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Publication Date

2015-05-01

Data Availability

The data associated with this publication are available at:

<https://law.ucla.edu/news/tracking-coastal-adaptation-implementing-californias-innovative-sea-level-rise-planning>

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Pritzker Environmental Law and Policy Briefs

POLICY BRIEF NO. 7

May 2015

Tracking Coastal Adaptation: Implementing California's Innovative Sea Level Rise Planning Database

By Megan M. Herzog, Susanne C. Moser, & Sarah Newkirk

This policy brief offers recommendations regarding implementation of A.B. 2516, which directs the California Natural Resources Agency and Ocean Protection Council to develop an online database of actions taken across the state to plan for sea level rise. The authors and contributors to these recommendations collectively bring expertise in coastal law, climate change adaptation, program evaluation, and survey research. These recommendations may be useful to other states, policymakers, researchers, and private entities seeking to enhance the compilation, publication, and analysis of information about climate change adaptation.

Introduction Sea level rise presents a significant climate change adaptation challenge for California. The state has over 3400 miles of coastline, millions of coastal residents, and an economy dependent on coastal natural resources. Higher sea levels threaten residents, public and private development, critical infrastructure, and natural resources with increased risk of flooding, inundation, storm damage, shoreline erosion, saltwater intrusion, and beach loss.

Although California has long been a worldwide leader in mitigating global climate change through reducing greenhouse gas emissions, the state has only recently begun to focus seriously on adaptation actions, which aim to reduce or adjust the adverse impacts of climate change. California's coastal communities, agencies, and public and private entities are largely in the early stages of planning for and addressing climate-related changes on the coastline.¹ Because the coast is an integrated system, and entities throughout the state have similar adaptation needs and challenges, coordination in sea level rise adaptation across sectors, jurisdictions, and scales of governance is not just beneficial but essential. Yet recent reports on sea level rise have cited a lack of integration between the many actors engaged in adaptation in California and

consequently have called for improved information-sharing.²

In response, the California Legislature recently enacted one of the state's first laws designed to advance climate adaptation. A.B. 2516,³ which Governor Brown signed on September 21, 2014, directs the California Natural Resources Agency (CNRA) and Ocean Protection Council (OPC) to publish information about state and selected local efforts to respond to sea level rise in a publicly accessible online database. The law requires the following entities to submit relevant information to the database biannually: airports and ports in the coastal zone or San Francisco Bay area, investor-owned utilities and publicly owned electric or natural gas utilities in the coastal zone or San Francisco Bay area, regional water quality control boards, and several state entities with relevant jurisdiction (see **Box 5** below).⁴ Notably, municipalities and counties do not fall under the reporting requirements of A.B. 2516.

The CNRA and OPC are currently in the process of developing an implementation strategy for A.B. 2516. A.B. 2516 was not accompanied by an appropriation of funds to support its implementation. With sufficient resources, however, the database has the potential to become one of the most

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robust sea level rise planning information portals in the country, and an example that other jurisdictions may wish to duplicate.⁵

Importantly, the law grants the agencies broad discretion to determine which types of sea level rise planning information to include in the database, whom to survey, and how to organize the data. These decisions are not insignificant. Creation of the database offers an opportunity to help establish a coastal adaptation survey and dataset that may be useful not only for state and local planning but also for broader assessment of California's preparedness for sea level rise. And although mandatory reporting is limited to a discrete list of entities, all public and private actors engaged in coastal climate change adaptation—in California and beyond—stand to gain valuable knowledge and insight from the database. Furthermore, because California's database is the first of its kind, the agencies' choices about which information to survey, whom to survey, and how to structure the database have the potential to influence the form and scope of future adaptation databases in other jurisdictions.

This policy brief provides recommendations to the CNRA, OPC, and California Legislature regarding how to harness A.B. 2516 to enhance coastal climate change preparedness in California. The authors and contributors to these recommendations collectively bring expertise in coastal law, climate change adaptation, program evaluation, and survey research. Overall, acknowledging that the CNRA and OPC have limited resources to devote to implementation of A.B. 2516, we urge the agencies to work over the next several years to the best of their capacity toward developing a database that can play an integral role in the development

and promotion of coordinated, integrated, and effective state adaptation policy.

Key recommendations include:

1. The CNRA and OPC should survey entities to obtain data that—when ever possible—is quantifiable and relates to metrics regarding entities' adaptation capacity, actions, and progress, and that will, over time, enable database users to evaluate the pace and effectiveness of adaptation activities in California.
2. The online database should be designed so that it is easy for users to search for, retrieve, and contextualize data.
3. To gain a fuller picture of coastal adaptation efforts and the state's preparedness for coastal climate change impacts, the CNRA and OPC should, as administrative resources allow, seek information from coastal municipalities and counties on a voluntary basis even though local governments do not fall under the data disclosure requirements of A.B. 2516.
4. Over time, the CNRA and OPC should consider adding tools to enable users to view relevant geospatial information in interactive maps.
5. Upon demonstration that the database can effectively serve user

Box 1. A.B. 2516 Implementing Agencies

Ocean Protection Council — coordinates the ocean-related activities of state agencies and recommends critical policy reforms

Natural Resources Agency — manages and protects the state's natural, historical, and cultural resources

needs, the CNRA and OPC should seek longer-term authorization and funding to maintain the database indefinitely as a cornerstone of state adaptation monitoring and evaluation efforts.

assessing projected impacts and potential responses. A.B. 2516 aims to facilitate more effective and coordinated sea level rise adaptation planning while educating the public about California's preparedness for coastal changes.

I. Background

Sea level rise is already affecting California's coastline, yet most managers and policymakers are still in the early stages of

A. Causes and Impacts of Sea Level Rise

Warmer global temperatures are causing ocean water to expand and ice to melt into

Box 2. State of California Sea Level Rise Adaptation Planning Timeline

2008: Executive Order S-13-08 calls for the development of a statewide climate adaptation strategy and orders state agencies to plan for sea level rise.

2009: **CNRA** completes the *California Climate Adaptation Strategy*. ● State Lands Commission publishes a *Sea Level Rise Preparedness Report* regarding facilities on sovereign lands.

2010: Sea level Rise Task Force develops a *Sea Level Rise Interim Guidance Document* to guide state agencies on how to incorporate sea level rise into planning and decision making. ● S.B. 1066 requires the Coastal Conservancy to address climate change impacts to coasts.

2011: OPC adopts a resolution encouraging all state agencies to adhere to the *Sea Level Rise Interim Guidance Document*.

2012: Emergency Management Agency and the CNRA publish *California Climate Adaptation Planning Guide* to aid local governments in adaptation planning. ● National Research Council releases scientific report, *Sea level Rise for the Coasts of California, Oregon, and Washington*.

2013: Coastal Commission releases draft guidance on how local governments should incorporate consideration of sea level rise into coastal planning and permitting. ● A.B. 691 requires certain trustees of public trust lands to submit to the State Lands Commissions assessments of how they will adapt to sea level rise. ● Sea level Rise Task Force updates the *Sea Level Rise Guidance Document* to incorporate new science about sea level rise. ● Governor's Office updates *General Plan Guidelines* to guide local governments in incorporating climate adaptation into land-use planning.

2014: **A.B. 2516 requires the CNRA and OPC to develop an online sea level rise planning database.** ● CNRA completes *Safeguarding California*, an update to the state's Climate Adaptation Strategy. ● OPC adopts a resolution encouraging public and private entities to incorporate *Safeguarding California's* recommendations into all relevant decisionmaking. ● Little Hoover Commission releases report, *Governing California Through Climate Change*, urging state and local leaders to prepare for climate change.

2013-Present: State agencies offer grants to local governments to fund updates of coastal zoning plans and sea level rise adaptation planning.

Box 3. The Adaptation Process



the sea. Over the past century, sea levels have already risen several inches along the California coast. The best available science projects that sea levels will continue to rise several feet over the coming decades.⁶ Reducing greenhouse gas emissions can help to slow the acceleration of sea level rise; but regardless of any future successes in climate change mitigation, California must prepare for changes to its coastline.

Sea level rise presents significant risks to California's natural and cultural resources, critical infrastructure, private and public property, and economy. Higher sea lev-

els will exacerbate the impact of coastal storms, contribute to saltwater intrusion into freshwater supplies, and increase the number of structures vulnerable to destructive coastal flooding, erosion, and inundation. These impacts could disrupt vital public services, endanger human health, and damage ecosystems. Additionally, sea level rise in combination with seawalls and other coastal armoring structures intended to protect development will result in beach loss, with potentially devastating impacts to recreation, tourism, and wildlife.⁷

Box 4. Examples of Sea Level Rise on Adaptation Strategies

protection strategies

- Defend the location of development (e.g., critical infrastructure or densely developed areas) with seawalls or other hard armoring
- Renourish beaches through sand replenishment programs
- Restore and enhance natural coastal stabilization structures such as wetlands

accommodation strategies

- Harness traditional regulatory tools like building, zoning, and floodplain development codes to increase new development's resilience through, e.g., density restrictions, setbacks, impact fees, or freeboard requirements.

managed retreat strategies

- Channel new development out of vulnerable areas while allowing existing development to be relocated, demolished, or inundated
- Restrict hard armoring and the rebuilding of development after storms or bluff failure
- Employ "rolling development restrictions," legal tools that prevent development from interfering the natural inland migration of the tideline

B. Adaptation in California

Public and private entities along the California coast should begin taking action to adapt to changing conditions; but the process of assessing vulnerability to sea level rise and selecting and implementing adaptation strategies requires time, staff, technical and legal expertise, scientific information, funding, stakeholder engagement mechanisms, and political will—all of which strain limited resources. Consequently, many of California's public and private entities are only in the very beginning stages of coastal adaptation planning.⁸ Some coastal local governments, ports, and private coastal entities have conducted or are currently preparing vulnerability and risk assessments, and several have developed broad adaptation plans; as of yet, however, few entities have taken steps to implement sea level rise adaptation strategies.⁹ Improved access to information about adaptation resources and what adaptation actions other coastal entities are taking could help further adaptation progress and effectiveness.

