Integrating Regional Sediment Management and Sea Level Rise Adaptation

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Table 22 Funding sources for components of the Matilija Dam Removal project. From Venturariver.org (not exhaustive).

ACRONYMS AND ABBREVIATIONS

AB	Assembly Bill
BCA	Benefit-Cost Analysis
BEACON	Beach Erosion Authority for Clean Oceans and Nourishment
Caltrans	California Department of Transportation
CCC	California Coastal Commission
CDP	Coastal Development Permit
CEQA	California Environmental Quality Act
CIP	Capital Improvement Plan
CNRA	California Natural Resources Agency
USACE	U.S. Army Corps of Engineers
COG	Council of Governments
CSMW	Coastal Sediment Management Workgroup
CZMA	Coastal Zone Management Act
FEMA	Federal Emergency Management Agency
HMP	Hazard Mitigation Plan
JPA	Joint Powers Authority
LCP	Local Coastal Program
LHMP	Local Hazard Mitigation Plan
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NBSD	Nature-Based Shoreline Design
NOAA	National Oceanic and Atmospheric Administration
OPC	Ocean Protection Council
RCD	Resource Conservation District

RCC	Regional Climate Collaborative
RSM	Regional Sediment Management
RSMP	Regional Sediment Management Plan
SLR	Sea Level Rise
SPMD	Sediment Placement and Management District
TMDL	Total Maximum Daily Load
USGS	United States Geological Survey
WRDA	Water Resources Development Act

EXECUTIVE SUMMARY

Sediment is one of California's most overlooked and underutilized adaptation resources. From fine-grained silts that nourish coastal wetlands to coarse sands and cobbles that stabilize beaches and shorelines, sediment plays a critical role in enhancing the physical and ecological resilience of coastal systems. Yet across the state, Regional Sediment Management Plans (RSMPs) and broader climate adaptation strategies remain siloed, often developed independently by engineering and planning teams with minimal integration. As sea-level rise (SLR) accelerates and natural disasters intensify, a strategic shift is needed to treat sediment as a foundational element of climate resilience. This work synthesizes a review of RSMPs, local adaptation plans, and BEACON's climate vulnerability assessments, supported by a statewide practitioner survey, to identify integration gaps, implementation barriers, and opportunities for improved coordination. Document review provided a useful context for the state of California RSMP, but the documents reflected an idealized picture of RSMP rather than a complete history of what has actually been implemented and the challenges of implementation. The survey and other working knowledge of RSMP challenges were essential to completing the analysis. This summary reviews key findings of this effort, provides targeted recommendations, and outlines next steps for improving the integration of sediment management and climate adaptation across California's coast.

Key Findings

1. Sediment–Adaptation Planning Disconnect: Climate adaptation and sediment management are typically addressed in isolation, developed by different professional sectors with limited coordination. RSMPs are often high-level and technical, focused on flood control and dredging, while adaptation plans are more policy-oriented and geared toward land use and community planning. As a result, few regions successfully integrate sediment considerations into local land use or sea-level rise (SLR) planning frameworks. RSMPs also tend to lack implementation detail and often omit funding and permitting pathways (Section 4.2.1; Figure 12).

This divide is further reinforced by institutional roles: adaptation planning is usually led by municipal or county long-range planners, while sediment management falls under engineers, harbor authorities, or flood control districts. The mismatch in geographic scale—regional planning for RSMPs versus local focus for adaptation efforts—leads to poor alignment in practice. Surveyed agencies confirmed this gap, with many adaptation practitioners reporting unfamiliarity with sediment planning tools or strategies.

2. Governance and Permitting Barriers: Jurisdictional complexity and regulatory misalignment present significant barriers to integrated sediment and adaptation planning. Climate adaptation and sediment management are typically handled by different departments within local and regional agencies, resulting in fragmented responsibilities and limited

coordination. Permitting processes are complicated by agency mandates that often conflict, creating procedural inefficiencies. These institutional barriers are exacerbated by high permitting costs, extended timelines, and unresolved logistical challenges related to sediment transport, sorting, and storage. Survey data confirmed that permitting hurdles and lack of interdepartmental alignment hinder the implementation of sediment strategies and limit their inclusion in climate adaptation frameworks (Section 4.3; TablesTable 1Table 16).

3. Sediment Variability: Many RSMPs rely on "average annual" sediment budgets that assume consistent harbor bypassing rates of sand, which downplays the importance of episodic events and the role of diverse sediment sizes in adaptation. This approach limits consideration of sediment delivery variability and post-disaster surpluses—key opportunities for shoreline resilience. Non-sand materials such as muds, cobbles, boulders, and even eco-concrete or reef-building substrates remain underrepresented in planning, despite their potential to reduce coastal hazards and support habitat restoration. Techniques such as channel dredge discharge relocation and backpassing are similarly underused, often excluding adaptive, nature-based features that could improve delivery efficiency and reduce transport losses. Survey results show that practitioners are increasingly exploring broader sediment options, but most RSMPs lag in formalizing these approaches (Sections 2.2.3 and 3.3; TablesTable 3Table 11; Figure 14).

4. Transportation, Sorting, and Storage: Logistical barriers remain a major limitation in effective sediment use across California's coast. Most RSMPs lack planning for stockpile sites, transport routes, and sorting infrastructure. A core challenge is efficiently moving sediment from source to receiver sites, especially when mixed grain sizes require sorting or when opportunistic storage is needed. These added costs and coordination gaps limit timely adaptation. To improve readiness, RSMPs should include transport strategies and integrate sediment inventories into long-term planning (Section 2.2.2 ; TablesTable 2Table 14).

5. Funding: Many RSMPs fail to quantify the role of beaches as coastal protection infrastructure, focusing instead on tourism. Yet California beaches buffer communities from storm-driven flooding, providing public safety, ecological, and recreational value—critical benefits often omitted from cost-benefit analyses (Sections 3.4 and 3.5; TablesTable 6,Table 6 Summary of how the eleven RSMP's include economics of sediment management actions through quantification such as cost benefit analyses. Color indicates depth of consideration, with darker green signifying greater depth.Table 7, Table 14; Figure 9). Techniques such as channel dredge bypassing and backpassing are underutilized, and rarely incorporate nature-based strategies that could improve delivery and reduce longshore transport costs compared to offshore sources. While RSMPs list potential funding pathways, traditional funding by the Army Corps of engineers, flood control districts, and occasional competitive grant limit implementation. Survey feedback underscores limited staff capacity and inconsistent funding tools across jurisdictions. Quantifying the flood protection role of beaches is now essential to unlock state and federal resilience funding.

6. Governance and Jurisdictional Challenges: Despite recommendations across RSMPs, no new regional sediment governance bodies have formed since their adoption (Section 5.1; Table 16Table 18). Joint Powers Authorities (JPAs) and Memoranda of Understanding (MOUs) are frequently suggested, but remain largely unimplemented. BEACON—a long-standing JPA—demonstrates the value of regional forums for raising awareness, coordinating advocacy, and fostering dialogue among elected officials. However, BEACON also illustrates key limitations: it lacks mandated authority, cannot enforce jurisdictional commitments, and excludes critical entities like harbor districts from decision-making. This fragmentation hinders the creation of enforceable, cross-boundary sediment strategies, limiting integration of RSM with broader climate adaptation planning.

7. Outreach and Understanding Deficits: Public and political understanding of sediment's role in resilience remains limited across all levels of government (Section 4.3.5; Figure 15). Existing outreach has focused more effectively on climate change impacts and adaptation planning, but sediment rarely features in those efforts. Continued outreach with regional sediment managers through surveys and workshops is essential. Native American Tribes and historically underrepresented communities are often left out of sediment-related discussions, undermining equity and buy-in for RSM efforts. While climate adaptation outreach has improved awareness and funding, RSM-specific education lags behind, with little visibility, limited metrics, and weak engagement outside technical circles.

Recommendations

1. **Update and Align RSMPs with Adaptation Planning:** To improve implementation and relevance, RSMPs must reflect current climate realities and planning frameworks.
    - Integrate sea-level rise, disaster-driven sediment variability, and habitat restoration into RSMPs.
    - Use sediment surpluses from high-flow or post-disaster events as opportunities for adaptive placement.
    - Coordinate RSMP updates with LCPs, LHMPs, CIPs, and other climate planning frameworks to ensure consistency and accountability.
    - Utilize beach monitoring datasets to support monitoring for climate adaptation pathways
2. **Expand Consideration of Sediment Types and Sources:** Many RSMPs focus narrowly on sand, ignoring the utility of a broader sediment range.
    - Broaden grain size considerations to include silts, muds, cobbles, boulders, and innovative materials like eco-concrete.
    - Reconnect coarse sediments from debris basins to coastal systems, especially after disasters.
    - Develop and maintain standardized regional sediment inventories linked to project and habitat needs.

3. **Enhance Interregional Governance and Collaboration:** Governance fragmentation is a key barrier; broader and more representative collaboration is needed.
    - Expand the CSMW and regional governance bodies to include adaptation planners, harbor districts, Tribes, public works, transportation agencies and historically underrepresented groups.
    - Establish interregional coalitions to advocate for sediment-related policy and funding.
    - Support knowledge exchange through shared technical capacity, inventories, and monitoring frameworks.
4. **Streamline Permitting and Regulatory Integration:** Permitting challenges remain a major barrier to implementation.
    - Establish a statewide framework of permit conditions for sediment reuse projects, covering construction, monitoring, and placement methods.
    - Develop programmatic EIRs and templates to reduce project delays.
    - Apply "Cutting the Green Tape" principles and leverage Coastal Act Sections 30233(b) and 30233(d) to support beneficial reuse and adaptive permitting.
5. **Integrate Sediment into Climate Resilience Frameworks:** Sediment management must be fully embedded in the broader landscape of adaptation planning.
    - Require the inclusion of sediment strategies in LCPs, General Plans, LHMPs, and adaptation plans.
    - Cross-train planners and engineers to promote integration at every stage of the planning cycle.
    - Use scenario planning to address sediment needs under extreme events and climate futures.
6. **Quantify Multi-Benefit Outcomes:** To secure long-term funding, sediment strategies must demonstrate value beyond engineering metrics.
    - Quantify flood protection, ecosystem services, and recreational benefits in cost-benefit analyses.
    - Frame beaches and dunes as public infrastructure eligible for resilience and infrastructure grants.
    - Promote the use of ecosystem service valuation in sediment project planning and assessment.
7. **Support Pilot Projects and Adaptive Implementation:** Pilot projects can test and demonstrate innovative sediment reuse strategies.
    - Implement scalable pilots that explore sediment sorting, storage, transport, and reuse.

- Use monitoring data from storms and shoreline changes to inform placement strategies.
- Align pilot projects and routine flood control activities with long-term adaptive strategies, including living shoreline maintenance cycles.

8. **Elevate Outreach, Equity, and Public Understanding:** Increased awareness and equitable engagement are essential for successful implementation.

    - Launch targeted outreach to Tribes, underrepresented communities, and local officials.
    - Highlight success stories and build support through transparent performance tracking.
    - Promote equitable funding structures that reduce disparities across jurisdictions.

Conclusion and Next Steps

Sediment is not waste—it is a climate adaptation resource. To leverage it, California must break down professional silos, streamline permitting pathways, reinforce regional coordination, and expand funding models. Key next steps include:

- Launching cross-jurisdictional demonstration projects
- Creating permitting templates for adaptive sediment strategies
- Embedding sediment metrics in benefit-cost modeling
- Developing outreach indicators and tracking systems
- Advancing regional sediment inventories and logistics plans
- Promoting beaches as frontline infrastructure

With strategic investment, unified policy, and inclusive governance, sediment can be elevated to a foundational pillar of California's adaptive resilience strategy.

1 BACKGROUND

Governance of sediment management has been a challenge for decades, in California and beyond. Complex and conflicting regulations, and a lack of coordinated implementation of state and federal priorities has led to poor integration and lackluster solutions. However, several key requirements for critical policy and regulatory reform have aligned, as listed below.

Sediment is finally being recognized as a key resource. The atmospheric river and bomb cyclone erosion events experienced in 2023 and 2024 served to sharpen the focus of regulators at all levels of government, and to drive a search for innovative solutions.

Additionally, sediment availability is soon to be at the highest level in recent years, at exactly the time there is the greatest desire for this sediment for sea level rise and erosion management. Recent moves to remove dams and impoundments structures (Klamath, Elwah, Matilija, Rindge, Cleveland National Forest) illustrate recognition of the need for comprehensive sediment management, including restoring watershed sources. These features capture terrestrial sources of sediment, particularly cobbles, that are critical to limiting erosion of the nearshore environment, and their removal will change the playing field. Additional sources of sediment arise through lagoon restoration projects, debris flows from natural disasters and debris basin cleanouts, and offshore sand sources. Additionally, the US Army Corps of Engineers has indicated greater willingness to incorporate beneficial reuse of sediment from navigational dredging activities.

Furthermore, there is increasing evidence and acknowledgement of the secondary impacts of hard protective structures, and an enhanced level of support for nature-based solutions. Longshore transport has been disrupted by coastal armoring, meaning that those sediments that do reach the coast are not able to move where nature intended. The negative impacts of hard structures on adjacent beaches have also been recognized.

Finally, historic levels of funding have been provided for coastal resilience. Alignment of these factors provides an opportunity to highlight the ineffectiveness of the existing sediment framework, and to suggest alternative management and funding arrangements that integrate sediment management with climate planning.

2 REVIEW OF CALIFORNIA COASTAL SEDIMENT MANAGEMENT PLANS

2.1 COASTAL SEDIMENT MANAGEMENT PLAN BACKGROUND

The California Coastal Sediment Management Workgroup (CSMW) was established in 1999 with a goal to address coastal sedimentation and erosion issues and to "restore and protect beaches, wetlands, and other coastal environments by restoring natural sediment supply to those areas and optimizing the use of sediment from ports, harbors, and other opportunistic sources" through the development of a Sediment Master Plan (SMP) (Figure 2). The CSMW was led by the US Army Corps of Engineers (USACE) and the California Natural Resources Agency (CNRA). CNRA member groups included the California: Ocean Protection Council; Division of Boating and Waterways; Department of Parks and Recreation; California Coastal Commission; State Lands Commission; State Coastal Conservancy; California Geologic Survey; Department of Fish and Wildlife; and San Francisco Bay Conservation and Development Commission.

In its original formation, the CSMW was primarily a collaboration between federal and state agencies, with little local or municipal engagement, and its primary focus was on finding sand to nourish beaches. In 2003 and 2004 a series of regional public workshops were held to share the goals with the public, to gather information on local sedimentation and erosion issues, identify ongoing sediment management activities and support coordination and cooperation. The series of workshops highlighted that different parts of the state have different sediment concerns, varying at a local level and requiring local knowledge and expertise to address.

Thus, one of the major outcomes of these meetings was a decision to separate the California coast into littoral cells or sandsheds for sediment planning purposes. This led to a host of statewide scientific research on sediment impoundment behind dams and coastal armoring structures as well as the development of individual littoral cell sediment budgets using average annual navigation dredge volumes. Some of these efforts led to foundational studies such as Patsch and Griggs (2003) using dredge data as a proxy for long-term sediment budgets, Willis and Griggs (2003) and Limber et al. (2008) work on defining littoral cell boundaries and identifying littoral cut-off diameters—i.e., the grain size below which sediment is no longer part of the active coastal transport system—and Warrick et al. (2008) study in Imperial Beach, which found that a small number of storm events account for the vast majority of sediment delivery from rivers to the coast.

These led to the development of Coastal Regional Sediment Management Plans (CRSMPs), which are shown in Figure 3. The CRSMPs were subsequently developed over the course of a decade, between 2008 and 2018 (**Error! Reference source not found.**). These plans were largely developed by scientific and engineering consultants working with local government planning staff with funding the California Department of Boating and Waterways (now State Parks).

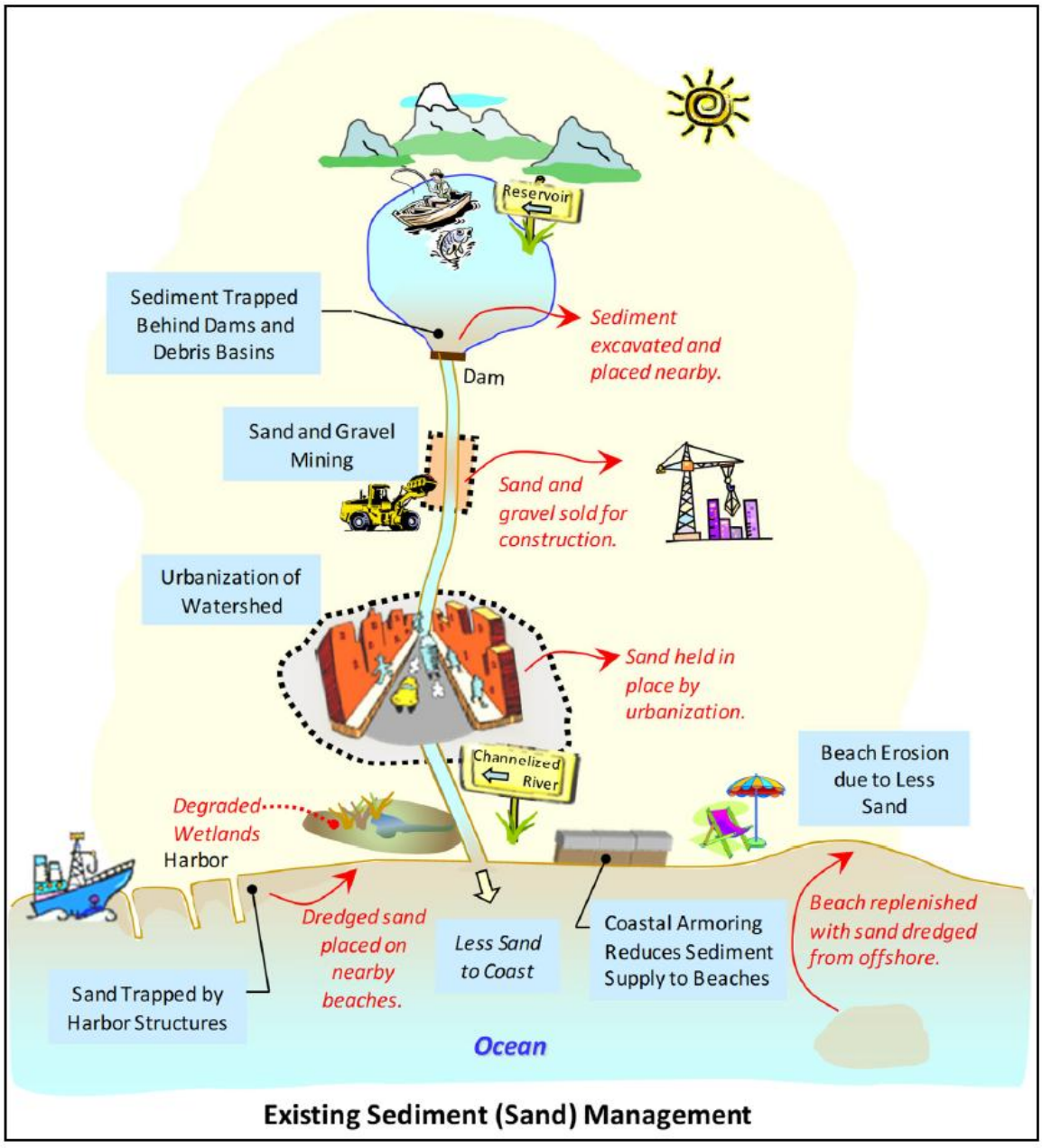


Figure 1 A depiction of "coastal sediment management without regional cooperation" on the top, as shown in the California Sediment Master Plan Report (2021).

Throughout these plans, the general focus is on the average annual sediment budget, as reflected in dredging costs, erosion rates, and sedimentation. This use of the annual average does not capture extremes, often caused by storm events, and sometimes in the form of disasters that require immediate actions. This is a notable limitation of the CRSMPs.

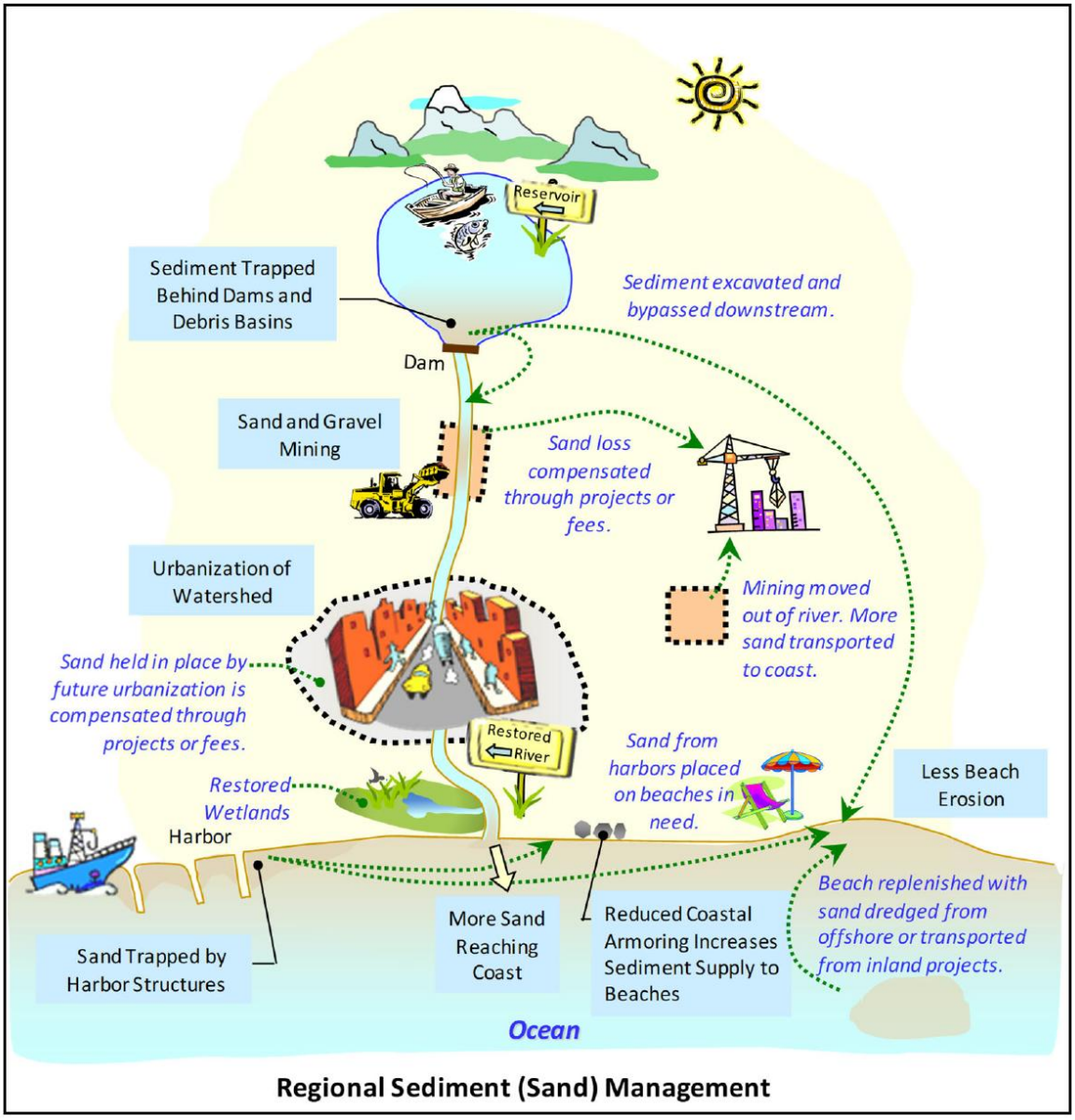


Figure 2 A depiction of "a regional approach to CA coastal sediment management", as shown in the California Sediment Master Plan Report (2021).

Most CRSMPs typically include:

- Sediment budget based on average annual dredge volumes
- Recommendations for potential local governance structures to support Plan implementation.

- Evaluation of physical sandshed conditions, such as erosion hotspots, sedimentation, and sand transport dynamics within the Plan area, including sediment sinks or retention structures such as dams and coastal armoring.
- Identification of known and potential sediment sources and receiver sites that may benefit from Regional Sediment Management (RSM).
- A cost-benefit analysis related to sediment management activities within the Plan boundaries.
- Review of sensitive species and habitats located in the Plan area.
- A public outreach strategy designed to engage key stakeholders and the broader community.
- Recreational use descriptions for beaches including beach visitation rates and descriptive assessments of beach usage, e.g. surfing.
- Geospatial data layers that represent physical and ecological information for integration into CSMW's geospatial database.

Across the plans, sediment is consistently identified and utilized as a tool to adapt to climate change, with a strong focus on how to use sand dredged from harbors and navigational channels for beach nourishment projects through sediment bypassing (sending sand down the littoral drift). However, the logistical framework to implement projects, including financing, cost benefit analyses, governance, grain size, sediment sources, and permitting roadmaps is variable across the plans and largely localized in individual jurisdictions. Furthermore, the scope of sediment management in the plans can be narrow – use of fine grains and cobbles is only considered in some of them. Many of the plans do not consider RSM strategies beyond the traditional framework of navigational dredging and nourishment via bypassing. Some More innovative strategies include sediment back passing (moving sand up the littoral drift, in an attempt to keep it within the littoral cell) and nature mimicking living shoreline approaches, such as enhancing beaches with offshore reefs, assessing and implementing managed retreat, living shorelines, tidal marsh creation, and upstream restoration.

Figure 3 Geographic range of California's CRSMPs, as shown in the California Coastal Sediment Master Plan Report (2021).

California's science and policy positions on climate planning changed drastically over the course of the decade that the RSMPs were written. As such, the more recent plans tend to address sea level rise in a more comprehensive way. In 2008, Governor Schwarzenegger issued an executive order requiring state agencies to consider 4.6 feet of sea level rise in planning projects, and when the first RSMPs came out, the state had only just begun to consider SLR. In 2009, when the Southern Monterey Bay and BEACON CRSMP's were published, sea level rise science was not as fully included into policy, but by 2018 when the most recent plan was published, inclusion of sea level rise in state policy was required. Thus, the degree to which sediment management was integrated into climate adaptation planning varied depending on when the RSMPs were written.

Recent literature highlights the need to improve implementation of RSMPs through better coordination and regional capacity building. Goodrich et al. (2020) note that despite the statewide development of RSMPs, actual implementation has lagged due to permitting complexity, lack of dedicated funding, and inconsistent agency engagement. They point to BEACON and other regional groups as important platforms for collaboration, pilot project delivery, and information-sharing. These findings reinforce the value of aligning sediment management with interjurisdictional sea level rise adaptation planning on the Central Coast.

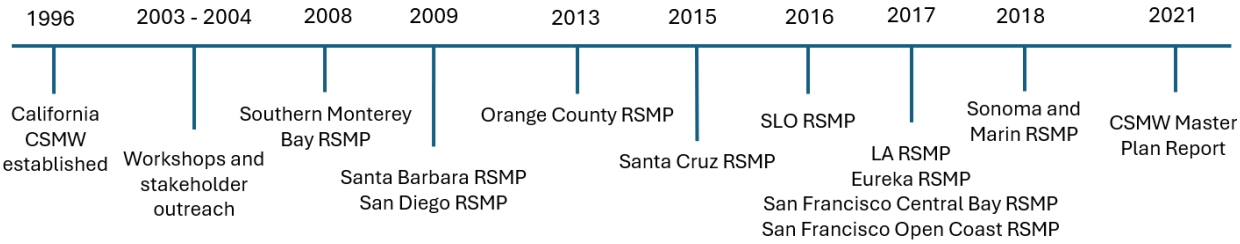


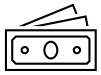
Figure 4 Timeline of California's sediment management activities

2.2 RSMP REVIEW

This project conducted a comprehensive review of the RSMPs based on a set of themes to compare the similarities and differences as well as the strengths and weaknesses across the reports to identify best practices and knowledge gaps, particularly on how governance and financing have evolved. The team identified eight key themes related to regional sediment management and assessed each of the eleven RSMPs to compare how the plans addressed each of the key themes. The themes included:

- Governance: How is regional sediment management governed? Are multiple options presented? How are stakeholders involved in developing the governance structure? How are decisions made about sediment regionally? At a jurisdictional level?
- Sediment sources: Does the plan identify diverse sediment sources and sinks to consider in regional sediment management projects?
- Projects: Does the plan identify sediment management projects that will address current erosion and future climate change concerns using sediment from within the region?
- Sea level rise: How is sea level rise considered in the plan? Is it integrated throughout the background, the recommended actions, and plans? Is sediment used as a tool to adapt to climate change?

Grain size: Is sediment of various grain sizes considered? Are cobbles and fine-grained sediment such as silt and mud considered in addition to sand?



Financing: How will regional sediment management be funded? Does the plan present a variety of financing options? Does the plan outline steps necessary for the region to generate funds for implementation of identified projects?

Staffing: Does the plan recommend staffing levels for implementing the regional sediment management plans?

Economics of beach nourishment: Does the plan assess whether beach nourishment is economically viable through cost-benefit analyses, surveys of beach usage, coastal protection value of the beach, or cost estimates of beach nourishment?

High level findings illustrate that all eleven plans successfully identify a range of local sand sources, that can be used in addressing regional beach erosion problems. This includes estimates of sources and sinks of sediment and current littoral cell budgets based on dredge volumes, and identification of areas of particular erosion concern.

Beyond identifying sediment sources and specific areas of erosion concern, however, the degree to which they provide logistical frameworks for governing the movement of sediment, financing the movement of sediment, dealing with unsorted sediment and utilizing a range of grain sizes, and using sediment to adapt to climate change is highly variable. The eight RSMP themes are all discussed in more detail below.

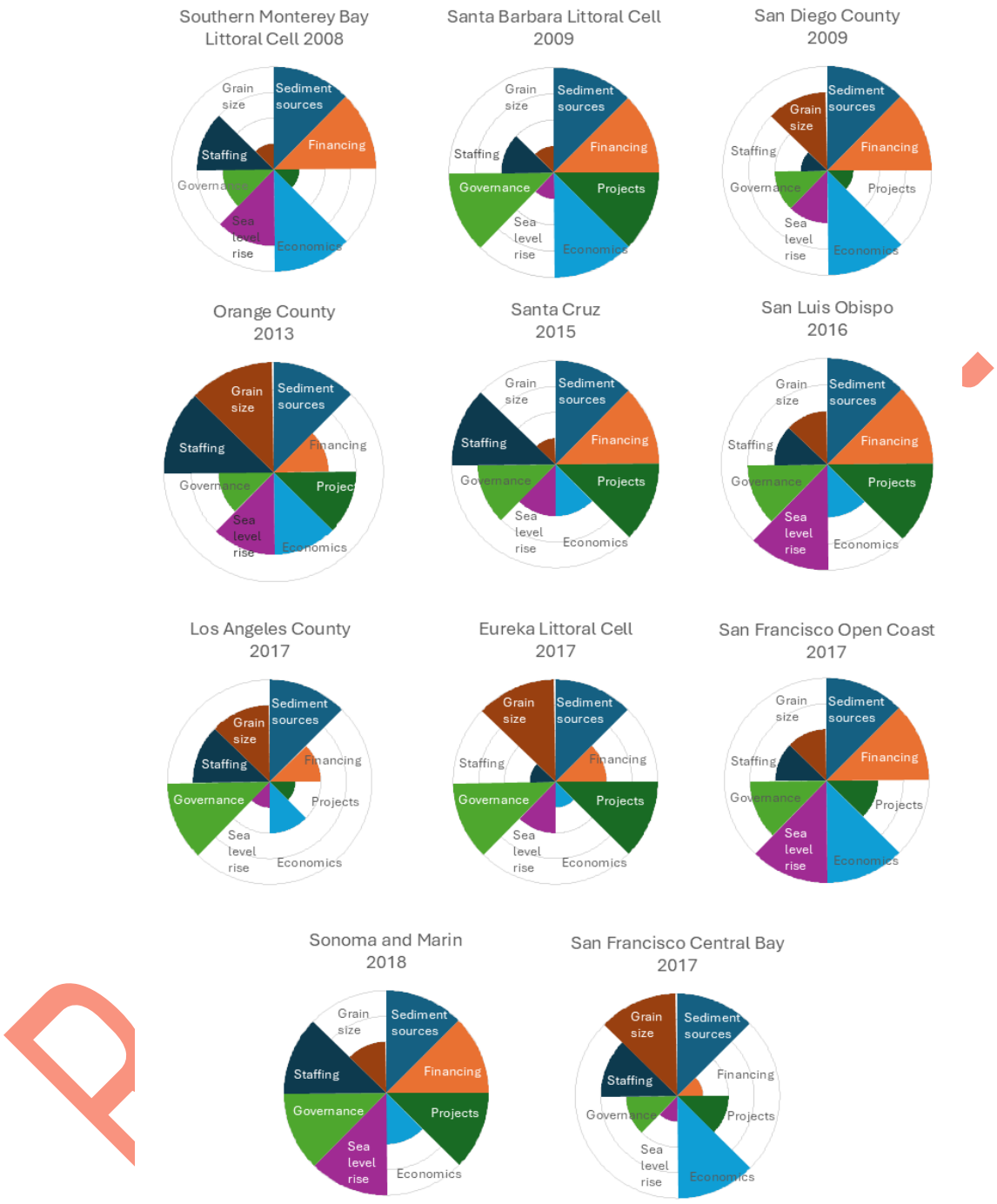


Figure 5 Pie charts of the eleven different regional sediment management plans, showing degree of development across eight different categories: sediment sources, financing, projects, economics, sea level rise, governance, staffing, and grain size. These different categories are explored more in depth in the following section, with excerpts from well-developed plans highlighted to explore best practices.

