important foundation for ocean resource management decisions, the Ocean Science Trust works with scientists, citizens, managers and policy-makers to build shared understanding and trust in science for healthy, resilient and productive coasts and oceans.

More information can be found at *www.oceansciencetrust.org*

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INTRODUCTION

The challenge: Adapting to sea-level rise in California

California has shown leadership in prioritizing, researching, and developing a broad mandate for climate change adaptation (e.g., Assembly Bill 32, Executive Order S-13-08, Safeguarding California, Climate Change Research Plan). As a result, California's coastal decision-makers are aware of the general effects of climate change, and sea-level rise in particular. California's coastal institutions are working to address the emerging impacts of climate change; however, these organizations often face capacity and resource constraints that impede their ability to implement existing climate adaptation policies (Finzi Hart et al., 2012; Tribbia & Moser, 2008; DWR, 2013; DWR, 2014).

California has invested in a range of data, tools, and guidance products (e.g., seafloor mapping, Cal-Adapt, CO-CAT Sea-Level Rise Guidance) in recent years to promote statewide consistency in planning for sea-level rise and more effective responses to related coastal impacts like flooding and erosion. These investments are advancing knowledge of climate change and its consequences for the state's coastal communities. But advancing knowledge is not the same as increasing capacity to deal with sea-level rise and other climate impacts. Bringing new knowledge to bear on complex issues, such as coastal adaptation planning, requires consideration of what new policies and institutions are needed, and how existing policies and institutions can change to be more effective. And it requires thoughtful engagement and negotiation among producers and users of knowledge (Dilling & Lemos, 2011; Jacobs, Garfin, & Lenart, 2005; Sarewitz & Pielke Jr., 2007).

Sea-level rise is expected to increase the severity of coastal flooding and erosion in the coming decades (NRC, 2012). Adapting to rising seas is among the most challenging issues that coastal decision-makers face, and a lack of adequate training, technical support, and information tailored to their decision making context makes it difficult to effectively manage and plan for this emerging threat (Finzi Hart et al., 2012). There is a need for useful information and guidance to plan at multiple levels of government for these anticipated impacts.

Incorporating sea-level rise into floodplain management

To address the complex and evolving needs of coastal managers and planners around sea-level rise, the Ocean Science Trust is collaborating with the California Department of Water Resources and Scripps Institution of Oceanography on a NOAA-funded project to develop useful information products to support and better prepare local communities to plan and adapt to sea-level rise and coastal flooding. This project will take new information on regional-scale sea-level rise, wave runup and tides, and translate it into products and processes that are directly relevant to coastal planners, and which can be "mainstreamed" into existing programs.

Specifically, this project will incorporate information about potential sea-level rise impacts into a supplement to the California Department of Water Resources' existing publication *The National Flood Insurance Program in California: Quick Guide* (DWR, 2007) -- a resource for floodplain managers which contains simplified guidance on how to comply with Federal Emergency Management Agency's National Flood Insurance Program. The *Quick Guide* supplement being developed for the project will provide contextual and technical information that communities can use to bring explicit consideration of sea-level rise into their planning, local floodplain ordinances and other relevant programs.

In addition to producing discrete information products, the broader goals of this effort include advancing the capacity of coastal decision-makers to incorporate sea-level rise science into their planning and policy activities and to serve as a model for how to incorporate expected future conditions from sea-level rise into managing coastal floodplains. To achieve this, the project approach is organized into several key components (also described in Figure 1):

- Science Needs Assessment: Ocean Science Trust has conducted interviews with stakeholders about the challenges, barriers, and opportunities for developing effective information products and engagement processes related to sea-level rise.
- Focus Group: A Focus Group of floodplain managers and coastal decision-makers is helping to shape the outputs of this project. Members of the Focus Group will also serve as conduits to their broader communities, promoting partnerships and strengthening the network of institutions focused on addressing coastal vulnerability and climate adaptation
- Sea-Level Rise Modeling: Scripps Institution of Oceanography will develop indices of potential coastal flooding at five representative locations across California.
- Non-regulatory Guidance Products: Based on findings from this Science Needs Assessment, and the Focus Group, this project will prepare non-regulatory guidance and information products to support coastal flood planning and management.
- Workshops and Trainings: The Department of Water Resources will organize a series of workshops and trainings to disseminate the guidance products produced to key stakeholders and potential users.