California state agencies are required by executive order to take sea level rise into account in their planning and decision-mak-

ing.¹⁰ Additionally, certain local trustees of state public trust lands are legally required to address sea level rise impacts.¹¹ California has developed a sea level rise policy guidance document and statewide climate adaptation strategy that offer broad direction to these entities about how to respond to sea level rise and other coastal changes.¹² Still, state-level actors need additional resources and capacity-building to meet the scope and scale of the coastal climate change challenge. Critical needs include tools to enhance interagency coordination and to facilitate assessment of the progress and effectiveness of the state's coastal adaptation actions.

At the local level, California currently encourages, but largely does not require, local governments and private entities to plan for sea level rise and other climate-change-related impacts to coastal resources.¹³ Notably, however, the state does require local governments and ports to manage the coastline to enhance public access, conserve natural resources, and mitigate hazards. The California Coastal Act of 1976 sets forth a framework for planning, regulation, and development permitting along

the state's coastline.¹⁴ The state's "coastal zone" extends roughly 1000 feet inland from the shore (but excludes the San Francisco Bay area, which has its own shoreline governance structure under the jurisdiction of the San Francisco Bay Conservation and Development Commission).¹⁵ Under the Coastal Act, all cities and counties in the coastal zone are required to prepare a Local Coastal Program (LCP), a collection of documents including a coastal land-use plan and accompanying maps, permitting procedures, and ordinances. The Coastal Commission must certify that an LCP conforms to the policies of the Coastal Act.¹⁶

Local Coastal Programs provide a poten-

tially valuable tool for adaptation planning and implementation. Currently, many jurisdictions still lack a certified LCP, and those jurisdictions with a certified LCP in place are unsure of how exactly to incorporate sea level rise.¹⁷ Many have not been updated in decades. In response to the growing need to update and integrate considerations of climate change into LCPs, the Coastal Commission recently released a draft guidance document containing broad principles to help local governments update LCPs to incorporate sea level rise adaptation.¹⁸ State agencies have offered grants to local governments to support LCP updates as well as adaptation planning and implementation more generally. Information about

Box 5. State Entities Subject To A.B. 2516 Data Disclosure Requirements

State Coastal Conservancy — uses creative non-regulatory techniques to purchase, protect, restore, and enhance access to coastal resources, and facilitate coastal climate adaptation

State Lands Commission — provides stewardship of sovereign lands and waterways, including coastal tidelands that are affected by potential adaptation actions such as hard armoring and beach nourishment

State Water Resources Control Board — manages water resources and drinking water supplies, including resources and infrastructure located in the coastal zone and potentially vulnerable to coastal climate impacts

Department of Transportation — manages highways, intercity railways, and public airports, many of which are located in the coastal zone and potentially vulnerable to coastal climate impacts

California Coastal Commission — plans and regulates development and conservation of the coastal zone in partnership with local governments; instructs local governments on how to incorporate considerations of climate change into local coastal planning and regulation

San Francisco Bay Conservation and Development Commission — protects, enhances, and regulates development in San Francisco Bay; coordinates local adaptation planning efforts

California Energy Commission — guides state energy policy and planning, including as to power plants, transmission and distribution lines, and other energy infrastructure located in the coastal zone and potentially vulnerable to coastal climate impacts

the status of LCPs and other relevant local plans (e.g., Local Hazard Mitigation Plans, General Plans) will thus provide valuable data to state government actors and other interested entities about local approaches to coastal adaptation.

C. A.B. 2516, “Planning for Sea Level Rise Database”

Recognizing the sea level rise adaptation challenges facing California, the 2013 State Assembly established a Select Committee on Sea Level Rise and the California Economy (Select Committee). The Select Committee held four hearings with technical experts and industry leaders,¹⁹ and in August 2014, published the report *Sea Level Rise: A Slow-Moving Emergency*.²⁰

The Select Committee’s report identified the need for better coordination and information-sharing about sea level rise adaptation, finding that sea level rise “does not stay within jurisdictional boundaries” and “affects many sectors and agencies, which are often intertwined and dependent on each other.”²¹ The report called for creation of a statewide database to: 1) serve as a consolidated repository for the wealth of sea level rise planning information generated in California; 2) facilitate interagency coordination to improve adaptation efficiency; and 3) help educate and engage the public.²²

The chair of the Select Committee, Assemblyman Richard Gordon, subsequently introduced A.B. 2516, “Planning for Sea Level Rise Database.” The bill became law on September 21, 2014. Under this new law, the CNRA and OPC must develop by January 1, 2016 an online database “describing steps being taken throughout the state to prepare for, and adapt to, sea level rise.”²³ Public and private entities such as airports, utilities, seaports, state agencies (see **Box 5** above), and regional water quality control boards shall submit relevant information to the database biannually, as requested by the CNRA and OPC. Notably, A.B. 2516 does not require any of these entities to develop or adopt sea level rise adaptation plans, or otherwise “alter the duties, responsibilities, and jurisdiction of state agencies” in regard to sea level rise adaptation.²⁴ The

law will sunset after two years, on January 1, 2018, unless the legislature decides to extend its requirements.²⁵

II. Recommendations

The idea of a statewide sea level rise planning database is novel and commendable. Although several states require agencies or local governments to consider sea level rise in their planning or decision-making, no other state legislature has adopted a policy requiring the development of an adaptation database.²⁶ Consolidating information in one central, public, easily accessible location could be immensely valuable to many adaptation actors. Below, we offer recommendations to the CNRA, OPC, and California Legislature regarding the potential users and uses of the database, data collection, survey structure, metrics and indicators for adaptation success, database form and functionality, and the future of the database beyond the requirements of A.B. 2516.

A. Database Users and Applications

The potential applications of the database should help guide database content, form, and functionality. Since the CNRA and OPC lack the resources to conduct a user needs assessment, we offer some thoughts about the potential users and uses of a sea level rise planning database. We see four primary interrelated objectives the database can serve for potential users, as outlined in **Box 6** and discussed further below. These inform our later recommendations.

The database can help state actors and others track progress on sea level rise adaptation and evaluate its effectiveness.

State-level government actors, non-profit organizations, advocates, and researchers are the most likely users of the database, and evaluating sea level rise adaptation preparedness is one of their key research needs. Understanding the progress of current and on-going efforts can offer guidance regarding how to prioritize future actions, policies, and investments; reward good actors; and target actors in need of additional

Box 6. Sea Level Rise Planning Database Uses And Users

EVALUATING SEA LEVEL RISE PREPAREDNESS

for use by: state government staff • elected and appointed officials within state agencies • the State Legislature • the Governor's Office • non-profit organizations and advocates • academic researchers

PROMOTING COORDINATION & MINIMIZING ADAPTATION REDUNDANCY

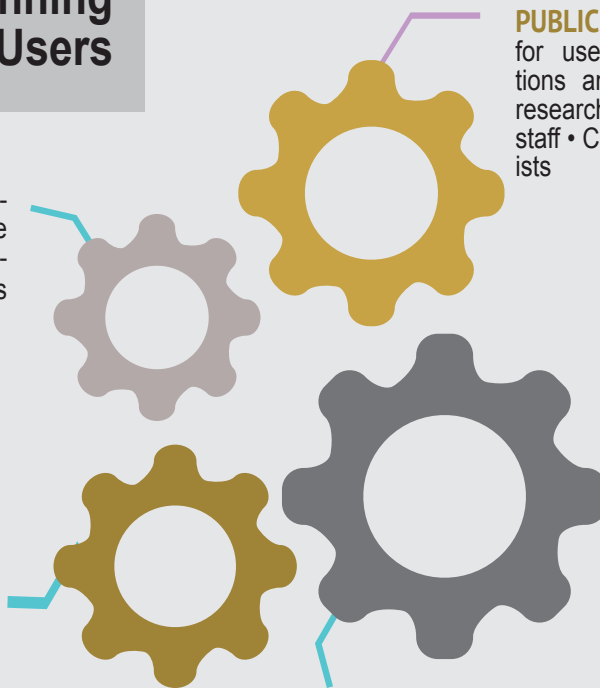
for use by: • state government staff • elected and appointed officials within state agencies • the State Legislature • the Governor's Office • coastal local government staff • private partners in government adaptation projects • coastal businesses and utilities

PUBLIC EDUCATION

for use by: non-profit organizations and advocates • academic researchers • federal government staff • California residents • journalists

PROVIDING A MODEL FOR OTHER JURISDICTIONS

for use by: climate adaptation actors at all levels and in all sectors outside of California



support. To the extent that the database includes metrics and indicators that allow for measurable tracking of adaptation progress and appraisal of preparedness, the database potentially could serve as a useful tool for understanding what constitutes “successful” adaptation—or at least what is meaningful progress in the desired direction—and to evaluate the effectiveness of California’s adaptation efforts.

