

RESILIENCE IN THE GOLETA SLOUGH COASTAL AREA

Synthesizing Climate Hazards
& Regional Priorities



RESILIENT CITIES CATALYST





EXECUTIVE SUMMARY

The Goleta Slough Coastal Resilience Acceleration Initiative (the Initiative) is an effort supported by State Coastal Conservancy and led by Resilient Cities Catalyst in partnership with Tidal Influence, Heal the Ocean, Integral Consulting Inc., and the University of California Santa Barbara's Ocean and Coastal Policy Center (UCSB).

The Goleta Slough is central to the natural ecosystem in the Santa Barbara region, supporting ecological diversity and important watershed and shoreline processes. The Slough is also a built environment, incrementally filled and hemmed in by more than a century of urban expansion and economic growth. The challenges of managing the Slough in relation to the built environment have been an on-going concern for the last half-century, and a specific focus of the Goleta Slough Management Committee since the early 1990s. This management complexity is further exacerbated due to the array of governing jurisdictions and land owners in the Slough area.

Beyond its inherent management challenges, Goleta Slough faces the mounting threat of climate change, which is expected to bring more severe storms, increased flooding, coastal erosion, and rising sea levels. These physical processes manifest as coastal hazards in the built environment, causing increasing damage to development, infrastructure, public safety, the local economy, community well-being, and natural ecosystems. These effects are also compounded by increased drought, wildfire, and extreme heat days projected for the larger region. Against this backdrop, the Initiative is focusing on the need for increasing coastal resilience to safeguard the well-being of the region and its residents through strategic adaptation actions that both recognize the critical importance of the natural and social dimensions of the Goleta Slough area and leverage the decades of shared community and governmental commitment to the proactive management of the Slough.

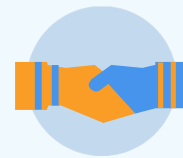
This report summarizes previous technical and scientific studies as well as governmental plans to aid in further phases of the Initiative. It includes descriptions of the dynamics of the ecosystem and natural landscape of the Goleta Slough and surrounding areas, highlights key social and environmental entities, and synthesizes climate impacts and stated priorities for the region, including:



Ecosystem
Protection and
Stewardship



Coastal Resilience
and Adaptation



Collaborative and
Forward-Looking
Governance



Climate Mitigation
and Resource
Sustainability



Sustainable Growth
and Mobility



Community
Well-Being and
Equity

These priorities were identified through an analysis of 95+ documents created/published over the last 30 years and provide the evidence base for advancing efforts that increase coastal resilience. Analysis of the documents also reveals that the top shocks and stresses to the Slough environs varied widely across different geographic scales, but that general environmental degradation, including the loss of biodiversity and degradation of water quality, was the most referenced concern. Other frequently referenced shocks and stressors included both coastal/tidal and rainfall flooding and coastal erosion. Understanding how sudden-onset shocks and the long-term stresses impacting the Slough interrelate in its complex socio-ecological system will inform future steps for the Initiative, particularly in determining the selection criteria for prioritizing adaptation strategies and projects that will deliver the greatest resilience benefit to communities.

Increasing coastal resilience is essential to safeguarding the well-being of the region, its communities, and the natural systems of the Goleta Slough.

Importantly, this report details the historic trend of built assets in the Goleta Slough area being consistently prioritized over the natural ecosystem. In the face of increasing climate impacts, a significant decision point has been reached signaling the need for a transformative shift in the approach to the Goleta Slough area such that investments

equally prioritize the health and restoration of natural systems to ensure longterm socio-ecological vitality and resilience.

This report will serve as part of the evidence base to inform the Initiative's ultimate goal to identify and support strategies that push for this new, more resilient paradigm – prioritizing approaches that deliver multiple benefits to restore and conserve natural resources, reduce harms to valuable infrastructure, protect recreational activities and public spaces, and highlight the cultural heritage of the Goleta Slough and surrounding coastal area.

As another part of the Initiative's approach, the project team will deploy a community-centered engagement process to build on these learnings. The report and community engagement together will inform a process for resourcing tangible efforts to advance resilience. With the goal to move from decades of planning to implementation, the work ahead necessitates sustained collaboration across jurisdictions and meaningful engagement with the communities who live, work, and recreate in and around the Goleta Slough.

OVERVIEW

The Goleta Slough Coastal Resilience Initiative emerged as part of a set of efforts to address increasing climate impacts and support regional resilience building – particularly for the Goleta Slough and surrounding areas. Funded by the State Coastal Conservancy, the effort is led by Resilient Cities Catalyst in close partnership with Tidal Influence, Heal the Ocean, Integral Consulting Inc., and the University of California at Santa Barbara’s Ocean and Coastal Policy Center (UCSB). It is one of multiple efforts supported by the State Coastal Conservancy to address coastal resilience and climate change in the region.

This report aims to synthesize challenges facing the area, including sea level rise, flooding, and other climate-driven impacts and illustrate how they interact with the Goleta Slough. The results will help better inform the Initiative’s ultimate mission: to contribute to strengthening the resilience of the Goleta Slough coastal area in Santa Barbara County, CA through advancement of effective coastal adaptation projects toward implementation.



BACKGROUND & FRAMING

Climate Change & Resilience

The Goleta Slough and surrounding Santa Barbara county is predominantly low lying and is therefore more vulnerable to experiencing impacts of climate change on a shorter time scale. In fact, the region is experiencing the impacts of climate change now, and it will only get worse without effort to adapt.

Impacts from climate change are already affecting the coast of California, and are projected to intensify hazards in the coming decades, including increasing frequency and intensity of storm events and wildfires, flooding, beach erosion, sea level rise, and damage to infrastructure. These combined impacts threaten natural ecosystems, the built environment, the local economy, and community safety. Because climate impacts are not felt uniformly across geographies or communities, proactive protective measures for natural ecosystems and vulnerable populations in the area are critical.

The concept of resilience emerged from ecological systems research that identified that these natural systems endure, recover, evolve, and adapt from disturbances while still maintaining their functions. This concept is now a core component of “social-ecological systems” thinking, which examines the linked nature of human and natural systems.

Applied to the Goleta Slough and surrounding coastal area, the pursuit of resilience encompasses social, ecological, and development dimensions, aiming to minimize vulnerability, reduce exposure to hazards, and accelerate recovery without compromising the long-term health and productivity of ecosystems and communities. Resilience is demonstrated by a system’s ability to anticipate, withstand, recover from, and adapt to chronic stresses (slow-burning, underlying challenges) and shocks (acute crises such as extreme weather events) while maintaining essential functions, services, and identity. In the Slough, this might look like building capacity to withstand both gradual sea level rise eroding critical wetlands and acute flooding events that have recently swamped surrounding areas. Caught between urban development and rising waters, the Slough requires particular attention in order to protect both the ecological function and the communities that call the area home.

Because climate impacts are not felt equally, equity must be central to how resilience is defined and implemented.

To achieve resilience for the Slough, nature-based solutions are a critical mechanism to conserve, restore, or strengthen natural ecosystems, and are typically approaches that use natural processes and habitats to create resilient infrastructure and deliver multiple benefits. This approach also can reduce negative impacts on the built infrastructure and most effectively protects natural and social systems (a concept that will from here on be referred to as socio-ecological). Additionally, climate change does not impact populations equally or uniformly, as lower-income households, renters, and under-resourced communities often face disproportionate impacts and longer recovery times. Therefore, equity is a central component of defining resilience. The goal of the Initiative is to identify strategies and projects that will increase this capacity in a meaningful way.

In light of how climate change is fundamentally reshaping the region, building resilience requires rethinking how natural systems, including the coast, must be managed – past approaches to coastal management are not sufficient in the face of increasing hazards and systemic complexities. Just as the natural and built environment ecosystems are implicated in a complex system with reverberating effects, climate hazards don't happen in isolation. They interact with and amplify each other, disrupting systems and community members' lives.

The urgency of a coordinated resilience effort is clear. Recent extreme storm events (see Figure 1), which are also exacerbated by ongoing regional drought conditions, and the implications of impending sea-level rise highlight the urgency of advancing implementation efforts to strengthen the resilience of the Goleta Slough and surrounding areas. At the same time, state and regional resilience mandates are creating new opportunities to align local priorities with broader policy and funding frameworks.



Figure 1: 2026 Flooding of Santa Barbara Airport. Source: [Santa Barbara Independent](#), Ingrid Bostrom, January 3, 2026.

Geographic Focus

The Goleta Slough Area

The Goleta Slough (see Figure 2) is many things: in addition to being a coastal wetland system, estuarine marine protected area, endangered species habitat, and significant Chumash tribal cultural site, it is also the location of critical regional and inter-regional transportation and utility infrastructure, including a national airport, an important state and local road network, a public access point for recreation, and a central geographic feature of Goleta and southern Santa Barbara County.

The Goleta Slough watershed (Figure 3) encompasses approximately 48.2 square miles in Santa Barbara County and includes the drainage from the following seven creeks: Atascadero, Carneros, Las Vegas, Maria Ygnacia, San Jose, San Pedro, and Tecolotito. These creeks carry freshwater and sediment from the Santa Ynez Mountains, through agricultural and residential areas before converging in the Slough and ultimately discharging into the Pacific Ocean. This broader Goleta Slough Area is a managed ecosystem; the watershed has been altered through installation of debris basins, and airport retention basins and tide gates, rerouting of creeks, and extensive sediment management practices. The Goleta Slough also sits within the larger “sand-shed” that includes the Santa Barbara Littoral Cell and the additional coastal watersheds that bring sediment to the coast. Strategies focusing on sediment dynamics at the mouth of the Slough and Goleta Beach may need to account for this larger sandshed.



Figure 2: Goleta Slough Coastal Area

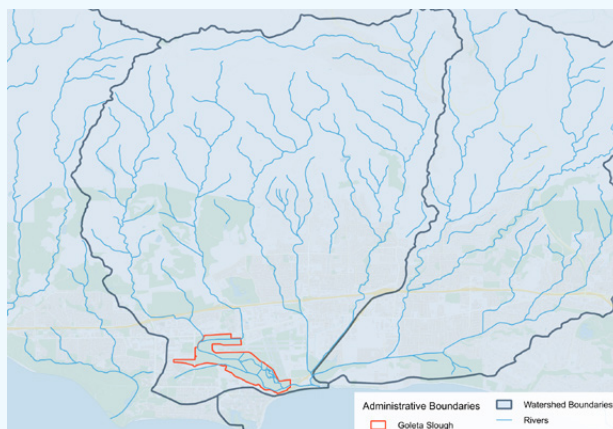


Figure 3: Goleta Slough Watershed

The Natural Ecosystem

The Slough is a dynamic type of coastal wetland ecosystem called a bar built estuary that receives fresh water and sediment from multiple creeks and is connected to the ocean tides for part of the year.

A bar built estuary, at its most basic level, is an estuary that is sometimes open to the ocean and sometimes closed off to the ocean by a sandbar. It fluctuates seasonally based on stream flow and waves, forces which are themselves controlled by the combination of watershed discharge, wave energy, and sand transport. These forces ultimately combine to affect a sandbar at the mouth of the lagoon which is intermittently closed or open (see Figure 4).

In the case of the Slough, a closed mouth means that the sandbar has formed across the full mouth (or opening) of the Slough and prevents fluvial (riverine) water from draining out to the ocean, instead allowing inflow to fill the Slough like a bathtub (see Figure 5). In contrast, an open mouth means that the sand bar has breached (opened) to allow tidal exchange from the ocean (see Figure 6).

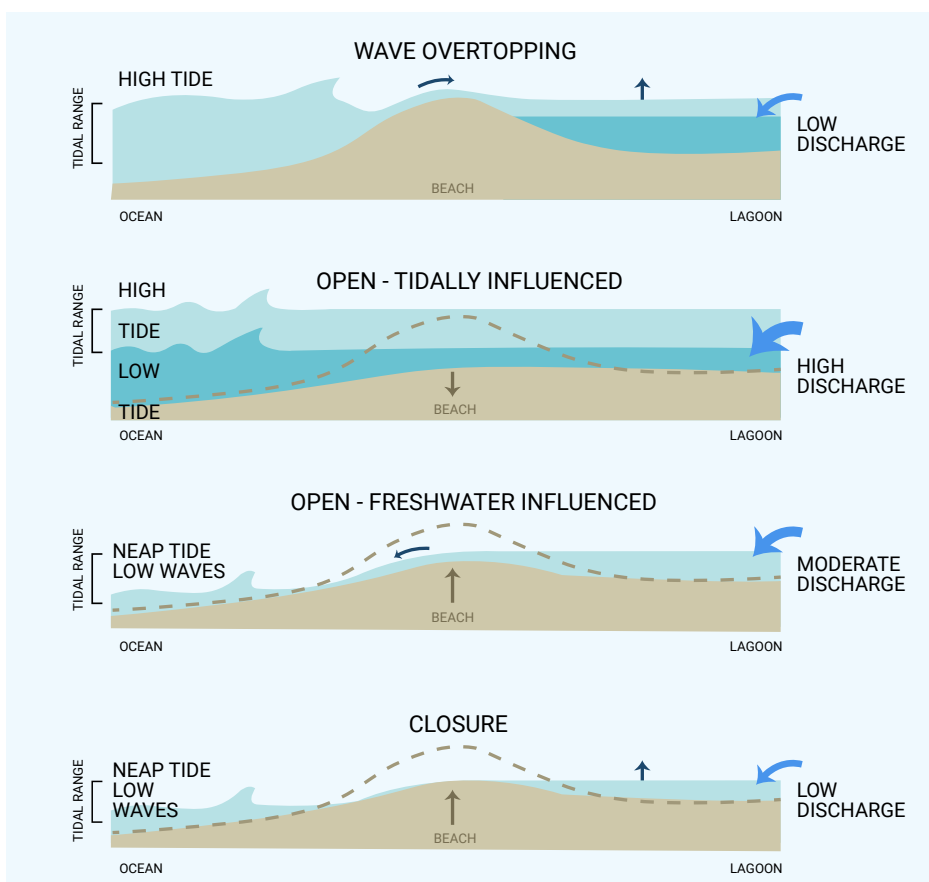


Figure 4: Bar Built Estuary Opening and Closure Process. Source: Goleta Slough Area Sea Level Rise and Management Plan, prepared for the Goleta Slough Management Committee by ESA, 2015.



Figure 5: Closed Slough, flooding visible. Source: 2015 [City of Goleta Coastal Hazards Vulnerability Assessment and Fiscal Impact Report](#).



Figure 6: Open Slough, land visible. Source: D. Revell.