Ultimately, the information products, trainings, and engagement efforts from this project will advance the capacity of decision makers to prepare for, and respond to the impacts of sea-level rise on coastal communities. This Science Needs Assessment will provide critical insights into not only the information needs of decision-makers around sea-level rise, but will also reflect the supply and demand of information on coastal flooding, to ensure that the resulting products are useful to decision-makers at multiple levels of governance.

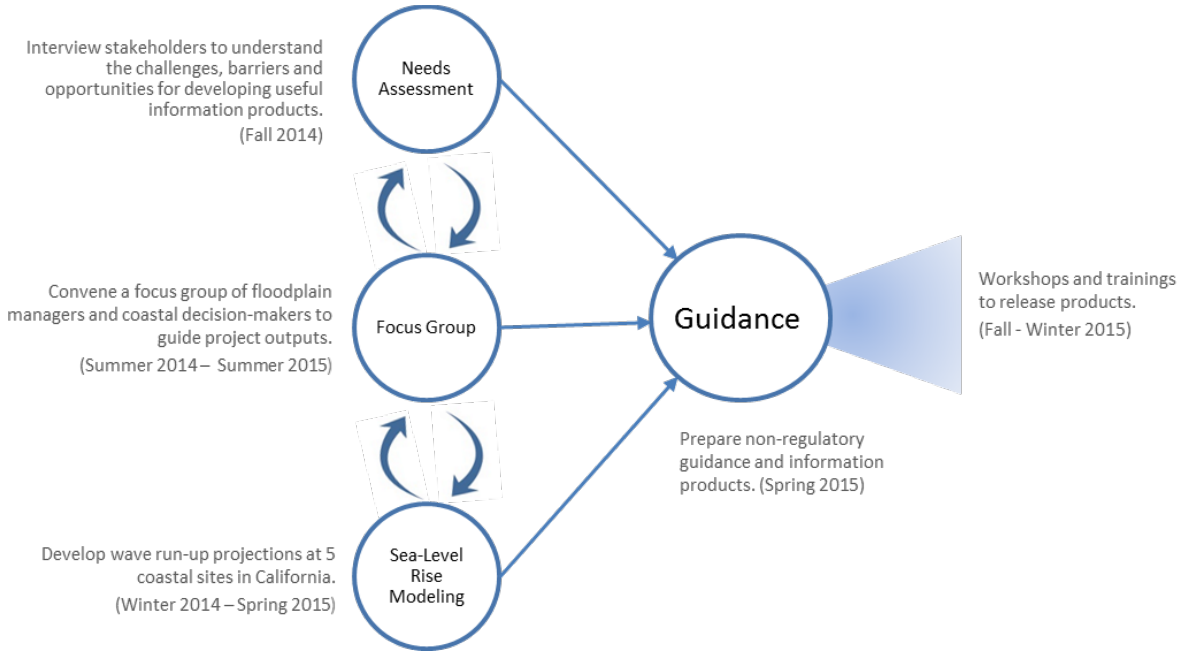

Figure 1. Sea-Level Rise and Floodplain Management Project Components

ASSESSING SCIENCE NEEDS

As a "boundary organization," (see Clark et al., 2011; Guston, 2001 for background) Ocean Science Trust strives to bring scientists, managers, and policy-makers together around ocean resource management challenges. Integrating science into decision-making can be a challenging and complicated process. Scientists, managers, and policy-makers often operate in fundamentally different worlds, with different processes, timelines, and priorities. Science Needs Assessment has been a valuable approach to laying a foundation for constructive interaction among these communities. Through interviews, focus groups, and/or surveys, Science Needs Assessments explore the science and information needs of decision-makers and the processes by which they access and use scientific knowledge in their work.

At the foundation of Science Needs Assessments is the recognition that understanding institutions and their decision-making processes is just as important as identifying specific information needs. Effectively addressing science needs requires insight into how decision-makers use and access scientific information, what constraints and opportunities they face in decision-making processes, and the broader political and institutional contexts in which decisions are being made. In addition to addressing science needs and gaining a deeper understanding of how agencies use science, Science Needs Assessments can also help to strengthen relationships and collaborations between decision makers and scientists, another important objective of this project.