In addition, the database can serve as a resource for government and academic entities engaged in large-scale data compilation and analysis efforts.

The database can minimize redundancy and encourage collaboration among California’s adaptation actors. Local government staff, their private partners, coastal businesses, and utilities may find the database useful and relevant to their adaptation planning efforts. Many staff involved in

local adaptation planning, such as county floodplain managers and municipal land-use planners, lack basic information about how other coastal actors are responding to sea level rise. Additionally, they may lack the technical and policy tools necessary for effective adaptation planning. These actors have expressed a desire for fora for collaboration and sharing ideas. This database could provide an impetus and a foundation for such collaboration. With a shared database, entities can access valuable data and avoid running the same assessments multiple times, thus improving adaptation efficiency. For instance, neighboring entities may be able to share vulnerability assessment data, and an entity evaluating a particular adaptation strategy may benefit from reviewing another entity’s cost-benefit assessment of that strategy in a similar circumstance.

State government actors engaged in adaptation and their partners also may find the database useful to the extent that it offers

new information or displays and stores routinely used information in an easy-to-access way. In particular, data about non-state entities would be useful to state government actors. While state government actors already have at least some information—particularly as relates to their mission and jurisdiction—many do not know the details or geographic distribution of what other state agencies have done to date on adaptation. This lack of detailed knowledge persists despite established mechanisms for inter-agency information-sharing (e.g., through the coordinating efforts of the OPC). The database would allow state agencies to further improve or facilitate their coordination on sea level rise adaptation.

The database can improve public education about and engagement in sea level rise adaptation. The stated goal of A.B. 2516 is to “provide the public with an education tool that will enable parties to view up-to-date information from a single, centrally located source about actions taken . . . to address sea level rise.”²⁷ Improved public

access to centralized information about sea level rise adaptation has the potential to enhance public and media engagement in local and state-level sea level rise adaptation planning processes, raise awareness of the risks posed by sea level rise and the potential solutions, and motivate independent adaptation actions.

The database can serve as a model and resource for other jurisdictions, positioning California as a leader. As noted above, the database will be the first of its kind in the country. The database can serve as model for other jurisdictions and entities outside of California that seek to enhance the compilation and publication of information about adaptation planning, and can contribute to climate preparedness beyond California’s borders. The database thus represents an opportunity to position California as a leader in sea level rise adaptation information-sharing, just as California is a leader in greenhouse gas emissions mitigation. Positioning California as a first-actor and model for other jurisdictions is a goal that underlies

Box 7. Comparing Popular Online Survey Tools

	Google Forms	QuestionPro	Qualtrics	Survey Monkey
Unlimited number of questions and responses	Free	10 questions & 100 responses for free; unlimited for \$75/month	\$250-400/year	10 questions & 100 responses for free; unlimited for \$26/month
Question types	Very basic.	More options.	More options	Basic.
Respondents can save and edit responses, allowing for collaboration	Free	Free	\$250-400/year	Free
Answers can automatically direct respondents to specified follow-up questions (“branching”)	Free	\$12/month	\$250-400/year	\$26/month, \$300/year
Respondents can upload files directly through the survey	Not available	\$75/month	\$250-400/year	Not available
Answers are downloadable in a spreadsheet	Free	\$12/month	\$250-400/year	\$26/month, \$300/year

the state climate adaptation strategy and other state environmental policies.

B. Form and Scope of Data Collection

With the above users and uses of the database in mind, and mindful of the CNRA and OPC's limited time and resources, we recommend that the agencies solicit data via a web-based survey tool. Over time, as resources allow, we urge the CNRA and OPC to expand their survey effort beyond entities subject to the reporting requirements of A.B. 2516 to seek information from coastal local governments and other significant adaptation actors on a voluntary basis. Without detailed local information, the database will be of limited usefulness in minimizing adaptation redundancy and evaluating California's sea level rise preparedness.

Use a web-based survey tool to solicit information for the database. The CNRA and OPC have broad discretion to determine the format of the data collected. Entities must submit information "in a format determined by the [CNRA]."²⁸ A web-based survey tool would be an efficient method to collect information. We compare the features of several popular online survey tools in Table 3 below.

In particular, we note that the CNRA and OPC will need to collect files from survey respondents. According to A.B. 2516, listed entities must provide to the CNRA and OPC any "studies, programs, modeling, mapping, cost-benefit analyses, vulnerability assessments, adaptation, assessments, and local coastal programs...that have been developed for the purposes of addressing or preparing for sea level rise."²⁹ The survey instrument should indicate clearly how a respondent is to provide these and supplementary documents if the chosen survey tools does not allow respondents to upload files directly (e.g., requesting respondents to submit files separately via email, a web-based file storage tool, or a weblink to information that is already publicly available online).

After conducting the general survey, the CNRA and OPC can

follow up as needed with more targeted surveys to staff with particular expertise. We note that determining which individual(s) within entities to approach with a survey is a persistent challenge in any effort to compile data regarding adaptation planning. Not all entities have a single individual with designated responsibility for adaptation planning coordination, and, in some cases, adaptation planning is a cross-cutting interdepartmental effort (particularly for large entities). For many respondents, completing the survey will likely require collaboration between several individuals (e.g., lead planners, planning staff, staff with technical expertise, and consulting partners). One approach the CNRA and OPC might consider to enhance data collection and fill any gaps is to conduct a general survey, then follow up as may be necessary with more targeted small-scale surveys to staff with specific expertise.

Send a specialized supplemental data request to the Coastal Commission to collect data regarding LCPs. A.B. 2516 specifically requires the Coastal Commission to report whether each local jurisdiction in the coastal zone has adopted an LCP, when the LCP was created and last updated, and whether the LCP "addresses sea level rise."³⁰ The CNRA and OPC should thus submit a unique supplemental data request to the Coastal Commission. As the law does not provide any further guidance regarding how to determine if an LCP "addresses sea level rise," the CNRA and OPC may find it beneficial to consult with Coastal Commission staff regarding criteria that conform to the Coastal Commission's draft sea level rise guidance document. Criteria could include, e.g., whether the LCP has been updated within the past ten years to reference coastal climate change and sea level rise specifically as considerations guiding local planning and permitting.

Be aware of potential legal obstacles to data collection from private entities. The CNRA and OPC should be aware that the private parties subject to the reporting requirements of A.B.



2516—including investor-owned utilities and some airports—may be shielded from providing certain types of proprietary information to the government, or may be able to prevent the government from publicizing certain information in a public database.³¹ The CNRA and OPC may wish to seek counsel on this matter from an attorney with experience in data disclosures.

Over time, as resources allow, seek information from coastal municipalities and counties on a voluntary basis.

The extent to which the database will be successful in minimizing redundancy, encouraging collaboration among adaptation actors, and aiding evaluation of California’s climate preparedness depends on the breadth of entities and information surveyed. A.B. 2516 only requires a small number of entities to submit information to the database.³² Notably, however, the law is very broadly drafted and does not restrict the CNRA and OPC from asking additional entities to submit information voluntarily. After completing the initial survey effort required by A.B. 2516, we strongly urge the CNRA and OPC to survey additional entities beyond the above-listed entities, as their resources allow. In particular, we emphasize the importance

of requesting information from arguably the most critical category of adaptation actors on frontlines of sea level rise adaptation: coastal municipalities and counties.

Because local governments have jurisdiction over planning along much of the state’s coastline, data from local governments is essential to developing a database that allows users to derive meaningful conclusions about California’s sea level rise preparedness. Additionally, because California residents are likely to care most about climate impacts to the places where they live, work, and recreate, data from local governments will enhance public education and engagement with the database. Indeed, surveying local governments would help further the statutory objectives of developing “an effective inventory of sea level rise planning in the state”³³ and “provid[ing] the public with an educational tool” that showcases “information . . . about actions taken by cities, counties, cities and counties, regions, and public and private entities to address sea level rise.”³⁴

The CNRA and OPC may wish to begin with a small group of local governments initially, then refine their survey approach for a statewide audience. Early respondents can then help motivate the larger planning

community to participate. In the future, the CNRA and OPC may have additional resources to extend the survey's reach to even more voluntary respondents located in the coastal zone such as: other state agencies not subject to A.B. 2516's reporting requirements; federal and military property owners and managers, large businesses and employers (e.g., hospitals and universities), small businesses, industrial sites, and adaptation partners (e.g., technical consultants and non-profit organizations). In the meantime, we urge the CNRA and OPC to support wide dissemination of the survey and should post information from voluntary respondents to the database.