2.2.1 Governance structures, challenges and opportunities

All the regional sediment management plans (RSMPs) included in this review discuss governance options to some degree, with the exception of the Santa Barbara Littoral Cell RSMP, which already has a formalized governance; the BEACON Joint Powers Authority (JPA), established in 1986. BEACON has 1.5 dedicated staff with a board of directors that includes elected officials for each of the jurisdictions. BEACON has nine jurisdictions including the Cities of Goleta, Santa Barbara, Carpinteria, Ventura, Oxnard, and Port Hueneme, as well as the Counties of Santa Barbara and Ventura. In 2020, BEACON approved bylaws for a Science Advisory Committee (SAC) and selected the first 12 members. The committee began meeting starting in 2021 to review how best available science can be adopted into RSMP activities in the BEACON region. In December 2021, the SAC and BEACON adopted a Research Agenda which highlighted some of the key data gaps and expanded the types of monitoring needed to include not only physical shoreline data, but also coastal ecology, as well as human uses, and economic data needs.

The BEACON governance structure is recommended as a governance model in several other plans, including Southern Monterey Bay, Orange County and San Diego. While recommending specific governance structures is a step in the right direction, stakeholder support is key to long-term success. Santa Cruz and the two San Francisco Bay plans present governance options to be determined by stakeholders. The remaining plans suggest possible governance structures with procedural group approaches (committees, existing departments and staff members) to engage stakeholders and determine the appropriate governance structure through that process (Figure 6).

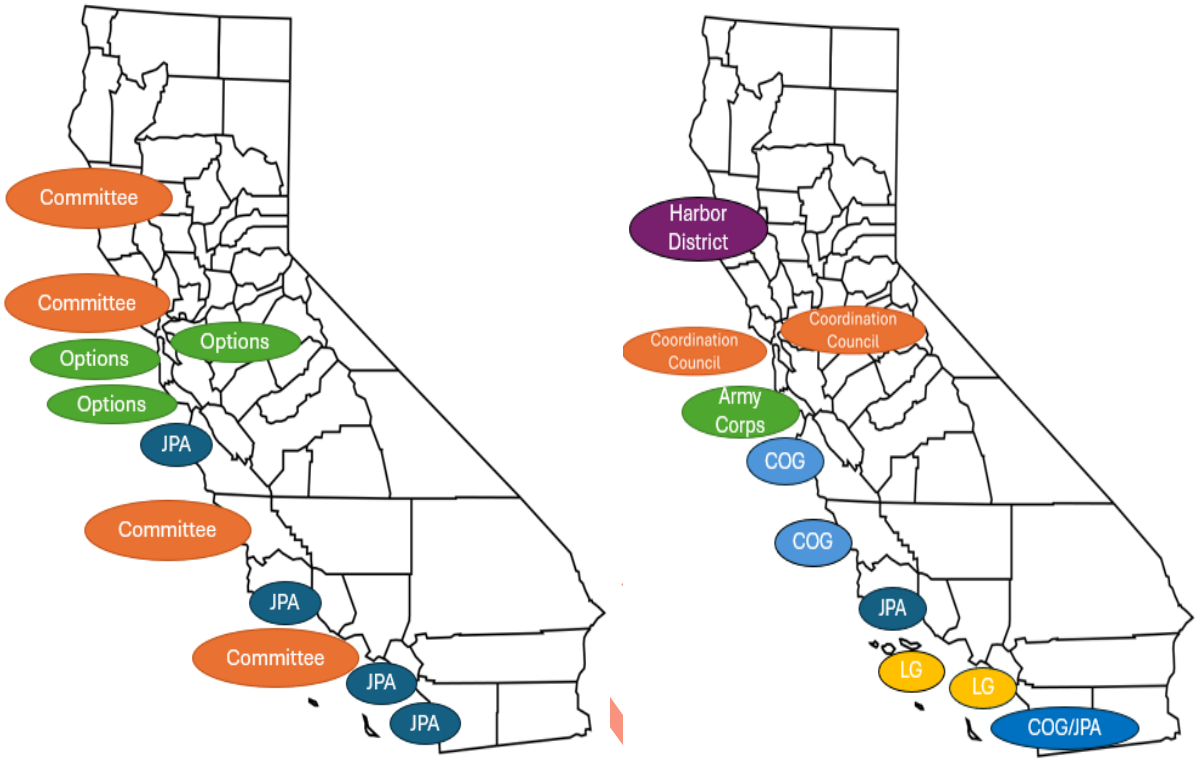


Figure 6 Governance recommendation of each regional sediment management plan compared to current status.

We identify the BEACON jurisdiction as having the most developed governance structure due to its proven history of successful RSMP implementation. Among the other plans, those that provide the most flexibility and allow for most substantial stakeholder co-design, are identified as most developed. Rather than recommending specific governance structures, these plans lay the foundation for stakeholder-driven governance structures through formation of committees and enhanced coordination and stakeholder engagement (Table 1).

Table 1 Summary of how the eleven RSMP's address governance. Color indicates depth of consideration, with darker green signifying greater depth.

Governance Structure

	Santa Barbara	2009	This is the only plan reviewed which does not discuss governance structure, though it is actively governed by a JPA. Many of the other plans reference the BEACON governance structure as a model.
More Developed	San Luis Obispo	2017	The San Luis Obispo County RSMP appoints The San Luis Obispo County of Governments (SLOCOG) to appoint a CRSMP Policy Advisory Committee who will seek input from stakeholders and subsequently make recommendations to The SLOCOG Board. The LA County CRSMP highlights the existing Departments of Beaches and Harbors and Public Works and recommends a staff program manager to be dedicated full time to CRSM issues and coordinate between existing departments, and with the cities of Long Beach and Santa Monica which manage their own beaches. The Eureka Littoral Cell RSMP recommends the creation of a Joint Regional Sediment Management Committee (JRSMC) which would coordinate and make recommendations for the CRSMP. The Plan recommends The JRSMC establishes a Memorandum of Understanding to lay out the structure and Management role of representatives on The committee, which should include the Humboldt Bay Harbor and Conservation District as well as local municipalities and tribes. Similarly, The Sonoma and Marin RSMP, which is the most recently published Plan, reviews governance options recommended by other RSMPs and suggests an open process to determine a governance structure driven by stakeholders and local governments.
	Los Angeles County	2017	
	Eureka	2017	
	Sonoma and Marin	2018	
	Santa Cruz	2015	The Santa Cruz JPA puts forward four governance options, including status quo, increased stakeholder engagement, a governance structure led by an existing agency, such as a local university, and then establishing a JPA modeled after BEACON. Though the RSMP presents these options it makes no recommendation. Similarly, the San Francisco Open Coast Littoral Cell RSMP puts forward four governance options (Status quo, Coordinating Network, Existing Jurisdiction(s) as the Lead CRSMP Agency, Special District including Geologic Hazard Assessment District and Joint Powers Authority) but makes no recommendation. The San Francisco Central Bay RSMP presents a cursory discussion of several governance challenges but puts forward no options nor recommendations.
	San Francisco Open Coast	2016	
Less Developed	San Francisco Central Bay	2017	
	Southern Monterey Bay	2008	The Southern Monterey Bay CRSMP and the San Diego RSMP, as well as the Orange County RSMP, published in 2013, all discuss the existing governance structures of associated governments and recommend establishing a joint powers authority, modeled after the BEACON JPA. The San Diego region is governed by the San Diego Associated Governments (SanDAG) Shoreline Committee and the Southern Monterey Bay region identified the Associated Monterey Bay Area Governments (AMBAG). AMBAG did not have a strong enough regional role to effectively govern RSM.
	San Diego County	2009	
	Orange County	2013	

2.2.2 Sediment sources

The plans each list a variety of sediment sources. Each plan scored equally high, as they all included a range of options tailored to the region. Sources collected across the plans are listed below. While all the RSMPs successfully list the sediment sources available within the littoral

cell(s), each of these sediment sources comes with its own set of challenges (Table 2). The challenges tend to be named in the plans, but few solutions are provided some of which are addressed in the plans. A major challenge that applies to almost all sediment sources listed across the reports is determining an efficient way to transport sediment from source to reciever site. Most of the RSM plans focus on bypassed sediments which simply are dredged from the navigation channel and placed downcoast, however sediment back passing or moving sediment upcoast to locations that are settlement starved , or opportunistic sediment actions which requires moving sediment from up in the watershed down to the coast are not as fully included.

Sediment size is another challenge for many sources, particularly those that hold sediment which has not already been naturally sorted through fluvial or marine transport (such as debris basins, construction materials, and sediment behind dams). Contamination is also a challenge, particularly for harbor dredged sediments. These challenges are included below, as they relate to each of the sources. Finally, beyond physical challenges, cross-jurisdictional cooperation is a challenge as well, as sediment sources may not exist in the same city or even in the same county as receiver sites, requiring collaboration and cooperation across political boundaries.

Table 2 Summary of the sediment sources in the RSMPs and their associated challenges

Sediment Sources	Challenge		
	Sorting	Contamination	Transportation
Sediment traps in creeks	√	√	√
Debris basins	√		√
Dams (Matilija and Rindge)	√		√
Rivers	√	√	√
Sand dunes			√
Construction excavated material	√	√	
Reservoirs		√	√
Harbor dredge material	√	√	√
Lagoon sediments	√	√	√
Offshore sand			√
Beach backpassing			√
Flood protection channels	√	√	√
Cliff erosion	√		√
Navigation channels bypassing		√	√

2.2.3 Sediment of all sizes (mud, silt, sand, cobbles)

Some RSMPs include a range of grain sizes more than others. The primary focus of most of the plans is sand, but some of the plans also include non-sand sediments such as mud and cobbles. While sand is the ideal sediment size for maintaining beaches, it is also in short supply

in many places, due to impoundment behind dams, debris basins, and coastal armoring and becoming increasingly limited as sea levels rise. As such, the best practice in RSMPs is to include as wide a range of sediment sizes as possible, from mud to cobbles (Table 3).

Figure 7 Images of cobbles (top left), fine sediment (top right), and sand (bottom) being utilized for enhancing coastal resilience.

Muds and silts can be used in estuarine sediment management supporting marsh habitat restoration. Sand can be used for beach nourishment and dune creation. Cobbles can be used for creating naturally hardened shorelines that limit erosion of other sediment types. These various sediment sizes are sorted in systems where there is natural movement and distribution of sediment (e.g. in connected watersheds), but when natural movement of sediment is interrupted by, e.g., development and flood control structures, natural sorting does not occur. Thus, sediment from debris basins or behind dams will likely be poorly sorted by grain size.

While treatment of a wide range of sediment size is ideal, certain parts of the coast inherently have more diverse landforms and grain sizes. For example, the Santa Barbara littoral cell is home to beaches, cliffs and several estuaries, with sediment supplied by rivers, creeks and cliff

erosion, while the Southern Monterey Bay littoral cell is essentially one long sandy beach with sand supplied from the Salinas River and erosion of the beaches and dunes.

Another consideration is that Orange County and San Diego County have both implemented Sand Compatibility Opportunistic Use Programs (SCOUP). SCOUPs involve ranking previously utilized sediment sources using a three-fold classification system (suitable for direct placement, nearshore placement and unsuitable for beach nourishment) and matched with suitable receiver sites identified in the CRSMP. As such, these two plans have laid the groundwork for further planning related to grain size. The Sonoma Marin, San Luis Obispo and Southern Monterey Bay plans all recommend exploring implementation of SCOUPs as a possible future step, and a stakeholder comment in the Santa Barbara plan inquires about development of a SCOUP. After development of the Southern Monterey Bay and BEACON RSMPs, SCOUPs were developed in those jurisdictions. The City of Monterey established a regional SCOUP program and EIR in 2019 but has never gotten a CDP or had another jurisdiction adopt the program, although the City of Marina is working on integrating it into their LCP policies. SCOUPS have not been implemented in the Sonoma Marin or San Luis Obispo regions since the RSMPs were written. Currently Los Angeles County is in development of a SCOUP program.

BEACON set up and permitted a 5 year opportunistic nourishment program but it was never activated because dry years occurred in the permit window. Debris flows caused by fire and flood events generally followed the locations identified in the SCOUP, but sediment was placed under an emergency permit. The large volume of sediment from the recent disasters in the BEACON region illustrated the limited capacity of the 5 receiver sites to accommodate the large volume so the Santa Barbara County BeachSMART program is revisiting that with intention of expanding the list of receiver sites, establish a SCOUP program, and update the RSMP. For more discussion please see section 5.4.

Table 3 Summary of how the eleven RSMP's address grain size. Color indicates depth of consideration, with darker green signifying greater range of sediments.

Grain size

More Developed	Orange County	2013	The Orange County CRSMP discusses the grain size envelopes of the various beaches and receiver sites in the region and discusses the grain sizes of potential sediment sources and includes the use of cobbles in the recommended activities. The Eureka Littoral Cell and the Central San Francisco Bay CRSMP both include non-sand management strategies which are primarily related to fine grain sediment spreading as a path to marsh restoration. Inclusion of fine sediment management practices in these plans is likely because these regions are home to the largest estuaries in the state of California. However, estuarine environments with fine sediment exist along the coast of the whole state and best practice would be to include fine sediment management practices in each coastal sediment management plan.
	Eureka	2017	
	San Francisco Central Bay	2017	
	San Diego County	2009	The San Diego CRSMP discuss the grain size envelopes of the various beaches and receiver sites in the region, and discuss the grain sizes of potential sediment sources as well, inclusive of non-sand grain size. Similarly, the LA County CRSMP discusses debris basins as non-viable sources of sediment due to distance from the coast, but also introduces a dam in Malibu with mixed grain sizes and significant sand content as a possible source.
	Los Angeles County	2017	
Less Developed	San Francisco Open Coast	2016	The SLO, San Francisco Open Coast, and Sonoma/Marin CRSMPs each mention grain size, and note it as a data gap, but do not include discussions of grain size envelopes of receiver sites or grain sizes of potential sources.
	San Luis Obispo	2017	
	Sonoma and Marin	2018	
	Southern Monterey Bay	2009	The BEACON, Southern Monterey Bay, and Santa Cruz CRSMPs are focused on sand only and contain little to no information regarding grain size. While Southern Monterey is almost entirely sandy beaches, Santa Cruz and the BEACON region both could utilize other grain sizes such as cobbles in their plan.
	BEACON	2009	
	Santa Cruz	2015	

2.2.4 Inclusion of sea level rise considerations

Inclusion of sea level rise in the eleven CRSMPs varied largely based on the timing of the plan creation. The first round of CRSMPs in Southern Monterey Bay, BEACON, and San Diego barely mentioned sea level rise. However, in 2013, California's Assembly Bill (AB) 691 required trustees of state lands where average granted land revenues were greater than $250,000 annually, to prepare and submit an assessment to the California State Lands Commission (Commission) on how the local trustee proposed to address sea level rise. Since many of these trustees were ports and harbors with ongoing navigational dredging, sea level rise began being integrated into the CRSMPs. Beaches and coastal sediment are both public trust resources, and so after 2013, managers of these resources were required to consider sea level rise. Thus, RSMPs written after the passage of AB 691 generally have a more thorough approach to integrating sea level rise into sediment management.

While including SLR considerations into regional RSMPs is ideal, certain jurisdictions have made significant investments into SLR adaptation planning, which has historically been a

separate planning process at a jurisdictional level, while RSMP's tend to include multiple jurisdictions and consider more of a navigation or flood control focus and are done a larger regional littoral cell or sand shed.

Outliers to this general trend of improved inclusion of sea level rise over time are the Los Angeles County and San Francisco Central Bay CRSMPs. These plans, both published in 2017, barely touch on sea level rise or climate impacts to sediment management, despite both of these regions having some of the highest population densities and future exposure to SLR in the state of California. Another consideration is political geography and the intensity of urban development, where there may be competing influences. It is typically easier from both a practical and political perspective to plan for sea level rise on less developed coastlines with less-organized property development sectors. Conversely, there may not be the same level of urgency for management of sediment to support beach-related tourism and recreation. This may have played into the degree to which SLR was considered in the Eureka RSMP.

For example, Los Angeles County has developed a Sea Level Rise Vulnerability Assessment and the San Francsico Bay Conservation and Development Commission has supported a Regional Shoreline Adaptation Plan. While these topics may be missing from the RSMP's, that does not signify neglect. Rather, this highlights the challenge of streamlining and combining RSMP and SLR and climate adaptation plans and operationalizing the recommendations delivered through RSMPs. In Table 4, the darkest green category contains plans that have fully and deeply integrated sea level rise considerations into sediment management planning while the lightest shade of green includes plans that have little to no mention of SLR.

Table 4 Summary of how the eleven RSMP's address sea level rise. Color indicates depth of consideration, with darker green signifying greater depth.

	Sea level rise		
More Developed	San Francisco Open Coast	2016	The SLO CRSMP has a section on changes in sea level, a section on how sea level rise will induce flooding and erosion, a section on sea level rise adaptation, and the topic sea level rise is present throughout the presented list of potential CRSM activities. Similarly, the San Francisco Open Coast CRSMP has a section on sea level rise and timeframe of the plan and a section on climate change impacts to the region, as well as sea level rise embedded in the geomorphic modeling of hazard zones and discussed thoroughly throughout the plan. The Sonoma and Marin CRSMP also has a section on sea level rise and sea level rise is discussed thoroughly and embedded throughout the plan.
	San Luis Obispo	2017	
	Sonoma and Marin	2018	
	Southern Monterey Bay	2009	The Southern Monterey Bay RSMP has a section on predicted sea level rise that gives specific estimates of future shoreline erosion rates on the region's coastline. The OC CRSMP has a section on water levels which discusses sea level rise, a section on how sea level rise impacts beaches and it also includes a recommendation on performing a study to assess beach sustainability with sea level rise.
	Orange County	2013	
Less Developed	San Diego County	2009	The San Diego and the Eureka RSMP both mention sea level rise but do not explicitly consider it in its recommendations or analyses. The Santa Cruz RSMP has a section on changes in sea level but does not explicitly consider sea level rise in its recommendations. However, the plan does point to numerous other sea level rise studies level in the region.
	Santa Cruz	2015	
	Eureka	2017	
	Santa Barbara	2009	The Santa Barbara Littoral Cell RSMP (2009) makes a cursory mention of sea level rise in Table 2, noting briefly that shoreline recession rates in areas of high erosion may further accelerate. Similarly, The Central San Francisco Bay RSMP, written nearly a decade later (2017), makes one mention of sea level throughout the report, even though the Bay Area is central to California's vulnerability to sea level rise. Likewise, the LA County CRSMP (2017) makes only cursory mentions to sea level rise, though it does make a recommendation to locate offshore sand for beach nourishment in a future with higher sea levels.
	San Francisco Central Bay	2017	
	Los Angeles County	2017	

2.2.5 Projects

The plans all recommend specific regional sediment management projects to address erosional hotspots. However, not all the plans specifically recommend projects that address future climate change concerns using sediment from within the region.

The RSMPs from Santa Barbara, Santa Cruz, San Luis Obispo, Eureka, and Sonoma and Marin each recommend sediment management actions that use regional sediment to reduce future climate erosion risk. Furthermore, each of these five plans identify sediment management actions beyond beach nourishment and shoreline hardening, including enhancing beaches with offshore reefs, assessing and implementing managed retreat, tidal marsh creation, and upstream restoration.

The Orange County, San Francisco Central Bay, and San Francisco Open Coast plans either do not mention climate change or mention it briefly, but do include creative adaptation strategies that address future climate erosion risk.

The San Diego, Southern Monterey Bay, and Los Angeles County RSMPs do not address sea level rise and climate change and only suggest traditional sediment management such as beach nourishment.

Table 5 Summary of how the eleven RSMP's consider projects that utilize sediment to reduce erosion risk and coastal hazard acceleration. Color indicates depth of consideration, with darker green signifying greater depth.

	Projects		
More Developed	Santa Barbara	2009	In the Santa Barbara RSMP, many suggested RSMP actions are related to using sediment within the county to reduce impacts of climate change, including utilizing sediment behind dams and in debris basins as well as some beach restoration actions. The Santa Cruz RSMP presents a list of RSMP options for various areas within the county, most of which are related to climate adaptation. Actions include managed retreat, beach nourishment, and cliff stabilization among others. The San Luis Obispo lists RSMP actions and some mention sea level rise. Listed projects include a beach sustainability study, a sediment management plan for a reservoir in the county, and developing a sand compatibility and opportunistic use program. The Eureka RSMP lists several ways to use various types of sediment to prepare for climate change including coastal dune enhancement, tidal marsh restoration, creating soft shorelines within the bay, and dike rehabilitation. The Sonoma and Marin RSMP lists various climate adaptation strategies involving sediment, including managed retreat, watershed and beach restoration, and living shorelines.
	Santa Cruz	2015	
	San Luis Obispo	2017	
	Eureka	2017	
	Sonoma and Marin	2018	
Less Developed	Orange County	2013	Suggested projects are scattered throughout the Orange County RSM. They are mostly related to beach nourishment and use of dredge materials, but there is also a mention of emptying debris from the Prado Dam and allowing it to re-enter the watershed and a sea level rise beach sustainability study. The San Francisco Open Coast RSMP includes brief mentions of SLR and climate change, but most of the projects are essentially climate adaptation strategies. The plan includes mentions of beach restoration. Similarly, the San Francisco Central Bay RSMP includes no specific mention of climate change, though many of the projects are related to climate adaptation, including habitat restoration, living shorelines, and watershed connectivity.
	San Francisco Open Coast	2016	
	San Francisco Central Bay	2017	
	San Diego County	2009	The San Diego RSMP includes sediment management approaches for various categories of sediment sources. It includes no mention of sea level rise and is primarily focused on how to utilize sand for beaches most effectively. The Southern Monterey Bay RSMP includes several strategies but none of them specifically address climate impacts. The three options presented are beach nourishment, stopping sand mining, and allowing dunes to retreat. The LA County RSMP includes no mention of climate change within the adaptation strategies.
	Southern Monterey Bay	2009	
	Los Angeles County	2017	

2.2.6 Economics of beach nourishment

2.2.6.1 Benefits

- Most CRSMPs have a strong focus on beach nourishment coupled with navigational channel dredge bypassing, which, in many regions, is the primary coastal sediment management action proposed due to the role beaches play in offsetting erosion and their recreational value in California (King, 1999; Pendleton et al., 2012). However, the degree to which the CRSMPs evaluate the economic benefit of beach nourishment varies across the reports (

Notably, the two plans that are least developed are from Eureka and Sonoma/Marin, which are in the northern part of the state where there are many remote beaches and less high-density beach tourism. As such, the lack of information on costs and benefits of beach nourishment may be due to the regional geography and patterns of development and recreational use, rather than an oversight of the plans themselves. Of the more developed (dark green) plans, the San Diego and Southern Monterey Bay RSMPs are the only two that include beach recreation and coastal protection services in their cost benefit analyses. The San Diego RSMP estimates coastal protection benefits using a method developed by King et al. (2007) and the Southern Monterey Bay RSMP does not include information on the methods used to determine coastal protection services of beaches. The remainder of RSMPs focus on beach recreation only. Quantifying the role of beaches in coastal protection is critical to supporting integration of regional sediment management and climate adaptation planning and is recommended as best practice. It is a requirement if proponents are seeking funding from the Federal government for sediment management projects.

Table 6), with some plans including cost-benefit analyses and some plans not addressing this issue at all. The benefits of beach nourishment are often valued by quantifying beach visitation rates per width of beach and multiplying this by an estimate of the 'day value' of a beach visit, with wider beaches resulting in higher recreational value. Two of the plans discuss the coastal protection benefits of beach nourishment and include risk reduction in their cost benefit analysis.

Beaches also provide ecological benefits, such as habitat provision, nutrient cycling and water filtration. There are limitations to the extent to which these can be effectively incorporated into benefit cost assessments of beach replenishment, due to the absence of underlying biophysical information. Nevertheless, the focus on recreational benefits of beaches omits important factors that should be considered in a holistic benefit cost analysis.

2.2.6.2 Costs

The costs of beach nourishment depend on volume, frequency, and method of sand application as well as sand unit costs. These unit costs have multiple dimensions, and may include purchasing the sand from commercial suppliers. Unit costs are typically higher for small opportunistic projects. Mobilization costs for large dredging and nourishment costs may exceed one million dollars, before considering permitting and design costs, but the volumes moved may have a lower unit cost.

Importantly, cost benefit analysis included in the existing documents do not consider the potential cost advantages of using channel dredge bypassing. Bypassing would provide sediment to the downcurrent beach location, while also reducing the required frequency of navigational dredging. Beneficial reuse of the sand that is removed for navigational reasons also has a lower incremental cost than sourcing sand from elsewhere. It is therefore important to compare only the incremental costs of such ongoing programs with their potential benefits.

2.2.6.3 Benefit cost analyses

Best practices in the economic assessment of nourishment options are to quantify the ratio of the benefits and costs of a project, known as calculating the benefit cost ratio (BCR). The BCR can be compared across different sediment management options. Projects that have ratios higher than one are considered cost-effective, but higher ratios may be required depending on the source of funding. For example, the US Army Corps of Engineers (Corps) requires a BCR of above 2.5, while using a discount rate of 7% per annum.[1] This rate heavily discounts benefits in the far distant future, when the most severe climate change impacts are expected, so it can disadvantage nourishment projects. Such a discount rate may be appropriate for nourishment projects in which the added sand often stays for as short as a matter of months to years before

[1] https://www.congress.gov/crs-product/R44594

traveling down the littoral cell (Griggs, 2024). Analysis of fate of beach nourishment in San Diego revealed that sand stayed on the beach for about four years. Additional funding rules limit the full consideration of the recreational benefits of nourishment projects, as the Corps has a larger focus on mitigation of flood and erosion impacts. Without conducting studies of sufficient detail to establish costs and benefits to allow calculation of the BCR for the different alternatives, this case can't be made. Examples of sediment management strategies throughout the plans with BCRs higher than one include:

- Central San Francisco Bay: Nourishment at McNears, Baker Beach, Crown Beach, and Albany Bulb. B:C = 19.1, 1.1, 5.2, and 8.1, respectively
- San Diego Plan: sediment is dredged from offshore and delivered to the coast at a rate of approximately 500,000 cubic yards per year. B:C = 1.2.

Notably, the two plans that are least developed are from Eureka and Sonoma/Marin, which are in the northern part of the state where there are many remote beaches and less high-density beach tourism. As such, the lack of information on costs and benefits of beach nourishment may be due to the regional geography and patterns of development and recreational use, rather than an oversight of the plans themselves. Of the more developed (dark green) plans, the San Diego and Southern Monterey Bay RSMPs are the only two that include beach recreation and coastal protection services in their cost benefit analyses. The San Diego RSMP estimates coastal protection benefits using a method developed by King et al. (2007) and the Southern Monterey Bay RSMP does not include information on the methods used to determine coastal protection services of beaches. The remainder of RSMPs focus on beach recreation only. Quantifying the role of beaches in coastal protection is critical to supporting integration of regional sediment management and climate adaptation planning and is recommended as best practice. It is a requirement if proponents are seeking funding from the Federal government for sediment management projects.

Table 6 Summary of how the eleven RSMP's include economics of sediment management actions through quantification such as cost benefit analyses. Color indicates depth of consideration, with darker green signifying greater depth.

	Economics of beach nourishment and other sediment management actions		
More Developed	Santa Barbara	2009	The BEACON CRSMP does an extensive economic analysis of the present value of beach nourishment at all the beaches within the littoral cell, with benefit determined by beach usage and amenities at each beach. Similarly, the Southern Monterey Bay CRSMP does a comprehensive assessment of the value of beach nourishment, taking into account recreational benefits as well as coastal protection services provided by beach nourishment. The SANDAG CRSMP calculates benefit cost ratios for several different management/nourishment scenarios, with benefits also including recreation and coastal protection. Similarly, the SF Open Coast CRSMP calculated the net economic benefit of the various management alternatives by comparing recreational benefit and project cost, and the San Francisco Central Bay CRSMP calculates cost benefit ratios of beach nourishment at the most popular beaches in the region.
	Southern Monterey Bay	2009	
	San Diego County	2009	
	San Francisco Open Coast	2016	
	San Francisco Central Bay	2017	
	Orange County	2013	The Orange County CRSMP performs an estimate of the value of recreation at county beaches, but does not compare this to the costs of the suggested management approaches. Similarly, the SLO CRSMP estimates recreational value of the beaches but does not compare this to the costs of the CRSMP projects.
	San Luis Obispo	2017	
Less Developed	Santa Cruz	2015	The Santa Cruz CRSMP does not address the economic costs or benefits of beach nourishment and suggests such an analysis as a possible future study, though it does quantify beach usage throughout the region. Similarly, the LA County CRSMP presents beach use statistics and presents a rough estimate of the total value of all the beaches in the county and the economic loss of county-wide beach deterioration, but does not present any figures on value or project costs at any individual beach.
	Los Angeles County	2017	
	Eureka	2017	The Eureka CRSMP does not address costs or benefits associated with beach nourishment or any other recommended strategy. The Sonoma and Marin Plan does not address costs or benefits either and identifies this as a data gap.
	Sonoma and Marin	2018	

2.2.7 Funding sources and revenue raising potential

A wide variety of funding sources could be used to support CRSMP projects and efforts. All the plans mention the challenge of fundraising for CRSMP and most list possible funding sources. Many of them highlight the primary role that funding from the U.S. Army Corps of Engineers has historically played in funding navigational dredging, though it is noted that USACE primarily funds are "limited to projects where there is a federal interest" and typically require 30-50% local support. Importantly, in 2023 the USACE established a goal of increasing the use of beneficially reused sediment to 70% of dredge material by 2030, which will shift the playing field. If 70% of sediment is required to be directed to beneficial reuse, cost comparison of

disposal options will not be comparing against inexpensive offshore disposal, but rather against other beneficial uses of sediment. Thus, while innovation and creativity will be required to meet this goal, and this newly established priority may open new opportunities for beneficial reuse in California RSMP.

In Table 7, the darkest green section includes plans that identify numerous, varied, and specific funding sources. The next shade includes plans that make generalized suggestions about potential funding sources but do not present specific recommendations. The lightest green shade includes a plan that mentions funding challenges but does not present suggestions or recommendations.

Table 7 Summary of how the eleven RSMP's address funding sources for sediment management projects. Color indicates depth of consideration, with darker green signifying greater depth.

			Funding sources
More Developed	Southern Monterey Bay	2008	The BEACON CRSMP identifies several funding mechanisms to support sediment management activities. These include transient occupancy taxes, beach parking fees, and sales taxes, property taxes, snack bars, and mitigation fees. The Southern Monterey Bay CRSMP identifies numerous federal and state agencies that may be able to support sediment management strategies, as well as several local fundraising options. Similarly, the Santa Cruz CRSMP identifies the USACE, the USFWS, CA Department of Boating and Waterways, CA State Coastal Conservancy, and local funding sources. The Sonoma Marin CRSMP lists these same potential funding sources, in addition to the US EPA, the California Ocean Protection Council, regional sales taxes, parking fees, and development impact fees. The San Diego CRSMP identifies regional sales taxes, rental car fees, transient occupancy taxes, property tax assessments, parking fees, development impact fees and inland sediment transport offset funds as possible funding mechanisms. Similarly, the SLO CRSMP identifies transient occupancy taxes, property taxes, sales taxes, and geological hazard abatement districts. The plan quantifies the potential revenue and assesses feasibility for each. The San Francisco Open Coast Plan identifies the CA DBW, the USACE, geologic hazard abatement districts, transient occupancy taxes and sale taxes as possible funding sources.
	Santa Barbara	2009	
	San Diego County	2009	
	Santa Cruz	2015	
	San Francisco Open Coast	2016	
	San Luis Obispo	2017	
	Sonoma and Marin	2018	
Less Developed	Orange County	2013	The Orange County CRSMP makes some vague suggestions (e.g. "establish funding stream to accommodate incremental RSM costs") but does present specific options to establish such a funding stream. Similarly, the LA County CRSMP suggests "collaborating with state and federal authorities" to access funding for CRSM but does not elaborate. The Eureka CRSMP identifies the primary funding partner to be the USACE and discusses some of the opportunities and challenges related to USACE funding for navigational dredging, but does not make specific recommendations or suggest alternatives.
	Los Angeles County	2017	
	Eureka	2017	
	San Francisco Central Bay	2017	The Central SF Bay CRSMP mentions funding challenges throughout the report but does not put forward suggestions or recommendations for how to develop funding sources.

2.2.8 Staffing

The plans make a variety of suggestions on staffing needs for RSMP endeavors. Four plans recommend hiring at least one person: The LA County and Southern Monterey Bay plans each recommend establishing and hiring a single dedicated staff position to handle RSM projects, and The Sonoma Marin and the Orange County plans both recommend creating at least one staff position to implement the plan.

The other plans make more general suggestions. The Santa Cruz plan suggests creating one short-term staff position and subsequently one or more long-term RSM staff positions. The Central SF Bay plan implies that BCDC staff can take on RSM activities. The SLO plan suggests seeking funding to support staff to implement the plan but does not specify how many staff positions will be required. Similarly, the SF Open Coast Plan alludes to staffing needs but does not specify how many people will be required and if this means creating new staff positions, and the BEACON plan recommends hiring "staff" but does not say how many positions this will be. The Eureka and San Diego plans make no mention of specific staffing needs.