Ocean Science Trust conducted a Science Needs Assessment to help guide decisions about the framing, structure, and delivery of the *Quick Guide* supplement. Key stakeholders (e.g., local floodplain managers, city planners, coastal policy/decision-makers, engineers, and scientists) were interviewed to document the various challenges, barriers, and opportunities for developing useful information products on sea-level rise and coastal flooding. This Science Needs Assessment builds on findings from a review of existing studies that address the capacity of decision-makers to confront coastal management challenges in California and the types of information that could promote effective adaptation, planning, and implementation in the face of climate change.

METHODS

The Ocean Science Trust has conducted Science Needs Assessments for a number of projects across a variety of issues.[1] The Science Needs Assessment for this project draws from methods and approaches of these prior assessments and is organized into five main steps:

> ***Step 1. Background***: Conduct a literature review of relevant reports and studies that document current coastal management needs and challenges with specific consideration of the project goals.
>
> ***Step 2. Participant scoping:*** Identify potential participants to interview based on direct partner feedback and the broader institutional make-up of organizations that produce and use information on sea-level rise and coastal flooding.
>
> ***Step 3. Designing interviews***: Develop a semi-structured protocol to guide interviews.
>
> ***Step 4. Conducting interviews:*** Conduct interviews in-person and via telephone and record detailed notes.
>
> ***Step 5. Compiling and interpreting results:*** Review interview responses to identify key themes and relevant findings.

These steps are described in further detail below.

Current coastal management needs and challenges in California

A handful of studies were conducted to understand the diverse needs of coastal decision-makers around sea-level rise and floodplain management in California, in addition to the

[1] To learn more about Ocean Science Trust's work implementing Science Needs Assessments, visit http://calost.org/science-initiatives/?page=asna

challenges and opportunities that exist for integrating resources into management and planning processes at various scales. As a preliminary step, Ocean Science Trust reviewed these studies (see Appendix A for list of references) and noted their different methods and approaches and relevant findings.

Designing and conducting interviews

The Ocean Science Trust developed a semi-structured interview protocol with guidance from project partners. The questions (See Appendix B for the full list) reflect the existing needs of coastal managers identified in the literature. In addition, the questions were crafted with specific consideration of the following *primary* goals of the Science Needs Assessment:

- Understand the challenges and opportunities for developing and implementing effective sea-level rise guidance and information products.
- Understand the processes through which sea-level rise information products are provided and adopted.
- Understand the utility of existing sea-level rise guidance and information products.

Secondary goals were to:

- Understand the relationships and partnerships that currently exist among the California Department of Water Resources, Federal Emergency Management Agency, and local coastal agencies.
- Assess the level of engagement and interest in this project and identify individuals to participate in a project Focus Group that will provide guidance to project processes and outputs.
- Identify opportunities for coordination with other parallel projects or initiatives.

To increase the utility of potential products, project partners deemed it important to capture the views of other perspectives beyond those of local floodplain managers that are associated with the National Flood Insurance Program. As a result, interviewees included local floodplain managers, long-range planners, resource managers, coastal flooding and hazard mitigation program coordinators, coastal policy decision-makers, and physical process and engineering experts. In total, 30 individuals were interviewed via telephone and in-person (when feasible). These individuals represented twenty-four unique institutions, and included staff from state and federal agencies, local governments, and consulting firms (see Appendix C for a complete list of the entities interviewed).

In addition to gathering insights from multiple management perspectives, this interview process provided an opportunity for Ocean Science Trust to clarify its role in the project and explain its broader organizational mission to interviewees who were unfamiliar with its work.

Detailed notes from the interviews were analyzed for key themes related to science needs, interagency collaboration, and specific issues related to floodplain management programs conducted by the California Department of Water Resources and/or the Federal Emergency Management Agency.

FINDINGS

Literature Review

The reports reviewed identify a range of needs and challenges decision makers have in using existing sea-level rise science and tools. Below is a list of common themes.

Institutional resources and capacity for addressing sea-level rise in local management and planning are limited

There is a need for long-term and sustainable funding for coastal flood management and planning. The current lack of funding and program support makes it difficult for local government agencies and departments to effectively address and consider sea-level rise in their activities. Aligning priorities around sea-level rise at the state and regional levels and streamlining the delivery and investment of funds for coastal flooding projects can help address these deficiencies (Finzi Hart et al., 2012; Tribbia & Moser, 2008; DWR, 2013; DWR, 2014).