A portion of coastal local governments and other entities will be eager to provide information voluntarily.

We expect that a portion of coastal local governments will choose to contribute data to the database even though they are not required by law to do so. In our experience, local governments are often eager to participate in voluntary adaptation-related processes and enthusiastic about contributing to the development of tools that ultimately will enhance their adaptation capacity and expand their knowledge of actions taken by other entities. This is further demonstrated by the response rate to a 2011 survey of California coastal professionals about their adaptation needs. Researchers received nearly 600 voluntary responses, constituting a response rate of 25 percent, to a sixty-eight-question survey that took the average respondents longer than an hour to complete.³⁵

Collecting information from local governments could be accomplished while minimizing administrative burdens.

Acknowledging the CNRA and OPC's concerns about their limited administrative capacity, we emphasize that asking coastal local governments to voluntarily complete the survey could be accomplished in a way so as not to impose substantial additional burdens on the CNRA and OPC. First, the survey instrument itself can be freely distrib-

uted via email and weblink, and the marginal cost of storing and incorporating into the database additional data from local governments likely would be low. Second, because local governments are not subject to the requirements of A.B. 2516, the CNRA and OPC need not worry about meeting statutory deadlines for posting local government data on the online database (although we reiterate that local data is key to several of the above-listed uses of the database, and so should be incorporated into the database as quickly as possible).

Third, the CNRA and OPC could seek help from partner organizations and sister agencies with an interest in generating a robust database. These entities can capitalize on existing relationships with local governments to reinforce the CNRA and OPC's request, and help disseminate the survey through, e.g., email distribution lists, sea level rise adaptation trainings, and collaborative adaptation partnerships. Another potential strategy to increase voluntary survey responses would be to award bonus points to any state-funded coastal planning grant proposals in which consulting partners declare their willingness, with local government approval, to submit information to the database.

C. General Survey Content and Structure

As noted above, by July 1, 2015, listed entities must provide to the CNRA and OPC any "studies, programs, modeling, mapping, cost-benefit analyses, vulnerability assessments, adaptation, assessments, and local coastal programs . . . that have been developed for the purposes of addressing or preparing for sea level rise."³⁶ Furthermore, it appears that the CNRA and OPC have broad discretion to require listed entities to provide any additional information about sea level rise planning that the agencies deem necessary and appropriate.³⁷ We note that this suite of information can be interpreted broadly to encompass information concerning any activities *relevant to* sea level rise adaptation (e.g., installation and maintenance of coastal hard armoring structures), regardless of whether the activities are *explicitly or solely* for the purpose of

Box 3. Typical Survey Questions (and the data they produce)

- **Short answer text:** where the answer requested is numerical (e.g., 3 years, 2 staff, \$1000)
- **Scale:** respondents rank something along an ordinal scale (e.g., a ranking on a scale of 1 to 10)
- **Checkboxes:** respondents select unlimited options from a list, resulting in *categorical* answers (e.g., types of adaptation actions included in a local plan)
- **Multiple choice:** respondents select one or more options from a list or drop-down menu, providing *categorical* answers (e.g., the types of stakeholders involved in an adaptation effort)
- **Simple choice** (e.g., “yes”/“no”/“do not know” answers to a factual question)
- **Long answer text** (e.g. project description)
- **Geographical location:** provide exact geographic coordinates to allow spatial analysis
- **Upload files** (e.g., photos or project documentation)

sea level rise adaptation.

Given the types of information at issue, we recommend that the survey instrument should be short, well-focused, and seek descriptive and quantifiable data that complements prior coastal data collection efforts.

The survey should be clearly structured, easy to complete, unambiguous in language, and balance the time requirement to supply information and the level of detail obtained. A well-focused and easy-to-complete survey is likely to generate the best data. We urge the agencies to develop a survey instrument that respondents can complete easily, in stages (if necessary), and without having to guess at meanings and intents of questions. We urge the state to obtain expert help from researchers skilled in survey research. Our later recommendations regarding specific survey content are mindful of the need to strike an appropriate balance between developing a robust dataset and ensuring the survey instrument is not so lengthy or complex that it discourages completion.

The survey should seek data that is suitable for policy and scientific analyses and, whenever possible, quantifiable. To enable database users to track sea level rise adaptation preparedness, the survey should seek data that is suitable for sophisticated policy and scientific analyses. Whenever possible—but not necessarily always—the CNRA and OPC should design the survey questionnaire to obtain data that is:

- quantifiable (allowing, e.g., statistical analysis and GIS density mapping);
- objective and verifiable (e.g., linked to supporting documents);
- relevant to answering critical policy questions (e.g., evaluating the state of sea level rise preparedness, evaluating adaptation success or progress, identifying persistent barriers to action); and
- useful to establishing baselines and trends over time.

The survey should complement and build off of prior coastal data collection efforts.

The CNRA and OPC's survey will not be the first data collection effort related to coastal resilience and climate adaptation in California. Some prior related survey efforts include the following.

- In 2009 and 2010, the State Lands Commission surveyed its **major lessees and the major local trustees of public trust lands** regarding the extent to which they had considered the future impacts of sea level rise on their facilities.³⁸ The survey asked questions about, *inter alia*, what sea level rise projections respondents have used, how facilities would be impacted by sea level rise, any observed impacts to date, cost estimates, adaptation strategies under consideration, and unmet adaptation needs.
- In 2011, fifteen organizations collaborated to survey nearly 600 **California coastal professionals** regarding their coastal climate adaptation needs. The survey sought information about current management challenges, attitudes toward climate change, familiarity with sea level rise adaptation tools, and adaptation needs and barriers. The 2011
- survey was based largely on a similar survey conducted in 2005-2006.³⁹ Although the survey was designed to enable repeat data collection, future repeats are desirable but contingent on funding. There are currently no plans to repeat the survey in another approximately five-year interval.
- In 2013, the insurance regulators of California, Connecticut, Minnesota, New York, and Washington required **large insurers** licensed to operate in any of the states to complete a survey developed by the National Association of Insurance Commissioners regarding climate-related risks. Survey questions sought information about, *inter alia*, governance structures and risk management programs to manage climate-related risks, how respondents utilized computer modeling, and stakeholder engagement methods.⁴⁰
- For over twenty years, the Governor's Office of Planning and Research has conducted an **Annual Planning Survey**. Results historically were included in the *California Planners' Book of Lists*. The Annual Planning Survey compiles information on statewide planning trends, and typically includes questions related to *inter alia* greenhouse gas mit-



igation, general plans, emergency planning, conservation, and building codes. Although survey traditionally has not covered the topic of climate adaptation, it could be used as a potential vehicle for obtaining data for the sea level rise database.⁴¹

The CNRA and OPC can use these survey instruments as a model for question format (where appropriate) and should seek to integrate relevant existing information from these surveys into the database, and complement and enhance existing datasets with the additional information requested through A.B. 2516.

D. Survey Metrics and Indicators

California state agencies have expressed a growing desire not just to encourage sea level rise planning but also to ensure that resultant adaptation policies and their implementation are efficient and in the furtherance of overarching state coastal and adaptation policy goals.⁴² The data collected under A.B. 2516 should reinforce and enhance California's broader adaptation goals, and facilitate evaluation of adaptation planning progress, outcomes, and needs.

The survey should seek data that relates to metrics regarding entities' adaptation capacity, actions, and progress, and that will, over time, enable database users to evaluate the pace and effectiveness of

coastal adaptation activities

in California. Below, we offer some recommendations regarding useful indicators that would facilitate measurable tracking of adaptation progress and appraisal of adaptation preparedness, building on work previously conducted in coastal California and on the West Coast.⁴³ They fall into six general categories, each a necessary dimension of adaptation success: 1) capacity, 2) process, 3) decision-making and information, 4) actions/implementation accomplished to date (including preliminary actions such as budgeting or staffing that by themselves do not yet reduce vulnerability, but are critical in the process of ultimately doing so), 5) barriers overcome, and 6) outcomes.

Acknowledging the CNRA and OPC's concerns regarding their limited resources, we propose that the agencies could proceed in a stepwise fashion in developing the survey, if necessary. Rather than incorporating all of the below indicators in the first round of data collection, the CNRA and OPC could focus first on three discrete categories that are information priorities for the CNRA and OPC themselves: capacity, actions/implementation accomplished to date, and outcomes. In future survey rounds, and perhaps with additional resources, the CNRA and OPC could augment the initial survey with additional questions aimed at a more comprehensive assessment of adaptation progress and effectiveness.

SAMPLE SURVEY CONTENT

CAPACITY

What is the approximate length of the shoreline that your entity manages or is concerned about (i.e., entire length of coastal waterfront, including ocean, bay, lagoon, and estuarine shorelines, within your jurisdictional limits)?

Fiscal Capacity

What funds are available to your entity for activities related to addressing sea level rise and related coastal climate impacts (e.g., vulnerability or risk assessments, options assessments, planning activities, implementation of any adaptation-related tasks, monitoring and evaluation, stakeholder engagement and communication throughout the process etc.)?

