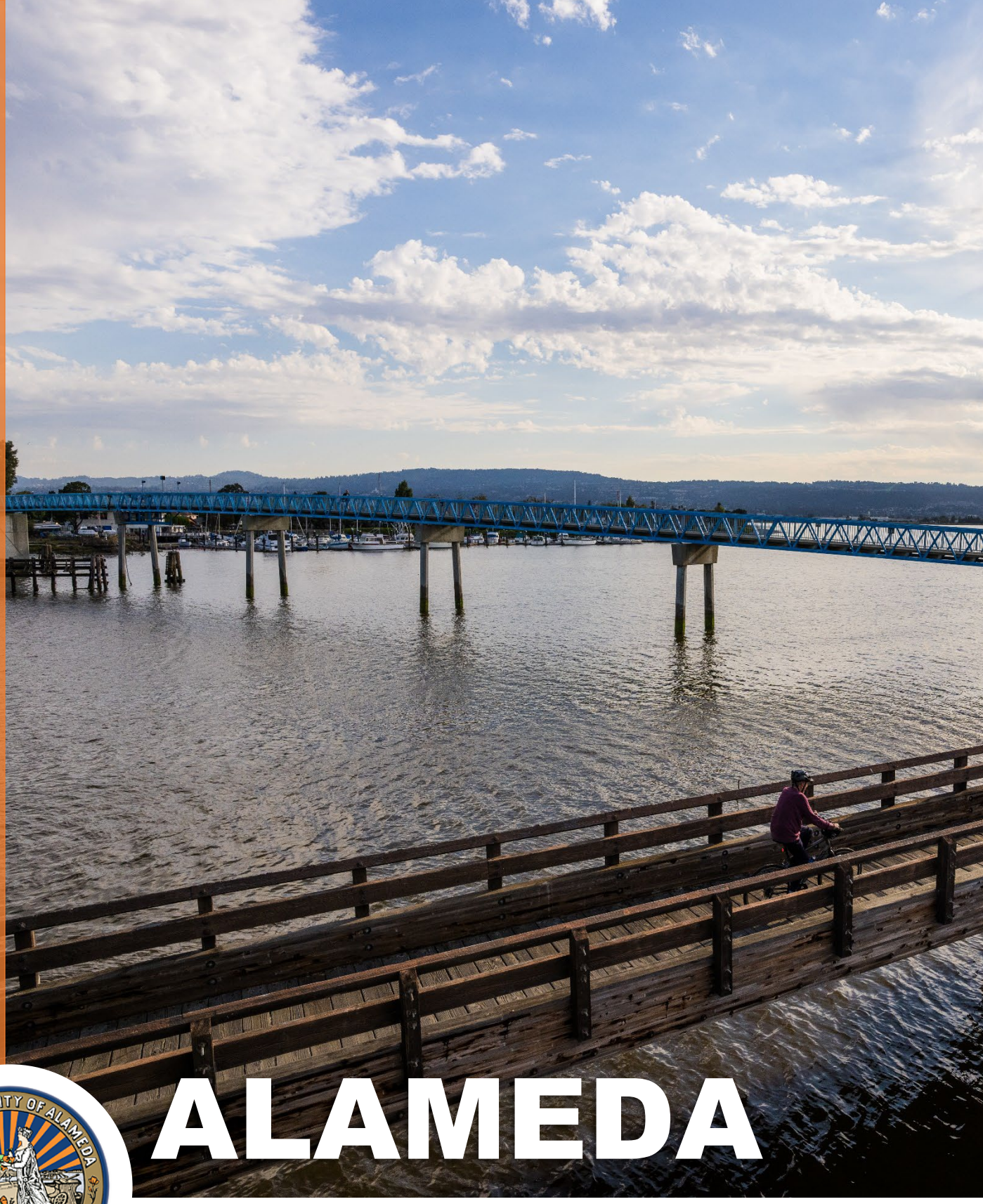


# ALAMEDA

# Climate Adaptation and Hazard Mitigation Plan

**September 16, 2026**

# Acknowledgements

We would like to thank the following individuals for their contributions to the development of this plan.

- Members of the Mitigation Planning Team (Green Team)
  - Danielle Mieler, Sustainability and Resilience Manager
  - Allen Tai, Planning, Building and Transportation Director
  - Oscar Davalos, Building Official
  - Steven Buckley, Planning, Building and Transportation
  - Gail Payne, Planning, Building and Transportation
  - Lisa Foster, Planning, Building and Transportation
  - Erin Smith, Public Works Director
  - Scott Wikstrom, Public Works
  - Brendin Christolear, Public Works
  - Echo Lee, Public Works
  - Ricardo Delatorre, Public Works
  - Liz Acord, Public Works
  - Matt Nowlen, Alameda Recreation and Parks Department
  - Heather Heinbaugh, Alameda Municipal Power
  - Jon Green, Alameda Municipal Power
  - Edbert Nguyen, Alameda Municipal Power
  - Sarah Henry, Public Information Officer
  - Eric Fonstein, Base Reuse and Economic Development
  - Mike Billington, Public Works
  - Chris Ferrara, Alameda Municipal Power
  - Dallas Andrews, Fire Department
  - Mark Saur, Fire Department
  - Nick Luby, Fire Chief
- Pathways Climate Institute: Dr. Kris May, Daisy Ramirez Lopez
- Stanford University and the NHERI SimCenter (contributors to Detailed Earthquake Risk Assessment): Professor Gregory Deierlein, Dr. Adam Zsarnoczay, Tamika Bassman, Jaewon Saw, Sijin Wang

Photo credits: Maurice Ramirez, unless otherwise noted

# Table of Contents


**EXECUTIVE SUMMARY ..... VII**

Climate and Natural Hazard Risks in Alameda ..... viii

Focus on Equity ..... ix

Climate Adaptation and Hazard Mitigation Strategy ..... ix

Vision ..... ix

Hazard Mitigation and Adaptation Goals ..... x

Hazard Specific Goals ..... x

Completed Strategies ..... xi

Priority Climate Adaptation and Hazard Mitigation Strategies ..... xii

Implementation and Updates ..... xvv

**CHAPTER 1 INTRODUCTION ..... 1-1**

Background ..... 1-2

Purpose ..... 1-2

Key Terms ..... 1-3

Relationship to Other Plans ..... 1-3

Focus on Equity ..... 1-4

Vision Statement and Hazard Mitigation and Adaptation Goals ..... 1-6

Vision ..... 1-6

Hazard Mitigation and Adaptation Goals ..... 1-6

Hazard Specific Goals ..... 1-7

The History of Alameda ..... 1-7

What Has Changed Since the 2022 Plan ..... 1-9

Scope and Content ..... 1-10

**CHAPTER 2 HOW WE DEVELOPED THE PLAN ..... 2-1**

Plan Development Process ..... 2-2

Incorporation of Existing Plans, Studies, Reports, and Technical Information ..... 2-2

Stakeholder Engagement and Community Outreach ..... 2-3

Green Team ..... 2-4

Community Engagement ..... 2-4

Key Partner and Neighboring Jurisdiction Outreach ..... 2-9

Boards and Commissions ..... 2-10

Plan Approval and Adoption Process ..... 2-10

**CHAPTER 3 ASSET INVENTORY ..... 3-1**

The People of Alameda ..... 3-2

Age Characteristics ..... 3-2

# Table of Contents (Continued)


Race and Ethnicity ..... 3-3
Household Composition ..... 3-3
Income and Employment ..... 3-3
Social Vulnerability Assessment ..... 3-4
Alameda Economy ..... 3-6
Employment ..... 3-6
Buildings ..... 3-6
Residential Buildings ..... 3-7
City Owned Buildings ..... 3-8
Buildings Owned by Other Agencies ..... 3-8
Care Facilities ..... 3-8
Land Use ..... 3-9
Utilities ..... 3-10
Stormwater and Sewer Systems ..... 3-11
Drinking Water System ..... 3-12
Electric System ..... 3-13
Natural Gas System ..... 3-14
Communications and Technology Systems ..... 3-15
Transportation ..... 3-17
Shoreline, Natural, and Recreation Areas ..... 3-18
Contaminated Lands and Waste ..... 3-20
Public Health and Welfare ..... 3-22
**CHAPTER 4 HAZARD CHARACTERIZATION AND RISK ASSESSMENT ..... 4-1**
Overview of Hazards Impacting Alameda ..... 4-2
Earthquakes ..... 4-3
Hazard Description ..... 4-3
History ..... 4-7
Probability of Future Earthquakes ..... 4-10
Earthquake Risk Assessment ..... 4-12
Flooding ..... 4-13
Hazard Description ..... 4-14
History ..... 4-25
Probability of Future Flooding ..... 4-28
Flood Risk Assessment ..... 4-34
Tsunamis ..... 4-40
Hazard Description ..... 4-40
History ..... 4-43

Probability of Future Tsunamis ..... 4-45
Tsunami Risk Assessment ..... 4-45
Tsunami Evacuation ..... 4-46
Heat ..... 4-47
Hazard Description ..... 4-47
History ..... 4-49
Probability of Future Heat Events ..... 4-49
Heat Risk Assessment ..... 4-50
Drought ..... 4-50
Hazard Description ..... 4-50
History ..... 4-51
Probability of Future Droughts ..... 4-52
Drought Risk Assessment ..... 4-54
Wildfire-Related Hazards ..... 4-55
Hazard Description ..... 4-56
History ..... 4-56
Probability of Future Wildfire-Related Events ..... 4-58
Wildfire Hazards Risk Assessment ..... 4-58
Dam Breach Inundation ..... 4-62
Hazard Description ..... 4-62
History ..... 4-64
Probability of Future Dam Breach Inundation ..... 4-64
Dam Bream Inundation Risk Assessment ..... 4-64
Other Hazards Not Considered in this Plan ..... 4-65
**CHAPTER 5 CLIMATE ADAPTATION AND HAZARD MITIGATION STRATEGY ..... 5-1**
Climate Adaptation and Hazard Mitigation Strategy Development ..... 5-2
Capabilities Assessment ..... 5-2
Planning and Regulatory ..... 5-2
Administrative and Technical ..... 5-4
Fiscal ..... 5-4
Education and Outreach ..... 5-5
National Flood Insurance Program (NFIP) Participation ..... 5-6
Community Rating System (CRS) Participation ..... 5-6
Mitigation Strategies ..... 5-7
Completed and Ongoing Strategies ..... 5-7
Priority Mitigation Strategies ..... 5-8
Strategies for Location-Based Priority Flooding ..... 5-20
Strategies Provided by Key Partners ..... 5-20
**CHAPTER 6 FROM PLAN TO ACTION ..... 6-1**

Continued Public Involvement ..... 6-2
Integration into Other Planning Processes ..... 6-2
Keeping the Plan Current ..... 6-4
Plan Monitoring and Evaluation ..... 6-4
Plan Update Process ..... 6-4

# List of Appendices

APPENDIX A— Planning Process

APPENDIX B— Public Outreach

APPENDIX C— Community Survey

APPENDIX D— Detailed Asset Inventory

APPENDIX E— Detailed Earthquake Risk Assessment

APPENDIX F— Sea Level Rise and Coastal Flood Exposure Assessment and Vulnerability Considerations

APPENDIX G— Status Previous Mitigation Strategies

APPENDIX H— Priority Mitigation Strategies

APPENDIX I— Strategies for Location-Based Priority Flooding

APPENDIX J— Approval Documentation



# Executive Summary

The City of Alameda is a low-lying island community in the San Francisco Bay that is highly vulnerable to climate hazards from rising seas and earthquakes as a result of its older building stock and proximity to two major faults, as well as other hazards. That sea level rise or a natural disaster will impact Alameda in its future is a certainty; what is not certain is the extent to which the hazards will damage buildings and infrastructure and disrupt life for Alameda's residents and businesses. By understanding our risks and taking proactive action now, Alameda can be prepared for future disasters and reduce their impact.

The purpose of the Climate Adaptation and Hazard Mitigation Plan (Plan) is to help Alameda adapt to climate change, reduce the impact of future disasters and help us recover more quickly when disasters do occur.

The City of Alameda Climate Adaptation and Hazard Mitigation Plan:

- Meets the requirements established by the Federal Disaster Mitigation Act of 2000 (DMA 2000) and maintains eligibility for Federal Emergency Management Agency (FEMA) assistance grant programs, including:
    - Hazard Mitigation Grant Program (HMGP)
    - Building Resilient Infrastructure and Communities (BRIC)
    - Flood Mitigation Assistance (FMA)
- Aligns with other City plans, including the Shoreline Adaptation Plan (forthcoming), Climate Action and Resiliency Plan (CARP), General Plan and the Emergency Management Plan;
- Increases education and awareness of natural and climate-induced hazards and community vulnerabilities;
- Establishes a basis for coordination and collaboration among community entities such as private and public agencies, key stakeholders, and residents; and,
- Identifies and prioritizes future mitigation and adaptation projects.

The Plan addresses natural and climate-induced hazards that impact the City of Alameda and lays out Alameda's strategy for mitigating hazards and adapting to a changing climate. A hazard is an event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, damage to the environment, interruption of business, or other types of harm or loss. Hazard mitigation and climate adaptation refers to the actions taken to reduce or eliminate risk to human life and property from natural and climate change-induced hazards.

The success of this plan rests not only on our ability to implement the strategies laid out in this plan, but also on our ability to implement the City's Climate Action and Resiliency Plan (CARP) which was updated in 2025. The goal of CARP is to reduce our greenhouse gas emissions (GHG) by 50% below 2005 levels by 2030, become carbon neutral by 2045 and adapt to climate change. In 2019, the City of Alameda declared a climate emergency and called for an urgent and just citywide climate mobilization effort to reverse global warming and adapt as rapidly as possible to the growing global and local effects of climate change. In 2023, the sixth assessment report of the Intergovernmental Panel on Climate Change (IPCC) observed that human-induced climate change is already causing more extreme weather patterns that will continue to intensify and that global surface temperature will continue to increase and current emissions make it likely that warming will exceed 1.5°C during the 21st century and make it harder to limit warming below 2°C. unless deep reductions in $CO_2$ and other greenhouse gas emissions occur in the coming

decades.[1] By taking strong actions to reduce our GHG emissions, Alameda will do our part to achieve a climate safe path and avoid some of the most extreme climate effects we could face. The City of Alameda cannot avert global warming on its own. It will take an immediate and concerted effort on the part of community members, businesses, other cities and counties, the state, federal government and the world to come together and reduce our global emissions. Here in Alameda, we will do our part to reduce our emissions and prepare for the impacts that we will face. This Plan is our roadmap for adapting to the impacts of climate change we anticipate today and for mitigating other hazards we face such as tsunamis and earthquakes.

Flooding is one of the greatest climate threats that Alameda faces. The City identified location-based priority strategies to mitigate flood risks associated with overland coastal flooding due to high tides and/or storm surge, rising groundwater tables and emergent groundwater, and precipitation-based flooding. The strategies are identified for immediate (< three years), near-term (three to 10 years), and mid-term (10 to 30 years) implementation.

# Climate and Natural Hazard Risks in Alameda

Due to Alameda's proximity to major earthquake faults and our geography as a low-lying island community with older building stock, Alameda faces risks from a number of climate and natural hazards that have the potential to significantly disrupt daily life and cause damage to people and property.

Earthquakes, floods, sea level rise and groundwater rise pose the greatest risk to people and property in Alameda. Over 23 miles of shoreline surround both the main island of Alameda and Bay Farm Island. Today, much of this shoreline is vulnerable to flooding from both coastal storms where water enters the land along the lower elevations of the shoreline and overland from rainfall within the City during and after storm events. In the near term, both are likely to be temporary in nature, limited by high tide cycles and intensity of events, with flooding likely shallow - on the order of 2 feet or less in depth. However, as climate change increases the intensity of storm events, sea levels, and groundwater levels, the depth and extent of flooding is expected to increase and may become more frequent or permanent. Today's 100-year floodplain is approximately equivalent to 3 feet of sea level rise in the future. This inundation zone includes 1,505 residential buildings and 23 commercial buildings valued at over $2 Billion (2017 dollars).[2] Alameda's utilities and transportation network will all be impacted, especially the storm drain system which will be forced to manage increasing demands over time. Groundwater inundation in many of the island's interior low spots will increase these risks.

Combining all likely scenarios on nearby faults, Alameda has a 10 percent chance of experiencing "Very Strong" to "Violent" (MMI 8 to MMI 9) shaking in the next 50 years. This probability can also be expressed as a 0.2 percent chance per year, or a 500-year event, which could happen any time. A major earthquake

[1] IPCC, 2023: Summary for Policymakers. In: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland, pp. 1-34, doi: 10.59327/IPCC/AR6-9789291691647.001

[2] Baykeeper, 2017: The Economic Costs of Sea Level Rise in the Bay Area: The consequences of ignoring rising seas and the opportunities of living with a changing Bay. Accessed from: https://baykeeper.org/shoreview/economic-loss.html. Accessed on: July 22, 2026.

would cause significant damage to Alameda's older buildings and infrastructure, significant and prolonged disruption to the economy, and would harm and displace residents. Particularly vulnerable buildings in Alameda include unbraced single-family homes with a crawl space, above ground basement or living spaces over a garage as well as multi-family apartment buildings with open spaces on the ground floor or parking or retail, also known as 'soft-story' buildings. Liquefaction resulting from an earthquake will damage buried infrastructure and roads across much of the island and lead to prolonged utility outages.

Other hazards also may have significant impacts but are less likely to occur, or the consequences may be more limited in duration or impact. These hazards include tsunamis, heat, drought, wildfire related hazards of smoky air and power outages, and dam breach inundation. Each of these hazards and the risks they pose to Alameda is evaluated in the plan.

# Focus on Equity

Alameda recognizes that some members of the community will be more significantly impacted by natural disasters and may have a more difficult time recovering than others due to lack of stable housing, financial resources, and by zoning laws that have historically disproportionately placed people of color into areas of the city more vulnerable to natural hazards. Natural disasters disproportionately impact low-income residents, people of color, the young, the old and the disabled.

Social equity is critical to promoting healthy, resilient communities. Equity is the idea that one's race, ethnicity, gender, age, disability, and sexual orientation should not determine their outcomes and should not influence the distribution of resources, including housing, access to jobs and education, food, and environmental exposure. The City utilizes the Bay Conservation and Development Commission's (BCDC) Community Vulnerability Assessment to understand the level of social vulnerability to climate hazards across Alameda. Certain socioeconomic characteristics may reduce the ability to prepare for, respond to, or recover from a hazard event.

By explicitly addressing the needs of most impacted populations, the City seeks to undo historic and structural racism and contribute to building a healthy and diverse community, where everyone truly belongs. Given the interconnectedness of our ecosystems and the shared watershed of San Leandro Bay and the Oakland-Alameda Estuary, the City must work collaboratively to address equity not only for Alamedans but also for priority equity communities in adjacent jurisdictions such as Oakland and San Leandro. Working collaboratively with key stakeholders will help ensure more uniform protections exist for all, especially for under-resourced communities, and will help establish a unified voice to expedite hazard mitigation and climate adaptation.

# Climate Adaptation and Hazard Mitigation Strategy

## Vision

The Plan's vision is that the City of Alameda will be better prepared for future hazards and climate impacts by reducing the impact of climate change and disasters on our community and by ensuring equitable recovery from disasters when they do occur.

## Hazard Mitigation and Adaptation Goals

In addition to the vision statement, nine mitigation and adaptation goals were identified. These mitigation goals were developed in the 2016 Local Hazard Mitigation Plan (LHMP) and remain unchanged. There were no change in priorities since the last approval of the mitigation plan. Mitigation goals are broad statements that are achieved through implementation of the more specific mitigation actions. The mitigation goals are as follows:

- Reduce exposure to hazards where possible.
- Protect the health, safety and welfare of City of Alameda residents, workers and visitors.
- Minimize damage of public and private property.
- Minimize damage to the natural environment.
- Minimize disruption of essential services, facilities, and infrastructure.
- Timely and complete recovery.
- Increase understanding and awareness of hazards and hazard mitigation by City employees and the public.
- Participate in mitigation and resiliency by all stakeholders, as appropriate.
- Protect the City's character.

## Hazard Specific Goals

The Climate Action and Resiliency Plan (CARP) identified hazard specific goals, which have been updated and adopted for this Plan. The hazard specific goals are as follows:

- **Sea level rise and storm surges:** Protect assets from sea level rise and storm surges, including community vitality and recreational opportunities, plan future land use to avoid impacts, and enhance natural shoreline habitat to mitigate impacts.
- **Flooding:** Increase the resiliency and capacity of the stormwater system to prevent flooding of assets during extreme precipitation events.
- **Drought:** Reduce water consumption and increase drought-resistant landscaping.
- **Extreme heat:** Reduce the heat island effect and protect vulnerable populations from heat impacts during heat waves.
- **Wildfires:** Protect public health from smoke impacts during wildfire events, especially among vulnerable populations.
- **Earthquakes:** Reduce property damage and loss of life in an earthquake, especially for areas at risk of liquefaction, and increase the ability for a timely restoration of service.
- **Tsunamis:** Reduce property damage and loss of life in a tsunami and prepare for the safe evacuation of people from the shoreline during a tsunami.

- **Effective implementation and capacity building:** Develop financial and human resources and increase transparency, community engagement, social resilience, and support for effective implementation of climate adaptation and hazard mitigation strategies.

## Completed Strategies

The following strategies were completed during the 2023-2026 planning period:

- Held regular meetings of the Oakland Alameda Adaptation Committee (OAAC), formerly known at the San Leandro Bay/Oakland Alameda Estuary Adaptation Working Group, with neighboring jurisdictions, agencies and community-based organizations to coordinate San Leandro Bay/Oakland-Alameda Estuary flood and adaptation projects to protect and restore water quality, habitat, and community resilience. (Strategy C3)
- Completed 30% design drawings and community engagement for Bay Farm Island Adaptation Project with grant funding from Federal Emergency Management Agency (FEMA). (Strategy I6)
- Completed design concept for Estuary Adaptation Project with grant funding from California Department of Transportation (Caltrans). (Strategy I6)
- Began Geomorphology and Ecology Study to inform design concept for South Shore beach area. (Strategy I6)
- Received Environmental Infrastructure authorization in the 2024 Water Resources Development Act (WRDA) to implement storm drain and shoreline improvements along the northern shoreline of Alameda Point. (Strategy I6)
- Began development of a Shoreline Adaptation Plan that details preliminary strategies and pathways for shoreline communities to take as the climate and shorelines change over time, as required by state law with grant funding from San Francisco Estuary Partnership (SFEP) and National Fish and Wildlife Foundation (NFWF). (Strategy S1)
- Converted lawn to drought tolerant landscape at City Hall and City Hall West. (Strategy B2)
- Completed a cost-benefit analysis and scope of work to apply for a FEMA HMGP grant to provide financial assistance to retrofit soft-story apartment buildings and encouraging residents of single-family homes to take advantage of the California Earthquake Brace and Bolt Program retrofit grants. (Strategy B4)
- Received Community Rating System 8 classification. (Strategy B5)
- Adopted a new Floodplain Ordinance to enhance flood risk reduction for all buildings within the City's floodplain. (Strategy L2)
- Completed additional groundwater analysis building on the 2020 study with a review a subset of monitoring well data post 2020, with an emphasis on the well observations in the spring of 2023 that consider the groundwater surface in response to the winter 2022/2023 rainfall events. (Strategy S2)
- Adopted the 2025 California Building Standards Code and adopted local amendments to the 2025 California Fire Code, Energy and Green Buildings Standards Code. (Strategy B10)
- Signed an MOU with AUSD for Mass Care and Shelter in an emergency. (Strategy E4)

The status of each strategy included in the 2022 Hazard Mitigation Plan is shown in **Appendix G**.

## Priority Climate Adaptation and Hazard Mitigation Strategies

The priority climate adaptation and hazard mitigation strategies include those from the 2022 LHMP that were selected for continuation and new strategies identified by staff and community members. The strategies in this plan align with General Plan policies.

**Buildings**

- **B1 Water Efficiency and Conservation.** Minimize water use in existing and new construction and landscaped areas to make Alameda more resilient to drought and generate less wastewater.
- **B2 Rising Groundwater.** Prepare for the impacts of rising groundwater levels on private and public property.
- **B3 Seismic Retrofit for Private Buildings.** Require owners of vulnerable structures, to the extent feasible, to retrofit existing structures to withstand earthquake ground shaking, and require retrofitting when such structures are substantially rehabilitated or remodeled.
- **B4 Flood Insurance.** Continue the City's participation in the National Flood Insurance Program and the Community Rating System as a Class 8 community. Maintain Alameda's Community Rating to reduce flood insurance costs.
- **B5 Design for Flooding.** Implement programs and amend regulations to require and incentivize flood-proofing retrofits to existing buildings in flood-prone areas and require all new development to raise finished floor elevations and design for sea level and associated groundwater rise based on the most current regional projections.
- **B6 Building Codes.** Maintain up to date building codes and adopt new codes as needed to improve building safety and reoccupancy in an earthquake, fire, flood or other disaster.
- **B7 Fire Prevention in Existing Properties.** Encourage existing properties to minimize the risks of fire and include adequate provisions for emergency access and appropriate firefighting equipment.
- **B8 Cool/Green Buildings.** Incentivize and consider requiring the installation of cool roofs, green roofs, and/or other energy-efficient cool building methods to mitigate heat impacts and reduce runoff.
- **B12 Sea Level Rise Protection.** Reduce the potential for property damage and loss, and loss of natural habitat resulting from sea level rise.

**Infrastructure**

- **I1 Critical Public Assets.** Ensure resilience and long-term functionality of critical public assets threatened by earthquakes, sea level rise or rising groundwater.
- **I2 Stormwater Detention.** Design street rights-of-way, parks, other public spaces, street trees and landscaping to be resilient to temporary flooding and to serve as temporary water detention sites where feasible.

- **I3 Urban Forest.** Take actions to maintain and expand the number of trees in Alameda on public and private property to improve public health, reduce pollution, and reduce heat island effects.
- **I4 Lagoons.** Continue to preserve and maintain all lagoons as natural habitat as well as an integral component of the City's green infrastructure network and flood control system.
- **I5 On-Island Generation.** Support development of on-island solar power generation and wind power.
- **I6 Public Infrastructure Priorities.** Identify public transportation, streets, electric facilities, stormwater and wastewater facilities, open space, shoreline assets, and other public assets vulnerable to sea level and groundwater rise and flooding hazards and earthquakes and prioritize projects for adaptation funding, including strategies for Location-Based Priority Flooding.
- **I7 Green Infrastructure.** Implement the 2019 City of Alameda Green Infrastructure Plan to increase and incorporate areas for green infrastructure in Alameda to help infiltrate stormwater and reduce street flooding. Green infrastructure can be implemented and designed in pre-existing infrastructure plans or new development plans.
- **I8. Underground Utilities.** Continue to replace overhead electrical power lines with underground lines and require new development to underground power lines to improve the safety and reliability of the power grid and minimize disruption by fire or other natural disasters.
- **I9 Lifeline Standard Estuary Crossing.** Work with Caltrans, Alameda County, and other regional agencies to retrofit and improve at least one estuary crossing to meet a lifeline standard to ensure access to the larger region for emergency access, equipment supplies, and disaster response and recovery shortly after a major seismic event.
- **I10 Emergency Firefighting Water Supply.** Create an emergency water supply system to ensure sufficient firefighting capabilities after an earthquake or large emergency.

**Land Use**

- **L1 Land Development.** Require that new development include onsite stormwater detention, reduce the potential for property damage, and loss of natural habitat, which results from groundwater and sea level rise.

**Emergency Response**

- **E1 Heat and Wildfire Smoke Emergencies.** Create a network of clean air and cooling emergency shelters throughout Alameda.
- **E2 Emergency Preparedness.** Maintain emergency management and disaster preparedness as a top City priority.
- **E3 Tsunami Preparedness.** Prepare Alameda for tsunamis and prepare for a timely evacuation from the shoreline with a focus of access and functional needs populations.
- **E4 Emergency Coordination.** Coordinate local emergency preparedness efforts with local, state and federal partners in preparation for natural and man-made disasters and ensure that

the City's disaster response communication technologies are compatible with other agency communication technologies.

- **E5 Wildfire Smoke.** Prepare for future wildfire smoke events.
- **E6 Emergency Response and Disaster Preparedness.** Preserve access for emergency response vehicles to people and property and for evacuation.

**Communication, Community and Coordination**

- **C1 Public Communication.** Maintain and promote community programs to train volunteers, support vulnerable community members like seniors and individuals with disabilities, coordinate with food banks and other local aid organizations, and assist police, fire, and civil defense personnel during and after a major earthquake, fire, or flood.
- **C2 Air Quality Alerts.** Continue to partner with Bay Area Air District to enhance awareness of air quality index alerts and related outreach and education to protect the health of residents.
- **C3 Regional Partnerships.** Actively participate in regional discussions on groundwater and sea level rise mitigation, infrastructure improvements, and adaptation strategies.
- **C4 Collaboration.** Work collaboratively with other jurisdictions and agencies to reduce fire hazards in Alameda, such as post-earthquake fire hazards, with an emphasis on mutual aid agreements.
- **C5 Neighborhood Resilience Coordination.** Consider piloting building electrification, water conservation and other climate initiatives at a block or neighborhood level to more cost effectively transition to climate friendly energy, water, and resource use.
- **C6 Social Vulnerability.** Prioritize the needs of frontline communities when prioritizing public investments and improvements to address climate change.

**Studies and Plans**

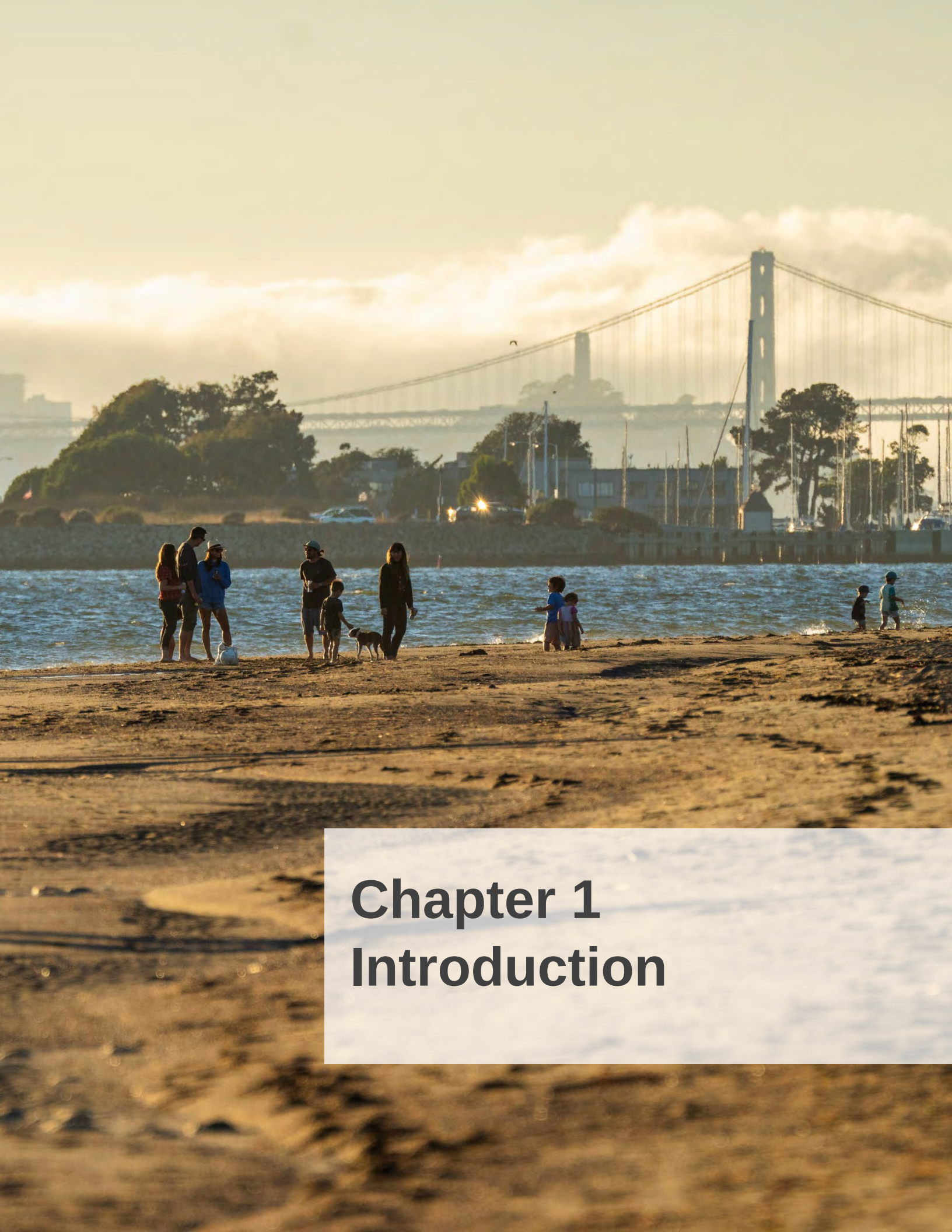
- **S1 Shoreline Adaptation Plan.** Develop a shoreline adaptation plan that includes additional vulnerability studies as needed, economic analysis, groundwater rise studies and other data collection as needed to identify the range of flood risk reduction, groundwater management and adaptation strategies over time from short- to long-term as well as land use, building and infrastructure design standards needed to help Alameda adapt to rising sea and groundwater levels and comply with BCDC's Regional Shoreline Adaptation Plan Guidance.
- **S2 Rising Groundwater.** Collect new data, add groundwater monitoring wells, analyze additional contaminants and potential landfill risks, update liquefaction zones and continue to refine the quality of the groundwater model to better prepare for the impacts of rising groundwater levels on private and public property.
- **S3 Flood Hazard Maps.** Prioritize the review and publishing for public discussion the latest and most up to date flood hazard and sea level rise forecasts from all trusted sources.

# Implementation and Updates

The Climate Adaptation and Hazard Mitigation Plan is a living document that must be regularly reviewed and updated. Public participation is an integral component of the mitigation planning process and will continue to be essential as this Plan evolves and is updated over time.

The Sustainability and Resilience Manager will be charged with maintaining, evaluating and updating this Plan on an annual basis within the 5-year cycle. Progress on plan implementation will be reported to City Council at a public meeting annually, coincident with the annual report of the Climate Action and Resiliency Plan.

Per federal regulations, this plan must be updated every five years. The Sustainability and Resilience Manager will ensure that a complete review and update of the Plan, including the hazard analysis and mitigation strategy, is completed before the expiration of the current Plan. The plan update process will follow much the same process as followed in the 2026 update.



# Chapter 1
# Introduction

# Background

The City of Alameda is a low-lying island community of approximately 80,000 people in the San Francisco Bay that is highly vulnerable to inundation from rising seas and rising groundwater. Alameda is also highly vulnerable to earthquakes because of its older building stock and proximity to two major faults, as well as other hazards. That a disaster will strike Alameda in its future is a certainty; what is not certain is the extent to which the hazards will damage buildings and infrastructure and disrupt life for Alameda's residents and businesses. Climate change has ensured that our future will be riskier than our past but by understanding our risks and taking proactive action now to mitigate risks and reduce our greenhouse gas emissions that contribute to climate change, Alameda can be prepared for future disasters and reduce their impact.

The Alameda Climate Adaptation and Hazard Mitigation Plan (Plan) serves as an update to the 2022 Local Hazard Mitigation Plan. It aligns with and nests within the Climate Action and Resiliency Plan (CARP). This plan was updated to align with the 5-year CARP update cycle. The Plan is also aligned with the General Plan Safety Element and Emergency Operations Plan.

Flooding is one of the greatest climate threats that Alameda faces. The City identified location-based priority flooding strategies to mitigate flood risks associated with overland coastal flooding due to high tides and/or storm surge, rising groundwater tables and emergent groundwater, and precipitation-based flooding. The strategies are identified for immediate (< three years), near-term (three to 10 years), and mid-term (10 to 30 years) implementation.