Across all these plans, the typical minimum staffing recommendation is one full-time person, with additional staff positions if funds permit. The plans vary on whether the RSM staff is a new position or a reallocation within an existing unit. Plan review alone is not enough to determine whether staff positions were ever created and filled. A retrospective analysis of advertisements and employment numbers is outside the scope of this review. RSM staffing in the BEACON region includes 1.5 full-time employees and consultants according to need. The qualifications of the staff needed for RSM projects tend to be scientists or engineers with a flood control and navigation background. These skills differ than the skills of staff heavily involved in adaptation planning, which tend to be more planning focused. Some cross training or capacity building may likely be required to bridge this gap

3 BEACON VULNERABILITY AND ADAPTATION PLAN REVIEW

BEACON provided access to an online data repository that included a tabulated internal review of vulnerability and climate adaptation plans completed in each of the BEACON municipalities, along with additional documents related to specific projects. These municipalities include Goleta, the City of Santa Barbara, Carpinteria, the City of Ventura, Oxnard, Port Hueneme, The County of Santa Barbara, and the County of Ventura. The documents included Local Land Use Plans, Sea Level Rise Vulnerability Assessments, Climate Adaptation Plans, Sustainability Plans, Corps and California Coastal Commission permits, among others, with lengths reaching up to more than 250 pages. Table 8 shows an overview of the count and range of years for these documents. Funding sources for development of these documents include the California Coastal Commission, the State Coastal Conservancy and local governments. More specific information on the documents included in this analysis can be found in Appendix A.

Table 8 Summary of the documents received from BEACON and reviewed for each jurisdiction

Jurisdiction	Number of documents	Range of years	Planning (GP, LUP, LCP)	Sediment management	Climate Adaptation	Climate Vulnerability	Climate mitigation
Goleta	13	2003 - 2023	0	9	1	2	1
City of Santa Barbara	28	1982 - 2022	6	3	8	7	4
Carpinteria	23	1996 - 2002	7	7	2	7	0
City of Ventura	4	2018 - 2022	0	0	2	1	1
Oxnard	5	1982 - 2016	2	1	1	1	0
Port Hueneme	6	2019 - 2021	4	1	0	1	0
County of Santa Barbara	15	2010 - 2023	1	6	2	3	4
County of Ventura	30	2009 - 2022	7	3	10	10	0

To review the range of documents, a customized Microsoft 365 Copilot Agent was tailored for vulnerability and climate document analysis. This involved designing custom prompt structures that aligned with the key objectives of the analysis. The agent was iteratively refined through prompt engineering to ensure it met the criteria for extracting relevant insights and summarizing key findings effectively, with special focus to financing and sediment management considerations. To optimize the agent's performance and improve the clarity of results, the workflow was structured into two distinct reporting phases, allowing the agent to process and generate outputs in more manageable sections. This segmentation ensured that the analysis remained coherent, accurate, and aligned with project goals. The search terms used in the AI analysis are listed below:

- Sediment management
- Debris flow
- Ebb
- Offshore
- Nourishment
- Dredge/Dredging
- Deposition
- Beneficial reuse
- Opportunistic
- Source
- Sand
- Coastal Act Section 30233(d)
- Cobbles
- Mud
- Fines
- Silt
- Debris
- Erosion
- Funding
- Financing
- Governance
- Flood control
- Levee
- Cost-benefit/benefit-cost
- BEACON
- Recreation
- Surf

Once the initial AI-generated reports were produced, human reviewers conducted a quality assurance review, assessing the output for relevance, accuracy, and completeness. Based on their feedback, the Copilot Agent was reconfigured, adjusting prompts and refining its analytical approach to enhance precision and alignment with expectations. With the optimized agent in place, the Copilot Agent was deployed across the entire document set, ensuring that all materials were processed consistently and efficiently, delivering a final set of structured reports that met the project's assessing funding, governance, and use of coastal sediment in regional climate documents. Human reviewers then utilized the AI-generated summaries to assess the way the documents addressed the RSMP themes defined in Section 2.1.

The agent-led analysis provides an assessment that is limited both by the selection of source documentation (focused on documents provided by BEACON, and located from municipal and CSMW databases), and by the date of completion of the documents. For example, RSMPs that were developed later in the process reflect changes in understanding and policy direction that were not possible to incorporate into the earlier RSMP documents. Summaries in this section should not be interpreted as a reflection of the full range of sediment management and climate resilience actions of any of the named municipalities, but as a review of the available policy and planning documents, up to the latest date of the reviewed publications.

High level findings from this analysis indicate that some jurisdictions within the BEACON region have sediment management more effectively integrated into their coastal climate planning documents than others. For example, the City of Santa Barbara and Ventura County had the most relevant documents (of those provided by BEACON) and also included sediment management considerations in a relatively comprehensive manner. While some jurisdictions have more coverage of RSMP themes in their coastal climate documents than others, none of them fully address all themes identified.

Additionally, this process revealed that sediment is consistently identified and utilized as a tool across the BEACON region to adapt to climate change, but the logistical framework to implement such projects, including financing, cost benefit analyses, governance, grain size, and sediment sources are, is variable and largely localized in individual jurisdictions (Figure 8). This is a similar finding to that in the RSMP reviews. These themes are all discussed more in depth in the following pages.

The main limitation of this analysis is that the documents included were limited to those provided by BEACON, which spanned up to 2023, and may not be fully reflective of all climate-related actions either during the period of coverage, or in subsequent years. Climate documents created after 2023 by any of the jurisdictions were not included. Thus, gaps identified in this report may be filled by work done between 2023 and 2025 in the BEACON jurisdictions. Additionally, the documents provided by BEACON were sorted into jurisdictional folders upon their delivery. Integral did not move or modify the jurisdictional assignment of any

of these documents and the following findings assume that the jurisdictional sorting done by BEACON was accurate.

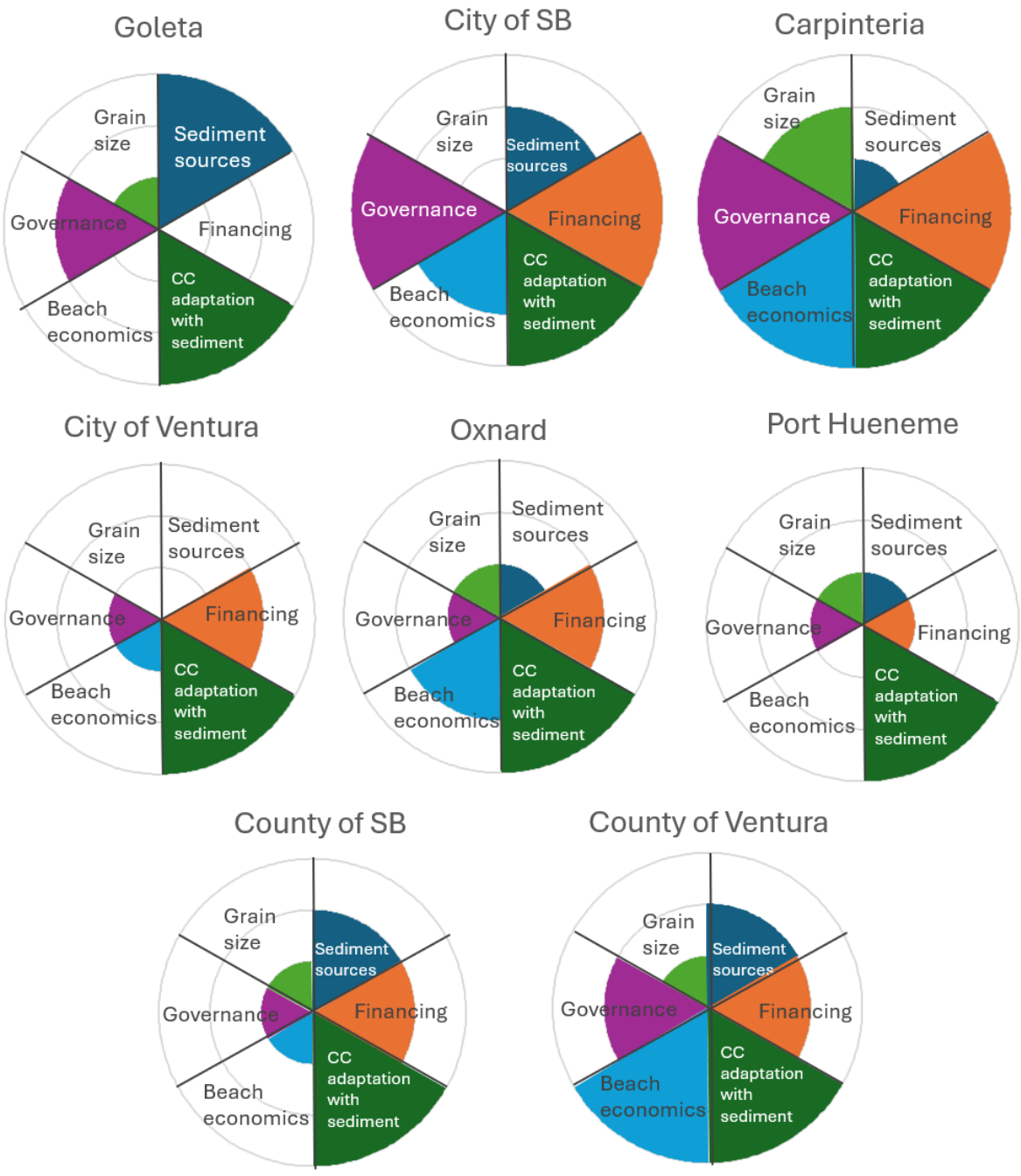


Figure 8 Summary of representation of regional sediment management themes across the climate vulnerability and adaptation assessment documents from the BEACON region

3.1 GOVERNANCE OF SEDIMENT MANAGEMENT

Table 9 The references to governance of sediment management in the BEACON region climate documents

Jurisdiction	Governance structure
City of SB	1. BEACON mentioned as the central organization managing the beach enhancement program. 2. BEACON mentioned as a collaborating agency. 3. BEACON mentioned as a regional collaborative entity for shoreline management . 4. Explicitly mentioned in reference to the Coastal Sand Management Plan. 5. Mentions BEACON as a Joint Powers Agency used to implement sediment management and discusses regional consensus-driven sediment management policy and guidance. 6. Mentions BEACON as a Joint Powers Agency involved in coastal erosion management. 7. Governance mentioned in the context of updating the Coastal Regional Sediment Management Plan. 8. Mentions of BEACON updating the Coastal Regional Sediment Management Plan.
Carpinteria	1. Mentions of BEACON throughout and discussion of regional sediment management and coastal governance. 2. Mentions BEACON relating to projects and programs addressing coastal hazards. 3. Mentions of BEACON regarding beach nourishment planning. 4. Mentions of BEACON's role and jurisdiction in addressing coastal erosion and beach nourishment. 5. Mention of BEACON regarding regional management of beach sediment. 6. Mentions coordination with BEACON to protect City resources from coastal hazards. 7. Explicit mentions of BEACON.
County of Ventura	1. BEACON extensively referenced throughout. 2. BEACON mentioned in the context of regional shore protection. 3. BEACON mentioned as a Joint Powers Authority. 4. BEACON mentioned as a Joint Powers Agency.
Goleta	1. BEACON is the primary entity in the document which describes BEACON's beach nourishment demonstration project at Goleta Beach. 2. BEACON mentioned in the context of the program to place beach replenishment material at multiple sites including Goleta Beach County Park. 3. BEACON is mentioned as part of the governance structure dealing with coastal management issues. 4. BEACON mentioned in the context of implementation of sediment management. 5. BEACON mentioned as a joint powers authority whose members consist of the local government agencies in Santa Barbara and Ventura Counties', including mentions of previous BEACON permits for beach nourishment.
Oxnard	1. BEACON mentioned as one of the entities with whom the City should coordinate adaptation planning at a regional level under the proposed "Community Scale Adaptation Planning" policies.
City of Ventura	1. Explicitly mentioned as "Beach Erosion Authority for Clean Oceans and Nourishment" partnering with the City to apply for grants and manage the Surfer's Point Managed Retreat Project.

More Developed

Less Developed

Port Hueneme	1. Governance mentioned as "The City shall work with expert agencies (e.g., United Water Conservation District, Fox Canyon Ground Water Management Agency, the Ventura County Watershed Protection District, and/or BEACON)".
County of SB	1. The need for unified governance mentioned

The documents from the City of Santa Barbara and Carpinteria mention the BEACON JPA extensively in the context of project and programs for sediment management. The county of Ventura and Goleta documents have several mentions of the sediment governance. Oxnard, the City of Ventura, and Port Hueneme each have only mention of governance frameworks for sediment management. The County of Santa Barbara does not touch on this topic across the documents. Overall, the explicit representation of governance of sediment is variable across the reviewed climate documents, and particularly weak in the County of Santa Barbara and the southern cities within the region.

3.2 SEDIMENT SOURCES

The sediment sources identified as climate adaptation resources across all the provided climate adaptation documents are listed below (Table 10). While Goleta has fewer documents than other jurisdictions in the region (n = 13, Table 8), a wide range of sediment sources were listed across those documents (n = 7). These sources included sediments from within the city limits (e.g. flood control channels and creeks in the Goleta Slough) as well as sediment from other municipalities (e.g. dredged sand from the Santa Barbara Harbor). Using sediment on Goleta Beach was mentioned many times throughout these documents due to past placement of debris flow sediment on Goleta Beach after the Thomas Fire and mudslides of 2018.

The City of Santa Barbara and the counties of Santa Barbara and Ventura also listed a variety of sediment sources, including sediment from debris basins, creeks, harbor dredge, construction, and the Matilija Dam. The City of Santa Barbara mentions sediment from creeks in Goleta Slough, but other than that these plans all focus on sediment within their own jurisdiction. Finally, Carpinteria, Oxnard and Port Hueneme plans all list only one sediment source, each within their jurisdictional boundaries. The City of Ventura plans do not identify sediment as a climate adaptation resource.

Table 10 The sediment sources included as climate adaptation resources in the BEACON region climate documents

	Jurisdiction	Sediment Sources
More Developed	Goleta	1. Beneficial reuse of sediment from debris basins for beach nourishment 2. Sediment from creeks is removed and beneficially reused for beach nourishment at Goleta Beach 3. Beneficial reuse of dredged sand from Santa Barbara Harbor for beach nourishment at Goleta Beach 4. Offshore dredging and beach nourishment components while attempting to maintain natural sediment flow patterns through a permeable design 5. Beneficially reusing suitable sediment removed from flood control channels for beach nourishment 6. Beneficially reusing dredged material from flood control activities for beach nourishment at Goleta Beach 7. Reusing debris flow sediments for beach nourishment
	City of SB	1. Beneficial reuse of harbor dredge material for beach nourishment 2. Sedimentation in the Goleta Slough from Carneros and Tecolotito Creeks 3. Sediment basins and removal programs but does not specifically address beneficial re-use opportunities. 4. Using surplus sand from upland construction projects to replenish six designated beaches along the South Central Coast
	County of SB	1. Beneficial re-use of sediment dredged from upstream debris basins 2. Beneficial reuse of dredged sediments in marsh restoration and beach nourishment projects, demonstrating cost-effectiveness and ecological benefits. 3. Use of dredged sediments for beach nourishment 4. Increased sediment fluxes from watersheds due to more intense storms and wildfire
Less Developed	County of Ventura	1. Beneficial reuse of sand dredged from Channel Islands Harbor 2. Debris basins 3. Matilija Dam sediment 4. Sediment yield of Calleguas Creek
	Carpinteria	1. Debris basins in the Carpinteria Valley
	Oxnard	1. Sand that accumulates in the Channel Islands Harbor sand traps
	Port Hueneme	1. Port Hueneme sediments which are physically compatible with Hueneme Beach for nourishment
	City of Ventura	1. Sand removal at Pierpont Beach

This comparison illustrates that, based on the materials reviewed, some are more actively considering a broad range of sediment types to adapt to climate change than others, and some agencies are considering sediment as a regional resource more than others. As identified in the BEACON RSMP, sediment is a valuable shared resource, and integrating regional management of sediment into future climate planning documents will be essential. The history of events in the region likely influenced the trends shown in Table 10, given that Goleta Beach and Carpinteria were regional receiver sites of Thomas Fire sediment from the debris flows. This is discussed more in Section 5.2.

3.3 SEDIMENT OF ALL SIZES

Five of the eight jurisdictions mention non-sand sediment sizes as a climate adaptation resource in their planning documents (Table 11). Carpinteria, Goleta, and the two counties each consider cobbles to be a climate adaptation resource, and Port Hueneme mentions silty sands. These plans mention coarse cobble materials as useful for maintaining beaches, reducing erosion and incorporated into living shorelines. However, debris basins are identified as "starving" beaches of coarse sediments in the Carpinteria documents. Cobbles which were once present in Carpinteria have been largely eliminated by seasonal construction of the storm berms changing the natural cobble sorting and transport.

The example of a cross-shore cobble delta created by debris flow sediments impounded sand, recreating a recreational beach, is identified as a potentially successful temporary shoreline protection method (See Section 5.2). Thus, these plans identify the components of regional sediment management – the coarse sediment is trapped in debris basins, and the plans identify it as useful for shoreline projects. However, actionable plans to get coarse sediment from debris basins to the coast are not presented. The absence of this linkage is a key limitation of both planning processes and hinders implementation. Notably, while this approach is absent from the reports, it did happen in Santa Barbara and Ventura counties, using BEACON designated beaches to determine receive sites. This highlights that the documents analyzed to not necessarily capture the entire history of sediment management in the BEACON region.

Table 11 The mentions of sediment of all sizes as a resource in the BEACON region climate documents

	Jurisdiction	Grain size
More Developed	Carpinteria	1. Beach nourishment using sand and cobbles to create living shorelines 2. Sediment debris basins contain coarse materials, which are essential for storm buffering on beaches 3. Need for large grain sediments, cobbles, mud
	Goleta	1. Touched on in context of debris placed on Goleta beach
	Port Hueneme	1. Sediment types such as silty sands and their compatibility with beach materials
Less Developed	County of SB	1. The cobble berm at Goleta Beach Park, formed by flood control debris as a successful, low-cost alternative to traditional shoreline protection methods
	County of Ventura	1. The beneficial reuse of cobbles and other coarse sediment materials as a component of a comprehensive sediment management strategy
	Oxnard	1. Touched on in context of placement of silt and sand mixture from dredging operations
	City of SB	n/a – sand is the only focus
	City of Ventura	n/a – grain sizes not discussed

3.4 ECONOMICS OF BEACH NOURISHMENT

The County of Ventura and Carpinteria each have extensive discussions of cost-benefit analyses of coastal adaptation options, as well as discussion of beach valuations, including recreational value of the beach, and for Ventura County, recreational value of surfing (Figure 9 Data on economic and tax revenue impacts from spending associated with beach recreation. The total estimated spending on beach recreation is just below $113 million annually, generating $916,800 in sales taxes for County and City governments and agencies, and $2.3 million in transient occupancy taxes. From the Ventura County Resilient Coastal Adaptation Project Sea Level Rise Vulnerability Assessment.[2] The City of Santa Barbara and Oxnard also have numerous mentions across documents of cost benefit analyses and the recreational value of the coast. The two counties both have scant discussion about the economic value of beaches. Goleta and Port Hueneme do not include these concepts at all.

Site	Yearly Attendance	Source	% surfers	Value of Surfing	Total Recreational Value
North Coast	1,170,000		38%	$46,352,800	$64,628,000
Rincon	350,000	BEACON	75%	$17,062,500	$20,562,500
La Conchita	40,000	BEACON	25%	$650,000	$1,850,000
Mussel Shoals	10,000	BEACON	90%	$585,000	$625,000
Hobson	90,000	Interviews	76%	$4,446,000	$5,310,000
Rincon Parkway North	100,000	BEACON	30%	$1,937,000	$4,745,000
Faria County	100,000	Interviews	46%	$3,003,000	$5,155,000
Rincon Parkway South	30,000	BEACON	55%	$1,072,500	$1,612,500
Mondos	210,000	BEACON	80%	$10,920,000	$12,600,000
Emma Wood	240,000	CA State Parks	43%	$6,676,800	$12,168,000
Central Coast	1,410,000		46%	$36,510,500	$70,442,500
C Street	400,000	BEACON	97%	$25,116,000	$25,660,000
San Buenaventura	500,000	CA State Parks	4%	$1,300,000	$20,500,000
Oxnard Shores	50,000	BEACON	15%	$487,500	$2,187,500
Silverstrand	410,000	BEACON	33%	$8,794,500	$19,782,500
Port Hueneme	50,000	BEACON	25%	$812,500	$2,312,500
South Coast	470,000		16%	$6,110,000	$21,150,000
Point Mugu	470,000	CA State Parks	20%	$6,110,000	$21,150,000
County Total	3,050,000		100%	$88,973,300	$156,220,500

Figure 9 Data on economic and tax revenue impacts from spending associated with beach recreation. The total estimated spending on beach recreation is just below $113 million annually, generating $916,800 in sales taxes for County and City governments and agencies, and $2.3 million in transient occupancy taxes. From the Ventura County Resilient Coastal Adaptation Project Sea Level Rise Vulnerability Assessment.

[2] Ventura County Resilient Coastal Adaptation Project Sea Level Rise Vulnerability Assessment. 2019

Table 12 The mentions of economics of beach nourishment as a resource in the BEACON region climate documents

	Jurisdiction	Economics (how to keep beaches)
More Developed	Carpinteria	1. Implicit mentions of cost benefit analysis related to economic evaluation and avoided costs to protect property through beach nourishment. 2. Explicit mention and implicit discussions of cost benefit analysis throughout involving economic impacts and adaptation strategies. 3. Explicit mention of cost benefit analysis in context of evaluating adaptation strategies (page ES-10). 4. Explicit mentions of cost benefit analysis throughout and implicit discussions throughout when evaluating adaptation strategies, also identifying recreation as a key public trust use vulnerable to sea level rise 5. Explicit mentions regarding the importance of considering cost-benefit when implementing mitigation actions. 6. Explicit mentions of funding and costs and comparison of project costs to potential damage 8. Explicit mention regarding sediment management practices evaluating beneficial reuse options based on cost-benefit analyses with explicit mentions throughout in context of recreational amenities, opportunities, value, tourism, and activities, referencing surf breaks as vulnerable resources.
	County of Ventura	1. Economic benefit analysis for beach nourishment projects discussed with extensive discussion of recreational value of beaches. 2. Recreation mentioned as a key aspect of coastal value and project benefits. 3. Mention of "benefit/cost analysis" with recreation extensively discussed, including economic benefits of beach recreation and surfing mentioned as a higher-value recreational activity, with detailed economic valuation. 4. Benefit cost analysis mentioned throughout . Recreation value mentioned and surfing is noted as contributing to the non-market benefits of beaches. 5. Cost benefit analysis mentioned a method for prioritizing mitigation actions. 6. Cost benefit analysis mentioned through discussion of 'fiscal impacts' and used to quantify losses/values and estimate/compare adaptation costs. 7. Cost benefit analysis mentioned as prior work informing the vision and as a recommended next step: 'Economic assessment', 'Evaluate fiscal impacts', 'Economic Analysis'.
Less Developed	City of SB	1. Cost benefit analysis explicitly mentioned as the core methodological framework of the entire document with beach recreation explicitly mentioned as an important value and specifically analyzed as a "non-market impact" 2. Cost benefit analysis explicitly mentioned in multiple sections with detailed analysis of costs and benefits of adaptation strategies 3. Includes a Benefit-Cost Analysis estimating economic impacts and the cost-effectiveness of adaptation strategies 4. Recreation is listed as a benefit of the Surfers Point Managed Shoreline Retreat Project and is implicitly one of the core goals of the projects (see page 4 regarding coastal access). 5. Recreation explicitly mentioned as valuable activities potentially impacted by beach narrowing with economic consequences 6. Recreation explicitly mentioned as an economic benefit of maintained beaches

Oxnard	1. Recreation mentioned throughout as a key public value and use of the coast protected under public trust doctrine and California Coastal Act 2. "Recreational value in the form of beach attendance" is mentioned as a factor included in the net benefits calculation. Also implicitly referenced through discussions of beaches, coastal access, harbors, etc. 3. Mentioned "beach recreation" as a key benefit whose value is considered in the cost-benefit analysis. Also implicit in discussions of beach access and attendance. 4. Cost/Benefit Analysis is mentioned as the title for the analysis evaluating adaptation strategies, detailing what net benefits include and exclude. Also implicitly referenced through net benefits/costs discussions for various adaptation strategies. 5. Cost-benefit analysis described as the method used to compare different sea level rise adaptation strategies by evaluating economic trade-offs.
City of Ventura	1. Recreation explicitly mentioned throughout as a key economic and cultural activity along Ventura's coastline, including recreational boating, surfing, park visits, fishing, and paddleboarding 2. Recreation explicitly mentioned as a significant economic activity; "Beaches, museums, the harbor, the neighboring Channel Islands, and downtown areas attract over a million visitors annually"
County of SB	1. States that "The County will qualitatively evaluate the costs and benefits of potential adaptation strategies"
Goleta	n/a – not explicitly discussed in the context of coastal climate adaptation, though mentioned explicitly in the context of emissions reductions
Port Hueneme	n/a – not mentioned in any context

3.5 FUNDING SOURCES

The City of Santa Barbara and Carpinteria identify a wide range of potential funding sources for climate adaptation activities (>8), the County of Ventura and City and Oxnard each identify several (2-4), and Port Hueneme only identifies the Army Corps of Engineers as a possible funder (Table 13). Funding options do not appear in the documents from Goleta or the County of Santa Barbara. Importantly, this exercise identifies some fundings sources that did not emerge from the RSMP analysis: public-private partnerships and a Harbor Preservation Fund.

Table 14 contains the funding opportunities identified across the RSMPs and the climate documents. These mechanisms span across several categories: federal funding, state funding, and taxes and fees. While federal and state funding could pay for RSMP activities, these options either rely on legislation or one time grant funding, which may not be a reliable source of future funding. Utilizing fees or taxes to fund RSMP activities would be a more flexible and sustainable alternative, providing new continuous funding streams.

Notably absent from this list is the USACE Harbor Navigational Trust Fund, which is created by a Harbor Maintenance Tax charged against the value of imports and domestic cargo arriving at U.S. Ports that have federally-maintained harbors and channels. This tax is deposited into the trust fund, which is then used to fund maintenance dredging, dredge disposal areas, and construction of jetties and breakwaters.

Table 13 The mentions of funding sources for coastal climate adaptation in the BEACON region climate documents

	Jurisdiction	Financing
More Developed	City of SB	1. Local agency contributions 2. Developer participation/development impact fees 3. Grants to fund opportunistic beach fill projects 4. Opportunistic funding 5. Integration into existing budgets 6. Current revenue 7. State loans 8. Federal funding 9. Bond financing 10. Harbor Preservation Fund 11. Grants from the California Coastal Commission and the Coastal Conservancy 12. Public-private partnerships 12. Local contributions
	Carpinteria	1. state and federal grants 2. Local assessments 3. Cost-sharing arrangements 4. Development impact fees 5. Federal, state, and local funding sources for infrastructure improvements 6. Legislature's initial funding for AB 691 assessments 7. Local assessments 8. Potential mitigation fees
Less Developed	County of Ventura	1. Transient Occupancy Taxes (TOT) 2. Parking fees 3. Sales taxes 4. Potential mitigation fees.
	Oxnard	1. Grant funding from the State 2. Mitigation fees for seawall projects
	City of Ventura	1. Grants 2. Leveraging city budgets to fund strategic projects
	County of SB	1. Cap and trade funding 2. Proposition 68 funding
	Port Hueneme	1. Army Corps of Engineers
	Goleta	n/a - Funding for climate mitigation efforts is discussed but not for climate adaptation or sediment management

Table 14 Funding sources identified across the RSMs and climate documents

Funding opportunities identified in RSMPs and Climate Docs	Background and examples
Federal Funding Agencies	

U.S. Army Corps of Engineers	**Continuing Authorities Program (CAP)**: allows USACE to study and construct projects without additional authorization from Congress. Project costs are generally capped at $5–10M federal expenditure **General Investigation (GI) Study**: USACE conducts a feasibility study that may recommend a larger project for authorization (i.e., a project costing more than CAP program funding limits)
The U.S. Fish and Wildlife Service	**Cooperative Conservation Initiative:** provides funding for projects that restore natural resources and establish or expand wildlife habitat. A 50% match is required of the project sponsor **Cooperative Endangered Species Conservation Fund**: provides funding for implementation of conservation projects or acquisition of habitat that will benefit federally listed threatened or endangered species. The required match by the local sponsor for this program is 25% of estimated project cost (in-kind contributions are accepted).
NOAA Marine Sanctuaries	**Settlement funds** are occasionally received for violations involving disturbance of the seabed. These funds must be used to protect and restore Sanctuary habitats, and could potentially be used for evaluation, planning and implementation of projects related to retention of beach habitat.
U.S. EPA	**Wetland Program Development Grants:** provide eligible applicants an opportunity to conduct projects that promote the coordination and acceleration of research, investigations, experiments, training, demonstrations, surveys and studies relating to the causes, effects, extent, prevention, reduction and elimination of water pollution. WPDGs assist state, tribal, local government agencies and interstate/intertribal entities in building programs to protect, manage and restore wetlands. Such funding could be utilized to implement sediment management activities.
State Funding Agencies	
California Department of Boating and Waterways (now CA State Parks)	**Public Beach Restoration Program (PBRP)**: Provides the funding vehicle for the legislature to support restoration, enhancement, and maintenance of California beaches (CDBW and SCC, 2002). In many cases, state money has been used to leverage federal Corps funding. **Beach Erosion Control Program**: focuses more on structural solutions such as groins or breakwaters, but the newer PBR focuses more on restoration projects such as beach nourishment. The PBR program can fund beach restoration and nourishment projects, or feasibility or research studies.
California Coastal Commission	**Coastal Development Permit (CDP) process:** establishes special conditions on individual permits requiring mitigation fees. For example, The Coastal Commission and SANDAG entered into a cooperative agreement through which a Public Recreation Beach Impact Mitigation Fund was established to make money available for projects that enhance public recreational access. The fund consists of fees collected by the Coastal Commission as mitigation for the adverse impacts on public recreational use of the region's beaches, used to implement projects that provide public recreational improvements, including but not limited to public beach access, bluff top access, viewing areas, public restrooms, public beach parking, and public trail amenities.
California Coastal Conservancy	Funding from SCC grants ranges from $10,000 to several million dollars depending upon fund availability and the "need, significance, and urgency of the project." Potentially relevant funding programs include**: Urban Waterfronts, Wetlands, Site Reservation, Resource Enhancement, and Case Studies**. Another potential source of future funding for CRSMP implementation is fees collected by the CCC through the **Coastal Development Permit process**. For example, in the San Diego region the CCC and SANDAG entered into a cooperative agreement by which a **Public Recreation Beach Impact Mitigation Fund (seawall fees)** was developed to make money available for projects that enhance public recreation access. Availability of SCC grant money depends entirely on the availability of funds (i.e. recent bond measures).