How much funding has your entity sought from each of the following for the purposes of addressing sea level rise and related coastal climate impacts:

state funding?

federal funding?

private funding?

foundation funding?

funding from non-grant sources, including general funds, general operating funds and/or bond funds?

How much funding has your entity received from each of the following for the purposes of addressing sea level rise and related coastal climate impacts:

state funding?

federal funding?

private funding?

foundation funding?

funding from non-grant sources, including general funds, general operating funds and/or bond funds?

What is the estimated gap between the funds available to your entity and the funds needed to address sea level rise and related coastal climate impacts?

Please comment on the key challenge(s) your entity has faced in seeking, obtaining, and utilizing funding from the above sources for the purpose of addressing sea level rise and related coastal climate impacts.

Staffing Capacity

How many staff are currently working at your entity at least one-quarter time to develop or advance policies, programs, or projects of which addressing sea level rise is an express purpose (either in whole or in part)?

How many staff are currently working at your entity at least one-quarter time to develop or advance policies, programs, or projects of which addressing sea level rise is an incidental purpose (e.g., LCP updates)?

How many staff at your entity have addressing sea level rise, climate change, and/or coastal climate adaptation expressly written into their job description? (Please upload copies of relevant job descriptions.)

Does your entity have on staff a Chief Resilience Officer or other senior staff person whose job expressly includes helping the entity understand and/or address climate risks and develop adaptation strategies?

Yes No Do Not Know

Does your entity have on staff a GIS Analyst or other technical staff person whose job expressly includes the entity acquire, visualize, and analyze spatial information for planning purposes related to sea level rise?

Yes No Do Not Know

How does your entity perceive its ability to assess climate-related coastal risks and adaptation options in-house?

not at all able not well able moderately able well able

How does your entity perceive its ability to solicit outside expert advice on climate-related coastal risks and adaptation options (from, e.g., consultants, academic partners, extension services, NGOs, businesses)?

not at all able not well able moderately able well able

How does your entity perceive its ability to develop effective stakeholder engagement and communication strategies in-house ?

not at all able not well able moderately able well able

How does your entity perceive its ability to solicit outside expert advice on effective stakeholder engagement and communication strategies (from, e.g., consultants, academic partners, extension services, NGOs, businesses)?

not at all able not well able moderately able well able

Please comment on your entity's greatest perceived staffing and skill-building need(s) in terms of stakeholder engagement and communication expertise.

Institutional Capacity

Does your entity have partnerships with any of the following for the purposes of addressing sea level rise (in whole or in part)? **Check all that apply.**

- academic institution,
- private sector entity (e.g., consultants),
- non-profit organization,
- another jurisdiction or regional collaborative, and/or
- other. _____

Indicate which of following institutional mechanisms and pathways your entity is currently utilizing to address sea level rise and related coastal climate impacts. **Check all that apply.**

- general plan update,
- hazard mitigation plan,
- capital investment plan,
- LCP,
- climate action plan,
- resilience, adaptation, or sustainability plan, and/or
- other. _____

Please indicate which of following institutional mechanisms and pathways your entity currently is in the process of developing or updating to address sea level rise and related coastal climate impacts. **Check all that apply.**

- general plan update,
- hazard mitigation plan,
- capital investment plan,
- LCP,
- climate action plan,
- resilience, adaptation, or sustainability plan, and/or
- other. _____

How does your entity perceive the level of commitment and motivation of its staff to engage in work related to addressing sea level rise?

- | | | | |
|-----------------------|-----------------------|-----------------------|-----------------------|
| none at all | low | moderate | high |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

PROCESS

Which category best describes your entity's current phase of sea level rise planning and implementation? **Select one.**

- not yet begun,
- understanding (e.g., assessing risks and vulnerabilities),
- planning (e.g., assessing adaptation options),
- implementing, or
- monitoring and evaluating implemented options.⁴⁴

If your entity has begun considering the impacts of sea level rise, approximately how long have you done so? **Select one.**

- not applicable,
- less than 6 months,
- 6 months to 1 year,
- 1-3 years,
- 3-5 years,
- more than 5 years.⁴⁵

NOTE:

Additionally, if desired, Likert-scale rating questions could be used to assess process qualities, such as perceptions of the degree of transparency and effectiveness of process, the efficiency of meetings, the effectiveness of process facilitation, and the degree of participation by staff, external experts, partners, stakeholders, and elected officials.

List any key categories of internal and external stakeholders engaged in the adaptation planning, decision-making, implementation and/or monitoring process.

DECISION-MAKING AND INFORMATION

Information Used

Please provide citations to or copies of the top three most-referenced resources (i.e., information, reports, tools, datasets, maps, computer models, guidance documents, etc.) that the entity has utilized for the purposes of each of the following:

- evaluating historical coastal hazards,
- projecting future sea level rise and related coastal climate impacts (e.g., which climate change scenarios, sea level rise projections, storm scenarios, any downscaled or locally modeled sea level rise impacts), and
- assessing physical, ecological and socioeconomic vulnerability or risk to projected sea level rise and related coastal climate impacts.⁴⁶

Approaches Used

To your knowledge, which of the following types of assessments has your entity used to determine its risks and adaptation options? **Check all that apply.**

- scenarios analysis,
- robust decision-making framework,
- climate impacts or risk assessment,
- vulnerability assessment,
- cost-benefit or cost-effectiveness analyses, and/or
- valuing ecosystem services analyses.

Decision-making

Has your entity determined coastal adaptation objectives?

- Yes No Do Not Know

If yes, list objectives.

Which of the following criteria formally or informally guide your entity's adaptation decision-making process?

- cost-effectiveness or a certain range of costs,
- achievement of a given level of protection against floods,
- social equity,
- no negative environmental consequences,
- economic benefit,
- environmental benefit,
- sociocultural benefit,
- political acceptability,
- other.

In addition, the survey could inquire, through multiple-choice or write in questions, as to who has the opportunity to shape adaptation decisions and who is ultimately responsible for making key decisions.

TIP!

The qualities of the process of arriving at key decisions in the adaptation process (e.g., budget or staffing decisions, approval of new policies or procedures, choice among various adaptation options, or prioritization of risks or vulnerabilities) is often critically important to the acceptability of the decision.

Information Needs

Rank the following types of information in terms of their priority as an informational need for your entity.

	low	medium	high
Locally specific coastal flooding maps (30-100 years out, with uncertainty),	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Locally specific coastal erosion information (30-100 years out, with uncertainty),	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Regionally specific projections of temperature extremes (extreme lows, extreme highs, with seasonal detail),	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Regionally specific projections of precipitation extremes (very dry, very wet periods; with seasonal detail),	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Regionally specific projections in storm regimes (with uncertainty),	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Locally specific ecological information,	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Legal guidance or analysis,	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cost estimates (with uncertainty) of different adaptation options.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

ACTIONS TAKEN/IMPLEMENTATION ACHIEVED TO DATE

Has your entity taken significant action since January 1, 2010 to:

	yes	no	do not know	currently in progress
Improve staff's understanding of sea level rise and other coastal climate impacts and/or adaptation planning and implementation (e.g., trainings, hiring experienced staff, information exchanges)?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seek or obtain funding for actions related to sea level rise and other coastal climate changes?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Create work groups that will focus on adaptation-related efforts?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Develop a stakeholder engagement process?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Educate stakeholders or the broader public?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Assess vulnerability to sea level rise and other coastal climate impacts?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Assess risks associated with sea level rise and other coastal climate impacts?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Set adaptation objectives or develop a vision for the entity successfully adapting to sea level rise and coastal climate change?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Develop and evaluate potential adaptive responses to projected sea level rise and other coastal climate impacts?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Select adaptation strategies or actions?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	yes	no	do not know	currently in progress
Integrate adaptation strategies, plans or actions into existing policies, hazard mitigation plans, or other plans?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Implement adaptation strategies, plans or actions?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Monitor existing adaptation strategies, plans or actions?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Modify existing adaptation strategies, plans or actions?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Does the entity have an express policy or policies to address sea level rise and other coastal climate changes? If yes, please provide a copy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do the entity's most recently adopted strategic plan, general plan, long-term development plan, and/or equivalent documents explicitly include considerations of sea level rise and other coastal climate changes? If yes, please provide a copy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Does the entity's LCP or Port Master Plan explicitly include considerations of sea level rise and other coastal climate changes? If yes, please provide a copy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

BARRIERS TO OVERCOME

Whether or not your entity has already taken action to prepare for the possible impacts of climate change, how much of a hurdle has each of the following issues been in your efforts to date?

	big hurdle	small hurdle	not a hurdle
Lack of funding to implement a plan,	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lack of funding to prepare a plan,	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Insufficient staff resources to analyze relevant information,	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Current pressing issues are all-consuming,	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lack of technical assistance from state or federal agencies,	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lack of public demand to take adaptation action,	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Internal disagreements on the importance on climate change,	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lack of social acceptability of adaptation strategies,	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Opposition from stakeholder groups,	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lack of clarity about what adaptation options are available,	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lack of a legal mandate to take climate change impacts into account,	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lack of access to relevant information and data,	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	big hurdle	small hurdle	not a hurdle
The magnitude of the problem is too overwhelming to address,	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The science is too uncertain,	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Legal pressures to maintain the status quo,	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lack of clarity about how climate change relates to staff's jobs. ⁴⁷	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Of the hurdles you identified as “big hurdles”, select the three most important hurdles encountered and overcome in the past two years. Then, identify for each the three most important factors that have helped your entity overcome that particular barrier (i.e. effective leadership, education or training, effective process facilitation, funding obtained, added staff capacity, expert advice/technical analyses, legal clarification, top-level commitment or mandate, bottom-up commitment or pressure, and other.)