Interagency collaboration can be more effective through strengthened coordination and leadership

The responsibility for addressing sea-level rise is fragmented across agencies and departments, resulting in a need for interagency collaboration (DWR, 2013). And while a certain level of interagency collaboration is occurring, often through working groups, there is a need for leadership and consistency in these efforts (DWR, 2014). Interagency collaboration can provide multiple benefits that include sharing resources, aligning strategies and priorities, and streamlining sea-level rise policies across institutions.

Tools and information products should be coupled with user training and education

Many local planning and management agencies lack in-house capacity to use and apply sophisticated tools, such as analytical or forecasting models and decision support tools to their activities. Given this limited capacity, managers have expressed a need for education and training on how to use and implement these products, with examples of their application. This makes it easier for managers and other users (including consultants) to integrate these tools into their daily work and decision-making processes (NOAA, 2011; Finzi Hart et al., 2012; Tribbia & Moser, 2008).

Existing data and tools need to be collated and shared more broadly

The majority of managers access data and tools through consulting in-house colleagues, the Internet, or professional trade journals. However, coastal decision-makers have expressed a need to streamline access to these resources (Finizi Hart et al., 2012). Especially in California where there has been a proliferation of tools and guidance products, there is a need to create dedicated places (e.g., online portals) for sharing and consolidating existing data and tools and for organizing and categorizing these resources based on their application to specific sectors or regions. (*Lifting the Fog,* 2014).

Comprehensive adaptation planning for sea-level rise requires integrated modeling and assessments

There are additional data and modeling needs beyond localized sea-level rise projections to support adaptation planning. These include: high resolution topography and bathymetry data (NOAA, 2011), tidal change information, storm surge models (DWR, 2014), shoreline erosion models, wetland migration models, biological data on critical habitats, socioeconomic data, and analyses that consider tradeoffs of different adaptation options to the built and natural environment (Finzi Hart et al., 2012).

Science needs to be more directly linked to practice

Coastal managers' needs around sea-level rise extend beyond just data and tools; understanding information needs and addressing sea-level rise adequately require formal processes and interaction between information producers and users. This can occur through formal boundary organizations or other forums for communication between these two groups. Ultimately, facilitating communication between the information producers (scientists) and users (managers) can help to link information to decision-making and management in a tangible, practical manner (Tribbia & Moser, 2008).

Science Needs Assessment

The findings from this Science Needs Assessment were broad, and varied across organizations, offices, cities, and counties. Common themes among the findings did emerge, however, and in many ways reinforced the findings from the literature review. The findings have been organized according to the goals of the Science Needs Assessment. This helped to both frame and structure the analysis and synthesis of the findings in a way that supports the key objectives of this project:

- *Understand the science needs of coastal and floodplain managers; and*
- *Develop useful information and guidance products that can address those needs*.

These general findings are followed by a list of more specific, focused findings that more directly guide the information products to be generated by this project.

Challenges and opportunities for developing and implementing sea-level rise guidance and information products

There are challenges in developing and implementing effective sea-level rise tools, guidance, and other information products, at all levels of management. In general, findings reinforce observations in the literature that a lack of program support and institutional capacity at the local level poses the most significant barrier to integrating sea-level rise information into management and planning processes. This applies to coastal management in general, as well as the specific issue of floodplain management. There are limited resources to develop and implement sea-level rise adaptation policies, or respond to funding streams that are available to develop locality-specific products. Further, there is a lack of staff resources to review and evaluate current sea-level rise information, tools, and guidance products.

Meeting the multitude of information needs of decision-makers around sea-level rise was also identified as a key challenge because these needs are complex, nuanced, and are often department-, site-, or project-specific. For example, the practical framing of sea-level rise varies across management context. A floodplain manager's information needs might focus on how sea-level rise will affect the boundary of a coastal flood zone, whereas a city planner's information needs might focus more on characterizing sea-level rise impacts on coastal development and understanding the underlying physical process that cause those impacts. In addition, managers are working at quite different scales. While many planning *activities* may require information that is downscaled and site-specific, many *offices and departments* may desire information that is scalable and applicable to a broader set of activities and geographies.