California Ocean Protection Council	The Ocean Protection Council (OPC) is another state agency that may provide funding for RSM projects, primarily for planning and feasibility studies. The OPC ensures that California maintains healthy, resilient, and productive ocean and coastal ecosystems for the benefit of current and future generations. The OPC is committed to basing its decisions and actions on the best available science, and to promoting the use of science among all entities involved in the management of ocean resources. Similar to SCC, OPC funding is related to bond initiatives and proposals must align with the strategic plan of the agency.
Taxes and Fees	
Sales taxes	One proposal, considered for San Diego County by SANDAG several years ago, was a 0.25 percent **quality of life increase in the sales tax rate**. State law allows such funds to be used for a variety of projects to improve the quality of life in a region and could be used to support beach restoration.
Transient occupancy taxes (levied on short term rentals , e.g. hotels, Airbnb's)	City of Solana Beach recently increased its transient occupancy tax to 13%. The City used some of the proceeds from this increase to create a fund to finance beach restoration.
Property taxes/ad valorem taxes	These are taxes levied on the price of a good or service that are equal to a certain percentage of the price. These taxes are typically assessed on real estate such as with Real Estate Transfer taxes when a property exchanges hands. Ad Valorem taxes are commonly used in the State of Florida.
Real estate transfer tax	Orange County currently levies a property transfer tax (similar to Florida's real estate transfer tax) of $1.10 per $1000 on all sales of private property in the county. Of the tax revenue, 50 3.73 Everest International Consultants, Inc. Orange County Coastal Regional Sediment Management Plan percent goes to cities (e.g., San Clemente). This money is dedicated to general fund revenues. This rate is consistent with the vast majority of cities/counties in the state though a few cities in Alameda County such as Berkeley ($16.10), Oakland ($16.10) and Piedmont ($14.10) charge significantly higher rates. Although raising the property transfer tax and dedicating some or all of this is possible, it is likely to be less politically feasible than other solutions.
Tax levied on sporting goods	In 1993, the Texas State Legislature passed a bill for the revenue source for state and local parks to a draw from the g**eneral sales tax attributable to sporting goods**. Park funding comes from a portion of Texas general sales tax revenue that is 'attributed' to sporting goods.
Mello Roos (special districts established by local governments in California as a means of obtaining additional public funding)	**Bond proceeds in Mello-Roos Districts** are for the purpose of "public land improvements." Because it takes a 2/3-majority vote of residents within a given boundary to establish a Mello-Roos District in an existing territory, it is unlikely that a significant percentage of coastal communities are Mello-Roos Districts. It is necessary to further investigate the environmentally fragile coastal zones that may qualify for Mello-Roos funding to determine if they fall within a Mello-Roos District.
User fees	**Beach parking fees** are sometimes discouraged, particularly by the California Coastal Commission. Since day trippers spend much less than overnight visitors and much of this spending takes place out of town (e.g., on gas or food), they generate very little tax revenues for local communities. To limit revenue collection to "free riders" who come from out of town as well as to increase the political viability of such a move, parking fees could be limited to non-residents by giving residents decals. This can include parking or beach-use fees, which are often levied on visitors, but not required of local residents. Many communities charge for parking in beach areas.
Rental car fees	A daily fee on rental cars in a county follows a similar philosophy to TOTs, which raise funds by leveraging fees or taxes on visitors.
Development impact fees	Development Impact Fees on residential, commercial, and industrial development could be considered to help fund regional sediment management needs. Studies could be prepared to demonstrate the impact new development has on sediment transport through coastal watersheds to the beaches in order to determine an appropriate cost sharing distribution.
Sediment impoundment fees	Water districts or other agencies are charged a small **sand mitigation fee** for disrupting sediment flow in a watershed by, e.g., dams and flood control structures

Hazard mitigation fees and hazard abatement districts, or cost sharing among beneficiaries	In 1996 a group of homeowners in Capitola whose property fronted the cliff decided to form a Homeowners' Association, which could use **membership dues** to fund hazard mitigation efforts that benefit participants. From this group of residents, a proposal was presented to the Capitola City Council to form a Geological Hazard Abatement District (GHAD).
Special assessments for high risk properties	Private property at high-risk of erosion damage would be required to pay a special fee that would not be required of other properties that are not at risk and proportionally higher than those that are at moderate or low risk. In Florida, for example, the state assesses a **tax based upon the distance of the structure from the beach**.
Fees on leases of public beaches	A number of beaches in California have snack bars or restaurants which are owned by the city or leased to a private company. **Fees on lessees** could fund sediment management. For example. the City of San Clemente collects several hundred thousand dollars a year from rentals on its pier restaurants.
Inland sediment transport offset funds	A **fund could be set up to cover incremental costs associated with implementation of the opportunistic sand programs** (e.g. the additional cost of transporting sediment to an appropriate receiver or storage site, as opposed to using it for other purposes such as fill or aggregate). The matching fund could take many forms. The matching fund could utilize existing or new funding sources, including use of any of the funding sources listed above, or an entirely new and separate funding source for regional sediment management. The coastal cities could impose a supplemental fee for the issuance of grading permits within their jurisdiction. If set aggressively enough (i.e., high fee) then this fee could be used as an incentive for project sediment suppliers to place suitable inland sediment on local beaches by making it more expensive to do otherwise.
Public private partnerships	A Public-Private Partnership (PPP), also known as a P3, is a long-term collaboration between a government and a private sector entity to deliver a project or service, often involving private funding and revenue generation. PPPs are often used for large-scale infrastructure projects like roads, bridges, hospitals, and public transportation, but can also be used for other services. The private sector typically finances the project upfront, and then recovers its investment through fees charged to users or taxpayers over the life of the contract.

Historically, a number of west coast ports have been 'donor' ports, generating more in HMTF revenue than they require in expenditure on dredging, particularly the Port of Los Angeles and Port of Long Beach. The federal Water Resources Development Act of 2020 would have returned some of the 'donor' funds to be used by the donor ports.

Whilst beneficial reuse by the Corps is permitted, and more recently, encouraged, the incremental costs associated with that reuse verses open water disposal are borne by the non-federal sponsor of a nourishment project. This limits the capacity for use of one of the most obvious sources of sediment.

3.6 INCLUSION OF SEDIMENT MANAGEMENT CONSIDERATIONS IN CLIMATE ADAPTATION MEASURES

All of the BEACON region jurisdiction climate documents provide a variety of ways to use sediment to adapt to climate change and sea level rise (Table 15). Each jurisdiction had several sediment management considerations spread across their climate documents, from beneficial reuse of dredge sediments to habitat restoration and support, to opportunistic use of sediment from debris basins.

Table 15 Summary of the ways sediment management is considered in the climate documents of the BEACON region.

Jurisdiction	Sediment as climate adaptation
Carpinteria	1. beach nourishment using sand and cobbles to create living shorelines 2. redirecting sediment currently exported from the watershed to replenish beaches 3. potentially modifying debris basin cleanout practices and using mud placement in the Carpinteria Salt Marsh to increase sediment discharge
Goleta	1. emergency sediment removal and beach disposal activities following debris flows. It emphasizes the beneficial reuse of sediment for beach nourishment. 2. annual desilting program and beach nourishment at Goleta Beach, highlighting sediment testing and monitoring to ensure suitability for beach placement and performance. 3. regional sediment management through the reuse of sediment from debris basins for beach nourishment. It emphasizes the need for strategic sediment placement and ongoing management. 4. sediment management placement activities, including desilting operations and beach nourishment, and their impacts on local ecosystems
Oxnard	1. beach nourishment as a "soft armoring" adaptation strategy beneficial for both storm protection and recreation 2. maintaining the natural littoral transport system interrupted by harbor construction: sand that accumulates in the Channel Islands Harbor sand traps is dredged and placed downcoast at Hueneme and Silver Strand Beaches
Port Hueneme	1. reuse of harbor dredged material for beach nourishment, separating suitable material for beach nourishment from unsuitable material that requires contained disposal. 2. sediment types such as silty sands and their compatibility with beach materials and the placement of suitable dredged material onshore or nearshore to nourish beaches, while unsuitable sediments are disposed of at a designated site.
City of SB	1. the importance of dredging for maintaining the harbor and replenishing downcoast beaches. It mentions the use of dredged spoils for beach replenishment and the need for monitoring shoreline processes to manage sand budgets effectively. The City is responsible for harbor dredging, with federal funds authorized for this purpose. 2. This report details the sediment composition, primarily sand, found to be uncontaminated and suitable for beach nourishment. The sediment is managed by the Army Corps of Engineers, with environmental commitments to minimize impacts. 3. Discusses sediment augmentation projects using dredged material to restore marshes, with sediment sourced from nearby dredging projects. The responsibility lies with multiple agencies, including USGS and local authorities. 4. It mentions the management of sediment by dredging and placement as part of the city's efforts to manage erosion and flooding impacts. The responsibility for sediment management is implied to be part of the city's adaptation planning efforts. 5. The report details sediment management activities, including dredging and beach nourishment. It discusses the types of sediment used, such as clean and suitable grain size, and the responsibility of the city to ensure compliance with environmental standards. 6. sediment types, such as sandy sediment, and the management of dredged materials. It highlights the responsibility of the Corps in monitoring and ensuring the suitability of sediment for beach nourishment. 7. details on sediment types, such as fine sand, and the management of dredged materials for beach replenishment. It outlines the responsibility of the Corps in ensuring sediment compatibility and environmental compliance.

City of Ventura	1. managed Retreat Strategy for Surfers Point/Promenade with multiple phases and seeking grant funding 2. need for sediment augmentation and the management of sediment flow to support coastal dune habitats in adapting to sea level rise. 3. removal and relocation of nuisance windblown sand at Pierpont Beach, managed by the Public Works department. The city explores opportunities to relocate removed sand to other sections of City and State Park beaches prone to sand loss.
County of SB	1. maintenance dredging of Santa Barbara Harbor and beneficial reuse of the dredged material to be placed on East Beach, either on the beach itself, within the surf zone, or in the nearshore area. 2. sediment augmentation projects, including the sourcing and application of sediment for habitat restoration, and the challenges associated with sediment composition and distribution. 3. dredging program for Santa Barbara Harbor, detailing the removal and placement of sediment to maintain navigation channels 4. flood control operations
County of Ventura	1. beneficial reuse of dredged materials for marsh restoration and beach nourishment. The projects illustrate the importance of understanding sediment sources, grain size, and transport dynamics. They demonstrate how aligning regional dredging projects with restoration needs can lead to efficient and cost-effective solutions, reducing the need for disposal and mitigating negative impacts on the environment. Successful projects also point out the value of coordinating various permits and agencies. 2. need for sediment (sand and cobbles) to mitigate erosion and restore dunes to protect existing infrastructure 3. The Ventura Harbor dredging highlights the ongoing need for sediment management and a commitment to balancing navigation with environmental protection. Beneficial re-use of dredged material is a key aspect of the plan, with suitable material slated for beach replenishment. The project incorporates mitigation measures to minimize potential environmental impacts, including pre- and post-dredging surveys for invasive species and sensitive habitats. The success of beneficial re-use depends on careful monitoring and management to ensure material suitability and to avoid unintended consequences. The project emphasizes a collaborative approach, engaging various agencies and stakeholders in the permitting process. The multi-year schedule and phased approach allow for monitoring and adaptive management. 4. The potential for beneficial reuse of dredged material is mentioned in the context of beach nourishment and coastal restoration projects. Several jurisdictions highlight opportunities for integration with existing sediment management plans and ongoing projects (like the Ormond Beach Restoration and Access Plan), which demonstrates an understanding of the interconnectedness of sediment management and hazard mitigation. The importance of maintaining natural systems and considering green infrastructure as mitigation strategies is evident throughout.

4 SURVEY DESIGN FOR OUTREACH TO RSM AND ADAPTATION PLANNERS

4.1 STATEWIDE ONLINE SURVEY – TARGETED AT COASTAL JURISDICTIONS, PLANNING DEPARTMENTS AND PUBLIC WORKS

4.1.1 Survey Design and Delivery

In partnership with Integral, BEACON developed and distributed an online survey to assess the current disconnects between regional sediment management and coastal adaptation planning in California. The survey was distributed to a curated list of 252 federal, state, and municipal sediment management and coastal adaptation planning practitioners on October 31st, 2024, with four follow-up communications sent through December 18th, 2024. Survey recipients included both public sector, academics, and private consultants chosen in consultation with BEACON, Coastal Conservancy, and ASBPA and CSBPA members residing in California, current and former CSMW staff, and RSMP authors.

4.1.1.1 Survey Design

To ensure each participant only responded to questions relevant to their professional expertise and experience, the survey employed branching logic. For example, specific questions asked each respondent about knowledge of individual regional sediment management plans with questions varying based on how many plans the respondent indicated that they had experience developing or implementing. This approach allowed for more detailed questions based on respondents' specific involvement with regional sediment management plans, while maintaining relevance and engagement throughout the survey.

4.1.1.2 Total Responses and Completion Rate

The survey received 87 responses, for a response rate of 34.5%, which is above the target rate of 20-30%, and well above the average for emailed surveys, which can be below 10%. The completion rate was 82%, resulting in 55 completed surveys that took an average of 35 minutes to complete. This rate is also considered excellent given the complexity of the responses requested and reflects the branched design and effort in development. These responses provided a robust dataset for analysis of current challenges and opportunities in integrating regional sediment management with coastal adaptation planning.

4.1.2 Survey Respondents

The survey highlighted information on personal roles, organizational roles, current governance strategies, and updated implementation status on regional sediment management plan recommendations to gather a complete and up-to-date picture of RSM and SLR planning and implementation.

4.1.2.1 Field of Expertise

Survey participants represented a diverse cross-section of California's regional sediment management and coastal management stakeholders (Figure 10), including those involved in planning and permitting (27%), coastal zone management (24%), engineering (10%), flood management (4%), and elected or appointed officials (1%). The remaining responses included coastal and marine scientists, educators, public safety, ecologists, economists, lawyers, hazard assessment and coastal resilience professionals, and researchers.

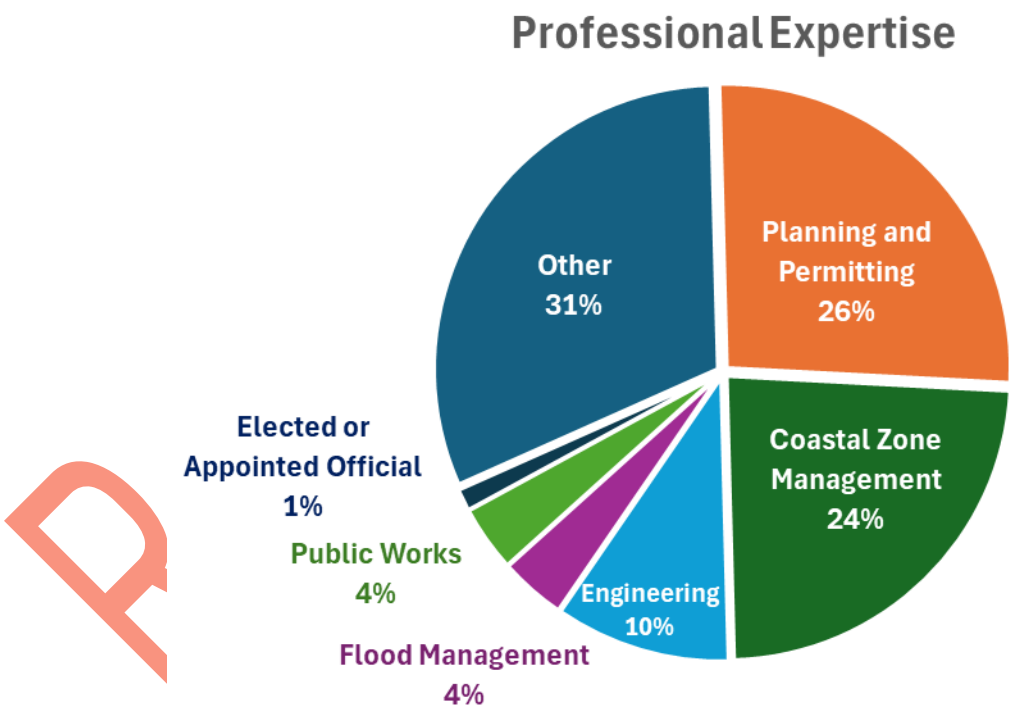


Figure 10 Area of technical expertise among survey respondents (N=79)

The survey captured perspectives across California's coastal jurisdictions (Figure 11). Approximately half of the total sample work in government, with 22% being affiliated with local city or county government, 17% with the federal government, and 12% with state government.

Approximately one-third of participants were affiliated with consulting firms (19%), academia (9%), and regional planning authorities (2%). The remaining 19% of survey respondents listed being retired or affiliated with multiple different sectors; for instance, 4% of survey respondents listed being affiliated with both local city and county governments as well as regional planning authorities.

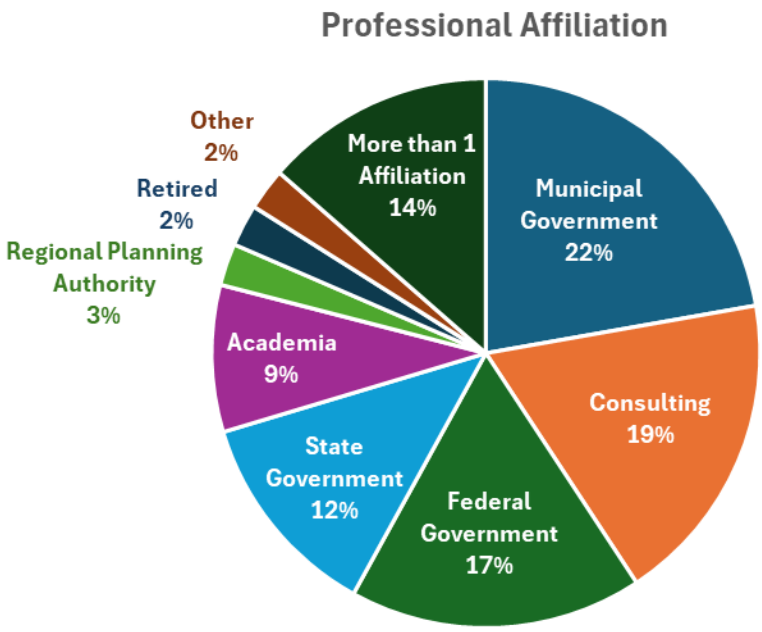


Figure 11 Affiliation of survey respondents by management sector (N=81)

4.1.2.2 Years of Experience

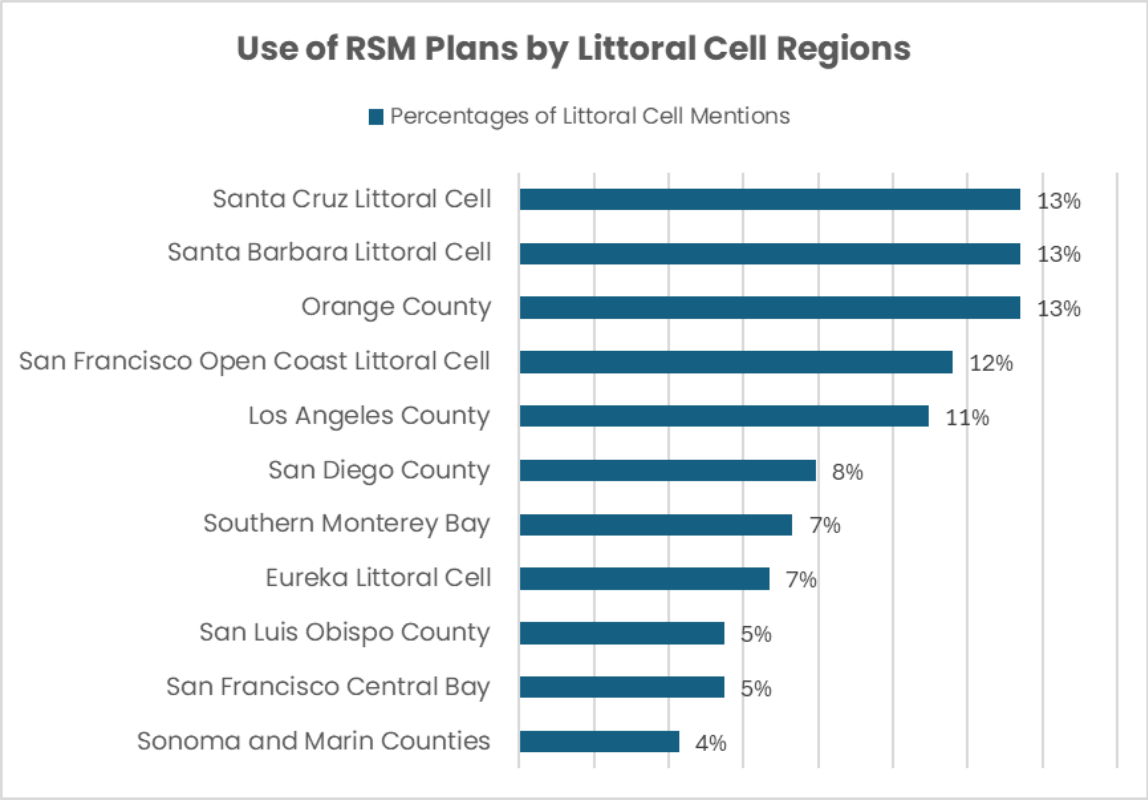
Respondents had an average of 16.5 years of experience working in regional sediment management and an average of 13 years of experience working in coastal adaptation planning. Most respondents reported having worked in both regional sediment management and coastal adaptation planning, with 9% of respondents reported working only in regional sediment management and 3% of respondents reporting working only in climate adaptation planning. Those that reported working in only one of the two sectors appeared to have less experience on average than those who have worked in both, with those having experience only in regional sediment management having an average of 7.4 years of experience and those only in climate adaptation management having an average of 8.0 years of experience. This likely reflects duration of employment, as respondents within the survey sample with longer careers will

have had the opportunity to work across multiple aspects of coastal management. Additionally, this is consistent with the fact that RSM planning began several years before sea level rise vulnerability assessments and adaptation planning.

4.1.2.3 Region

Survey respondents not only had a diverse range of experience in different sectors, but they also had a diverse range of experience in littoral cells along the California coast. When asked what regional-level coastal geography they currently work, 27% of survey respondents listed working in all littoral cells, this is likely representative of members in the original CSMW. Of respondents who focus their work on a specific littoral cell, 37% of respondents listed currently working within Santa Barabara, 13% listed Oceanside, 7% listed San Francisco, and 4% listed Los Angeles. Other littoral cells listed by respondents includes Laguna, Mission Beach, San Pedro, Santa Cruz, Monterey, Humboldt, Eureka, Bodega Bay, and Point Reyes.

Respondents also had a diverse range of experience having either worked on or with Regional Sediment Management plans.



The three most-used RSM plans include Santa Cruz, Santa Barbara, and Orange County. All of these RSM plans had a wide range of use by different RSM practitioners all over the state. For

instance, the Santa Cruz Littoral Cell plan has been used or worked on by professionals as far north as Eureka and as far south as Imperial Beach.

4.2 SURVEY RESPONSES

4.2.1 Current Sediment Management and Climate Adaptation Strategy Alignment

Most survey respondents (70%) reported working for organizations in which sediment management and climate adaptation strategies are either mostly aligned (38%) or in total alignment (32%), despite the deficiencies identified in the documents reviewed in Section 2 (Figure 12). This may reflect improvements in alignment since the date of publication of reviewed documents, or the fact that the CRSMP and climate adaptation planning documents do not fully reflect the day-to-day public works activities or the true level of integration within the respective organizations.

When describing specific integration efforts within their organizations, respondents frequently mentioned the beneficial use of dredged materials as a key strategy. For instance, a planning and permitting official at the U.S. Army Corps of Engineers explained that there is a “big focus on beneficial use of dredged material (navigation dredging), regional sediment management, and engineering with nature to adapt to climate change.” This integration extends beyond federal agencies to private sector organizations as well. A flood manager at Moffatt & Nichol described their firm's efforts to "push [to link] beneficial reuse of dredged material to flood management [and] resiliency."

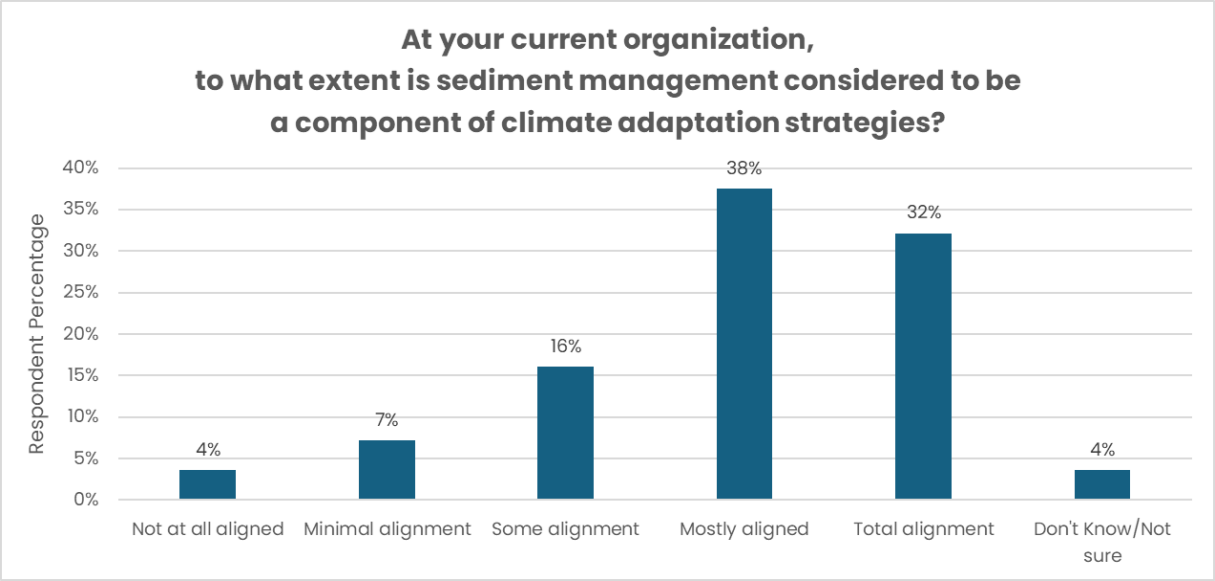


Figure 12 Alignment of regional sediment management and climate adaptation within respondent organizations

Of those respondents who selected working for an organization that has either no alignment or minimal alignment, all were affiliated with federal or local government entities. For instance, one Coastal Zone Manager at the California Coastal Commission approached the question from a personal perspective rather than an organizational one, stating they "have not been directly involved in climate adaptation."

Some respondents indicated that their organizations were in transitional phases regarding the integration of climate adaptation strategies. A planning and permitting professional at Ventura County Public Works Agency Watershed Protection anticipated near term improvements in alignment with climate adaptation strategies, explaining that "with the completion of the Local Coastal Program and sea-level rise assessments [for the city of Oxnard], policies will be developed to address the risks of sea-level rise." This is because, “with the completion of the Local Coastal Program and sea-level rise assessments [for the city of Oxnard], policies will be developed to address the risks of sea-level rise.” When asked the same question, a coastal zone manager at the Ocean Protection Council noted that the organization is currently working to change its lack of alignment by implementing “coastal adaptation projects [as well as] research around effective coastal adaptation strategies.”

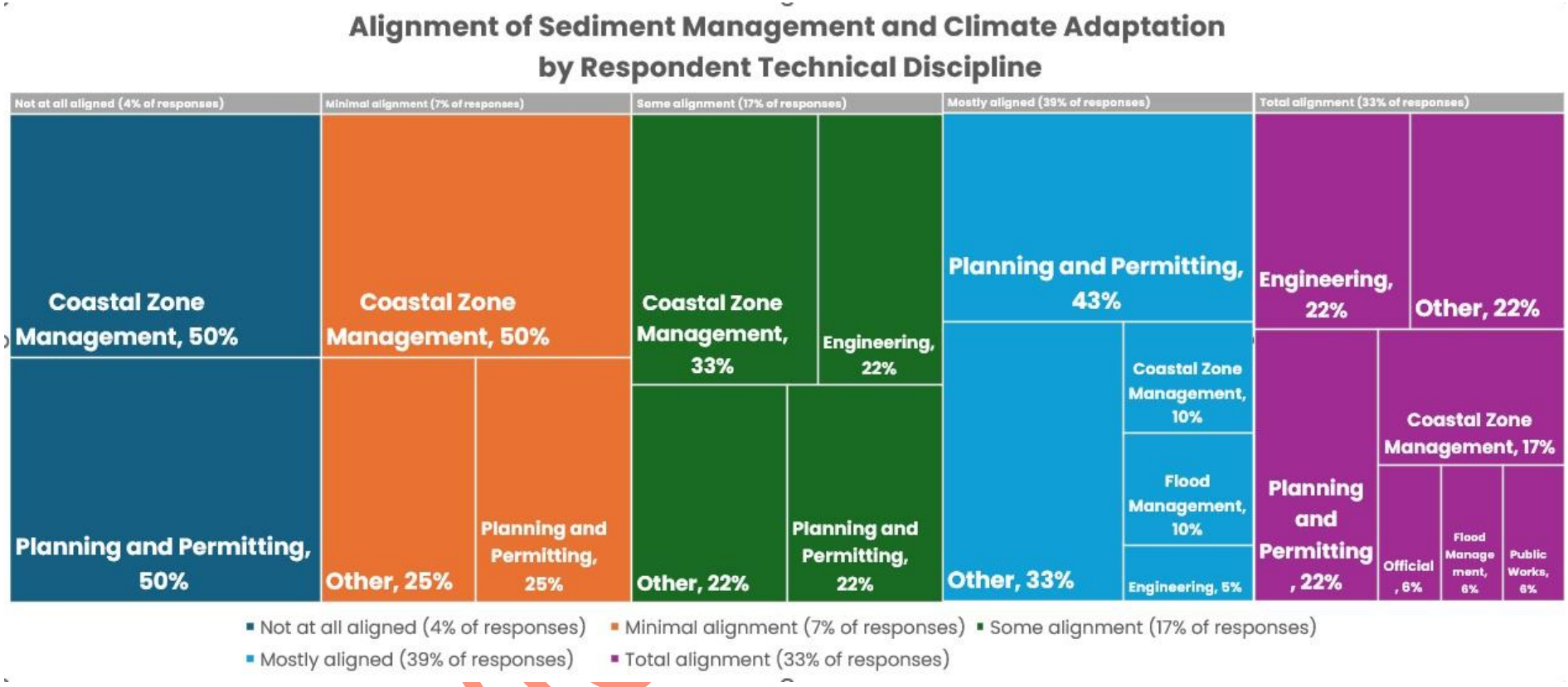


Figure 13 Perceived alignment of Sediment Management and Climate Adaptation, by Respondent Technical Discipline

Note. The above graph illustrates the relationship between survey respondents' technical expertise and the extent to which they believe their organization considers sediment management a component of climate adaptation strategies. The categories that encompassed all survey respondents included the following: Planning and Permitting, Coastal Zone Management, Public Works, Flood Management, Engineering, Finance and Accounting, Elected or Appointed Official, and Other. The "Other" category consisted of 31% of respondents, 40% of whom are researchers, 25% coastal scientists, 15% coastal resilience practitioners, 10% educators, 5% economists, and 5% law practitioners.

4.2.1.1 Sediment sizes considered

According to the survey, sand, cobbles, fines, silt and gravel were the most frequently considered sediment in sediment management decisions (Figure 14). Of respondents that selected “other”, they listed eco-concrete, boulders, and reef. Whether a reef would be considered a sediment would depend on the composition and integrity of the substrate materials.

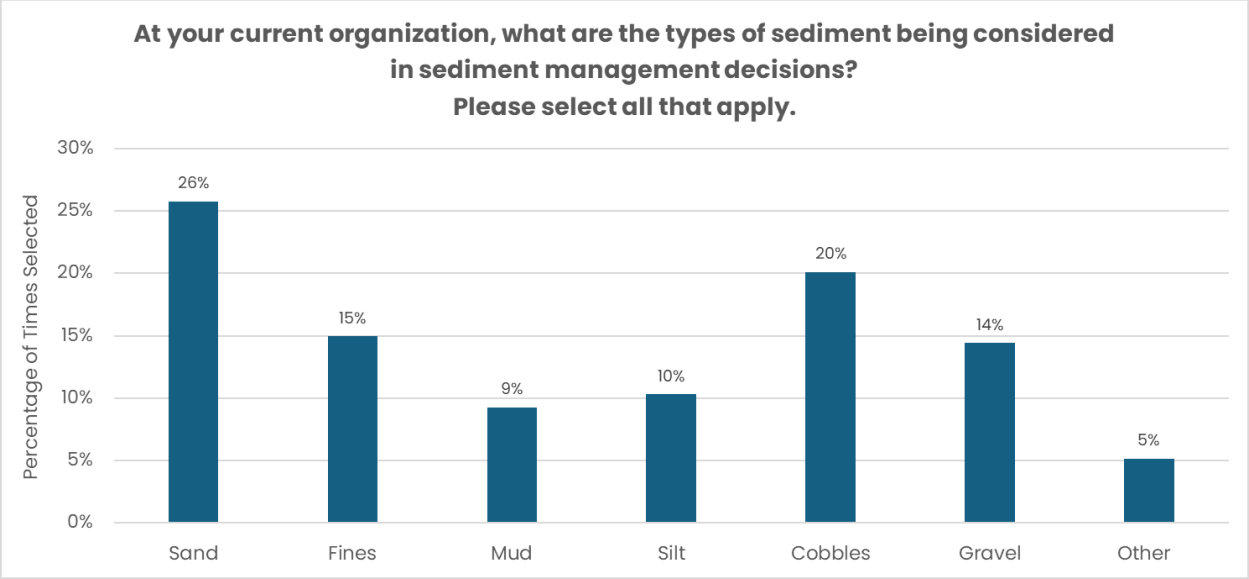


Figure 14 The types of sediment being considered in sediment management decisions.

4.2.1.2 Regional Sediment Management Plan Experience

Almost three quarters (73%) of survey respondents have either used or helped create RSM plans in their current or previous roles (Figure 15). This number includes both those who assisted in preparation of the RSMP, but may not be involved in implementation, and vice versa.