# Purpose

The purpose of the Plan is to help Alameda adapt to a changing climate, reduce the impact of future disasters and help us recover more quickly when disasters do occur. The Plan:

- Meets the requirements established by the Federal Disaster Mitigation Act of 2000 (DMA 2000) and maintains eligibility for Federal Emergency Management Agency (FEMA) assistance grant programs, including the:
  - Hazard Mitigation Grant Program (HMGP)
  - Building Resilient Infrastructure and Communities (BRIC)
  - Flood Mitigation Assistance (FMA)
- Aligns with other plans, including the Long-term Adaptation Plan (forthcoming), Climate Action and Resiliency Plan (CARP), General Plan and the City's Emergency Management Plan;
- Increases education and awareness of natural and climate-induced hazards and community vulnerabilities;
- Establishes a basis for coordination and collaboration among community entities such as private and public agencies, key stakeholders, and residents; and,
- Identifies and prioritizes future mitigation and adaptation projects.

# Key Terms

The Plan addresses the risk the City of Alameda faces from natural and climate induced hazards and describes mitigation and adaptation actions that can be taken to reduce the risk we face and enhance the community's resilience to hazards.

**Risk** is the consequence of the interaction between a hazard and the characteristics that make people, and places vulnerable and exposed (UNDRR Terminology, 2017).

A **hazard** is an event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, damage to the environment, interruption of business, or other types of harm or loss.

**Exposure** refers to the people, infrastructure, housing, and other assets located in hazard prone areas.

**Vulnerability** is the physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards.

**Hazard mitigation** and **climate adaptation** refers to the actions taken to reduce or eliminate risk to human life and property from natural and climate change-induced hazards.

**Resilience** refers to the ability of a city's systems, businesses, institutions, communities, and individuals to survive, adapt, and grow no matter what kinds of acute shocks and chronic stresses they experience.

# Relationship to Other Plans

The Plan is different from the Emergency Response Plan which prepares the City to respond when a disaster occurs, and may include such actions as providing emergency response, equipment, food, shelter, and medicine. However, climate adaptation and hazard mitigation planning support emergency response by minimizing community disruption, loss of life, and property damage resulting from disasters.

The City's General Plan is a statement of goals, objectives, policies and actions that describe the community's priorities for the next 20 years. The 2040 General Plan provides a long-term strategy for how Alameda will address climate change, affordable housing, equity and inclusiveness, safe streets, open space and park funding priorities, and disaster preparation. As the Plan must be updated every five years, it provides the near-term actions Alameda will take to achieve our long-term goals and is adopted as an appendix to the General Plan Safety Element.

The Plan lays out Alameda's strategy for mitigating natural hazards and adapting to a changing climate. The success of this plan rests not only on our ability to implement the strategies laid out in this plan, but also on our ability to implement the City's Climate Action and Resiliency Plan (CARP). The goal of CARP is to reduce our greenhouse gas emissions (GHG) by 50% below 2005 levels by 2030, become carbon neutral by 2045 and adapt to climate change. In 2019, the City of Alameda declared a climate emergency and called for an urgent and just citywide climate mobilization effort to reverse global warming and adapt as rapidly as possible to the growing global and local effects of climate change. By taking strong actions to reduce our GHG emissions, Alameda will do our part to achieve a climate safe path and help avoid some of the extreme climate effects we face. Of course, this City of Alameda cannot avert global warming on its own. It will take an immediate and concerted effort on the part of community members, businesses,

other cities and counties, the state, federal government and the world to come together and reduce our global emissions. Here in Alameda, we will do our part to reduce our emissions and prepare for the impacts that we will face.

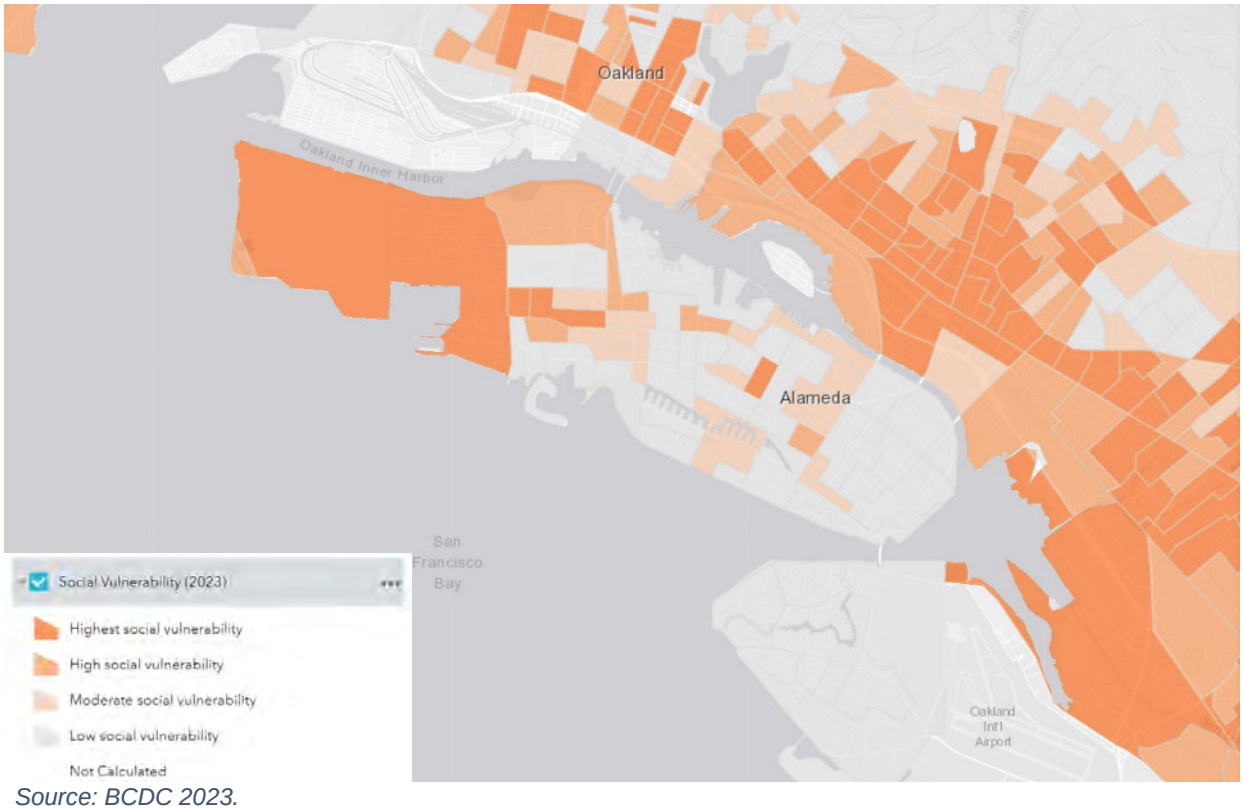
# Focus on Equity

Alameda recognizes that some members of the community will be more significantly impacted by natural disasters and may have a more difficult time recovering than others due to lack of stable housing, financial resources, and by zoning laws that have disproportionately placed people of color and community members with the fewest resources into areas of the city that are more vulnerable to natural hazards. Natural disasters disproportionately impact low-income residents, people of color, the young, the old, and the disabled. The goal of this plan is to identify and mitigate those needs to reduce the impact of future disasters on all Alameda residents and speed recovery when disasters do occur.

Social equity is critical to promoting healthy, resilient communities. Equity is the idea that one's race, ethnicity, gender, age, disability, sexual orientation should not determine their outcomes and should not affect the distribution of resources, including housing, access to jobs and education, food, and environmental exposure.

The City utilizes the Bay Conservation and Development Commission's (BCDC) Community Vulnerability Assessment to understand the level of social vulnerability to climate hazards across Alameda. Certain socioeconomic characteristics may reduce the ability to prepare for, respond to, or recover from a hazard event. **Figure 1-1** presents the areas of social vulnerability in Alameda.

***Figure 1-1: Social Vulnerability to Climate Hazards Across Alameda***




*Source: BCDC 2023.*

Mapping vulnerability is helpful to ensure that the CARP and LHMP are equitably implemented across the city, focusing resources where they are needed most. There are a variety of ways the City can work to support equitable implementation of CARP programs. These include procedural, distributional, and structural equity.

- **Procedural equity**: Transparent, fair, and inclusive process; ensure all are treated openly and fairly; and increase civic engagement opportunities. For example, the City can focus future outreach and engagement efforts for priority populations most sensitive to the impacts of climate change.
- **Distributional equity**: Fairly distribute resources, benefits, and burdens; and prioritize resources for communities that experience greatest inequities and unmet needs. The City can focus program implementation in neighborhoods with the highest social vulnerability and need.
- **Structural equity**: Make a commitment to compensate for past harms and prevent future unintended consequences; and address underlying structural and institutional systems that are the root causes of social and racial inequities. The City can support transformational initiatives, linking climate program implementation with job training, local hire, and other economic development objectives.

By explicitly addressing the needs of most impacted populations, the City seeks to undo historic and structural racism and contribute to building a healthy and diverse community, where everyone truly belongs. Given the interconnectedness of our ecosystems and the shared watershed of San Leandro Bay and the Oakland-Alameda Estuary, the City must work collaboratively to address equity not only for Alamedans but also for priority equity communities in adjacent jurisdictions such as Oakland and San Leandro. Working collaboratively with key stakeholders will help ensure more uniform protections exist for all, especially for under-resourced communities, and will help establish a unified voice to expedite hazard mitigation and climate adaptation.

The Plan's equity goal aligns with the Alameda 2040 General Plan equity goal to:

> "…promote equity, environmental justice, and a high quality of life for everyone irrespective of income, race, gender, sexual orientation, cultural background or ability by recognizing and changing local policies, programs, ordinances, and practices that serve to perpetuate injustices suffered by under-served and underrepresented populations and proactively engaging these populations in all City decision making."

The General Plan includes several actions designed specifically to "prioritize the needs of the most vulnerable communities when prioritizing public investments and improvements to address climate change" (General Plan, CC-2).

- **Equity.** Ensure opportunities for leadership and actions to involve and benefit Alameda's low-income individuals, seniors, youth, people of color, unhoused, individuals with disabilities, and socio-economically disadvantaged communities from environmental and climate change impacts.
- **Environmental Justice.** Ensure the equitable treatment and full involvement of all people when considering actions to reduce the adverse impacts of climate change on residents regardless of age, culture, ethnicity, gender, race, socioeconomic status, or geographic

location. Prioritize actions that will reverse historic policies of racial discrimination and exclusion.

- **Assessments.** Utilize Alameda's Social Vulnerability Assessment in the Climate Action and Resiliency Plan or similar tool to identify neighborhoods and specific groups with high levels of social vulnerability in order to prioritize locations for action and improvements.

The CARP included a social vulnerability assessment that informed the consequences and strategies in this plan. Each strategy also includes an equity consideration to help guide equitable implementation of the strategy.

# Vision Statement and Hazard Mitigation and Adaptation Goals

According to Alameda's 2040 General Plan Safety Element to which this Plan is aligned,

"Alameda aspires to be a resilient city that is able to adapt to a changing climate and reduce the loss of life, property damage, and environmental degradation from disasters while accelerating economic recovery from those disasters. Alameda enhances community resilience by improving the buildings and infrastructure we all rely on, responding to disasters quickly and effectively, helping owners rebuild damaged buildings quickly, protecting tenants, and keeping businesses open during recovery."

## Vision

The Plan's vision is that the City of Alameda will be better prepared for future hazards and climate impacts by reducing the impact of climate change and disasters on our community and by ensuring equitable recovery from disasters when they do occur.

## Hazard Mitigation and Adaptation Goals

In addition to the vision statement, nine mitigation and adaptation goals were identified. These mitigation goals were developed in the 2016 Local Hazard Mitigation Plan (LHMP) and remain unchanged. Mitigation goals are broad statements that are achieved through implementation of the more specific mitigation actions. The mitigation goals are as follows:

- Reduce exposure to hazards, where possible.
- Protect the health, safety, and welfare of City of Alameda residents, workers, and visitors.
- Minimize damage of public and private property.
- Minimize damage to the natural environment.
- Minimize disruption of essential services, facilities, and infrastructure.
- Ensure timely and complete recovery.
- Increase understanding and awareness of hazards and hazard mitigation by City employees and the public.
- Participate in mitigation and resiliency by all stakeholders, as appropriate.

- Protect the City's physical and social character and diversity.

## Hazard Specific Goals

The hazard specific goals, originally adopted in the Climate Action and Resiliency Plan (CARP), have also been updated and adopted for this Plan. The hazard specific goals are as follows:

- **Sea level rise and storm surges:** Protect assets from sea level rise and storm surges, including community vitality and recreational opportunities, plan future land use to avoid impacts, and enhance natural shoreline habitat to mitigate impacts.
- **Groundwater rise:** Protect assets from groundwater rise and consider the impacts of groundwater rise in projects that involve underground infrastructure.
- **Inland flooding:** Increase the resilience and capacity of the stormwater system to prevent flooding of assets during extreme precipitation events.
- **Drought:** Reduce water consumption and increase drought-resistant landscaping.
- **Extreme heat:** Reduce the heat island effect and protect vulnerable populations from heat impacts during heat waves.
- **Wildfires:** Protect public health from smoke impacts during wildfire events, especially among vulnerable populations.
- **Earthquakes:** Minimize loss of life, community disruption, and property damage in an earthquake, especially for areas at risk of liquefaction, and prepare for a timely and equitable restoration of community functionality.
- **Tsunamis:** Reduce property damage and loss of life in a tsunami and prepare for the safe evacuation of people from the shoreline during a tsunami.
- **Effective implementation and capacity building:** Develop financial and human resources and increase transparency, community engagement, social resilience, and support effective implementation of climate adaptation and hazard mitigation strategies.

# The History of Alameda

The City of Alameda, located seven miles east of San Francisco and just west of Oakland, is made up of Alameda Island and Bay Farm Island. The City includes 10.61 square miles of land. Alameda is a charter city founded in 1854 and incorporated in 1872. The City of Alameda provides a full range of municipal services, including public safety, public works, community development, and community services. The City also provides electric utility services through Alameda Municipal Power.




At the time of the arrival of the Spanish, Alameda was a peninsula of land covered by a dense forest of coastal live oak and inhabited by the Confederated Villages of Lisjan, an Ohlone people who spoke Chochenyo and sustained themselves through hunting, fishing and gathering. Settlement

of Alameda by Europeans and other non-natives began in 1820, when Luis Peralta divided Rancho San Antonio among his four sons. Alameda derived its original name, “the Encinal,” from the large stands of native oaks (“encino” means “oak” in Spanish) on the Main Island. The name “Alameda,” meaning “grove of poplar trees,” was given to the City as a poetic gesture upon popular vote in 1853.

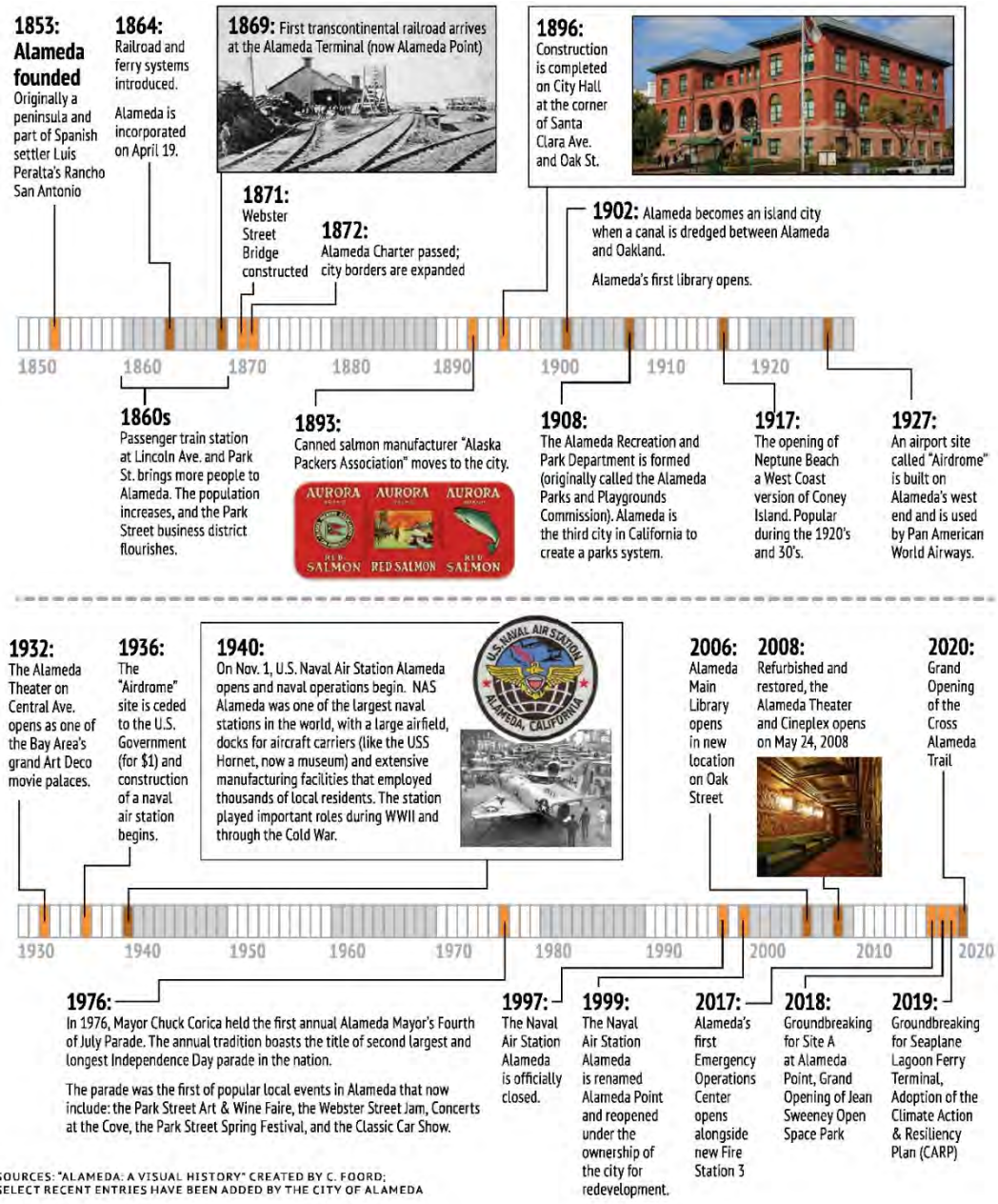
In 1849, the California Gold Rush brought Americans and Northern Europeans to the San Francisco Bay. Many made their fortunes in supplying goods and services to the region’s burgeoning population. Among these were two young entrepreneurs, William Worthington Chipman and Gideon Aughinbaugh, who purchased the Encinal from Antonio Maria Peralta for $14,000 in 1851, the year after California became a state. They subdivided the land and sold tracts for residences and orchards. By 1872, three separate settlements, the Town of Alameda, Encinal, and Woodstock, were established in the east, central and western sections of the peninsula. The Town of Alameda was granted a charter by the State Legislature in 1854; incorporation of all peninsula settlements under one local government occurred in 1872.

Early growth of residential, commercial and industrial areas depended upon water and rail transportation and an excellent climate. The City’s industrial waterfront and small commercial districts (“the stations”) were developed in conjunction with rail improvements, while neighborhoods of Victorian homes and beach resorts were built attracting tens of thousands of weekend visitors. Major shipyards and Neptune Beach (the “Coney Island of the West”) were established along the northern and southern shores to take advantage of the island’s coastal assets. In 1902, the Tidal Canal was completed and Alameda became an island.

In the decades between 1920 and 1970 the City witnessed cycles of boom and bust. Following an enlightened era of civic building during the 1920s, Alameda endured difficult years of political scandal and corruption through the 1930s. The entry of the United States into World War II focused the City’s attention on the war effort. During World War II, shifts ran around the clock at the Alameda Naval Air Station (commissioned in 1940) and in the City’s shipyards. The City’s population reached an all-time high of 89,000

By 1973 concern about the replacement of Victorian homes by boxy apartment buildings and the prospect of all-apartment development on Bay Farm Island led to passage of initiative Measure A, which prohibits residential structures having more than two units. Despite this restriction, an average of 300 homes per year were built between 1970 and 1990, mainly on Bay Farm Island. Over the years, the City adopted several ordinances that overrode certain provisions of Measure A to remain consistent with State law. In 2021, the California Department of Housing and Community Development (HCD) officially declared Article 26 preempted and unenforceable. Bay Area growth pressure has facilitated redevelopment of unused shipyards on the Northern Waterfront as business parks, homes, and marinas. The City is currently redeveloping the former Alameda Naval Air Station into mixed use residential, commercial, and industrial use called Alameda Point.

*Figure 1-1 Timeline of Alameda History*




# What Has Changed Since the 2022 Plan

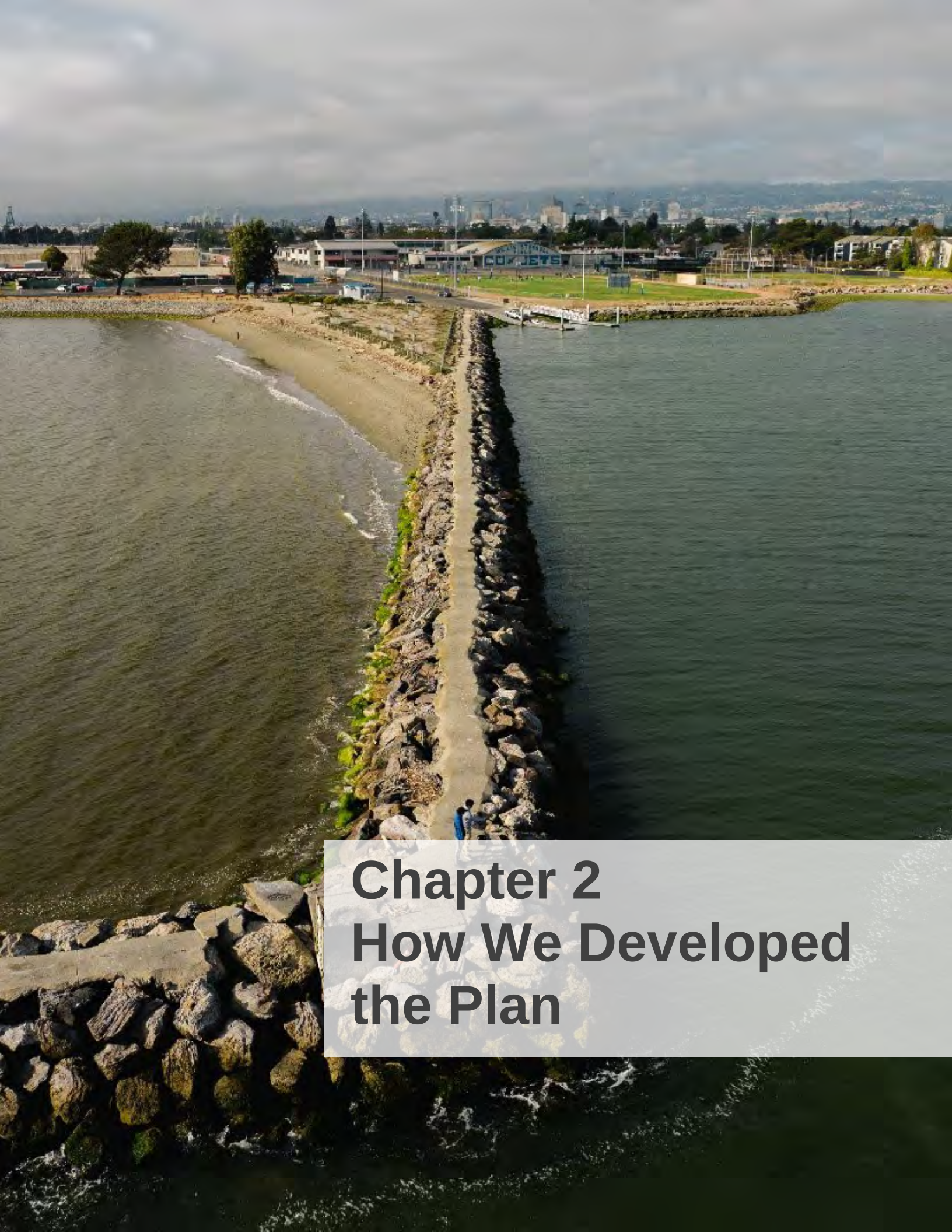
Since the 2022 Local Hazard Mitigation Plan was adopted, several significant things have occurred. Alameda has updated its General Plan, which includes a Safety Element and new Conservation and Climate Change Element to align with this Hazard Mitigation Plan. Alameda also updated the Climate Action and Resiliency Plan (CARP) concurrently to this plan update. Since 2021, Alameda has been leading the Oakland Alameda Adaptation Committee (OAAC) to plan for sea level rise adaptation in the Oakland-Alameda subregion. The Oakland Alameda Adaptation Committee (OAAC) is a coalition of shoreline communities and stakeholders working to accelerate sea level rise adaptation, protect and restore water quality, habitat and recreation and promote community resilience. OAAC has been working

on two high-priority projects – the Estuary Adaptation Project and the Bay Farm Island (BFI) Adaptation Project – and a Shoreline Adaptation Plan as required by SB272 (Laird). These planning efforts include analyses of conditions and recommendations for consideration by OAAC and the City on the concept designs, funding, phasing and governance.

In light of these developments, the Plan was revised and reorganized to better meet the needs of Alameda today and to align with the updated General Plan and CARP. The overall priorities of the plan are unchanged since the plan was last adopted, but the Plan more fully considers climate change impacts and serves as an update to the adaptation chapter in CARP. The Plan considers one new hazard: Groundwater rise that results from rising sea levels.

## Scope and Content

The Climate Adaptation and Hazard Mitigation Plan presents recommendations and strategies for implementing climate change adaptation and mitigation actions in Alameda. **Chapter 2** describes the process used to update the plan. **Chapter 3** describes the assets within Alameda, including the people, economy, buildings, and infrastructure at risk in natural disasters. **Chapter 4** describes the hazards we face and consequences of those hazards for Alameda. **Chapter 5** describes the actions the City will take to reduce our risk from natural and climate-related hazards. Finally, **Chapter 6** describes how the City will implement and maintain the Plan over time. Appendices provide additional detail and supporting information for the Plan's chapters.



# Chapter 2
# How We Developed the Plan

# Plan Development Process

Key steps in the Plan development process included the following steps:

- Step 1: Review previous plan and new information.
- Step 2: Scope and organize the Planning Team.
- Step 3: Identify assets and assess hazards.
- Step 4: Conduct risk assessment and analysis.
- Step 5: Develop and prioritize hazard mitigation and adaptation strategies.
- Step 6: Conduct stakeholder engagement and community outreach.
- Step 7: Draft and finalize the plan. The City developed a draft Plan, which was revised to incorporate community input during the review process in Step 6, and then produced a final Plan.

# Incorporation of Existing Plans, Studies, Reports, and Technical Information

The plan update included the review and incorporation of existing plans, studies, reports, and technical information to inform the hazard and risk assessment and development of strategies.

- **Alameda Strategic Plan (2023-2026):** The Strategic Plan is a tool to help the City Council guide staff's work over the next several years by developing a shared vision and priorities with specific projects included to meet those priorities. The Strategic Plan also informs the budget and is reviewed and updated annually.
- **Alameda Municipal Power Strategic Plan (2020-2025):** Alameda Municipal Power (AMP) Strategic Plan contains AMP's mission, acknowledges challenges that need to be addressed, strategies and performance indicators. This plan focuses on providing affordable, accessible, reliable, and sustainable energy to the City of Alameda.
- **Alameda 2040 General Plan (2022).** The General Plan is a statement of goals, objectives, policies and actions that describe the community's priorities for the next 20 years. California State law requires that every city adopt and maintain an up to date, internally consistent general plan. The General Plan addresses climate change, affordable housing, equity and inclusiveness, safe streets, open space and park funding priorities, and disaster preparation.
- **Climate Action and Resiliency Plan (2025).** The Climate Action and Resiliency Plan is a long-term plan to reduce Alameda's Greenhouse Gas emissions that cause climate change through equitable improvements to transportation, buildings, energy use, and waste management and adapt to the impacts of climate change, such as rising seas and increasing extreme heat and smoke days.
- **The Response of the Shallow Groundwater Layer and Contaminants to Sea Level Rise (2020).** The study developed an estimate of the existing groundwater surface and analyzed the response of the shallow groundwater table to a suite of sea level rise scenarios. Areas

with emergent groundwater flooding and existing contaminant concentrations above human health benchmarks were identified as potential areas of concern.

- **FEMA FIRM maps.** The Federal Emergency Management Agency (FEMA) has prepared Flood Insurance Rate Maps (FIRMs) within the City of Alameda and identified the areas with a one percent chance of flooding in any given year, known as the Special Flood Hazard Area (SFHA), and commonly referred to as the 100-year floodplain. Over 1,000 properties within the City of Alameda are located within an SFHA. Current FIS and FIRMs were revised December 21, 2018.
- **Oakland Alameda Adaptation Committee Projects documents (2024)**
    - Existing Conditions Report
    - Sea Level Rise Criteria
    - Vulnerability Assessment
    - Planning Principles
- **ABAG Stronger Housing Safer Communities (2015).** The project was designed to better understand the challenges Bay Area housing and communities face from earthquakes. The project engaged local stakeholders and topical experts to identify the housing and communities that are particularly vulnerable, and to develop locally relevant strategies to address the specific vulnerabilities and consequences identified. The project was led by the ART Program and the Association of Bay Area Governments (ABAG) Resilience Program
- **BCDC Regional Shoreline Adaptation Plan (2024).** The Regional Shoreline Adaptation Plan (RSAP) for the Bay Area is a long-term planning effort to protect communities, critical assets, developed shoreline areas and natural ecosystems, enhance the resilience of Bay and shoreline systems and increase their adaptive capacities to flooding and rising sea levels.
- **Plan Bay Area 2050 (2021).** Plan Bay Area 2050 focuses on four key issues: the economy, the environment, housing and transportation. This new regional plan outlines strategies for growth and investment through the year 2050, while simultaneously striving to meet and exceed federal and state requirements. The plan will identify a path to make the Bay Area more equitable for all residents and more resilient in the face of unexpected challenges. The Metropolitan Transportation Commission and the Association of Bay Area Governments are expected to adopt Plan Bay Area 2050 in fall 2021.
- **USGS HayWired Scenario (2018).** The HayWired project models the impacts on housing, infrastructure, the economy and community in the San Francisco Bay area from a magnitude 7 earthquake and associated aftershocks on the Hayward Fault.

# Stakeholder Engagement and Community Outreach

An open public involvement process is essential to the development of an effective plan. As demonstrated below, community members were provided multiple opportunities for public comment on the plan during the drafting stage and prior to plan approval. In addition, the City also engaged

neighboring communities and jurisdictions on the plan development. Comments received during the public engagement phase were incorporated into the final plan.

## Green Team

The City convened an interdepartmental planning team to guide development of the Plan and met between May and November 2024. The Green Team met monthly throughout the plan development process to oversee and guide the Plan update process. The planning team was specifically responsible for:

- Developing and participating in community and key partner engagement strategy
- Providing updates to plan sections as needed
- Reviewing and providing input on draft plan
- Identifying new mitigation strategies (goals, actions, prioritization of actions, implementation plan)
- Ensuring integration with other citywide plans (two-way exchange)

Agendas for the planning team meetings are included in **Appendix A** and a list of participants are included in the Acknowledgements.

### Stakeholder Meetings and Interviews

The team met with staff from key City departments and conducted two rounds of stakeholder meetings with civic and community organizations: the Chamber of Commerce and business groups, housing organizations, and youth climate and sustainability leaders. Specific community groups included Community Action for a Sustainable Alameda (CASA), 100K Trees for Humanity, Alameda Food Bank, REAP Climate Center, West End Arts District, Bay Area MakerFarm, Bike Walk Alameda, a member of the district wide PTA, YouthPower Climate Action, Amplify, and Encinal Environmental Cooperative. These representatives were invited to participate through email. The community organization CASA was also a member of the Green Team.

## Community Engagement

### Website

The planning team established a dedicated webpage for the plan update on the City website. The site can be found at: www.alamedaca.gov/hazardmitigationplan.

### Social Media

The community survey and workshops were promoted on the city's Facebook account on May 1 and June 10 and reshared on several other community Facebook accounts, The City's Facebook account has over 12,000 followers. The community survey was also promoted on the Alameda sustainability newsletter, which has over 1,400 subscribers, and emailed to hundreds of stakeholders ranging from youth interested in the environment to business owners to community-based organization members.

### Community Survey

In April 2024, a community survey was shared to provide the opportunity for community members to identify their natural hazards of concern and actions that they have taken to prepare for natural hazards.

A link to the survey was included on the city's website and was shared via the city's social media account, stakeholder email lists, and the City's sustainability newsletter. An invitation to complete the survey was also included on community partners' social media pages. Postcards with information about the community workshops were also printed and distributed to each of the branch libraries, in city hall (finance office, passport office and permit desk), and in businesses along Park St. And Webster St. to make them available to members of the public. The survey was also promoted during Alameda's Spring Shindig held on April 20 and Alameda's Bike Festival on April 27. 147 responses were received to the community survey between April 18, 2024 and May 13, 2024. The survey responses were reviewed and analyzed for incorporation into the draft plan. A copy of the survey questions is included in **Appendix B**. Of all the listed hazards, survey respondents were most concerned with sea level rise and rising groundwater, droughts and water shortages, air pollution, and flooding and severe storms with 61% of respondents as "very concerned" about sea level rise and rising groundwater. A summary of responses is shown in **Figure 2-1 to 2-6**. A full summary of the survey and questions are included in **Appendix C**.

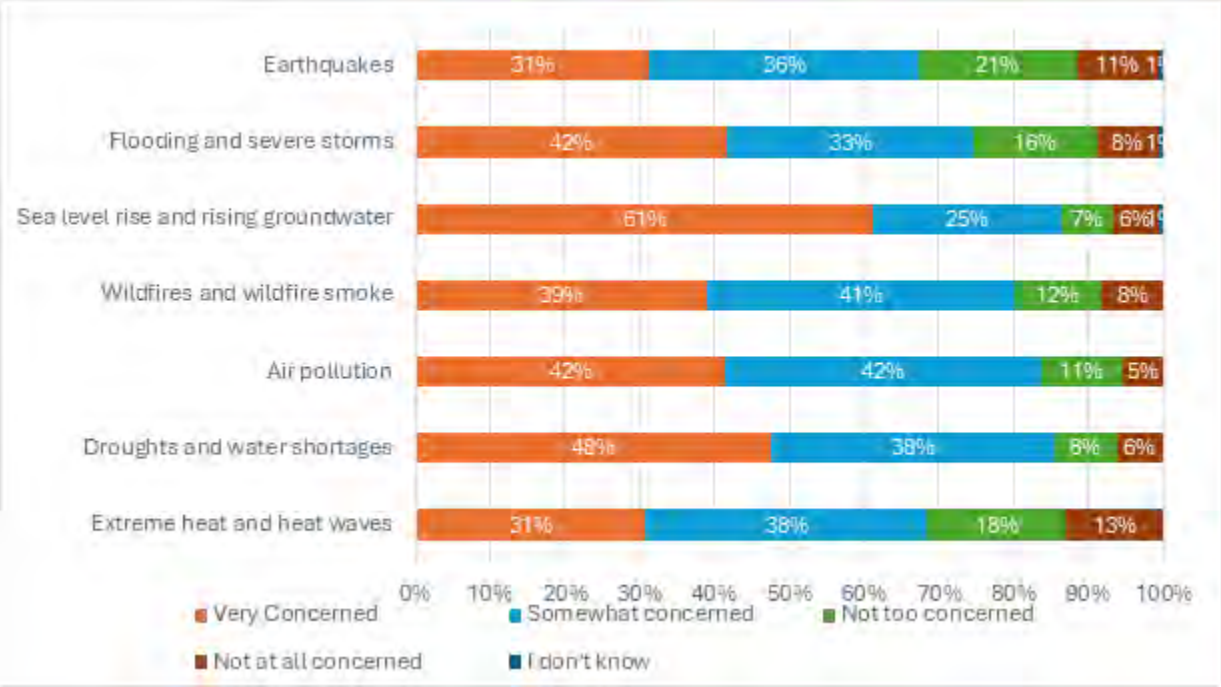



***Figure 2-1: How concerned the community is about climate hazards in Alameda***

Over half (54%) of the survey respondents feel that they and their households are only "somewhat prepared" for disasters (**Figure 2-2**). Nearly half of the respondents (48 percent) replied that they think the City is only somewhat prepared for disasters (**Figure 2-3**). The most common actions residents have taken to prepare for emergencies are to store at least 3 days of food and water, brace their gas water, install a gas shut-off valve, secured heavy furniture to the wall and purchase earthquake insurance (**Figure 2-4**).