This dynamic process of opening and closing can result in flooding in several key areas of the Slough. In a closed condition, the lagoon fills like a bathtub based on wave overtopping and watershed flows and surrounding areas can experience ponded lagoon flooding—a natural process in bar-built estuaries that helps accrete sediment across the marshplain but which has undesirable impacts on infrastructure and development that may have encroached into the natural hydrological footprint of the low lying slough systems, such as the Santa Barbara Airport, sanitation facilities, roads, and commercial and residential buildings in Old Town Goleta (Figures 7-10).

Lagoon flooding typically reaches a maximum during early winter season rain events that fill the slough rapidly before breaching to the ocean. Another process which adds complexity to the already dynamic nature of flooding within the Slough are severe wave events.

At times the Goleta Slough opens to the ocean; at others, a sandbar closes it off, causing water to fill the Slough like a bathtub.

The management of most of California's intermittently open estuaries is significantly complicated by the historic development and interventions constraining the natural dynamic of open and closing at the estuary mouth. This has led to an ongoing debate about how

to manage the mouths of intermittently open estuaries in southern California. Some systems like the [Los Penas-quitos Lagoon in Del Mar](#) and [Bolsa Chica Wetlands](#) in Huntington Beach, are managed to be kept open in order to maintain water quality at levels that support marine wildlife and submerged aquatic vegetation. This requires constant monitoring of water levels and sand accretion as well as budgets for mouth dredging. Other systems, like [Aliso Creek Estuary in Laguna Beach](#), are allowed to close and remain closed until they naturally breach in order to maintain water levels in the wetland to support estuarine organisms. This requires continual oversight to ensure that the mouth is not artificially breached for recreational purposes and to ensure that the surrounding infrastructure is not flooded before the breach occurs. In recent years, mouth closures at the Huntington Beach Wetlands caused fish kills and impacts to eelgrass due to high water temperatures and low dissolved oxygen levels. At this site, artificial breaching was not allowed for many months due to the proximity of an active California least tern colony.



Figure 7: Closed Mouth, Lagoon Flooding of Airport. Source: [Goleta Slough Area Sea Level Rise and Management Plan](#), 2015.



Figure 8: Flooding in Old Town Goleta in 2014. Source: [City of Goleta Coastal Hazards Vulnerability Assessment and Fiscal Impact Report](#) 2015.



Figure 9: Flooding of Intersection of Fairview and Hollister during the 1997-1998 El Niño Flooding event. Source: [City of Goleta Coastal Hazards Vulnerability Assessment and Fiscal Impact Report](#), 2015.



Figure 10: Mechanical Breach of the Goleta Slough in 2014. Source: [City of Goleta Coastal Hazards Vulnerability Assessment and Fiscal Impact Report](#), 2015.

In most instances for the Slough, these challenging mouth management issues are the result of 1) existing restrictions to where the system can naturally breach, 2) alterations to the watershed, 3) beach management practices, and/or 4) regulatory issues related to the protection of natural resources. All of these considerations are an on-going balancing act that will ideally produce results that meet the needs of wildlife, reduce flooding, and are also acceptable and permissible by resource and regulatory agencies. Mouth management must also be considered in relation to other inland or upland interventions that may change the flooding dynamics that typically drive artificial breaching or management of lagoon water levels. Additional study may find that inland flood controls or even relocation of development out of flood areas prove to be a more effective way to balance estuary management over the long run.

Managing the Slough's mouth is an ongoing balancing act—meeting the needs of wildlife, reducing flooding, and complying with regulatory requirements.

As a result of being a bar-built estuary, the Slough can be further defined as a dynamic salt marsh ecosystem, which includes a mix of saltwater, brackish, freshwater, and adjacent habitat types, including estuarine, riverine, and palustrine wetlands; introduced grassland; upland scrub; and oak woodland. Species found in the Slough thrive in

estuarine, brackish, and freshwater environments, as well as environments without water. These include various types of waterfowl, shorebirds, raptors, mammals, reptiles, amphibians, invertebrates, and many rare or listed species. For example, the endangered tidewater goby (*Eucyclogobius newberryi*) is found in several of the tributary creeks; endangered southern steelhead trout (*Onco-rhynchus mykiss*) and state endangered Belding's savannah sparrow (*Passer-culus sandwichensis beldingi*) also rely on the Slough's wetland habitats. Together, these species highlight the ecological importance of the Slough and the need to balance management activities with habitat protection.

The current state of the ecosystem and the habitat makeup of the Slough today is substantially different from historical conditions. The Slough is fragmented by berms, airport basins, tide gates, concrete flood control channels, and surrounding development constrains the extent of the "transition zone" between the tidal and upland habitat, reducing the ability for the wetland habitats to migrate upslope as the sea level rises, particularly if hard infrastructure and coastal armoring protection is a priority (see Figure 11). This is sometimes referred to as "coastal squeeze."

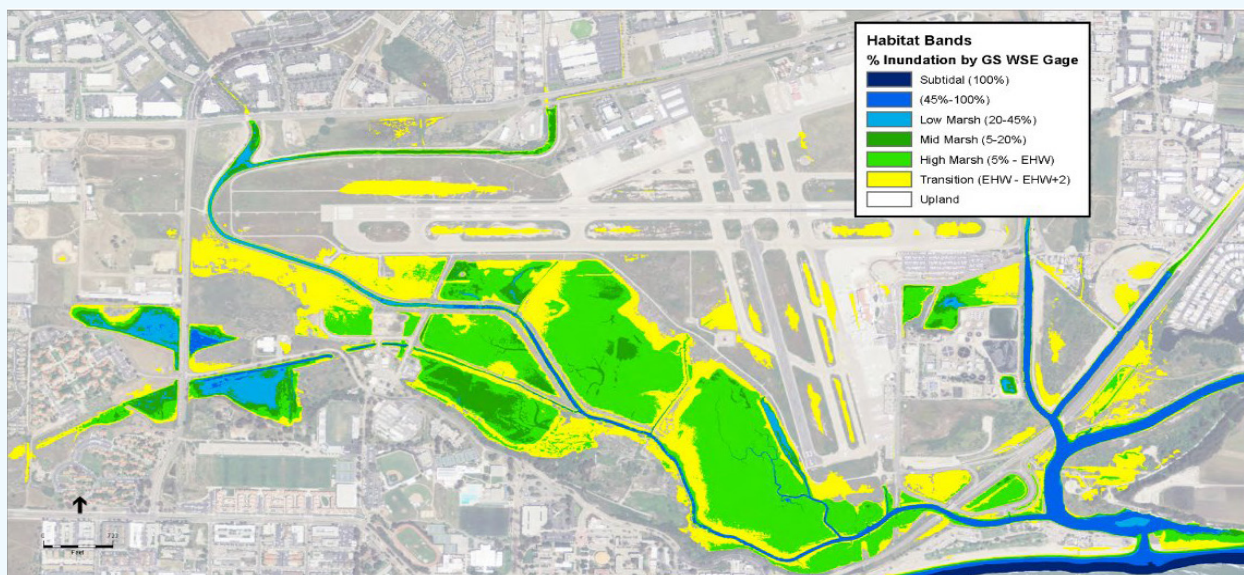


Figure 11: Habitat bands of the Goleta Slough with open tide gates. Source: *Goleta Slough Area Sea Level Rise and Management Plan*, Prepared for The Goleta Slough Management Committee by ESA, 2015.



Efforts to protect and conserve the natural ecosystem have led to designations by various land management and ownership agencies that further delineate geographies within the ecosystem, creating multiple discrete approaches to protection and management. The Goleta Slough Ecosystem Management Plan (GSEMP) Area refers to the vital estuarine wetlands and surrounding habitats of Goleta Slough and encompasses the Goleta Slough Ecological Reserve and the Goleta State Marine Conservation Area, two specific designations established to facilitate habitat restoration, species protection, and conservation of coastal and marine resources.

The Goleta Slough Ecological Reserve was established and designated by the California Fish and Game Commission in 1983 to protect the existing natural ecosystem. The Goleta State Marine Conservation Area is a Marine Protected Areas (MPA), a designation that safeguards diverse coastal habitats like marshes, beaches, and reefs, allowing some activities like recreational fishing (finfish/inverts) but prohibiting harming marine life, creating vital nurseries and feeding grounds for fish, birds, and mammals.

The History & Cultural Significance

The Goleta Slough area has been shaped by both natural processes and human use for centuries. As the original stewards of the Goleta Valley, and the Goleta Slough, the Chumash maintained the natural ecosystem for thousands of years as an extensive, tidally influenced wetland used for fishing, hunting waterfowl, harvesting plants, and as part of a broader network of coastal and inland trade and travel routes. A large Chumash village known as Helo' was

one of many important cultural sites historically located on Mescaltitlan Island and in the Slough (see Figure 12). The Goleta Slough still holds deep tribal cultural significance for the Chumash people, but is largely no longer accessible to the local tribal community due to airport regulations and private property restrictions.

Although the Goleta Slough remains culturally significant to the Chumash people, access to this ancestral landscape is now largely restricted.

Following Spanish colonization in the late 1700s, land use around the Slough began to shift as ranching and agriculture expanded under the mission and rancho systems. In the 1800s, during Mexican and later American periods, grazing, farming, and early infrastructure projects led to increased sedimentation and the first alterations to creek channels and wetlands. The Great Flood of 1861-62, followed by a period of overgrazing and drought, filled in the deepwater Goleta Bay and forever changed the landscape into the tidal marsh we have today. By the late 19th and early 20th centuries, drainage, diking, and filling accelerated to support agriculture, rail lines, roads, and eventually airport development, significantly reducing the size of the Slough and disconnecting it from natural tidal processes. In the 1930s, General Petroleum Corporation began drilling in the area in search of oil, but after minimal results, the Southern Counties Gas Co. began instead extracting natural gas and by 1939 they successfully injected gas into the underground reservoir and built a

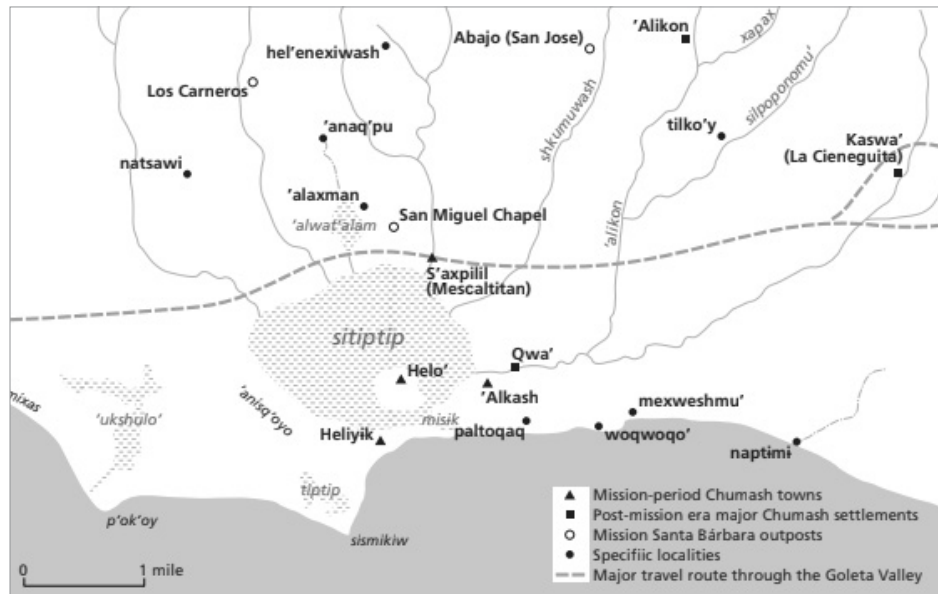


Figure 12: Ethnographic Place Names of the Goleta Valley. Source: [Goleta Slough Prehistory: Insights Gained From a Vanishing Archaeological Record](#).

compressor site for sustained operations, with La Goleta Gas Field still operating as an underground gas reservoir and storage facility today. In the 1940s, Mescaltitlan island was partially leveled during the construction of the Santa Barbara Airport, and was used to fill marsh and salt flat habitats, an act which significantly impacted the cultural resources there and permanently altered the estuarine landscape. Utilizing the existing airstrip during World War 2, a Marine Corps Air Station was also established in 1942. The same location was later developed into the Goleta Sanitary District wastewater treatment plant site.

These changes set the stage for late 20th-century recognition of the Slough's ecological value and subsequent efforts to protect and manage what remains as a critical coastal wetland. Each of the different ways to identify the Goleta Slough and the surrounding area have specific implications and uses, but for the purposes of this report the term "the Slough" will be exclusively used to reduce confusion and to represent all relevant environmental and sociological facets of the multiple systems that exist in a common area.

The Slough Dynamics & Management

Management of this 2,250-acre ecosystem is complex, reflecting both its ecological diversity and its location at the intersection of multiple governing jurisdictions and land owners. The Slough has a patchwork of overlapping governing jurisdictions, with no single entity having full authority over decision-making or visioning for how to manage slough resources and development in and around the Slough. Multiple local, regional, and state government entities, private sector businesses, and non-profit organizations own or have management authority over part of the Slough (Figure 13).