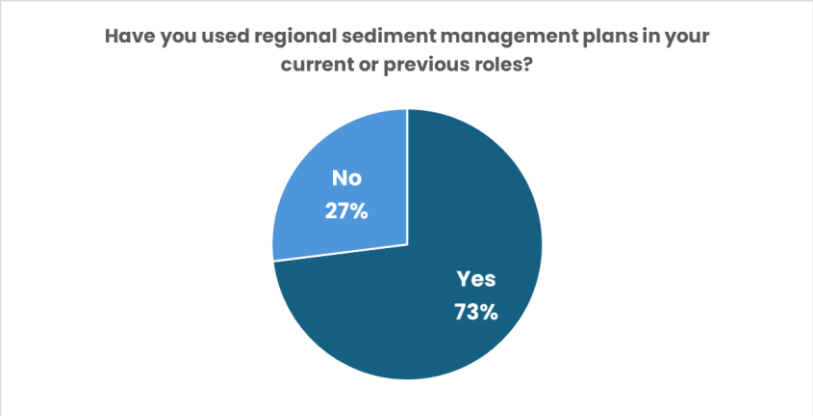
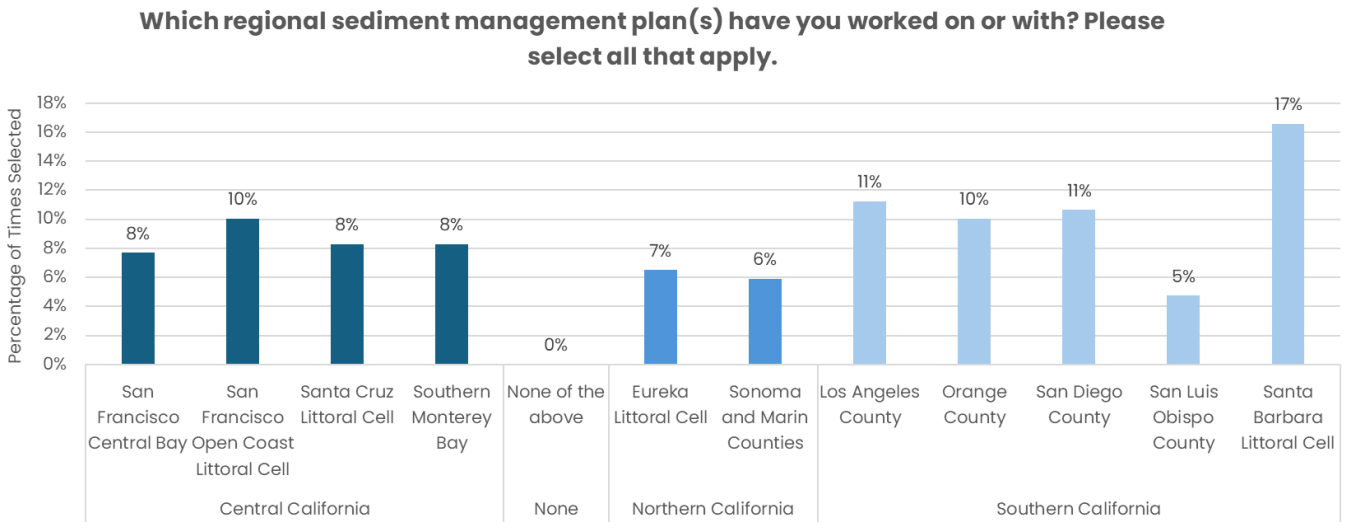


Figure 15 Percent of survey respondents that have and have not used regional sediment management plans in their current or previous roles

Of those that indicated that they had experience working with RSM plans, about half stated that their experience was with RSMPs was within littoral cells located in southern California (Figure 16, including Santa Barbara, Ventura, Los Angeles, Orange, and San Diego Counties). About 40% stated their experience with RSMPs was in central California (including San Francisco open coast and Central Bay, Santa Cruz, Southern Monterey Bay and San Luis Obispo counties). 13% stated their experience was in northern California (Eureka, Sonoma and Marin counties).



Responses: 47

Figure 16 The RSMPs worked on by the survey respondents

4.2.2 Governance processes

When asked what elements a part of their organization's structure and operation are, 22% of survey respondents selected formal governance, 19% selected planning and implementation documents, and 13.5% selected meetings and voting (Figure 17).

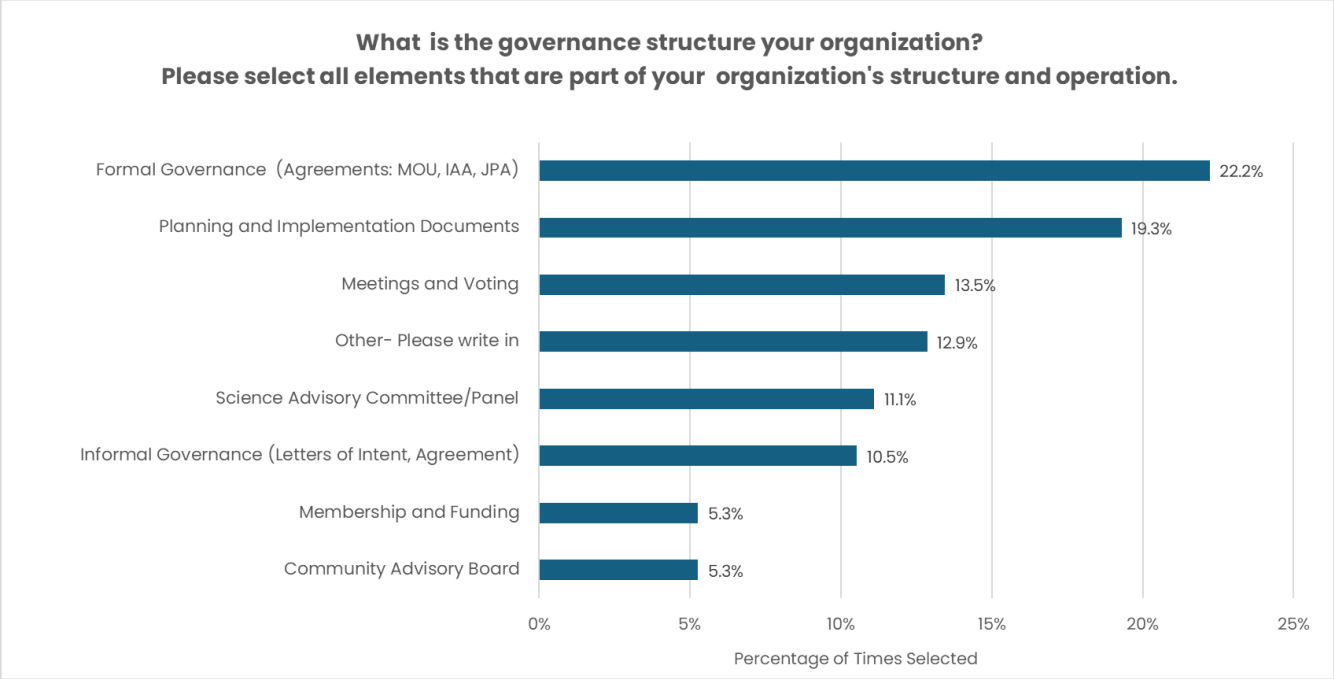


Figure 17 The governance structures utilized by survey respondents.

Based on elements that their organization has; respondents were asked to list each component as a strength or a weaknesses of their organization's governance structure and processes (Table 16). Overall, respondents listed more supporting than limiting components. The most commonly listed supporting factors were in the categories of *formal governance* and *planning and implementation documents*.

Table 16 Qualitative statements around supporting and limiting components of governance elements and operations (all quotes from survey).

Supporting	Limiting
Formal governance	
• *Allows for the community to take a proactive role in the actions taken by the City.* • *Commits federal government to aiding non-federal partners that would otherwise not have the funds to address regional sediment management and climate adaptation problems* • *Enabling legislation to fund coastal protection/restoration/access/adaptation projects* • *As a JPA, BEACON successfully functions as a government agency* • *Cost sharing capabilities* • *Ability to initiate and codify policies* • *Clear parameters to follow; It's clear to all how decisions are made and who will pay for what* • *Formal structure has provided a platform for seeking funding and development of regional coastal management policies.*	• *Time and process delays* • *Sometimes hard to achieve in a timely way to realize beneficial use projects*
Informal governance	
• *Flexible, provide clarity to relationships with partners* • *flexible support* • *Land ownership* • *Bring people together to get things done*	• *Time and process delays* • *Sometimes hard to achieve in a timely way to realize beneficial use projects*
Membership and funding	
• *Providing money to help achieve partner goals* • *all the local policy bodies at the table* • *Manage the Shoreline Preservation Working Group - members are elected officials, government agencies, NGO's that work in the space; jurisdictional membership fees support Regional beach sand projects and monitoring*	• *SANDAG is made up of 18 cities and the County of San Diego. 8 cities have coastlines. 10 do not. Non coastline cities think that coastal management is not their issue. Only a coastal city problem. A more focused organization (e.g., coastal city JPA) maybe a better model.*
Meetings and voting	

• *Best available science is the goal for project approaches* • *Strong technical analysis and collaboration, value driven* • *Ensures best available science is included in federal decision-making, with members from academia, high levels of USACE, and direct involvement of USACE leadership.* • *large group of employees with multidisciplinary background* • *We provide science products to help decisionmakers* • *Best Available Science* • *we have a good understanding of coastal processes and sediment dynamics, lead discussions at TACs and Working groups* • *Strong set of biologists on board that participate in local resilience planning efforts* • *best available science* • *Experience, Knowledge, agency leadership*	• *None listed*
Community advisory board	
• *We are part of coalitions in several regions that represent a variety of interests* • *Includes wide range of voices*	• *Some community advisory boards struggle to accomplish their goals due to multiple differing opinions of how to reach those goals causing a stalemate.*
Planning and implementation	
• *Much effort and thought is given to development of project staff reports and restoration and mitigation designs and monitoring* • *Depends on project* • *Standardized procedures and processes for planning and what should be included in planning documents. Transparent and comprehensive* • *project history* • *Forward-looking* • *HDR provides a wide range of consulting support including, pre-planning, community engagement, grant funding, developing EIR documents, vulnerability and hazards analysis, climate adaptation planning, and resilience planning.* • *The City has staff with the technical expertise to manage the development and adoption of planning and implementation documents. In addition, there is often sufficient grant funding available to contract with technical experts as needed.* • *depends on the LCP or policy but as a mechanism is a strength* • *because our agency leads the region in SLR adaption & RSM* • *Lay the foundation for implementation* • *rigorous planning and engineering analyses*	• *Funds are not always available and hold up plans/implementation*

• *CAP, Coastal Vulnerability Assessment and Fiscal Impact Report (SLR Adaptation), Community Wildfire Protection Plan* • *site specific project parameters (grant agreements)* • *CEQA lead and role* • *Sediment Management policies and regional beach sand nourishment projects including env and design documents, contracts* • *Its the foundation and framework from which we operate and do our work* • *Its good to have a plan* • *The Corps process, while cumbersome, can lead to funding to implement*	

4.3 BARRIER ANALYSIS

Respondents were asked to identify obstacles, the structural and operational barriers to implementation of regional sediment management (RSM) project implementation Figure 18).

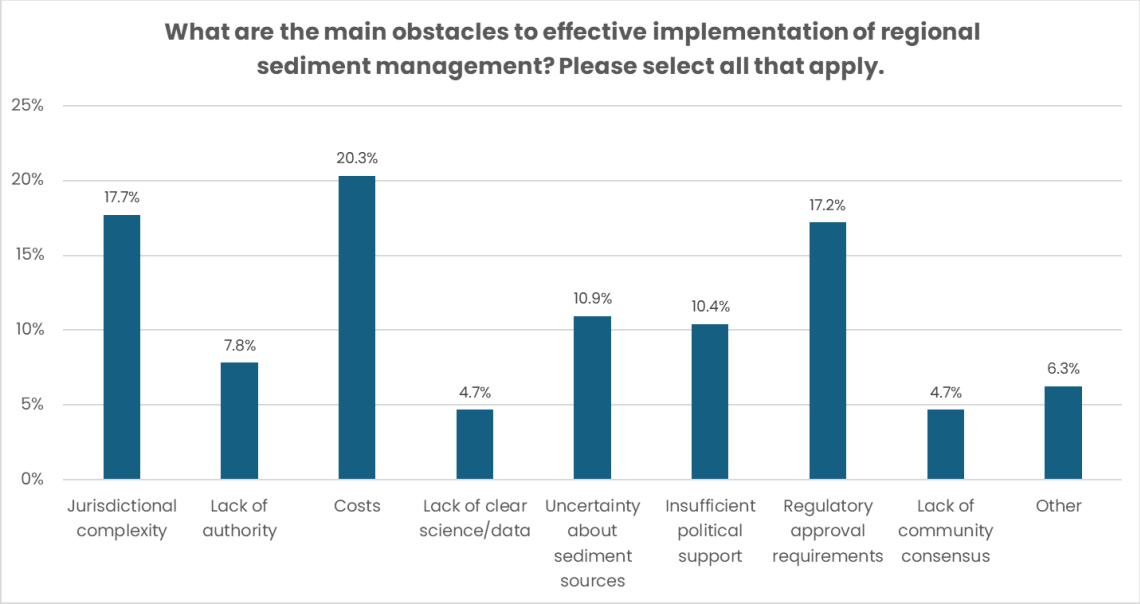


Figure 18 Main obstacles to effective implementation of regional sediment management.

Responses collected by the survey suggest that the most significant obstacles that regional sediment management practitioners faced are costs (unspecified) (20.3%), jurisdictional complexity (17.7%), and regulatory approval requirements (17.2%) with more than half of

respondents selecting at least one of these as barriers to the effective implementation of regional sediment management. These barriers are likely indicative of a deeper structural governance disconnect between the two policy objectives (implementing effective regional sediment management planning with coastal adaptation), including institutions that inhibit or disincentivize collaboration, a misalignment in policy prioritization on a state and federal level, and complex and inefficient regulatory processes.

4.3.1 Costs

According to the survey, RSM practitioners face financial challenges in effective implementation or regional sediment management. One example of how high costs act as an obstacle to RSM program implementation is in the transportation costs of sediment. The limited availability of dredging equipment exacerbates these financial challenges, as mobilization costs are a substantial component of smaller dredging projects.

In addition to the costs of implementing projects, according to previous research, the costs of permitting also poses a barrier to using sediment in living shoreline projects (Goodrich et al., 2023).

4.3.2 Capacity

Regional sediment management practitioners also mentioned facing limitations on staff availability to work on and effectively implement regional sediment management programs at both the state and local level. This is not only the case for organizations like BEACON, but also for state and federal government staff members.

4.3.3 Jurisdictional Complexity

Sediment management becomes more complex when multiple jurisdictions are involved. This type of jurisdictional complexity is not unique to sediment management; in fact, Kat Jones discusses jurisdictional complexity as an impediment to effective implementation of wildfire management practices. Like wildfire management, managing sediment effectively "requires cross-boundary co-management efforts involving multiple actors who represent different levels of governance (federal, tribal, state, local) and types of ownership (federal, private, municipal, etc.)" (Jones et al., 2024).

The implications of jurisdictional complexity were highlighted by respondents throughout the survey. Collaboration and coordination between organizations across jurisdictions has been challenging and often lacked staff capacity and a shared actionable strategy (Educator at University of California, Santa Barabara). Initiating and maintaining collaboration between different agencies

"...is difficult because each organization has different goals."

For instance, when implementing regional sediment management projects, organizations must deal with the federal government, the California Coastal Commission, and multiple state regulatory agencies. The challenge also lies in the fact that “they don’t always agree among themselves” (Ulibarri et al., 2020).

In addition to regulatory and policy complexity, management of sediment across jurisdictional boundaries complicates funding arrangements, as many of the financing mechanisms are dependent on location-based special districts or ad-valorem property tax assessments. Use of these funds outside the area in which they are collected can face regulatory challenges, and establishing such funds may require support from the majority of residents in multiple jurisdictions, at the same time.

4.3.4 Regulatory Considerations

Managing sediment across jurisdictions has notable regulatory challenges as well, including a complex permitting process. Navigating these regulatory requirements can be time-consuming and costly, for any single jurisdiction much less multiple jurisdictions. This complexity delays essential projects and hinders progress; for example, one challenge cited in the survey is “the time it takes to get through CEQA and NEPA processes and obtain regulatory approvals” (southern California Consultant).

This is a barrier to regional sediment management activities that have been identified in previous research. In Goodrich et al. 2024, though, a number of “interviewees recognized the importance of permits for protecting the environment,” they also noted that “obtaining them takes a long time and is expensive.” Participants in this study “reported that in some cases, permitting costs sometimes prohibited sediment management activities from moving forward” at all (Goodrich et al., 2023).

Agency Limitations

Each agency has its own mandate for different scales. For example, a federal agency directive focusing on maintaining navigation varies drastically from a local flood control agency balancing flood protection with species protections or a parks district focused on recreational use. Within agencies, long range climate planners focus on policy improvements while public work engineers focus on project implementation typically prioritized in a 5-year Capital Improvement Plan. One retired coastal processes consultant described permitting agencies as being “siloed single-mission 'thematic'” agencies, suggesting that the variety of goals and missions across regulatory agencies is hindering the ability to manage sediment and plan for climate change. This consultant suggested that an “Agency of Coastal Adaptation” may be an effective solution.

4.3.5 Political Will and Capacity

Another obstacle is the lack of policy and financial support for RSM programs at the local, state and federal level. This lack of political priority and support may reflect the lack of understanding of effective regional sediment management among non-technical groups and the public in general who may observe beach closures and increased construction traffic. For instance, there is a “perception that the sand just washes away after the first storm” (SANDAG Planning and Permitting official).

4.4 RECOMMENDATIONS FROM SURVEYS

When asked what the main obstacles to effective implementation of regional sediment management, respondents highlighted costs, regulatory approval requirements, and jurisdictional complexity (Figure 19).

These results highlight funding, decision-maker support, sediment inventories, and regulatory and permitting requirements.

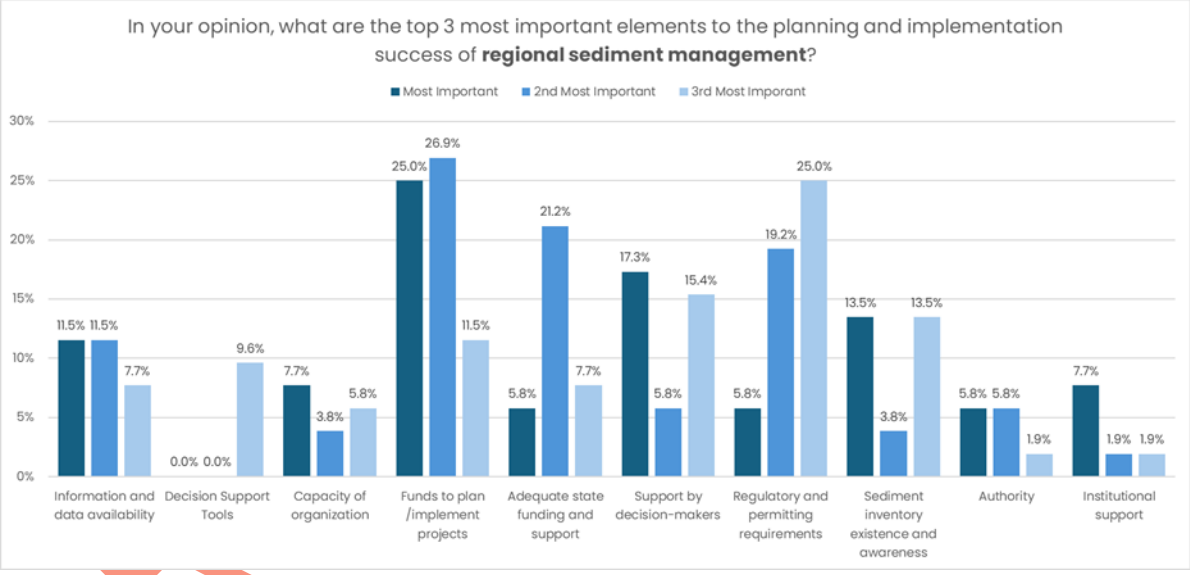


Figure 19 The most important elements to the planning and implementation success of regional sediment management

4.4.1 Collaborative Governance

Survey respondents proposed different strategies to overcome jurisdictional complexity challenges and improve collaboration among different agencies, ultimately allowing for the facilitation of regional sediment management and coastal resilience planning integration.

Experts specifically suggested involving a more diverse range of expertise in decision-making processes. For instance, one recommendation was to formally integrate the participation of beach ecologists into the development of best management practices, particularly for beach replenishment projects. Another recommendation to overcoming the hurdle of the jurisdictional complexity and inter-organizational collaboration was establishing a separate "interregional collaboration group" to discuss and advocate for resources to execute coastal initiatives, thus creating a forum where diverse stakeholders can align their strategies and resources (SANDAG Regional Planning Authority).

4.4.2 Funding and Political Support Strategies

Both the political and financial support of the state will be a crucial component to effective RSM and Coastal Adaptation planning integration and implementation. This theme that "nature-based/living shoreline project and sediment is currently under supported/not funded by State programs" was reflected in responses throughout the survey (Engineering Consultant). This overall lack of financial support may be in part due to a lack of political support.

The survey offered a few different ideas that may be used to address the current funding and political support challenges. One planning and permitting SANDAG official suggested exploring the "state purchase or long-term lease of hopper dredge equipment" as a more cost-efficient sediment transportation option. Another planning and permitting official at Orange County Parks suggested developing an interregional collaboration group that could more effectively advocate for increased funding to support regional sediment management projects.

While gaining political support is important, it requires the support of the public. An example of locations in which RSM implementation has lacked public support is in the City of Carpinteria. Public outcry over truck traffic, water quality and beach closures have caused political challenges for knowledgeable and supportive elected officials. One concrete step mentioned often by survey respondents was promoting programs and campaigns that prioritize public education on coastal processes. This will ultimately allow agencies to "continue to address the source of sediment deficiency and impediments to longshore transport (dams, seawalls, coastal development, etc.)" (Planning and Permitting Consultant).

4.4.3 Regulatory Reform Recommendations

Survey results identified regulatory approval requirements as the third most selected obstacle to effective implementation of regional sediment management initiatives. According to a Coastal Zone Manager at the California State Lands Commission, one promising approach is to develop "a clear and concise permit streamlining process similar to the Long Term Management Strategy's Dredging Materials Management Office and NOAA's North-Central California Sediment Coordination Committee sediment roadmap." This recommendation builds

on existing successful models that have demonstrated effectiveness in coordinating multi-agency reviews and approvals.

Survey respondents also emphasized the need for regulatory frameworks that can adapt to changing coastal conditions. A permitting and planning representative from SANDAG specifically noted that "more regulatory flexibility on the grain size allowed to be used on beaches" would improve the effectiveness of regional sediment management initiatives.

Easing regulatory hurdles and complexities would allow for more effective implementation of coastal management initiatives.

4.4.4 Recommendations for CSMW

Survey respondents also recommended steps for the next version of the Coastal Sediment Management Workgroup.

4.4.4.1 Better Outreach and Engagement

Expert Practitioners

Survey respondents consistently highlighted the need for the California Sediment Management Workgroup (CSMW) to better engage with regional sediment management practitioners.

According to a representative from the City of Carpinteria Public Works Department, the CSMW needs to take a more interactive approach to engaging with stakeholders to identify priorities and challenges where the CSMW can focus its resources. By "interviewing agency staff and other stakeholders to understand their priorities and how the CSMW can benefit the work that they are already doing, as well as future goals," the CSMW can more effectively direct its staffing and funding resources where it is most needed.

Additionally, several respondents recommended the CSMW offer a more diverse range of expertise than is currently involved in discussions around RSM planning. A researcher and educator at California State University Channel Islands emphasized the importance of "engaging researchers, policymakers, and practitioners" in CSMW activities. A Coastal Zone Manager at the State Coastal Conservancy similarly recommended that “decisionmakers and environmental groups, tribes, etc., concerned about habitat impacts” be included in these conversations as well.

The survey revealed that there is not currently sufficient effective engagement with local elected officials and staff. For instance, a planning and permitting representative at the U.S. Environmental Protection Agency recommended that, moving forward, the CSMW actively conduct “appropriate and frequent outward facing messaging to state officials on climate resiliency via smart sediment management” be a priority. This messaging would not *“focus on sediment, but rather [on] adaptation needs.”*

General Public

In addition to better engaging with professional regional sediment management practitioners, survey respondents also emphasized the importance of the CSMW's role in engaging with the general public. The CSMW has the opportunity to actively involve community members in the discussion around regionally effective sediment management practices. By doing so, the CSMW can strengthen its relevance, effectiveness, and impact in advancing regional sediment management practices.

One concrete step that could be taken in this direction, recommended by an engineering consultant, is to distribute "regular updates and [commit to] ongoing engagement" with the public. An example of ongoing engagement may include "host[ing] occasional meetings to extend education on sediment management regionally" (Planning and Permitting for the City of Oxnard). Taking steps towards "better communication of activities and [project] results over time" will allow the CSMW to have a more impactful presence by better understanding and addressing public concerns (Engineering Consultant). As discussed previously in section 4.4.2, greater public awareness and support will be reflected in political support, both of which being crucial components to the successful implementation of regional sediment management.

Another component of public engagement is promoting, implementing, and effectively communicating the impacts of projects with beneficial, tangible impacts; in other words, focusing on "implementing pilot projects that could be readily adopted with limited resources" would be a step in this direction (Researcher at Regional JPA). Ultimately, the "general public needs to be shown what [regional sediment strategies] can work and what [strategies do] not [work] for certain regions" (Official at the San Mateo County Harbor District). In other words, it is recommended that the CSMW demonstrate and effectively communicate the benefits of effective regional sediment management strategies.

4.4.4.2 More Diverse Involvement

Survey respondents emphasized the need for greater diversity of expertise within the Coastal Sediment Management Workgroup (CSMW). Specifically, a coastal zone manager at the California Coastal Commission recommended expanding beyond the current focus on engineering and geology to include the perspectives of "ecologists/biologists in sediment suitability decisions, [such as for] appropriate uses of sediment, beach nourishment design and planning, and protection, restoration, and enhancement of beaches and watersheds."

An engineer from the California Coastal Commission offered structural advice, suggesting the CSMW should "limit participation from agencies to one or two key staff members for a core workgroup that is trying to get things done and expand to larger field when it's more about general awareness, coordination and idea dissemination." This approach provides an opportunity to balance efficiency with inclusivity.

4.4.4.3 Broader Educational Resource and Data Repository

Throughout the survey, survey respondents suggested the CSMW act as an educational resource and data repository for both regional sediment management practitioners and the general public. A representative from Santa Barbara County Flood Control District specifically noted that "previous documents prepared by CSMW are no longer available online" and recommended that this valuable information be restored and made accessible again. A researcher and educator from California State University Channel Islands also highlighted the importance of greater "report accessibility" as a means of facilitating more effective engagement with stakeholders as well. Lastly, the need for consistent "webpage maintenance" was specifically noted by a planning and permitting representative from the USACE San Francisco District. Ultimately, it will be important to use the CSMW as a “continued space to share technical information [and] identify opportunities for matching sed[iment] needs w[ith] sources” (California Coastal Commission Ecologist)

In addition to providing a platform in which to store sediment management resources, survey respondents also requested that the CSMW play a role in highlighting or promoting “research around sediment best practices” (Coastal Zone Manager at Ocean Protection Council). Providing a platform for this research will allow facilitate “advocating that sediment is critical for any

Additionally, the CSMW should “supporting re-evaluating littoral cell function given SLR and adaptation needs” (Engineering Consultant). It would be beneficial for the CSMW to “include (1) coarser sediments (gravels, cobble, boulder lag deposits) and (2) collect data on littoral sediment thickness (depth to bedrock, hardpan) and (3) characterize littoral shores in terms of morphometrics - that is, geometry and dynamics of functional” (retired consultant).

These resources provide important context, baseline data, and lessons learned that can inform current and future initiatives.

4.4.4.4 Project Selection

Survey respondents highlighted the importance of strategic project selection and clear goal definition. For instance, a Coastal Zone Manager pointedly recommended that the CSMW "broaden focus beyond expensive and temporary beach nourishment projects." By expanding beyond traditional beach nourishment—which often requires repeated investments for only

temporary results—the CSMW could explore approaches to sediment management that are more effective, larger scale and longer-term.

Complementing this perspective on project selection, a planning and permitting professional at the US Environmental Protection Agency emphasized the importance of "clear goals for implementation of regional projects." They noted that successful implementation "may require prioritization based on readiness, funding, and public interest among the various coastal programs."

4.4.4.5 Restructure

The current structure of the Coastal Sediment Management Workgroup (CSMW) presents opportunities for reorganization to better accommodate the nuances throughout California's extensive and varied coastline. A planning and permitting professional at the San Francisco Bay Regional Water Quality Control Board recommended " that the CSMW be broken into subcommittees to focus on regional management. California is a very large state making statewide sediment management very challenging." This observation points to the limitations of a centralized approach when addressing such geographically diverse coastal systems. The success of the "Long-Term Management Strategy for the [San Francisco] Bay" provides a compelling model for how regionally focused efforts can be successful.

4.4.4.6 Funding & Staffing

Survey respondents identified funding and staffing as important needs that must be met for the future effectiveness and success for the CSMW. A key recommendation emphasized the need for financial stability through "consistent funding and staffing," coupled with "a concerted effort to educate and coordinate with the agencies that permit sediment removal" (Coastal Zone Manager at BEACON). Another approach to increasing and efficiently using funding called for the CSMW to "identify and prioritize creative and pragmatic approaches to increase sediment budgets through deeper collaboration" (Planning and Permitting Consultant). Both recommendations highlight the importance of inter-agency cooperation in maximizing the CSMW's ability to maintain its ability to facilitate regional efforts to protect, enhance and restore California's coastal beaches and watersheds (Coastal Sediment Management Workgroup Home Page 2025).

5 FOUNDATIONS OF SUCCESSFUL SEDIMENT MANAGEMENT

5.1 GOVERNANCE STRUCTURES AND PROCESSES

Various governance structures currently existing for implementing RSM programs. Survey responses and a literature review were used to identify what governance structures and processes are currently used and working well for California RSM, and what structures and processes might be adopted to improve RSM.

5.1.1 Joint Powers Authority

Joint Powers Agreements (JPAs) is a type of formal governance mechanism that enables public agencies to collaborate on shared initiatives. When two or more public agencies establish a JPA, they create an entirely new legal entity separate from the member organizations—distinguishing JPAs from more informal and limited governance structures (Kincaid & Stager, 2015). Authorized under California's Joint Exercise of Powers Act (Government Code Title 1, Division 7, Chapter 5), these entities allow agencies to "jointly exercise any power common to the contracting parties" for specific purposes (California Legislative Information). JPAs effectively serve as vehicles for resource sharing, program implementation, infrastructure development, and service delivery across jurisdictional boundaries. JPAs are often “created in order to jointly share a common power, implement a program, build new facilities, or deliver a service” (Marin County Local Agency Formation Commission). An additional component of JPA formation involves establishing a clear financial structure, determining whether members must contribute funds, whether these contributions will be equal or varied, and the underlying basis for funding allocations (Kincaid & Stager, 2015). This governance structure has been successfully implemented throughout California in various contexts, including the West Contra Costa Transportation Commission, Port Hueneme Water Agency, and the Pajaro Regional Flood Management Agency. Additionally, it is “worth noting that not all JPAs are regional. Many are formed for narrow, specific purposes. For example, JPAs are commonly used to form joint insurance and risk management programs.” (CALCOG). BEACON is a prime example of a JPA being used for sediment management, and, to some extent, for climate adaptation via beach nourishment and sediment management for climate resilience. As described in Section 2.3.1, outside the BEACON region, other RSMPs have also recommended JPAs as governance structures, inspired by the BEACON model.

Table 17 Supporting and limiting factors for a joint powers authority

Supporting	Limiting
• *Framework Promotes Cooperation*. Promotes inter-jurisdictional cooperation by creating a framework in which entities can pool resources, coordinate efforts, and eliminate redundant actions or overlapping services (Nevada County Grant Jury, 2022) • *Promote Efficiency*. This collaborative framework ultimately leads to reduced expenses and time managing multiple voter initiatives across jurisdictions (Nevada County Grant Jury, 2022). • *Diverse Financing Opportunities*. Provides the ability to raise immediate and upfront funding by issuing revenue bonds (Bernstein, 2020). JPAs may also raise revenues from dues paid by member agencies as well as impact fees from development projects. • *Protect Members from Liability*. "California law states that members are responsible for a newly formed joint powers agency's debts, liabilities, and obligations unless their JPA specifies otherwise. Thus, JPAs commonly state that members do not intend to be liable, either jointly or severally, for the new agency's liabilities, debts, and obligations, shielding members from individual liability for the agency's actions" (Kincaid & Stager, 2015).	• *Lack of Transparency*. Vertical model JPAs (i.e., JPAs "formed within the same organization and controlled by a single authority instead of serval") do not contain "the same checks, balances, and accountability as horizontal model JPAs," and are more vulnerable to corruption (Nevada County Grand Jury, 2021). • *Circumnavigate Voter Approval*. To avoid risk of defaulting on unpaid debt, JPAs could internally use the organization's general fund or other internal sources without voter approval (Nevada County Grand Jury, 2021). • *Lack of Public Support.* Expansive projects may inevitably spark frustration by taxpayers and residents of counties who are paying for activities in other counties .(Bernstein, 2020) • *Regulatory Restrictions*. "A JPA will need to provide proper notice to both the Secretary of State and Controller each time the agreement is amended. If it fails to give proper notice of its creation through a JPA or of an amendment of its JPA, it is prohibited from issuing bonds or incurring debts until the proper filings are complete." • *Reporting Requirements*. Report all receipts and disbursements. Additionally, they may need to comply with additional statutory compliance requirements should they elect to invest funds and or issue bonds.

5.1.2 Council of Governments

Councils of government (COGs) are essentially general-purpose JPAs (CALCOG). More specifically, COGs are a type of regional planning agencies that represent member city and county governments to provide cooperative planning, coordination, and technical assistance in addressing cross jurisdictional challenges (WRCOG). While the adoption of JPAs are officially authorized by state law, COGs are formed "following discussion and negotiation on common goals and objectives" (WRCOG). These organizations have a wide range of responsibilities, all

of which are determined by its member jurisdictions and agencies. Such responsibilities include transportation planning, air and water quality planning, waste management, and regional housing assessments. Most COGs, especially those "in larger urban or metropolitan areas, are largely funded from state and federal sources" (WRCOG pdf). This includes federal funding, sales taxes, service fees, and membership dues (San Joaquin Council of Governments) (Fresno Council of Governments).