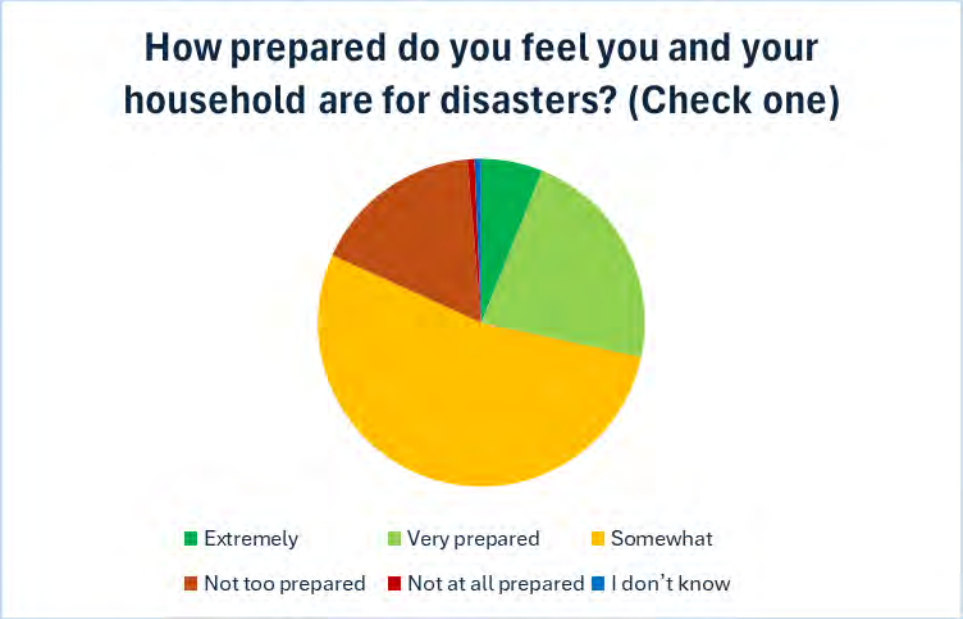



*Figure 2-2 How Prepared Are Survey Respondents for Disasters in Alameda (2022 survey)*

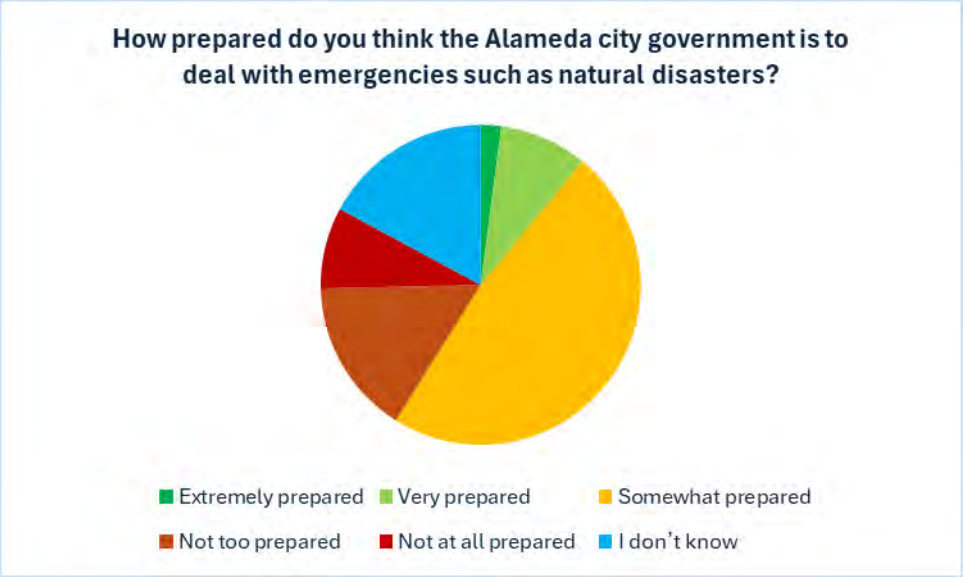



*Figure 2-3 How prepared respondents think Alameda City government is to respond to emergencies*

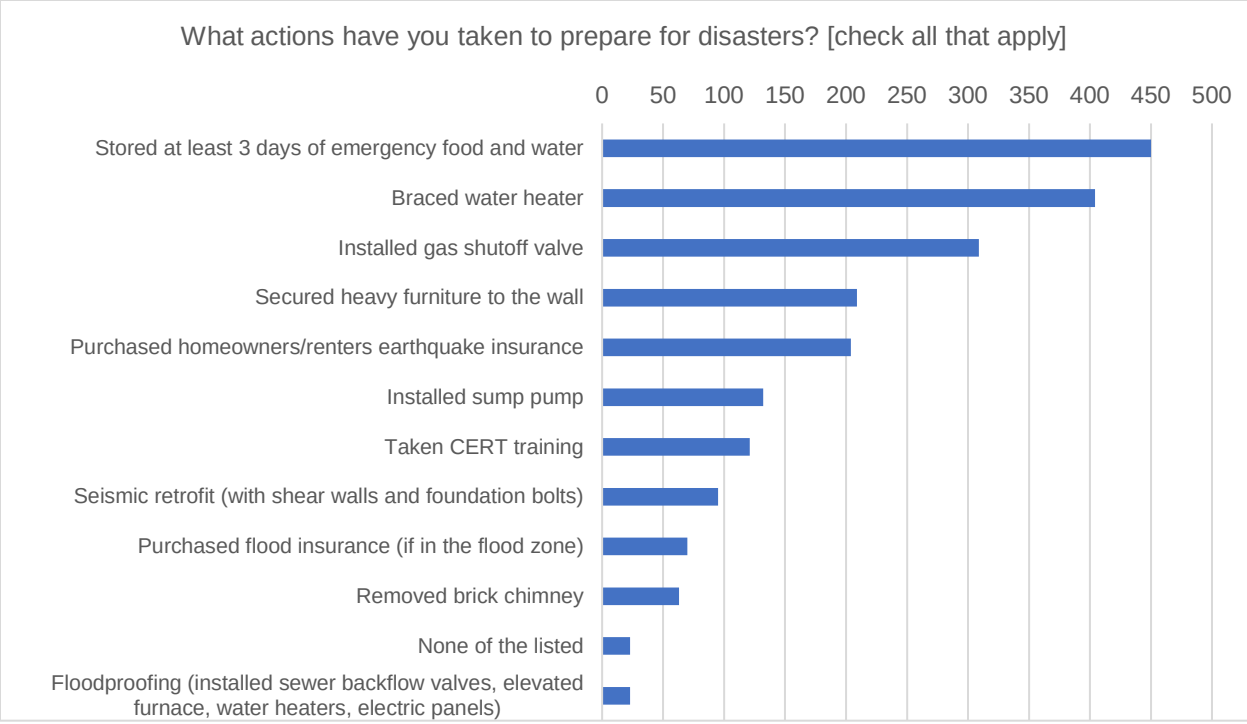



***Figure 2-4 Actions Respondents Have Taken to Prepare for Disasters***

As shown in **Figure 2-5**, while a large majority of the respondents were Alameda residents, a few respondents don't live but work or shop and dine in Alameda. Of those that live in Alameda, about 20% each live in Bay Farm, West End, Central, and East End. About 10% live in Southshore and 1% live in Alameda Point.

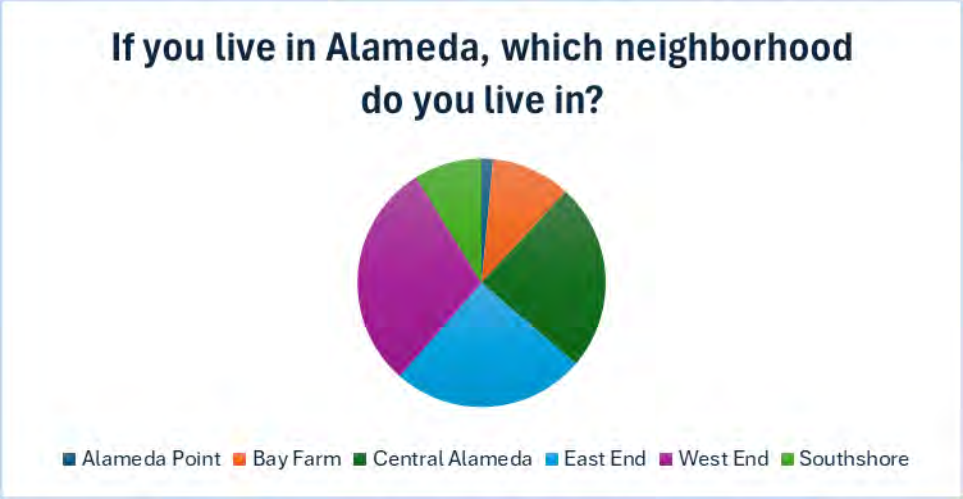



***Figure 2-4 Respondents' Relationship to Alameda***

As shown in **Figure 2-5**, 25% of survey respondents rent their homes and 71% own their homes, compared to the City as a whole, which is about 52% renters and 48% homeowners.[1]

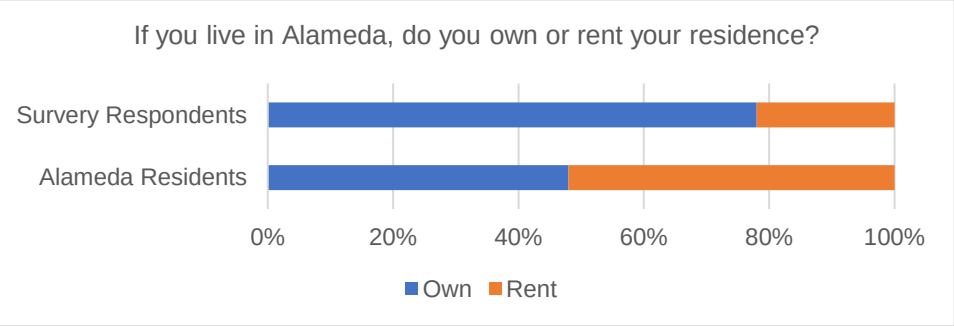



***Figure 2-5 Respondents Who Own or Rent Their Homes Compared to Residents Citywide***

The survey respondents are over-represented by individuals that identify as White or Mixed compared to Alameda residents overall. Alternatively, there is under representation from Asians, Hispanics or Latinos, Black or African American, American Indian or Alaskan Native and Native Hawaiian or other Pacific Islander as compared to Alameda residents overall.[2]

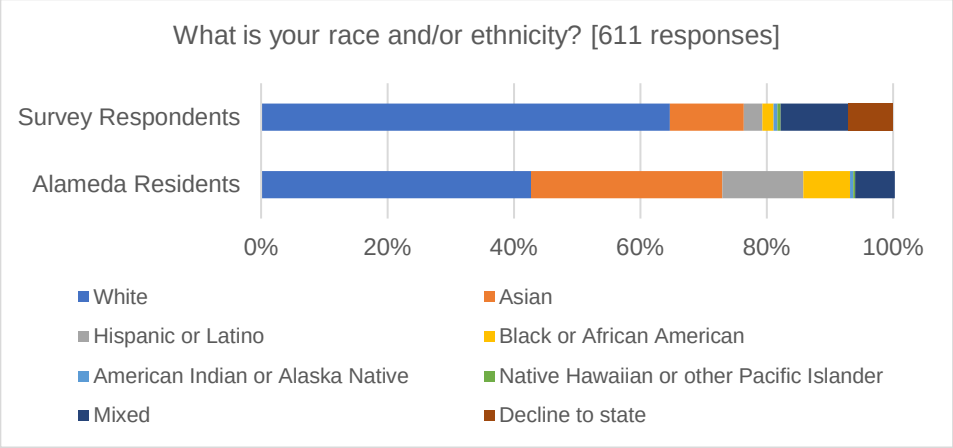



***Figure 2-6 Race and/or Ethnicity of Survey Respondents Compared to Residents Citywide***

## Emails

Survey respondents were asked to provide their email address to receive updates on the Plan and an email list sign up was also created on the Plan website. The email list was used to advertise the community survey, dates for public workshops, board and commission meetings, and to share a link to the draft plan for public comment. Copies of the emails are included in **Appendix B**.

## Community Workshops

Community workshops were conducted to provide input on the draft plan on the following dates:

[1] Quick Facts Alameda city, California, U.S. Census Bureau
[2] Quick Facts Alameda city, California, U.S. Census Bureau

- June 25, 2024, 6pm – 7:30pm
- December 18, 2024, 5:30pm – 7pm

A copy of the presentation used for these community meetings is provided in Appendix B. Sea Level Rise Adaptation Community Workshops

In August and December 2024, the Oakland Alameda Adaptation Committee held public workshops to educate residents on sea level rise dangers and adaptation projects, and to gain community input. Flyers promoting the workshops were handed out to residences near the shoreline in Alameda. The workshops were promoted on the City of Alameda's events page, on the City's adaptation project webpages, through multiple community partners' channels, Eventbrite, through the City's social media, and the City's sustainability and adaptation newsletters (totaling over 3,000 subscribers). OAAC workshop materials can be found online at www.alamedaca.gov/OaklandAlamedaAdaptationCommittee.

### Incorporation of Public Comment

Responses from the community survey were considered in the development of the draft plan and helped inform the prioritization of hazards in the plan. Comments on the draft plan were received by email or verbally during public comments at board and commission meetings and from community workshops and were documented and incorporated into the final plan. Comments received on the Public Review Draft Comment Form on the City's website were considered in the development of the final draft plan. No significant changes resulted from comments received during the public review period.

## Key Partner and Neighboring Jurisdiction Outreach

Key partners and neighboring jurisdictions were invited to comment on the draft plan during the public review period by emails to staff and through announcements at Oakland Alameda Adaptation Committee meetings, as well as through emails to the membership of that group. Specific agencies with mitigation strategies in the plan were also contacted by email during the drafting of the plan to provide input to the plan. Agencies that were contacted during the development of the Plan include:

- Alameda County
- Alameda Housing Authority
- Alameda Unified School District
- Association of Bay Area Governments (ABAG)
- BART
- Bay Conservation Development Commission (BCDC)
- Caltrans
- East Bay Regional Parks District
- EBMUD
- City of Oakland
- City of San Leandro
- City of San Francisco

- Metropolitan Transportation Commission (MTC)
- PG&E
- Port of Oakland

## Boards and Commissions

The draft plan was presented at publicly noticed meetings of the following boards and commissions:

- Transportation Commission, February 26, 2025
- Planning Board, March 10, 2025
- Public Utility Board, April 21, 2025

An example staff report and presentation used for board and commission meetings can be found in **Appendix B**.

### City Council

The City Council held a study session on the update of the Climate Action and Resiliency Plan (CARP). Hazard Mitigation Plan and Zero Waste Implementation Plan (ZWIP) on October 15, 2024. City Council gave feedback on the draft vision, goals and strategies, and key priority implementation plans.

City Council reviewed the final draft plan at a meeting on April 1, 2025, and directed staff to forward the plan for CalOES review. Staff reports for these City Council meetings can be found online at https://alameda.legistar.com/Calendar.aspx.

# Plan Approval and Adoption Process

Staff will follow the following process for approval and adoption of the Climate Adaptation and Hazard Mitigation Plan:

- The final draft Plan incorporating public comments was submitted to CalOES for initial review.
- Following CalOES determination that the planning requirements have been met and the Plan is ready to be approved, the Plan was forwarded to FEMA for review and approval.
- Following FEMA's determination that the Plan is "Approvable, Pending Adoption", staff will present the final Plan to City Council for adoption by resolution. The resolution will also incorporate the plan into the General Plan Safety Element for compliance with AB 2140.



# Chapter 3
# Asset Inventory

This chapter describes the assets within Alameda, including the people, economy, buildings, and infrastructure at risk in natural disasters. A detailed inventory of buildings and open space owned by the City of Alameda, as well as other non-city owned buildings that serve critical community functions is provided in **Appendix D**.

# The People of Alameda

In 2025, Alameda's population was approximately 76,876 with a diverse array of businesses employing an estimated 25,000 people. Alameda's population at 89,000 with the commissioning of the Alameda Naval Air Station (NAS) in 1940 declined rapidly following its closure in 1997; however, the City has seen some growth (6.4 percent) since 2000. This is partly due to residential growth in the former military installations, as well as in the formerly industrial Northern Waterfront; this growth is expected to continue in the coming decade.

The Association of Bay Area Governments projects that the San Francisco Bay Area will reach an estimated 10.3 million residents by 2050, up from around 7.8 million today.[1] Alameda's population is projected to reach 92,000 by 2040. The City of Alameda projects to add 10,000 to 12,000 new housing units over the next 20 years to provide its share of the regional housing need.[2] Alameda's projected population increase will result largely from residential development in industrial areas and former military installations. New housing development is planned at Alameda Point and Alameda Landing, and along the Northern Waterfront. These areas are designated as priority development areas in the regional plan, Plan Bay Area. Both areas are also subject to sea level rise, liquefaction in earthquakes and tsunamis. All new developments include mitigation to address these hazards. Additional housing opportunities exist for accessory units and additional units on existing residential properties, and along the Park Street and Webster Street commercial corridors and the community's several shopping center sites. All new infrastructure in these areas are built to modern day standards that can better withstand natural hazards. A Master Infrastructure Plan was completed for Alameda Point in December 2014 that addresses flood protection and site grading with extensive consideration given to projected sea level rise.

## Age Characteristics

Alameda's population is becoming older over time – see **Table 3-1**. As with many communities in the county and across the nation, there has been an increase in the percentage of community members over the age of 55, while the percentage of children is remaining fairly constant. This shift toward an older population is important in planning for future disasters, as seniors may have more difficulty preparing for disasters and may need additional assistance when a disaster occurs.

***Table 3-1 Population Age Distribution, 2000–2025***

| Age Group | Alameda Population | | | |
|---|---|---|---|---|
| | 2000 | 2010 | 2020 | 2025 |
| Under 15 | 18.0% | 17.1% | 18.0% | 18.73% |
| 15 – 19 | 5.5% | 5.7% | 4.3% | 4.91% |
| 20 – 34 | 20.4% | 18.3% | 18.1% | 16.87% |

[1] Plan Bay Area 2050

[2] Alameda 2040 General Plan

| | | | | |
|---|---|---|---|---|
| 35 – 54 | 34.0% | 31.7% | 29.9% | 30.12% |
| 55 – 64 | 8.8% | 13.8% | 11.99% | 13.6% |
| 65 + | 13.3% | 13.5% | 16.81% | 17.16% |
| Total | 100.0% | 100.0% | 100.0% | 100.0% |

Sources: 2000, 2010, and 2020 Census, 2025 American Community Survey

## Race and Ethnicity

Alameda has a diverse population and has become more diverse over the last two decades. The non-Hispanic white population declined 14 percent from 2000 to 2025. At the same time, the Asian population grew about three percent and the Hispanic population (of every race) grew by 4.6 percent since 2000.

***Table 3-2 Race and Ethnicity Distribution, 2000–2025***

| Race and Ethnicity | Alameda Population | | | |
|---|---|---|---|---|
| | 2000 | 2010 | 2020 | 2025 |
| White alone | 56.9% | 50.8% | 48.2% | 43.1% |
| Black or African American alone | 6.2% | 6.4% | 7.4% | 6.0% |
| American Indian or Alaska Native alone | 0.7% | 0.6% | 0.5% | 0.5% |
| Asian alone | 26.1% | 31.2% | 30.3% | 28.8% |
| Native Hawaiian or other Pacific Islander alone | 0.6% | 0.5% | 0.3% | 0.5% |
| Some other race alone | 3.3% | 3.3% | 5.1% | 4.9% |
| Two or more races | 6.1% | 7.1% | 8.2% | 16.2% |
| *Total* | *100.0%* | *100.0%* | *100.0%* | *100.0%* |
| Hispanic (of any race) | 9.3% | 11.0% | 11.5% | 13.9% |

Sources: 2000, 2010, and 2020 Census, 2025 American Community Survey

## Household Composition

The City of Alameda had 29,988 total households.[3] 8,484 households have children under 18 in the home. Alameda has an average of 2.56 people per household. 34.5% of residents over 5 years old speak a language other than English at home. 6.8% of Alameda residents are living with a disability. These residents may have additional challenges responding to a disaster.

## Income and Employment

Alameda's per capita income is $75,137 and 66.1% of residents over 16 years old are in the labor force.[4] According to the ACS, the median household income in 2024 was $137,697 which is higher than the

[3] U.S. Census Bureau, American Community Survey, 2020-2024

[4] U.S. Census Bureau, American Community Survey, 2020-2024

county ($129,367). As shown in **Table 3-3**, more than one-third of the households in Alameda are categorized as lower income.

***Table 3-3 Households by Income Level, 2020***

| Income Level | Renter Occupied | | Owner Occupied | | Total | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| Extremely Low Income ≤30% of AMI | 3,060 | 10.0% | 1,400 | 4.6% | 4,460 | 14.6% |
| Very Low Income >30 to ≤50% of AMI | 2,010 | 6.6% | 1,265 | 4.1% | 3,275 | 10.7% |
| Low Income >50 to ≤80% of AMI | 2,610 | 8.6% | 1,550 | 5.1% | 4,160 | 13.6% |
| Moderate >80 to ≤100% of AMI | 1,790 | 5.9% | 875 | 2.8% | 2,665 | 8.7% |
| Above Moderate >100%+ of AMI | 6,340 | 20.8% | 9,610 | 31.5% | 15,950 | 52.3% |
| **Total** | **15,815** | **51.9%** | **14,700** | **48.1%** | **30,515** | **100.00%** |

Source: CHAS 2016–2020 ACS

The US Department of Housing and Urban Development's (HUD) 2020 Comprehensive Housing Affordability Strategy (CHAS) data set provides information on households by income group for the City of Alameda. According to the CHAS data, in 2020, approximately 4,460 households (14.6 percent of total households) in the City of Alameda were extremely low income. Of those households, 4.6 percent were owner-occupied, and 10 percent were renter-occupied households (see **Table 3-3** above).

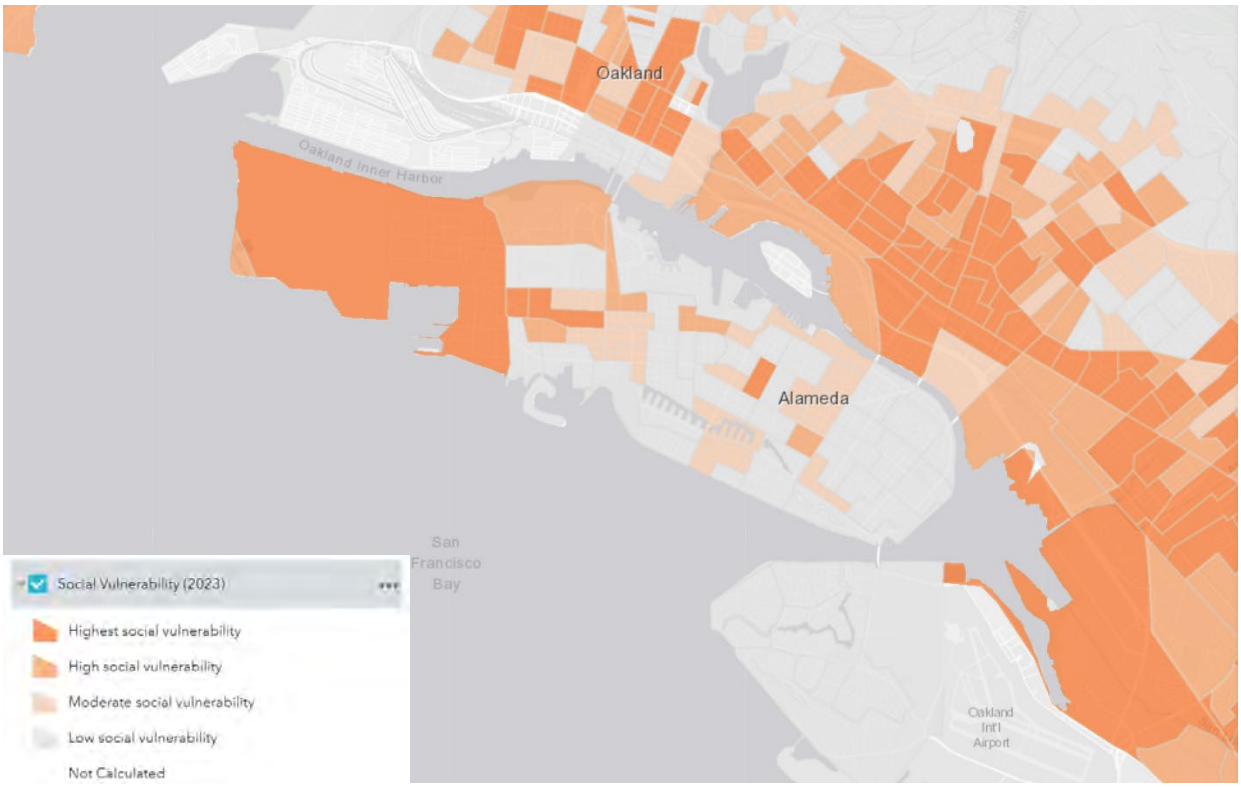
Forty two percent of all renters and 30.1 percent of all homeowners in Alameda are housing burdened, meaning they spend more than 30 percent of their income on housing costs.[5] 20% of renters and 11% of homeowners spend more than 50 percent of their income on housing costs. Low-income, Black and Latinx, Native American and female renters are more likely to be rent burdened. Black and Latinx homeowners are also more likely to be rent burdened.

## Social Vulnerability Assessment

The impacts of climate change will be unevenly distributed across Alameda and the region. Lower-income residents, seniors, renters, and other priority populations will bear much of the burden of climate change, with many of those groups having the fewest resources to adapt to changing conditions.

The City utilizes the Bay Conservation and Development Commission's (BCDC) Community Vulnerability Assessment to understand the level of social vulnerability to climate hazards across Alameda. Certain socioeconomic characteristics may reduce the ability to prepare for, respond to, or recover from a hazard event. **Figure 3-1** presents the areas of social vulnerability in Alameda.

[5] Bay Area Equity Atlas, https://bayareaequityatlas.org/




Source: BCDC 2023

***Figure 3-1: Social Vulnerability to Climate Hazards Across Alameda***

Mapping vulnerability is helpful to ensure that the LHMP is equitably implemented across the city, focusing resources where they are needed most. There are a variety of ways the City can work to support equitable implementation of CARP programs. These include procedural, distributional, and structural equity.

- **Procedural equity**: Transparent, fair, and inclusive process; ensure all are treated openly and fairly; and increase civic engagement opportunities. For example, the City can focus future outreach and engagement efforts for priority populations most sensitive to the impacts of climate change.
- **Distributional equity**: Fairly distribute resources, benefits, and burdens; and prioritize resources for communities that experience greatest inequities and unmet needs. The City can focus program implementation in neighborhoods with the highest social vulnerability and need.
- **Structural equity**: Make a commitment to compensate for past harms and prevent future unintended consequences; and address underlying structural and institutional systems that are the root causes of social and racial inequities. The City can support transformational initiatives, linking climate program implementation with job training, local hire, and other economic development objectives.

# Alameda Economy

## Employment

Just as with population growth, employment history has been turbulent in Alameda over the past decades. Jobs decreased in the 1990s as the result of the NAS and FISC closures and declined again between 2000 and 2010 as result of the nationwide economic recession. Job growth is expected to rise in the decades ahead in Alameda with the redevelopment of the former NAS and the Northern Waterfront. Currently, the largest private employers in Alameda include Penumbra Inc., Abbott Diabetes Care, Exelixis Inc., Alameda Hospital, Bay Ship and Yacht, and Safeway Stores. The largest employment industries are restaurants and drinking establishments; media, computer technology & professional services; maritime industries; and life sciences & alternative energy. **Table 3-4** shows current and projected jobs for Alameda and Alameda County. Alameda's business community is expected to create between 10,000 to 12,000 new jobs over the next twenty years. Most of the new jobs will be located at Alameda Point, along the Northern Waterfront, and in the Harbor Bay and Marina Village business parks.[6]

***Table 3-4 Historic and Projected Employment, 2010–2040***

| Year | Alameda | | Alameda County | |
|---|---|---|---|---|
| | Total Employment | % Change | Total Employment | % Change |
| 2010 | 29,265 | -- | 705,540 | -- |
| 2020 | 38,905 | 32.9% | 858,685 | 21.7% |
| 2030 | 41,730 | 7.3% | 901,080 | 4.9% |
| 2040 | 42,420 | 1.7% | 952,940 | 5.8% |

Source: ABAG Projections 2018

The City continues to grow, as industrial and former military lands are turned into residential housing, and as densities increase in already built out area. Rents and housing prices continue to rise as tech workers from Silicon Valley, San Francisco, and the San Mateo Peninsula are priced out of the housing markets there. The short-term effect is the decreased resiliency of residents who must spend more of their disposable income on housing, and less on disaster preparation and recovery. The likely long-term effects will be a shift to a more affluent population, and the loss of retirees, people with disabilities, families with young children, and more diverse populations.

# Buildings

Alameda's building stock contains a wide range of building types, ages and uses that house and serve the residents and businesses of Alameda. According to Assessor's Parcel Data (2018), the City of Alameda contains 18,868 buildings, ranging in age from the mid 1800's to present. Most Alameda buildings are privately owned, but the city and other public agencies own and maintain many buildings critical to the functioning of the community. Many of Alameda's buildings are vulnerable to flooding from sea level rise, storm surge, and major rainfall events, primarily due to access issues created by flood events and the resulting inability to provide services. Alameda's mild climate combined with its older

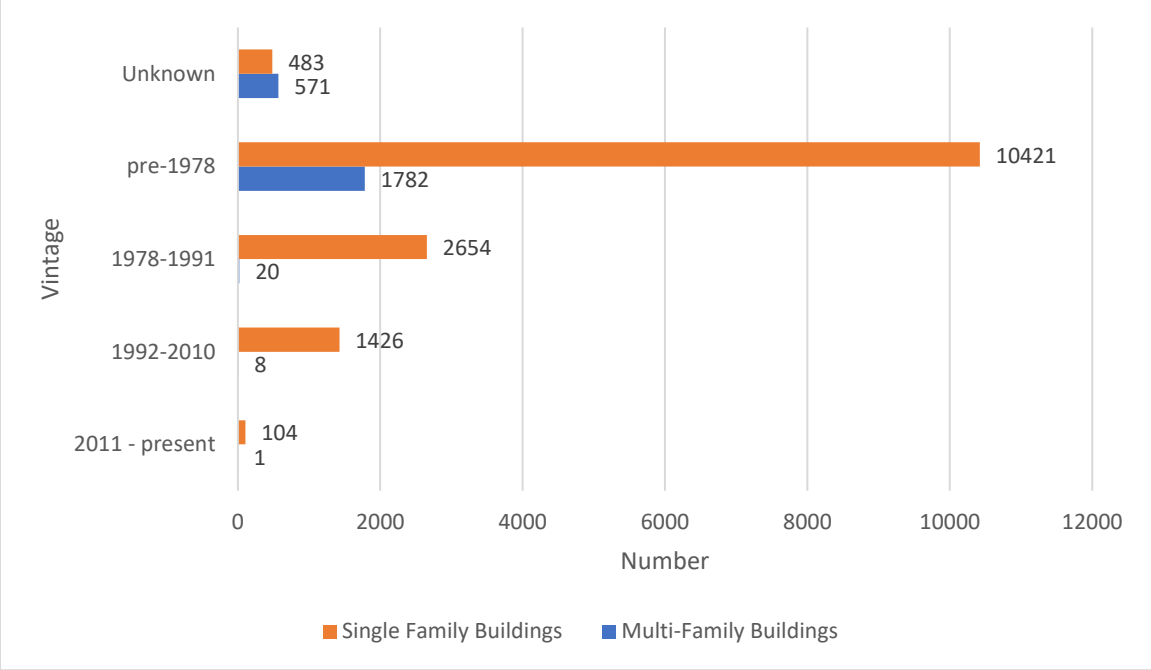
[6] Alameda 2040 General Plan

building stock means that many buildings are not properly weatherized and can be uncomfortable on very cold or hot days and older buildings are also not designed to protect occupants from the effects of poor air quality. Many of Alameda's older buildings are also vulnerable to damage in earthquakes, particularly buildings with cripple walls, soft-stories, unreinforced masonry buildings, nonductile concrete buildings, and tilt ups. Even most newly constructed buildings built to code are designed to protect the safety of the occupants inside, but not necessarily to be reused following a major earthquake. These building types and their vulnerability to earthquakes are described in more detail in **Appendix E**.

This section describes the general building stock of Alameda. A more detailed inventory of City owned buildings is provided in **Appendix D**.

## Residential Buildings

The vast majority (92.5%) of Alameda's building stock is residential.[7] Alameda's residential building stock includes 15,088 single family residential buildings and 2,382 multi-family buildings, containing 14,679 units, meaning about half of Alameda's residential units are multi-family and half are single family, including townhomes and duplexes. About half of Alameda's residents are renters and half own their homes. Seventy percent of Alameda's residential buildings were built before 1978 when most modern building and energy codes took effect, and very few were built in the last decade, however current ongoing development projects will provide more newer homes in the coming years than Alameda saw over the previous decade. These pre-1978 homes and apartments are in the greatest need of upgrades and retrofits for weatherization, energy efficiency, and seismic and flood. They are also more likely to have issues with lead, asbestos and mold that can impact the health and safety of residents.




Source: Electrifying Existing Residential Buildings in Alameda, 2021

***Figure 3-1 Breakdown of residential buildings by year-built***

[7] Electrifying Alameda's Existing Residential Buildings, 2021

The City of Alameda projects to add 10,000 to 12,000 new housing units over the next 20 years to provide its share of the regional housing need.[8] The majority of the growth in Alameda will occur on the former Naval Air Station lands at Alameda and along the Northern Waterfront of Alameda. New housing is also projected to be supplied through accessory dwelling units and additional units on existing residential properties, and along the Park Street and Webster Street commercial corridors and shopping centers.

## City Owned Buildings

The City of Alameda's building portfolio consists of 47 structures, totaling approximately 575,000 square feet of property. The properties vary greatly, both by age and design. By way of comparison the City's oldest building, City Hall, was constructed in 1895, and its most recent, Krusi Park Recreational Center, was built in 2021. Alameda's critical facilities are equipped with backup generators. Other City buildings are being equipped with technology to enhance the standard HVAC filtration, enabling fresh filtered air beyond the HVAC unit's standard specifications. Buildings without central air handling are furnished with mobile filtration units. To provide fresh air and cooling respite during periods of heat and/or poor air quality from wildfire smoke, renovations are nearly complete at the Mastick Senior Center and West End Library to designate them as Fresh Air and Cooling Centers. The West End Library is also replacing its natural gas furnace and water heater with electric ones to reduce the building's carbon emissions, in line with the City's Climate Action and Resiliency Plan. The new Krusi Park Recreation Center was built all-electric as well.

## Buildings Owned by Other Agencies

The City houses a number of facilities belonging to other governmental agencies and school districts. These include buildings of the Alameda Housing Authority, Alameda Unified School District, Peralta Community College District, Alameda County, East Bay Regional Park District, the State of California, and the U.S. Government. Many of these buildings serve vulnerable populations including children and people with low incomes.

## Care Facilities

The City is home to a number of facilities that serve and/or house vulnerable populations, such as day cares, elder cares, medical offices and clinics, a hospital, private schools, and others. These facilities range from private homes to larger facilities and range in age and construction type as well. The City maintains a listing of current locations as this is critical information for effective disaster response that includes:

- Health Care
  - Alameda Hospital
  - Medical offices, clinics, urgent care centers, pharmacies, and laboratories
  - Six skilled nursing and rehabilitation facilities
- Childcare
  - 68 childcare and family day care centers
- Adult care and housing

[8] Alameda 2040 General Plan

- Six assisted living facilities
- Three adult day care facilities
- 11 elder care residential facilities
- One housing facility for people with disabilities

- Schools
  - College of Alameda
  - Public K-12 schools
  - Private K-12 schools

# Land Use

The goal of Alameda's 2040 General Plan Land Use Element is to "maintain and enhance safe, healthy, sustainable, complete and connected neighborhoods, districts, and waterfronts that support a high quality of life and fair and equitable access to affordable housing, employment, education, recreation, transportation, services, and participation in public decision making." Alameda contains a variety of land use classifications that describe the existing and intended location, distribution, intensity and physical character and form of development and land use across the city, as shown in **Figure 3-3**. Since 2016 most new development in Alameda has occurred in designated mixed-use areas along the Northern Shoreline and Alameda Point. Development in these areas must be designed to accommodate at least two feet of sea level rise with adaptative measures to accommodate future sea level rise, including preserving inland land and right of way along the perimeter of the site such that existing shorelines and floodwalls could be elevated to manage sea level rise. While more development has occurred in areas that have increased vulnerability to earthquakes, flooding, sea level rise, coastal erosion, groundwater rise, tsunami, heat, drought, wildfire, and dam breach inundation in recent years, the mitigation actions described here are working to minimize that increased vulnerability.