Interviews also revealed both a demand and political support for the provision and adoption of useful sea-level rise guidance and information in a number of local contexts. To that end, existing pathways, such as regulatory and planning frameworks and incentive-based mechanisms like grant programs provide opportunities to address this demand and integrate sea-level rise information into coastal management and planning.

General plans, special area master plans, and community plans are a few examples of blueprints that guide local considerations around managing the built and natural environment. These regulatory and planning programs implemented at the local level are updated periodically based on guidance from state and federal counterparts. Local communities are using these updates as an opportunity to address sea-level rise. The City of Monterey recently updated its hazard mitigation plan and included considerations of climate impacts, including sea-level rise. These climate change considerations were designed to be consistent with the state hazard mitigation plan overseen by the California Office of Emergency Services and were supported in-kind by subject matter experts from NOAA. The County of Santa Cruz is also taking the opportunity to address sea-level rise as it updates its flooding ordinances. The County is working to ensure these ordinances are consistent with its local climate adaptation plan and is supporting this work through outside grant funds.

Planning and regulatory ordinances are often quasi-regulatory. Local communities are not required to maintain them or update them. Many agencies, especially at the state and federal level, that provide funds to support these types of programs are developing guidance and

amending grant criteria to incorporate sea-level rise considerations into on-the-ground projects. Some examples include the California Coastal Commission local coastal program update grants and the California Office of Emergency Services hazard mitigation grants. Failure to adapt to these changing policies can place communities in jeopardy of accessing dedicated funding streams that can be leveraged to support a broad range of services beyond climate adaptation and mitigation.

Processes through which sea-level rise information products are provided and adopted

There are many entities attempting to address the widespread demand for sea-level rise guidance and information products. Federal and state agencies and academic research groups were identified as key providers of sea-level rise information and tools for management and planning. Federal agencies such as NOAA and USGS have developed online sea-level rise mapping tools (e.g., NOAA Sea Level Rise Viewer, USGS Coastal Storm Modeling System) and are disseminating these tools through trainings and workshops that educate practitioners on their use and application in local coastal planning activities.

Academic research institutions are another key producer of sea level rise information, partnering with state agencies and local governments to deliver the best available science on sea-level rise. For example, researchers from UC Santa Cruz, with funding support from the California Energy Commission, developed a guidebook to assist decision-makers in California's coastal cities and counties in developing sea-level rise adaptation plans for their local communities (Russell and Griggs 2012). The authors then used this guidance in a related report that assesses the vulnerability of the City of Santa Barbara to future sea-level rise and associated coastal hazards (Griggs and Russell 2012).

Regional collaborative groups, local government associations, and public-private partnerships were identified as bodies that develop, adopt, and implement sea-level rise policy, guidance, and tools for planning at the local level. These products are then generally put into practice through Climate Action Plans, which often serve as the primary planning guidance on climate change adaptation at the local level. The San Diego Regional Climate Collaborative and the Los Angeles Regional Collaborative for Climate Action and Sustainability are two groups working to improve coordination on climate change issues at the local and regional level. Their network of partners spanning government, business, academia, and the community are leveraging their expertise and resources to produce sustainable and implementable climate change strategies. These efforts have produced a number of projects and initiatives that address adaptation to sea-level rise.

The San Diego Regional Climate Collaborative developed a sea-level rise adaptation strategy for the San Diego Bay that comprised of an assessment of community vulnerability and supporting adaptation recommendations (Hirschfeld and Holland 2012). ICLEI – Local Governments for Sustainability led this effort with support from the Tijuana National Estuarine Research Reserve. Similarly, the Los Angeles Regional Collaborative for Climate Action and Sustainability developed a sea-level rise vulnerability assessment for the City of Los Angeles that also included

strategies for adaptation (Grifman et al. 2013). The City of Los Angles and USC Sea Grant oversaw this initiative. Both of these projects were driven by stakeholder input and informed by the best available science coming out of local academic partners and other research groups. These efforts were funded by a combination of public and private funds and are helping to directly inform policy and implementation activities around sea-level rise. For example, this information has been integrated in the Climate Action Plans for several local governments in the San Diego Bay area, as well as the port and regional water authority. In Los Angeles, additional funding has been secured to evaluate sea-level rise adaptation strategies that could be introduced into a general plan or local coastal plan.