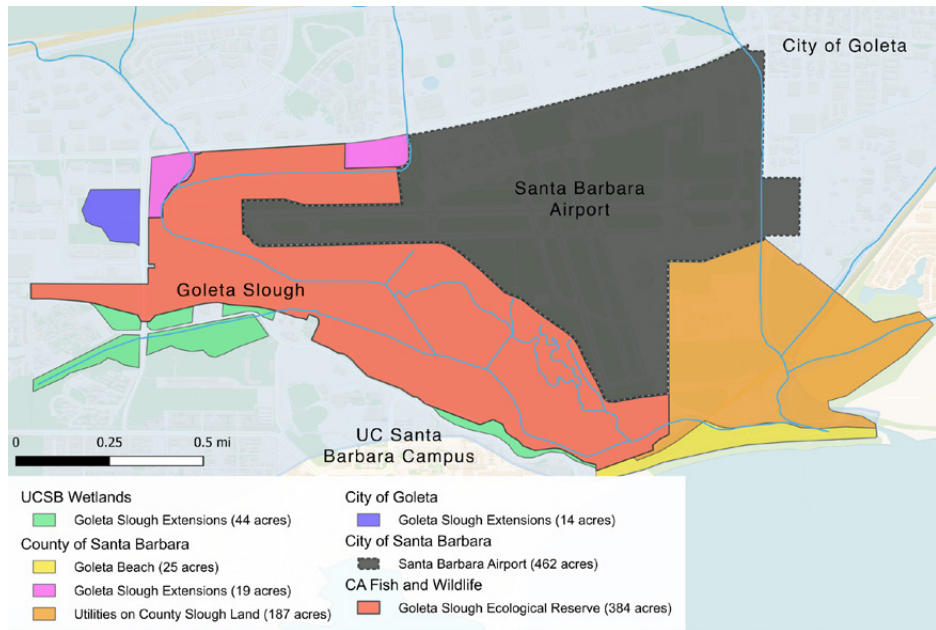


Figure 13: Map of Land Ownership/Authority in the Slough

Ownership:

- The Airport was originally developed in the Slough in late 1930s because of its flat, open areas of wetlands that were filled with sediment from Mescalitlan Island, and was formally acquired by the City of Santa Barbara in 1941
- The Goleta Slough Ecological Reserve was established and designated by the California Fish and Game Commission in 1983 to protect the existing natural ecosystem and is managed by the California Department of Fish and Wildlife (CDFW)
- The County of Santa Barbara and the University of Santa Barbara also hold land and have jurisdictional boundaries within the Slough ecosystem area

Management:

- Formal management responsibilities are divided among the the City of Santa Barbara, City of Goleta, County of Santa Barbara, UCSB, the California Department of Fish and Wildlife, and the California Coastal Commission.
 - The City of Santa Barbara owns the Santa Barbara Airport property, which makes up 462 acres in the Slough.
 - County of Santa Barbara owns and manages the Goleta Beach and parts of the Slough extension, as well as utilities within the Slough.
 - The City of Goleta owns a small 14 acre piece of the Slough
 - UCSB owns and manages the UCSB Wetlands, which is 44 acres within the Slough and adjacent to the Campus.
 - The California Department of Fish and Wildlife and the California Coastal Commission manage the Goleta Slough Ecological Reserve, which represents 384 acres and the only protected land within the Slough.
- The federal government also plays a role through the U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration (NOAA),

and the Army Corps of Engineers. The Federal Aviation Administration (FAA) is also a central management actor given its significant role in shaping the maintenance and development of the Airport.

- The Santa Barbara County Flood Control District and BEACON, a Joint Powers Authority, are also stakeholders given their roles in sediment management
- The Goleta Sanitary District and the Goleta West Sanitary District, hold easements or property for their infrastructure and facilities near or adjacent to the Slough
- The Santa Barbara County Flood Control District conducts maintenance and dredging activities, managing flood protection and water flow in the Goleta Slough, and maintains key feeder creeks to the Slough from the larger watershed (Tecolotito, Carneros, Atascadero, San Jose, San Pedro)
- The Goleta Valley Vector Control District, also referred to as Mosquito and Vector Management District, manages mosquito populations throughout the Slough
- The California Department of Transportation maintains State Roadway 217, which runs through the Slough
- The Land Trust for Santa Barbara County holds conservation easements and has managed restoration projects on specific parcels in the Slough
- Southern California Gas Company (SoCalGas) owns La Goleta Gas / Storage Field and given its location directly under the Goleta Slough, maintains proactive management of its interactions with area

Each entity brings different mandates—aviation operations and FAA requirements, land use, housing, ecological conservation, water quality, transportation infrastructure, and academic research—creating a mosaic of overlapping authorities, each with unique priorities.

Aviation, conservation, infrastructure, housing, and water management priorities converge in the Slough—often without a unified framework.

The Goleta Slough Management Committee (GSMC), established in the 1990s and funded by the City of Santa Barbara through the Airport, was created as the first mechanism to address the complex jurisdictional landscape. The GSMC seeks to provide an open forum that brings together all of the jurisdictions and regulators across the geography to

better share information and coordinate the management of significant events on both the natural habitats and the built environment in the Slough. While the GSMC is an important information sharing platform, its structure doesn't allow for it to have any comprehensive governance leadership, or influence large scale projects – two critical components to successfully advancing the Slough's resilience.

Without a single owner or governing authority of the Slough or a designated lead agency to oversee the area, projects have the potential to advance in silos, missing opportunities to consider how the various social and environmental objectives in the area could be better integrated through a more holistic community vision for the Slough. As the impacts of sea level rise, severe storms, flooding, and other natural events intensify, these jurisdictions recognize that existing management structures are insufficient to address current and future challenges.

The Development of the Slough

Today, the Goleta Slough's urban landscape is inextricably linked with the Slough's ecological systems, creating a complicated socio-ecological relationship.

Over the past century, the Slough has become home to a mix of natural and built infrastructure that coexist. The built infrastructure in and around Slough now provides critical services, like water, sanitation, power, and mobility, for the entire region. This development has occurred alongside some investments in the natural ecosystem, but their coexistence is increasingly strained as the built infrastructure expands and the impacts from climate change become more frequent and pronounced.

Regional leaders must decide how to balance investments in the natural ecosystem and built infrastructure, recognizing their interdependence. As the climate and regional demands continue to evolve over the next 50 years, the balance between prioritizing the natural and the built environment must also shift.

The Built Infrastructure

These assets represent critical infrastructure for the region's transit, water and sanitation services, economy, and recreation and are integral to the lifestyle of residents in the larger region. The most prominent infrastructure entangled with the Slough includes the Transportation Corridors, Santa Barbara Municipal Airport, Wastewater Facilities & Utilities, and Oil & Gas Operations (see Figure 14). Each asset has its own set of challenges and interplay with the Slough, including added impacts of climate change. The overlay of these utility and transportation facilities have become so engrained into the fabric of the area that they have been historically valued over the needs and considerations of the natural ecosystem.

The sections that follow provide detailed examinations of these assets. Drawing on physical evidence and planning documents, they illustrate the high level risks facing the built infrastructure of the Slough and serve to help identify opportunities to increase resilience.

Transportation Corridors

The Slough contains several critical transportation corridors that serve both local and regional mobility, including Hollister Avenue, State Route 217, and the Union Pacific rail line. Each provides essential connectivity — Hollister as the spine of Old Town Goleta and a link to Highway 101, SR 217 as the primary access route to UCSB and the Airport, and the rail line as part of the region's goods and passenger network. All three transportation corridors face

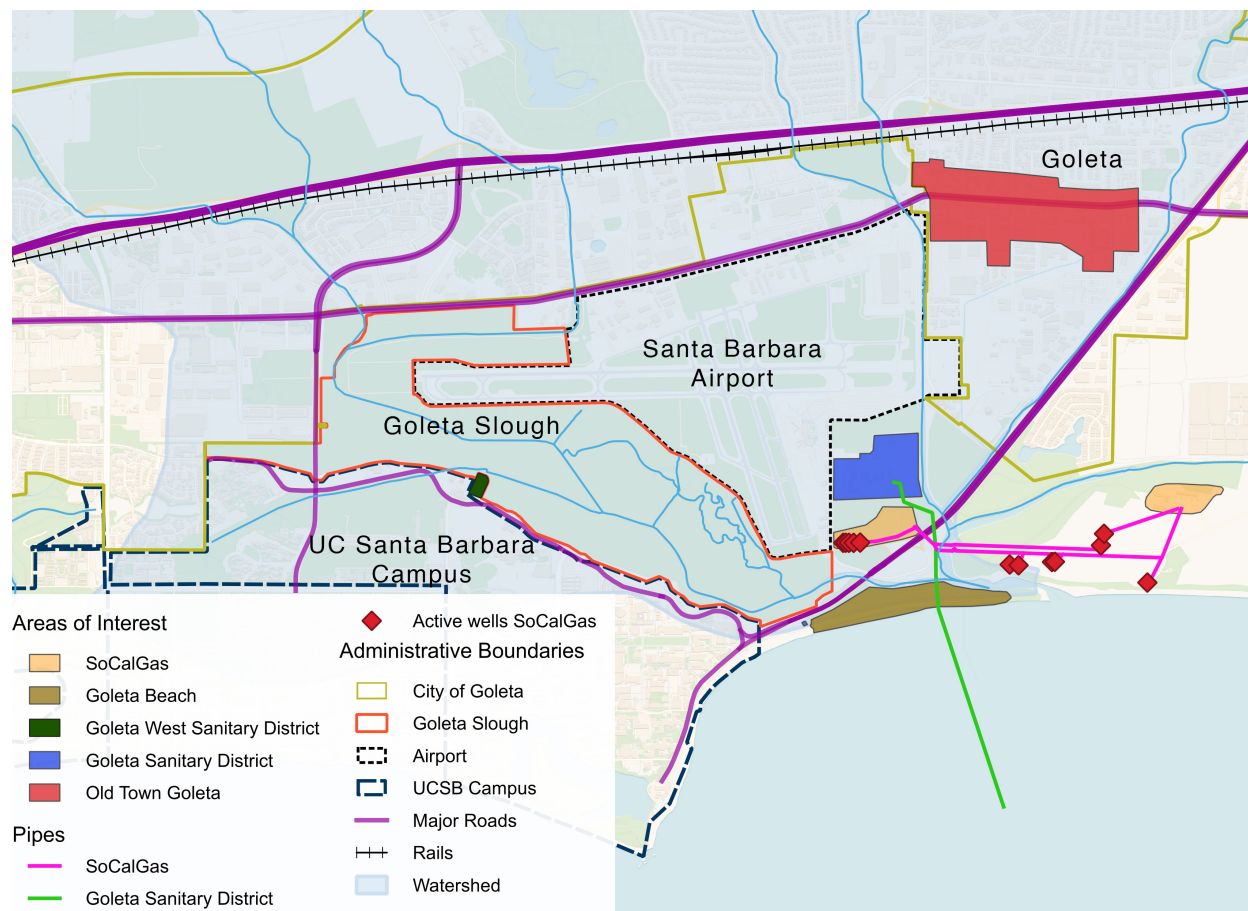


Figure 14: Overview of Goleta Slough and Surrounding Areas of Interest.

exposure to flooding associated with the Slough's bar built estuary dynamics, and coastal storm events, which will continue to worsen with increased frequency and severity of storms and projected sea level rise.

Hollister Avenue has experienced repeated closures during El Niño events and storm-driven flooding, disrupting access to Old Town and adjacent neighborhoods. Santa Barbara County is located in a coastal plain.

Infrastructure that underpins regional mobility and economic activity is increasingly exposed to flooding and climate-driven hazards within the Goleta Slough.

Precipitation from storms is funneled down from Santa Ynez Mountains through numerous sub-watersheds through creeks and streams that meet the coastal plain and empty into lagoons and estuaries, and ultimately into the Pacific Ocean. The rail line runs through the coastal plain and is elevated through many of these low-lying areas via trestles, culverts and bridges.

Projections also demonstrate SR 217, which runs immediately adjacent to the Slough, will face inundation under future high-water scenarios. These projections, which also show inundation of Hollister Avenue around the Slough, underscore the compounding risks to transportation infrastructure that underpins both local access and regional connectivity.

Santa Barbara Municipal Airport

The airport is owned by the City of Santa Barbara and has been in operation since 1946. Its location within the Slough makes it highly vulnerable to flooding, with both runways and terminal areas at risk. Historical extreme storm events illustrate the scale of flooding impact, most recently resulting in major closures in November 2025 - January 2026. In the past, lagoon flooding impacting the Airport was typically managed through mechanical breaches of the Slough inlet by Santa Barbara County Flood Control District under emergency permits, where excavators were used to dig through the sandbar and allow water to drain into the ocean, which in turn reduced the water levels within the Slough and flooding impacts on airport critical assets.

The practice of mechanical breaching provided short-term relief from lagoon flooding but also raised ecological concerns. Since 2018, the U.S. Fish and Wildlife Service (USFWS), the National Oceanic and Atmospheric Association (NOAA)'s National Marine Fisheries Service (NMFS) have limited the use of mechanical breaching, citing potential impacts on sensitive species such as the tidewater goby and Southern steelhead trout. [Vulnerability Assessments](#) (see Appendix A) conducted by the Airport show that without adaptation in the near-term (2024-2100), increased precipitation due to predicted climate change significantly raises flood risks, in the mid-term (2048-2076), runway flooding and airport closures increase from 21% to 61%, and in the long-term (2068-2108), the airport will likely become non-operational due to annual flooding and related costs.

Utilities

Utilities in and around the Slough include water supply infrastructure, energy systems, and regional power distribution. Together, these networks illustrate how the Slough intersects with essential services across the Goleta Valley.

The Goleta Water District (GWD) maintains key facilities near Goleta Beach, including a recycled water main along Moffett Place and Sandspit Road. Recycled water, first introduced in 1995, is primarily used for irrigation and restroom facilities. GWD also manages potable supply through multiple sources including Lake Cachuma, deliveries from the California State Water Project, and production wells in the Goleta Groundwater Basin. In wet years, groundwater injection provides a measure of long-term storage. These diverse sources highlight the complexities of the water system and limit GWD's ability to relocate infrastructure outside of the Slough. The location of these pipes has also limited adaptation solutions to address coastal erosion at Goleta Beach given that the main runs under the parking lot along the shoreline.

The *La Goleta Gas Field*, operated by Southern California Gas Company (SoCalGas), underlies portions of the Slough and adjacent areas, supporting regional energy demand through a subsurface network of wells and pipelines. Located between Atascadero Creek and Goleta Beach near More Mesa and the Santa Barbara Airport, the subsurface reservoir has been in use since 1929, first as an oil field and then in 1941 as an underground storage facility with an on-site compressor station. It holds 21.5 billion cubic feet of natural gas and is central to supporting the northern end of the transmission pipeline system. Foundation support structures were installed to address vibrations caused by compressors, but little data is available to identify how this infrastructure impact the Slough ecosystem. Additionally, as SoCalGas looks to expand, they will introduce drill rig lighting that could have further impacts.