Given Alameda's exposure to a wide range of climate hazards, most notably sea level rise and storm surge flooding, existing and future land use planning needs to incorporate adaptation strategies to keep residents and businesses out of harm's way. This involves important decisions about how to modify existing land use, where development opportunities still exist, and how to design new development and redevelopment that can adapt to future climate conditions—particularly flood and liquefaction risk. Land use policies are an important avenue to creating a resilient Alameda.




*Source: Alameda 2040 General Plan*

***Figure 3-2 Land Use Designations***

# Utilities

The broad types of utilities in the City are overhead (power, telecom), underground-dry (power, telecom, gas), underground-wet (water, sanitary sewer, storm drain), and utility buildings (substations, telecom switching, pump stations). In addition, there is solid waste handling (trash pickup and landfills), and there are abandoned fuel pipelines on Alameda Point. The City owns and maintains the sanitary sewer collection system (excluding the interceptor pipes that convey flow to the regional treatment plant), storm and electrical infrastructure. The City also is responsible for the Doolittle Landfill. Potable water and natural gas are provided by the East Bay Municipal Utility District (EBMUD) and Pacific Gas and Electric (PG&E), respectively. The following entities manage and maintain utility systems in Alameda:

- Stormwater system = City of Alameda
- Wastewater system = EBMUD (treatment and transmission) and City of Alameda (sewer collection system within city limits)
- Drinking water system = EBMUD and City of Alameda (Alameda Point water system)

- Electric System = AMP
- Natural Gas System = PG&E
- Communications = varied (private)

These agencies have completed assessments on some utility sectors in Alameda, including the PG&E vulnerability assessment, City of Alameda storm drain modeling, and EBMUD water supply assessments. Plans are in place for specific utility sectors, including the City of Alameda Storm Drain Master Plan, City of Alameda Sewer Master Plan, EBMUD 2015 Urban Water Management Plan, and EBMUD Sewer System Management Plan. Collectively, these plans address key vulnerabilities to the city's utility systems to ensure climate change impacts are integrated into short- and long-term planning.

City-owned water, sewer, storm, and electrical utilities are summarized in **Table 3-5.**

***Table 3-5. City-Owned Sewer, Storm and Electrical Utilities***

| Utility | Amount |
|---|---|
| Sewer Mains | 142 miles |
| Sewer Manholes | 3,122 each |
| Sewer Pump Stations | 42 each |
| Storm Pipes and Cross Culverts | 90 miles |
| Storm Manholes | 2,058 each |
| Storm Pump Stations | 11 each |
| Other Storm Structures (ex. Catchbasins, outlets) | 401 each |
| Storm Outfalls | 227 each |
| Alameda Point Water System | 35.8 miles |
| Alameda Municipal Power Distribution Overhead | 86 pole miles |
| Alameda Municipal Distribution Underground | 181 circuit miles |
| Alameda Municipal Transmission Overhead | 6.8 pole miles |
| Alameda Municipal Transmission Underground | 1.9 circuit miles |

The sewer, storm and electrical systems are vulnerable to a variety of hazards. In storm events downed trees can damage overhead lines and flooding can impact pump station function. In earthquakes, electrical substation and pump station components can be destroyed by strong shaking, often requiring more extensive and time intensive repairs to return service. Underground pipes can shear, crack or reverse grade. Alameda Municipal Power recognizes that large earthquakes may damage key facilities, and that electric power might be lost for limited periods of time. The potential for a loss of power means that emergency and critical uses should have dedicated emergency power sources.

# Stormwater and Sewer Systems

## Stormwater

Drainage generated within Alameda's main island and Bay Farm Island watersheds can come from a variety of sources such as storm events, residential sump pump groundwater discharges, vehicle washing, hydrants/firefighting, pressure washing of sidewalks, and illegal mopwater discharges from

restaurants directly into the gutter. On the main island, Central Avenue is the “spine,” or high point that runs east/west through Alameda, and drainage generated from these sources flows either north or south from Central Avenue along street gutters, crossing intersections along the way via channels cut under the sidewalks. A closed-system network located in the lower elevations of the island composed of catch basins, manholes, and pipes receives this drainage when it has increased in volume and discharges it either to the estuary to the north, and to the south either to the Alameda West Lagoon system or directly to the Bay (depending on the outfall location). Pump stations located around the main island lift stormwater up that has drained to low points around the island and discharge it directly to the Bay.

There are 5 lagoons interconnected by bridges and cross-culverts that make up the lagoon system. This salt-water fed system plays an important role in Alameda’s stormwater treatment, because it receives runoff containing oils, greases, and trash that has accumulated on pavement and properties throughout the watershed and can trap them within the lagoons rather than discharging them directly to the Bay. The lagoon system also receives runoff from approximately half of the South Shore Center property. Due to the two-mile length of the lagoon system, it has stilling qualities for pollutants and sediments and ultimately discharges out of a concrete weir and outfall channel that crosses under Bayview Avenue to the Elsie Romer Bird Sanctuary.

In recent years full trash capture (FTC) devices have been installed in many catch basins to trap items greater than 5mm in size and prevent them from flowing downstream. The City has an ongoing maintenance program that cleans out the FTC devices on a periodic basis.

### Sewer

The City of Alameda owns and maintains the sanitary sewer system that includes 142 miles of sewer mains and 43 pump stations. When the network reaches a low point, sewer pump stations lift wastewater and help it further along to its ultimate destination.

Collected wastewater is conveyed to East Bay Municipal Utility District’s (EBMUD) regional. EBMUD treats wastewater for seven communities in its wastewater service area, including Alameda. It owns and operates an award-winning wastewater treatment plant near the Bay Bridge that serves 650,000 customers in the San Francisco Bay, including Alameda residents.

The City’s Sewer Master Plan includes a hydraulic capacity assessment and recommendations for upgrades and replacements. As the state and others release new guidance, the City of Alameda can determine the best way to incorporate climate change in sewer system modeling and planning. Potential impacts from climate change include infrastructure damage associated with flooding (e.g., to sewer pumps), rising groundwater levels (e.g., to pipes and other subsurface assets), and low flow during periods of drought and increased water conservation efforts.

## Drinking Water System

EBMUD provides high-quality drinking water for 1.3 million customers in Alameda and Contra Costa counties. EBMUD owns and maintains all water lines within Alameda. Water service to the City of Alameda is provided by four underwater pipeline crossings at three separate locations between the City of Oakland, Alameda Island, and North Bay Farm Island. The two locations that serve Alameda’s main island are under Oakland inner Harbor, and run between Marina Village Parkway and Oakland’s Embarcadero, and between Broadway and Oakland’s Derby Avenue. The pipeline serving Bay Farm Island runs under the Tidal Canal from the end of Veterans Court to Towata Park on the main island. Failure of one of three existing crossing locations could lead to a reduction in the level of service for

existing customers and potentially reduce the available water supply to Alameda Island and North Bay Farm Island. Three new pipeline crossings are proposed to replace the existing pipeline crossings to ensure long-term reliability of the water distribution system, meet existing and future water needs, and facilitate repair and replacement of aging infrastructure.

In the future, EBMUD plans to extend its recycled water service to the City of Alameda, including Alameda Point. EBMUD's source of recycled water for Alameda Point is generated at their Main Wastewater Treatment Plant (MWWTP) located at the eastern landing of the Bay Bridge. The recycled water facilities at the MWWTP utilize microfiltration and extra disinfection to produce recycled water that meets or exceeds the California Department of Health standards for unrestricted use.

EBMUD is internationally recognized for its proactive seismic improvements of facilities in its service area, as well as strengthening vulnerable portions of aqueducts, dams and Sierra reservoirs. The District also works closely with other agencies on emergency responses planning and hazard mitigation.

Many residences in Alameda have private wells on their property that are primarily used for irrigation. However, in an emergency these wells could potentially be used for drinking water if the EBMUD system is down. These wells are generally deep and not impacted by surface contaminants or saltwater intrusion from rising sea levels. It is currently unknown how many of these wells currently exist and are in operation.

### Alameda Point Water System

The Alameda Point water system is a community water system serving the area formerly known as the Alameda Naval Air Station. The water system is located within the street network east of Main St. The City of Alameda has caretaker responsibilities for the water system pursuant to a Cooperative Agreement between the City and United States Department of the Navy. As part of the planned development at Alameda Point, the water system will be upgraded in accordance with the Alameda Point Master Infrastructure Plan and will be owned and operated by EBMUD.

The Alameda Point water system is a water distribution system, but it does not include water treatment plants. The City of Alameda contracts with EBMUD to operate and maintain the water system. Water distributed by the Alameda Point water system was purchased from EBMUD and treated in EBMUD's Orinda or Upper San Leandro Water Treatment Plants.

## Electric System

AMP serves all of Alameda and has approximately 86 pole miles of overhead distribution lines, 181 circuit miles of underground distribution lines, 6.8 pole miles of overhead transmission lines, and 1.9 circuit miles of underground transmission lines. It serves approximately 34,809 customers, comprised of approximately 30,650 residential customers and 3,779 commercial customers, and 370 other users, and had a peak demand of approximately 61.5 megawatts.

AMP sources its 100% clean power from a variety of geothermal, wind, landfill gas, and hydropower generation resources across northern California. Power is delivered to Alameda through PG&E's transmission system. AMP's transmission lines cross beneath the estuary to Oakland in two locations - one to the north and one south. These lines provide redundant service to Alameda and if one line goes out, the other can supply all of Alameda's power demand. In the unlikely event that enough transmission lines serving the greater Bay Area are taken offline by PG&E, it is possible curtailment affecting Alameda could occur.

Rolling blackouts can occur when the California electric grid becomes overtaxed. This occurred recently in August 2020 during a heat event when projected power demand exceeded capacity. There is an elevated risk of additional CAISO supply shortages over the coming summers due to the drought (drought impacts the availability of hydropower) and continued extreme heat events. AMP has procured sufficient resources to meet AMP's loads, however, during rolling outages all utilities must participate in load shedding. If a rolling blackout is called for, AMP will typically have one of 10 circuits (2,000 –4,000 customers each) on outage for 30-60 minutes before rotating to the next circuit in the list. A circuit will not repeat until all other circuits have experienced an outage.

If there is limited power available in the grid, AMP will coordinate with the Northern California Power Agency (NCPA) to support Alameda's system. Two Combustion Turbines (CTs) NCPA are in Alameda, each with a capacity of approximately 25 megawatts. Along with two other CTs owned by NCPA, these facilities provide peak load and reserve capacity for NCPA member communities and districts. Central Dispatch Center in Roseville can remotely start or stop each turbine and bring these units fully online within ten minutes. These facilities possess dual fuel capability, with natural gas as the primary fuel and diesel fuel being available in the event of a natural gas curtailment. The CTs cannot independently provide power to Alameda; however, they provide additional resources to the grid and can help relieve pressure on the local area's transmission lines.

AMP is planning to install a 2.0-megawatt photovoltaic solar facility at Doolittle Landfill (Mt. Trashmore) at the intersection of Doolittle Drive and Harbor Bay Parkway. The electricity will be fed directly into the electric grid from an interconnection point adjacent to the site. Transformers and switchgear will potentially be located at the bottom of the property. The landfill is being monitored by City of Alameda while decomposition occurs beneath the landfill cap. An open space park is planned at the former landfill in 25 years when the site is anticipated to be safe for public use. Increasingly residents also have rooftop solar with battery storage on their homes and businesses. This technology is becoming more widespread and affordable and provides a resilient local supply of clean energy with added resilience during grid outages.

As part of modernization of its system, AMP is in the process of undergrounding its electrical system. About half of Alameda's power system has already been undergrounded since the inception of the program in 1984. The undergrounding projects typically convert overhead wires to underground, install pad-mounted equipment, install updated streetlighting poles, and install a joint trench with other utilities, including City use.

City-owned electrical assets are summarized in **Table 3-5** and examined in detail in **Appendix D**.

## Natural Gas System

PG&E provides natural gas to Alameda residents. PG&E has a staff of 20,000 prepared to respond to restore service after disasters and storms. They also have a well-established priority system for restoring power to emergency services before other community needs.

Natural gas infrastructure is subject to damage and disruption in areas with soil failure, for example landslide and liquefaction. Natural gas lines can also rupture in earthquakes when buildings are damaged or when natural gas appliances topple. Broken lines can create fires if ignited until the fuel supply is exhausted. The repair of damaged underground lines will take time. Following the Loma Prieta earthquake, it took about 30 days to repair damaged lines in the San Francisco Marina.

The large-scale natural gas transmission lines that service the cities along the East Bay shoreline of Alameda County are primarily located near the bay shore. The transmission line does not run through the City of Alameda but instead runs along a single corridor through Albany, Berkeley, Emeryville before splitting into two parallel lines in Oakland that run through Oakland, San Leandro and Hayward. Across the entirety of the natural gas line between Albany and Hayward the natural gas transmission line(s) pass through medium-level susceptibility zones with some lines passing through very high liquefaction susceptibly zones in East Oakland and San Leandro.

# Communications and Technology Systems

The City owns a variety of communications and technology infrastructure.

## Webster Street Smart Corridor

In 2016, City and Alameda County Transportation Commission (Alameda CTC) completed a Smart Corridor on Webster Street and Constitution Way, two of Alameda's most travelled corridors and island ingress/egress routes. The corridor includes CCTV cameras, video detection systems, dynamic message signs, microwave detection, and emergency vehicle and transit priority equipment on existing traffic signal infrastructure on Webster Street between the exit of the Webster Street Tube and Central Avenue and surrounding areas. Wireless communications were also installed via the unlicensed 5GHz wireless band to facilitate the management of the corridor infrastructure; however, the City does not currently engage the Smart Corridor infrastructure for traffic management, which could be a later project phase.

## Citywide 5G Deployment

As the climate for wireless service changes, many large service providers are actively pursuing opportunities for 5G installations via collocation on public equipment or on public property. In light of that, Public Works staff proactively developed a City ordinance, permitting, procedure, and design guidelines to support the deployment of 5G equipment in Alameda. Public Works now has an approved master license agreement with Verizon, which would allow Verizon to deploy small wireless facilities on City street light poles to enhance 5G coverage. This is currently limited to commercial use by Verizon subscribers/customers.

## Development-Built Infrastructure

The City requires developers to install empty conduit to serve future City communications needs in the vicinities of new development projects. Empty conduit has been deployed in this manner under several development projects in the last several years, including, but not limited to:

- Alameda Point – Two 2-inch conduits roughly bounding the project along Tower Avenue, Pan Am Way, Midway Avenue, and Saratoga Street.
- Webster-Posey Tube Interconnection (Caltrans) – One 4-inch conduit along Mitchell Avenue between Mariner Square Loop and Mariner Square Drive east of the tunnel portal buildings as AMP conduit.
- 2100 Clement – Two to three-inch conduit was installed on the project frontage and nearby cross street which is located at Clement Avenue and Willow Street as AMP conduit.
- Alameda Landing – One to two-inch conduit was installed for traffic signal interconnect in the general project vicinity, which is generally bounded by Fifth Street, Mitchell Avenue, Mariner Square Loop, and Willie Stargell Avenue as AMP conduit.

- Del Monte – Two to four-inch conduit for traffic signal communications is planned in the general project vicinity which is bounded by Entrance Street, Clement Avenue, Buena Vista Avenue, and Sherman Street.

## Public Works-Built Infrastructure

In 2021, Public Works completed an installation of wireless radios along Webster Street, Park Street, and Constitution Avenue. The deployment placed 18 wireless radios along the corridor for wireless communication to support signal timing coordination along these key corridors.

## Municipal Area Network

When founded originally, Alameda Municipal Power (AMP) was also intended to be a telecommunications provider and began development of a citywide fiber network. Financial constraints caused AMP to ultimately sell that portion of their business to Comcast. Despite the sale, AMP maintains a private fiber optic network that it uses to manage its own systems and also leases some of the infrastructure to the City for administrative use. The administrative network in use by the City is referred to as the Municipal Area Network (MAN). As part of this agreement, AMP provides the technical support and management of the MAN.

Currently, the MAN utilizes AMP fiber infrastructure to interconnect the City's various facilities, which are spread around the City. City buildings are interconnected via four core sites where key network infrastructure is housed. AMP has deployed layer 3 switches at all four core sites and each City facility. The four core sites are located at the City Hall Building 2, AMP's Service Center facility, the Corica Park Golf Course, and City Hall. The network topology is set up as a redundant ring for the core sites and hub and spoke topology for the edge sites. Each of these cores is interconnected with each other via AMP fiber to form a ring and the remaining facilities are interconnected in a spoke configuration via AMP fiber from one of the cores.

## Planned Projects

In recent year when AMP has undergrounded electrical wires, the City has installed conduit for other City use as part of the joint trench and plans to do so on future undergrounding efforts. This effort includes the installation of conduits for communications interconnect of traffic signals. There is one upcoming undergrounding project on Otis Drive between Broadway and High Street, and on Broadway between Encinal Avenue and La Jolla Drive.

## Private Communications Service Providers

Communications systems, including cellular networks (for mobile data and voice), fixed landlines and broadband internet systems are owned by a wide range of private operators. These networks also rely on private third-party operated fiber networks and data centers. Broadband internet connection is provided by cable, DSL, and increasingly, fiber networks. The largest internet providers in Alameda are Xfinity/Comcast and AT&T. The primary cellular operators are AT&T, Verizon, Sprint and T-Mobile.

Cellular networks are organized around cell sites, which transmit data from the user and the cell site via radio waves.[9] Macro cell sites are typically located on buildings and cell towers, while small cell sites used to add capacity to the network or typically located on utility poles. Macro cell sites typically have battery backup for 4 to 12 hours, while small cell sites typically have no backup power. Small cell sites

[9] Lifelines Restoration Performance Project, City and County of San Francisco, 2020.

route data to hubs where it is aggregated and sent to switching centers via the fiber network. No hubs or switching centers are located in Alameda.

Alameda Community Radio 96.1 KACR-LP is a low power FM station that broadcasts from a rooftop on Park St. The frequency is shared with 96.1 KJTZ Encinal Radio, a Low-Power FM radio station operating at Encinal High School, and KEXU-LP broadcasting from Jack London Square in Oakland.

The communications system is critical to emergency services, and protections to ensure uninterrupted connectivity are very important. However, the varied ownership and oversight of the telecommunications system makes it difficult to implement adaptations because the City of Alameda does not directly control assets. In the event of an emergency where cell sites are damaged or there is no power, communications providers will deploy temporary generators or cell towers to augment and restore the network. Fuel is critical to the continued operation of the communications network when the power is out.

# Transportation

The transportation sector contains a network of assets that are critical to social, economic, and physical well-being, as well as emergency response. These transportation assets connect Alameda to other services in neighboring Oakland and beyond, and they support vehicular movement (roads, bridges, tubes), public transit (buses and ferries), bicycle/pedestrian paths and water access (marinas, docks and waterways with private boats). Connections to adjacent communities are uniquely limited and therefore particularly sensitive and prone to congestion. Alameda has three ferry terminals operated by the Water Emergency Transportation Authority (WETA), five ways on/off the main island via bridges/tubes and three roadways in/out of Bay Farm Island. Access to BART stations in Oakland are relatively close but require using the already congested crossings. WETA also has their Central Bay Operations and Maintenance Facility located in Alameda Point. The facility, which opened in 2018, provides a base to maintain its fleet, includes an Operations Control Center for service dispatch and an Emergency Operations Center, which would serve as a primary location for WETA to coordinate the provision of emergency transportation services in the event of a regional disaster or transportation disruption.

The transportation sector's vulnerability to sea level rise and flooding from intensifying storm events not only puts these assets at risk, but also impacts other sectors, amplifying socioeconomic and public health risks. Some of the transportation system's vulnerability stems from its lack of redundancy. With limited connections on and off the island of Alameda, the community will strongly feel any disruptions to tubes, bridges, or ferry service. Some isolated areas, like Ballena Island, rely on single methods of access and are at elevated risk if inundation undermines or blocks transportation assets.

During and right after a disaster, transportation facilities serve vital functions of providing access for emergency vehicles, Public Works and utility repair teams, evacuation, distribution of food and supplies, and movement to shelters. For long term recovery, transportation corridors are needed to facilitate removal of debris, delivery of repair materials, and restoration of normal commuting and daily activities. Fuel is a vital part of the transportation system. Power and telecom are needed for full restoration of traffic signal, SMART technology functions as well as electric vehicles, which are estimated to total at least 1,500 in Alameda. **Table 3-6** summarizes street ownership/responsibility within City limits. The City of Alameda is also responsible for 89 signalized intersections.

*Table 3-6. Street Inventory*

| Street Owned By | Mileage |
|---|---|
| City - Local Classification | 113.2 |
| City - Arterial Classification | 33.5 |
| Caltrans | 4.9 |
| Private & Federal | 39.4 |
| *Total:* | *191.0* |
| Bikeways | 57 |

In addition to the City and State maintained streets, the following transportation structures are located within the City of Alameda and owned by the agencies listed:

- High Street bridge (Alameda County)
- Park Street bridge (Alameda County)
- Miller-Sweeney bridge at Fruitvale Avenue (Alameda County)
- Fruitvale rail bridge - abandoned (U.S. Army Corps of Engineers)
- Bay Farm Island vehicular and bike/pedestrian bridges (Caltrans)
- Webster and Posey Tubes (Caltrans)
- Constitution Way Overcrossing (Caltrans)
- Grand St bridge (City of Alameda)
- Ballena bridge (City of Alameda)

# Shoreline, Natural, and Recreation Areas

Alameda is unique in that it is an island community with dense, urban development. It has approximately 23 miles of combined perimeter shoreline, between the main island and Bay Farm Island. Shoreline consists of a mixture of both engineered shorelines (primarily seawalls or levees and associated riprap and other armoring) and a variety of natural shoreline habitats. Alameda's main island is composed mostly of riprap shoreline, and to a lesser extent bulkheads, natural shoreline, and beach. Bay Farm Island's shoreline is almost exclusively riprap of large diameter, due to the wave action that can be seen coming from the west. Susceptibility of shoreline to wave action has played a large role in determining the shoreline protection level required.

In many areas, including the full perimeter of Bay Farm Island, shorelines provide a protective distance between the Bay waters and residential homes, buildings, properties, utilities, and other infrastructure. Shorelines also provide a public access area for the public to enjoy the waterfront and many parts of it are designated as the San Francisco Bay Trail.

The engineered structures and natural shorelines that surround Alameda are not FEMA-accredited, and it is unknown how they will behave in the event of a large-scale coastal flooding or earthquake event - given development of Alameda in many places (particularly Bay Farm Island) mainly consisted of placing a few

feet of sandy fill over the existing young bay mud. Several shoreline protection projects currently underway have the goal of becoming FEMA accredited.

Like engineered shorelines, natural shorelines can attenuate waves and mitigate the impacts of sea level rise and storms. They also provide ecosystem benefits, including open space, water quality, air quality, carbon sequestration, and species habitats. Shoreline areas include wetlands, tidal flats, and marshes. Both engineered and natural shorelines provide recreational benefits, as the San Francisco Bay Trail and other public shoreline access points run along them. Both engineered and natural shorelines face risks of overtopping, erosion, and potential failure as San Francisco Bay water levels rise, and they will need to be adapted over time. Deferred maintenance of some flood protection structures makes them more vulnerable.

The City of Alameda also maintains 24 parks and a total of 492 acres of parkland as shown in **Figure 3-4**. Alameda parks include a variety of sports facilities, playgrounds, open space, pools, recreations centers and a golf complex. 94% of Alamedans use the parks at least once annually and the golf complex receives over 25,000 visitors a year.

While open spaces may not be required during or immediately after a disaster, quick recovery of these facilities is necessary for the full recovery of the City. Restoration of open spaces is also needed for the recovery of the wild animals and plants that call Alameda home. Some recreation facilities, including the O'Club and Alameda Point Gym are designated staging and pickup sites for the school district in the event of an emergency. City owned park and open space facilities are examined in **Appendix D**.




Source: Alameda 2040 draft General Plan

***Figure 3-3 Existing and Planned Parks and Open Space in Alameda***

# Contaminated Lands and Waste

Properties with land use histories that include heavy industrial and manufacturing operations could potentially have contaminants in their soil and groundwater. Contaminants at these properties are addressed through remedial action plans that are implemented under the oversight of the California Environmental Protection Agency (CalEPA) or, in the case of federal properties and Superfund properties, the U.S. EPA. These types of properties can be vulnerable to sea level rise impacts such as flooding and rising groundwater if those changes result in a release of hazardous substances. CalEnviroScreen (May 2023) identifies several contaminated and cleanup sites within Alameda.

Additional information regarding contaminated sites within Alameda can be found at the CalEPA Department of Toxic Substances Control (DTSC) EnviroStor website and the CalEPA RWQCB GeoTracker website.

### Case Study: Alameda Point

Alameda Point can be used as a case study for how contaminated sites can be managed to account for the effects of sea level rise. Alameda Point is the former naval air station previously located on the western portion of Alameda. The naval base operated from 1940 until it was officially closed in 1997. During its operation, a number of industrial activities across the base resulted in residual contamination in soil and groundwater that continue to be addressed today. Contaminants in soil and groundwater include petroleum hydrocarbons, metals, chlorinated solvents, semi-volatile organic compounds, and radiological isotopes. The U.S. Navy is required to complete remedial activities under the oversight of the U.S. EPA as well as the DTSC and the RWQCB. Remedial technologies implemented at Alameda Point generally include the following:



*This former naval base is being remediated and provides opportunity to expand the existing wetlands. Photo credit: Richard Bangert.*

- **Excavation and removal:** Soil contamination is excavated from the property and disposed of at a facility outside of Alameda. Under this scenario, it is not expected that sea level rise will adversely affect the site because the source material has been removed.
- **In situ groundwater treatment:** These technologies typically use substrates that can be injected into the groundwater to degrade the specific contaminant. They are generally used for sites that have chlorinated solvents or petroleum hydrocarbons in groundwater. The Alameda Point remedial plan requires extensive monitoring during remediation and post-remediation to verify that the remedial action can achieve its goals. The monitoring programs can assess what a change in condition (e.g., rising groundwater levels) has on the contaminant in question. These remedial activities typically degrade the contaminant to concentrations that are protective of human health and the environment; therefore, it is not expected that sea level rise will adversely affect the site.
- **Capping and institutional/engineering controls:** In some instances, soil contamination or contamination within subsurface utilities is addressed through capping or institutional controls. Typically, a cap will require the installation of a layer of soil that eliminates direct contact with the contaminated soil and can prevent surface water from infiltrating into the contaminated soil and into the groundwater. Institutional controls are measures recorded in a property deed that restrict how a property is used and/or what activities are permissible. A remedy that includes these types of measures requires long-term monitoring to verify that the remedy remains protective of human health and the environment. Inspections are typically required annually, and the remedy must be evaluated in detail at five-year intervals. The additional monitoring will identify if changing conditions resulting from sea level rise are adversely affecting the environmental conditions at the site.

# Public Health and Welfare

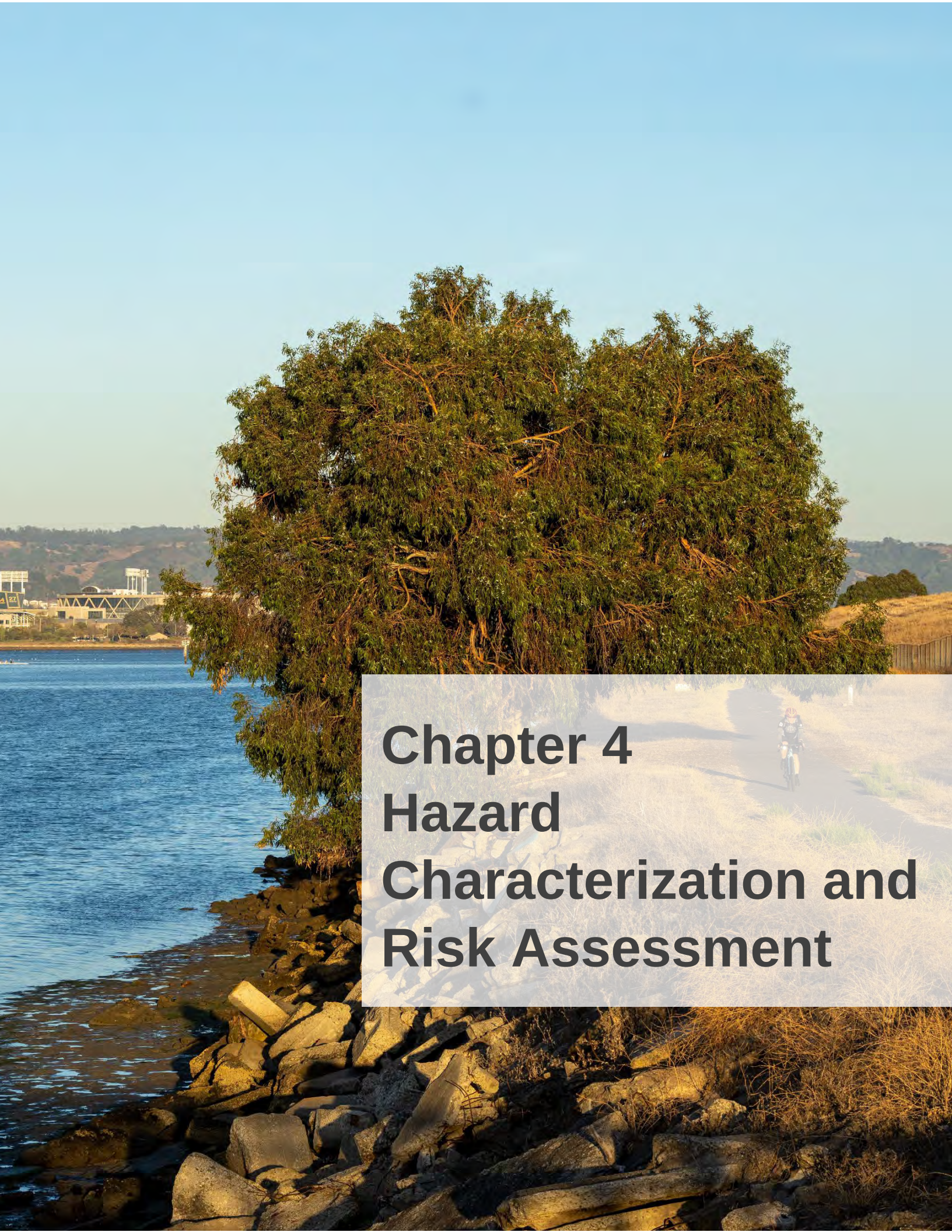
Natural disasters can have major and insidious impacts on public health, the extent of which varies depending on geography, the number and severity of impacts affecting a particular population, socioeconomic status, and other factors. Socially vulnerable populations are particularly at risk. Climate hazard-related public health impacts affecting Alameda consist primarily of higher temperatures, increased air pollution from wildfires, increased flooding from sea level rise and rainstorm events, and severe drought.

Flooding can cause multiple public health impacts, such as mobilizing contaminants in soil (from hazardous waste sites), preventing access to safety, or preventing access to health care facilities due to

flooded roads or public transit routes. More extreme heat events represent another major public health risk, as vulnerable populations (elderly, infants, those with existing health conditions, those living and working in areas without adequate shade, and those with limited access to air conditioning) can suffer heat exhaustion, stroke, difficulty breathing, and even death. When heat is combined with air pollution impacts, such as elevated ozone levels and wildfire smoke, the impacts are exacerbated. In addition, Alamedans are inexperienced in dealing with extreme heat and wildfires and therefore lack adequate preparation. Others lack resources to purchase air conditioning. More energy use for air conditioning results in increased costs, further affecting those with limited resources. It also increases GHG emissions, which further affects climate change and its associated impacts.

California's Fourth Climate Change Assessment highlights the indirect effects of climate change in the Bay Area, such as the combined impacts of increased allergens, air pollution, harmful algal blooms, heat, and disease vectors (e.g., insect and rodent populations). While each of these stressors can seem minor in isolation, their combined effects represent significant public health impacts to socially vulnerable populations who lack the financial capacity to respond.

Earthquakes and tsunamis would also have widespread significant public health impacts and are the two hazards likely to cause significant fatalities in Alameda. Both hazards will also damage a significant number of residences and buildings and result in widespread displacement. Disruptions to schools, housing and basic services will stress vulnerable populations especially and the very long recovery and rebuilding period following a major event will disrupt everyone's daily lives for many years.



# Chapter 4
# Hazard Characterization and Risk Assessment

# Overview of Hazards Impacting Alameda

Alameda is impacted by several natural hazards that have the potential to significantly disrupt daily life and cause damage to people and property. This chapter provides an overview of the hazards that impact Alameda and assesses the risks they pose to Alameda's people, economy, buildings, and infrastructure.

Hazards impacting Alameda that were considered in the plan were reviewed and assessed based on their likelihood of future occurrence and their consequences to Alameda's people and assets if the hazard were to occur. **Table 4-1** provides a summary of the hazards considered and their relative likelihood and consequence. Based on this analysis, it was determined that earthquakes, floods and sea level rise pose the greatest risk to people and property in Alameda. Other hazards may also have significant impacts but are less likely to occur, or the consequences may be more limited in duration or impact. These hazards are still considered and addressed in the context of this plan, but the primary focus of the plan is on the three hazards of greatest concern.

***Table 4-1 Summary of Hazard Analysis***

| Hazard | Likelihood | Consequence | Hazards of Concern |
|---|---|---|---|
| Earthquakes | Likely | Catastrophic | Hazards of Greatest Concern |
| Flooding | Likely | Moderate to Catastrophic | |
| Sea level rise | Likely | Catastrophic | |
| Coastal erosion | Likely | Moderate | Hazards of Concern |
| Groundwater rise | Likely | Moderate | |
| Tsunamis | Possible | Moderate to Catastrophic | |
| Heat | Likely | Moderate | |
| Drought | Likely | Moderate | |
| Wildfire-related hazards | Likely | Moderate | |
| Dam breach inundation | Unlikely | Moderate | |

This risk posed by natural hazards can be defined as the consequence of the interaction between a hazard and the characteristics that make people, and places vulnerable and exposed (UNDRR Terminology, 2017).

This chapter provides a brief description of the risk posed by each hazard. For hazards of greatest concern, the following appendices provide additional details on the analysis, including exposure of assets to hazards:

- APPENDIX D— Detailed Asset Inventory
- APPENDIX E— Detailed Earthquake Risk Assessment
- APPENDIX F— Subregional Flood Exposure and Vulnerability: A Sea Level Rise and Coastal Flood Exposure Assessment and Vulnerability Considerations for the Oakland-Alameda Subregion

# Earthquakes

An earthquake is the hazard most likely to cause rapid, extensive damage in Alameda. This damage will primarily result from violent shaking and ground disturbances. Other hazards associated with earthquakes such as fault rupture and landslides are not possible for Alameda. The perceived intensity of an earthquake is related to the energy released by the earthquake (its magnitude), how close it is, and the underlying soil conditions. Bay Farm Island and Alameda Island consist of central cores of higher ground that are relatively stable, and surrounding areas of man-made fill or "made ground" that can amplify shaking and liquefy in earthquakes.

In addition to the damage to Alameda itself, the city depends upon its mainland connections for transportation, utilities, commerce, and services. Major damage to Oakland, San Leandro, and adjacent cities would have an indirect impact on Alameda in both the short term and long-term recovery of the City. After an earthquake, Alameda may experience isolation and disruption until bridges and utility crossings are restored.