One example of a COG is the Southern California Association of Governments (SCAG), which covers six counties, 191 cities, and more than 19 million people (SCAG). Other examples of COGs include the Association of Bay Area Governments (ABAG), which covers nine counties and 100 cities, and the Association of Monterey Bay Area Governments (AMBAG), which includes 18 cities and 2 counties, and the San Diego Association of Governments, which is both a metropolitan planning organization and a council of governments, that brings local decision-makers together from the region's 18 city councils, County supervisors, as well as non-voting representation from state and regional transportation and water authorities to develop solutions to regional issues such as transportation and adaptation.

The SanDAG Shoreline Preservation Working Group has several active projects related to sediment management including: shoreline Photo Monitoring; Nearshore Habitat Inventory; Regional Shoreline Monitoring Program; Sand Compatibility and Opportunistic Use Program; Coastal Regional Sediment Management Plan; and Regional Transportation Infrastructure Sea Level Rise Assessment and Adaptation Guidance. They have also been the catalyst for two major Regional Beach Sand Projects. In 2001 offshore sand was place on 12 beaches and in 2012 another nourishment project was placed on 8 local beaches.

5.1.3 Memorandum of Understanding/Agreement (MOU/MOA)

A memorandum of understanding (MOU), used interchangeably with the term Memorandum of Agreement (MOA), is an agreement between two or more "parties governed by state contract law and common law" (Kincaid & Stager, 2015). These types of agreements can range from non-binding agreements "to comprehensive agreements committing parties to specific actions and funding obligations" Unlike some formal agreements, MOUs "do not create separate entities from their members" (Kincaid & Stager, 2015).

Table 18 Supporting and limiting factors for a memorandum of understanding

Supporting	Limiting
• *Flexibility*. For many, the fact that MOUs are a step down from a formal contract is why they are so useful (Adobe). This is beneficial because, if any party finds the objectives and goals are not being met, the agreement can easily be terminated (Corporate Financial Institute) • *Clarity*. Ensures that all participants are in agreement on the partner roles and activities, thereby decreasing misunderstanding and conflicts (Corporate Financial Institute)	• *Flexibility*. Because MOUs are not legally binding, either party may exit the agreement or not meet the requirements outlined in the agreement without consequences (Corporate Financial Institute) • *Restrictive Funding Opportunities*. MOUs do not have the authority to raise revenues by issuing bonds. Additionally, MOUs are a non-binding provision that simply states that parties will be expected to contribute financial resources needed to develop the contemplated project(s). Given the provisions are not binding, the parties really are not bound to provide contributions (Kincaid & Stager, 2015). • *Lack of Liability Protection for Members*. "Generally, an MOU/MOA does not offer the same protection as" other governance structures (Kincaid & Stager, 2015).

5.1.4 Regional Climate Collaboratives (RCCs)

Regional climate collaboratives (RCCs) are a relatively new type of regional entity that is largely focused on sharing information, lessons learned and leveraging their networks to support fundraising initiatives around climate change. The first RCC's were created in 2023 through a grant program administered by the California Strategic Growth Council. Through that grant program. RCC's are networks of a range of stakeholders that may including public agencies, Native American Tribes, community-based organizations and non-profits, businesses, and academic institutions, working together to facilitate the development and implementation of climate mitigation and adaptation strategies, leverage resources, share expertise, and promote equitable adaptation (University of San Diego). Their present capacity allows application for and receiving funding, but they have limited regulatory power.

RCCs consist of common characteristics. First, participants share adjacent or overlapping boundaries. Second, participants share and benefit from the same systems (i.e., natural, social, economic, economic, infrastructure, and so on). Lastly, while state or federal representatives and staff may participate, collaborations rise primarily out of local concerns and goals (Georgetown University). Some examples of RCCs include North Coast Resource Partnership (7

counties), Central Coast Climate Collaborative (6 counties), San Diego Regional Climate Collaborative (1 county, 19 municipalities), and the Santa Barbara County Regional Climate Collaborative with subcommittees focused on Clean Energy; Natural Lands, Working Farms & Regenerative Agriculture; and Sea Level Rise Adaptation. The Central Coast Climate Collaborative and the Santa Barbara Collaborative are supported by member dues, while others are supported by grants from the Strategic Growth Council.

While the RCCs have not directly been involved in regional sediment management, one of the potential benefits for this type of governance is that RCCs are formed at a more appropriate regional scale and include wider participation than only public municipalities.

Currently, however, most of the RCC's are more about sharing and leveraging and lack any official governance authority, with agencies and members either paying dues and/or volunteering time of interested and dedicated staff members that are more often associated with planning departments and/or sustainability offices.

Table 19 Supporting and limiting factors for regional climate collaboratives

Supporting	Limiting
• *Promotes Diverse Stakeholder Collaboration*. Membership may include both non-profit, public, and private organizations (California Strategic Growth Council). • *Climate Focus.* Focuses on addressing community climate resilience (Alliance of Regional Collaboratives for Climate Adaptation).	• *Collaboration.* Difficulties integrating climate goals into daily operations when working with local entities. • *Limited Capacity.* Limited staffing and time to dedicate to regional climate initiatives. • *Limited Funding.* Limited financial resources. • *Communication with Public.* Challenges in effectively communicating goals to the public. • *Data Gaps.* Gaps in research, data, and analysis needed to inform decision-making and achieve meaningful regional impact.

Source: https://www.adaptationclearinghouse.org/resources/regional-collaboratives-for-climate-change-a-state-of-the-art.html

5.2 FINANCING MECHANISMS

5.2.1 RSM funding

To date, the funding mechanisms used and suggested for regional sediment management have been limited to those listed in Table 14. Primary sources include USACE Navigation Dredging Program, the California Department of Boating and Waterways (now State Parks) recreational boating fees, BEACON dues, and Flood Control funding. The following sections describe possible paths to expansion of RSMP funding.

5.2.2 Climate Adaptation Funding

Fully integrating sediment management into climate adaptation planning is a critical step in increasing funding for sediment management projects. Sediment management has been primarily funded by the Corps and the California Division of Boating and Waterways (now CA State Parks). Climate adaptation, on the other hand, has been funded by a wide array of sources, both federal and state. Better integration of RSM into climate adaptation may open more opportunities for funding.

Several thorough reports have already been developed to explore the possibilities for funding and financing climate adaptation in California, including:

- Proposed Funding Pathways for Adaptation to Climate Change in California (Roberts et al., 2021)
- Paying for Climate Adaptation in California: A Primer for Practitioners (AECOM, 2018)
- Climate adaptation finance and investment in California (Keenan, 2019)

(AECOM, 2018) developed a comprehensive list of funding and financing tools, highlighting the benefits and drawbacks of each (Table 20).

Table 20 Funding and financing tools for climate adaptation in California, with key benefits and drawbacks, adapted from AECOM, (2018)

Key characteristics of different funding and financing tools			
Tool	**Who Pays**	**Key Benefits**	**Key Drawbacks**
Funding tools			
Grants	Federal, state, local funds/taxpayers	Money raised from broader geographies (e.g. federal level) can be invested locally Can be used to attract additional funding	High capacity needed to apply for and manage and report on funds Redirects money that could be used for other purposes
Assessments	Property owners	Costs linked to benefits Flexible geography Not considered a tax under Prop 26	Extensive documentation of benefits required Approval requires support of a majority of affected property owners

Taxes			
Ad valorem property tax for voter-approved debt	Property owners	Potential for significant funding	Requires two-thirds approval of district's registered voters
Parcel tax	Property owners	Can be regional in scale Flexible use	Requires two-thirds approval of district's registered voters Flat rate is regressive
Tax-increment financing (TIF)	Property owners	Not subject to Proposition 13* limitations	Issuance of TIF bonds requires 55% voter approval in district Requires redirecting future property tax revenue Dependent on anticipated increases in value; limited for highly built-out areas Requires district property owners to voluntarily allocate increment to the district
Mello-Roos tax	Property owners	Low approval thresholds for new development Boundaries do not need to be contiguous Tax could be based on relative risk-reducing benefits	If more than 12 registered voters, requires two-thirds approval of district's registered voters
Other taxes (e.g. sales, gas, hotel, utility users, business license)	Residents, businesses, visitors	Typically general taxes, which require only a simple majority for cities and counties to levy (less than two-thirds threshold for special taxes) or two-thirds of legislature for state general taxes	Can be regressive
Fees			
Property related fees: water, stormwater, and wastewater fees	Users	Majority protest threshold for publicly owned utilities is lower than other voter approval thresholds Privately owned water utilities are exempt from Proposition 218* (these deliver water to roughly 20% of the state's residents) Not considered a tax under Prop 26*	Publicly owned utilities subject to Proposition 218; Finds raised must directly support operations and dates cannot be tiered to address affordability issues Private utilities' rate setting is regulated by California Public Utilities Commission
Non-property-related fees: gas, electric	Users	Not subject to Prop 218* No voter approval required, not considered a tax under Prop 26*	Funds raised must directly support operations; Rate setting regulated by CPUC for privately owned utilities or by elected boards for publicly owned utilities
Developer impact fees	Developers, Property Owners	Can be used to ensure new development is resilient No voter approval required; not considered a tax under Prop 26*	Ties to market conditions which are often cyclical and difficult to forecast Requires new development/major redevelopment to manifest resilience at a meaningful scale

Other user fees (e.g. transit fares, tolls)	Users	Fees charged to those who use and benefit from the services	Participation of disadvantaged and vulnerable communities may be limited without affordability programs
In lieu fees	Developers, Property Owners	A mitigation sponsor collects funds from permittees in lieu of providing permittee-responsible compensatory mitigation required under a regulatory program. The sponsor uses the funds pooled from multiple permittees to create one or more sites to compensate for aquatic resource functions lost as a result of the permits issued.	Requires new development/major redevelopment to manifest resilience at a meaningful scale. Increased cost to coastal landowners and developers
Sand/Recreation Mitigation Fees	Developers, Property owners	Fees are placed on permit applicants for coastal development and/or coastal armoring projects to compensate the public for lost recreation opportunity. These fees could be used for sediment management.	Requires new development/major redevelopment to manifest resilience at a meaningful scale. Increased cost to coastal landowners and developers
Lease fees	Businesses	Lessees of state lands pay a fee associated with their lease application. These fees could be used for sediment management.	Increased costs to businesses
Private Involvement			
Business Improvement districts	Businesses, consumers	Useful for district-wide infrastructure that could benefit from economics of scale (e.g. stormwater infrastructure) Contributes private revenues to public or shared goods	Limited revenue generation Require contiguous boundaries
Enterprise revenues (e.g. naming rights, concessions)	Businesses	Contributes private revenues to public good Effective for funding operations and maintenance expenses	Limited revenue generation Commercialization of and less public control over public space
Incentives (e.g. exemptions, discounts)	Businesses, Developers, Property Owners	Encourages investment that may not otherwise occur	Jurisdictions forfeiting potential revenue sources
Community benefit agreements	Businesses, Developers, Property Owners	Can involve communities in the planning and development process	Can be time and resource intensive to adequately determine and address community needs and negotiate between key players
Regulations (e.g. building codes)	Businesses, Developers, Property Owners	Passes upfront costs to the private consumer, placing less burden on the public to invest in adaptation needs/disaster bailouts Institutionalizes building standards that account for future risk	Requires regulatory action by appropriate state agency Can deter development
Financing tools			
Bonds			
Municipal bonds (general obligation bonds, revenue bonds)		Commonly used	Subject to voter approval requirements

Private activity bonds	Encourages private sector participation	Limited application and amount
Pay for success financing (social impact bonds, environmental bonds)	Transfers risk of achieving intended outcomes from public sector to private sector	Limited use to date Significant monitoring and evaluation required
Green bonds	Social impact investor appeal Publicizes commitment of spending towards environmental purposes	Limited use to date Lack of standardization of what it means to be "green" Administrative complexity
Insurance linked securities (catastrophe bonds, resilience bonds)	Less or no correlation with markets adds investor appeal	No resilience bonds as of 2017
Loans		
Federal loans	Commonly used Applicable dedicated loans for transportation and water infrastructure	Dependent on authorization from Congress
Revolving loan funds	Dedicated state programs focused on water and infrastructure programs	Sustainability of programs dependent on loan repayments
Program related investments (PRIS)	Flexible application	Requires alignment of philanthropic goals with adaptation and resilience

*Key California Legislation:

California Proposition 13 (1978): People's Initiative to Limit Property Taxation

This is one of the most significant and long-lasting pieces of legislation in California's history, especially when it comes to property taxes and public funding. It was passed by voters in June 1978 and drastically changed how property taxes are assessed and collected in the state. Proposition 13 limits property tax rates to 1% of a property's assessed value, plus any voter-approved local taxes or assessments. Properties are assessed at their purchase price, not current market value. The assessed value can increase by no more than 2% per year, regardless of how much the property's market value rises. Property is only reassessed to market value when it changes ownership or undergoes significant improvements.

California Proposition 218 (1996): "Right to Vote on Taxes Act"

This is a constitutional amendment approved by voters and significantly changing how local governments levy taxes, assessments, fees, and charges. Its purpose is to protect taxpayers by requiring voter approval for certain local government revenue increases and to limit how local agencies impose property-related charges. Key provisions are that general taxes (used for any purpose) must be approved by a majority vote of local voters in general elections and that special taxes (for specific purposes) require a two-thirds voter approval. It applies to cities, counties, and special districts. The legislation also restricts assessments, requiring that local governments must clearly identify the specific benefit to the property and notify property owners and allow a protest ballot procedure (a majority protest can block the assessment). No

assessments are allowed for general public benefits—only for specific, direct benefits to the property. Finally, the legislation required that property-related fees and charges must be proportional to the cost of service provided to the property, can't be used to fund general government services (e.g., police or fire), and that for services like water, sewer, and refuse collection, a majority protest process applies. Some fees may also require a majority vote of property owners or two-thirds voter approval.

California Proposition 26 (2010): Supermajority Vote for Certain Taxes and Fees

This proposition sought to amend the California Constitution to require a two-thirds supermajority vote in the legislature to impose certain new taxes and fees, including those labeled as "fees" but intended to generate revenue. The proposition was approved by voters, thereby raising the threshold for imposing certain taxes and fees. It reclassified certain fees as taxes, thereby subjecting them to the two-thirds legislative approval requirement. It potentially increased the difficulty for local governments to impose or increase fees for services, as these would now require a supermajority vote.

This list is an excellent summary of the variety of funding categories available for climate adaptation in the state. It can be used as a starting point to assess and weigh options as funding opportunities are considered. Importantly, in November 2024, **California Proposition 4** was passed, which allowed the state to issue $10 billion in general obligation bonds to fund climate and water projects. The Proposition 4 funding will be well aligned with BEACON's mission of using sediment management to address erosion concerns as it includes funding for coastal resilience and sea level rise, flood planning, and nature-based solutions (Figure 20).

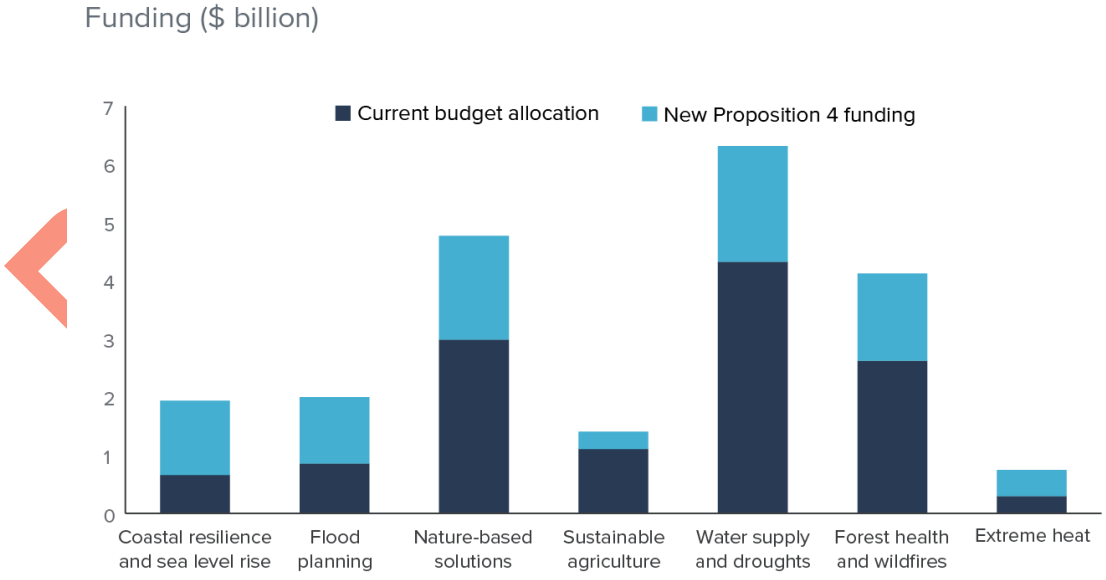


Figure 20 Proposition 4 funding categories. Source: Public Policy Institute of California.

As an overarching concept, funding sources should be matched to the demands or costs both in terms of scope and timing. The funds should be spread across as large a number of sources or payees as possible. They should have sufficient longevity, or through investment allow for streams of ongoing funding, such that capital repayments and operational and maintenance costs can be covered over the entire life of the project. They should also align the beneficiaries of a given project with the means of raising revenue, noting that there may be multiple beneficiaries of the same project. For example, cleaning of debris basins may reduce inland flooding, while also providing finer sediment for raising elevations near the shoreline to reduce flooding there, or provide sand for beach replenishment. Financing mechanisms should also be equitable. It should be noted that even with ad-valorem taxes that are equitable in principle, the increases in property values in coastal regions of California over the past decades have created a class of long-term residents who are asset-rich, but do not have sufficient free capital resources for additional fees and charges.

To weigh the pros and cons of various funding and financing options, multi-criteria decision analysis frameworks can be used. This process involves developing a list of criteria and evaluating the strength of each option on the criteria to ultimately come up with a weighted score for each option. For example, Keenan (2019)developed a useful framework for selecting which funding strategy or strategies to pursue for climate adaptation in, shown in Table 21.

Table 21 Example of weighted scoring of funding strategies for climate adaptation based on pre-determined criteria, adapted from (Keenan, 2019)(Keenan, 2019)(Keenan, 2019)(Keenan, 2019).

Rank	Funding strategy	Source of funds	Revenue generating potential	Cost of funds	Long-term sustainability	Flexibility of funds	Timing	Trade-offs for other city needs	State/federal political feasibility	Local/regional political feasibility	Administrative complexity	Equity/Cost burden
1	Local property tax increment from Infrastructure financing districts	4	4	4	5	4	4	5	4	4	5	4
2	Community facilities district	4	4	4	4	4	3	5	4	3	3	4
3	USACE CAP 103 Program	4	4	5	3	3	4	4	5	4	3	4
4	State property tax increment from Infrastructure financing districts	4	4	3	4	4	3	5	3	4	3	4
5	General obligation bonds	4	4	4	4	3	3	2	4	3	4	5
6	Cal-and-trade program funding	4	4	4	3	3	4	3	3	3	4	4
7	State resilience general obligation bond	4	4	4	4	3	3	5	3	3	5	4
8	State sales tax increase	4	4	4	4	4	3	1	4	2	4	3
9	Hotel assessment	4	4	5	3	4	3	2	4	2	5	4
10	Increased parking revenues	4	4	4	3	3	3	2	4	1	4	4

11	Assessment district	4	4	4	4	4	3	3	5	1	1	4
12	USACE general investigation	4	4	4	4	3	1	3	3	3	2	4
13	Philanthropy	4	2	4	2	4	2	5	4	4	4	4
14	Historic tax credits	4	3	4	2	1	3	4	4	4	5	4
15	Tax/fee on marina use	4	1	4	4	4	4	3	4	1	4	4
16	Cruise tickets surcharge increase	4	1	3	4	4	3	4	4	5	4	4
17	Advertising	4	1	2	3	4	4	4	4	2	4	4
18	RM3 bridge toll funding program	4	4	4	4	3	2	1	1	2	3	3
19	Vehicle license fee increase	4	3	3	2	4	3	1	4	1	4	4
20	Parcel tax	4	3	4	2	4	3	2	4	2	4	1
21	Naming rights	4	1	4	2	4	5	5	4	2	3	4
22	Congestion pricing	1	4	3	4	3	2	2	2	1	1	2
23	Public-private partnership	4	5	1	3	4	3	4	5	1	3	2
24	Utility user tax surcharge	4	3	2	3	4	2	1	3	1	5	3
25	Transit impact development fee	3	1	1	3	2	4	1	4	2	5	4
26	Transportation funding	3	5	3	3	3	1	2	1	3	1	5
27	Real estate transfer tax increase	5	3	3	3	3	3	1	4	1	1	3
28	Surcharge on event tickets	4	1	1	3	5	3	2	4	1	4	3
29	Environmental impact bonds	2	1	3	2	5	2	2	4	2	2	4
30	Sale/lease increment of port assets	3	2	3	5	4	2	1	1	1	3	4
31	Regional gas tax	4	5	1	1	3	2	1	2	1	2	2
32	Increased ferry charges	4	1	1	2	5	2	3	2	1	4	3
33	Hazard mitigation grants	2	1	3	1	1	1	3	1	3	4	2
34	Pension plan investment	3	3	3	1	5	1	2	1	2	2	3
35	Geologic Hazard Abatement Districts	3	1	1	3	5	1	5	3	1	1	4
36	Infrastructure trust bank	5	2	1	1	3	2	2	1	1	1	5
37	Transit pass transfer fee	1	1	1	1	1	1	1	1	1	1	1

integral

38	Resilience bonds/ insurance value capture	1	1	1	1	1	1	1	1	1	1	1

5.3 BEACON CASE STUDIES OF INTEGRATED RSMP AND ADAPTATION PLANNING

This section is divided into two sections, case studies and opportunities. The case studies section includes the successful managed retreat project at Surfers Point, some summary of the lessons learned and successes at Goleta Beach, and Carpinteria. The opportunities in the BEACON region are vast, and this section will discuss a few of the opportunities ahead.

5.3.1 Surfers Point Living Shoreline

The Ventura River mouth, famous for its popular surf break, has experienced a receding shoreline at an average rate of 1.5 ft per year since the late 1990s causing degradation of a bike path owned by the State and a parking lot owned by the County. This deteriorating infrastructure became a safety hazard, so in 1995 the City of Ventura began developing plans restore the beach. The Surfers' Point Managed Retreat Project was created in 2005 after years of negotiation and coordination by city planners, state and local organizations. The project involved relocating the degraded bike path and parking lot, establishing a 65-foot retreat zone, and restoring a natural beach area. Cobbles from Santa Paula Creek and sand from Calleguas Creek and Pierpont dunes were used to retreat the parking lot, widening the beach and build dunes. Vegetation was planted and maintained largely by volunteers.

The City of Ventura also engaged in beach renourishment and planted sand dunes with natural vegetation with the help of local volunteers. Seeds were harvested from nearby Emma Wood State Park. Management of Surfers' Point is currently carrying out Phase 2 along the eroding downcoast section that expands the Phase one design by realigning the bike trail and retreating the parking lot then restoring cobbles, and sand to recreate dunes with bioswales to capture and filter storm water runoff and reduce erosion.

The project required permits from the California Coastal Commission, a Coastal Development Permit (CDP), and permits from the US Army Corps of Engineers and the Central Coast Regional Water Quality Control Board. It also included significant dialogs (and an MOU) with Ventura County Fairgrounds who controlled/managed the ocean front parking lots and have allowed the space to allow the relocation and realignment of the parking lots and bike path and make room for the cobble and dune living shoreline.

Phase one cost a total of about $4.5 million, with $1.6 million provided by the California Coastal Conservancy. Phase two has an estimated cost of $18 million, with $16.2 million provided by the California Coastal Conservancy (venturariver.org).

Figure 21 Aerial imagery of Surfers Point in Ventura before and after the managed retreat project. Source: https://www.climate.gov/news-features/climate-case-studies/restoring-surfers-point

Figure 22 Surfers Point, effectiveness of living shoreline with and without dunes in the kite boarding area during a large storm wave event in 2015. Photo courtesy Paul Jenkin.

5.3.2 BEACON South Central Coast Beach Enhancement Program

The BEACON SCCBEP program was an opportunistic sediment management program that allowed for the deposition of suitable upland or offshore materials onto selected beaches in Santa Barbara and Ventura Counties. Examples of upland materials sources included debris basins, private and public construction projects that generate excavated material, and sand acquisition from sand quarries. Examples of offshore material sources were dredging from Santa Barbara Harbor and offshore borrow sites. The program covered five beaches to potentially receive such material. The selected beaches were:

- Goleta Beach (Santa Barbara County)
- Ash Avenue Beach (City of Carpinteria)
- Oil Piers (County of Ventura)
- Surfers Point (City of Ventura)
- Port Hueneme Beach (City of Port Hueneme)

In July 2002, BEACON certified a Mitigated Negative Declaration environmental document for SCCBEP. The SCCBEP included multiple permits including:

- Federal: US Army Corps of Engineers; USFWS for all beaches
- State: CA Coastal Commission; CA State Lands Commission; Regional Water Quality Control Board (RWQCB) for all beaches

- Local: City Permit – Port Hueneme for Port Hueneme Beach; City Permit – Carpinteria for Ash Avenue Beach; County Permit – Santa Barbara for Goleta Beach; City Permit – Ventura for Surfers Point Beach.

The planning and permitting phase of the SCCPEB covered more than five years (2000-2005), and was funded by CA Department of Boating and Waterways and a federal grant to complete environmental documents, designs for sand placement on beaches and securing permits to allow the placement of predetermined maximum quantities of sand per year, on each of the listed beaches. The implementation phase of the SCCBEP allowed for placement of suitable opportunistic material on the permitted beaches during the five-year permit life (2005-2010). During this time two pilot projects were implemented.

- November 2005 approximately 3000 cubic yards of sando from Santa Barbara harbor West beach was placed on Goleta beach
- 2010 approximately 50,000 cubic yards of sand from the Santa Barbara harbor was backpassed to Goleta beach. About 1/3 of that sand was trucked from West beach and the remaining 2/3 barged from the Santa Barbara harbor.

The original permit was never renewed or extended past the initial five years.

5.3.3 Goleta Beach County Park Slough and Beach

Goleta Beach has been eroding for many years Beginning in the 1997 to 1998 El Nino and progressing for several years resulting in a complete armoring Goleta beach. By the mid 2010s, there was little to no beach fronting Goleta beach county park.

At the same time, Goleta Slough has been trapping sediment both due to a combination of many factors, both human and climate related. Santa Barbara County flood control district and BEACON have made many efforts to place sediments on Goleta beach to reduce flooding in the Slough and beach erosion.

The Santa Barbara County Flood Control District has several permits (Permit: 4-21-0379) for an ongoing sediment removal and flood carrying capacity improvement program for Los Carneros and Tecolotito creeks within the upper Goleta Slough area, and a five-year permit from 2012 – 2017, followed by a ten-year extension through 2027 (Permit: 4-11-069) for removal of sediment from the lower reaches of Atascadero Creek, San Jose Creek, San Pedro Creek, and the main channel of Goleta Slough on an as-needed basis. The stated purpose of the program is to maintain existing flood water carrying capacity in the two creeks to reduce potential flooding of adjacent developed areas, residences, roadways, and the Santa Barbara Airport, and to provide sediment for beach nourishment. Sediment is tested and all suitable excavated sediment is placed in the surf zone at Goleta Beach County Park. If the sediment

does not meet testing criteria, it is taken to an upland disposal site either outside of the coastal zone or at a site within the coastal zone permitted to receive such fill.

5.3.4 Thomas fire debris flow disaster and sediment management

In December 2017 the Thomas Fire engulfed the hills upslope from Santa Barbara and Montecito. In January 2018, torrential rain spurred debris flows that took 23 lives in Montecito, filling and overflowing regional debris basins. In the years following the Thomas Fire, debris basins were emptied and sediment was placed on Goleta Beach and Ash Avenue in Carpinteria to maintain storm preparedness and reduce flood risk levels. These placements were done under emergency permits but generally followed the South Central coast beach enhancement project. The difference in the sediment placement at each beach showed the benefits of regional sediment management projects.

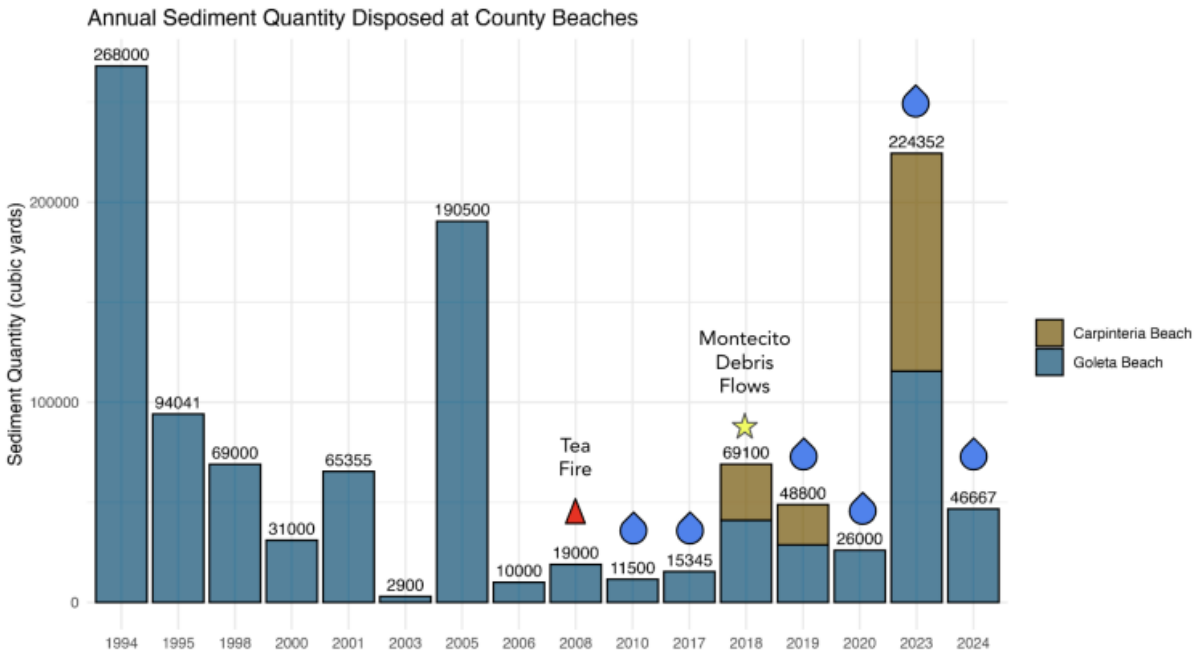


Figure 23 Adapted from Finding Balance in Our Managed Beaches: Policy Recommendations to Mitigate Emergency Sediment Disposal Impacts in Santa Barbara County (Bren report 2025) Copy of DebrisEase Final Report. From data provided by SBCFCD, the annual sediment quantity (in cubic yards) disposed at Goleta Beach and Carpinteria from 1994 to 2024 is visualized in a bar graph. The red triangle represents a fire event, blue raindrops indicate years with heavy precipitation events, and the 2018 Montecito debris flows are signified with a yellow star.

5.3.4.1 Goleta Beach

Placement of Montecito debris flow cobbles and sediments were placed in a cross shore delta, mimicking a natural flood deposit that served to retain sand moving along the coast and restoring a sandy beach to what had previously been backed only by a revetment.

Figure 24 Images of the sediment deposited at Goleta Beach from the Montecito debris flow.

Figure 25 Aerial image of Goleta Beach 2/19/2016 showing eroded conditions.

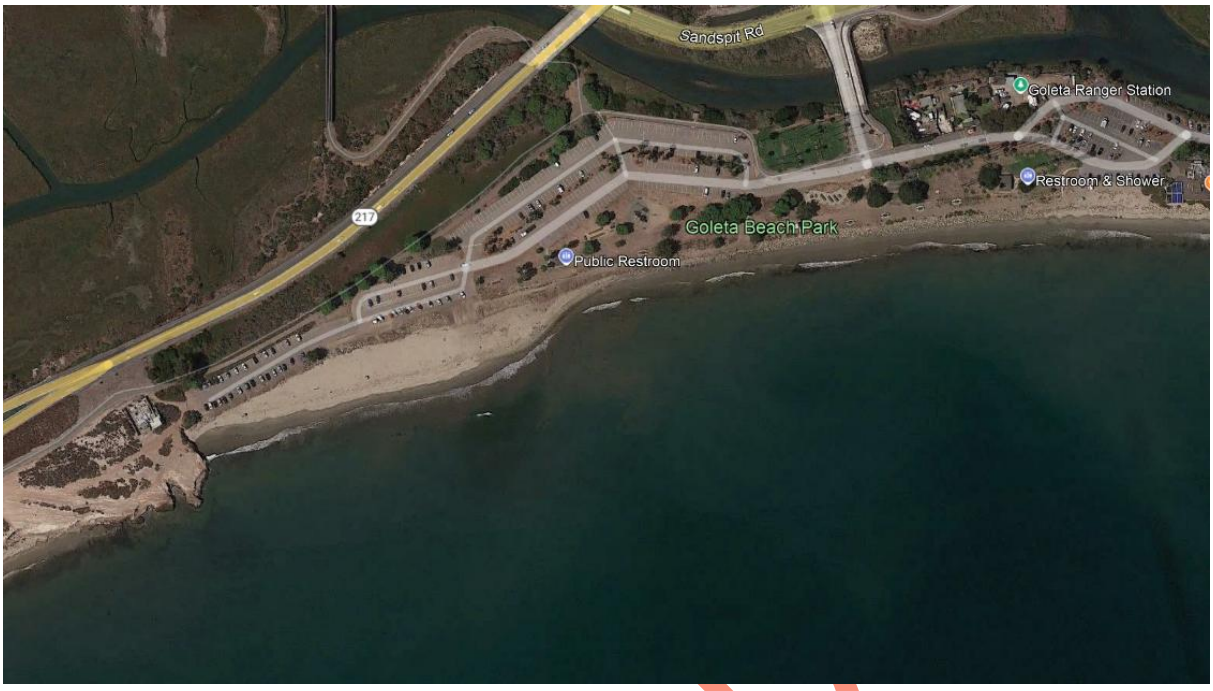


Figure 26 Aerial image of Goleta Beach on 8/19/2019 showing effectiveness of cobble groin at retaining sand.