Three most important factors that helped your entity overcome this barrier.

Barrier #1

[Drop-down menu should auto-populate with barriers marked as “big hurdles”.]

Barrier #2

Barrier #3

OUTCOMES

Measuring Success

Does your entity have an established mechanism(s) for evaluating the success of adaptation projects?

Yes No Do Not Know

If yes, describe those mechanisms:

What has your entity accomplished to date in terms of each of the following to address to sea level rise and related coastal climate impacts? Please provide copies of any relevant documentation.

Number of structures in the coastal floodplain elevated?

Number of structures in the coastal floodplain flood-proofed?

Number and types of structures removed out of the coastal floodplain?

Acreage or linear extent of green/nature-based infrastructure installed? _____

Linear extent of grey/hard coastal protection infrastructure installed or repaired? _____

Acreage of coastal habitat restored? _____

Numbers of acres of upland habitat purchased (e.g., to allow wetland migration)? _____

Permanent change in policy or rules? _____

Perceived significant shifts in public involvement, awareness and understanding (with evidence)? _____

Perceived significant shifts in organizational culture around living with and managing a changing environment? _____

Other? _____

Entity's Desired Adaptation Outcomes

Please describe in your own words your entity's desired adaptation outcomes:

Which of the following adaptation outcomes does your entity desire?

Check all that apply.

- improve current situation (e.g., higher level of protection against hazards than at present, improved management of land holdings, improved environmental stewardship or restored ecological functioning, improved functionality of facility, greater economic development, greater social justice, and/or improved governance),
- sustain current situation (e.g., maintain level of protection against hazards at current level, maintain land holding in place, maintain environmental assets in place, maintain basic functionality of facility, maintain economic activity at current level, and/or maintain socioeconomic conditions),
- transform current situation (e.g., remove assets or facilities at risk, allow natural process to reclaim shorefront and restore natural shoreline, fundamentally change uses of at-risk coastal areas, and/or reshape governance), and/or
- other. _____

NOTE:

Finally, the CNRA and OPC should seek the following types of data regarding respondents' achieved adaptation outcomes, indicating that it is not always possible to already point to achieved outcomes, but that the state is interested in actual evidence that adaptation efforts are achieving desired outcomes. Generally, the CNRA and OPC should pursue three tracks of questions to inquire about: 1) mechanisms for measuring success, 2) the goals and outcomes pursued by the entity, and 3) contributions to achieving state coastal management goals (as codified, e.g., in the California Coastal Act or as articulated in the OPC's forthcoming visionary action plan⁴⁸).

TIP!

Once the state has developed its vision of successful adaptation, develop relevant categories, and ask respondents to subjectively rate how they contribute to achieving each of those goals (e.g., Significant/Medium/Minor/No effort expended in the entity's adaptation work toward meeting this state goal).

E. Database Format and Functionality

The CNRA has wide latitude to organize and format the online database in whatever “manner it determines best to provide the public with clear, useful, and readily accessible information.”⁴⁹ The database need not include all information collected; the CNRA “shall make a determination as to which sea level rise planning information is necessary for inclusion...”⁵⁰ The only specific statutory requirement is that data must broadly be organized by geographic region, and sortable to display information about the LCP of each coastal zone jurisdiction.⁵¹ Below, we offer recommendations about how the CNRA and OPC can format the database to best serve the previously identified users and objectives.

The database should allow users to sort, view, and compare data by key parameters. To best facilitate the objectives of reducing adaptation redundancy, assisting collaborations, and engaging the public, users should be able easily to access data specific to any number of parameters, as well as these parameters in combination, through a simple interface backed by a Boolean search algorithm. Important search parameters may include, but should not be limited to:

- geographic area—including by coastal region, local government, segment of a local government responsible for submitting an LCP, or special district;
- LCP status;
- respondent type (e.g., state agency, local government, port, or utility);
- type of resource or infrastructure that is the focus of the adaptation action (e.g., pier, wetland, beach, or roadway); and
- type of adaptation project (e.g., hard armoring, beach nourishment, or managed retreat).

The database should allow users to download raw data in tabular and GIS-compatible formats. The database should enable

easy download of raw data in tabular and GIS-compatible format, where appropriate, with metadata (e.g., the year the data was produced, the source of the data, and its resolution). This will enable researchers to further analyze the data and allow other entities to incorporate California’s data into broader data compilation efforts and visualization tools, such as data compilation projects underway through the National Oceanic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA). It will also enable the data be integrated with the sustained



National Climate Assessment's indicators set, which is currently under development.⁵²

The online database should be designed to allow users easily to access and contextualize data.

A visually attractive, easy-to-navigate interface and the use of straightforward language would facilitate public access and engagement. In addition, to serve most effectively as a centralized source for up-to-date information about sea level rise planning, the database should incorporate some contextual information about the science of sea level rise and adaptation planning, thus enabling users to understand the significance of the data. For instance, the database could include boxed sections that distill highly relevant information from the National Research Council's 2012 report, *Sea Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future*,⁵³ the *California Adaptation Planning Guide*,⁵⁴ the state's climate change adaptation strategy,⁵⁵ and/or coastal state agencies' various sea level rise guidance documents.⁵⁶

Ideally, if resources allow, the database website should link to and integrate with existing online resources about sea level rise and climate change adaptation, such as the adaptation materials in the Climate Change Adaptation Portal or Cal-Adapt—an important go-to resource for researchers, local government officials and the interested public to access online information about climate adaptation in California.⁵⁷

Over time, the CNRA and OPC should consider adding functionality to display geospatial information in interactive maps.

Given the large amount of geospatial data the CNRA and OPC may collect, we recommend that the CNRA and OPC seek resources to expand and enhance the database website over time to incorporate interactive maps to display and analyze data. We recommend that the CNRA and OPC incorporate staff with GIS experience, as well as Cal-Adapt designers, into discus-

sions regarding the database and development of the survey questionnaire to ensure the survey seeks the appropriate geospatial information in the appropriate formats.

Some map-related functionalities that might be valuable on the database website include:

- visualizations of survey respondents as individual map icons with differing icon designs, colors, icon sizes etc. to communicate relevant information (e.g., each local jurisdiction could be represented with an icon that indicates, through its design and color, whether the locality has a certified LCP and whether that LCP incorporates considerations of sea level rise; each survey respondent could be represented with an icon that indicates whether the entity completed a sea level rise vulnerability assessment);
- pop-up information boxes associated with each map icon that display additional textual information and a link(s) to more detailed data;
- overlays of other relevant publicly available GIS datasets for visual comparison (e.g., flood risk maps, maps including socioeconomic data, other layers of information available in Cal-Adapt, etc.);
- density mapping to signify the concentration of a particular feature per geographic area (e.g., adaptation projects, vulnerability assessments) and spatially continuous mapping to signify the total extent of different adaptation achievements (e.g., total length of hard and green infrastructure or total number of flood-proofed structures along the CA shoreline). Such maps could highlight areas of significant adaptation activity versus areas needing priority assistance; and
- regional selection criteria in which a user can draw an area of interest to determine what spatial information, locally relevant guidance, or sample legal language is available for that region.⁵⁸

Interactive mapping tools that might serve

as a useful reference in developing the database include (but are not limited to): The Nature Conservancy's Coastal Resilience Ventura visualization tool (soon to be upgraded to Coastal Resilience California);⁵⁹ Our Coast, Our Future's flood map;⁶⁰ the California Emergency Management Agency's Hazard Mitigation Web Portal;⁶¹ and Cal-Adapt.⁶² Additionally, we note that the California Geoportal is a useful source of existing publicly available geospatial data layers relevant to sea level rise planning in California.⁶³

Over time, the CNRA and OPC should consider including a web forum for multi-regional dialogue. Many data compilation websites include forums for users to converse with one another about best practices and metadata for new spatial layers. The sea level rise planning database could also provide a platform for this type of dialogue, as well as a platform for dialogue among members of California's local planning community. A web forum would enhance information transfer and reduce redundancy

Over time, the CNRA and OPC should consider releasing periodic statistical summaries of the information in the database. Statistical summaries would enhance the accessibility of, usefulness of, and public engagement with the information in the database. The CNRA and OPC could potentially seek partnerships with academic researchers and with the Governor's Office of Planning and Research to produce the summaries.