## Hazard Description

The total amount of energy released in an earthquake is described by the earthquake magnitude. The moment magnitude scale (abbreviated as M) is logarithmic; the energy released by an earthquake increases logarithmically with each step of magnitude. For example, the 1906 San Andreas earthquake, M7.8, released 500 times more energy than the 2014 South Napa Quake, M6.0. But fortunately, the frequency of large earthquakes is much less than that of smaller earthquakes. "Strong" earthquakes, M6.0-6.9, occur about 120 times per year somewhere in the world, "major" earthquakes, M7.0-7.9 occur about 18 times per year, and a "great" quake of M8.0 or more is likely to occur only once in the world per year. Fortunately, the types of faults in the Bay Area (strike/slip) are unlikely to produce quakes larger than M8.0. Farther up the coast in Oregon, Washington and Alaska, with subduction faults, M9.0 quakes are possible. When subduction zone earthquakes occur offshore, they may also produce tsunamis, which can impact Alameda.

Earthquakes with the same magnitude of energy released can have different effects on nearby facilities, depending upon how close the rupture is, direction of the rupture, and the type of soil at the site. The Modified Mercalli Intensity (MMI) scale illustrates the intensity of shaking experienced at a particular location by considering the effects on people, objects, and buildings. The MMI scale describes shaking intensity on a scale of 1-12. MMI values less than 5 don't typically cause significant damage; MMI values greater than 10 have never been recorded. The USGS makes shake maps that show the MMI in areas surrounding the epicenter of an actual or scenario earthquake. **Table 4-2** below shows the expected damage caused by various MMIs.

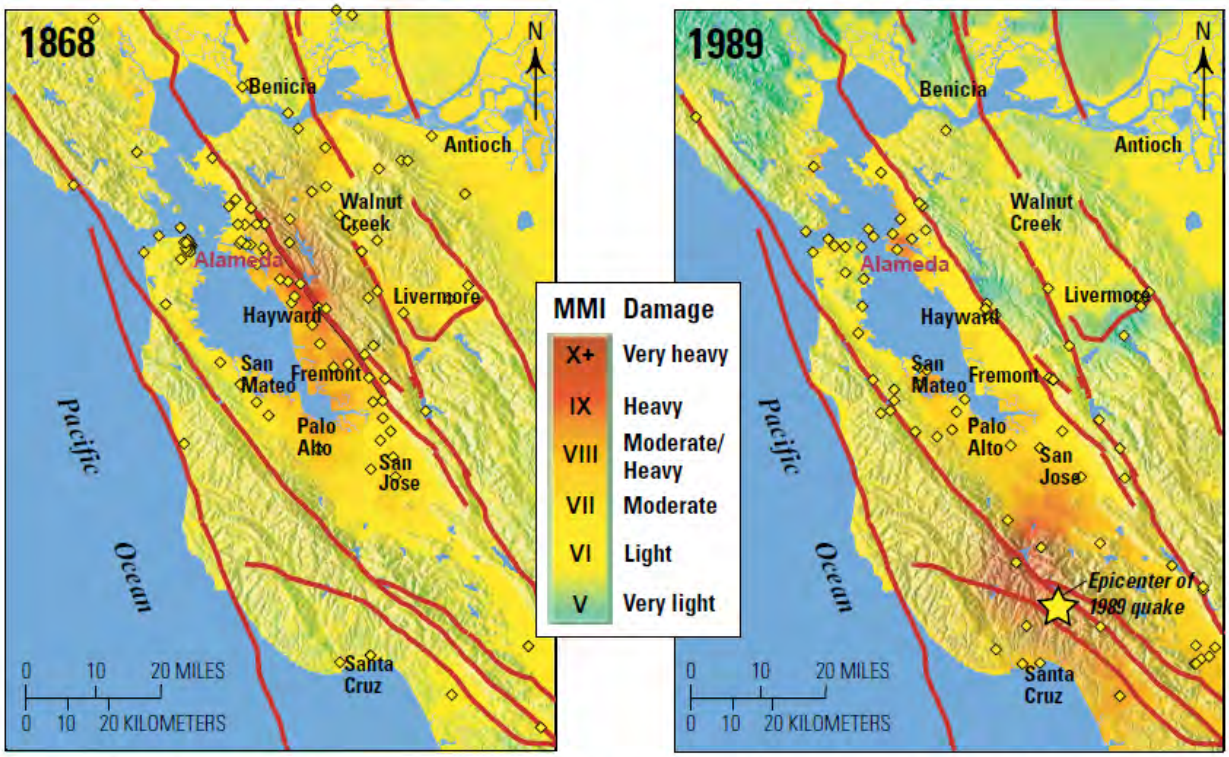
The worst-case scenario for Alameda is a major earthquake along the southern portion of the Hayward Fault, because that is the closest fault to Alameda, only four miles away. A major earthquake on any one of the faults in the Bay Area is predicted to cause at least some ground disturbance on the made ground portions of Alameda. Made ground is much more sensitive to shaking and ground disturbance. Shaking is likely to be felt all over Alameda, but more violently on made ground.

*Table 4-2. MMI Intensity Table*

| Intensity | Building Contents | Masonry Buildings | Multi-Family Wood-Frame Buildings | 1&2 Story Wood-Frame Buildings |
|---|---|---|---|---|
| MMI 6 | Some things thrown from shelves, pictures shifted, water thrown from pools | Some walls and parapets of poorly constructed buildings crack. | Some drywall cracks. | Some chimneys are damaged, some drywall cracks. Some slab foundations, patios, and garage floors slightly crack. |
| MMI 7 | Many things thrown from walls and shelves. Furniture is shifted. | Poorly constructed buildings are damaged and some well-constructed buildings crack. Cornices and unbraced parapets fall. | Plaster cracks, particularly at inside corners of buildings. Some soft-story buildings strain at the first-floor level. Some partitions deform. | Many chimneys are broken and some collapse, damaging roofs, interiors, and porches. Weak foundations can be damaged. |
| MMI 8 | Nearly everything thrown down from shelves, cabinets, and walls. Furniture overturned. | Poorly constructed buildings suffer partial or full collapse. Some well-constructed buildings are damaged. Unreinforced walls fall. | Soft-story buildings are displaced out of plumb and partially collapse. Loose partition walls are damaged and may fail. Some pipes break. | Houses shift if they are not bolted to the foundation or are displaced and partially collapse if cripple walls are not braced. Structural elements such as beams, joists, and foundations are damaged. Some pipes break. |
| MMI 9 | Only very well anchored contents remain in place. | Poorly constructed buildings collapse. Well-constructed buildings are heavily damaged. Retrofitted buildings damaged. | Soft-story buildings partially or completely collapse. Some well-constructed buildings are damaged. | Poorly constructed buildings are heavily damaged, some partially collapse. Some well-constructed buildings are damaged. |
| MMI 10 | Only very well anchored contents remain in place. | Retrofitted buildings are heavily damaged, and some partially collapse. | Many well-constructed buildings are damaged. | Well-constructed buildings are damaged. |

Source: ABAG, 2013, Modified Mercalli Intensity Scale

**Figure 4-1** shows shake maps showing the MMI of ground shaking for the historic magnitude M 6.9 quakes in 1868 on the Hayward Fault and the 1989 Loma Prieta earthquake on the San Andreas fault. In places, Alameda experienced MMI 8 (very strong) to 9 (violent) intensity shaking during these two quakes.




*A ShakeMap showing the inferred intensity of ground shaking in the 1868 earthquake (measured as MMI, or Modified Mercalli Intensity), compared to a ShakeMap for the 1989 magnitude 6.9 Loma Prieta earthquake. Red lines are major earthquake faults; black line shows the portion of the Hayward Fault that ruptured in 1868; diamonds show locations of damage reports (1868) and seismic recordings (1989).*

***Figure 4-1 Shake Maps Comparing Damage from the 1868 Hayward Earthquake (approx. M6.9) to the 1989 Loma Prieta Earthquake (M6.9)***

## Earthquake Liquefaction

Earthquakes can cause ground disturbances, including liquefaction and subsidence. Liquefaction occurs when the underlying saturated sands and muds lose strength and liquefy during shaking and may even come to the surface as mud boils. Subsidence happens when small pockets or whole neighborhoods sink down permanently because of the loss of strength during liquefaction. During the Loma Prieta Earthquake for example, Franciscan Way, which was built on 40-year-old made ground, sank slightly due to liquefaction. This caused difficulties with the sanitary sewer system and necessitated the construction of a sanitary sewer pump station to boost flows from the neighborhood to the main line. The storm drain lines, while still functional, were also impaired. Several residential streets needed emergency repair due to differential settlement.

Ground improvement techniques to mitigate liquefaction and subsidence, include replacement of the liquefiable soils, compaction by various techniques, grouting, deep pile mixing, gravel piles and lowering the groundwater table, all of which are challenging techniques in an already built environment. **Figure 4-2** shows areas that are highly susceptible to liquefaction throughout the city. **Appendix H** shows maps of city sewer and storm drain facilities in relation to liquefaction susceptibility. In a Hayward Fault earthquake, the areas of the city with very high liquefaction potential have an approximately 50 percent

chance of liquefying, while the medium liquefaction potential areas have less than a 5 percent likelihood of liquefying. [1]

As groundwater rises with rising sea level, more areas of Alameda may become susceptible to liquefaction. For more information on rising groundwater, see the Flooding section. Because Alameda's groundwater table is already relatively high, the impact of a rising groundwater table is anticipated to be relatively minor, especially over shorter time horizons. [2]




*Figure 4-2 Liquefaction Susceptibility Map*

## Earthquake Caused Fires

After direct losses caused by violent shaking, liquefaction and subsidence, the largest secondary effect to consider during and after an earthquake is fire. The Great Earthquake of 1906 was also known as the Great Fire of 1906, because much of the damage to San Francisco was caused by fires started by the earthquake. Post-earthquake fires can be caused by damage to natural gas lines, electrical lines, toppled water heaters, and appliances. After an earthquake, fire-fighting efforts may be hampered by the number of simultaneous fire ignitions across the city, streets blocked by rubble or trees, lack of water pressure, lack of mutual aid if Oakland and San Leandro are equally hard-hit, and loss of access across bridges. Firefighting personnel would have to be split between fighting fires and performing paramedic services.

[1] Jones, J.L., Knudsen, K.L., Wein, A.M., 2017, HayWired scenario mainshock—Liquefaction probability mapping, chap. E of Detweiler, S.T., and Wein, A.M., eds., The HayWired earthquake scenario—Earthquake hazards: U.S. Geological Survey Scientific Investigations Report 2017–5013–A–H, 126 p., https://doi.org/10.3133/sir20175013v1.
[2] Grant, A.R., at al. (Draft) Changes in Liquefaction Severity in the San Francisco Bay Area with Sea-Level Rise

In Alameda, fires following earthquakes could be very damaging due to firefighting resources being stretched thin and the dense urban environment with older wood structures likely to be damaged and the ability of fires to rapidly spread between structures. Areas that experience liquefaction are also more vulnerable to post-earthquake fires because of the greater potential for underground natural gas lines to rupture and start fires and because water lines in these areas may also be damaged, preventing firefighting with regular resources. Areas with hazardous materials may have the potential for explosions, fires, or toxic smoke. Laboratories are significant concern for hazardous material fires.

## Other Earthquake Related Losses

In addition to the direct losses caused by earthquakes and earthquake-started fires, there are other secondary effects to consider during and after an earthquake, especially if the surrounding cities are impacted. This includes loss of circulation for emergency vehicles, evacuation, damage to buildings, lack of access to hospitals, lack of access for mutual aid outside of the City, loss of utilities such as power, water, telecom, and natural gas, generation of large quantities of debris, release of hazardous materials, and loss of population displaced by damaged housing, industry and commerce.

Since Alameda is relatively flat, it is not exposed to the earthquake hazards of seismically triggered landslides. There are no known faults running through Alameda and no history or geological evidence of fault rupture in Alameda. There is a hypothetical chance of minor sloughing along the shoreline perimeter, since much of the perimeter is built on mudflats, subject to liquefaction.

# History

The Bay Area has experienced about 20 strong earthquakes and one major earthquake in the past 165 years, including the 1868 Hayward Fault quake (~M6.9) and 1906 San Andreas quake (M7.8). Those two earthquakes occurred before the infilling of made ground in Alameda, and when the majority of buildings in Alameda were relatively flexible wood construction. The most notable damage was to the brick tower at Alameda City Hall, built in 1895 and damaged by the San Francisco earthquake in 1906. The damage was extensive enough to warrant removal of the tower in 1937.

**Table 4-3** and **Table 4-4** show the historic recorded earthquakes along the Hayward and San Andreas Faults, respectively.

***Table 4-3. Recorded or Deduced Strong (M6.0+) Earthquakes along the Hayward Fault***

| Date | Magnitude | Notes |
|---|---|---|
| 1315 | Over M6.3 | Based on geologic data |
| 1470 | Over M6.3 | Based on geologic data |
| 1630 | Over M6.3 | Based on geologic data |
| 1725 | Over M6.3 | Based on geologic data, predates California missions |
| 1868 | M6.8 to M7 | Based on geologic data, predates California missions |
| 1984 | M6.2 | Morgan Hill (on nearby Calaveras Fault) |

Source: USGS Earthquake Catalog. https://earthquake.usgs.gov/earthquakes. Accessed October 7, 2024.

*Table 4-4. Recorded Strong (M6.0+) and Major (M7.0+) Earthquakes along the San Andreas Fault*

| Date | Magnitude | Notes |
|---|---|---|
| 1812 | M7+ | Southern California |
| 1838 | M7 | Santa Cruz Mountains |
| 1857 | M7.9 | Fort Tejon |
| 1890 | M6.3 | Corralitos |
| 1906 | M7.8 | San Andreas (San Francisco Quake) |
| 1940 | M7.1 | Imperial Valley |
| 1983 | M6.5 | Coalinga |
| 1989 | M6.9 | Scotts Valley (Loma Prieta Quake) |
| 1991 | M6.3 | Fortuna |
| 1992 | M7.2 | Fortuna |
| 2019 | M6.4, M7.1 | Ridgecrest sequence |
| 2022 | M6.4, M6.2 | Ferndale and Petrolia |

Source: USGS Earthquake Catalog. https://earthquake.usgs.gov/earthquakes. Accessed October 7, 2024.

The 1989 Loma Prieta earthquake, M6.9, occurred after the infilling of Alameda along South Shore, Bay Farm Island, and Alameda Point. This quake caused $2.1M damage to properties owned by the City of Alameda, including buildings, fuel tanks, broken water mains, broken sewer lines, street buckling, and bulkhead damage. The dollar amount of private properties is not included here.

The earthquake was strong enough to cause the collapse of the nearby Cypress Structure in Oakland. There was documented liquefaction (mud boils) in the made ground at Alameda Point and Harbor Bay Business Park on Bay Farm Island. Several neighborhoods including South Shore experienced buckled streets and sidewalks, and subsidence that made the sanitary sewer pipes no longer flow downhill, requiring the City to build a new sanitary sewer pump station. **Figure 4-3** shows a map of the settlement damage to streets from the Loma Prieta Earthquake. All were in areas of made ground, outside of the original shoreline. The Loma Prieta earthquake also caused damage to the Miller Sweeney Bridge at Fruitvale Avenue causing it to be shut to all vessel traffic until repaired.

The only strong quake to occur in the Bay Area since the 1989 Loma Prieta Earthquake is the 2014 South Napa Earthquake (M6.0), which caused extensive building and underground utility damage in Napa, along the rupture of the West Napa Fault. The damage was highly concentrated in the Napa area and no damage was reported in Alameda. No state or federal disaster declarations for earthquakes that affect the planning area have occurred since the last Local Hazard Mitigation Plan update.

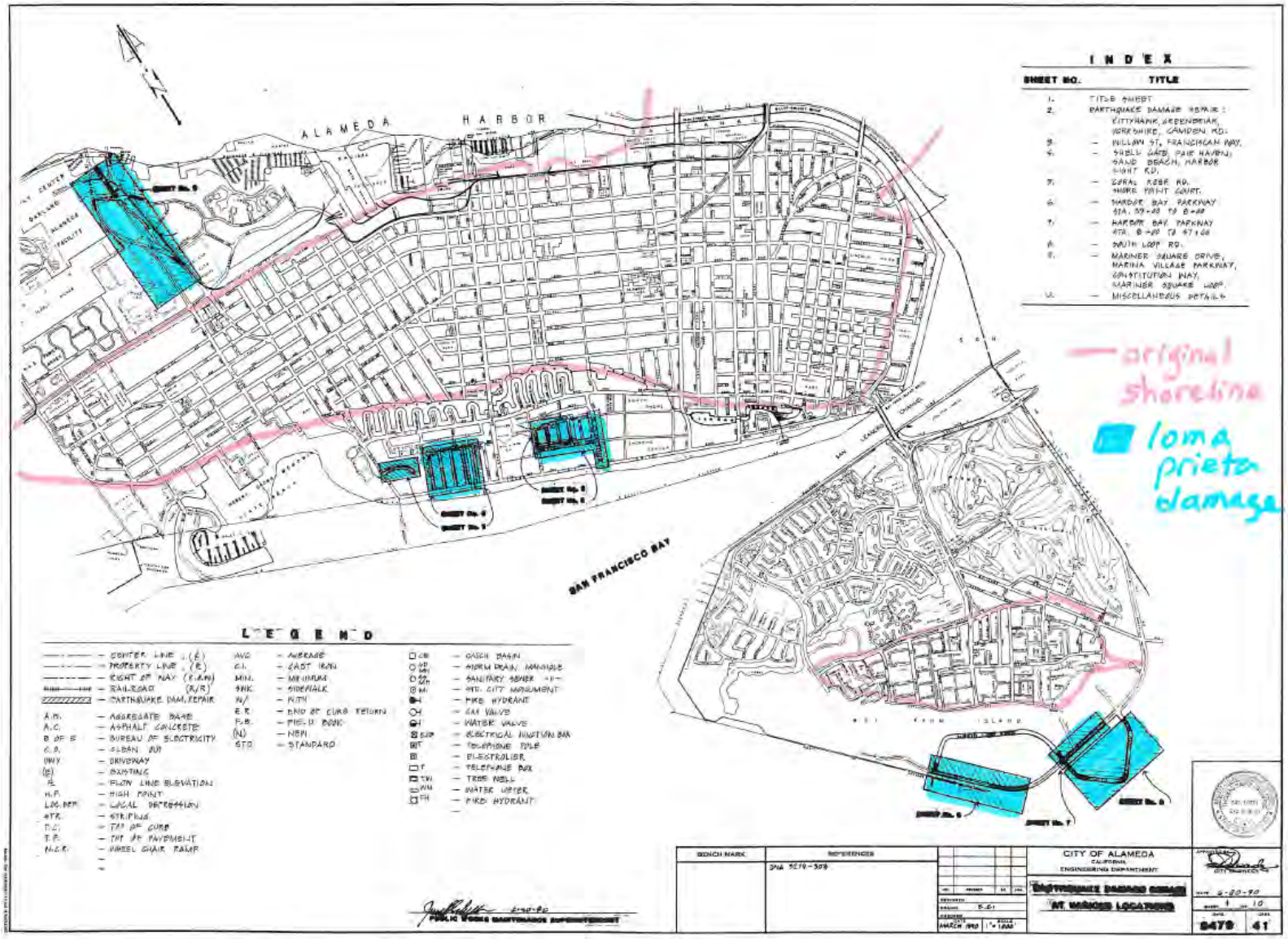



*Figure 4-3 Areas of Loma Prieta Earthquake Damage and Original Shoreline of Alameda*

## Probability of Future Earthquakes

According to the USGS, the chance of an earthquake of M6.7 or greater somewhere in the Bay before 2043 is 72 percent.[3] As shown on **Figure 4-4**, the chance of a M6.7 or greater earthquake on our closest fault, the Hayward-Rodgers Creek Fault, before 2043 is 33 percent. The likelihood of an earthquake on the next closest fault, the San Andreas, is 22 percent.

The California Integrated Seismic Network has developed scenario earthquakes and has shown what areas will be affected by each earthquake. A M6.8 quake on the Hayward fault or a M7.2 quake on the San Andreas fault is likely to cause at least a "strong" or MMI 7 shaking in Alameda. Combining all likely scenarios on nearby faults, Alameda has a 10 percent chance of experiencing "Very Strong" to "Violent" (MMI 8 to MMI 9) shaking in the next 50 years. This probability can also be expressed as a 0.2 percent chance per year, or a 500-year event, which could happen any time. **Figure 4-5** portrays this probabilistic seismic hazard.

Strong earthquakes strike the Hayward Fault at approximately 140-year intervals, with the last major one in 1868, so we may be due for another strong quake in the near term. USGS developed the HayWired earthquake scenario to depict a scientifically realistic depiction of a moment magnitude (Mw) 7.0 earthquake on the Hayward Fault with an epicenter in Oakland. In the scenario the Hayward Fault ruptures for 52 miles along its length. Such an earthquake would result in strong shaking that will trigger surface fault rupture, liquefaction, landslides, fires, and severe impacts throughout the entire Bay Area. **Appendix E** describes these impacts in greater detail. The HayWired scenario represents an earthquake with approximately a 150-year return period; one that has about a 20 percent chance of occurring in the next 30 years. While the impacts of this scenario are severe, it does not represent the worst-case earthquake by any means. By comparison, most newer buildings today are designed to protect the safety of occupants in earthquake shaking with approximately a 975-year return period, or a 2 percent chance of occurring in any 50-year period.

[3] Earthquake Outlook for the San Francisco Bay Region 2014–2043, USGS Fact Sheet 2016-3026. Available at https://pubs.usgs.gov/fs/2016/3020/fs20163020.pdf.

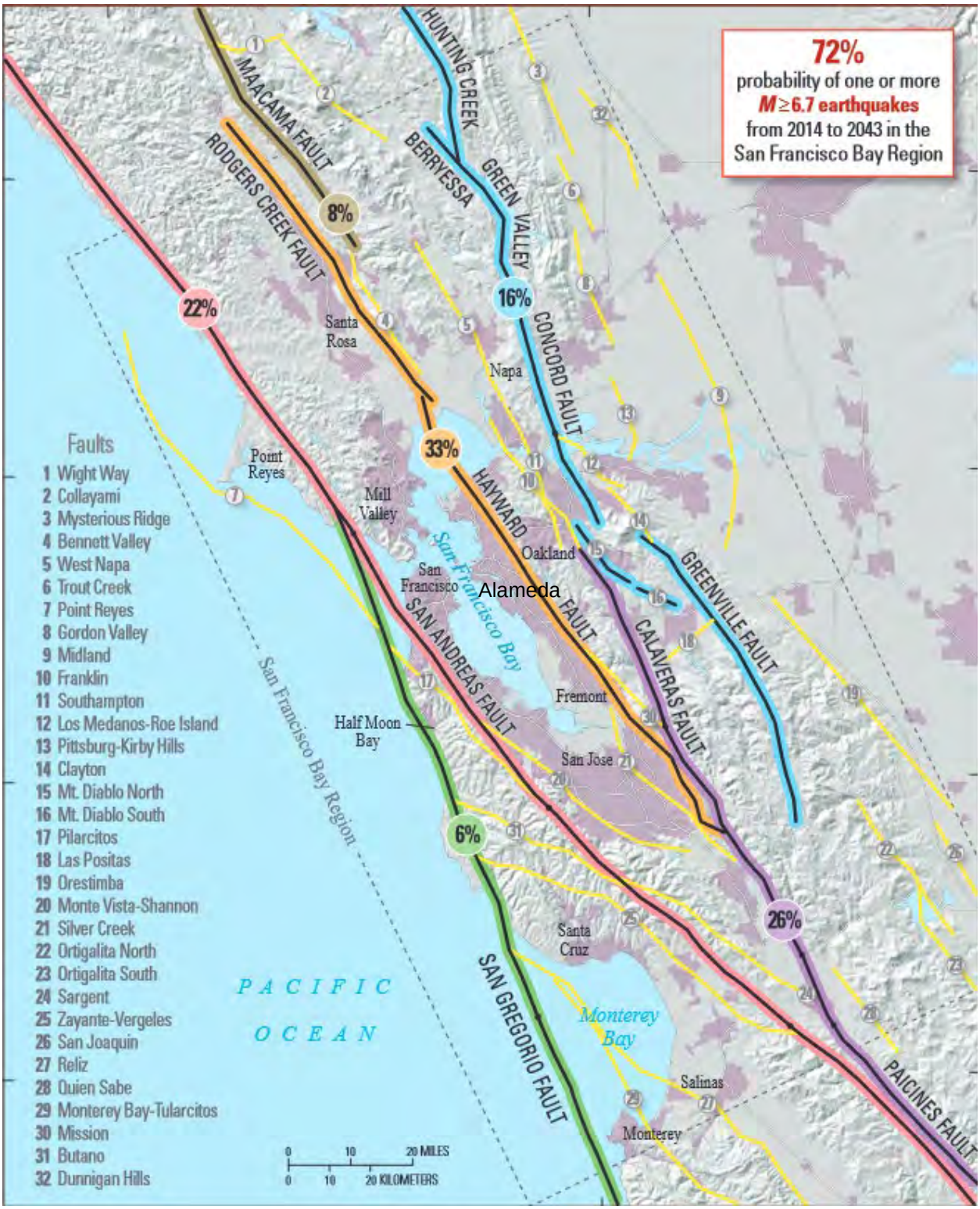



***Figure 4-4 Probability that a magnitude 6.7 or greater earthquake will occur on the Bay Area fault system before 2043***

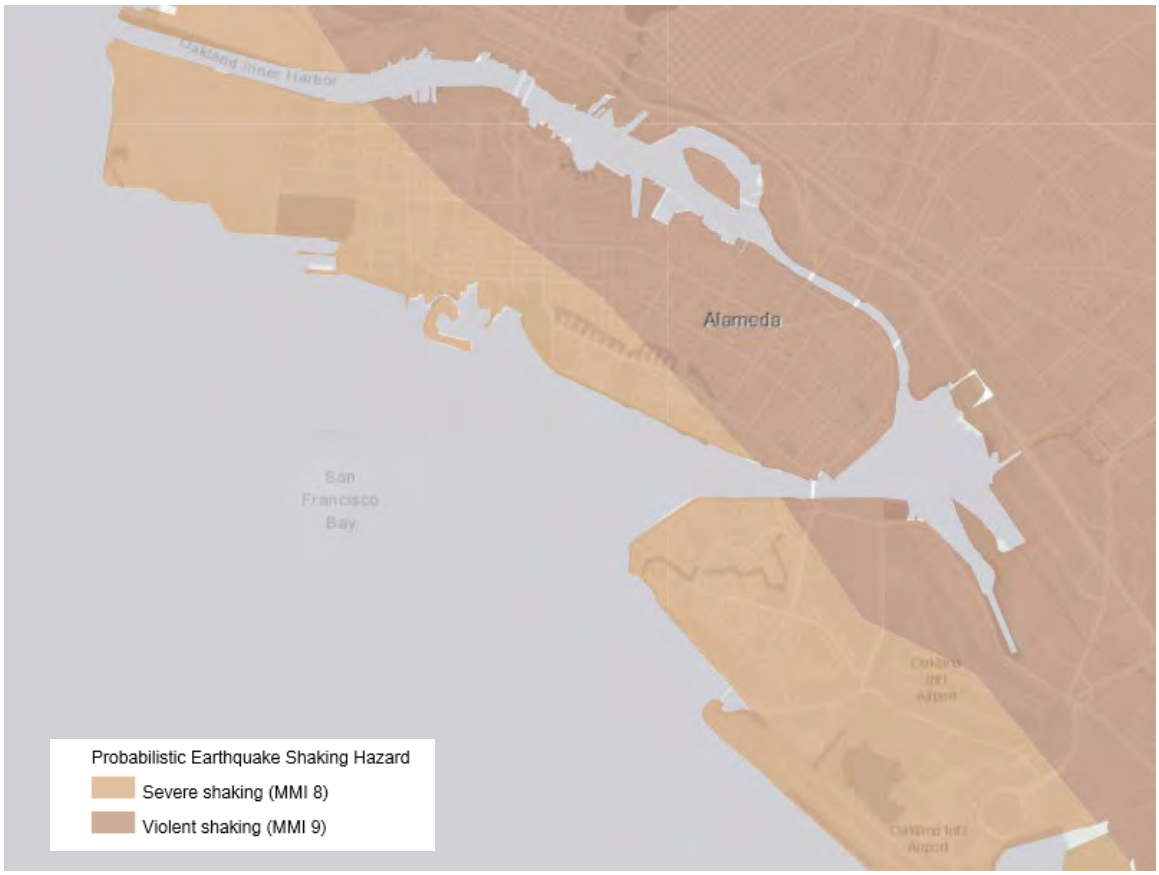



*Figure 4-5 Probabilistic Earthquake Shaking Hazard Map*

## Climate Adaptation and Earthquakes

Climate change will exacerbate certain earthquake hazards. Rising sea levels correspondingly cause rising groundwater levels. Soils that are more saturated with groundwater are more likely to liquefy and subside. Rising groundwater is explored in further detail in the Future Flooding section.

# Earthquake Risk Assessment

The vulnerability of Alameda assets to earthquake hazards is examined in detail in **Appendix E** and summarized below.

Certain types of buildings are more susceptible to shaking and ground disturbances of earthquakes. Older buildings constructed before modern building codes are generally not designed to withstand earthquake shaking. Single family cripple wall, multi-family soft-story, unreinforced masonry, nonductile concrete, and tilt-up buildings are building types that are particularly vulnerable to damage in earthquakes. Alameda has an unreinforced masonry program that has resulted in the seismic retrofit of all unreinforced masonry buildings with 5+ units. Alameda also has a soft-story evaluation program that has resulted in the voluntary seismic retrofit of 159 buildings with five or more housing units; however, sixty-three buildings containing over 900 housing units remain unretrofitted.

Newer buildings constructed to current California building codes are designed protect occupant safety but do not ensure that a building will be usable after an earthquake. In a region experiencing a housing shortage, designing newer buildings to a higher standard would lead to a faster recovery of these critical

buildings and the recovery of the community as whole. An additional 1 percent in construction cost to build new buildings to a "functional recovery standard" could increase the availability of homes and businesses by 75 to 95 percent following a major earthquake. [4]

Buildings subject to violent shaking can also dislodge asbestos or encapsulated (abated) asbestos, lead paint, and other hazardous materials. Broken plumbing can discharge sewage. Broken gas lines and damaged electrical wiring can spark fires and present health and safety hazards. Other hazards from shaking buildings include falling piping, shelving, and goods.

Some of the City's most important buildings are vulnerable to earthquake shaking because they were constructed with the building standards that pre-dated current knowledge about earthquake dynamics. The City Hall, for example, completed in 1896, lost its central bell tower during the 1906 San Francisco Earthquake. The tower was never re-built. Since then, most of the City buildings have been seismically retrofit, or have been constructed to more modern standards. Of particular concern are the 1940s era residences and hangers on Alameda Point, the former Alameda Naval Air Station, that would be subject to earthquake shaking, liquefaction, ground settlement, and flooding. The Alameda Point Master Infrastructure Plan addresses areas of redevelopment, where buildings will be constructed to modern day seismic standards and reuse areas where retrofit work may be needed.

Alameda's five estuary crossings have all been retrofitted to a "no collapse" standard, which means that while the bridge will survive without loss of life, significant repairs or replacement may be necessary. The Fruitvale railroad bridge is a collapse hazard that poses a hazard for the adjacent Miller-Sweeney bridge. Alameda is advocating for this bridge to be removed and replaced with a pedestrian/bike bridge and the U.S. Army Corps of Engineers as the bridge owner is conducting a disposition study to make recommendations regarding whether to cease operation and maintenance of the bridge and potential courses of action for what to do with the bridge. The City of Alameda has requested that Alameda County upgrade the Miller-Sweeney bridge and Bay Farm Island bridges to a "lifeline" standard, which would allow them to be nearly immediately usable following an earthquake.

The hundreds of miles of natural gas, water, sewer, and stormwater distribution and collection lines are all at risk of damage from liquefaction. **Appendix H** shows maps of city sewer and storm drain facilities in relation to the liquefaction susceptibility and shaking hazard. Neighborhoods that experience significant liquefaction may not have service restored for weeks or months. An average East Bay customer would lose water for an estimated six weeks and some will lose service for as long as six months. Water supply outages will impede fighting post-earthquake fires. Full restoration of the natural gas system can take up to six months because of the time it will take to integrity test the lines prior to repressurizing and number of qualified personnel required to relight pilot lights. [5]

# Flooding

Over 23 miles of shoreline surrounds both the Main Island of Alameda and Bay Farm Island. As such, the City of Alameda is vulnerable to flooding from both coastal storms where Bay floodwaters overtop low-lying areas along the shoreline and flood inland areas, and stormwater flooding from rainfall within the City during and after storm events. In the near term, both are likely to be temporary in nature, limited by high tide cycles and intensity of events, with flooding likely shallow - on the order of 2 feet or less in depth. However, as climate change increases the intensity of storm events, sea levels, and groundwater

[4] Haywired Earthquake Scenario, U.S. Geological Survey, 2018.
[5] Lifelines Restoration Performance Project, City and County of San Francisco, 2020.

levels, the depth and extent of flooding is expected to increase and may become more frequent or permanent. Today's 1 percent annual chance coastal floodplain is approximately equivalent to the area that could be inundated by daily high tides with 3 feet of sea level rise. Coastal and stormwater are not mutually exclusive. During high tides many of the city's outfalls are already under water and the pipes upstream are partially full as a result. Additionally, some outfalls have chronic issues with mud deposition and their inherent capacity is already reduced. When a coastal storm event occurs, temporarily higher sea levels back up already submerged pipes even more, and as rainfall enters the pipes from upstream this capacity is diminished further. An example of recurrent flooding in the city due to the combination of rainfall and a submerged outfall is on Main Street, next to the old entrance gate for the former Naval Air Station. This location experiences several inches of flooding within the street during certain combinations of tides and storm events.

In 2013, the City's storm drain outfalls were assessed visually for capacity, condition, and operation and maintenance prioritization. An updated comprehensive cleaning and condition assessment for the entire stormwater system has been completed for three watersheds totaling $650K. An additional watershed is planned for 2024-25 totaling $250K. Annual funding availability will determine when remaining watersheds can be completed.

Although there are not a significant number of recurrent flooding locations within the city, the combined factors described above may cause additional flooding issues if the storm drain system becomes overtaxed due to rising sea levels. The storm systems in late 2022 and early 2023 resulted in flooding in multiple locations throughout the city where flooding had not previously been observed, or the flooding was more severe than expected.

In some areas of the city, storm drainage is collected through pipes and flows down to a pump station. Alameda has 11 stormwater pump stations in total. In the case of pump stations, stormwater is pumped out to the Bay under pressure through a discharge line, not a gravity outfall pipe. Therefore, if the discharge line outfall is below high tide, it can still effectively pump. This is why rising sea levels will tend to have less of an effect on some portions of the city where pump stations exist, in lieu of gravity outfalls which can back up readily.

Alameda is very flat, especially in areas of made ground, with many streets originally constructed at minimum longitudinal grade. Over time the significant number of trees along City streets has led to an abundance of heaves caused by tree roots along street gutterlines. As a result, ponding of stormwater in front of homes is frequent and recurrent, and keeping catch basin grates and culvert inlets free of clogs caused by leaves is an issue the maintenance department stays busy with during the wet season. Many homes have sump pumps below them that discharge to the gutter as well, to minimize structural damage due to the high-water table found in various parts of the city. For this reason, ponding can occur within the gutterline during the dry season.

# Hazard Description

## Tides

With over 23 miles of shoreline along the Main Island of Alameda and Bay Farm Island, an understanding of tidal water levels is important for existing and future flood hazard characterization. The City of Alameda experiences about a 6.6 foot tide range on average, from (-) 0.2 feet Mean Lower Low Water (MLLW) to 6.4 feet Mean Higher High Water (MHHW), based on the NAVD88 datum (the NAVD88 datum, or zero elevation, is approximately the same as the elevations used in local tide tables, and is the datum used in

the Flood Insurance Rate Maps described below). The highest tides of the year, or "king tides" [6], normally occur during the winter months (e.g., November to February) and are usually above 7 feet NAVD88.

The ten highest tides recorded by NOAA in Alameda for the last 80 years measured 8.6 feet to 9.5 feet NAVD88 in elevation. These high tides occurred in El Niño winters when warmer than normal ocean waters resulted in elevated Bay water levels for prolonged periods (e.g., weeks to months) and severe winter storms can further elevated Bay water levels.