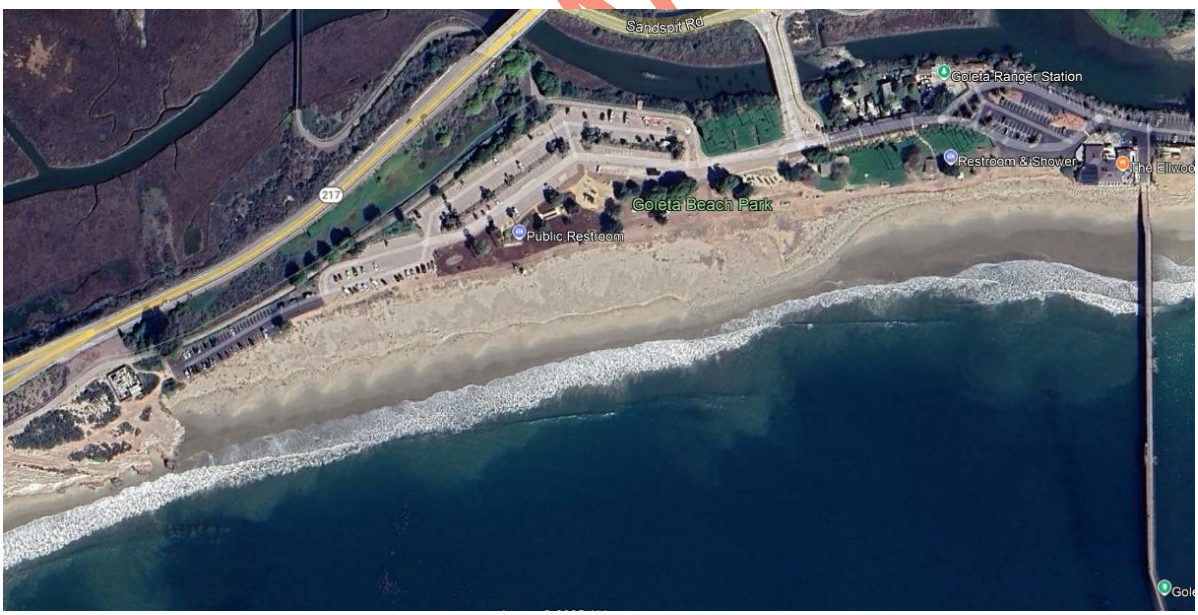


Figure 27 Aerial image of Goleta Beach on 2/23/2025 showing continual effectiveness of additional cobble placement as part of county flood control maintenance operations with the cobbles at beach migrating down coast.

5.3.4.2 Goleta and Carpinteria Debris Basin Sediment Placement and Coastal Plume Study

In response to the 2018 Montecito debris flows, Santa Barbara County conducted emergency beach nourishment at multiple locations, including Carpinteria Beach (Ash Avenue) and Goleta Beach, placing a combined total of over 65,000 m^3 of sediment sourced from upstream debris basins. These actions were conducted under emergency permits to expedite debris removal and reduce inland flood risk.

At Carpinteria, approximately 20,000 m^3 of material was placed—comprising ~14,000 m^3 of fine-grained sediment and ~6,000 m^3 of coarser material. At Goleta Beach, roughly 45,000 m^3 of mixed-grain sediment was deposited. In both cases, sediment was delivered by truck and spread across the upper intertidal and back beach zones.

Warrick et al. (2025) documented these placements through an extensive monitoring campaign involving aerial imagery, in-situ turbidity sensors, and numerical modeling to evaluate plume behavior and sediment transport. The study confirmed that:

- Fine-grained sediment formed distinct coastal plumes that dispersed rapidly—typically within one to two tidal cycles.
- At Carpinteria, the plume traveled south-southeast and offshore within hours of placement, with dissipation observed within 24 hours.
- At Goleta, sediment plumes were larger in scale due to higher volumes and wave exposure, yet still short-lived, with no sustained turbidity exceedances observed.
- Coarse-grained fractions contributed to temporary beach accretion near both placement sites, though long-term retention was not evaluated.

Water quality impacts were minimal and short in duration. The monitoring demonstrated that, when managed appropriately, debris basin sediment can be reused for coastal nourishment with low environmental risk. This study provides critical evidence that routine flood sediment removal practices could be aligned with sediment management and beach resilience strategies, especially when supported by rapid sediment characterization and interagency coordination. beach resilience strategies, especially when supported by rapid sediment characterization and interagency coordination.

Figure 28 Image of sediment debris flow placement at the end of Ash Avenue in Carpinteria

5.3.5 Santa Barbara County Debris Basin Best Practices Manual

The **BEACON Debris Basin Best Practices Manual (December 2024)** offers guidance for planning, designing, and maintaining debris basins in Santa Barbara County, especially in areas affected by wildfire and steep terrain. It focuses on how to better protect communities from flooding and debris flows while also allowing natural processes—like sediment flow to beaches and fish passage—to continue. The manual highlights the importance of thoughtful site selection, basin design that mimics natural stream conditions, and regular maintenance. It also encourages collaboration with regulatory agencies early in the design process and suggests funding options from FEMA and California state OES programs.

The manual includes detailed case studies of four debris basins that have already been retrofitted to improve their performance and reduce environmental impacts:

- **Cold Springs Creek** (retrofit completed in 2024)
- **Gobernador Creek** (retrofit completed in 2008)

- **Maria Ygnacio Creek** (retrofit completed in 2019)
- **Romero Creek** (retrofit completed in 2022)

Each retrofit project aimed to improve sediment transport, reduce the chance of flooding, and allow fish and other wildlife to move through the creeks more easily.

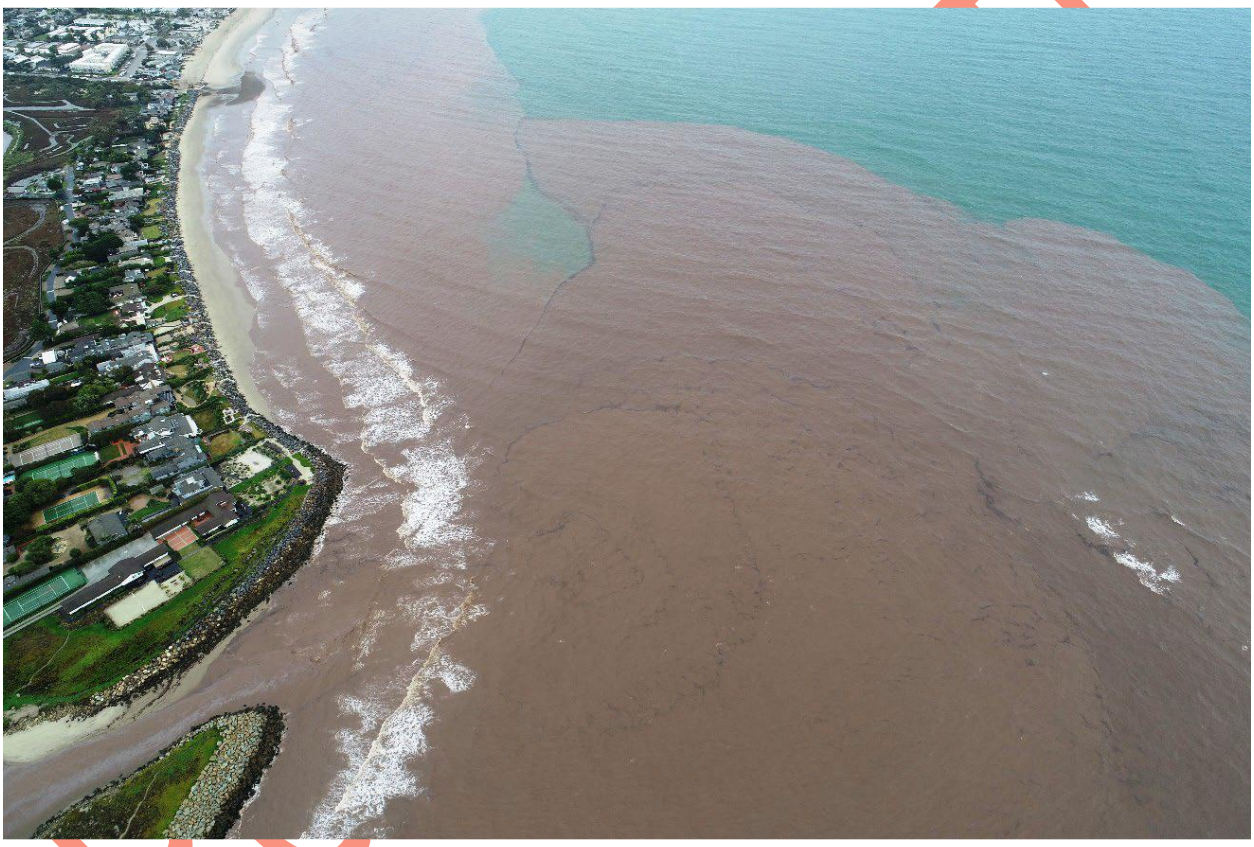


Figure xx. Sediment Transport to Downstream Beaches post rain event

Source: Santa Barbara County Flood Control District 2019

5.4 OPPORTUNITIES

5.4.1 Matilija Dam Removal

The Matilija Dam, on the Ventura River, located in Ojai California, was built to provide water supply, but has been non-functional for decades due to sediment build- up behind the dam, which has impounded 9 million cubic yards of sediment (fines, sand, and cobbles). In 2004, a proposal to remove the dam was approved, and years later, in 2016, the Design Oversight Group agreed on a new project approach for sediment management: transport of all sediment downstream to support beach replenishment. Under the current proposal, the Matilija Dam removal will be completed in phases, starting as early as 2030.

First, improvements for flood protection and future sediment transport will be established downstream of the dam. These improvements include replacing bridges over the river to allow for higher peak flows. Then, initial dam removal activities will prepare the dam and upstream reservoir for initial sediment release. During the dry season, two 12-foot diameter tunnels will be drilled through the base of the dam near the pre-dam creek channel. The tunnels would be opened just prior to a large storm event, which must be sufficient in magnitude and duration to move millions of cubic yards of stored sediment from behind the dam downstream to the Ventura River, estuary, and Pacific Ocean. This initial flush is expected to result in an initially restored creek channel through the dam area and reservoir sediments. The continued transport of fine sediment and the somewhat slower transport of coarser sediment deposits that have accumulated in the reservoir will occur next. Modeling (by Integral), shows what we would expect fine grained material moves through the system quickly, sand in a few years, and cobbles in a few decades.

Once an adequate quantity of sediment has been flushed from the dam site, the dam will be removed in one season by lowering it incrementally. After dam removal, continued sediment transport will continue. Habitat restoration will be accomplished by managed natural recruitment and non-native plant control. The removal plan will be accompanied and followed by monitoring.

Funding for the Matilija Dam removal has been received as grants over the past eight years. Table 22 details dates, funders, and amounts of recent grants. Most project funding has been from organizations associated with wildlife (WCB, NFWF, CDFW, SCC) due to the historic presence of southern steelhead, an endangered species, in the Matilija Creek watershed (a tributary to the Ventura River). In the mid 1900's, it was estimated that 3000 – 6000 southern steelhead occupied the larger Ventura River basin and current estimates hover in the single digits. While dam removal has sediment management implications, the funding history of this project illustrates that ecosystem-based habitat restoration projects may have a variety of co-benefits, opening up funding sources beyond those traditionally associated with sediment management.

Table 22 Funding sources for components of the Matilija Dam Removal project. From Venturariver.org (not exhaustive).

Dec 2016-2020	Resources Legacy Fund/Open Rivers Project		$707,500
May 2017	California Department of Fish and Wildlife	65% Design Planning Project	$3,300,504
Sept 2017	National Fish and Wildlife Foundation	Estuarine and Coastal Modeling	$278,002
May 2019	California Department of Fish and Wildlife	Santa Ana Bridge Replacement	$13,426,938
May 2020	California Wildlife Conservation Board	Design	$5,025,000
March 2021	State Coastal Conservancy	Camino Cielo Bridge Design/CEQA	$735,000
2017 - 2021	NGO	Strategic Project Support	$1,426,000
February 2023	California Wildlife Conservation Board	Design	$4,300,000

Figure 29 Matilija Dam. Source: Ventura County Star

5.4.2 Carpinteria Living Shorelines

To protect its coastline from risks associated with sea-level rise, flooding, and erosion, the City of Carpinteria has undertaken the Carpinteria Living Shorelines Project. The project aims to implement a nature-based flood defense along the city beach to increase shoreline resilience and protection. The project proposes to utilize vegetation, sand and cobbles to nourish the existing beach and create a dune system along the beach to serve as the first line of defense during a large storm event. Several potential sediment sources are identified in the report. Past research (BEACON 1989) has identified the location, quantity and quality of sand offshore from Goleta Beach County Park, Santa Barbara East Beach, Carpinteria City Beach, and the Santa Clara River delta. Additional sand may be available from the mouth of the Carpinteria Creek.

Sediment from channels and debris basins within the Carpinteria Marsh may also be available. Foothill debris basins may also be used as sources – currently, they are emptied into landfills, but with the necessary permits, such material could be used for construction in the living shorelines project. Finally, opportunistic use of sediment derived from local construction projects is also identified as a potential source. This work is supported by a $1.62 million grant from the California State Coastal Conservancy. This project is considered an adaptation project that may require ongoing maintenance. Connecting the routine flood control sediment management practices with this longer term adaptation strategy would be an excellent example of integrating RSM with adaptation.

5.4.3 Oil Piers artificial reef

The Oil Piers Artificial Reef is a proposed project by the U.S. Army Corps of Engineers to address beach erosion that intensified following the removal of the historic Oil Piers near Rincon Island. The original pier structure had served to reduce wave energy and trap sediment, helping to maintain beach width in a naturally sediment-limited area. In response to public concern over the resulting erosion and loss of surfable waves, the proposed artificial reef aims to replicate the sediment retention and wave-modifying functions of the groin using a submerged rock or reef structure. Notably, the project concept integrates surf recreation enhancement with coastal protection, seeking to improve surf recreation while reducing beach loss. A recreational surf break was explicitly included as part of the reef's design objectives, reflecting growing interest in multi-benefit coastal infrastructure. Although project development has stalled, the Oil Piers Artificial Reef remains a potential pilot study in sediment management that balances engineering, ecology, and recreation.

5.4.4 Mugu Submarine Bypass

Mugu Canyon is a submarine canyon in California, on the northern border of the Zuma Littoral Cell and the southern border of the Santa Barbara Littoral Cell. The Zuma littoral cell extends from Hueneme Canyon in the west to Point Dume in the east (Figure XX). The main sediment supplies in the Zuma Littoral cell include sea cliff erosion and sediment delivered from small streams in the Santa Monica Mountains. Historically, sand migrated across the head of the Mugu Canyon into the Zuma Cell from the Santa Barbara cell. However, the canyon headwall has migrated landward in recent years, leading to an increase in sediment lost into the Mugu Canyon, which now captures all the send leaving the Santa Barbara cell, and resulting in a narrowing of downcoast beaches (Griggs and Patsch 2018), including narrowing of Zuma Beach which is heavily trafficked and one of the most visited beaches in the region. Continuous nourishment with sediment otherwise lost into the Mugu Canyon has been suggested as a possible solution to erosion which is expected to accelerate with sea level rise. Research

suggests that the minimum amount of sediment needed for nourishment to mitigate erosion over the next 55 years is roughly equivalent to the amount of sediment that can be sustainably captured from Mugu Submarine Canyon without accelerating headwall erosion (Vruggink 2025). This could be executed through a sand bypassing system at the mouth of the Submarine Canyon, which is being explored as a possible solution by sediment managers in the region.

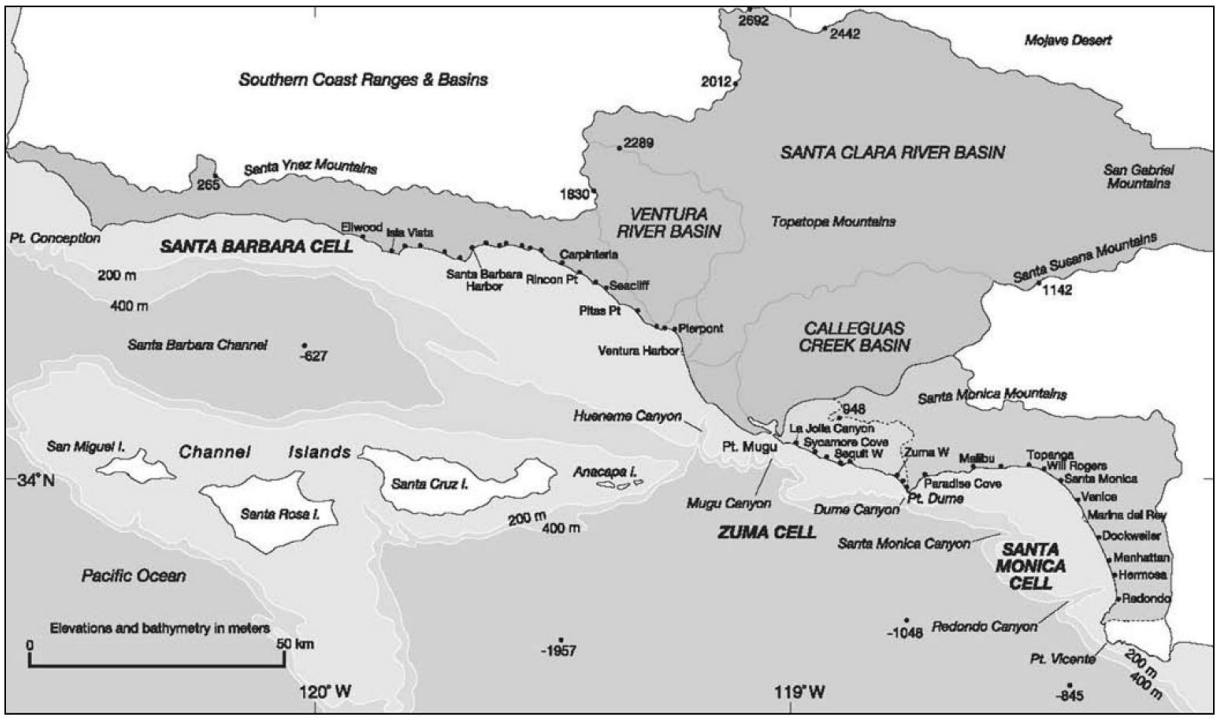


Figure 30 Southern California littoral cells and watersheds including the Mugu Canyon and Zuma Littoral Cell (from Zoulas and Orme, 2008)

6 DISCUSSION

A range of topics emerge from the RSMP and climate document analysis, interviews and Integral's background knowledge and research. We separate them into three themes of collaboration and coordination, project implementation, and funding and support.

6.1 COLLABORATION AND COORDINATION

An over-arching finding of this work is that coordination and collaboration between local and state agencies and local and state regulations and planning documents can facilitate improved regional sediment management. This can involve leveraging state regulations for RSMP in local documents and plans, coordinating across local planning documents, and streamlining the permitting and funding processes. The survey results called for coordination on the key topics of funding and permitting. Respondents mentioned the need to develop "regional funding coordination to support projects throughout Southern California" and an "interregional collaboration group to advocate for more funding." Respondents also mentioned the need for a "region wide regulatory permitting to allow for cross boundary actions like beach replenishment, off shore sand sourcing, and better river sediment management upstream (to improve sediment flow downstream)". These comments support the finding that improved interjurisdictional collaboration and cooperation could support regional sediment management activities. Survey respondents also mention the need for integrating ecology into RSMP, supporting the finding that intra- and inter-agency collaboration is needed in addition to cross-jurisdictional collaboration. To effectively manage sediment as climate change progresses, planners, engineers and ecologists need to talk to each other and co-develop projects and plans.

6.1.1 California Coastal Act Section 30233(b) and 30233(d)

Part B of Section 30233 from the California Coastal Act states:

> "Dredging and spoils disposal shall be planned and carried out to avoid significant disruption to marine and wildlife habitats and water circulation. Dredge spoils suitable for beach replenishment should be transported for these purposes to appropriate beaches or into suitable longshore current systems."

Part D of Section 30233 states:

> "Erosion control and flood control facilities constructed on watercourses can impede the movement of sediment and nutrients that would otherwise be carried by storm runoff into coastal waters. To facilitate the continued delivery of these sediments to the littoral zone, whenever feasible, the material removed from these facilities may be placed at appropriate points on the shoreline in accordance with other applicable

provisions of this division, where feasible mitigation measures have been provided to minimize adverse environmental effects. Aspects that shall be considered before issuing a coastal development permit for these purposes are the method of placement, time of year of placement, and sensitivity of the placement area."

These parts of the Coastal Act, written in 1972, have already laid the groundwork for integrating beneficial reuse of suitable dredge and flood control sediment into Local Coastal Plans. However, the degree to which planning documents reference and leverage this part of the Coastal Act is inconsistent. Across the 130 documents provided by the Client, Section 30233 is referenced in eleven of them. Across these eleven documents, Section 30233 is mentioned in the following contexts:

- **2009 Goleta Parks Monitoring Report**: Requests a coastal development permit to use dredge materials on Goleta Beach, and references 30233(b) as justification
- **1982 Santa Barbara LCP:** Section 30233 present but subsection (d) not specifically referenced
- **2015 Santa Barbara Harbor Dredge Federal:** Permit to put dredge from SB Harbor in West Beach instead of offshore and states that doing so is more cost effective and in compliance with Section 30233.
- **2016 Santa Barbara Harbor Master Plan**: Mentions that dredging West Beach to replenish downcoast beaches is consistent with 30233.
- **2019 SB Complete Certified LUP**: Restates the CCA text in policy 4.1-8
- **2019 SB City LCLUP Update:** "All diking, dredging, and filling activities shall conform to the provisions of Sections 30233 and 30607.1 of the Coastal Act…When feasible, spoils should be deposited in the littoral drift, except when contaminants would adversely affect water quality or marine habitats, or on the beach". This is focused on protecting against poor quality sediment rather than utilizing high quality sediment.
- **2019 SB County Coastal Hazards**: includes the CCA policy at the beginning of the document
- **2022 Santa Barbara Copy of F6a**: Approval of Santa Barbara Harbor dredge to be used for beach nourishment as it is in alignment with 30233a and b
- **2017 Ventura County Coastal Area Plan:** Mentions that projects within 100 feet of a wetland may be required to carry out the provisions of Section 30233 (b and c)
- **2018 Ventura Harbor Dredge**: Presents a plan to use a dredge to place on beach in compliance with Section 30233.

- **Ventura County 2021 Coastal Area Plan**: Mentions the policy but does not describe how Part b can be leveraged for regional sediment management

As LCPs across the state are being updated to incorporate sea level rise and coastal hazards, more specific details should be added to the local policy and will be a crucial nexus to streamlining RSM and adaptation planning as well as the expedite coastal development permits. Comprehensive integration of this Coastal Act Section into regional planning documents may support the development of innovative regional sediment management projects. Furthermore, the language in the Coastal Act could be strengthened to require beneficial re-use of sediments. Presently the Act uses "should" and "may" for sections 30233(b) and 30233(b), respectively, but that language could be changed to "shall" to require such activities. Details could include specific types of sediment and living shoreline projects that would be preferred and thus expedited.

6.1.2 California Cutting Green Tape Initiative

In 2020 the State of California identified "Cutting Green Tape" as a signature initiative to increase the pace and scale of environmental restoration. California has a proud tradition of strong laws that protect our environment from the effects of development and resource extraction. Unfortunately, projects that are beneficial to the environment can be slowed by the same processes and procedures that are designed to protect it. Cutting Green Tape seeks to remedy this problem.

Complex and overlapping permitting processes can result in fewer and smaller actions being taken at a slower pace and a greater expense. Much like the familiar term, "red tape," "green tape" represents the extra time, money, and effort required to get environmentally beneficial work done because of inefficiencies in our current systems. Cutting Green Tape means improving regulatory processes and policies so that this work can occur more quickly, simply, and cost-effectively.

The summary report, *Cutting Green Tape: Regulatory Efficiencies For A Resilient Environment*, made recommendations to streamline the regulatory process for environmental restoration, and one of the recommendations is specifically focused on the coastal zone:

> **Recommendation 11**: Exercise Coastal Commission authorities to advance restoration consistent with efficiencies authorized by SWRCB, CDFW, and CEQA.
>
> **Proposed Solution**: Coastal Commission explores and utilizes efficiencies within their authorities to advance small- and large-scale restoration that are consistent with and/or complementary to existing and planned efficiencies authorized by SWRCB, CDFW, and CEQA.
>
> **Other Considerations and Notes**: A particular consideration in any proposed solution is that the diffuse nature of how the Coastal Act is administered under individually

approved, separate Local Coastal Plans might make it challenging to apply statewide. One alternative that was considered during stakeholder input was to develop new legislation amending the California Coastal Act to exempt habitat restoration projects from the definition of development. This recommendation looks to allowances in the existing statute for projects that do not have a potential significant adverse effect, similar to what is stated in the CEQA Class 33 exemption criteria for small projects. Another alternative was for the commission to consider a coastal development permit exemption for projects meeting CEQA Class 33 criteria. This was advanced as consistent with Section 30610(e) of the California Coastal Act, which states that a permit is not required for a category of development that the commission has found to have "no potential for any significant adverse effect, either individually or cumulatively, on coastal resources or on public access."

This initiative paired with recommendations for leveraging and strengthening Section 30233(b) and 30233(d) of the Coastal Act could potentially ease the permitting burden of RSMP projects in the BEACON region.

6.1.3 Integrating sediment management into local climate planning documents

A reliable and cost-effective source of sediment is critical to the effective implementation of many climate resilience options, particularly nature-based solutions. To date, policy documents such as Local Coastal Plans, Climate Impact Plans, and Local Hazard Mitigation Plans include limited discussion of potential sources of sediment. These plans should all cross-reference the relevant Regional Sediment Management Plan. In some cases, multiple RSMPs may be relevant, as interjurisdictional sediment movement may be the most cost-effective option.

The availability of sediment sources should also be used in the initial feasibility assessment of adaptation options and development of desired futures, to ensure that communities have realistic expectations for the viability of options that are reliant upon sediment availability and delivery costs.

6.1.4 Leveraging existing guidance

The *Efficient Permitting Roadmap for Coastal Sediment Management*, developed by NOAA's National Centers for Coastal Ocean Science (NCCOS) in collaboration with the Office of National Marine Sanctuaries and California State Lands, serves as a comprehensive guide to streamline the permitting process for nature-based coastal resilience projects along the North-central California coast. By consolidating information from federal, state, and local agencies, the roadmap facilitates the application of sediment in projects like dune restoration, which are

essential for combating sea level rise, erosion, and flooding. The guide emphasizes the importance of sediment in enhancing coastal resilience and provides a user-friendly framework to navigate the complex multi-agency permitting landscape, supporting stakeholders in implementing sustainable coastal management practices.

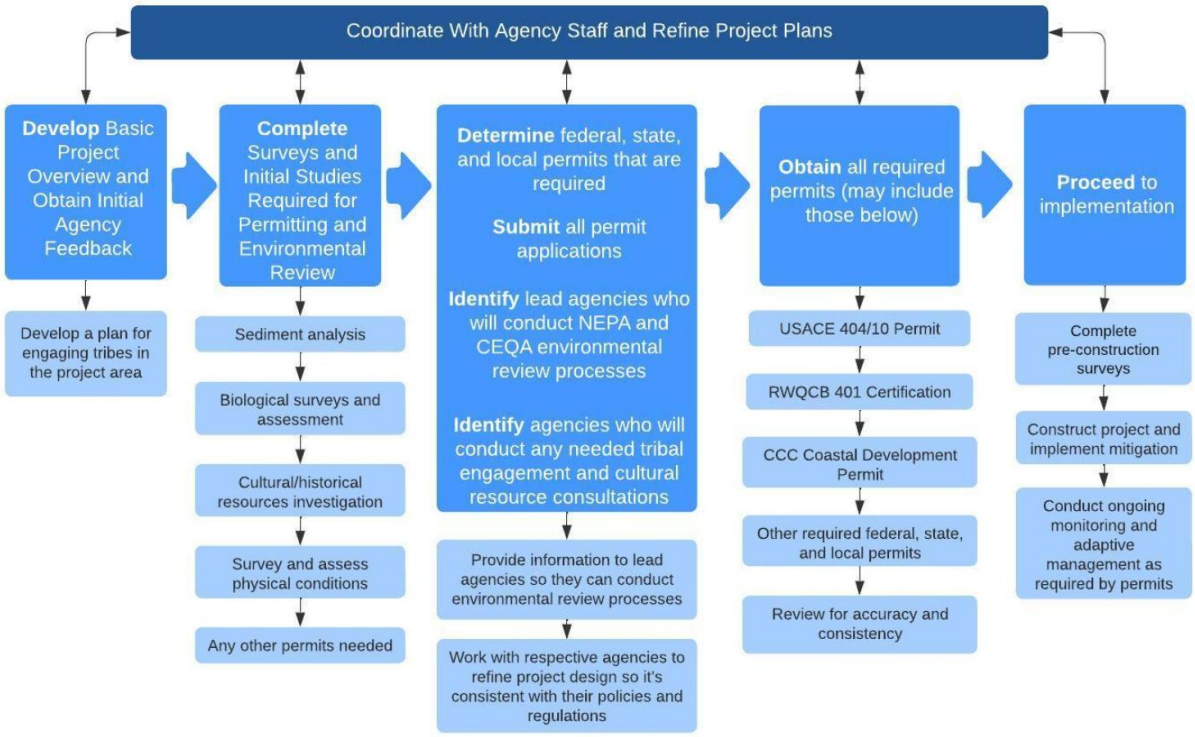


Figure 31 Flowchart depicting an overview of an efficient regulatory process. An overview of the regulatory process from the pre-application stage to formal permit applications to project implementation with the likely steps that will be required by project managers and agencies to complete each phase. NOTE: Project planners are generally responsible for carrying out each step of the process shown below, however, it is the responsibility of specific agencies to lead the environmental review process, initiate tribal engagement, and conduct the necessary consultations (e.g. for potential impacts to listed species, cultural or historic resources, protected habitats, etc.). From The *Efficient Permitting Roadmap for Coastal Sediment Management*, developed by NOAA's National Centers for Coastal Ocean Science (NCCOS) in collaboration with the Office of National Marine Sanctuaries and California State Lands.

6.2 PROJECT IMPLEMENTATION

The RSMP documents all discuss possible projects in a high level, theoretical way. However, many of the plans do not contain roadmaps to accomplish the project, including elements such

as specific funding sources, staff capacity, permitting requirements and jurisdictional coordination. This level of detail will be necessary to implement any project and should be included in the plans.

As evidenced by the RSMPs and climate documents, there is a clear silo separating sediment management and climate planning with several contributing factors. Primarily, the Coastal Sediment Management Working Group, which ultimately created the RSMPs was established in 1999 by the Corps and the California Natural Resources Agency (CNRA).

Navigation is a primary mission of the Corps and CNRA's main goal for the CSMW was protection and restoration of beaches. Thus, the RSMPs are strongly focused on coastal engineering and do not deeply integrate factors such as ecology and socioeconomics. Additionally, early RSMPs were largely driven by a goal of using sediment management to solve navigational dredging and beach erosion concerns, without consideration of climate impacts. In the years since CSMW's inception, climate change has become a major concern in California and beyond, and integrating sediment management and climate adaptation planning is a critical next step.

For example, in 2022, after completion of the last RSMP in 2018, *AB 691 Synthesis Report: Proactively Planning for Sea Level Rise Impacts on Granted Public Trust Lands* was published. This summary report outlines actions to be taken by the state, the state lands commission, and trustees of state lands to support alignment with AB 691. Some RSM-related recommendations of this report included:

> *6.4.4 Create a "no net loss" policy for beaches."*
>
> *6.4.12 Develop strategies to address impacts of hard armoring on public trust lands and explore opportunities to transition to hybrid or nature-based shoreline protection when and where feasible*
>
> *6.4.13 Ensure sediment management practices evaluate beneficial reuse options based on cost-benefit analyses that include ecosystem service valuation, recreational value, and damage reduction benefits.*

Aligning with these recommendations will facilitate integrating climate adaptation planning and sediment management practices. Moving RSM beyond traditional beach nourishment approaches will be essential as climate change and sea level rise accelerate into the next century, and creative use of sediment to meet the challenge of rising sea levels and stronger storms can be a part of the state-wide solution. Below are listed several specific examples taken from the collection of RSMPs that highlight holistic or creative approaches to using sediment as a climate adaptation tool:

- **Sonoma and Marin RSMP Regional Recommendation**: Coastal bluffs and beach zones throughout the region are eroding, threatening key infrastructure and transportation

assets. Long-term solutions at these locations may involve moving vulnerable infrastructure inland (managed retreat). Identify areas where managed retreat will allow for restoration of natural coastal processes, including the use of phased approaches. Look at applying sediment management actions to support and inform adaptation pathways with a clear definition of "adaptation pathways"

- **Sonoma and Marin RSMP Regional Recommendation**: Take a holistic, watershed approach to understand sediment budgets and dynamics, and identifying areas of restoration to improve downstream water quality and encourage natural sediment transport.