Understanding the utility of existing sea-level rise guidance and information products

Interviewees identified a range of sea-level rise information products and tools that they are aware of and/or use (see Table 1. below for a list of resources identified by interviewees). Yet because existing products vary in their form and function it is difficult to conduct an evaluation of the relative utility of these resources. Common features of useful tools/products include: intuitive interfaces, geospatial visualization capabilities, online accessibility, and referencing or aggregating additional or related resources.

The information needs around sea-level rise of those interviewed were varied, reflecting the specific user context. Some activities call for simpler tools and more general information, whereas others require sophisticated tools and detailed scientific and technical information. In addition, there are inherent tradeoffs in usability, with varying levels of complexity. Simpler tools and generalized guidance may require less translation and training to use and implement, but are limited in what they can effectively address. Complex and sophisticated tools, models, and analyses can provide more accurate, precise information, but often require additional staff and training to use and implement. Interviewees noted these dynamics, especially in the context of information needs around short-range and long-range planning. For evaluating near-term projects (e.g., CEQA), more specific and sophisticated resources are needed. Long-term area planning (e.g., general plan), on the other hand, requires less robust resources to carry out.

There is demand for sea-level rise tools and information products that translate complicated scientific concepts into management relevant formats. Yet a number of interviewees were not aware of resources that are applicable to their decision-making context and were often using outdated resources. With this in mind, it is important to consider tradeoffs between support of existing products and development of new resources.

Table 1: Sea-level rise information products identified by interviewees

Name	Producer	Product Type
Cal Adapt	California Energy Commission	Data, Visualization
Sea-Level Rise and Coastal Flooding	NOAA	Modeling, Visualization

Impacts Viewer		
Coastal Storm Modeling System (COSMOS)	Our Coast Our Future US Geological Survey	Modeling, Visualization
San Francisco Sea-Level Rise Pilot Project	Federal Emergency Management Agency	Regulatory Maps
California Coastal Commission Draft Sea-Level Rise Guidance	California Coastal Commission	Guidance
The State of California Sea-Level Rise Guidance Document	California Coastal and Ocean Climate Action Team	Guidance
Adapting to Sea-level Rise: A Guide for California's Coastal Communities	UC Santa Cruz California Energy Commission	Guidance
City of Santa Barbara Sea-Level Rise Vulnerability Study	UC Santa Cruz California Energy Commission	Guidance
California Multi-Hazard Mitigation Plan	California Office of Emergency Services	Guidance
Sea-Level Rise Vulnerability Study for the City of Los Angeles	City of Los Angeles University of Southern California Sea Grant	Report/Study
San Diego Bay Sea-Level Rise Adaptation Strategy	San Diego Foundation ICLEI – Local Governments for Sustainability	Report/Study
The Impacts of Sea-Level Rise on the California Coast	The Pacific Institute Philip Williams and Associates	Report/Study
San Francisco Bay Plan Update	Bay Conservation and Development Commission	Regulatory
Adapting to Rising Tides	Bay Conservation and Development Commission	Report/Study
Coastal Resilience Ventura	The Nature Conservancy	Modeling, Visualization
Surging Seas Tool	Climate Central	Modeling, Visualization
Sea-Level Rise for the Coasts of California, Oregon, and Washington	National Research Council	Report/Study
Lifting the Fog	NOAA, NEERS Collaborative, The Nature Conservancy, Coravai	Report/Study

Consideration of perspectives not identified in the interviews

To conduct this Science Needs Assessment a subset of organizations and communities were interviewed. A number of these entities demonstrated the capacity to address and implement sea-level rise policies and many have already taken measures to do so. There may be additional needs and priorities for groups that are in the process of developing their capacity, in terms of both staff availability and training, with regards to sea-level rise planning and management. Efforts will be taken to identify these needs and integrate them in the final products using the Focus Group participants as conduits to their broader communities of practice.