San Francisco Bay is the largest estuary in the western U.S., connected to the Pacific Ocean through the 300-foot-deep Golden Gate inlet. The tides, ocean-driven swells, and extreme water levels all enter the Bay through this single inlet. The large expanse of the Bay allows for the generation of wind-driven waves that are independent from oceanic processes, and the complex topography surrounding the Bay can transform the winds in a multitude of directions depending on the primary driver of the onshore or offshore winds or the track of the large storm system descending on the Bay Area. The water levels and wave heights of the Bay exhibit a high degree of variability driven by many factors, including the bathymetry, astronomical and oceanic cycles, windspeeds and direction, and atmospheric events.

The water levels of the Bay vary based on several tidal and oceanic cycles that range in scale from hours to millennia, as well as short- to medium-term increases due to atmospheric conditions (for example, the weather). The following five tidal and oceanic cycles are the primary drivers of regular (non-climate change related) water level variations, presented in order of increasing timescale from shortest to longest:

- A mixed semidiurnal tidal cycle, with two high tides and two low tides occurring each day, with each of the four tides reaching different elevations. These astronomical tides are driven by the gravitational attraction between the rotating earth, moon, and sun. The highest annual astronomical tides occur in June/July and Dec/Jan and are commonly referred to as king tides.
- A 14-day spring-neap cycle, with the highest energy (and largest tide range) occurring during spring tides during the new and full moon, and the lowest energy (and smallest tide range) occurring during neap tides when the sun and moon are at right angles to each other.
- An annual cycle in which water levels are generally lower in the spring and early summer and higher in the early fall through winter. The spring drop in sea level along the California coast, and observed at the San Francisco Presidio tide gage, results from the onset of strong winds blowing toward the Equator [7]. These winds, plus the Coriolis effect [8], push surface waters away from the coast. The higher sea level in the fall and winter are caused by the relaxation of these alongshore winds, coupled with the expansion of water caused by summer and fall warming trends. Since 2013, the water level drop in the spring has been less pronounced and water levels have remained high throughout the summer due to the presence of a large,

[6] "King Tide" is a non-scientific term commonly used to describe exceptionally high tides that occur during a new or full moon. They occur when both the sun and moon are closest to the Earth, causing a stronger than normal gravitational force. Although this occurs during both summer and winter in the Bay Area, historically, only winter king tides exceeded 7 feet NAVD88. However, changing summer conditions in recent years have resulted in National Weather Service coastal flood advisors in low-lying areas during summer king tides. The term king tide has become synonymous in the Bay Area for any high tide exceeding 7 feet NAVD88.
[7] USGS, 1999. El Niño Sea-Level Rise Wreaks Havoc in California's San Francisco Bay Region https://pubs.usgs.gov/fs/1999/fs175-99/
[8] The Coriolis effect is the tendency of winds and currents to veer to the right in the Northern Hemisphere and to the left in the Southern Hemisphere.

unusually warm patch of water off the coast commonly referred to as "the Blob" [9]. The Blob has affected water levels and west coast weather from Alaska to California [10]. It is currently unknown if this phenomenon will continue to persist.

- The El Niño/La Niña cycle (ENSO) where every 2 to 7 years the equatorial trade winds relax, or even reverse, and warm surface water moves back along the Equator toward South America. During El Niño conditions, unusually long, low waves are generated in the Pacific Ocean called "Kelvin waves." These waves appear to be about 6,000 miles long, traveling at speeds of more than 5 mph, with heights of up to 12 inches. As a Kelvin wave moves along the west coast, the higher water levels are propagated into the Bay. During the 1997/1998 El Niño season, Kelvin waves began raising sea levels by 6 inches in early May, and by late fall of 1997, water temperatures were well above normal, causing an additional rise of about 8 inches due to thermal expansion that lasted into spring 1998.
- The Pacific Decadal Oscillation (PDO) is a long-term (for example, 20 – 30 years) ocean fluctuation of sea surface temperatures in the Pacific Ocean. PDO includes both warm and cool phases which alter upper-level atmospheric winds, affecting ocean water levels, hurricane activity, droughts, and floods [11]. The phase of the PDO can also affect the relative local rate of sea level rise. The cool phase of the PDO pushes warm water away from the U.S. Pacific coast, suppressing local sea level rise. This dynamic led to a slower than anticipated rate of sea level rise measured at the Presidio tide gauge from the mid-1990s until about 2011. The PDO is currently in a warm phase, and NASA scientists are observing faster-than-average sea level rise along the west coast [12].

## Coastal Flooding

In 2018 the Federal Emergency Management Agency (FEMA) published new Flood Insurance Rate Maps (FIRMs) that show approximately 2,000 Alameda properties mapped within the 1 percent annual chance coastal floodplain, and at least 1,100 buildings (significantly more than in the previously published 2009 FIRMs). These areas have a statistical 1 percent chance per year of flooding by coastal floodwaters, though the event could feasibly happen in any year (or even multiple times within one year).

With the 2018 update, FEMA's mapping includes both AE Zones (high risk flood zones, with wave heights less than 3 feet) and VE Zones (high risk zones, with wave heights greater than 3 feet) surrounding Alameda's shorelines with varying associated Base Flood Elevations, or BFEs (the statistical 1 percent annual chance elevation to which coastal floodwaters or wave hazards may rise). Some BFEs along the shoreline are as high in elevation as 14 feet NAVD88, these areas experience wave hazards and wave runup that is typically limited to the shoreline. Thankfully, the low points along the city's shoreline that serve as entry points for coastal flooding occur in AE Zones where the BFE is limited to 10 feet NAVD88; therefore, coastal floodwaters would extend onto city land until they meet land at that same elevation. Nearly the entire city's land-based flood zone has a BFE of 10 feet NAVD88, which is the 1 percent annual chance Bay water level in the absence of wave hazards, also referred to as the stillwater

[9] Stanley, S. 2016. In the Eastern Pacific Ocean, the "Blob" Overshadows El Niño. Eos, Geophysical Research Letters 97. DOI:10.1029/2016EO056237

[10] Hayhoe, K., D. J. Wuebbles, D. R. Easterling, D. W. Fahey, S. Doherty, J. Kossin, W. Sweet, R. Vose, and M. Wehner. 2018. Our Changing Climate. Pages 72–144 in D. R. Reidmiller, C. W. Avery, D. R. Easterling, K. E. Kunkel, K. L. M. Lewis, T. K. Maycock, and B. C. Stewart, editors. Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II. U.S. Global Research Program, Washington D.C. DOI:10.7930/NCA4.2018.CH2

[11] DeFlorio, M. J., D. W. Pierce, D. R. Cayan, and A. J. Miller. 2013. Western U.S. extreme precipitation events and their relation to ENSO and PDO in CCSM4. Journal of Climate 26:4231–4243. DOI:10.1175/JCLI-D-120257.1

[12] NASA. 2021. Rising Waters: How NASA is monitoring sea level rise. https://www.nasa.gov/specials/sea-level-rise-2020/

elevation. For context, the BFE of 10 feet NAVD88 is 2.6 feet above the annual king tide elevation and could theoretically be achieved by a combination of a king tide plus a weather-related temporarily higher sea level. The updated flood mapping for Alameda is shown below and available at https://msc.fema.gov/portal/home.

According to the FIRMs, the Main Island of Alameda has its most extensive coastal flood entry locations in three main areas where the City shoreline is lower in elevation than the BFE; these occur along the northern, eastern, and Alameda Point shorelines (see **Figure 4-6**). Along the northern shoreline, this entry point is approximately 1,100 feet long and located behind (north of) the Webster and Posey Tube portals. Alameda Point is the largest portion of the Main Island affected by the 1 percent annual chance coastal flood event (portions shown on **Figure 4-6**); to the north, floodwaters would enter along a 1.5 mile stretch along Main Street and extend toward the northwest tip of the former Naval Air Station airfield. Floodwaters would also enter from the south along a 1.6 mile stretch that includes the former seaplane lagoon and federal property. Along the eastern shoreline, the entry location is approximately 350 feet long and includes the end of the Liberty Avenue right-of-way (see **Figure 4-7**).

Bay Farm Island is especially vulnerable to coastal flooding, as the lowest property elevations within the city are found here and are included within the flood zone. The issue of most importance is that flood waters can enter from multiple locations and combine into one interconnected flood zone. These entry points within city limits include the end of Veterans Court, the low point at the Lagoon System 1 North Outfall on the northern shoreline, and approximately 1,900 feet of Doolittle Drive. Additionally, flood waters originating within the City of Oakland along the 2 miles of shoreline along Doolittle Drive/State Route 61 would also affect Bay Farm Island: they would flow across the airport and enter Alameda over a stretch of 1.2 miles of Harbor Bay Parkway (the city line), inundating city properties.

While the Chuck Corica Golf Course is shown as part of the flood zone in **Figure 4-8**, it is worth noting that extensive fill material was imported and used to raise the grades across the golf course, and now mounds are in place along its eastern perimeter and throughout its interior. The exact effect that this fill material and regrading may have on Bay Farm Island flooding scenarios is unknown. FEMA relied on topographic data collected in 2010 and was not able to rely on the grading plans provided by the golf course because they were not certified by a licensed surveyor; therefore, it was not included in FEMA's analysis and is not reflected on the FIRMs. Regardless, floodwaters entering Bay Farm Island at the 1 percent annual chance coastal flood event could potentially flood Island Drive, Doolittle Drive, Harbor Bay Parkway, Ron Cowan Parkway, and the approach to the Bay Farm Island Bridge, compromising Bay Farm Island egress from both Oakland and the Main Island for emergency and recovery purposes.

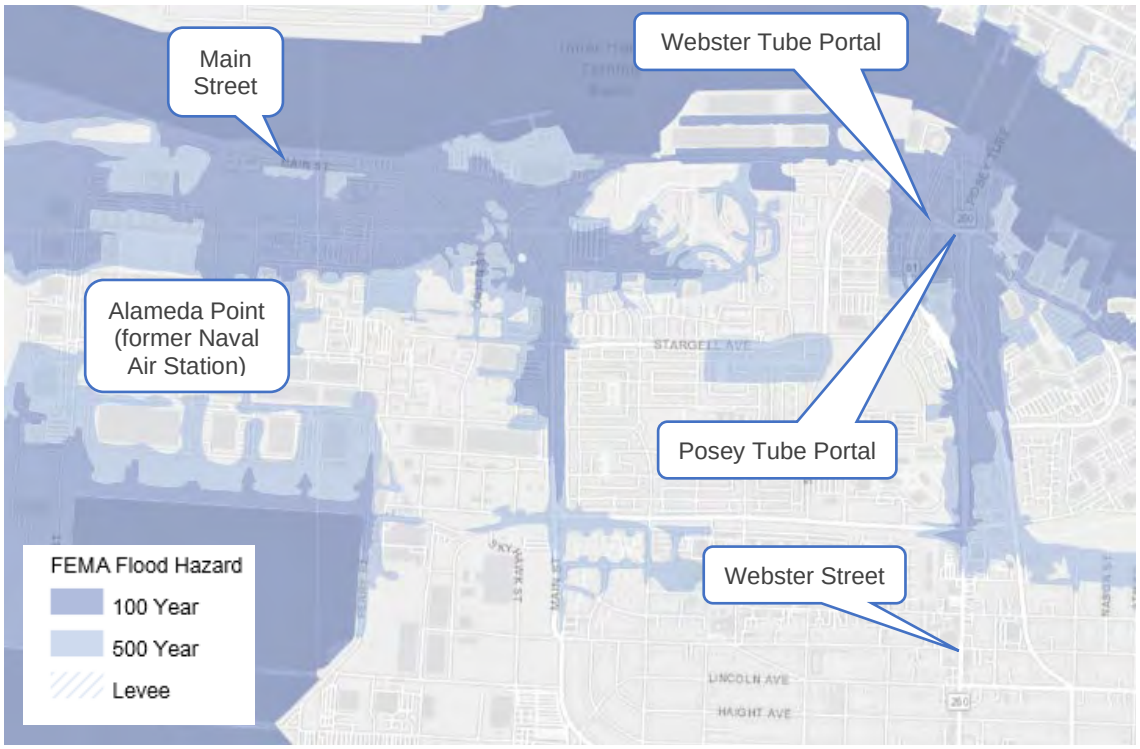



*Figure 4-6 Main Island: Current (2018) FEMA Flood Mapping Along Portion of Northern and Western Shorelines. Areas affected include Webster St and Tube Portals.*




*Figure 4-7 Main Island: Current (2018) FEMA Flood Mapping of Eastern Shoreline. Areas affected are Liberty Avenue and Fernside Boulevard neighborhoods.*

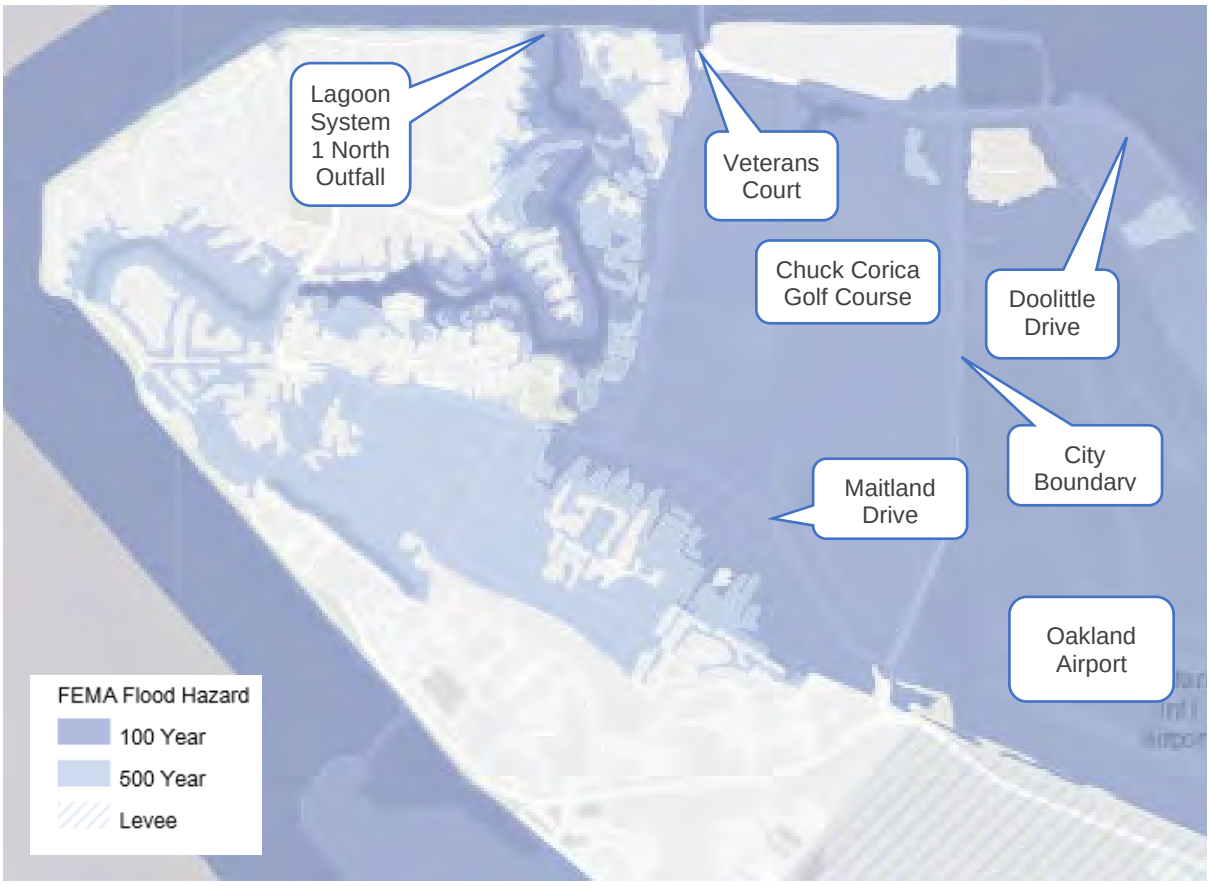



***Figure 4-8 Bay Farm Island: Current (2018) FEMA Flood Mapping. Areas affected are homes along Lagoon System 1 North, Island Drive, Maitland Drive and Mecartney Road***

In the above discussion, the potential coastal flooding is considered temporary – induced by storm events that have a beginning and end, and the FEMA flood maps reflect these temporary conditions. However, in the subsequent discussion on sea level rise the key difference will be that flooding conditions are considered permanent even though they may impact the same geographical area as a temporary storm today would. As such, a higher baseline sea level in the future could be considered the new "normal."

## Coastal Erosion

Coastal erosion can be caused by elevated Bay water levels, waves, or a combination of the two. Waves within San Francisco Bay are primarily generated from the friction between the wind and surface water. Wave generation occurs as the wind interacts with the water surface over a sufficient distance (fetch); large waves can only occur when both higher winds and longer fetch are present. Areas with short fetch distances cannot develop large waves even when subject to high winds. Accordingly, wave conditions along the Alameda shoreline are highly variable, with Bay-fronting portions (high wind and long fetch) of the shoreline subjected to large waves and San Leandro Bay and channel-facing portions of the shoreline (high wind and short fetch) subject to small waves. **Figure 4-9** shows the 1% annual chance of exceedance probability for a given wave height along the Alameda shoreline.

The wave heights, combined with the shoreline characteristics (i.e., steep, shallow, riprap armoring, seawall, earthen berm, beach, wetland, etc.), influence the height of the wave runup along the shoreline. The 1 percent annual chance stillwater elevation (in the absence of waves) is 10 feet NAVD88. FEMA

flood zones greater than 10 feet NAVD88 are wave hazard dominated (**Figure 4-10**). AE zones have wave hazards less than 3 feet, and VE zones have wave hazards greater than 3 feet.

Low-pressure systems (such as extratropical cyclones) typically result in high wind speeds that directly increase wave size; these storm events also cause elevated water surface elevations (storm surge) that can allow wave action to cause greater levels of damage as waves reach higher ground. Shoreline erosion that occurs at high water levels can jeopardize low-lying shoreline communities, particularly those areas that are levee protected.

Boat wakes from ship activity can also result in shoreline erosion. Although boat wakes are more prevalent than wind-driven waves, they are generally smaller in height. The riprap revetments designed for Bay Farm Island are governed by large wind-driven generated waves that are the dominant erosion hazard.

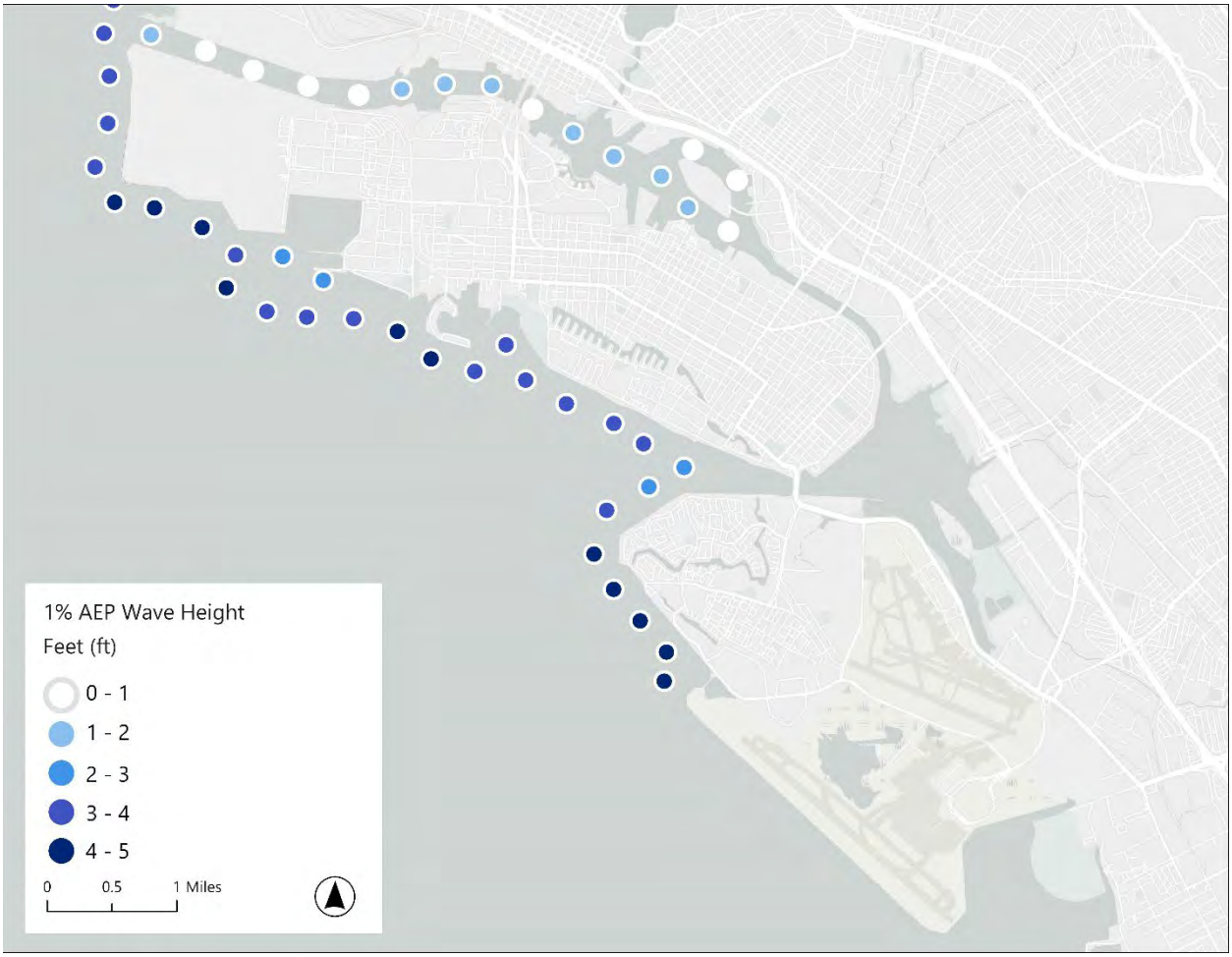



***Figure 4-9 Variation in Estimated 1 Percent Annual Chance Wave Height***

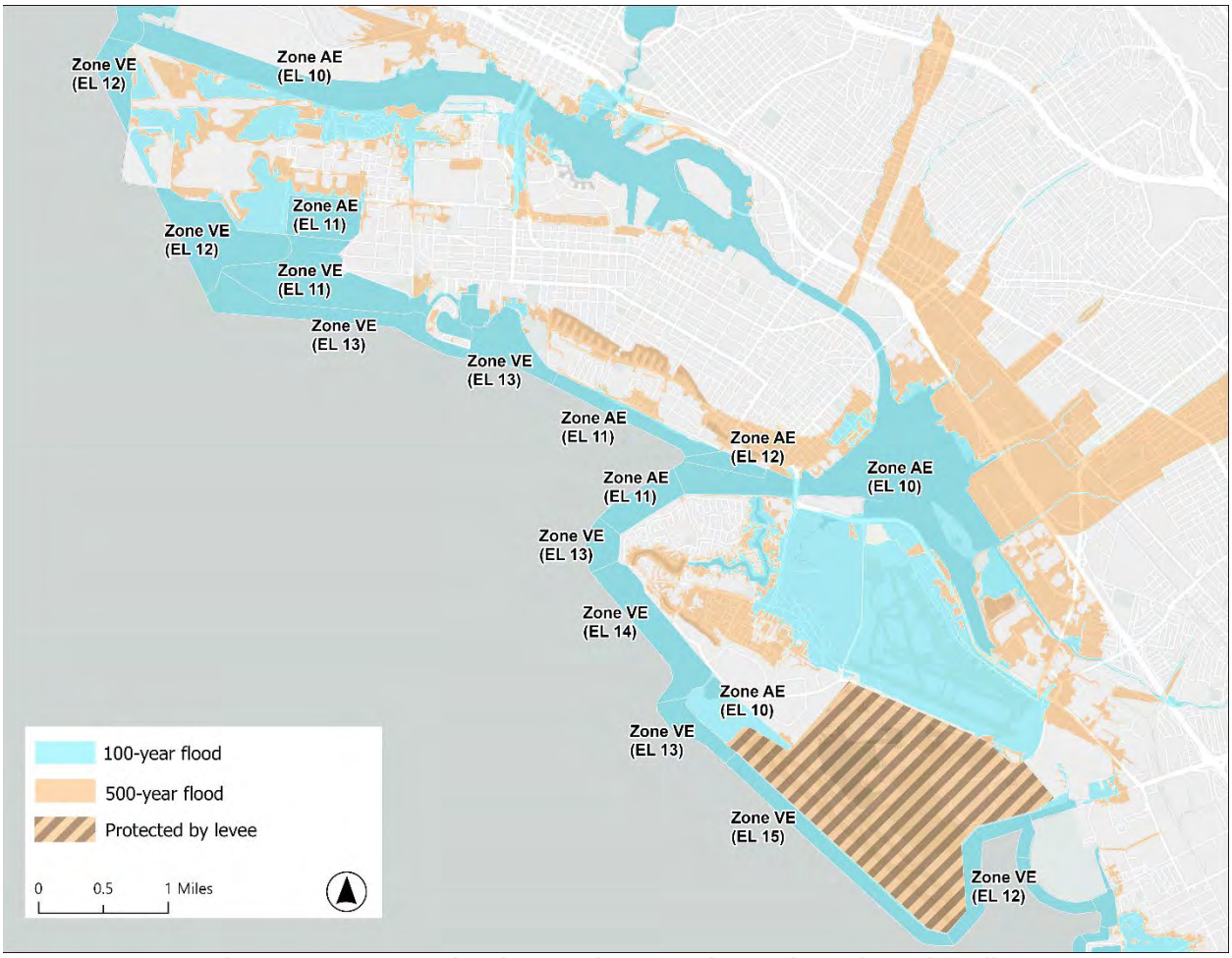



*Figure 4-10 FEMA Flood Hazard Zones along Alameda's Shoreline*

## Stormwater Flooding

**Figure 4-11 and Figure 4-12** depict the storm drain system in Alameda. Stormwater outfalls are indicated by blue triangles and pump stations by blue squares. The stormwater main lines, which are underground storm sewers that convey floodwaters and discharge either to the lagoons or directly to the Bay, are shown as blue lines.

The model simulated a statistical 10-year rainstorm event based on historic events. In both figures, the model shows where water may overwhelm the stormwater system in a theoretical storm (these are not actual flooding locations).

Red nodes indicate locations where surface flooding is expected to be greater than 1 foot in depth. Yellow nodes indicate locations expected to be 0.5 feet to 1 foot deep. Locations with less than 0.5 feet of flooding are shown in green nodes. These modeled flood nodes were used to consider the risk of stormwater flooding separately from flooding due to sea level rise and storm surge.

As the figures illustrate, flooding over 1 foot deep on the Main Island is located on the western side, along Singleton Avenue and the Webster Street corridor, and along the southern shoreline near Shoreline Drive, and the eastern shoreline on High Street and Fernside Boulevard. On Bay Farm Island flooding

over 1 foot deep is often located at the inlet to the storm drain system. Flooding between 0.5 feet to 1 foot deep is mostly located south of Mecartney Road.

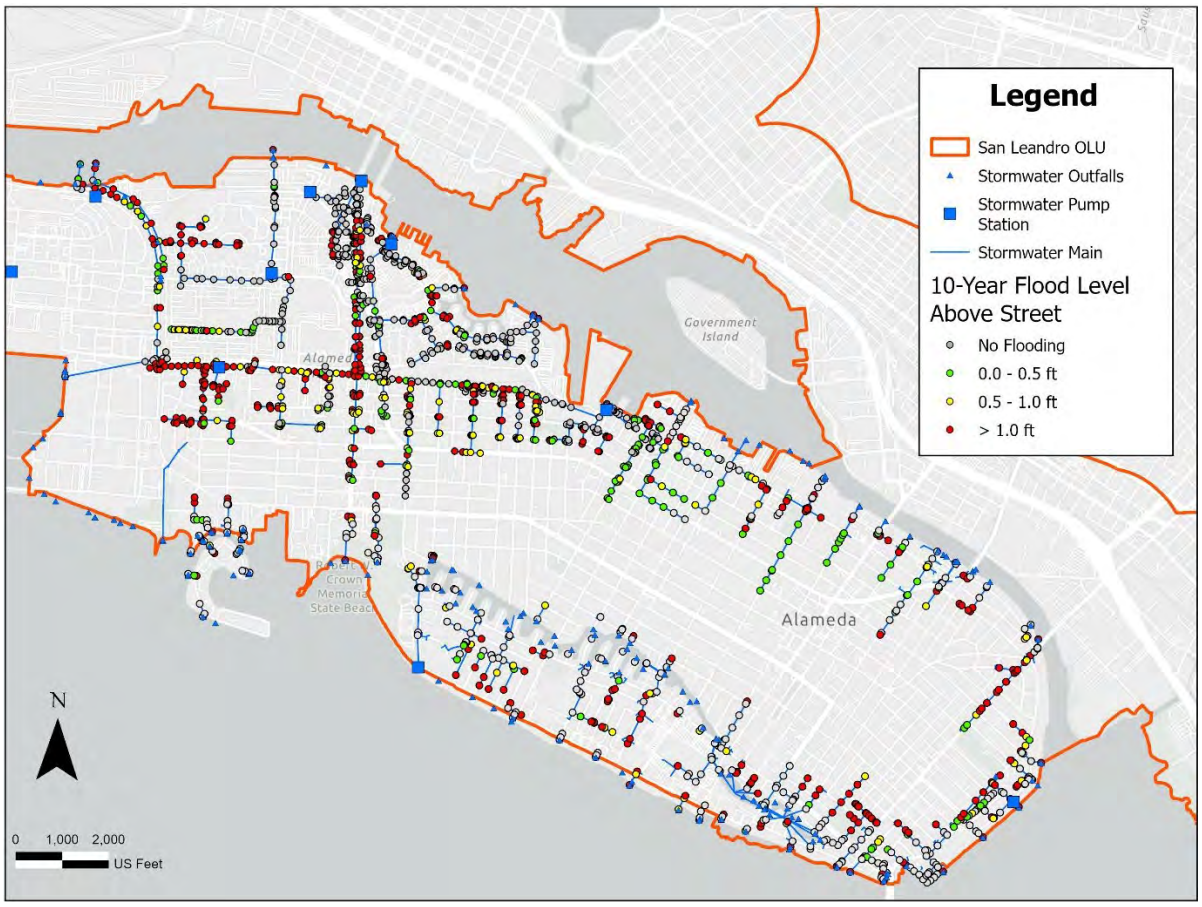



***Figure 4-11 Modeled surface flooding on the main island for a 10-year storm event. Results were filtered to show only locations with modeled flood depths of greater than 0.5 feet above street level. The points shown on this map reflect model node locations***

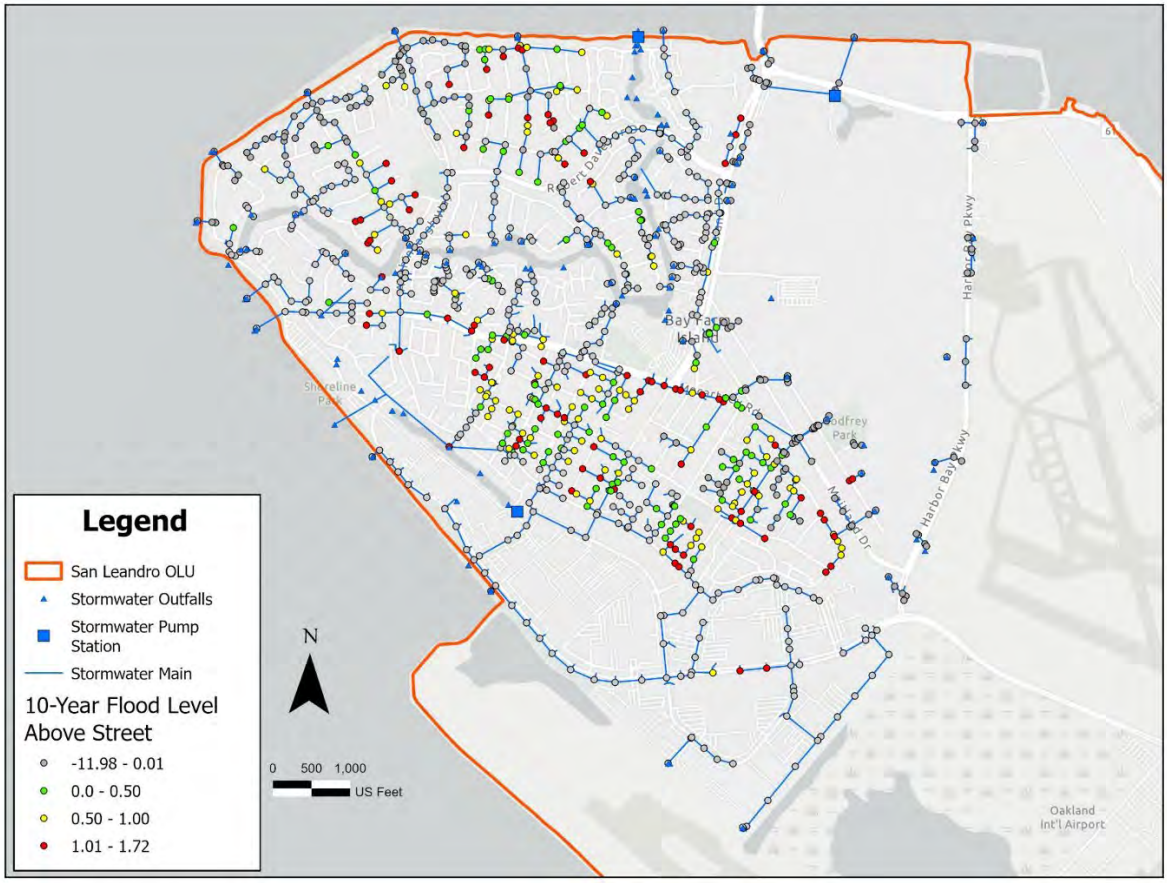



***Figure 4-12 Modeled surface flooding on Bay Farm Island for a 10-year storm event. Results were filtered to show only locations with modeled flood depths of greater than 0.5 feet above street level. The points shown on this map reflect model node locations***

The City has also modeled the existing stormwater collection system and determined what intersections are at risk of flooding during a 10-year storm and 25-year storm due to undersized pipes, undersized pump stations, or the inability to drain during high tides. Maps showing collection system-related flooding potential are shown in Appendix C of the City's Storm Drain Master Plan (2008). The City's storm drain modeling looked at 10 and 25-year storms, which is the normal return period used for storm drain construction. Storms larger than the 25-year storm, but less than the 100-year storm, are intended to be conveyed in the roadways to minimize property damage. However, both subsidence and development have altered overland flow paths on city streets; therefore, some areas of the city may be more prone to flooding than others.

## Groundwater Rise

The Main Island of Alameda and Bay Farm Island are both largely "made land" over former wetlands and tidal lands. As such, the shallow groundwater table is closely tied with the elevation of coastal waters in San Francisco Bay. The groundwater table varies with precipitation events, as the unsaturated ground above the water table can act as a sponge and soak up the rainfall. When the ground becomes fully saturated, rainfall runoff occurs. When subsequent storms occur, and the water table has not had time to reach equilibrium conditions with the Bay, the ground has less capacity to absorb rainfall and precipitation-based flooding occurs more quickly.

In 2020, the City of Alameda analyzed and mapped the elevation of the existing groundwater table to better inform planning decisions related to flood risk reduction [13]. **Figure 4-13** presents the depth to the shallow groundwater table based on updated existing groundwater mapping released in 2023 [14]. The map represent the highest annual groundwater tables – or the response of the groundwater table winter storm events. However, this analysis was completed before the 2022-23 winter season brought record rainfall to the Bay Area; therefore, the highest annual groundwater table is likely higher than shown on **Figure 4-13**.

Emergent groundwater – or groundwater that exceeds the ground surface and creates localized ponding, occurs primarily in the existing lagoon systems (**Figure 4-13**). However, the groundwater table is within 6 feet of the ground surface across substantial areas of the City. In these areas, the groundwater table can reduce storm drain conveyance due to infiltration and can flood below grade infrastructure such as basements.