- **San Luis Obispo Recommendation**: At present there is not a dredging program at Port San Luis. Instead, the Port District relocates sand 500 ft away, using an 8-inch pump, that provides just enough space for the sport launch. The channel is continually filled with sand, and the result is that the design water depth at some moorings was once 22 ft but is now 18 ft.. As a consequence, there is a need to dredge sand rather than relocate it. One RSM measure would be to move it to Pismo Beach. Supporting efforts could include continuing local funding, seeking project partners, and adding the project to local legislative platforms.

- **San Luis Obispo Recommendation**: Like development setbacks provided on the coast, setbacks on stream floodplains can also serve to protect the public interest. Clear examples of threatened development on low-lying river and stream floodplains already exist in the county. Flooding is expected to get even worse with increases in future sea levels. Setback and other limits on stream and river floodplain development have the potential to minimize these ongoing and future flood pressures.

Approaches like these are the role models for integrating RSMP and climate adaptation planning. Furthermore, by integrating management activities across these two critical axes, a wider range of funding sources will be available to support projects that meet both goals.

The San Diego and Orange County SCOUPs can provide inspiration and guidance on expanding opportunistic use of sediment with a range of grain sizes. For example, the City of Oceanside (San Diego) has a permit to place up to 150,000 yards of sand on the shoreline annually, and has a stockpile at El Corazon Yard. Similarly, Del Mar has a permit to place up to 180,000 cubic yards/5 years, and the plan includes truck routes from source to receiver sites. City of San Clemente has permit to place up to 300,000 cubic yards at four beaches. The City of Monterey has a permitted Opportunistic Beach Nourishment Program that was conceptually developed to implement across Southern Monterey Bay, however since the program and supporting environmental documents have only been certified by the City of Monterey the program has had limited application thus far, but does allow for harbor sediments to be placed on adjacent Del Monte Beach and dunes to reduce erosion risk.

While SCOUPs are critical for obtaining permits for opportunistic use, they do not necessarily solve all logistical challenges – sediment is not always available when it is needed and vice versa. Stockpile sites can bridge this gap by collecting sediment when it is available and allowing it to be used later. Another challenge is that sediment often needs to be sorted based on grain sizes, so that permit requirements can be met. Often beach placement requires less than 20% fine grained material, while wetland placement requires higher fine composition. Nature based approaches in higher wave environments like Surfers Point, coarser rounded cobbles are being sought and are often difficult to source and expensive to transport. Currently the sorting of sediment sourced from debris basins and flood control channels may require dewatering, and sorting before they can be opportunistically used.

BEACON can look to Australia for examples of successful implementation of RSMP including development impact requirements and sediment transportation methods. In Gold Coast, Australia, development on any site identified on the coastal erosion hazard overlay map as 0 to 500 m west of a seawall is required to return excess sand excavated during construction to the beach (ref). The regulation states that sand must be:

- cleaned using a 20mm sieve to remove all material other than clean sand; and
- delivered and deposited to a beach as directed by Council; and
- if the sand excavated on the site exceeds 1,500 cubic meters, a supervisor appointed by Council shall be employed for the duration of the sand excavation and deposition at the expense of the applicant.

In addition, the region has invested in the Surfers Paradise Sand Backpass System at the northern end of the City with the installation of a 7.8 km pipe, which has several discharge/nourishment locations to relocated sediment from the entrance of a navigation channel , south to nourish eroding beaches, upstream of the predominant littoral drift (Figure 32). This system is integrated into an existing sand bypass system on Southport Spit and it works because there is a breakwater and pumping jetty that captures the sand, so they're partially reverting bypass sand as backpass sand. While investing in the pipeline requires upfront funding, reduced maintenance and operations costs of the pipeline made it a cost-effective option when compared to alternatives such as trucking sand and transporting dredged sand by barge. At the southern end of the City, sand arrives across the state border due to the Tweed River Sand Bypass Project, which includes another sand bypass jetty and periodic dredging.

Figure 32 Diagram of the sand backpassing system in development in Gold Coast, Australia

This projects highlights some of the opportunities that the BEACON, and more broadly, California's need for better sediment transportation techniques. Presently, when sediment is beneficially reused in the state, it is typically transported from source to receiver site with truck trips, which limit the volume of sediment that can be transported and are also expensive. As the Gold Coast example shows, developing permitted infrastructure for sediment transportation may provide long term cost savings. Furthermore, Coastal California has existing infrastructure that could potentially be utilized for sediment transport. A prime example in Southern California the rail lines along the coast. Collaboration with the rail lines could enable sediment to be transported in large volumes and at low cost. Barges could also work. With either of these techniques, there would still be the logistical challenge of first and last mile transport to and from the rail line, but sediment could be moved long distances along the coast

for a cost much less than using truck trips, and with reduced greenhouse gas emissions. Rail locations adjacent to the coast are typically armored and should be identified where sidecasting sediment could be done to feed it into the littoral system. This could be relevant to both bypassing and backpassing of sediments. Existing infrastructure that could transport sediment is currently limited to the coastal zone of the BEACON region, so would likely be more feasible for sand bypassing or back passing operations from harbors than transportation of debris from inland basins to the coast.

6.3 FUNDING AND SUPPORT

A wide array of funding and financing tools exist to pay for climate adaptation in California, as presented in Section 4.1 the section below discusses some strategic considerations that may optimize outcomes of financing strategies in the BEACON region.

6.3.1 Beaches as natural infrastructure

In other states, defining nature as natural infrastructure has enabled new sources of funding to flow for nature-based risk reduction. In 2022, the first-ever award for coral reef restoration to protect people after a disaster was issued by FEMA's Hazard Mitigation Program (FEMA 2023). On the barrier coral reef offshore from San Juan Puerto Rico, FEMA HMP funds were issued to fund development of a mix of artificial reef substrate and living coral that work together to protect the shoreline. Additionally, three artificial reefs will be placed nearshore to reduce rough surf and dangerous currents around the public beach areas have caused drownings in the past. $3 million was allocated for the first phase, out of $38.6 million for the overall initiative.

Dating back to 2015, California has established ecosystems as natural infrastructure with the passage of AB 1482 (Gordon). This bill promotes the use of natural systems and "natural infrastructure" when developing physical infrastructure to address climate adaptation, and defines "natural infrastructure" as:

> "using natural ecological systems or processes to reduce vulnerability to climate change related hazards, or other related climate change effects, while increasing the long-term adaptive capacity of coastal and inland areas by perpetuating or restoring ecosystem services. This includes, but is not limited to, the conservation, preservation, or sustainable management of any form of aquatic or terrestrial vegetated open space, such as beaches, dunes, tidal marshes, reefs, seagrass, aquifers, parks, rain gardens, and urban tree canopies."

Several years later, in 2019 AB 65 (Petrie-Norris) amended the definition of natural infrastructure and used the definition of "natural infrastructure" as being eligible for federal funding through FEMA and other funding sources in the Government Code Sections that it amends.

Thus, using existing legislation and incorporating beach, marsh, dune ecosystems into California's Local Hazard Mitigation Plans may enable FEMA funds to be issued to support their restoration and management.

6.3.2 California Climate Resilience Districts

In 2022, California enacted Senate Bill 852 (SB 852), introduced by Senator Bill Dodd and co-sponsored by Insurance Commissioner Ricardo Lara. This legislation authorizes local city and governments to establish **Climate Resilience Districts (CRDs)**. These districts are empowered to finance and implement project aimed at mitigating climate change impacts such as wildfires, sea-level rise, extreme heat, drought, and flooding.

SB 852 addresses a critical gap in California's climate change response framework. While the state has taken important steps and allocated resources, it's local communities and governments that are on the front lines of this fight. Some local governments have responded proactively, but there is no consistent, long-term source of funding or staffing to support the planning and execution of climate-related initiatives at the local level. SB 852 empowers communities and regions to establish collaborative local entities that can cross jurisdictional boundaries and focus resources on the most pressing climate issues identified locally. It also creates a structure to coordinate and leverage local, state, federal, and private funding in a way that maximizes impact across jurisdictions.

6.3.3 Equity

An overarching challenge for funding RSMP is ensuring social equity. Coastal California currently has one of the most intense housing crises in the nation, and many of the options put forward for funding regional sediment management activities could exacerbate that problem. Development impact fees or sediment transport offset funds could both increase the cost or regulatory burden of building new housing. Increasing property taxes would also make homeownership even further out of reach for the many renters in coastal California. Furthermore, many of the funding mechanisms that use fees or taxes to fund sediment management require passage by ballot measure. Wealthier constituents may be more able to afford and thus more likely to vote for measures that increase their tax burden or cost of living to fund sediment management. This could result in innovative and creative sediment management approaches being concentrated in wealthy communities. Research on the social equity of financing nature-based solutions suggests a framework of considering place, process, and payment when assessing whether payment schemes exacerbate or ameliorate disparities (Thompson et al., 2023).

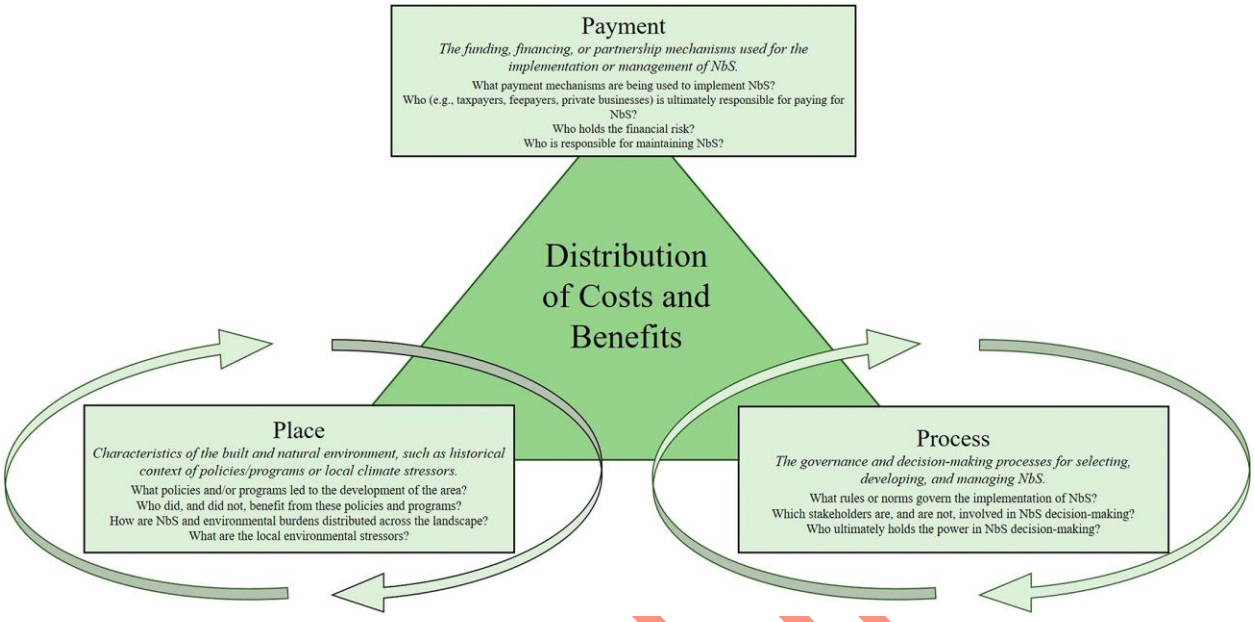


Figure 33 A framework for considering equity of payment schemes for nature-based solutions (Thompson et al. 2023)

Another recommended best practice is to consider equity in calculations of beach usage. By focusing only on number of visitors and value of real estate protected from flooding, the beaches with highest value are likely be disproportionately located in high income coastal communities and areas. The Santa Barbara Plan breaks beach visitation into surfer and non-surfer populations, while the other plans that quantify the value of beach visitation do not break it down by population at all. Equity could be considered in the design of financing models through polling to determine income levels of beach visitors and assessing the relative spending on beach visitation as a portion of income. Additionally, instead of determining flood protection value of the beach by calculating dollar value of real estate protected from flooding, the plans could:

- Use the number of dwellings or residents, rather than asset values, to rank protection options
- Weight protection of real estate by the inverse of census block income levels within the jurisdiction or relevant project area, such that damage to buildings in lower income census block groups get counted higher
- Quantify the amount of public resources protected from flooding by the beach (e.g. miles of roads, infrastructure) or the area protected from flooding and erosion.

7 CONCLUSIONS, RECOMMENDATIONS, AND NEXT STEPS

7.1 CONCLUSIONS

California's coastal regions and inland watersheds are increasingly vulnerable to the impacts of climate change, and effective sediment management has emerged as a critical component of addressing these challenges. The recent storms have underscored the urgent need for a cohesive and adaptive approach to sediment management that not only responds to immediate concerns but also anticipates long-term climate impacts. The growing recognition of the value of nature-based solutions—such as restoring beaches, dunes, and marshes—alongside more traditional engineering approaches offers a promising path forward. However, the success of these efforts hinges on the ability to implement them in a coordinated and sustainable manner.

For decades, the state has struggled with fragmented governance and funding for sediment management. The California Sediment Management Working Group (CSMW), established in the late 1990s, created a foundation for sediment management through regional sediment management plans (RSMPs), but these plans have not reached their full potential. Although these plans offer innovative concepts for managing sediment, they have often lacked the necessary technical specificity, including detailed roadmaps for implementation, clear permitting processes, and strategies for cross-jurisdictional coordination. This lack of integration has hampered their ability to effectively support climate adaptation planning at the local level.

This report highlights several key challenges and opportunities for improving sediment management in the face of climate change. A significant finding is that while RSMPs have initiated valuable conceptual work, they have not sufficiently addressed the practical elements required to implement these ideas. This includes the need for specific coordination between agencies across jurisdictions, comprehensive permitting procedures, and the identification of practical funding sources. Furthermore, the integration of ecology and socio-economic factors into sediment management remains a critical gap. As California faces more frequent and severe climate events, it is imperative that regional sediment management plans not only account for environmental needs but also consider social and economic impacts, ensuring that the solutions are equitable and inclusive.

California's legislative landscape is evolving to support these shifts. For example, the recent passage of Senate Bill 852 (SB 852) and the establishment of Climate Resilience Districts (CRDs) empower local communities to take proactive measures against climate change. These districts provide a mechanism for local governments to establish cross-jurisdictional collaborations, thereby facilitating integrated, region-wide solutions that address both sediment management and climate adaptation. Similarly, the growing acceptance of natural infrastructure, as evidenced by bills like AB 1482 and AB 65, highlights a shift toward using

ecosystems like beaches and wetlands as integral components of climate resilience strategies. These legislative frameworks offer a foundation for aligning sediment management with broader climate adaptation efforts, unlocking new funding opportunities, and ensuring that solutions are sustainable in the long term.

However, challenges remain. Chief among them is securing consistent, long-term funding for sediment management, particularly as many of the funding mechanisms available are fragmented or reliant on voter approval. The survey results revealed a clear need for more coordinated funding strategies, such as the creation of regional funding coordination systems and the development of interregional collaboration groups that could advocate for and facilitate access to funding. The current reliance on local taxes and fees, particularly in wealthier communities, risks exacerbating disparities in access to climate adaptation resources, potentially leaving low-income or underserved communities at a disadvantage. Ensuring that funding mechanisms are equitable is paramount to ensuring that all communities—regardless of wealth—benefit from sediment management and climate adaptation efforts.

The social equity challenges associated with sediment management funding also underscore the need for a more inclusive planning process. The interconnection between sediment management and broader climate adaptation goals—such as sea-level rise, extreme weather events, and habitat restoration—requires collaboration across a range of sectors. Planners, engineers, ecologists, and social scientists must work together to develop comprehensive solutions that consider the ecological, economic, and social dimensions of each project. This collaborative approach is essential for developing practical, actionable plans that can be implemented on the ground.

At its core, the challenge of sediment management in the face of climate change is a governance issue. The state's fragmented approach to sediment management, with its reliance on siloed planning, funding, and permitting processes, is not well-suited to the scale of the climate crisis. Moving forward, it will be essential to break down these silos and foster a more integrated and collaborative governance framework that supports cross-jurisdictional coordination, enhances stakeholder engagement, and streamlines administrative processes. This includes aligning local and state regulations, integrating sediment management into local climate adaptation plans, and providing clear guidance on the permitting processes for sediment-related projects.

Furthermore, the practical details of sediment management—such as sediment transport, storage, and sorting—must be more clearly addressed in regional sediment management plans. As highlighted by the findings in this report, while the RSMPs provide a high-level overview of potential projects, they often lack the specificity needed for implementation. This includes clear identification of funding sources, staffing needs, and coordination mechanisms between agencies. As climate change impacts accelerate, the state must ensure that regional sediment management plans are not just aspirational but are actionable, with concrete steps that can be taken to mitigate climate impacts in real-time.

In conclusion, California stands at a pivotal moment in its approach to sediment management. The state has laid the groundwork for more integrated, resilient, and sustainable sediment management strategies, but much work remains to be done. By fostering greater collaboration between local, state, and federal agencies, integrating sediment management with broader climate adaptation planning, and addressing funding and equity challenges, California can unlock the full potential of its sediment management strategies. The path forward requires a shared commitment to overcoming governance challenges, securing funding, and ensuring that all communities benefit from climate resilience efforts. Through thoughtful planning and coordinated action, California has an opportunity to lead the nation in developing innovative, effective sediment management strategies that will safeguard its coastlines, ecosystems, and communities for future generations.

7.2 RECOMMENDATIONS

This section summarizes key recommendations to improve the alignment of Regional Sediment Management Plans (RSMPs) with climate adaptation strategies, based on findings from document review and stakeholder surveys. These recommendations are grounded in the findings presented in previous sections and reflect the full range of physical, institutional, and policy challenges.

1. Update and Align RSMPs with Adaptation Planning: To improve implementation and relevance, RSMPs must reflect current climate realities and planning frameworks.

- Integrate sea-level rise, disaster-driven sediment variability, and habitat restoration into updates of the RSMPs, with a focus on the sections identified as lacking in the plan review (Figure 5).
- Use sediment surpluses from high-flow or post-disaster events as opportunities for adaptive placement.
- Coordinate RSMP updates with LCPs, LHMPs, CIPs, and other climate planning frameworks to ensure consistency and accountability.

2. Expand Consideration of Sediment Types and Sources: Many RSMPs focus narrowly on sand, ignoring the utility of a broader sediment range.

- Broaden grain size considerations to include silts, muds, cobbles, boulders, and innovative materials like eco-concrete.
- Reconnect coarse sediments from debris basins to coastal systems, especially after disasters.

- Develop and maintain standardized regional sediment inventories linked to project and habitat needs.

3. Enhance Interregional Governance and Collaboration: Governance fragmentation is a key barrier; broader and more representative collaboration is needed.

- Expand the CSMW and regional governance bodies to include adaptation planners, harbor districts, Tribes, public works, and historically underrepresented groups.
- Establish interregional coalitions to advocate for sediment-related policy and funding.
- Support knowledge exchange through shared technical capacity, inventories, and monitoring frameworks.

4. Regulatory Streamlining and Policy Integration: Permitting challenges remain a major barrier to implementation.

- Update planning policies to leverage Coastal Act Sections 30233(b) and 30233(d) to support beneficial reuse and adaptive permitting as well as developing a “no net loss of beaches” policy.
- Apply "Cutting the Green Tape" principles and establish a statewide framework of permit conditions for sediment reuse projects, covering construction, monitoring, and placement methods.
- Develop programmatic EIRs for RSM projects and templates to reduce project delays.

5. Integrate Sediment into Climate Resilience Frameworks: Sediment management must be fully embedded in the broader landscape of adaptation planning.

- Require the inclusion of sediment management strategies in LCPs, General Plans, LHMPs, and adaptation plans.
- Cross-train planners and engineers to promote integration at every stage of the planning cycle.
- Use scenario planning to address sediment needs under extreme events and climate futures.

6. Quantify Multi-Benefit Outcomes: To secure long-term funding, sediment strategies must demonstrate value beyond engineering metrics.

- Ensure sediment management practices evaluate beneficial reuse options based on cost-benefit analyses that include ecosystem service valuation, recreational value, and

damage reduction benefits Frame beaches and dunes as public infrastructure eligible for resilience and infrastructure grants.

Develop strategies to address impacts of hard armoring on public trust lands and explore opportunities to transition to hybrid or nature-based shoreline protection.

7. Diversify funding opportunities for RSM projects: establish long-term, flexible, and diversified funding mechanisms that integrate RSM with adaptation, ecosystem restoration, and hazard mitigation planning.

- Quantify the total value of sediment-based adaptation including the flood protection, habitat, and recreation benefits of beaches and living shorelines in cost-benefit analyses to access resilience funding.
- Establish cross-jurisdictional and flexible funding models by creating shared, adaptable funding tools that support phased RSM projects across regions and agencies.
- Position sediment projects as climate Infrastructure treating sediment-based solutions like living shorelines as infrastructure eligible for climate, resilience, hazard mitigation, and disaster recovery grants.
- Utilize navigational funding from the US Army Corps of Engineers for backpassing and bypassing projects, to avoid variability in the availability of funding for dredging and nourishment activities.

8. Support Pilot Projects and Adaptive Implementation: Pilot projects can test and demonstrate innovative sediment reuse strategies.

- Implement scalable pilots that explore sediment sorting, storage, transport, and reuse.
- Use monitoring data from storms and shoreline changes to inform placement strategies.
- Align pilot projects with long-term adaptive strategies, including living shoreline maintenance cycles.

9. Elevate Outreach, Equity, and Public Understanding: Increased awareness and equitable engagement are essential for successful implementation.

- Launch targeted outreach to Tribes, underrepresented communities, and local elected officials.
- Highlight success stories and build support through transparent performance tracking.

- Promote equitable funding structures that reduce disparities across jurisdictions.

7.3 USE EXISTING ENFORCEMENT AND IMPACT FEES SUCH AS SAND MITIGATION FEES FOR COASTAL ARMORING INTO A SET ASIDE FUND FOR IMPLEMENTING RSM PROJECTS.NEXT STEPS FOR CSMW

The California Sediment Management Workgroup (CSMW) is being revitalized and is poised to play a renewed leadership role in coordinating sediment management policy, science, and funding across the state. To ensure its success in this new phase, the following strategic actions are recommended:

- **Expand membership** to include long-range planners, public works agencies, harbor districts, ecologist, transportation agencies and tribal representatives to ensure broader representation and interagency collaboration.
- **Require integration of RSMPs into local and regional adaptation planning** as a condition of state-level funding. This will embed sediment strategies directly into Local Coastal Programs (LCPs), General Plans, and other key policy frameworks.
- **Standardize sediment inventories** and establish a centralized, accessible data portal to track grain sizes, volumes, and placement suitability statewide. Inventories should align with habitat and project needs and be updated regularly.
- **Support the development of statewide permitting templates** or a **programmatic Environmental Impact Report (EIR)** to streamline project approval using certain placement methods, and monitoring for sediment reuse and coastal resilience projects.
- **Define clear state policies that prioritize beneficial reuse and natural infrastructure**, including the use of dredged or opportunistically sourced sediment for ecological restoration and flood risk reduction.
- **Promote nature-based sediment reuse strategies** that support long-term climate adaptation, including scalable pilot projects and demonstration efforts that validate effectiveness and foster replication.
- **Align routine sediment maintenance practices** (e.g., dredging, basin cleanouts) with adaptation goals. Encourage agencies to plan for multipurpose outcomes and integrate these activities into climate resilience operations.
- **Advocate for flexible, cross-jurisdictional funding mechanisms** that allow for pooled resources, cost-sharing across time, and collaboration among jurisdictions within shared sandsheds.

- **Use monitoring data** from storm impacts and long-term shoreline change to inform future sediment placement, improve site selection, and support adaptive management.
- **Leverage CSMW's platform to support federal and state legislative strategies**, enabling advocacy for resilient sediment policy and sustained funding for sediment and adaptation projects.

By implementing these actions, CSMW can help transform sediment from an overlooked resource into a strategic asset—central to California's coastal resilience, ecological health, and economic sustainability.

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APPENDIX A

Goleta

2003 Goleta Demo Project
2009 Goleta Parks Monitoring Report
2012 Final Adopted Goleta Energy Efficiency Action Plan
2014 City of Goleta Final Climate Action Plan
2015 Goleta Slough Inlet Modeling Study
2015 Goleta Coastal Hazard Vulnerability and Fiscal Impact Draft Report
2017 Long-term Biological Monitoring Report for Goleta Beach
2017 Goleta California Coastal Commission Permit
2018 Public Notice from USACE For Sediment Removal and Beach Disposal
2019 Goleta Beach Shoreline Monitoring Program Annual Report
2021 Goleta California Coastal Commission Permit for Sediment Nourishing at Goleta Beach
2022 Goleta Slough Long-Term Monitoring Plan Results Memo
2023 Santa Barbara Flood Control Technical Memo

City of Santa Barbara

1982 City of Santa Barbara Local Coastal Plan
2005 BEACON Performance Guidelines
2005 Santa Barbara Dredge Lease
2009 The Framework of a Coastal Hazards Model—A Tool for Predicting the Impact of Severe Storms
2012 Climate Action Plan 2017 Implementation Status Update
2012 City of Santa Barbara Sea-Level Rise Vulnerability Study
2012 City of Santa Barbara Climate Action Plan
2012 UCSB Climate Action Plan
2015 Climate Change, Coastal Hazards, and Shoreline Response Modeling in California
2015 Goleta Slough Area Sea Level Rise and Management Plan
2015 City of Santa Barbara Sea Level Rise Vulnerability Assessment
2016 Final Environmental Assessment for the Santa Barbara Harbor Dredging Program
1996 City of Santa Barbara Harbor Master Plan
2017 City of Santa Barbara Climate Plan Report Appendix C
2017 Case Studies of Natural Shoreline Infrastructure in Coastal California
2017 Coastal Storm Modeling System: CA Central Coast
2017 Appendix A: Vulnerability Studies Completed for Santa Barbara
2019 City of Santa Barbara Local Coastal Program Coastal Land Use Plan
2019 City of Santa Barbara Coastal Land Use Plan
2019 City of Santa Barbara Sea-level Rise Adaptation Plan Benefit-Cost Analysis
2019 City of Santa Barbara LCP Amendment
2019 City of Santa Barbara Local Coastal Program
2019 City of Santa Barbara Sustainability Progress Report
2019 Santa Barbara County Coastal Hazards
2020 Appendix A of the Santa Barbara Sea Level Rise Vulnerability Assessment

2020 Letter of interest to the U.S. Army Corps of Engineers
2021 Santa Barbara City Final Adaptation Plan
2021 Executive Summary of Santa Barbara Sea Level Rise Adaptation Plan

Carpinteria

1996 Carpinteria Bluffs Coastal Access, Recreation, and Open Space Mater Program
2003 City of Carpinteria General Plan/Local Coastal Land Use Plan & Environmental Impact Report
2008 Review Plan for the Carpinteria Shoreline Feasibility Study
2016 City of Carpinteria Environmental Review & Monitoring Status Report
2017 Coastal Storm Modeling System Summary of Methods
2017 Carpinteria General Plan Key Decisions Memo
2018 City of Carpinteria Coastal Vulnerability and Adaptation Report
2019 Carpinteria General Plan Chapter 4: Climate & Sea Level Rise Science
2019 City of Carpinteria Sea Level Rise Vulnerability Assessment and Adaptation Project Executive Summary
2020 Carpinteria Dune Restoration Proposal
2020 Carpinteria USACE Letter Authorization
2021 City of Carpinteria General Plan 2021 Annual Progress Report
2022 State Lands Commission Staff Report 46
2022 City of Carpinteria Local Hazard Mitigation Plan
2022 City of Carpinteria Dune and Shoreline Management Plan
2022 AB 691 Summary Report
2022 Exhibits from The City of Santa Barbara Sediment Management Program
2022 AB 691 Synthesis Report
2022 State Agency Sea Level Rise Action Plan for California
2022 EPA Environmental Justice Screening Report for Santa Barbara
2022 Appendix C of the Santa Barbara Federal Maintenance Dredging Program
2022 Environmental Assessment of the Santa Barbara Harbor Maintenance Dredging Program
2022 Coastal Commission Approval of Santa Barbara Harbor Maintenance Dredging

Ventura

2018 Conserving California's Coastal Habitat
2019 City of Ventura Coastal Area Strategic Plan Proposal
2021 City of Ventura Energy Action Plan
2022 City of Ventura Climate Change Vulnerability Assessment

Oxnard

1982 Oxnard Coastal Land Use Plan
Herzog and Hecht et al, 2023
2018 Environmental Assessment for Channel Islands/Port Hueneme Maintenance Dredging
2018 Oxnard Local Coastal Plan Update
2018 Oxnard Sea Level Rise Adaptation Strategy Report

Port Hueneme

2019 Port of Hueneme Deepening Project Supplemental Environmental Assessment
2021 City of Port Hueneme Proposed Amendment to Local Coastal Program
2021 Port Hueneme General Plan Update Final Environmental Impact Report

2021 Port Hueneme General Plan Update Final Environmental Impact Report Appendices
2021 Port Hueneme General Plan
Port Hueneme Hazard Zones

County of Santa Barbara

2010 County of Santa Barbara Sustainability Action Plan
2011 Santa Barbara County Climate Action Strategy
2013 Santa Barbara Sustainability Program and Action Plan Presentation
2015 Goleta Slough Area Sea Level Rise and Management Plan: Appendix B - Goleta Slough Inlet Modeling Study
2016 County of Santa Barbara Sea Level Rise Coastal Resiliency Project Phase 2 Final Technical Report
2017 Santa Barbara Area Coastal Ecosystem Vulnerability Assessment
2017 Santa Barbara Coastal Resilience Work Plan
2017 County of Santa Barbara Energy and Climate Action Plan
2018 Toward Natural Infrastructure to Manage Shoreline Change in California
2021 Correspondence regarding amending the Santa Barbara County Local Coastal Program
2022 USACE Request for Comment on the Draft Environmental Impact Assessment of the Santa Barbara Harbor Operations and Maintenance Dredging program
2022 Goleta Slough Long-Term Monitoring Plan Results Memo
2017 Long-term biological monitoring program for Goleta Beach
2019 Goleta Beach Shoreline Monitoring Program Annual Report
2023 Santa Barbara Flood Control Technical Memo

County of Ventura

Coastal Regional Sediment Management Plan Central Coast from Pt. Conception to Pt. Mugu
2016 Santa Barbara and Ventura County Coastal Storm Modeling System Results
2017 Cobble Berms and other Coarse But Adaptable Natural Landforms
2017 Case Studies of Natural Shoreline Infrastructure in Coastal California
2017 County of Ventura General Plan Coastal Area Plan
2018 Ventura County Resilient Coastal Adaptation Project Sea Level Rise Vulnerability Assessment Appendix A1
2018 Ventura County Resilient Coastal Adaptation Project Sea Level Rise Vulnerability Assessment Appendix A2
2018 Ventura County Resilient Coastal Adaptation Project Sea Level Rise Vulnerability Assessment Appendix B
2018 Ventura County Resilient Coastal Adaptation Project Sea Level Rise Vulnerability Assessment Appendix C
2018 Ventura County Resilient Coastal Adaptation Project Sea Level Rise Vulnerability Assessment Appendix D
2018 Ventura Dredge Draft Environmental Assessment
2018 Ventura County Resilient Coastal Adaptation Project Sea Level Rise Vulnerability Assessment
2019 Southern California Resilience Initiative Pilot 1: Community Resilience Collaborative and Integrated Data Hub
2019 Ventura County Climate Change Vulnerability Assessment
2019 Ventura County Resilient Coastal Adaptation Project: Sea Level Rise Adaptation Strategies Report

2019 Projected Changes in Ventura County Climate
2019 Ventura County General Plan Appendix B: Climate Change
2019 Ventura County Request for SLR Vulnerability Study
2020 Heat Vulnerabilities in Los Angeles County: Resource and Methodology Assessment
2020 Coastal Adaptation Vision for Naval Base Ventura County Point Mugu
2020 Exhausted! Workers Confront Extreme Heat and Wildfire Smoke in California
2021 Ventura County General Plan Coastal Area Plan
2021 Climate Crossroads: California's Readiness to Act on Climate Resilience
2021 Ventura County Categorical Exclusion
2021 Lessons from the Woolsey Fire
2021 Budget and Staffing Plan for Climate Action Plan Implementation
2022 Budget and Staffing Plan for Climate Action Plan Implementation
2022 Ventura Harbor Dredge Permit
2022 Multi-Jurisdiction Hazard Mitigation Plan
2020 Ventura County General Plan Appendix B: Climate Change