The *Water Resource Recovery Facility (WRRF)*, operated by the Goleta Sanitary District, is located southeast of the Airport on what remains of Mescalitlan Island. Additional wastewater infrastructure connected to the Slough includes the ocean outfall pipe and maintenance vault at Goleta Beach, a pump station on Firestone Road, and a network of manholes and pipelines owned and operated by two agencies: the Goleta Sanitary District and the Goleta West Sanitary District. Notably, the Goleta West Sanitary District had a catastrophic spill in February 2024, when a hole in a sewer main running through the Slough from the Goleta West Sanitary District near UC Santa Barbara to the Goleta Sanitary District treatment plant spilled more than one million gallons

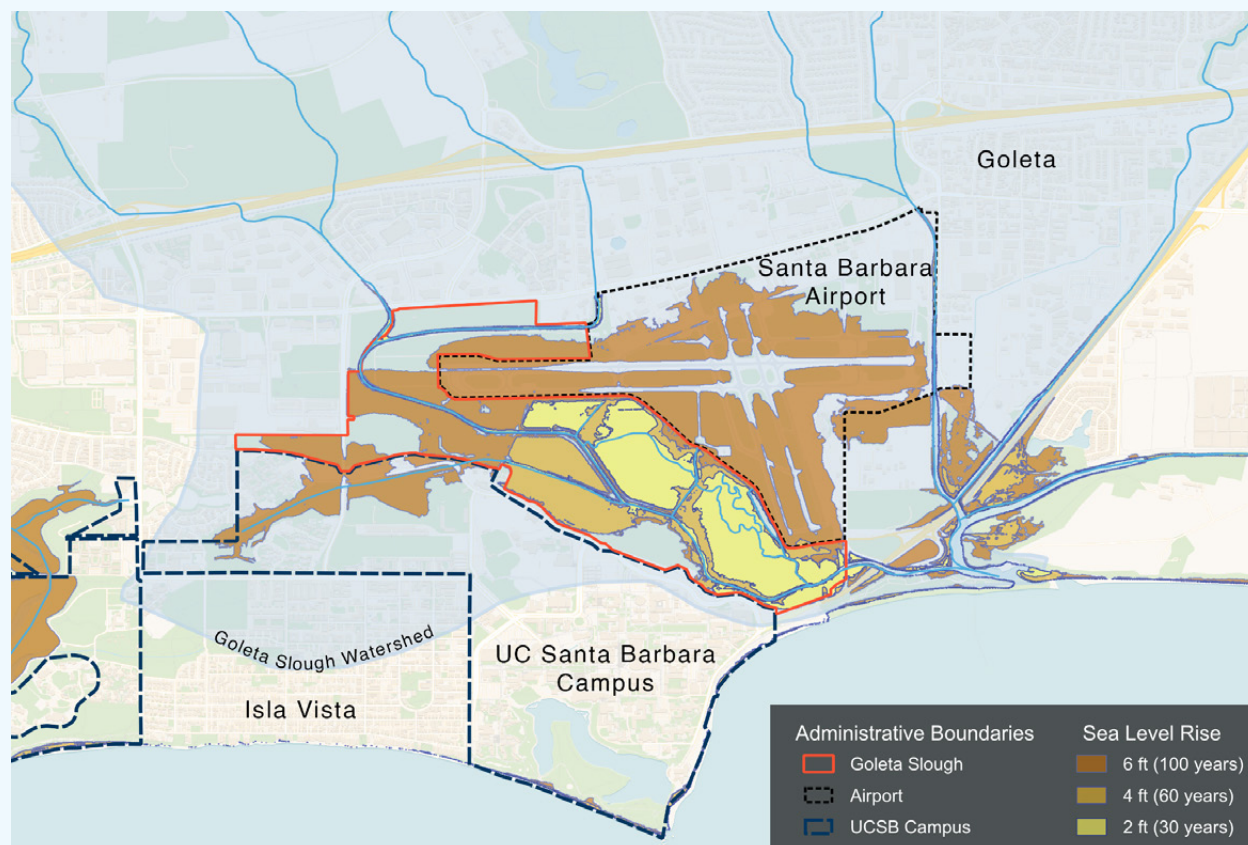


Figure 15: Sea Level Rise Projections for 30-100 Years.

of sewage into the Slough, causing closures of Goleta Beach. Spills remain a risk to the health of the ecosystem and the wider community.

Coastal and fluvial flooding from lagoon rise and tidal inflows is also a risk to wastewater infrastructure. The WRRF itself sits at a slightly higher elevation, but its access roads and surrounding infrastructure are closer to sea level and thus are expected to be increasingly exposed to flooding. Projections of sea level rise (see Figure 15) show that over the next 30-100 years rising baseline water levels will cause regular tidal flooding in locations that today only flood during storms.

Even today, major storm events and inlet closure lead to inundation of key corridors and transportation networks providing access to the WRRF and other facilities, compromising their ability to receive staff, equipment, and emergency response vehicles. As sea levels rise and these storms become more intense and more frequent, floodplain maps (see Figure 16) will need to be redrawn. Areas that today have a 1% (the 100-year floodplain) or 0.2% (the 500-year floodplain) annual risk of flooding will experience much higher probabilities of flooding by mid-century, and what is considered to be a 100-year storm today will produce waves reaching farther inland and greater depths of flooding in the future.

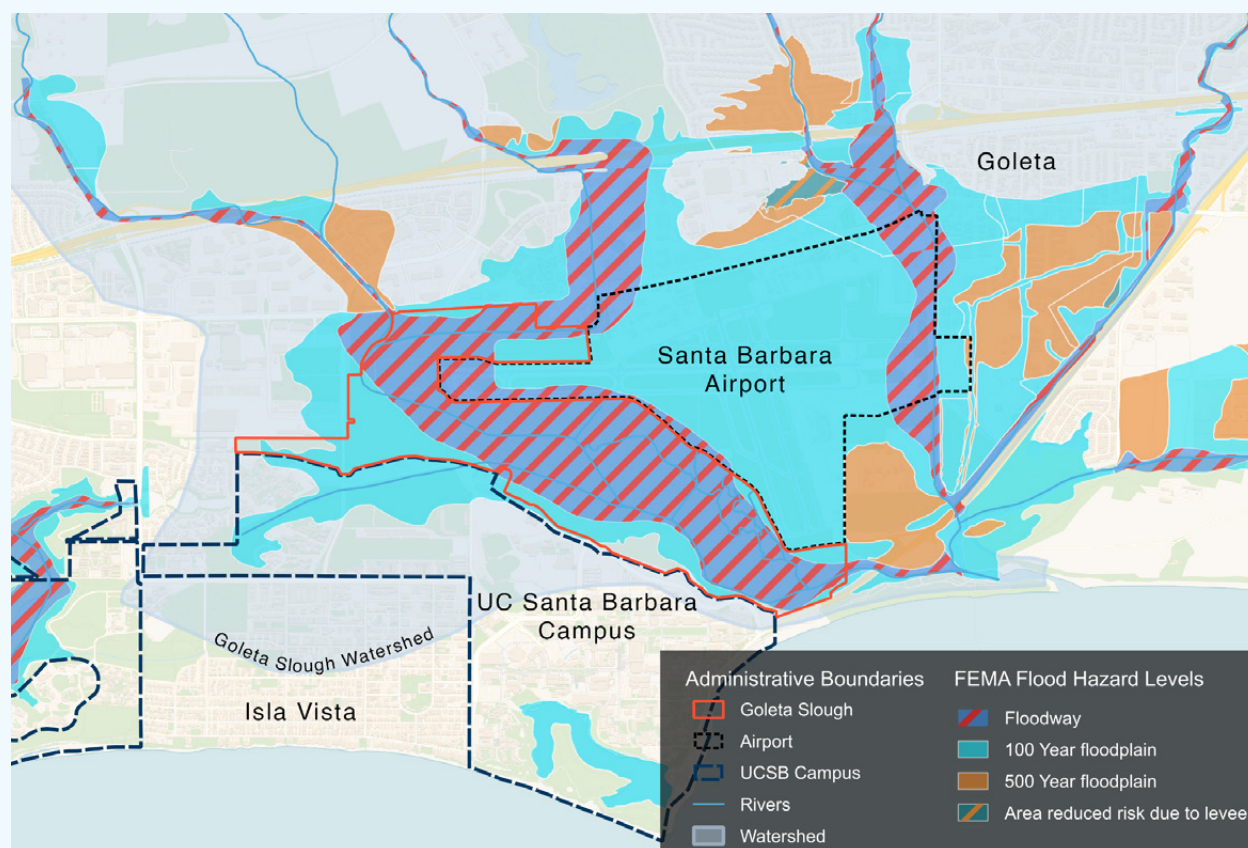


Figure 16: Today's Federal Emergency Management Agency (FEMA) floodplain and hazard designations.

Together, the combined effects of sea level rise and more intense precipitation predict increased frequency, duration, and severity of flooding within the Slough, exposing adjacent infrastructure and development. This will aggravate flood risk to utilities that are deeply entrenched and essential to supplying the area, as well as the larger region, with water, sanitation, and energy. This interdependence magnifies the consequences of disruption and underscores the need for coordinated resilience planning across socioecological systems.

Investment in Built Infrastructure

The robust annual and capital budgets are one indicator of the region's support for the built infrastructure within Slough. In 2024, The Santa Barbara Airport provided 26 daily nonstop flights to 14 different destinations with an annual budget of approximately \$40 million with forecasted total cost of over \$650 million, with \$440 million in operational and \$218 million in capital expenses projected by 2041. The Goleta Water District has an annual operating budget of \$68 million and serves approximately 87,000 people over 29,000 acres of territory. The Goleta Sanitary District saw an increase of \$6.92 million in fund cash balance for 2024/2025 fiscal year. SoCalGas reported a peak annual revenue of \$3.8 billion in 2024. These statistics, while not comprehensive, demonstrate a fraction of the financial and economic impact the utilities have for the region and are a marker for investment and prioritization. Of particular note, these financial sums do not reflect any valuation of recreational or ecosystem services provided.



Figure 17: Recently rebuilt Goleta Beach restaurant and cobble berms. Source: Resilient Cities Catalyst. Goleta Beach Site Visit, December 2024



Figure 18: Tides reaching cobble berm around recently rebuilt parking lot. Source: Resilient Cities Catalyst. Goleta Beach Site Visit, December 2024

The Social & Cultural Assets

Adding to the complexity of the socio-ecological system are two social and cultural assets – Old Town Goleta and Goleta Beach – that interplay with the Slough. Because of their locations adjacent to and in the Slough, they are heavily impacted by lagoon and rainfall flooding and severe storm wave events.

Goleta Beach

The Goleta Beach County Park (Goleta Beach), managed by the County of Santa Barbara, is a heavily used coastal destination adjacent to the Slough's mouth. With approximately 1.5 million visitors annually, it offers a 1,500-foot pier, restaurant, playgrounds, and a regional bike path. Free parking and open access to fishing make the park one of the region's most accessible and low cost coastal spaces, serving both recreational users and subsistence anglers, and underscoring its role in equitable public access to the coast.

This popular beach widens and narrows depending on the sequence of large wave events and climate cycles which affect wave direction and wave energy at the park. Since about 2000, the park has faced episodic coastal erosion and repeated storm wave damage (see Figures 19-20). Shoreline armoring and nourishment projects have been attempted over the past several decades, including the installation of a 800-foot-long emergency rock revetment in 2017. This coastal armoring protection resulted in an almost complete loss of the beach, a classic example of coastal squeeze (i.e., erosion from the ocean side and infrastructure limitations inland).



Figure 19: Rock revetment repair through emergency permits to stem storm-caused erosion. Photo Source: Tom Bolton, [Noozhawk](#), 2016.



Figure 20: Major erosion from winter storms at Goleta Beach County Park. Photo Source: Arthur Sylvester, [Noozhawk](#), 2016.

Goleta Beach also serves as a critical regional sediment receiver site for Santa Barbara County Flood Control District's sediment management activities. The District conducts two types of sediment placement operations at the beach: periodic placement of sediment from planned maintenance dredging of the Slough and its tributaries and emergency sediment placement actions in response to catastrophic events. An example of the latter occurred in 2018, following the devastating Thomas Fire and subsequent debris flow, when significant volumes of sediments were placed on Goleta Beach.

In recent years, efforts have been made to redirect regular sediment management activities such that they help combat coastal erosion and sea level rise in the region. One innovative approach at Goleta Beach used cobbles in a cross shore placed deltaic / groin formation which helped slow sand transport, widening the beach in more recent years. Santa Barbara County is currently working on a complementary project called BeachSMART to identify more effective sediment management activities including those at Goleta Beach.

Still, episodic storm events continue to overtop protective armoring measures (Figures 19-20). The park requires significant maintenance after storms, waves and erosion events. In January 2023, a severe storm caused significant damage to the park's restaurant and other facilities, underscoring the current vulnerability of the site to extreme wave events that will only increase with sea-level rise. The parking lot and restaurant were most recently repaired or rebuilt. These and other park improvements including turf, walkways, tables, trash cans, and benches, adjacent to the revetment along the shoreline were completed in 2025.

Old Town Goleta

The Old Town area includes residential areas and the Old Town Goleta business district, which is centered along Hollister Avenue and is the primary commercial hub for the City of Goleta. The corridor hosts a mix of retail, restaurants, and housing, and provides regional connections to U.S. Highway 101 and State Route 217. This area is among the most flood-vulnerable parts of the Goleta Slough system due to its elevation and position on the coastal

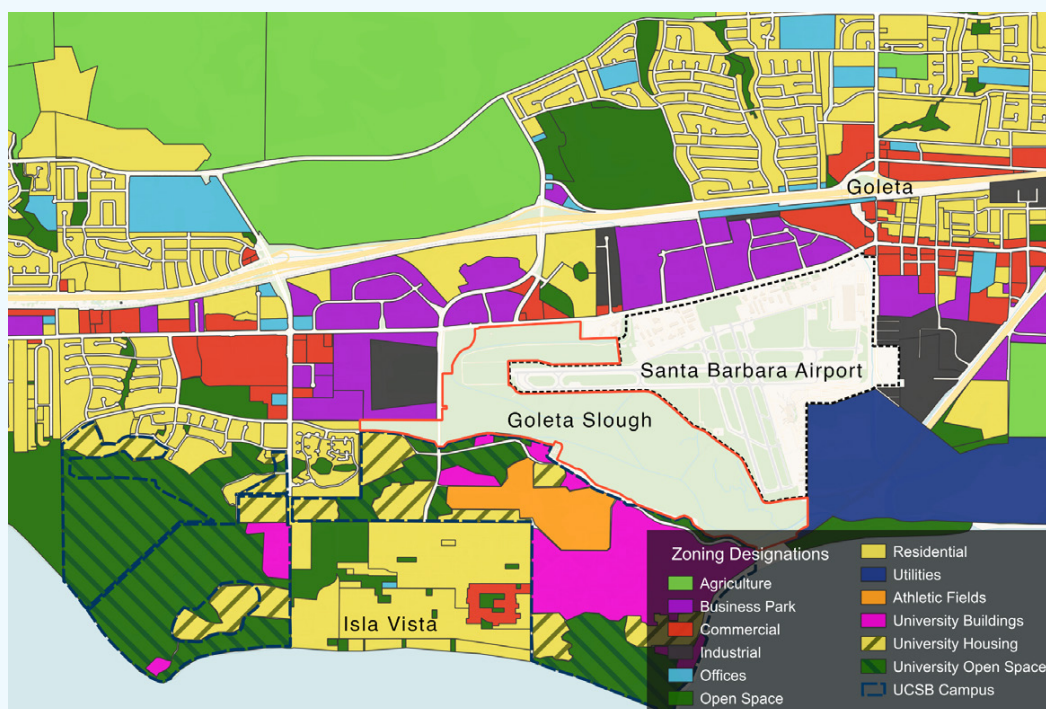


Figure 21: Existing zoning designations and major stakeholders in/around the Slough.

plain at the edge of the Slough with San Pedro and San Jose Creeks flanking both sides, and Las Vegas Creek channelized immediately to the North. Flooding in Old Town is often exacerbated during major storm events, particularly El Niño years, when creek inflows from the Santa Ynez Mountains and Slough flooding converge. Of special concern is Hollister Avenue itself, which serves as the community's main through-way and has already experienced numerous flooding incidents, underscoring the corridor's vulnerability to disruption. Fairview is also a key artery because it connects Hollister, Hwy 101, the airport and Hwy 217 and residential/commercial areas north of Hwy 101.