F. Looking Forward

Starting in 2016, entities subject to the requirements of A.B. 2516 are required to submit new or updated information to the database twice per year.⁶⁴ Because the law sunsets after two years, however, the CNRA and OPC are currently required to update the database barely a handful of times. For the database to be most useful as a resource for evaluating California's preparedness for sea level rise and engaging

the public in adaptation planning, data collection should continue beyond the sunset date of A.B. 2516. After a pilot period (the initial database period set forth in A.B. 2516, 2016-19), the CNRA and OPC should seek funding to conduct an independent evaluation to assess the usefulness of the database. With the results of that evaluation, we recommend that the CNRA and OPC seek funding, if warranted, for any necessary database adjustments and long-term maintenance and expansion of the database.

Upon demonstration that the database can effectively serve user needs, the CNRA and OPC should seek longer-term authorization and funding to maintain the database indefinitely as a cornerstone of state adaptation monitoring and evaluation efforts.

The database's effectiveness as a tool to enhance coastal resilience depends on a long-term commitment to database maintenance and growth. The CNRA and OPC should seek funding and other resources to help offset the administrative and financial burden of conducting the survey and maintaining the website. Over the next two years, the CNRA and OPC should update the State Legislature on progress, lessons learned, and funding needs to sustain and further substantiate the database. Other funding sources that may be helpful include NOAA grants, Proposition 84 funds, and private foundation grants. The CNRA and OPC may also benefit from formal partnerships with universities, private businesses, federal agencies, non-profit organizations, or other entities that benefit from use of the database.

In the meantime, pending identification of additional resources, we urge the CNRA and OPC to develop and, as existing resources allow, continually expand the database as if it were a permanent tool. Abandoning a data collection and publication effort about a vital, enduring public policy issue after only two years would be imprudent. Certain important trends and findings may only emerge from the data over a longer period. Additionally, because sea level rise adapta-



tion planning is only in the beginning stages throughout most of the state and will continue to unfold over the coming years and decades, the database should grow more valuable and more robust over time.

Over the next two years, if the database emerges as a useful tool for informing coastal resilience efforts and positions California as a national leader, the State Legislature may pass legislation expanding the reporting requirements of A.B. 2516. State policymakers often extend or permanently institutionalize temporary requirements after an initial trial period, as the policy demonstrates its usefulness. We note that without a legislative extension, the entities currently subject to A.B. 2516's data disclosure requirements will not be legally obligated to provide information to the database after the sunset of A.B. 2516. Should the legislature decline to extend the requirements of A.B. 2516 beyond 2018, we nonetheless urge the CNRA and OPC, to the best of their ability, to continue to distribute the survey instrument on a regular basis and request adaptation actors in California to provide information to the database voluntarily.

Conclusion Development of California's sea level rise planning database under A.B. 2516 is a once-in-a-generation opportunity for California to serve as a na-

tionwide leader in the adaptation policy arena. Moreover, the database that the CNRA and OPC develop could serve as a foundational resource to assess California's sea level rise preparedness and progress toward meeting coastal adaptation goals, as well as a model for more comprehensive adaptation information compilation efforts in California and beyond. A fully functional and comprehensive sea level rise planning database ultimately should be able to help answer questions like: *What is the state of adaptation in coastal California today?*, *What exactly are coastal entities doing to adapt to climate change?*, *Is California adequately equipped with the tools necessary to undertake adaptation?*, *Are we doing enough to prepare for the impacts of climate change?*, and *Where do we need to focus attention and resources to make more progress so that all Californians are protected and can continue to live prosperous lives in the face of change?*

The next two-year period is thus an important pilot period for the coast, the state, and quite possibly for the nation. We urge the CNRA and OPC in the strongest terms to develop the database fully anticipating its potential longevity, multi-functionality, and critical future role in informing adaptation policy.

Endnotes

- 1 See generally JULIETTE A. FINZI HART ET AL., RISING TO THE CHALLENGE: RESULTS OF THE 2011 CALIFORNIA COASTAL ADAPTATION NEEDS ASSESSMENT (2012), available at <http://woods.stanford.edu/sites/default/files/files/CACoastalAssessmentResults.pdf>.
- 2 See generally CAL. STATE ASSEM. SELECT COMM. ON SEA LEVEL RISE & THE CAL. ECONOMY, SEA LEVEL RISE: A SLOW-MOVING EMERGENCY (2014), available at http://sealevelrise.assembly.ca.gov/sites/sealevelrise.assembly.ca.gov/files/Select%20Committee%20Sea_level%20Rise%20Report.pdf [hereinafter SELECT COMMITTEE RPT.]; LITTLE HOOVER COMM'N, GOVERNING CALIFORNIA THROUGH CLIMATE CHANGE, Rep. No. 221 (2014), available at <http://www.lhc.ca.gov/studies/221/Report221.pdf>.
- 3 Assemb. B. 2516 (Cal. 2014), codified at CAL. PUB. RES. CODE div. 20.6.
- 4 *Id.* § 30965(a).
- 5 Other online information portals that compile sea level rise planning information include: Georgetown Climate Center's Adaptation Clearinghouse (<http://www.georgetownclimate.org/adaptation/clearinghouse>), the Climate Adaptation Knowledge Exchange (<http://www.cakex.org>), the National Oceanic and Atmospheric Administration's Digital Coast (<http://coast.noaa.gov/digitalcoast/>), ATLANTIC – Coastal Vulnerability to Sea-Level Rise: A Preliminary Database for the U.S. Atlantic Coast (<https://catalog.data.gov/dataset/atlantic-coastal-vulnerability-to-sea-level-rise-a-preliminary-database-for-the-u-s-atlantic-c>), and the Dynamic Interactive Vulnerability Assessment (DIVA) tool (http://unfccc.int/adaptation/nairobi_work_programme/knowledge_resources_and_publications/items/5358.php).
- 6 NAT'L RESEARCH COUNCIL COMM. ON SEA LEVEL RISE IN CAL., ORE., & WASH., SEA LEVEL RISE FOR THE COASTS OF CALIFORNIA, OREGON, AND WASHINGTON: PAST, PRESENT, AND FUTURE 108 (2012), available at http://www.nap.edu/catalog.php?record_id=13389 (projecting that by 2100, sea level is projected to rise 0.3 to 4.69 feet above the 2000 level North of Cape Mendocino and 1.38 to 5.48 feet south of Cape Mendocino).
- 7 See CAL. NATURAL RESOURCES AGENCY, SAFEGUARDING CALIFORNIA: REDUCING CLIMATE RISK 155-173 (2014), available at http://resources.ca.gov/docs/climate/Final_Safeguarding_CA_Plan_July_31_2014.pdf.
- 8 See generally FINZI HART ET AL., *supra* note 1.
- 9 See Megan M. Herzog & Sean B. Hecht, *Combatting Sea-Level Rise in Southern California: How Local Governments Can Seize Adaptation Opportunities While Minimizing Legal Risk*, 19 HASTINGS WEST NORTHWEST J. ENVTL. L. & POL'Y 463, 470-71 (2013).
- 10 See E.O. S-13-08 (Cal. 2008).
- 11 Assemb. B. 691 (Cal. 2013), codified at CAL. PUB. RES. CODE 6311.5.
- 12 SEA-LEVEL RISE TASK FORCE, COASTAL & OCEAN WORKING GROUP, CAL. CLIMATE ACTION TEAM, STATE OF CALIFORNIA SEA LEVEL RISE GUIDANCE DOCUMENT (2013), available at http://www.opc.ca.gov/webmaster/ftp/pdf/docs/2013_SLR_Guidance_Update_FINAL1.pdf (guiding state agencies in preparing for sea level rise); CAL. NATURAL RESOURCES AGENCY, *supra* note 6.
- 13 See generally, e.g., CAL. EMERGENCY MGMT. AGENCY & CAL. NATURAL RESOURCES AGENCY, *supra* note 9.
- 14 CAL. PUB. RES. CODE §§ 3000-30900.
- 15 *Id.* § 30103.
- 16 *Id.* § 30500; *id.* ch. 6, art. 2.
- 17 See CAL. COASTAL COMM'N, SUMMARY OF LCP PROGRAM ACTIVITY IN FY 11-12 (2012), available at http://www.coastal.ca.gov/la/docs/lcp/FY11_12_LCPStatusSummaryChart_FINAL.pdf.
- 18 CAL. COASTAL COMM'N, DRAFT SEA LEVEL RISE POLICY GUIDANCE: PUBLIC REVIEW DRAFT (2013), available at http://www.coastal.ca.gov/climate/slr/guidance/CCC_Draft_SLR_Guidance_PR_10142013.pdf.
- 19 See <http://sealevelrise.assembly.ca.gov/> for Select Committee meeting agendas, presentation materials, and videos of the hearings.
- 20 SELECT COMMITTEE RPT., *supra* note 2.
- 21 *Id.* § at 3.
- 22 *Id.* § at 80. See also Gov. Brown Signs Bill Creating Database for Sea level Rise Reporting, S.F. EXAMINER, Sept. 23, 2014, available at <http://www.sfoxaminer.com/sanfrancisco/gov-brown-signs-bill-creating-database-for-sea-level-rise-reporting/Content?oid=2905816>.

