

Ongoing Sea Level Rise-Related Adaptation Studies in Marin

City of San Rafael "Climate Adaptation - Sea Level Rise" White Paper

In January 2014, the City of San Rafael's Community Development Director Paul Jensen prepared a report on potential sea level rise in San Rafael. The paper a) identifies the key agencies that have been involved in studying and planning for sea level rise; b) presents the most current information and studies on sea level rise, particularly in the Bay Area; c) identifies potential funding sources to pursue for next steps; d) summarizes the studies underway in Marin and the North Bay; e) describes techniques and tools that have been developed for adaptation; f) identifies the San Rafael shoreline and levees areas to study, as well as potential opportunity areas for studying adaptation; and g) presents suggestions for next steps in moving forward with preparing a vulnerability assessment and long-term planning for sea-level rise.

C-SMART - Collaborating on Sea-level Marin: Adaptation Response Team

The Marin County Community Development Agency is leading this project to evaluate the vulnerabilities to sea level rise along Marin County's western coast, define adaptation strategies that will increase the resiliency of the coastal resources there, and share lessons learned with others. Funding has been awarded by the Ocean Protection Council and the California Coastal Commission.

Countywide Vulnerability Assessment – Marin ADEPt

The goal of the Marin Adaptation Demonstration and Education Project (Marin ADEPt) is to build a comprehensive sea level rise (SLR) adaptation plan that is effective, environmentally sound, economically feasible, publicly acceptable, and implementable. A Climate Ready grant from the California Coastal Conservancy will enable Marin County to coordinate stakeholder/agency collaboration in adaptation planning across all affected jurisdictions in Marin, to increase awareness and understanding of SLR adaptation among the citizens and decision-makers, and to carry out a design-level implementation demonstration project in Richardson Bay, including engineering analysis and public evaluation of potential adaptation alternatives that maximize public benefits. Finally, it is intended to serve as a model and guidance for other Bay Area SLR programs.

Youth Exploring Sea-level Rise Science (YESS)

The YESS project will engage high school science students (including those in traditionally underserved communities), in real-world climate change science and community resilience planning through vulnerability mapping and digital storytelling. Project partners will create and pilot an NGSS and Common Core aligned curriculum for students to learn about SLR and reflect on its impact on their lives and communities. Students will gather on-the-ground data and observations of flood vulnerability that can be used by municipal agency staff for planning purposes and by researchers for flood model validation. A "YESS Toolkit" consisting of curricula, data collection protocols, and other resources will be disseminated for communities in and beyond California to use. Project partners include the King Tides Project, Shore Up Marin, GreenUp Learning and Marin County Community Development Agency. Funding comes from the California Coastal Conservancy's Whale Tail grant and matching funds from the project partners.

Southern Marin Pilot Project

The project, sponsored by Supervisor Sears with support from Marin County Public Works, the Community Development Agency and the [San Francisco Bay Conservation and Development Commission](#), addresses how the climate change impacts of sea level rise will affect the future of Southern Marin communities, infrastructure, ecosystems and economy, and what strategies the County can pursue to reduce and manage these risks. The project area encompasses the Richardson Bay shoreline, from the Sewerage Agency of Southern Marin treatment plant in Mill Valley to Marin City. One product of this project is a local sea-level rise GIS application that includes NOAA sea-level rise and local infrastructure data.

OWL Project

For several months in spring 2015, Marin County residents will be able to use a new interactive tool to learn about the impacts of sea-level rise along southern Marin's bay shoreline. Built to resemble old-fashioned coin-operated binoculars common at vista points and national parks overlooks, a new and sophisticated interactive device, called an OWL, incorporates software that allows the viewer to see the area around them and also shows what projected rising waters will look like in the future. The two viewers, developed by San Francisco-based [OWLized](#), will be installed for 12 weeks as a pilot project along the Sausalito-Mill Valley multiuse pathway (installation dates are to be determined). The partnership includes the County of Marin, FEMA, OWLized, Autodesk, the nonprofit [Climate Access](#), and research partner [Dr. Susanne Moser](#) of Stanford University.

Richardson Bay Shoreline Study

A study of the Richardson Bay shoreline from Marin City through the portion of the Tiburon Peninsula in unincorporated Marin County is currently in progress through the Marin Department of Public Works Flood Control Division Watershed Group. The goal of this study is to develop engineering adaptation concepts and approximate costs to provide the engineering basis for future adaptation planning strategies.

Southern Marin Watershed Program

The Southern Marin Watershed Program is a collaborative effort of the City of Mill Valley, the County of Marin DPW, and Flood Control Zones 3 and 4. The purpose of the Watershed Program is to provide a framework to integrate flood protection and environmental restoration with public and private partners to protect and enhance Marin County's watersheds and to identify solutions that will enhance and protect the diverse habitat of the lands that drain into Richardson Bay. The program's scope includes identification of the impacts of sea level rise and the development of project concepts and approaches for adaptation to rising bay tides.