TRANSLATING FINDINGS INTO PRODUCTS

The findings from the Science Needs Assessment demonstrate that California's decision-makers have access to a wide range of information products, including sea-level rise mapping tools, online databases, and agency sea-level rise guidance and planning documents. However, these resources do not always meet the complex information needs to integrate sea-level rise into decision-making across the state and are not always delivered with sufficient resources and guidance to support their use. The breadth of these findings is helpful in identifying general characteristics of information products and drawing out common information needs. However, the scope and focus of this project are much narrower. The findings below are more directly relevant to developing this project's information products. These key themes can serve as guidelines and important considerations in developing these guidance products, including the *Quick Guide* supplement.

Modeling results and technical information should be relevant to management decision-making frameworks

The findings from the Science Needs Assessment demonstrate the importance of developing information products that are relevant to management processes, timescales, and metrics. Project collaborators from the Scripps Institution of Oceanography will be developing an index of future flooding conditions at six locations across the California coast. These outputs, while Illustrative of future flooding trends, fall short of information that can be used in on-the-ground coastal adaptation planning. Several interviewees noted that map products that illustrate the zone of future expected flooding could help them identify and share with their communities what site-specific areas are at risk to future flooding in ways that a flood index could not. Further, when developing the parameters for sea-level rise products, including flood maps, it is important to consider the timeframes that guide regulatory and planning decisions. For example, when the City of San Diego updated one of its community plans, it referred to Cal-Adapt to identify areas vulnerable to sea-level rise and associated coastal flooding. Staff was in need of outputs at 20-year intervals, but the information on Cal-Adapt was limited to 2050 and 2100. Accounting for these consideration needs in the process of establishing modeling parameters and defining end products could increase the relevance and utility of Scripps work.

Include information on shoreline erosion and geomorphic responses, in the context of sea-level rise

Several interviewees noted that existing sea-level rise guidance products often lack information on geomorphic response, such as beach, dune, and bluff erosion, which is inextricably linked to changing water levels (e.g., sea-level rise). Knowledge of the relationships between sea-level rise, shoreline change, and coastal flooding is critical for both near-term and long-term planning. While it may be infeasible to integrate these geomorphic responses into the technical modeling efforts of this project, at minimum qualitative information that addresses these coastal processes should be included.

Balance sophistication with simplicity by developing tiered guidance and information products

In the interviews it was suggested that the project partners develop a "multi-dimensional" information product that is organized, or tiered, to provide different levels of information for different audiences. The broadest level could provide guidance that focused on presenting general concepts and other relevant information to set the context. An additional level could provide more specific detail around the modeling methods and analyses. A final level could be a repository for raw data and other resources.

Co-produce products with potential users

Interviewees who had been directly involved in developing tools for coastal decision-makers noted that products are more useful when they're developed, informed, and tested by potential users, practitioners, and other relevant stakeholders. The co-production process can have other positive benefits, including assisting with the dissemination of products to intended users. In addition, ensuring that developers can engage with users throughout the lifecycle of the project can also help to increase the uptake and continued use of products. This project was proposed with these considerations in mind. For example, the Science Needs Assessment is designed to facilitate co-production, gathering relevant information from stakeholders and potential users to guide development of the end products. In addition, this project establishes an interagency focus group that identifies common goals and priorities, establishes processes that guide the outcomes of the project, including additional opportunities for end-users to engage and shape the product as it evolves.

Identify incentives that can support the development and use of information

There is cross-cutting demand for information and guidance to address sea-level rise at the local level. Communities that are incorporating sea-level rise information into their planning and regulatory mechanisms are often harnessing incentive structures, such as state and federal grant programs, to support such work. Within the context of the National Flood Insurance Program, the Community Rating System Program provides a potential incentive for communities to use the information and approaches advanced by this project. While this project focuses on the application of its outputs to the National Flood Insurance Program, clearly identifying and linking users to additional incentive programs for utilizing this type of information could help support the uptake and use of this project's end products.

Limited familiarity with the *NFIP California Quick Guide*

The *Quick Guide* provides general, simplified guidance for NFIP compliance, targeting local floodplain managers. Most interviewees were not familiar with the *Quick Guide.* This likely reflects the pool of interviewees for the Science Needs Assessment, which drew from more

categories of coastal professionals than just floodplain managers. In addition, most of those interviewed who have direct floodplain management responsibilities are utilizing resources (e.g., guidance, tools) that contain more in-depth information on coastal flooding than what is presented in the *Quick Guide*. Providing more detailed information and addressing additional information needs where feasible can encourage broader use of a *Quick Guide* supplement. Additionally, being strategic in the dissemination and outreach of this product will be important in ensuring its application.