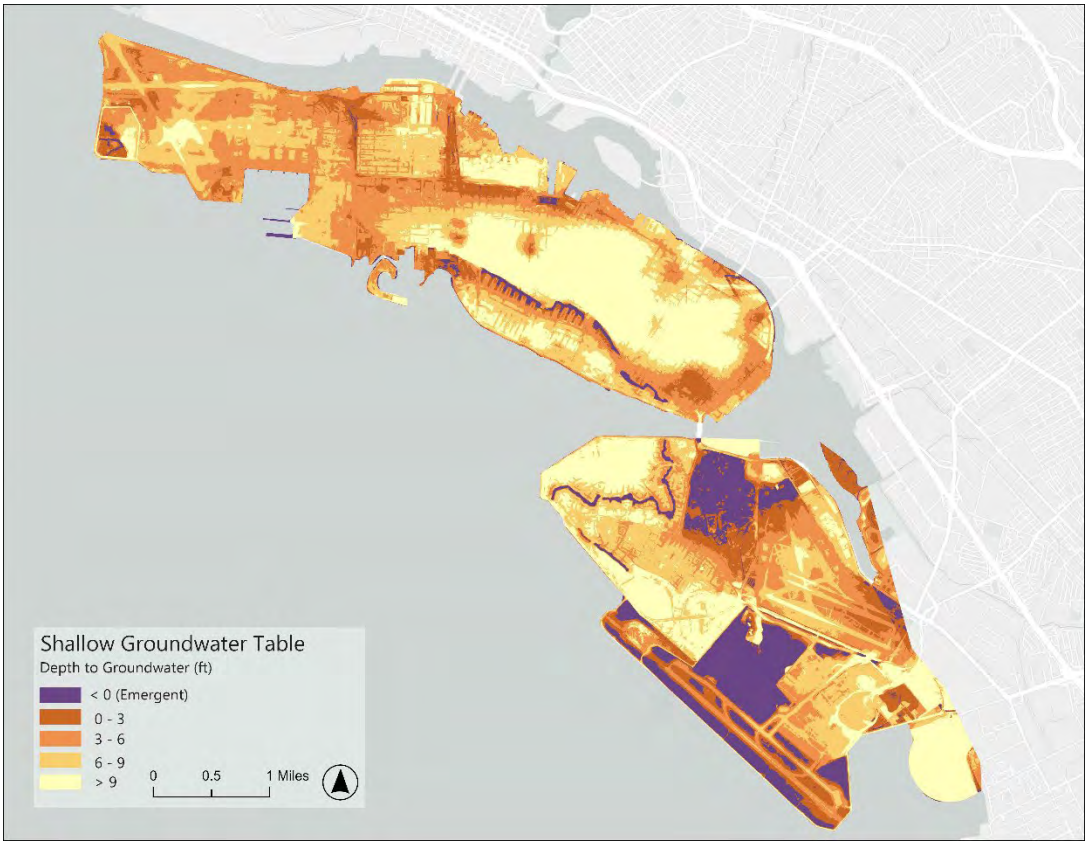



***Figure 4-13 Existing Depth to Shallow Groundwater Table for Alameda***

[13] May, CL, Mohan, A, Hoang, O, Mak, M, & Badet, Y (2020). The Response of the Shallow Groundwater Layer and Contaminants to Sea Level Rise. Report by Silvestrum Climate Associates for the City of Alameda, California. https://doi.org/10.13140/RG.2.2.33390.69445

[14] May CL, Mohan A, Plane E, Ramirez-Lopez D, Mak M, Luchinsky L, Hale T, Hill K. 2022. Shallow Groundwater Response to Sea-Level Rise: Alameda, Marin, San Francisco, and San Mateo Counties. Prepared by Pathways Climate Institute and San Francisco Estuary Institute.

## History

Flooding in Alameda is driven by high coastal water levels, heavy precipitation, or the co-occurrence of high coastal water levels and precipitation. Two types of storm systems bring rainfall to the San Francisco Bay Area, atmospheric rivers (ARs) and extratropical cycles (ETCs). ARs originate in the tropics and can bring light beneficial rain to torrential downpours and high winds. ARs can cause stormwater flooding, but ARs do not contribute to elevated Bay water levels or storm surge. ETCs develop offshore and bring clouds and mild showers to severe gale-force winds, thunderstorms, and heavy rain. ETCs are also associated with low pressure systems that elevate coastal waters above predicted tides. ETCs can cause stormwater flooding, coastal flooding, or compound flooding (the co-occurrence of both flood hazards).

ARs and ETCs on the more hazardous end of the spectrum are associated with an increased risk of flooding in low-lying areas throughout the Bay Area, including Alameda [15]. ARs and ETCs can also co-occur, creating Bomb Cyclone conditions with rapid pressure drops (and higher storm surge conditions), extreme winds, increased wave hazards, and extreme precipitation. Bomb Cyclones can cause coastal flooding, coastal erosion, and stormwater flooding. Back-to-back storm events also contribute to higher groundwater tables, exacerbating flood hazards. Since the last update to the Local Hazard Mitigation Plan there were three State Disaster Declarations involving flooding impacting the City of Alameda[16], including

- January 9, 2023 Severe Winter Storms and Flooding Disaster Declaration (EM-3591-CA)
- January 14, 2023 Severe Winter Storms and Flooding Disaster Declaration (DR-4683-CA)
- April 3, 2023 Severe Winter Storms and Flooding Disaster Declaration (DR-4699-CA).

No state or federal disaster declarations for groundwater rise, coastal erosion or sea level rise that affect the planning area have occurred since the last Local Hazard Mitigation Plan update.

### Coastal Flooding

Extreme coastal water levels are most common between November and March when El Niño conditions can elevate coastal water levels for weeks to months and winter storms can further elevate coastal water levels in response to low atmospheric pressure and heavy winds. Wind and wave set-up along the shoreline can also elevate localized coastal water levels and exacerbate flood conditions. When coastal water levels exceed the shoreline elevation, inland coastal flooding occurs.

Although the 1 percent coastal flood event shown on the effective FEMA FIRMs has not occurred to date, coastal flood waters regularly overtop low points along the shoreline, including along Shoreline Drive, Veterans Court, and Doolittle Drive. Recent years have seen an uptick in National Weather Service flood advisories due to high coastal water levels during both king tides and winter storm events. However, flooding in low-lying areas is typically the result of both elevated coastal water levels and precipitation-driven flooding.

### Coastal Erosion

The Main Island of Alameda and Bay Farm Island have both natural or “soft” shorelines and armored shorelines protected by seawalls, engineered revetments, and riprap. Shorelines are typically armored to prevent coastal erosion – either due to regular tidal action, storm-driven tides and winds, or boat wakes.

[15] San Francisco Bay Area Extreme Precipitation in a Warmer World. Volume 1: State of the Science. https://www.sfpuc.gov/about-us/reports/san-francisco-bay-area-precipitation-warmer-world
[16] FEMA Disaster Declarations for States and Counties. https://www.fema.gov/data-visualization/disaster-declarations-states-and-counties

Alameda's soft shorelines, such as South Shore and Crown Beach and the northern shoreline of Bay Farm Island are at greatest risk of erosion.

In 1981, storms eroded Crown Beach up to the edge of Shoreline Drive. During the El Niño winter of 1997-98, there was up to 2 feet of standing water on Main Street due to elevated Bay water levels and heavy precipitation during an AR-ETC combination storm event. And in 2006, storm waves damaged the Harbor Bay Ferry Terminal and washed away portions of the adjoining Coastal Trail. These events were relatively minor in terms of damage, and none involved structures. However, there is the potential for more extensive flooding and erosion.

Recent storm events, such as the Bomb Cyclone that occurred in October 2021 and the series of ARs, ETCs, and at least one Bomb Cyclone in the 2022-23 winter season caused substantial event-based erosion of soft shorelines. Erosion of South Shore Beach between Willow Street and Kitty Hawk Drive extends into the vegetated sand dunes and protecting Shoreline Drive, resulting in a loss of recreational space, valuable habitats, and threatening existing infrastructure. Erosion is also pronounced along the northern Bay Farm Island shoreline, with some areas experiencing 10 to 15 feet of erosion during the recent winter storms. The ongoing erosion is threatening the San Francisco Bay Trail and parks and open space.

## Stormwater Flooding

California has a history of megafloods, or outburst floods, with the largest storm on record considered to be the 1861-62 megaflood that destroyed a quarter of California's economy. However, California's development, land use and network of levees have substantially changed the landscape compared with 1861-1862 conditions. Record keeping and measurements have improved considerably over the past 150 years. For example, the rainfall recorded in San Francisco on Dec 31, 2022 exceeded previous records extending back to 1849, kicking off one of the wettest years on record throughout the Bay Area.

Of the thirteen costliest California storm seasons between 1949 and 2023, two were very strong El Niño winters (1982-83, and 1997-1998), which correspond with two of the highest Bay water elevations on record. Three were weak-moderate El Niño winters (1968-69, 1979-80, 1994-1995), four were neutral (1981-1982, 1985-86, 1992-93, and 1996-97), and four were weak-moderate La Niña winters (1955-56, 1964-65, 2016-17, 2022-23). The winter seasons with the costliest damage were (1994-95) a weak-moderate El Niño with 100-year to 1,000-year rainfall events [17], and (2022-23) a weak-moderate La Niña with 31 ARs impacting the West Coast between October 2022 and March 2023. In any given year, El Niño or not, there could potentially be a severe rainfall event. With the increased understanding and tracking of extreme storms, these events will become easier to predict and prepare for.

The most problematic recurring flooding location in the city was alleviated in 2021, which involved construction of two relief manholes in the Crown Beach sand dune area. The manholes were constructed in line with two culvert outfalls from Shoreline Drive and have their grates at a lower elevation than the catch basin grates feeding the outfalls within Shoreline Drive. This prevents Shoreline Drive and Kitty Hawk Road from flooding during a combination of large rain events and clogged outfall pipes, which maintenance crews had historically struggled with every wet season. However, this same area is also at risk of coastal erosion.

[17] El Niño and La Niña, Relationship to California Flood Damage 1949-50 to 2022-23: https://ggweather.com/enso/calif_flood.htm

In the winter of 2022 to 2023, early weather predictions for the season suggested California would experience low precipitation accumulations relative to average conditions, consistent with moderate La Niña conditions. However, the 2022-2023 winter season quickly became one of the wettest winters on record. The Bay Area was hit with nine back-to-back ARs, ETCs, and Cyclone Bombs between December 26, 2022, and January 16, 2023, with Alameda experiencing the most flooding impacts on December 31, 2022. The Bay experienced continued ARs and extreme rainfall events through March 2023. The Alameda Post weather station recorded over 5 inches of rain on New Year's Eve which quickly overwhelmed storm drains and caused stormwater flooding. Alameda experienced several roads closures due to excessive flooding, including the intersection of Webster Street and Willie Stargell Avenue and Harbor Bay Parkway, with some lasting several days. The excess stormwater also caused a pump station to fail, resulting in flooding along Fernside Boulevard.

## Groundwater

At present, the high groundwater table is not a direct contributor to flood conditions on its own. However, the stormwater flooding that occurred in the 2022-23 winter season was exacerbated by a prolonged high groundwater table due to the length of the rainy season and the number of storms that brought measurable rainfall to Alameda and the Bay Area.

An analysis of the highest annual groundwater table elevation between 2000 and 2020, compared to the elevation of groundwater table after the 2022-23 storm season, shows that on average the groundwater table was 1.8 feet higher after the 2022-23 storm season. This analysis relied on observations collected at 1,200 monitoring wells in and around Alameda that are part of the California State Water Resources Control Board's (SWRCBs) Groundwater Ambient Monitoring and Assessment Program, using observational data available through SWRCB's GeoTracker [18]. 993 wells (out of 1,200) were observed to have a higher groundwater table after the 2022-23 storm season than observed between 2000 and 2020. The highest annual groundwater table shown on **Figure 4-13** is based on well observations between 2000 and 2020 (i.e., does not account for the 2022-23 storm season). This would require an updated groundwater analysis to capture well observations post 2020 for the City of Alameda.

207 wells (out of 1,200) were observed to have a lower groundwater table after the 2022-23 storm season than observed between 2000 and 2020. Groundwater table elevations can vary significantly depending on soil characteristics and geology, impervious verses pervious ground surfaces, groundwater flow rates, groundwater pumping, and other factors. An in-depth comparison of groundwater table elevation is also limited by the number of well observations collected each year. Most wells are monitored twice per year, at the end of the summer or early fall when the groundwater table is generally at its lowest, and late spring or early summer when the groundwater table is generally at its highest (if significant rain occurred over the previous winter). A more accurate representation of the highest annual groundwater table would require more frequent monitoring.

## FEMA NFIP Claims

As of September 2024, FEMA's National Flood Insurance Program (NFIP) Claims Dashboard shows that FEMA has 46 flood loss claims for the City of Alameda (Community ID# 060002) since 1970. There is currently one Repetitive Loss (RL) residential structure and zero Severe Repetitive Loss (SRL) residential structures in the City of Alameda.

- 32 of claims were in winter 2022/2023

[18] https://geotracker.waterboards.ca.gov/

- 3 occurred during the October 2021 Cyclone Bomb
- 6 occurred during the strong El Nino winters that resulted in Baywide flooding 1982/83 and 1997/1998
- 5 others

Seven claims from 2022/2023 storms were rejected. Five others were rejected in 1983, 1998, 2001, 2017, and 2018. The total payout of claims from 1970 to 2021 was $30,865. The total payout from 2021 to 2023 was $641,501. Both the number of claims and total payout have increased dramatically in the past 3 years compared to the previous 51 years.

# Probability of Future Flooding

Existing flood conditions, such as those analyzed and mapped by FEMA, can be viewed as a potential and temporary condition, induced by a storm event that has a beginning and an end. In the future, sea level rise will increase Bay water levels, increasing areas that could be flooded by daily high tides, and resulting in coastal flood events that extend further inland with greater flood depths. Extreme precipitation events are also increasing in intensity, which could increase the potential for stormwater flooding across the city. It is anticipated that future storm surge, higher sea levels, elevated groundwater levels, and heavier rainfall during storm events will have a compound effect on increasing flooding scenarios within the city. There is a 1% likelihood of flooding from a 100-year storm occurring each year, a 2% chance of a 50-year storm occurring each year, and a 4% chance of a 25-year storm occurring each year. The State of California considers sea level rise of 3 feet by 2100 likely or of a 66% probability.[19]

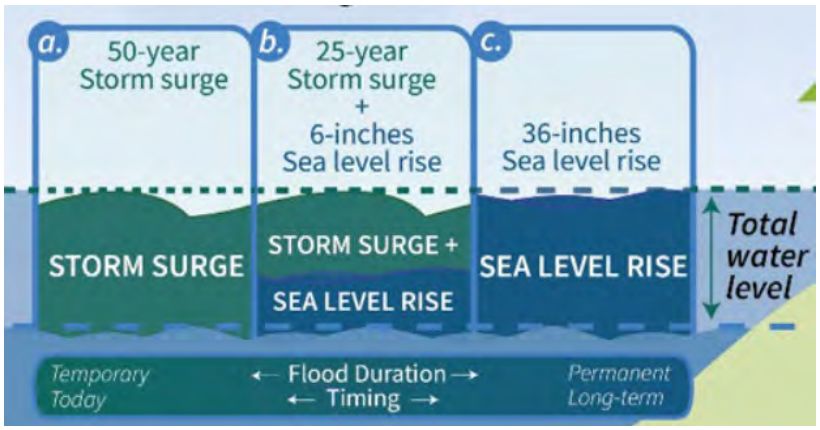
## Coastal Flooding

### Total Water Level vs. Sea Level Rise

The impacts associated with sea level rise related flooding use the inundation mapping developed by the San Francisco Bay Conservation and Development Commission's (BCDC) Adapting to Rising Tides (ART) program [20]. The ART mapping uses a total water level [21] (TWL) approach that allows one map to represent many potential futures, or many different combinations of storm surge return periods (e.g., 25-year, 50-year, 100-year) and sea level rise, above today's MHHW level. For example, a total water level of 36 inches above today's high tide can result from any of the following (as shown in **Figure 4-14**):

- 50-year storm event today
- 6 inches of sea level rise plus a 25-year storm event in the short term (6 inches sea level rise likely by 2030)
- 36 inches of sea level rise (around 2060–2070)

[19] State of California Sea Level Rise Guidance, 2024 Science and Policy Update: https://opc.ca.gov/wp-content/uploads/2024/05/California-Sea-Level-Rise-Guidance-2024-508.pdf
[20] https://explorer.adaptingtorisingtides.org/home
[21] Note that this use of total water level differs from FEMA's standard use of total water level which considers the impact of waves and wave runup along the shoreline.

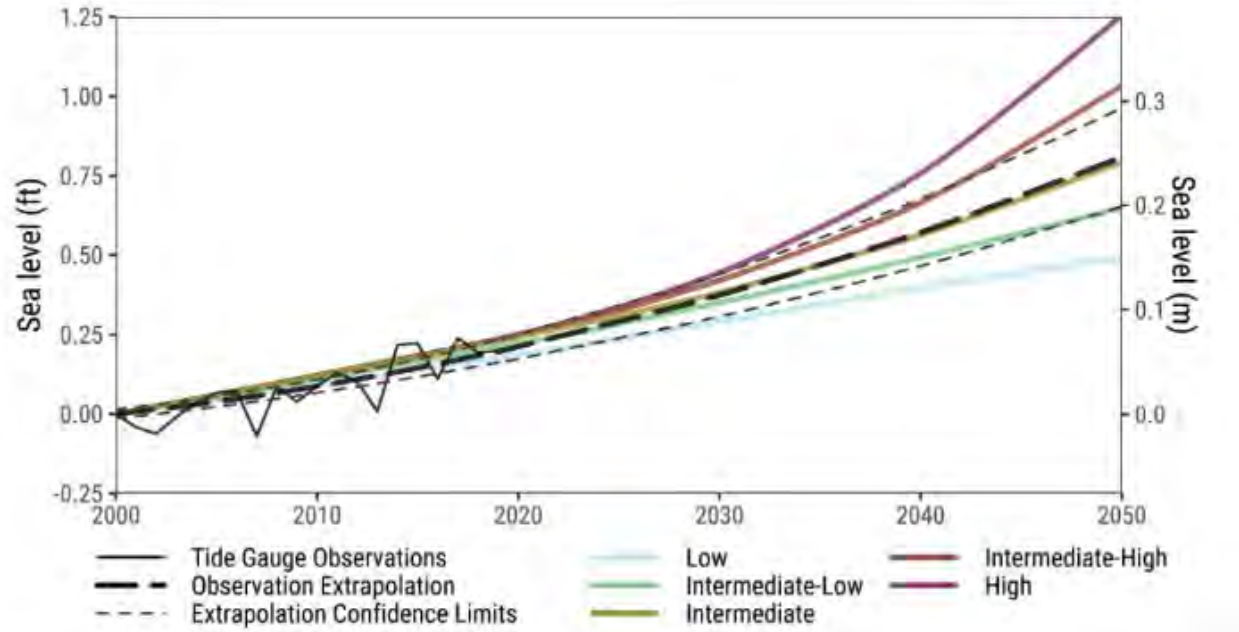



(Credit: BCDC Adapting to Rising Tides)

***Figure 4-14 Total Water Level as a Combination of Sea Level Rise and Storm Surge***

## Coastal Flooding Scenarios and their Potential Timing

Table 4-5 presents the main TWL projections shown on **Figure 4-14,** as well as additional projections, their respective elevations in feet NAVD88, the various flood scenarios represented by these TWLs, and the anticipated timing for these projections. **Table 4-6** presents the 2024 sea level rise projections recommended by the California Ocean Protection Council for San Francisco Bay.




*Source: Sweet et al. (2022), Collini et al. (2022)*

*Average annual water levels from tide gages are overlaid for context. The extrapolation confidence limits represent the 17th and 83rd percentile confidence interval for the observation-based extrapolations.*

***Figure 4-15 Southwest Region (California and Southern Oregon) Sea Level Rise Scenarios and Observation-based Extrapolations***

The updated sea level rise projections produced by the Federal Interagency Sea Level Rise Task Force suggest that California sea level rise is following the Intermediate curve.[22] **Figure 4-15** shows the sea level rise scenarios, along with an observation-based extrapolation of tide gage and satellite observations. This extrapolation is not extended past 2050, as the observed rate of sea level rise is based on past conditions, and with continued greenhouse gas emissions, the rate of sea level rise is likely to continue increasing. By 2050, California is likely to observe 9 to 12 inches of sea level rise. By 2100, assuming 3 degrees Celsius of warming, if California sea level rise continues to trend along the Intermediate scenario, there is a 5% probability of exceeding 4 feet of sea level rise (**Figure 4-15**). Higher rates of sea level rise could occur if greenhouse gas emissions continue to follow a very high emission scenario, coupled with rapid ice sheet melt and ice sheet disintegration.[23]

***Table 4-5 Total Water Levels, Flooding Scenarios, and Timing for Sea Level Rise Projections***

| TWL | Elevation (NAVD88) | Flooding Scenarios:<br>Sea Level Rise + Storm Surge | Approximate Timing for SLR Projections |
|---|---|---|---|
| MHHW + 36” | ~9.5 feet | 50-year storm<br>6” SLR + 25-year storm<br>12” SLR + 5-year storm<br>18” SLR + 2-year storm<br>24” SLR + king tide<br>36” SLR | Today (storm risk)<br>2030<br>2045<br>2050<br>2050<br>2070 |
| MHHW + 42” | ~10 feet (base flood elevation) | 100-year storm [24]<br>42” SLR | Today (storm risk)<br>2075 |
| MHHW + 66” | ~12 feet | 24” SLR + 100-year storm<br>30” SLR + 50-year storm<br>36” SLR + 25-year storm<br>42” SLR + 5-year storm<br>48” SLR + 2-year storm<br>52” SLR + king tide<br>66” SLR | 2050<br>2065<br>2070<br>2075<br>2080<br>2085<br>2100 |
| MHHW + 108” | ~15.5 feet | 66” SLR + 100-year storm | 2100 |
| MHHW + 124” | ~16.75 feet | 84” SLR + 100-year storm | 2100+ |

Note: Flooding scenarios and combinations are from the Adapting to Rising Tides Bay Area Sea Level Rise Analysis and Mapping Project. The timing of the sea level rise projections correspond roughly to the High scenario from the State of California Sea Level Rise Guidance, 2024 Science and Policy Update, as shown on Table 4-6 [25]

[22] Collini et al. 2022; Sweet et al. 2022
[23] Collini et al. 2022; Sweet et al. 2022
[24] The effective FEMA FIRMs depict the 1 percent annual chance coastal flood conditions for existing conditions, which corresponds to TWL of today’s MHHW plus 42 inches.
[25] State of California Sea Level Rise Guidance, 2024 Science and Policy Update: https://opc.ca.gov/wp-content/uploads/2024/05/California-Sea-Level-Rise-Guidance-2024-508.pdf

*Table 4-6 Sea Level Scenarios (in feet) for Alameda*

| Year | Intermediate | Intermediate-High | High |
|---|---|---|---|
| 2020 | 0.2 | 0.3 | 0.3 |
| 2030 | 0.4 | 0.4 | 0.4 |
| 2040 | 0.6 | 0.7 | 0.8 |
| 2050 | 0.8 | 1.0 | 1.3 |
| 2060 | 1.1 | 1.5 | 2.0 |
| 2070 | 1.4 | 2.2 | 2.9 |
| 2080 | 1.8 | 3.0 | 4.1 |
| 2090 | 2.4 | 3.8 | 5.3 |
| 2100 | 3.1 | 4.8 | 6.5 |

*Source:* State of California Sea Level Rise Guidance, 2024 Science and Policy Update[21]

Based on the 2024 OPC guidance, for a project intended to function through 2080, the project would consider designing and/or adapting to 2.0, 3.0, and 4.1 feet of sea level rise, respectively. OPC also recommends consideration of coastal flooding (i.e., 1-percent annual chance coastal flood event), wave hazards, shoreline erosion, and rising groundwater levels in addition to sea level rise. FEMA certified flood protection projects must also include 1 foot of freeboard.

The City of Alameda recommends using an adaptation pathways approach and planning for at least 50-years of sea level rise using the Intermediate scenario coupled with the 1-percent annual chance coastal flood event and including capacity for future adaptation improvements that address the Intermediate-High and High scenarios over the project's time horizon. Projects should also consider the increased risks that sea-level and groundwater rise, as well as changing weather patterns, would bring for tsunamis, liquefaction, and rainfall events. All projects should reference the latest OPC sea level rise guidance for confirmation on the rates of rise associated with the Intermediate, Intermediate-High, and High scenarios over a project's time horizon.

## Future Coastal Total Water Level Mapping

**Figure 4-15** depicts coastal flooding and/or permanent sea level rise inundation for four TWL scenarios: today's MHHW plus 24 inches, 36 inches, 66 inches, and 84 inches for the Main Island and Bay Farm Island, respectively.

With a TWL of 24 inches above today's MHHW, the Main Island could experience flooding impacts on Main Street and Alameda Point, particularly the Barbers Point Road residential area to the north and the wetland/tarmac area along the southern shore. For Bay Farm Island, Doolittle Drive adjacent to Oakland International Airport could flood.

With a TWL of 36 inches, flooding is more extensive, but the flooding is less than shown on the effective FEMA FIRMs (refer to Coastal Flooding section). This is because a TWL of 36 inches is just a few tenths of a foot lower than the BFE shown on the FIRMs. On Bay Farm Island, residential flooding is limited to the properties adjacent to the lagoons and to the south of the Chuck Corica Golf Course.

With a TWL of 66 inches, about one-third of Alameda Point could flood, with flooding reaching as far as the Marina Village Parkway neighborhood. The South Shore area, Crown Beach, and the eastern residential areas of the main island are all inundated. The flooding on Bay Farm Island also increases, with flooding reaching as far inland as Mecartney Road.

Finally, with a TWL of 84 inches, the western half of the Main Island is nearly flooded, as well as the entire South Shore area, and parts of the East and northern end of the island. The central portion of the island remains unflooded. Bay Farm Island is approximately 70 percent flooded. Few upland areas remain unflooded.




***Figure 4-16 Maps depicting inundation for MHHW (6.4 feet NAVD88) plus 24 in, 36 in, 66 in, and 84 in total water level scenarios for the Main Island and Bay Farm Island.***

## Coastal Flooding

If the 1 percent annual chance coastal flood occurred, floodwater could enter the Webster and Posey Tube portals that connect the cities of Alameda and Oakland through a tube that extends under the estuary channel. The floodwaters would impact Webster Street to the intersection of Atlantic Avenue by the College of Alameda, affecting commercial businesses, and to a lesser extent residential buildings. While land elevation ranges between 5 feet and 10 feet NAVD88 within this area, elevations of developed properties are generally between 7 feet to 10 feet NAVD88, meaning the depth of flooding would be limited to 3 feet or less for these properties (depending on the location). The impact on the Webster and Posey Tubes would be more severe. The tubes descend to a depth such that the top of the tubes is at least 40 feet beneath the northern shoreline ground surface. The extent of flooding within the tubes would depend on the elevation of floodwaters and the duration of the flood event.

Along the eastern shoreline, the 1 percent annual chance coastal flood could impact about 250 residential homes in the Fernside Boulevard / Liberty Avenue neighborhoods. Ground elevations range between 8 feet and 10 feet NAVD88 in this area, meaning flood depths near most residential structures would be limited to 2 feet or less

On Alameda Point, the 1 percent annual chance coastal flood event can flood numerous commercial businesses, industrial, residential, and City-owned properties, and federal lands such as the Least Tern nesting habitat on the former airfield tarmac. While elevations can be found as low as 5 feet NAVD88 on undeveloped properties on Alameda Point, elevations of developed properties are generally between 8 feet to 10 feet NAVD88, meaning flood depths of most structures would be limited to 2 feet or less

On Bay Farm Island, the 1 percent annual chance floodplain impacts over 600 homes. Properties on Island Drive and Maitland Drive (south of the Chuck Corica Golf Course) are at the lowest ground elevations, as low as 2 feet NAVD88. This means the event on Bay Farm Island could result in flood depths as great as 8 feet in these locations. However, several hundred of these homes are located along Lagoon System 1 North and are generally between 8 feet and 10 feet NAVD88 in elevation, meaning they would be subjected to a flood depth of 2 feet or less.

Note that roadways serving the areas described above would also be flooded to various depths depending on their elevations. Roadways along the northern shoreline, eastern shoreline, and Alameda Point areas will all experience flooding to a different degree. Similarly, the three major roadways that provide egress from Bay Farm Island to the Main Island (and Oakland via Doolittle Drive) will experience flooding to various degrees. This is explained in further detail in the detailed Subregional Flood Exposure and Vulnerability: A Sea Level Rise and Coastal Flood Exposure Assessment and Vulnerability Considerations for the Oakland-Alameda Subregion (**Appendix F)**. Priority Coastal Inundation Locations are summarized in **Chapter 5**.

Flooding can impact structures, yards, and roadways, causing disruption, loss of use, and damage to contents of residences, commercial establishments, schools, and other buildings. Floodwaters can damage underground utility boxes, prevent emergency circulation if streets are blocked, and release of hazardous material leachates. Recovery efforts may include removal of water, mud and debris; removal of moldy building material; repair of saltwater damage to electrical and telecommunication facilities; and replacement of goods and furniture stored in low-lying areas. High winds with storms can damage or

knock down trees onto streets, power lines or buildings, exacerbating storm-driven impacts and increasing recovery times. Storms combined with high tides can also cause coastal erosion, beach loss, habitat loss, shoreline street damage, shoreline trail damage, and marina damage.

As sea levels rise, inland flooding and the impacts described above will occur more frequently and will affect more infrastructure and residential, commercial, and industrial structures.

## Coastal Erosion

Wave hazards along the exposed Alameda shorelines are primarily depth limited. As coastal water elevations rise and create deeper water conditions, larger waves may propagate towards the shoreline increasing the potential for coastal erosion. All shorelines will experience increasing tidal, storm surge, and wave-driven erosion at higher elevations.

## Stormwater Flooding

As the climate warms, extreme rainfall events are becoming more intense, meaning they are bringing more rainfall, with the greatest increase occurring during shorter durations (e.g., 3-hour, 6-hour) which has significant implications for overwhelming sewer systems and flash flooding [26]. **Table 4-7** presents expected increases in rainfall for the 10-year and 100-year storm events associated with a highest emissions scenario evaluated by the Intergovernmental Panel on Climate Change (SSP5-85). By 2100, the 10-year, 3-hour rainfall event could bring 57 percent more rain, compared to the 10-year, 24-hour event which could bring 41 percent more rain.

Alameda's storm drain system is designed considering a static climate, meaning the projected changes shown in **Table 4-7** are not currently considered when evaluated storm drain improvements. However, storm drain systems are generally not designed to convey the 100-year event, and the level of increase in future storms may be beyond the capacity for most cities to convey underground.

Alameda's Storm Drain Master Plan has identified multiple improvements that will reduce stormwater flood risks, and the City has evaluated the impacts of rising sea levels on the system, including the gravity outfalls which discharge directly to the Bay. Alameda's Storm Drain Master Plan update should consider sensitivity testing related to future increased precipitation, and evaluate alternative approaches for stormwater flood risk mitigation, such as stormwater detention basins.

***Table 4-7 Summary of Total San Francisco Bay Area Rainfall Percent Increase***

| Frequency | Duration | 2050 | 2100 |
|---|---|---|---|
| 10-year | 3-hour | +22% | +57% |
| | 24-hour | +18% | +41% |
| 100-year | 3-hour | +26% | +67% |
| | 24-hour | +22% | +51% |

Source: San Francisco Bay Area Precipitation in a Warmer World Volume 1: State of the Science 2023, for the High Emission Scenario (SSP5-85)

[26] Mak, M, Neher, J, May CL, Finzi Hart J, Wehner M, Patricola, C. San Francisco Bay Area Precipitation in a Warmer World. Volume 2: Future Precipitation Intensity, Duration, and Frequency. Prepared for the City and County of San Francisco.

## Groundwater

Alameda's shallow groundwater table will rise as sea level rises [27]. **Figure 4-16** shows the relationship between sea level rise and groundwater in low-lying areas adjacent to the coast. As sea level rises the freshwater lens rises as well – even in areas that are not hydrologically connected to the ocean. The magnitude of groundwater rise due to sea level rise varies based on local geology and hydrology.

Rising groundwater tables can impact coastal communities long before the groundwater rises above ground and causes emergent flooding. The rising groundwater table can increase infiltration into the storm drain system, reducing its conveyance capacity. It will also decrease the amount of unsaturated soil above the water table capable of soaking up precipitation, resulting in faster rainfall runoff. The rising groundwater table will also interact with other underground infrastructure, such as building foundations, roadway subgrades, and utilities.

A large proportion of infrastructure is built within 6 feet of the ground surface, including most essential utilities and residential basements. Many Alamedans already experience basement flooding, where groundwater seeps in through cracks in the walls or foundations (see **Figure 4-17**). As sea levels rise and extreme storm events bring more rainfall, basement flooding will increase. Residents have already noted an increased need to run basement sump pumps, including some locations where sump pumps may run for many months of the year, including into the dry season.

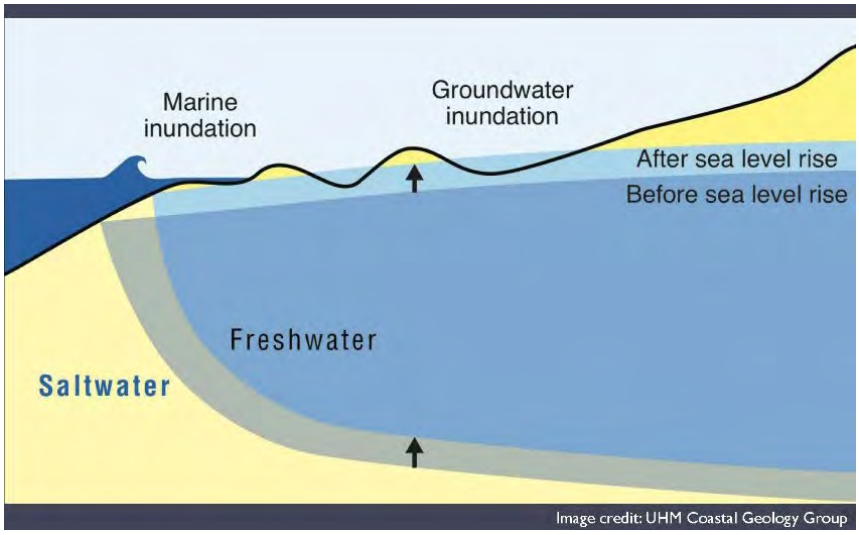



***Figure 4-17 Conceptual diagram of the relationship between sea level rise and groundwater, highlighting the potential for flooding and inundation to occur in shallow areas that are not hydrologically connected to the ocean (Habel et al., 2017).***

[27] May CL, Mohan A, Plane E, Ramirez-Lopez D, Mak M, Luchinsky L, Hale T, Hill K. 2022. Shallow Groundwater Response to Sea-Level Rise: Alameda, Marin, San Francisco, and San Mateo Counties. Prepared by Pathways Climate Institute and San Francisco Estuary Institute.