Flooding along Hollister Avenue threatens the main commercial corridor and primary transportation route for the Goleta community.

The adjacent Placentia neighborhood, a three-acre mixed-use residential and industrial district abuts the part of the Slough adjacent to the Santa Barbara Airport, with the San Jose Creek running between (see Figure 21 for zoning designations in the Goleta Slough area). Residences here include both single-family and multi-unit housing, alongside small industrial uses such as a tow yard and waterproofing business. Bordering the southern edge of Old Town Goleta, the remainder (which also constitutes the majority) of the neighborhood is bordered by vacant land and open space. The census tract which includes this neighborhood has been designated a "disadvantaged community" by the state of California based on "geographic, socioeconomic, public health, and environmental hazard criteria." Additionally, the low-lying position of the neighborhood leaves it highly susceptible to flooding during extreme rainfall events (see Figure 22).



Figure 22: Flooding in Old Town Goleta in January 2026. Photo Source: Ryan Collom, [Noozhawk](https://www.noozhawk.com), 2026.

The City of Goleta is currently undertaking a state-mandated Housing Element Update for the 2023–2031 planning period. This process involves identifying sites for future housing, and while the process includes environmental review and community input to ensure compliance with state requirements and local priorities, potential development in locations near the Slough can have ecosystem impacts and may face challenges with flooding or other extreme weather events, even in the near term (see Figure 23 for known development projects and potential rezone sites).

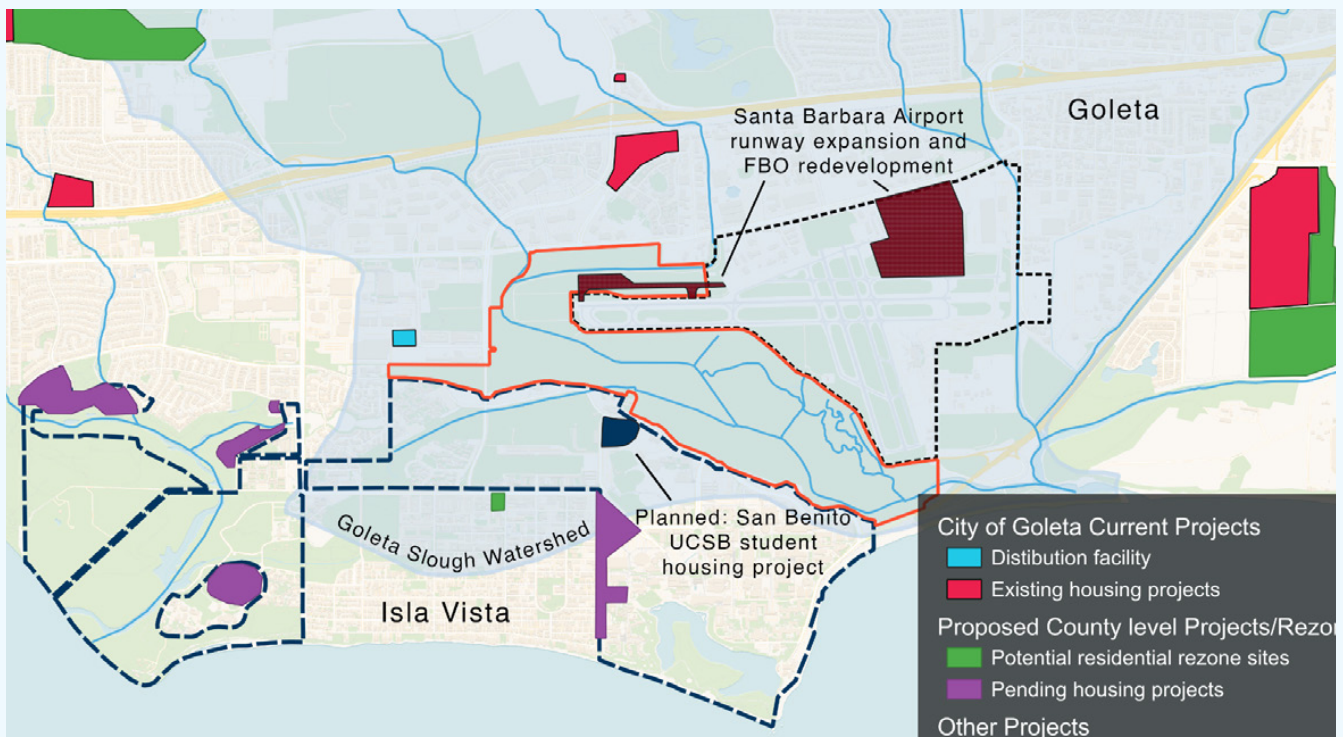


Figure 23: Known projects and potential rezoned areas in/around the Slough.

Synthesizing Regional Plans and Analyzing Climate Hazards

The vast array of entities involved in and influencing the Slough have invested significant efforts in planning, research, and analysis across various geographies, timescales, and focal points in and around the Slough. These efforts provide substantial data and perspectives regarding the challenges faced by the Slough. To better understand its physical, social, and economic landscape, this project aims to streamline and synthesize the findings from these efforts through a robust review of existing documents and literature.

Analysis & Approach

To understand the resilience challenges and opportunities of the Slough and avoid duplicating efforts, the project team undertook a review of more than 95 existing plans and documents identified through a combination of desktop research and references from local stakeholders (see Appendix A). This extensive review was designed to summarize and integrate the past and current landscape of resilience planning efforts, catalog existing or planned projects that may impact the resilience of the Slough, inform a scientific and

More than 95 plans and studies were reviewed to build an integrated, evidence-based foundation for resilience planning.

historic baseline which can be used to educate and raise awareness about the Slough ecosystem through community engagement, and ultimately act as the foundation for building an integrated resilience vision for the region.

A wide variety of plans and documents were included in the review ranging in geographic scale from site-specific (i.e. focused on a single site like the Santa Barbara Airport or the Goleta Slough mouth) to broader regional or national scale documents (Figure 24). The selection of documents included some foundational plans for the area but largely focused on more recent publications in the last 30 years and included documents authored by 31 different government, nonprofit, private, and academic entities (Figure 25). The most represented organizations in the review included the major anchor institutions (e.g. universities and government institutions), infrastructure owners, and local jurisdictions including the County of Santa Barbara, the City of Santa Barbara, the City of Goleta, the Santa Barbara Airport, and University of California Santa Barbara (UCSB). Larger regional governance entities such as the County of Santa Barbara and City of Santa Barbara had the highest number of publicly accessible documents, and the results are reflective of the focus areas within those documents.

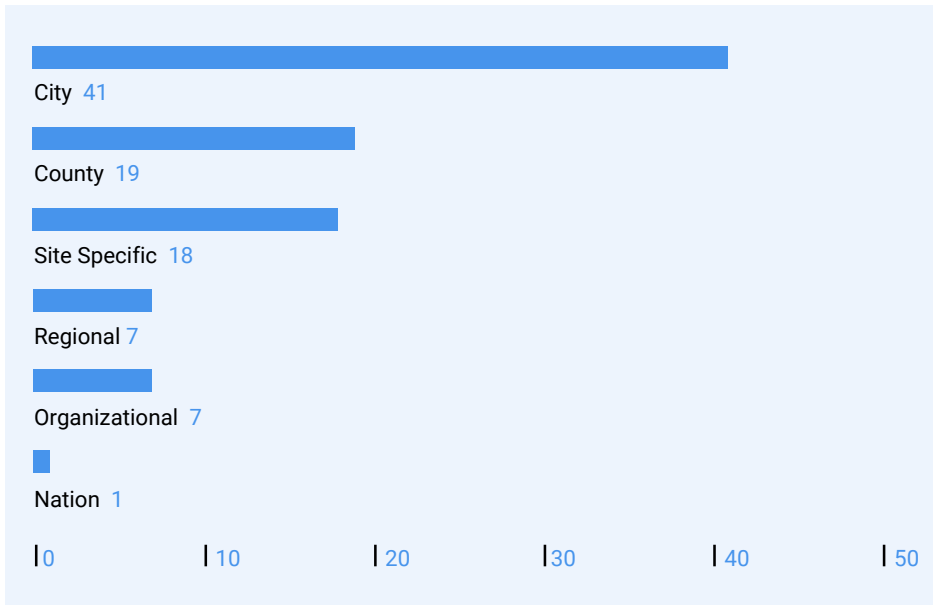


Figure 24: Jurisdictional Scale of Documents Reviewed.

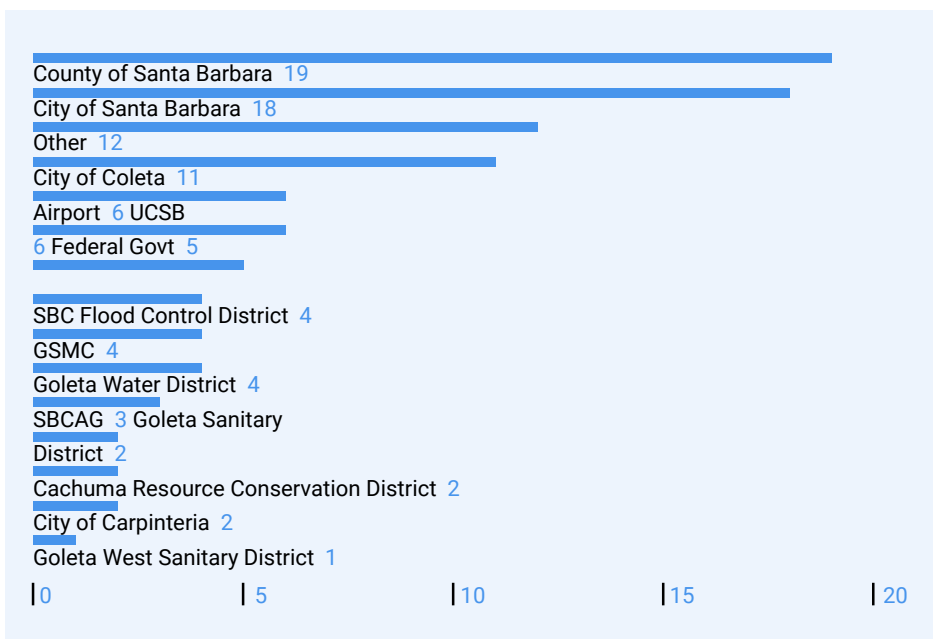


Figure 25: Authors of Documents Reviewed.

A case study, developed by partners at Integral Consulting LLC, further explores 20 “seminal” plans and outlines direct causal pathways for climate impacts (see Appendix B).

Methodology

The plan review process employed a structured analysis framework to extract and categorize information from planning documents including:

- Metadata such as title, date, and plan type;
- Shocks (acute crises) and stresses (slow-burning, underlying threats), captured through both explicit mentions and implicit references (e.g., rainfall change noted under “drought/water management issues”);
- Priorities for the Slough outlined in the plan or document;
- Projects relevant to the Slough and its surrounding communities that had an implementing entity. Project ideas without clear ownership were noted separately.

Shocks and stresses describe different types of impacts—acute events and long-term pressures—both critical to understanding resilience.

Shocks and stresses are a method of categorizing impacts defined by time and incident type, but do not inherently imply the severity of the impact – both shocks and stresses have varying degrees of severity and impact. Some challenges can be classified as either shocks or stressors depend

ing on the timeframe of an event. For example, coastal erosion might result from a sudden storm (a shock) or from gradual sea level rise (a stressor). The team worked together to identify relevant shocks and stresses applicable to the region (See Appendix C). Many shocks and stresses that were not directly related to coastal issues (but impacted the resilience of the region) were also included in the review.

Limitations

There were a number of limitations of the plan review. The list of plans that the team reviewed, while extensive, was not exhaustive and was weighted towards plans written by land owners and managers that were focused on coastal resilience and climate challenges. It included plans that were publicly available or provided by stakeholders and therefore did not cover critical perspectives from underrepresented groups with less published information, such as local Chumash bands or unpublished data and reports.

Additionally, the process for coding the plans inherently limited some of the granularity of the data and required team members to use their expert judgment when categorizing risks. While many key themes were identified during the plan review, the analysis was not intended to finalize a decision-making framework for project prioritization, which will require additional engagement and expertise.

Shocks: Acute Crises

The initial high level review of documents revealed that the top shocks to the region identified across jurisdictional boundaries include flooding (coastal/tidal, rainfall, and lagoon flooding), infrastructure failure, and coastal erosion (see Figure 26). Increased wildfires also emerged as a concern in the findings, and in March 2025, CalFire released [new wildfire risk maps](#) that showed a much broader land area in the coastal region that is vulnerable to fire. Additional shock events identified as risks through the documents included earthquakes, landslides/mudslides, hazardous materials accidents, extreme heat, tsunamis, and power outages. Priority shocks tracked closely across documents that were directly relevant to the Slough itself (i.e., documents that address the Slough or assets immediately around it) as well as in documents not directly addressing the Slough.

Individual hazards also do not have singular impacts. A shock, such as fluvial watershed flooding or coastal wave flooding, can trigger inlet closures, sediment shifts, or infrastructure failures. Adding in other shocks, from wildfire to earthquakes, further complicates the system response, as they often compound or amplify one another.