Stinson Beach Watershed Program Flood Study and Alternatives Assessment

Provides an assessment of wetland and floodplain restoration opportunities along Easkoot Creek, identifies integrated flood management and habitat restoration projects, explores opportunities to leverage local funding with State and Federal funds, and evaluates flows utilizing projected rise in sea level within Bolinas Lagoon. (Marin County Department of Public Works)

Novato Creek Watershed Hydraulic Study

The City of Novato and the County Flood Control District currently have a study in-progress to model changes to the existing flood protection system in the Novato watershed to enhance flood protection, enhance habitat and reduce dredging costs and impacts under current and future sea level rise scenarios. Portions of the City of Novato are highly vulnerable to sea level rise flooding and adaptation strategies are a central focus of this study.

Las Gallinas Creek Levee Evaluation

Primary goals of the evaluation are to assess the condition and performance of Santa Venetia's existing levee system, their failure risk, and to calculate potential damages which may occur in the event of a levee breach. This information is then used to help assess the design, cost, and feasibility of potential alternatives for levee improvement, including those meeting key requirements for FEMA certification and those providing flood protection under various sea-level rise scenarios. The U.S. Army Corps of Engineers has participated with the Marin County Flood Control and Water Conservation District in conducting the Section 205 study, and will provide an indication of whether federal interest may exist for continuation of the study and the design and construction of a preferred alternative.

Coyote Creek Levee Evaluation

The evaluation aims to assess the condition and performance of the existing levee system along Coyote and Nyhan Creeks and provide improvement alternatives ranging from maintaining the existing level of protection to meeting requirements for FEMA certification. An additional goal of the evaluation is to ensure the levee system's compliance with U.S. Army Corps of Engineer's operation and maintenance requirements. Various sea-level rise scenarios will be considered during the development of levee improvement opportunities. [Coordinated by County of Marin?](#)

Our Coast-Our Future (OCOF): Planning for Sea Level Rise and Storm Hazards Along the Bay Area's Outer Coast

Major project, led by Gulf of the Farallones NMS, Point Blue (formerly PRBO) and the US Geological Service, providing Bay Area natural resource managers, local governments and others with science-based decision-support tools to help Bay Area communities understand, visualize, and anticipate local coastal climate change impacts. Beta version for coast flooding is available now for testing.

Adapting to Rising Tides (East Bay – Bay Bridge to San Mateo Bridge)

BCDC leads this major sub-regional undertaking, a multi-stakeholder, 2-year project that is providing vast experience and lessons learned in planning for sea level rise and storm impacts. BCDC team is assisting in Southern Marin Pilot Project.

Adapting to Sea Level Rise Along the North Bay Shoreline

Project funded by the North Bay Watershed Association (NBWA) to support the shoreline of eastern Marin north to the Petaluma River. Project is being operated for the NBWA by PRBO Conservation Science.

Evaluating Tidal Marsh Sustainability in the Face of Sea-Level Rise: A Hybrid Modeling Approach Applied to San Francisco Bay

Scientific study led by Diana Stralberg for PRBO evaluating the sustainability and long-term resilience of marshes in the San Francisco Bay under a number of climate change scenarios. Suggests that under high sea level rise scenarios, marshes will suffer significantly, and proposes strategies for the preservation of marshes. Includes a web-based decision support tool to assist land managers in marsh adaptation.

Innovative Wetland Adaptation Strategies Study (Corte Madera Creek)

One of the first Bay Area projects to examine how to reduce the vulnerability of tidal wetlands to sea level rise. \$600K US EPA grant. Run by USGS, USF, consultants and Marin County Flood Control District.

PRBO San Francisco Bay Sea-Level Rise Decision Support Tool

This new online decision support tool with help managers, planners, conservation practitioners and scientists study sea level rise impacts on Bay Area tidal marshes and bird habitat.

The Horizontal Levee

The Bay Institute's groundbreaking study about the economic value of tidal marshes, demonstrates that nature performs critical functions for society. During the era of sea level rise, the marshlands of San Francisco Bay have become a critical adaptation tool. The study shows that restoration of San Francisco Bay's tidal marshes is one of the best and most inexpensive ways to protect valuable shoreline development from sea level rise during the next several decades. By using tidal marshes in combination with earthen levees, construction and maintenance costs can be reduced by almost 50%.