- 23 CAL. PUB. RES. CODE § 30963.
- 24 *Id.* §§ 30965(b), 30967.
- 25 *Id.* § 30968.
- 26 *See, e.g.*, 310 MASS. CODE REGS. 9.37(2)(b)(2) (requiring that new development in flood zones be designed for projected sea level rise during the design life of the structure); MD. CODE REGS. 26.24.02.03 (requiring the Maryland Department of the Environment to consider sea level rise when evaluating certain permit applications); 16-1-17 R.I. CODE R. § 350 (stating that the Rhode Island Coastal Resources Management Council will integrate sea level rise adaptation into its regulatory program).
- 27 CAL. PUB. RES. CODE § 30961.
- 28 *Id.* § 30966(a).
- 29 CAL. PUB. RES. CODE § 30962.
- 30 CAL. PUB. RES. CODE § 30964(b).
- 31 *See* Cal. Civ Code § 3462.1(d)(1)-(2) (defining “trade secrets” as “information, including a formula, pattern, compilation, program, device, method, technique, or process, that: (1) Derives independent economic value, actual or potential, from not being generally known to the public or to other persons who can obtain economic value from its disclosure or use; and (2) [i]s the subject of efforts that are reasonable under the circumstances to maintain its secrecy”); *id.* §§ 3426.1(b), 3426.2(a), 3426.3 (allowing private parties to protect trade secrets from disclosure and publication).
- 32 *Id.* § 30965(a).
- 33 *Id.* § 30963.
- 34 *Id.* § 30961.
- 35 FINZI HART ET AL., *supra* note 1, at 4.
- 36 CAL. PUB. RES. CODE § 30962.
- 37 *Id.* § 30966(a). The statute is somewhat unclear regarding what data listed entities must submit to the CNRA and OPC. Section 30964 states clearly that listed entities “shall submit to the [CNRA] sea level rise planning information . . . in a format determined by the agency.” The statute defines “sea level rise planning information” to mean “studies, programs, modeling, mapping cost-benefit analyses, vulnerability assessments, adaptation, assessments, and [certified LCPs] that have been developed for the purposes of addressing or preparing for sea level rise.” *Id.* § 30962. Then, section 30965 states that listed entities “shall provide sea level rise planning information described in Section 30964 . . . to the [CNRA]” Notably, this language both uses the defined term “sea level rise planning information” and broadly refers to a description in section 30964.
- Looking to section 30964, it is unclear to which description the subsequent section intends to refer. Section 30964(b) requires the Coastal Commission to provide information about LCPs, and describes that information. Section 30964(a) states that the CNRA “shall make a determination as to which sea level rise planning information is necessary for inclusion in the database” potentially including, *inter alia*, the person in charge of developing the information, geographic scope, the type or resource or infrastructure at issue, etc. This language appears on its face to grant the CNRA and OPC discretion to choose which data to post in the database from among the “sea level rise planning information” submitted. Read in combination with section 30965, however, it seems the legislature intended for section 30964(a) to expand the types of information that the CNRA and OPC can request from listed entities.
- In other words, we read the statute to allow CNRA and OPC not only to request the specified documents defined as “sea level rise planning information” but also additional information relevant to sea level rise planning, as the agencies consider necessary and appropriate in their broad discretion, and in a format of the agencies’ choosing, such as a survey questionnaire.
- 38 *See* CAL. STATE LANDS COMM’N, A REPORT ON SEA LEVEL RISE PREPAREDNESS (2009), *available at* http://www.slc.ca.gov/Reports/SEA_LEVEL_Report.pdf; CAL. STATE LANDS COMM’N, SEA LEVEL RISE SURVEY QUESTIONNAIRE (2010), *available at* http://www.slc.ca.gov/Sea_Level_Rise/SLR_Resurvey.pdf.
- 39 *See* FINZI HART ET AL., *supra* note 1.
- 40 *See* CERES INSURANCE PROG., INSURER CLIMATE RISK DISCLOSURE SURVEY REPORT & SCORECARD: 2014 FINDINGS & RECOMMENDATIONS (2014).
- 41 *See* GOVERNOR’S OFF. OF PLANNING & RESEARCH, ANNUAL PLANNING SURVEY RESULTS (2012), *available at* http://www.opr.ca.gov/docs/2012_APSR.pdf.

- 42 Ongoing state visioning and planning efforts relevant to the database include the following: California state agencies are currently developing strategies to implement the principles set forth in the most recent update to the state's climate adaptation plan, *Safeguarding California* (see CAL. NATURAL RESOURCES AGENCY, *supra* note 6); the OPC is developing a Visionary Action Plan for California, which will help guide implementation of the state's adaptation plan (on February 24, 2015, the OPC invited coastal state agency staff to a workshop to develop a guiding vision of adaptation success for California, which is meant to be integrated with OPC's forthcoming Visionary Action Plan); the Governor's Office of Planning and Research is working to develop a set of adaptation indicators that will help the state to assess progress toward climate change preparedness; the Climate Action Team, an interagency collaborative that coordinates California's climate mitigation and adaptation efforts, has developed a strategic research plan that includes calls for research to monitor and assess the effectiveness and progress of adaptation across the state (see generally CLIMATE ACTION TEAM, CLIMATE CHANGE RESEARCH PLAN FOR CALIFORNIA (2015), available at http://www.climatechange.ca.gov/climate_action_team/reports/CAT_research_plan_2015.pdf; see also CALIFORNIA'S FOURTH CLIMATE CHANGE ASSESSMENT: PROPOSED NON-ENERGY RESEARCH PORTFOLIO, available at http://resources.ca.gov/docs/climate/Fourth_Climate_Change_Assessment_Scope_of_Work_v1.pdf); and the Coastal Commission is finalizing its sea level rise guidance document (CAL. COASTAL COMM'N, DRAFT SEA-LEVEL RISE POLICY GUIDANCE (2013), available at <http://www.coastal.ca.gov/climate/slrguidance.html>).
- 43 Susanne C. Moser, *Successful Adaptation to Coastal Climate Change: Workshop for the State Coastal Leadership Group*, Oakland, CA (Feb. 25, 2015).
- 44 The same approach was used in FINZI HART ET AL., *supra* note 1.
- 45 The same approach was used in FINZI HART ET AL., *supra* note 1.
- 46 See FINZI HART ET AL., *supra* note 1, at IV.7 (question 35) for a list of information processing tools.
- 47 The same approach was used in FINZI HART ET AL., *supra* note 1.
- 48 This vision document is currently under development. Once drafted, survey respondents' adaptation achievements can be traced against the desirable outcomes as articulated in the vision.
- 49 CAL. PUB. RES. CODE § 30966.
- 50 *Id.* § 30964(a). See also *supra* note 36.
- 51 CAL. PUB. RES. CODE § 30966.
- 52 See, e.g., NOAA, DIGITAL COAST, <http://coast.noaa.gov/digitalcoast/>; NASA, <http://data.nasa.gov/>.
- 53 NAT'L RESEARCH COUNCIL COMM. ON SEA LEVEL RISE IN CAL., ORE., & WASH., *supra* note 5.
- 54 CAL. EMERGENCY MGMT. AGENCY & CAL. NATURAL RESOURCES AGENCY, *supra* note 9.
- 55 CAL. NATURAL RESOURCES AGENCY, *supra* note 6.
- 56 SEA-LEVEL RISE TASK FORCE, COASTAL & OCEAN WORKING GROUP, *supra* note 12.
- 57 See CAL-ADAPT – EXPLORING CALIFORNIA'S CLIMATE CHANGE RESEARCH, <http://cal-adapt.org/sealevel/>. See also ADAPTATION PROGRAMS – CALIFORNIA CLIMATE CHANGE, <http://www.climatechange.ca.gov/adaptation/>.
- 58 In many cases, data acquisition begins with what information is available for the region of interest. Many data visualization efforts have shifted towards an approach where the user can draw a box to see what is available in that region. It minimizes the time needed to search through the resolution of statewide layers.
- 59 COASTAL RESILIENCE, VENTURA COUNTY, CALIFORNIA, <http://www.maps.coastalresilience.org/ventura/>.
- 60 OUR COAST OUR FUTURE – OCOF FLOOD MAP, <http://data.prbo.org/apps/ocof/index.php?page=flood-map>.
- 61 CAL. EMERGENCY MGMT. AGENCY, HAZARD MITIGATION WEB PORTAL, <http://myplan.calema.ca.gov>.
- 62 CAL-ADAPT – EXPLORING CALIFORNIA'S CLIMATE CHANGE RESEARCH, <http://cal-adapt.org/sealevel/>.
- 63 STATE OF CALIFORNIA GEOPORTAL, <http://portal.gis.ca.gov/>.
- 64 CAL. PUB. RES. CODE § 30963.

Pritzker Environmental Law and Policy Briefs

This policy paper is the seventh of the Pritzker Environmental Law and Policy Briefs. The Pritzker Briefs are published by UCLA School of Law and the Emmett Institute on Climate Change and the Environment in conjunction with researchers from a wide range of academic disciplines and the broader environmental law community. They are intended to provide expert analysis to further public dialogue on important issues impacting the environment.

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The authors are grateful to Matthew Armsby, Meg Caldwell, Eric Hartge, Sean Hecht, and Anne Siders for their expert contributions. We are also grateful to Neil Raina for his legal research. Any errors are our own.

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