CONCLUSION

The findings from this Science Needs Assessment demonstrate that many local decision makers are working to address sea-level rise and related coastal impacts like coastal flooding. These coastal professionals are leveraging a range of policy, regulatory, and management mechanisms and a growing number of data, tools, and guidance products to meet the challenges posed by a changing climate. However, available resources to support planning and adaption to sea-level rise do not always contain information that is usable within varying decision-making contexts, and there is often a lack of training and technical support to onboard these resources at the local level.

The Science Needs Assessment conducted in support of this project was designed with specific consideration to the challenges of connecting new knowledge on sea-level rise to users with complex and evolving needs. This initiative is helping to proactively identify scientific research and information that reflect the complex and variegated needs of California's coastal decision makers around sea-level rise, while accounting for the capacity of decision-makers to make use of this knowledge.

The findings from this Science Needs Assessment are being used by the project's Focus Group as a roadmap to help shape the production and distribution of the *Quick Guide* supplement, helping to produce an end product that is relevant and usable to their broader communities of practice. Further, input from the Focus Group on the design of this Science Needs Assessment and interpretation of its findings is helping to build new knowledge of what constitutes actionable, decision support resources for planning and adapting to sea-level rise while simultaneously building trust and promoting partnerships between institutions that have a stake in a healthy and resilient coast zone.

Appendix A: References

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Appendix B: Science Needs Assessment Interview Questions

1. Can you tell us a little about the role you play in your organization?

2. Can you describe in general terms how your organization is addressing sea-level rise

    a. If applicable, in the context of coastal flooding.

3. One of the things this project will be doing is updating the Department of Water Resource's National Flood Insurance Program Quick Guide to include a supplement on coastal areas and flooding from sea-level rise. Are you aware of this product?

    a. Has your organization used the Quick Guide in the past?

        i. By incorporating guidance related to sea-level rise, tides and waves in a user-friendly manner, do you think this will increase your and/or your partners' use of the Quick Guide?
        ii. Is there anything else we should consider in developing this supplement, specifically with regards to making it user friendly for floodplain managers and coastal planners?

4. Does your organization coordinate with Federal Emergency Management Agency and/or Department of Water Resources on any activities relating to the National Flood Insurance Program along the coast?

    a. If so, can you briefly describe this interaction?

5. What are some examples of other products (e.g., science, guidance, tools) that address coastal flooding and inundation that you consider to be helpful useful and constructive (these can be existing or in the process of being developed)?

    a. What makes them useful?

6. What are some of the barriers to using, adopting or implementing these types of products?

7. There may be opportunities for you to continue to inform the production of the Quick Guide supplement, and the technical outputs from this process may have utility beyond the updated Quick Guide. Would you be interested in staying informed about our progress?

    a. A Focus Group of coastal decision-makers and floodplain managers will provide guidance at various points in the project's timeline, on the project outputs. Based on your knowledge, expertise and institutional setting we'd like to invite you to participate in this focus group. Would you be interested in participating in this?

b. If not, could you recommend any organization or individual for participation?

8. Would you be interested in staying informed about other Federal Emergency Management Agency and/or Department of Water Resources efforts related to the National Flood Insurance Program and considerations of future expected conditions (e.g., sea-level rise)?

9. Are there any other initiatives that parallel this project that we should be aware of, or other people we should reach out to?

Appendix C: Science Needs Assessment Interview List

CITIES AND COUNTIES
Del Norte County
Crescent City
Santa Cruz County and City
City of Monterey
City of Ventura
Los Angeles County
City of Los Angeles
San Diego County
City of San Diego
City of Chula Vista
AGENCIES
Federal Emergency Management Agency
California Department of Water Resources
California Office of Emergency Services
National Oceanic and Atmospheric Association Office of Coastal Management
Governor's Office of Planning and Research
State Coastal Conservancy
California Coastal Commission
Bay Conservation and Development Commission
Ocean Protection Council
United States Geological Survey
OTHER EXPERTS
AECOM
Environmental Science Associates
Everest International Consultants