BCDC/ABAG Multi Hazard Housing and Community Resilience Assessment for San Rafael Downtown PDA and Environs

This is a multi-hazard assessment, excluding wildfire, utilizing the BCDC ART Project process and tools in a localized area focused on housing and community resilience. The main focus is on how to keep people in their housing post disaster. They are keen on developing real strategies that can be put in place now or in the near future to help mitigate the effects of a coming disaster. They hope this information can be used by the jurisdictions they selected now, as well as in future planning processes, and hope that it can serve other jurisdictions that might be looking for models and real information they can use in preparing their own plan documents or strategies. The project encompasses all of the Canal Neighborhood, Gerstle Park, Downtown and part of Dominican.

Shore Up Marin – Social Equity Project

Shore Up Marin is a partnership founded by Earth Day Marin, Canal Welcome Center, Marin Grassroots and GreenUp Learning. Our newest partner is the Marin City-based MLK Coalition. Our mission is to support a diverse coalition of Marin residents across race, class and other differences, to advocate for equitable responses to climate change and sea level rise.

Their main focus is in mobilizing residents and stakeholders in low-lying areas in Novato, San Rafael, Southern Marin and West Marin. In their second year they will train members of at-risk communities on sea level rise, projected and current local impacts and public policy advocacy.

MCCMC Sea Level Rise Subcommittee

The Marin County Council of Mayors and Councilmembers (MCCMC) is working to educate themselves about the issues of Sea Level Rise and its impacts on the cities and towns in Marin in order to identify the gaps in planning and how elected officials can help. Principal council members on the subcommittee are Claire McAuliffe of Belvedere, Stephanie Moulton-Peters of Mill Valley, and Diane Furst of Corte Madera.

MCEP Vulnerability Assessment

The members of Marin Climate Energy Partnership have been working to coordinate a planning effort amongst the cities, towns and County of Marin to develop a comprehensive vulnerability assessment for all the local jurisdictions. They have established an Adaptation Working Group and have prioritized getting grant-ready as a 2014-2015 goal for MCEP.

The following summaries are courtesy of the Bay Area Climate & Energy Resilience Project (BACERP), based on input from Marin County climate stakeholders. The information was gathered via phone, email, web search, and an in-person group meeting co-hosted by the Marin Climate & Energy Partnership in December 2013.

Flood Control 2.0

This is a regional demonstration project on three creeks including Novato Creek in Marin that is developing a set of innovative approaches to bring environmental benefits and cost-savings to flood protection infrastructure along the bay shoreline. The strategy has two complementary approaches that transform costly, trapped sediment in local flood control channels into a resource: channel redesign where sufficient adjacent land use flexibility exists, and sediment redistribution for highly constrained channels. The project uses an interdisciplinary team linking regional science expertise with on-the-ground flood control agencies. Funding comes from the San Francisco Estuary Partnership and US EPA.

Aramburu Island Coarse Beach Restoration

A \$2.6 million project to restore a gravel and cobble beach on an island near Mill Valley to help protect habitat from sea level rise. In appropriate sites, engineered beaches of this type can provide erosion protection that is as effective as the traditional alternative—rock armoring—but less expensive to build, while also offering habitat and aesthetic benefits. Construction was completed in 2012 with re-vegetation and monitoring on going.

SF Bay Living Shorelines Project

Uses engineered oyster reefs and eelgrass beds to restore habitat and attenuate wave energy to reduce erosion. This project, led by the California Coastal Conservancy, is currently testing various reef approaches in San Rafael on property owned by the Nature Conservancy. This type of habitat supports many species of invertebrates, fish, and water birds.

Marin Carbon Project

Pilot project using California's largest land type—rangelands—to fight climate change

The Marin Carbon Project is a consortium of the leading agricultural institutions and producers in Marin County, university researchers, county and federal agencies, and nonprofit organizations seeking to demonstrate the potential of enhanced carbon sequestration in

Marin's agricultural and rangelands soils. Carbon farming involves implementing practices that are known to improve the rate at which CO₂ is removed from the atmosphere and converted to plant material and/or soil organic matter. Carbon farming is successful when carbon gains resulting from enhanced land management and/or conservation practices exceed carbon losses.

Preparing for Climate Change with Scenarios: A Marin County Case Study

Scenario planning to deal with climate uncertainty

"The Futures of Wild Marin," was a unique and compelling one-day workshop using climate scenario planning, conducted by Climate Adaptation Consultant Sara Moore, working with Marin conservation managers. The purpose was to help stakeholders deal with the uncertainty surrounding future climate change in Marin.

Climate Action Plans

Climate Action Plans (CAP's), completed by more than 40 Bay Area cities, set goals and strategies for greenhouse gas (GHG) emissions reduction. Recently, some cities have also begun to include climate adaptation strategies in their CAP's that address heat, sea level rise, extreme storms, higher fire risk, and other climate impacts.

Marin Countywide Plan

Marin County was one of the first counties in California to include GHG reduction goals (15% below 1990 levels by 2020) in its general plan, the Marin Countywide Plan, adopted in 2007.