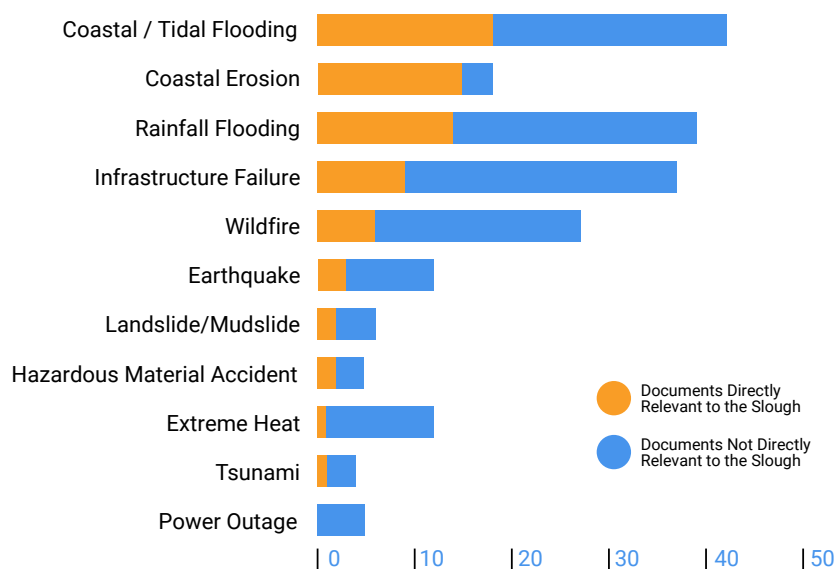


Figure 26: Top Shocks Mentioned in Reviewed Documents.

Stresses: Underlying and On-Going Systemic Impacts

A stress is characterized by long-term, chronic pressures that undermine a system's stability. These long-term environmental and socioeconomic challenges unfold over different timescales and can also amplify the impacts of shocks. A wide range of stresses were identified as persistent challenges for the Goleta Slough Coastal Area (Figure 27). Environmental degradation, which includes a wide range of impacts on the ecosystem such as loss of biodiversity, pollution, reduced water quality, and more, resulting from development, was identified across the highest number of documents. Climate-related stresses such as sea level rise and drought/water management challenges were also priority issues. Other frequently identified stresses included inadequate infrastructure, population growth, gentrification/development, public safety (particularly in the event of emergencies and natural disasters), and inadequate long-term planning. In plans directly addressing the Slough, versus broader regional plans, issues related to mouth management (such as a lack of a consistent framework for mouth breaching) and sediment management (including where debris from sediment basins is placed) were primary concerns. Once again, these stresses are interdependent with shocks; for example, the state of the Slough mouth is a risk factor for flooding, and sediment management is a key factor in reducing both flooding and coastal erosion. This result reflects the complexity of the bar-built estuary dynamics that exist in the Slough.

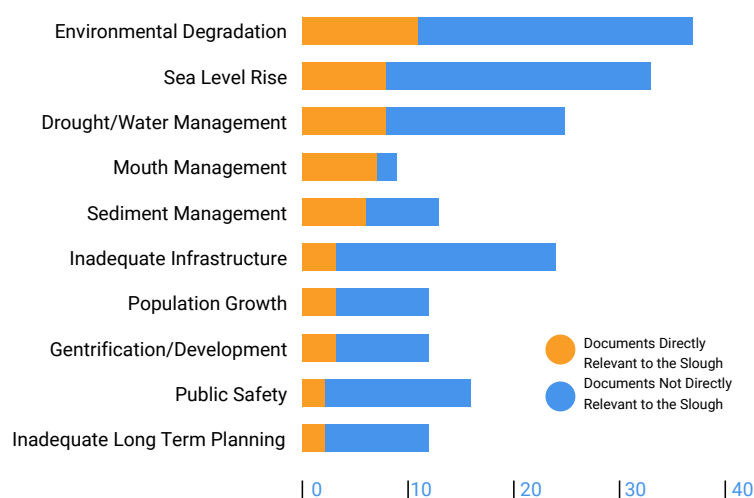


Figure 27: Top Stresses Mentioned in Reviewed Documents.

	COUNTY	LOCAL	SITE SPECIFIC
 ENVIRONMENTAL DEGRADATION	✗	✗	✗
 COASTAL OR TIDAL FLOODING	✗	✗	✗
 CLIMATE CHANGE	✗	✗	✗
 RAINFALL FLOODING/SEVERE STORMS	✗	✗	✗
 INFRASTRUCTURE FAILURE	✗	✗	✗
 WILDFIRE	✗	✗	
 SEA LEVEL RISE	✗	✗	✗
 DROUGHT/WATER MANAGEMENT CHALLENGES	✗	✗	✗
 COASTAL EROSION	✗	✗	✗
 PUBLIC SAFETY	✗	✗	
 INADEQUATE INFRASTRUCTURE		✗	✗
 GENTRIFICATION AND DEVELOPMENT PRESSURES	✗		
 LACK OF AFFORDABLE HOUSING	✗		
 ECONOMIC INEQUALITY	✗		
 EXTREME HEAT	✗		
 EARTHQUAKE		✗	
 POOR AIR QUALITY/POLLUTION		✗	
 OVERPOPULATION OR POPULATION GROWTH		✗	
 MOUTH MANAGEMENT			✗
 SEDIMENT MANAGEMENT			✗
 LACK OF OR DISPARITIES IN ACCESS TO OPEN SPACE/GREEN SPACE			✗
 SEVERE STORMS			✗

 top shocks/stresses at identified scale
  within top 10 shocks/stresses across all scales
  shocks/stresses that emerged as prevalent at identified scale but not at others

Figure 28: Top Shocks and Stresses at Different Scales. See Appendix B for full list.

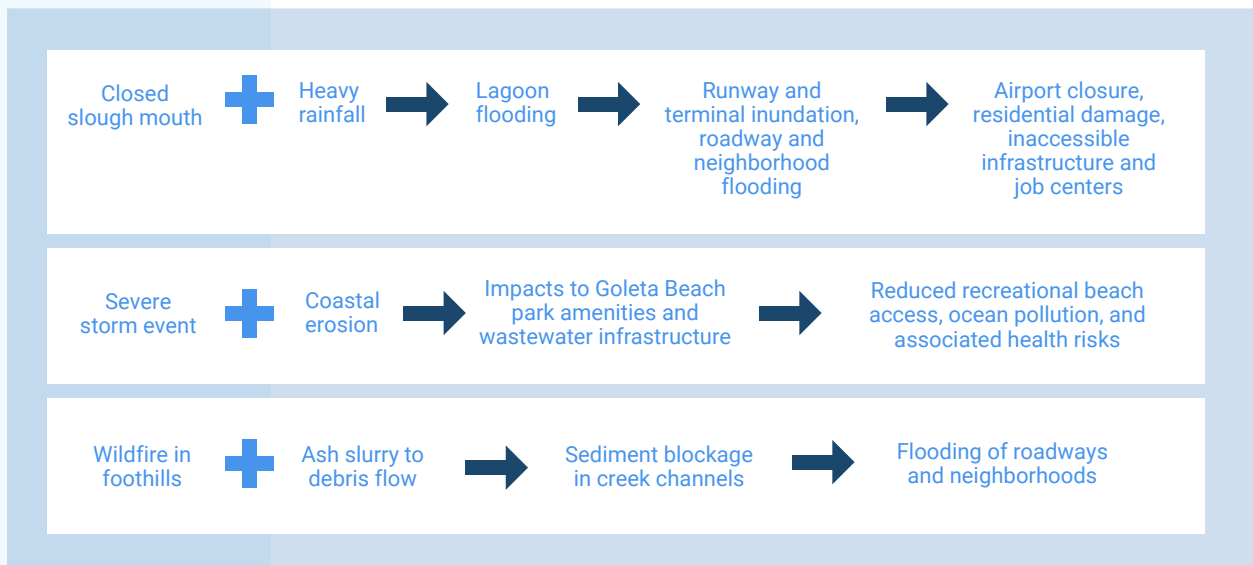
Importantly, the top shocks and stresses varied widely across different geographic scales (Figure 28). At the county scale, additional stresses that emerged as prevalent included economic inequality and lack of affordable housing. At the local scale (i.e. city-wide), poor air quality and pollution were uniquely highlighted. At the site-specific level, meaning a specific location within the Slough or other concise geographic point, challenges related to sediment management and lack of or disparities in access to open space were elevated concerns.

Understanding both the acute shocks and the long-term stresses impacting the Slough, and how they interrelate in complex socio-ecological systems, is an essential step in identifying the parameters for multi-benefit projects that deliver the greatest resilience benefit to communities.

Illustrating System Complexities

Cause-Effect Pathways

Cause-Effect pathways are one way to outline the sequence of events, conditions, and mechanisms that link an action or cause to its outcome. These pathways illustrate how a change in one variable can lead to a change in another through a series of steps, helping to understand how and why a particular result occurs. With the socio-ecological complexities of the Slough, cause-and-effect pathways more clearly demonstrate complex chains of events where climate-related events trigger cascading impacts on the Slough and its built infrastructure. A few examples localized to the Slough include the following (with arrows representing “leads to”):



More examples of cause-effect pathways, along with additional analysis of vulnerable Slough asset areas, are provided in Appendix B. Appendix B includes figures derived from a seminal plan set and associated metadata, with AI used to assist in organizing and summarizing patterns for cross-plan comparison.

Governance

The intertwined shocks and stresses and the complexities of socio-ecological systems in the Slough affirm that resilience cannot be understood through hazards and their mitigation alone. It is equally shaped by the institutional structures and jurisdictions tasked with ownership, management, and response. While the environmental system operates as a web of interconnected dynamics, government jurisdictions are often disjointed and siloed. This contrast sets up a central challenge: despite the fact that shocks

Across decades of planning, a shared vision emerges: coastal resilience must integrate ecosystem health, climate adaptation, effective governance, and community well-being.

and stresses cascade across boundaries, the resources and authorities to address them are divided across multiple owners. Each jurisdiction is tasked with managing their own infrastructure with limited opportunity to implement a holistic coastal resilience vision. An example of one such disconnect is the historical way regional sediment

management and climate adaptation planning have been carried out separately, despite their inherent overlap and the potential for synergies between plans and projects for greater return on investment.

Multiple jurisdictions play important roles in the Slough, but overlapping responsibilities can dilute accountability and slow action. Moreover, without a coordinated decision-making structure, there is no system for weighing tradeoffs between natural ecosystem health and built infrastructure in a neutral, intentional, and forward-looking way. Given the complexity and interconnection of both geography and climate impacts, any single jurisdiction's attempt to address the diverse array of shocks and underlying stresses in isolation (conceptually or geographically) will fall short of the necessary adaptive measures. In short, the complexity of the socio-ecological system in the Slough demands a resilience framework and governance approach that is just as interconnected.

Key Themes and Priorities for the Region

In addition to understanding the shocks and stresses that were included in planning documents, several themes emerged that will constitute the basis for developing a comprehensive vision for coastal resilience. While the language differs across agencies, geographic areas, and over time, the plans elevate six recurring priorities for the Goleta Slough Coastal Area. These themes were identified not only through quantification of shocks and stresses, but also the synthesis of qualitative priorities extrapolated by the plan reviewers. These themes crystallize how government, institutions, and residents engaged in planning processes imagine a more resilient future.



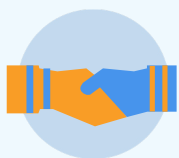
1. Ecosystem Protection and Stewardship

Protecting nature and ecosystems throughout the region was identified as a core priority. The Slough has a vast diversity of habitats and unique species that are highly valued, and the importance of supporting the health of the ecosystem as a whole to ensure that it continues to thrive and deliver vital community benefits was highlighted. Additionally, these natural habitats provide important benefits such as flood and erosion protection and are often valued as coastal resilience opportunities. Key recommendations include responsible management of the Slough and its broader watersheds, reduction of pollution that impacts the region's biological resources, restoration of native habitats, and protection of endangered and unique species such as steelhead trout and tidewater goby. The recreational value of the Slough's natural resources was also emphasized, and the need to preserve land for public recreation and educational opportunities came up frequently in planning documents.



2. Coastal Resilience and Adaptation

Reduction in the impacts of hazards and climate change on the natural environment, particularly the coast, and local communities, especially those that are most vulnerable, consistently appeared as a primary theme in plans. Deeper understanding of the vulnerabilities of socio-ecological systems demonstrates the need to ensure current and future development are resilient to known hazards and are supportive and beneficial to both ecological and social function. The use of nature-based solutions to address climate impacts was also elevated as the most effective avenue for achieving these considerations. Strategies for climate resilience and adaptation also included physical interventions, such as improving or relocating infrastructure, as well as promoting community resilience through public education, engagement, and emergency preparedness to facilitate a more rapid recovery in the aftermath of disasters. This theme touches on many of the shocks and stresses elevated and emphasizes that a successful future for the Slough and larger region requires effectively addressing climate impacts.



3. Collaborative and Forward-Looking Governance

The Slough is unique in part due to the overlapping nature of jurisdictions and their responsibilities. Because of this reality, collaborative governance is vital. In addition to effective regional coordination, the creation of a more effective framework for decision-making that streamlines the efforts of multiple stakeholders was identified as important across several plans. The need for fiscal responsibility, streamlined permitting, meaningful public engagement, and planning for the long-term future of the area (including the physical and financial impacts of identified shocks and stresses) was also repeatedly mentioned. Notably, effective climate-informed leadership was not specifically mentioned, but is an important concept for effective governance going forward.



4. Climate Mitigation and Resource Sustainability

In addition to adaptation planning efforts at the local level need to also mitigate the cause of climate change, which is human-driven emissions. Quantifying and reducing greenhouse gas emissions, advancing toward carbon neutrality, and transitioning fully to renewable energy sources are necessary. This commitment to sustainability extends to resource management more broadly, with goals focused on promoting recycling, reuse practices, alternative transportation and sustainable water use that support the region's long-term environmental health.



5. Sustainable Growth and Mobility

Population growth and housing pressures were consistently elevated along with the prioritization of thoughtful land use planning that steers development away from high-risk hazardous zones. Complicated and burdensome permitting processes emerged as a challenge to facilitating responsible development and the need for streamlined review was emphasized. Additionally, the need to create comprehensive, multi-modal transportation networks that reduce car dependence through pedestrian- and bike-friendly infrastructure and improve access for low-income, senior, and disabled residents was elevated.



6. Community Well-Being and Equity

Woven throughout the plans was recognition that climate resilience strategies must address the compounding social and economic stresses faced by vulnerable and disadvantaged populations who also experience disproportionate risks from climate impacts. Preserving community wellbeing through economic vitality and promoting equity and social inclusion as foundational elements of a resilient future were all uplifted. Acknowledgment of the cultural significance and importance of the Chumash community, including the cultural sites within the Slough, was not front and center in the reviewed documents and should be conscientiously included and prioritized in future planning efforts.

Together, these priorities highlight opportunities to incorporate multiple benefits while improving coastal resilience and offer a holistic landscape of goals for the community to move toward. This integrated community vision will be further developed during community engagement and outreach that began in Fall 2025 and will be published as a separate report.

Revisiting the Paradigm & Planning for a More Resilient Future

Over the past 100 years, built assets have consistently been prioritized over natural ecosystems. This has led to a one-directional relationship, wherein the ecosystem is manipulated in service of built infrastructure. The paradigm of modern society generally, but particularly in this regional context, has been predisposed to development and expansion of the built environment, at times at the expense of the conservation and protection of the natural ecosystem and cultural resources of the Slough.

To meet the social and economic needs of the region, it might seem more intuitive to address the immediate protection of the built environment. However, the results of this report signal a need for imagining more transformative changes to ensure the vitality of the whole socio-ecological system many decades into the future. It has also become increasingly evident that strengthening natural systems will ultimately positively benefit the entire socio-ecological system, including built infrastructure.

With a deep understanding of the current risks and projected future climate impacts to the region, there is now a pivotal opportunity to re-evaluate past decisions. However, changing this paradigm will take time. The community's reliance on infrastructure that is located in the Slough means that the socio-ecological system cannot radically transform overnight. The natural ecosystem will continue to support the resilience and functioning of built infrastructure and in the short term the imposition of the built environment may slow or limit the extent to which the Slough can be restored to a more functioning wetland ecosystem. In the coming decades, management entities and the community can push for a more bi-directional approach to address the projected impacts of climate change, with infrastructure investments equally prioritizing the health and restoration of the natural systems. In this future paradigm, the built infrastructure and the natural ecosystem are managed in support of each other and the wider community's resilience.

Every investment made is a decision point that can reinforce the status quo or nudge the region towards a paradigm shift—particularly moments when infrastructure is reaching the end of its usable life or impacted in a shock event. If the restaurant at Goleta Beach is damaged by waves again, will it be reconstructed in place? And if so, for how long? When the airport floods repeatedly or local utilities have sewage spills, how will managers respond?

These moments, particularly when a disaster (or shock) strikes, are the time to ask the question, what is the best path forward to reduce the potential future impacts? They represent opportunities to reassess whether rebuilding in place continues to serve the community's long-term interests. At these junctures, there are important questions to be answered: Why are we making this investment? Do we want to keep investing in this built asset? Is this investment being made at the expense of the ecosystem? Does it inherently prioritize the built environment? Does this investment make sense in the long term? Are there nature-based solutions and options we can explore or implement?

INITIATIVE NEXT STEPS

This report provides an initial foundation to inform future resilience planning in the Slough. By documenting how shocks and stresses cascade through the system, where ecological and social vulnerabilities exist, and what priorities have been determined through years of planning efforts contributes to the technical baseline for decision making, but is not enough to dictate decision making.

As another part of the Initiative's approach, the project team will deploy a community-centered engagement process to build on these learnings. The report and community engagement together will inform a process for resourcing tangible efforts to advance resilience. Throughout 2026, the project will advance through several critical phases:



Finalizing a publicly accessible digital repository, in the form of a website, which will include this report and resources that contributed to it, including planning documents



Gathering and synthesizing public feedback to inform a shared vision for the Slough



Aggregating projects and ideas that could contribute to resilience.



Using the priorities of this report and of the community vision as a guide, identify at least three projects to advance through funding and Initiative support.

With the goal to move from decades of planning to implementation, the work ahead necessitates sustained collaboration across jurisdictions and meaningful engagement with the communities who live, work, and recreate in and around the Goleta Slough.

Appendix A. List of Plans Analyzed

Plan Title	Plan Author/Creator	Year
Goleta Community Plan	County of Santa Barbara	1993
Goleta Slough Area Sea Level Rise and Management Plan	Goleta Slough Management Committee	2015
Open Space Management Plan	University of California Santa Barbara	2024
City of Carpinteria Sea Level Rise Vulnerability Assessment and Adaptation Project	City of Carpinteria	2019
HASB Agency 5-Year Plan 2025-2030	Housing Authority of the City of Santa Barbara	2024
Community Health Needs Assessment Report 2022	Santa Barbara County Public Health Department; Cottage Health	2022
A Comprehensive Vision for the Eastern Goleta Valley	Goleta Vision Committee	2006
City of Santa Barbara Enhanced Urban Water Management Plan	City of Santa Barbara	2020
Santa Barbara County Coastal Land Use Plan	County of Santa Barbara	2019
Flood Control Maintenance Activities in the Goleta Slough	Santa Barbara County Flood Control District	2010
Draft Creek Buffers Ordinance	City of Santa Barbara	2025
Santa Barbara Airport Drainage Master Plan Update	Airport (City of Santa Barbara)	2024
Occurrences of Steelhead Trout (<i>Oncorhynchus mykiss</i>) in Southern California, 1994-2018	California Fish and Wildlife	2020
City of Santa Barbara Capital Improvement Program	City of Santa Barbara	2023
City of Santa Barbara Local Coastal Program Coastal Land Use Plan	City of Santa Barbara	2019
City of Santa Barbara Environmental Resources Element	City of Santa Barbara	2011
Goleta Beach County Park Environmental Carrying Capacity Study and Management Plan	County of Santa Barbara	1999
RGP 63 Goleta Slough Berm Elevation Lowering Pre- and Post-Project Report	Santa Barbara County Flood Control District	2017

Plan Title	Plan Author/Creator	Year
University of California – Policy on Sustainable Practices	University of California Office of the President	2024
Strategic Energy Plan: City of Goleta	City of Goleta	2019
City of Santa Barbara Open Space, Parks and Recreation Element	City of Santa Barbara	2011
Supplement to the Environmental Impact Report Goleta Slough Dredging Project	Santa Barbara County Flood Control District	2000
Santa Barbara Airport Wildlife Hazard Assessment	Airport (City of Santa Barbara)	2016
UCSB Long Range Development Plan	University of California Santa Barbara	2010
Goleta Water District Urban Water Management Plan	Goleta Water District	2020
Isla Vista Trash Capture Project	County of Santa Barbara	2024
San Marcos Foothills Preserve Long-Term Open Space Management Plan	County of Santa Barbara	2014
FY 2022-23 Work Program Project Description Summaries	County of Santa Barbara	2022
Draft Isla Vista Mobility Study	Isla Vista Community Services District	2024
Santa Barbara Airport Summary of Recent Flooding	Airport (City of Santa Barbara)	2024
Santa Barbara Airport Climate Vulnerability Assessment and Risk Evaluation	Airport (City of Santa Barbara)	2024
Old Town Goleta Vision Plan	Cal Poly SLO/City of Goleta	2013
City of Goleta Two Year Budget Plan 2023/24 & 2024/25	City of Goleta	2023
City of Goleta 5-Year CIP Project List	City of Goleta	2023
Goleta Creeks and Watershed Management Program	City of Goleta	2024
City of Goleta General Plan/Coastal Land Use Plan	City of Goleta	2006
City of Goleta Climate Action Plan	City of Goleta	2014
City of Goleta Coastal Hazards Vulnerability Assessment and Fiscal Impact Report	City of Goleta	2015
City of Goleta Community Wildfire Protection Plan	City of Goleta	2012
City of Santa Barbara Adopted Operating and Capital Budget for Fiscal Year 2025	City of Santa Barbara	2024

Plan Title	Plan Author/Creator	Year
City of Santa Barbara 2023-2031 Housing Element Update	City of Santa Barbara	2023
Community Wildfire Protection Plan	City of Santa Barbara	2021
City of Santa Barbara Urban Forest Master Plan	City of Santa Barbara	2014
Local Hazard Mitigation Plan	City of Santa Barbara	2023
Goleta Slough Mouth Management Biological Assessment	City of Santa Barbara	2015
Achieving Climate Resilience on the California Central Coast	Community Environmental Council	2022
County of Santa Barbara Adopted Budget FY 2023-2024	County of Santa Barbara	2023
2024 - 2029 Capital Improvement Program	County of Santa Barbara	2024
Open Space Element	County of Santa Barbara	2009
2030 Climate Action Plan	County of Santa Barbara	2024
Eastern Goleta Valley Community Plan	County of Santa Barbara	2015
10-Year Wastewater Treatment Plant Capital Improvement Plan	Goleta Sanitary District	2023
Goleta Sanitary Water Resource Recovery District Strategic Plan	Goleta Sanitary District	2020
Goleta Sanitary District Spill Technical Report	Goleta Sanitary District	2024
Goleta Slough Ecosystem Existing Conditions and Monitoring Report	Goleta Slough Management Committee	2012
Drought Preparedness and Water Shortage Contingency Plan	Goleta Water District	2021
Goleta Water District Local Hazard Mitigation Plan	Goleta Water District	2023
Southern California Steelhead Recovery Plan	NOAA, National Marine Fisheries Service, West Coast Region	2012
2023 5-Year Review: Summary & Evaluation of Southern California Steelhead	NOAA, National Marine Fisheries Service, West Coast Region	2023
Exceptional Events Mitigation Plan	Santa Barbara County Air Pollution Control District	2024
Santa Barbara Airport Land Use Compatibility Plan	Santa Barbara County Association of Governments	2023
Goleta Slough Long-Term Monitoring Plan Results Memo	Santa Barbara County Flood Control District	2022
Capital Finance Plan	University of California Office of the President	2022

Plan Title	Plan Author/Creator	Year
City of Santa Barbara Sea Level Rise Vulnerability Assessment	City of Santa Barbara	2015
Incorporation of Nature-Based Solutions in Civil Works Projects	USACE	2024
Seismic Safety & Safety Element	County of Santa Barbara	2023
Goleta Slough Prehistory	Santa Barbara Museum of Natural History	2020
City of Santa Barbara Sea-Level Rise Adaptation Plan	City of Santa Barbara	2021
Vision for the Gaviota Coast	Gaviota Coast Conservancy	2021
Together to Zero - Reaching Carbon Neutrality in the City of Santa Barbara	City of Santa Barbara	2019
Goleta Water District Infrastructure Improvement Plan 2025-2030	Goleta Water District	2025
Investing in the Transportation Network: Major Regional Projects, South County	Santa Barbara County Association of Governments	2021
UC Santa Barbara Sea Level Rise Adaptation Strategy	University of California Santa Barbara	2022
Coastal Regional Sediment Management Plan	Beach Erosion Authority for Clean Oceans and Nourishment (BEACON)	2009
Goleta Sanitary District Climate Adaptation Plan	Goleta Sanitary District	2022
Santa Barbara County Conservation Blueprint	Cachuma Resource Conservation District	2017
Santa Barbara Area Coastal Ecosystem Vulnerability Assessment	California Sea Grant	2017
Geotechnical Evaluation: Bluff Retreat and Recommendations for Updating the Isla Vista Bluff Policy	County of Santa Barbara	2019
Santa Barbara County Climate Change Vulnerability Assessment	County of Santa Barbara	2021
Bylaws of the Goleta Slough Management Committee	Goleta Slough Management Committee	1992
Connected 2050: Regional Transportation Plan and Sustainable Communities Strategie	Santa Barbara County Association of Governments	2021
Fish Kills Information	Santa Barbara County Flood Control District	n.d.
MTD Moves Ahead	Santa Barbara MTD	2022

Plan Title	Plan Author/Creator	Year
UC Santa Barbara Climate Action Plan	University of California Santa Barbara	2016
City of Goleta Creek & Watershed Master Plan	City of Goleta	2020
City of Santa Barbara Land Use Element	City of Santa Barbara	2011
City of Santa Barbara Circulation Element	City of Santa Barbara	2011
hasbarco 5-Year Plan FY2025	Housing Authority of the County of Santa Barbara	2024
City of Carpinteria Dune and Shoreline Management Plan	City of Carpinteria	2022
City of Goleta Local Hazard Mitigation Plan	City of Goleta	2023
Goleta Slough Emergency Mouth Opening Project Report	City of Santa Barbara	2012
County of Santa Barbara 2023-2031 Housing Element Update	County of Santa Barbara	2023
County of Santa Barbara Active Transportation Plan	County of Santa Barbara	2023
Santa Barbara County Recreation Master Plan Draft	County of Santa Barbara	2025
Sea Level Rise & Coastal Hazards Vulnerability Assessment	County of Santa Barbara	2017
Wetlands in intermittently closed estuaries can build elevations to keep pace with sea-level rise	USGS	2021
Tsunami Response Plan	City of Santa Barbara	2012
City of Santa Barbara Safety Element	City of Santa Barbara	2013
Santa Barbara's Regional Priority Plan for Wildfire Resilience and Ecosystem Health	Santa Barbara County Wildfire Resilience Collaborative	2020
Community Solutions for Climate Resilience	Community Environmental Council	2021
Goleta Watersheds and Wildland-Urban Interfaces: Enhancing Fire Safety and Riparian Forest Health	Environmental Defense Center	2021

Appendix B. List of Shocks & Stresses

Shocks

- Civil Unrest
- Coastal or Tidal Flooding 45
- Cyber Attack
- Dam Failure
- Earthquake
- Extreme Heat
- Financial or Economic Crisis
- Hazardous Materials Accident (including post wildfire)
- Infrastructure Failure
- Institution Closing / Relocating
- Landslide / Mudslide
- Liquefaction
- Mass Transit Crash (Rail or Plane)
- Pandemic or public health emergency
- Power Outage
- Rainfall Flooding / Stormwater
- Severe Storms
- Sinkhole
- Supply Chain Breakdown
- Tsunami
- Wildfire Stresses
- Affordability
- Climate Change
- Coastal Erosion
- Complex Regulatory Environment
- Disparities in Health Outcomes
- Displaced Populations or Migrants
- Displacement and Gentrification
- Drought
- Economic Inequality
- Environmental Degradation
- Food Insecurity
- Grid Reliability
- Hazardous Waste/Material
- Homelessness/Houselessness
- Inadequate Infrastructure
- Inadequate Long-Term Planning
- Inadequate Public Transportation Systems
- Inadequate Sanitation Systems
- Insecure Municipal Finances
- Lack of Affordable Childcare
- Lack of Affordable Housing
- Lack of Green Space
- Lack of or Disparities in Access to Open Space
- Loss of Biodiversity
- Overlapping Jurisdictional Authorities
- Poor Air Quality/Pollution
- Population Growth or Overpopulation
- Public Safety
- Sea Level Rise (including groundwater intrusion)
- Sediment Management
- Structural Racism
- Traffic Congestion
- Uncontrolled Urban Development
- Water Insecurity

Appendix C. Integral Consulting: Cause-and-Effect Pathway Analysis

Because shocks and stresses do not act independently, a cause-and-effect framing is essential for understanding resilience in the Goleta Slough. Shocks and stresses interact with the Slough's physical processes, built infrastructure, and governance in ways that can produce cascading and compounding impacts, such as fluvial watershed flooding that propagates sediment through the lagoon system, altering ecological conditions and creating secondary impacts on adjacent infrastructure and access. Applying a cause-and-effect lens supports a clearer synthesis of how different shocks and stresses operate through distinct mechanisms and how their effects converge across systems and assets.

Mapping of Shock Coverage

To support consistent cross-plan comparison and a clearer synthesis of how different types of shocks affect the Slough, a revised six-bin shock typology was developed, and all documents from the original literature review were re-categorized accordingly (Figure A1). This process involved consolidating closely related shocks, previously tracked separately, and refining broad shock categories where distinct mechanisms were relevant to the Slough system.

For example, several geophysical hazards that appeared as separate shock types in the original metadata were combined into a single Earthquake / Tsunami / Liquefaction category to reflect their shared triggering events and overlapping impact pathways. Conversely, the original single "flooding" shock was expanded into three distinct flooding categories: Flooding – Coastal Wave, Flooding – Fluvial Watershed, and Flooding – Lagoon, reflecting differences in physical processes, locations of impact, and adaptation and management implications within the Slough system.

Note on Sea-Level Rise

In the process of categorizing shocks for this analysis, Sea-Level Rise (SLR) was not treated as a distinct shock category. Instead, it was translated into the Coastal Wave Flooding bin due to its significant role in exacerbating coastal flooding risks. SLR influences not only storm-driven coastal flooding but also regular tidal inundation, making it a key driver of coastal wave flooding. While SLR generally exacerbates all types of flooding (Coastal Wave, Fluvial Watershed, and Lagoon Flooding), it was not weighted separately in this analysis.

Given the increasing and pervasive impact of SLR, it should be considered a central factor when evaluating the modern-day threats to the Goleta Slough, as its influence on flooding risks is widespread and compounding across multiple shock categories.

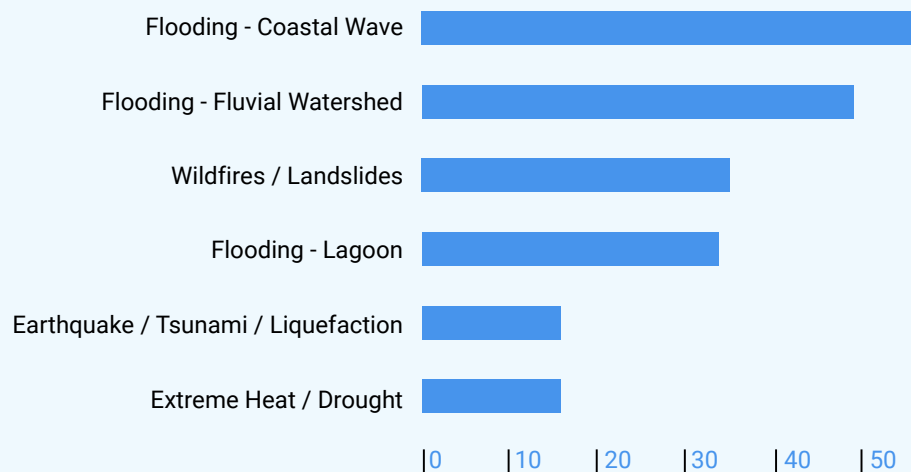


Figure A1. Frequency of Binned Shock Types Across Reviewed Plans

Shock categories reflect a revised typology developed to support cross-plan comparison, including the consolidation of related hazards and the refinement of categories where distinct mechanisms are relevant. Note: "Number of plans" is a count of plans in which each shock type is addressed; plans referencing more than one shock category will be counted separately in the associated shock bin.

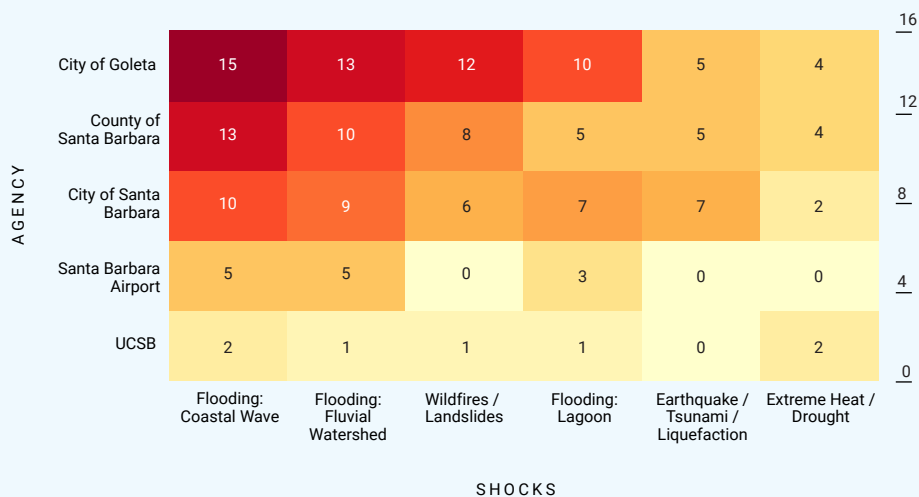


Figure A2. Heat Map of Shocks by Agency

This heat map summarizes the distribution of the binned shocks across the primary agencies and asset owners (based on metadata from the all-plans literature review), and highlights emphasized or underrepresented hazards, linking them to the agencies responsible for addressing them.

Agency-Based Mapping of Shock Coverage

Because resilience planning in the Goleta Slough area involves multiple agencies and asset owners with distinct mandates, jurisdictions, and implementation responsibilities, it is important to understand not only which shocks are considered in planning documents but also which spatial extent those documents are focused on. To support this, each planning document was mapped to a “planned agency focus” using available metadata (Figure A2). This approach attributes documents to the agency, department, or asset owner most closely associated with the planning responsibility, even when the document was prepared by a consultant or third party. The resulting agency-based view helps clarify how risk and exposure are framed institutionally, which hazards are emphasized or underrepresented across responsible entities, and where gaps or overlaps in responsibility may exist. This perspective is particularly important in a system where impacts cross jurisdictional boundaries while planning authority and implementation capacity remain distributed.

Seminal Plans and Causal Pathway Development

From the ~100 documents reviewed, a focused subset of 20 seminal plans was identified to support deeper cause-and-effect analysis (Table 1). These documents were chosen for their direct relevance to evaluating the coastal resilience of Goleta Slough assets or adjacent ecosystems, providing specific spatial evidence such as mapped hazards, modeled outputs, and documented historical events. These seminal sources form the initial foundation for establishing cause-and-effect pathways that spatially link causative processes, events, system responses, and impacts. They help inform the identification of recurring mechanisms, compounding interactions, and critical thresholds, which are crucial to understanding how disruptions propagate through both natural and built systems in the Slough area.

Table 1: Seminal Plans Informing Cause-and-Effect Pathways for Goleta Slough Resilience

Plan Title	Year	Lead Agency/Author	Scope / Focus
Goleta Water District - Infrastructure Improvement Plan 2025-2030	2025	Goleta Water District	Identifies capital investment needed for the District to fulfill legal obligations, maintain service levels, address system deficiencies
Santa Barbara Airport Climate Vulnerability Assessment and Risk Evaluation	2024	City of Santa Barbara (prepared by ESA)	Evaluates Santa Barbara Airport’s vulnerabilities and risks to airport assets and operations from coastal and flood hazards
City of Goleta General Plan/ Coastal Land Use Plan	2024	City of Goleta Planning and Environmental Services Department	Comprehensive policy framework and vision to guide future physical development, land use, environmental protection

Plan Title	Year	Lead Agency/Author	Scope / Focus
Capital Improvement Program, County of Santa Barbara (2024-2029)	2024	County of Santa Barbara	Multi-year planning tool identifying and implementing the County's short-term and longterm capital needs
City of Goleta Local Hazard Mitigation Plan	2023	City of Goleta	Local hazard mitigation plan for Goleta aimed at reducing impacts of natural and human-caused hazards
Santa Barbara County Multi-Jurisdictional Hazard Mitigation Plan (MJHMP) 2023	2023	County of Santa Barbara Office of Emergency Management	Identifies, evaluates, and mitigates natural and human-caused hazards in Santa Barbara County and incorporated cities
City of Santa Barbara Capital Improvement Program Fiscal Years 2024 to 2028	2023	City of Santa Barbara	Five-year capital improvement program outlining planned and projected capital project needs across various City departments
Goleta Sanitary District Climate Adaptation Plan	2022	Goleta Sanitary District	Assesses vulnerability of wastewater facilities to coastal, fluvial, and estuarine hazards, particularly sea level rise
Santa Barbara County Climate Change Vulnerability Assessment	2021	Santa Barbara County Planning and Development Department (with consultant support from Revell Coastal)	Assesses how climate change may harm the community by analyzing the severity of climate change hazards
Goleta Water District Drought Preparedness and Water Shortage Contingency Plan	2021	Goleta Water District	Describes conditions that constitute a water shortage emergency, defines stages of action, and provides guidance during declared water shortages
Goleta Water District 2020 Urban Water Management Plan Update	2021	Goleta Water District (prepared by Woodard & Curran)	Long-term planning document ensuring reliable water supplies through 2040, outlining water supplies, challenges, and strategies

Plan Title	Year	Lead Agency/Author City of	Scope / Focus
City of Santa Barbara Sea-Level Rise Adaptation Plan (2021)	2021	Santa Barbara – Community Development Department (Planning Division), with consultant support from Revell Coastal and ESA	Adopted policy and planning framework (part of the City's Local Coastal Program). Threshold-based adaptation strategy
Santa Barbara County Coastal Land Use Plan	1982/ rep. 2019	County of Santa Barbara Planning and Development	Local Coastal Program for Santa Barbara County's coastal zone, providing policies and land use designations
Santa Barbara Area Coastal Ecosystem Vulnerability Assessment	2017	California Sea Grant (NOAA, UCSB, UCSD, USGS)	Multidisciplinary research investigating future changes to southern Santa Barbara County's climate, beaches, watersheds, and wetland habitats
County of Santa Barbara Sea Level Rise & Coastal Hazards Vulnerability Assessment	2017	County of Santa Barbara (Long Range Planning Division)	Multi-year effort to evaluate impacts of sea level rise and other coastal hazards along the Santa Barbara County coastline
City of Goleta Coastal Hazards Vulnerability Assessment and Fiscal Impact Report	2015	City of Goleta (prepared by Revell Coastal)	Science-based assessment using climatic modeling and fiscal impact analysis
Goleta Slough Area Sea Level Rise and Management Plan	2015	Environmental Science Associates (ESA) for Goleta Slough Management Committee	Updates previous management plans for Goleta Slough area, incorporating climate change analysis
Goleta Slough Mouth Management Biological Assessment	2015	City of Santa Barbara Airport Department (prepared by Rincon Consultants, Inc., Stillwater Sciences, Dudek, BASH Incorporated)	Biological assessment for the Goleta Slough Mouth Management Project, proposing actions to control high water levels

Plan Title	Year	Lead Agency/Author	Scope / Focus
Goleta Slough Sea Level Rise Vulnerability Assessment – Coastal Conservancy Staff Recommendation	2012	Coastal Conservancy	Staff report and recommendation to authorize funding for the City of Santa Barbara to update the Goleta Slough Management Plan
Goleta Slough Ecosystem Management Plan (GSEMP)	1997	Goleta Slough Management Committee (GSMC)	Foundational ecosystem management framework covering approximately 2,250 acres in and around the Goleta Slough

Mapping Shocks to Location/Asset Categories

Based on the seminal plans (see Table 1), the asset areas most consistently addressed in resilience planning were consolidated into standardized “location categories” to link binned climate shocks to the places they affect and to visualize cross-plan coverage of shock–location pairings (Figure A3).



Figure A3: Climate Vulnerability Heat Map for Goleta Slough

This heat map illustrates the vulnerability to climate shocks of various Goleta Slough locations. The location categories, derived from the seminal plans, reflect the primary assets and areas identified in resilience planning.

Cause-Effect Pathways

Drawing on the key binned shocks and system response categories, specific cause-effect pathways were identified to show where and how the Goleta Slough area's assets are impacted by these shocks (see Table 2). These pathways, derived from the seminal plans, provide the rationale for taking action to protect the resilience of these assets and the communities that depend on them. The pathways highlighted are not exhaustive but offer context-specific examples of the risks involved.

Table 2. Cause-Effect Pathways for Impacts on Goleta Slough Assets

Asset	Cause-Effect Pathway	Sources
Transportation	Lagoon flooding + storm inflows → Closure of Hollister Avenue, SR 217, and rail line → Disrupted access to Airport, UCSB, and Old Town	<i>County MJHMP (2022); Goleta LHMP Annex (2022)</i>
Santa Barbara Airport	Closed inlet + storm inflows → Lagoon flooding → Runway and terminal inundation → Airport closures (1969, 1995, 1998, 2017, 2023, 2024)	Goleta Slough SLR & Management Plan (2015); City of Goleta CHVIR (2015)
Utilities	Extreme heat + drought → Increased demand for water and electricity → Stress on water supply reliability, energy grid, and La Goleta Gas Field operations	Goleta Water District UWMP (2020); City of Goleta Climate Action Plan (2014); County MJHMP (2022)
Wastewater Facilities	Lagoon flooding + tidal inflows → Access routes inundated (e.g., Firestone Road, Hollister Avenue) → Disruption of WRRF operations and emergency response capacity	Goleta Sanitary District Climate Adaptation Plan (2022); County MJHMP (2022)
Goleta Beach	Severe coastal storm + chronic erosion → Overtopping and infrastructure damage → Impacts to park amenities and wastewater outfall facilities	<i>County MJHMP (2022); Goleta Beach 2.0 Project CEQA Record (2013)</i>
Old Town Goleta	Major storm event (El Niño) → Creek and Slough overflow → Flooding of Hollister Avenue and adjacent neighborhoods	City of Goleta CHVIR (2015); County MJHMP / Goleta LHMP Annex (2022)

AI Integration in Resilience Planning

In tracing and analyzing the cause-and-effect pathways, AI was used to cross reference plans, identify overlapping locations to map and organize complex information, particularly where gaps existed in the available documentation and literature review. Given the complexity of linking shocks to impacts on Goleta Slough assets, AI supported the synthesis by helping structure pathway logic and identify plausible linkages for review. All of these cause and effect pathways were reviewed by the Integral team and are directly referenced. This use of AI streamlined the analysis and facilitated cross-document comparisons. AI was applied as an initial screening tool and iterative thought partner rather than a standalone “black box.” Key pathway outputs and interpretations were subject to internal QA/QC review by resident technical experts.