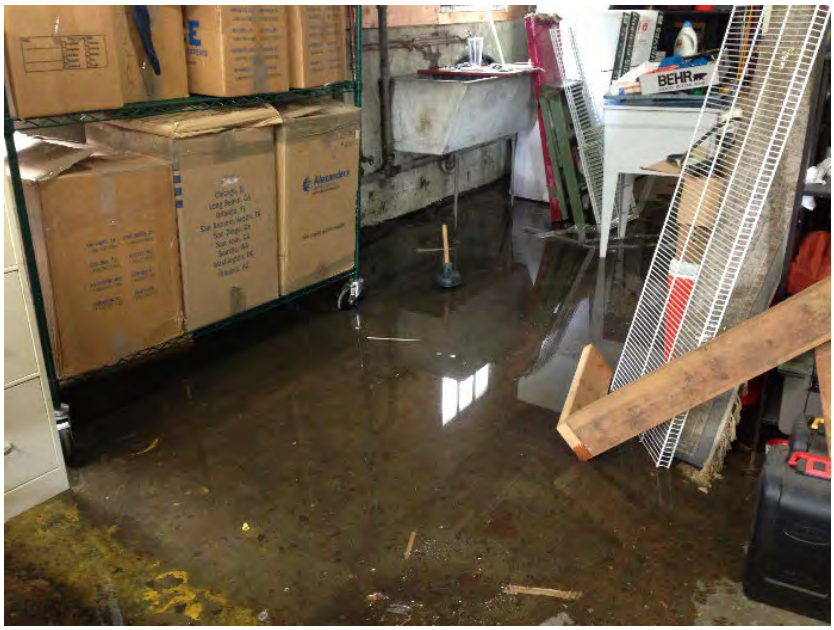


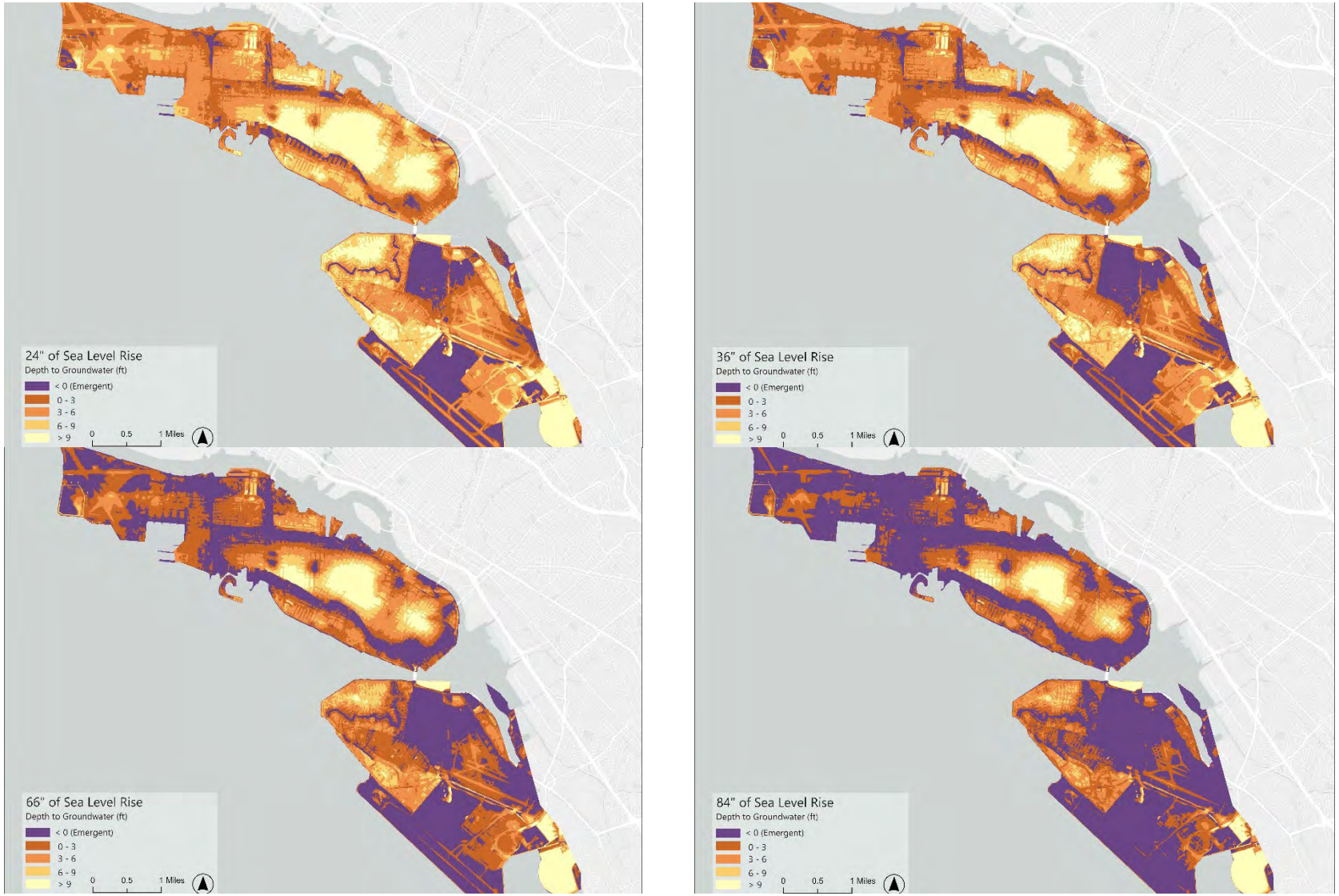

Photo Credit: Arthaey Angosii

***Figure 4-18 Example of Basement Flooding***

**Figure 4-13** depicts the existing shallow groundwater table in Alameda, representing the highest annual groundwater table elevation. The highest annual groundwater table elevation is typically used to inform the design of foundations and belowground infrastructure. **Figure 4-18** depicts how the depth to the groundwater table decreases as the groundwater tables rises in response to sea level rise. Structures and infrastructure located in areas where the existing depth to groundwater is greater than 6 feet (**Figure 4-13**) may not be designed to withstand a fluctuated groundwater table with sea level rise. **Figure 4-19** depicts areas where emergent groundwater – or permanent surface ponding – could become more common with 24, 36, 66, and 84-inch sea level rise scenarios. The emergent groundwater scenario is based on the 36-inch SLR scenario which has a 66% chance of occurring by 2100 based on the State of California's projection.[28]

The Chuck Corica Golf Course is shown as an area with emergent groundwater risks today; however, the groundwater analysis and mapping does not consider the recent imported fill and raised grades that have changed the flood risk of the golf course.

[28] State of California Sea Level Rise Guidance, 2024 Science and Policy Update: https://opc.ca.gov/wp-content/uploads/2024/05/California-Sea-Level-Rise-Guidance-2024-508.pdf




*Source: Shallow Groundwater Response to Sea Level Rise, 2022.*

***Figure 4-19 Depth to Groundwater with 24, 36, 66 and 84 inches of Sea Level Rise***




*Source: Shallow Groundwater Response to Sea Level Rise, 2022.*

***Figure 4-20 Emergent Groundwater with 24, 36, 66 and 84 inches of Sea Level Rise***

# Tsunamis

## Hazard Description

Tsunami waves are triggered by sudden displacement of large volumes of water, most commonly caused by large underwater earthquakes, but can also be caused by submarine landslides, volcanic activity, or other disturbances.[29] Tsunami waves typically do not "break" like normal surf waves. Instead, they often rush ashore as a rapidly rising surge of water, like a fast-moving tide, with powerful currents that can extend much farther inland than normal tides. Even small waves (low amplitudes) can produce dangerous currents, especially in harbors and near shorelines. This is why Tsunami Advisories focus on currents rather than flooding.

Tsunamis impacting Alameda can result from offshore earthquakes within the Bay Area, or from distant offshore subduction faults such as those in the Pacific Northwest, Alaska, Japan and South America. The greatest risk to Alameda is from events in distant locations, including the Cascadia subduction zone and the Aleutian Islands. These events could generate significant tsunami waves that would reach Alameda, providing several hours or more warning time for evacuation.

Local tsunamis could theoretically be generated from offshore earthquakes or submarine landslides within the Bay Area, which would provide little warning time. However, these faults are not likely to produce significant tsunamis because they primarily move horizontally, producing little vertical displacement of the seafloor and therefore a low likelihood of generating significant tsunamis. The risk of a significant tsunami generated by local Bay Area faults is considered low compared to distant subduction-zone sources.

### The Warning System

When a potential tsunami occurs, the National Tsunami Warning Center (NTWC) issues bulletins to provide alerts to state and local jurisdictions. These bulletins are based on rapid analysis of earthquake magnitude, location, and depth using over 1,000 seismic stations, typically within minutes. Initial alerts are based on seismic data only and are followed with updates incorporating sea-level gauges and tsunami forecast models to refine the threat.

There are four levels of "alert" that can be sent by the NTWC (from least to greatest significance):

- **Tsunami Information Statement**: Issued to inform and update emergency managers and the public that an earthquake has occurred, or that a tsunami Watch, Advisory or Warning has been issued elsewhere in the ocean.
- **Tsunami Watch**: Issued to alert emergency managers and the public of an event which may later impact the Watch area coastline. May be upgraded to an Advisory or Warning (or canceled) based on updated information and analysis.
- **Tsunami Advisory**: Issued due to the threat of a tsunami which may produce strong currents or waves dangerous to those in or near the water; typically called when forecasted tsunami amplitudes between 0.3m and 1m (1ft and 3ft) above existing tidal conditions are expected. Coastal communities are advised that beach and harbor areas could expect rapid, moderate tidal changes and strong currents.
- **Tsunami Warning**: Issued when a tsunami with significant widespread inundation is imminent or expected; typically called when forecasted tsunami amplitudes are equal to or greater than

[29] See: USGS, What are tsunamis?

1m (3ft). Coastal communities are advised to evacuate people from low-lying areas identified as vulnerable to tsunamis.

Visit http://ntwc.arh.noaa.gov/ for current tsunami alert bulletins.

## Location and Extent

The Tsunami Hazard Area Map shown in **Figure 4-21** was developed by the California Geological Survey in partnership with the California Governor's Office of Emergency Services. The map identifies areas (shown in yellow) that could be inundated by tsunamis generated by a suite of credible extreme tsunami scenarios.[30]

The map and its associated data are based on the best available scientific information, including the State of California's 2009 Tsunami Inundation Maps for Emergency Planning and enhanced high-resolution modeling using a 975-year return period probabilistic tsunami scenario. In addition, the mapped boundaries have been expanded to account for potential local tsunami sources not captured in probabilistic models.

To improve usability for emergency response, hazard boundaries are also adjusted to align with recognizable geographic features such as streets. Local stakeholders—including emergency managers, first responders, and subject matter experts—are consulted to ensure the final hazard areas support safe and effective evacuation.

The area of Alameda within the tsunami inundation zone includes most of the Alameda Main Island, except an area in the center of the island between 3rd Street and Fernside Blvd, and Clement St and Clinton St, and all of Bay Farm Island (see map below for more detail).The Tsunami Hazard Area Map supports the development of evacuation routes, public safety planning, and local tsunami response procedures, including the Tsunami Evacuation Playbooks developed for Alameda County.

[30] State of California, 2021. Tsunami Hazard Area Map, Alameda County; produced by the California Geological Survey and the California Governor's Office of Emergency Services; dated 2021, displayed at multiple scales.

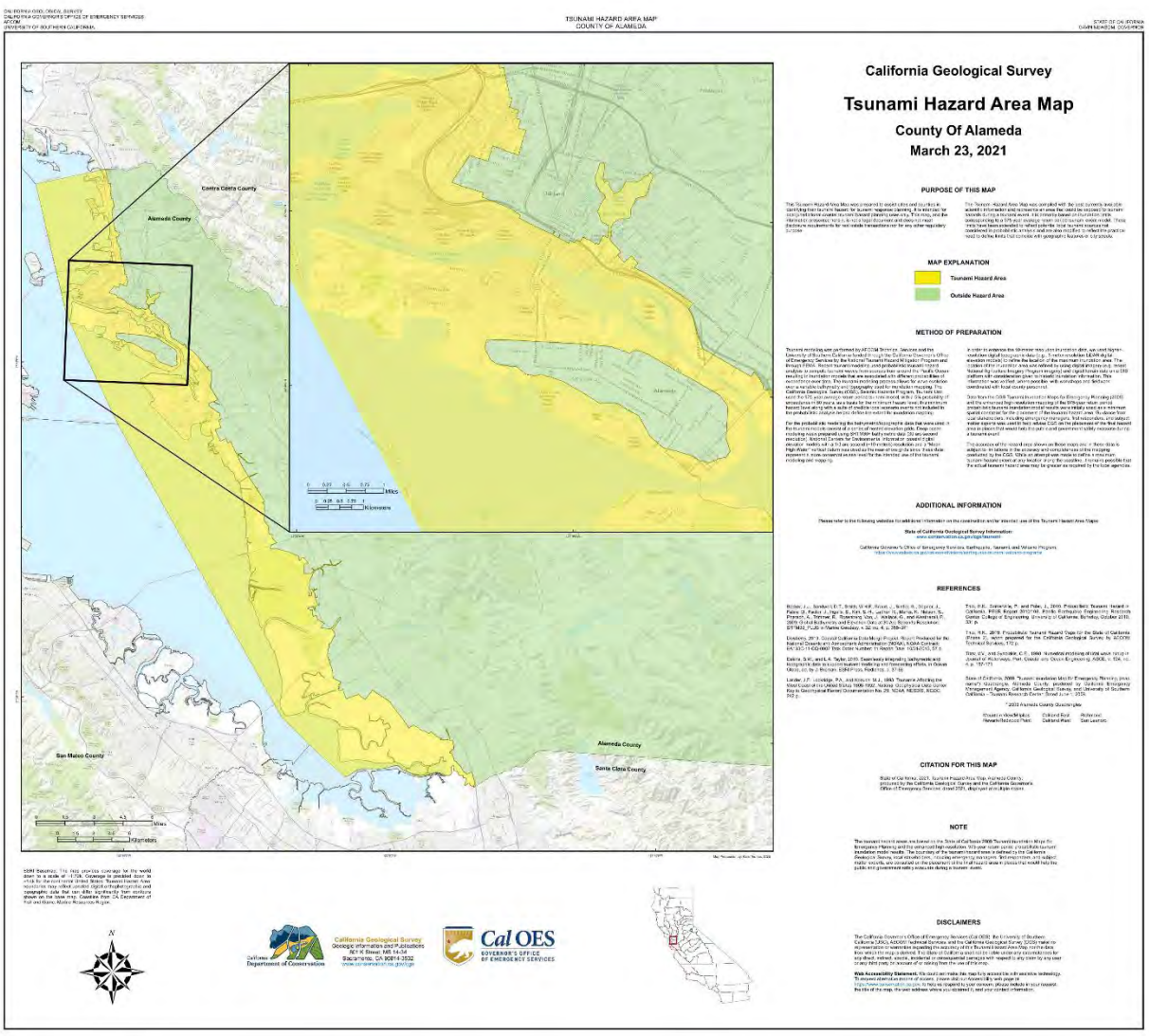



*Figure 4-21 Tsunami Hazard Area Map*

## Tsunami Evacuation Playbooks

In 2023, the California Geological Survey, the California Governor's Office of Emergency Services, and the National Oceanic and Atmospheric Administration released updated California Tsunami Evacuation Playbooks for Alameda County (California Tsunami Evacuation Playbook No. C09-ALA-05). The playbooks provide:

- Tsunami-specific evacuation maps
- Information on potential harbor hazards
- Operational guidance to assist emergency managers in preparing for tsunamis generated by sources at varying distances from the California coast

The playbooks support detailed emergency planning by incorporating refined modeling of tsunami wave heights, and tidal conditions. These analyses help forecast potential tsunami impacts and identify areas that may experience inundation or hazardous currents under different tsunami scenarios. Local

emergency managers can use this information to define evacuation zones, coordinate response actions, and improve preparedness for future tsunami events.

### Evacuation Phases

The tsunami evacuation zones identified in the California Tsunami Evacuation Playbooks are referred to as Evacuation Phases. Each phase corresponds to increasing levels of potential tsunami impacts and guides emergency managers in determining appropriate evacuation actions. The areas covered under each phase are generally described as follows:

**Phase 1 – Water & Docks:** Evacuation focuses on beaches, harbor docks and piers, and vessels in marinas and nearshore waters. Even relatively small tsunamis can generate strong and hazardous currents in harbors and coastal waterways. Mitigation actions include outreach to the maritime community, coordination with harbor operators, and use of maritime guidance such as the Maritime Response Playbook to reduce risks to vessels and harbor infrastructure.

**Phase 2 – Shoreline & Low-lying:** Evacuation includes low-lying coastal areas that may experience flooding similar to areas affected during coastal storms combined with King Tides. Mitigation actions include improving flood preparation, protecting critical infrastructure, and implementing measures that reduce vulnerability to coastal flooding and tsunami inundation.

**Phase 3 – Inland Neighborhoods:** Evacuation extends to larger areas and reflects the potential for more significant tsunami flooding. Mitigation actions include public education, use of mass notification systems, and coordination with local media to ensure timely public warnings and evacuation messaging.

**Maximum Evacuation Phase – Entire Hazard Zone:** This phase represents the largest evacuation area and is generally similar in extent to the tsunami hazard area identified on official state tsunami hazard maps. Events of this magnitude may be generated by large distant subduction zone earthquakes, such as those occurring along the Alaska–Aleutian subduction zone. Mitigation actions focus on widespread public warning, coordinated evacuation, and regional emergency response.

## History

Since 1946, when record keeping increased, there have been 30 tsunamis within the San Francisco Bay, and of those, about half have been recorded in Alameda. Error! Reference source not found. contains a detailed list of all tsunamis that have been measured in Alameda since 1946. Historical recorded heights in Alameda have ranged from 0.02 feet to 0.51 feet. Most records are under 3 inches.

***Table 4-8 Tsunamis in the San Francisco Bay with Measurements Recorded in Alameda***

| Year | Location Name | Source Earthquake Magnitude | Distance From Source (km) | Travel Time (hours) | Maximum Water Height in Alameda (m) | Maximum Water Height in Alameda (ft) |
|---|---|---|---|---|---|---|
| 1946 | Alaska | 8.6 | 3545 | 5:54 | 0.2 | 0.66 |
| 1952 | Japan | 8.1 | 7601 | | 0.02 | 0.07 |
| 1952 | Russia | 9.0 | 6003 | 8:57 | 0.4 | 1.31 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1957 | Alaska | 8.6 | 4388 | 6:10 | 0.18 | 0.59 |
| 1960 | Chile | 9.5 | 9787 | 15:39 | 0.31 | 1.02 |
| 1968 | Japan | 8.2 | 7727 | | 0.1 | 0.33 |
| 1992 | Cape Mendocino, CA | 7.2 | 337 | | 0.04 | 0.13 |
| 1994 | Russia | 8.4 | 7265 | | 0.04 | 0.13 |
| 2006 | Tonga | 8.0 | 8402 | | 0.04 | 0.13 |
| 2010 | Chile | 8.8 | 9635 | 15:10 | 0.12 | 0.39 |
| 2011 | Japan | 9.1 | 7939 | 10:49 | 0.51 | 1.67 |
| 2012 | Canada | 7.7 | 1833 | 4:08 | 0.11 | 0.36 |
| 2015 | Chile | 8.3 | 9304 | 14:49 | 0.06 | 0.20 |
| 2021 | Alaska | 8.2 | 3295 | | 0.06 | 0.20 |
| 2022 | Tonga | Underwater volcano | 8513 | | 0.23 | 0.76 |
| 2025 | Russia | 8.8 | 5993 | | 0.33 | 1.08 |

Source: National Geophysical Data Center / World Data Service: NCEI/WDS Global Historical Tsunami Database. NOAA National Centers for Environmental Information. doi:10.7289/V5PN93H7. Accessed March 17, 2026

Recent studies of tsunamis conducted by the United States Geologic Survey (USGS) Science Applications for Risk Reduction (SAFRR) tsunami scenario also examine paleo tsunamis.[31] This study looks back in geological time by using core sampling and other means to identify tsunami events before record keeping. Although there has not been an impact or any major devastation from tsunami in more than 100 years, geologic study suggest that significant tsunamis have impacted the San Francisco Bay Area in the past and are likely to happen again.

## Other Historic Tsunamis Impacting San Francisco Bay

There have been two tsunamis that have caused damage within the broader San Francisco Bay, including the 1964 Alaskan event (M9.1) which caused widespread damage to the West Coast, including $2.2M in recorded damage and water heights up to 1.52 feet in the San Francisco Bay Area and Half Moon Bay and one death in Bolinas. The other tsunami event resulted from the 2011 Tohoku (Japan) earthquake (M8.9) which caused $125,000 damage at the Berkeley Marina and had water heights up to 1.50 feet. This tsunami caused at least $48M statewide but resulted in only a non-destructive 6-inch wave along the shoreline of Alameda.

## Recent Tsunamis Affecting Alameda

No state or federal disaster declarations for tsunamis affecting the planning area have occurred since the last Local Hazard Mitigation Plan update in June 2022. However, two tsunami bulletins for an area that included Alameda were issued in recent years on December 5, 2024 and July 29, 2025.

### December 5, 2024 Cape Mendocino Earthquake and Tsunami Warning

On **December 5, 2024** at 10:44am, an earthquake with a magnitude of 7.0 occurred approximately 30 miles offshore of Cape Mendocino. At 10:49am the National Tsunami Warning Center issued a tsunami warning via the Wireless Emergency Alert (WEA) for the coastal areas of California from Davenport (10 miles NW of Santa Cruz) to Oregon. When the warning was issued, the City convened key personnel at

[31] USGS, The SAFRR (Science Application for Risk Reduction) Tsunami Scenario

the Emergency Operations Center, which included police, fire, the City's Manager's Office, City department heads, Alameda Unified School District (AUSD) and Alameda Municipal Power (AMP). The City was also in communication with the County and East Bay Regional Parks District (EBRPD). During the emergency, the City:

- Sent mass notification alerts through Everbridge and social media platforms with actions to take and when the alert was canceled,
- Recommended that two schools relocate to higher ground,
- Began calling harbormasters with actions to take, and alerted City staff with actions to take.

Less than an hour later, at 11:54am the warning was canceled, and Alameda did not experience any tsunami activity.

### July 29, 2025 Kamchatka Peninsula, Russian Earthquake and Tsunami Advisory

On **July 29, 2025** at 4:24pm, earthquake with a magnitude of 8.8 occurred off the eastern coast of the Kamchatka Peninsula in the Russian Far East. At 5:19pm the National Tsunami Warning Center issued a tsunami watch for the entire California coast, including the San Francisco Bay. The watch was upgraded to an advisory at 6:27pm. When the advisory was issued, the City convened department heads and key staff at the Emergency Operations Center. During the emergency, the City sent email and text alerts and posted on the City website and social media channels with actions to take and called harbormasters with recommended actions to take. At 10:20am on July 30, 2025, the advisory was canceled. When the advisory was cancelled, the same notification systems were used to notify the community of the cancellation.

Alameda experienced a maximum height of 1.2ft above current tide at 2:47am on July 30th. No damage or impacts occurred as the tide was low at the time of maximum inundation.

## Probability of Future Tsunamis

The probability of a tsunami occurring can be described as return period, the average time between events, or as the likelihood of a tsunami occurring in any given year (annual probability). The Tsunami Hazard Area Map depicts a tsunami with an average 975-year return period which has a 0.1 percent annual chance of occurring and a 5 percent chance of occurring in a 50-year period

Climate change will exacerbate tsunami hazards. Rising sea levels will allow tsunami waves to travel farther inland. Just as high tides increase coastal flooding and inundation levels, sea level rise raises the baseline water level along the coast. As a result, the maximum height and inland reach of tsunami runup will increase over time.

## Tsunami Risk Assessment

### Vulnerability

An event causing maximum tsunami inundation could affect large portions of the main island of Alameda, California and, in a worst-case scenario, could inundate much of Bay Farm Island. New housing development planned at Alameda Point and along the northern waterfront incorporates mitigation measures designed to reduce coastal flooding risk. However, in the event of a tsunami, buildings located near the shoreline could still be vulnerable to flooding, debris impacts, and strong currents. Residents

living in floating homes and marina communities may face elevated risk due to their proximity to the water and the potential for hazardous currents and rapidly changing water levels.

As Alameda's population grows and ages, seniors and older adults may face increased mobility and communication challenges during evacuation. Alameda's unhoused population may also be particularly vulnerable, as individuals living outdoors or in vehicles in low-lying areas could have greater exposure to tsunami hazards and fewer resources to receive warnings or evacuate quickly. These populations may face increased risk of injury, displacement, or other impacts during a tsunami event.

Even in tsunami events where flooding and inundation are limited, strong and unpredictable currents can still cause substantial damage. Ports, harbors, and marinas are particularly exposed to these current hazards. The 2011 tsunami generated by the 2011 Tōhoku earthquake and tsunami caused widespread damage to harbors along the California coastline and within San Francisco Bay, largely due to strong currents rather than coastal flooding. When tsunami waves enter the Bay, water moving through narrow channels and estuaries can accelerate, intensifying currents near shorelines and marinas. These currents can break mooring lines, damage docks, and cause vessels to collide with structures. Similar damage occurred at Berkeley Marina and Santa Cruz Harbor during the 2011 event.

Although tsunamis affecting Alameda are relatively rare, any tsunami that enters San Francisco Bay can pose hazards to marinas, beaches, and low-lying areas that already experience coastal flooding.

### Impact

Although tsunamis are rare events and have not historically caused significant damage in Alameda, future events could have significant consequences. A large tsunami could damage marinas, ships, piers, low-lying homes, and other facilities within the tsunami inundation zone, potentially resulting in catastrophic losses.

According to a U.S. Geological Survey analysis of the maximum tsunami-inundation zone based on multiple credible sources, an estimated 39,515 Alameda residents were living in that maximum hazard zone as of 2010 Census data — the highest residential exposure of any city in California.[32] This estimate predates recent population growth and ongoing development, including housing construction at Alameda Point, suggesting that the number of residents exposed to maximum tsunami inundation has likely increased.

The high residential exposure in tsunami hazard zones means that a substantial portion of Alameda's population could be directly affected by a major tsunami event. A worst-case inundation could damage or destroy homes, businesses, and critical infrastructure, leading to potential billions of dollars in economic losses, displacement of residents, and possible injuries or loss of life.

## Tsunami Evacuation

In the unlikely event that a significant tsunami is expected, the City will issue warnings to alert the public of areas that would need to be evacuated based on the Tsunami Playbook and information provided by county, state, and federal sources. Notifications will come from AC Alert, NextDoor, Facebook, broadcast TV, radio, wireless emergency alerts (WEA), as well as directly from the U.S. Tsunami Warning System (https://tsunami.gov).

[32] Wood N, Ratliff J, Peters J, Shoaf K (2013b) Population vulnerability and evacuation challenges in California for the SAFRR tsunami scenario, chap. I. In: Ross SL, Jones LM (eds) The SAFRR (Science Application for Risk Reduction) tsunami scenario, U.S. Geological Survey Open-File Report 2013-1170.

Residents are advised to be aware of natural warning signs, such as feeling a strong earthquake or noticing unusually rapid water recession at the shoreline. A tsunami event can last for several hours or longer, with multiple waves arriving over time. Dangerous currents and elevated water levels may persist for several hours to days after the initial waves, particularly in harbors, marinas, and narrow channels. Residents should avoid returning to affected areas until official authorities declare it safe.

**Boaters:** Evacuating offshore in a boat is **not recommended**, as navigating and maintaining a vessel in offshore waters during a tsunami is extremely hazardous. Boats are safest when securely docked. Offshore evacuation would require deep water (at least 180 feet) for over 24 hours, which may not be feasible.

**Traffic and mobility:** Central Avenue represents one of the highest areas on the main island. Community members are strongly encouraged to walk or bicycle to the center part of the main island or drive/bike beyond I-880 to reach higher ground outside identified hazard areas. Residents can support traffic flow by reducing the number of cars used during evacuation and by walking or biking when possible. Evacuation routes into Oakland and beyond will be coordinated between Oakland and Alameda and other agencies to route traffic safely out of hazard areas.

# Heat

## Hazard Description

Extreme heat events are expected to increase in frequency, severity, and duration in Alameda due to climate change. Projected changes include an increased number of extreme heat days and warm nights, higher temperatures during extreme heat events, and longer duration heat waves

An **Extreme Heat Day** is defined as a day between April and October when the maximum temperature exceeds the 98th percentile of historical daily maximum temperatures (1961–1990 baseline).[33] For Alameda, the Extreme Heat Threshold is **89°F**.

A **Warm Night** is defined as a night when the minimum temperature does not fall below the 98th percentile of historical overnight minimum temperatures (April–October, 1961–1990). For Alameda, the Warm Night Threshold is **61.5°F**. Warm nights are concerning because buildings do not naturally cool down when overnight temperatures are warm, thereby increasing overnight energy consumption for cooling and producing public health impacts such as heat stress and even excess mortality. Warm nights can also negatively impact ecosystems and water supplies, particularly snowpack.

The heat index shown in **Figure 4-23**. is an accurate measure of how hot it really feels when the effects of humidity are added to high temperature.

[33] https://cmip5.cal-adapt.org/tools/extreme-heat/

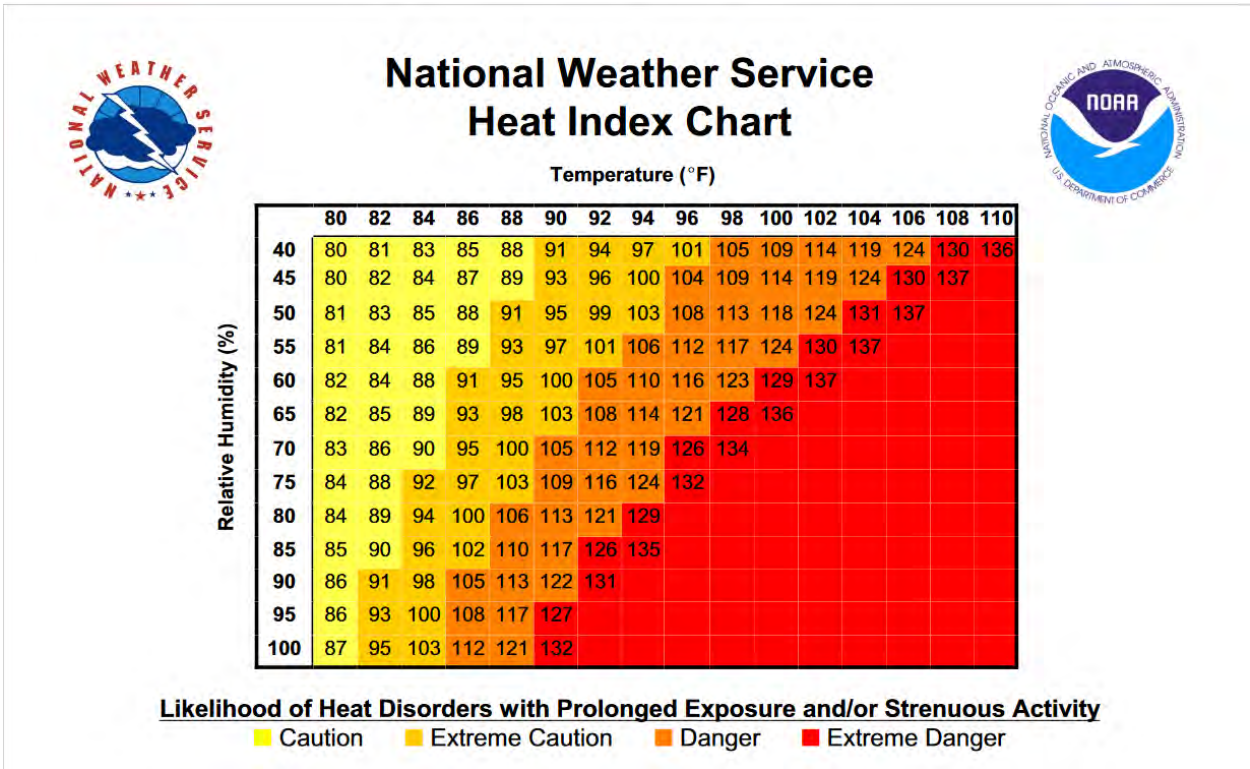



***Figure 4-22 National Weather Service Heat Index Chart***

The National Weather Service has created the **HeatRisk** forecast which provides a quick view of heat risk potential over the upcoming seven days. [34] The heat risk is portrayed in a numeric (0-4) and color (green/yellow/orange/red/magenta) scale which is similar in approach to the Air Quality Index (AQI) or the UV Index. During heat or extreme heat events, local National Weather Service offices may issue heat-related messages as conditions warrant. Such messages include:

- **Excessive Heat Outlook:** Issued when the potential exists for an excessive heat event in the next three to seven days. An outlook carries a minimum 30 percent confidence level that the event will occur.
- **Excessive Heat Watch:** Issued when conditions are favorable for an excessive heat event in the next 12 to 48 hours. A watch is given when the level of confidence that the event will occur reaches 50 percent or greater.
- **Excessive Heat Advisory:** Issued when an excessive heat event is expected in the next 36 hours. An advisory is used for a less severe event that is not assumed to be life-threatening, when caution is advised to mitigate the event's impact.
- **Excessive Heat Warning:** The most serious alert, issued when an excessive heat event is expected in the next 36 hours, or such an event is occurring, is imminent, or has a very high probability of occurring. A warning assumes the potential for health consequences due to extreme heat.

[34] National Weather Service Experimental HeatRisk: Identifying Potential Heat Risks in the Seven Day Forecast. Retrieved from: https://www.wrh.noaa.gov/wrh/heatrisk/?wfo=hnx

## Location and Extent

Extreme heat affects all of Alameda and can be exacerbated by the City's relatively high average maximum relative humidity, which increases the heat index (how hot it "feels" when humidity is combined with air temperature (California Energy Commission, 2018). Unlike localized hazards, drought is regional in scale and impacts the full planning area simultaneously.

Certain areas may experience more severe localized heat due to high concentrations of paved surfaces, dark, heat absorbing building materials, limited tree canopy and dense development.

# History

In 2024, Alameda experienced a heat wave during which temperatures exceeded 89°F on six days within an eight-day period (September 30 – October 6). Cooling centers were activated during these events at branches of the Alameda Free Library. Cooling centers were also activated in September 2022 during a heat event.

No state or federal disaster declarations related to extreme heat affecting the planning area have occurred since the last Local Hazard Mitigation Plan update.

# Probability of Future Heat Events

The probability of future extreme heat events in Alameda is **high and increasing**. Climate projections indicate more frequent Extreme Heat Days, substantial increases in Warm Nights, longer and more intense heat waves. According to the Global Facility for Disaster Reduction and Recovery, there is more than a 25% chance that at least one period of prolonged exposure to extreme heat, resulting in heat stress, will occur in the next five years in Alameda[35].

As shown in **Table 4-9**, between 1961 and 1990, Alameda averaged three Extreme Heat Days and five Warm Nights per year. Under a medium emissions scenario, Alameda is projected to experience an average of six Extreme Heat Days and 25 Warm Nights per year by mid-century and eight Extreme Heat Days and 46 Warm Nights by of end of century.

***Table 4-9 Number of Extreme Heat Days and Warm Nights per Year in Alameda***

| Timeframe | Number of Extreme Heat Days per Year when daily maximum temperature is above 89° F | Number of Warm Nights per Year when daily minimum temperature is above 61.5° F |
|---|---|---|
| Modeled Historical (1961-1990) | 3 | 5 |
| Mid-Century Projection (2035-2064)* | 6 | 25 |
| End-Century Projection (2070-2099)* | 8 | 46 |

*Projections assume a medium emissions scenario (RCP 4.5 from the Fifth Intergovernmental Panel on Climate Change (IPCC) Assessment Report on Climate Change): a scenario where GHG emissions peak by 2040 and then decline. In California, annual average temperatures under this scenario are projected to increase 2°C - 4°C by the end of this century, depending on the location.

[35] https://thinkhazard.org/en/report/28865-united-states-of-america-california-alameda/EH

## Heat Risk Assessment

### Vulnerability

More extreme heat events represent a public health risk to the people of Alameda that can cause heat exhaustion, stroke, difficulty breathing, and even death.

Extreme heat disproportionately affects vulnerable populations. In Alameda, populations at elevated risk include: low-income populations (approximately one-third of households), older adults (a growing percentage of the population since 2013), young children, individuals with chronic health conditions, people experiencing homelessness, transit-dependent individuals, and outdoor workers.

Low-income residents may lack financial resources to prepare for or respond to extreme heat events and may live in housing without air conditioning. Increased energy costs associated with cooling can further burden these households.

### Impact

The public health impact of extreme heat events will be most severely felt for vulnerable populations and include heat-related illnesses and mortality, exacerbation of cardiovascular and respiratory conditions, and increased emergency medical response demand. When combined with poor air quality, such as due to elevated ozone levels and wildfire smoke, these health risks can be compounded. A California Energy Commission study indicates that over the past 15 years, heat waves have claimed more lives in California than all other declared disaster events combined.

Alameda residents may have limited experience preparing for or responding to extreme heat events. As a result, community awareness, preparedness measures, and behavioral adaptations to prolonged heat may be limited. In addition, some households lack the financial resources to purchase or operate air conditioning. Increased reliance on air conditioning during extreme heat events leads to higher household energy costs, disproportionately impacting residents with limited financial resources.

Extreme heat may also cause pavement heave and damage to roadways (Caltrans, 2018), stress on electrical systems due to increasing air conditioning demand and potential power outages during peak demand times.

# Drought

## Hazard Description

Drought is a prolonged period of abnormally low precipitation resulting in water shortages that can adversely affect water supply, ecosystems, agriculture, power generation, and public health. In California, drought conditions are driven by natural climate variability and are increasingly intensified by climate change.

Rising average temperatures, declining Sierra Nevada snowpack, and increasingly variable “boom or bust” precipitation patterns are contributing to more frequent and severe droughts statewide. Scientific studies indicate that precipitation deficits are more than twice as likely to produce drought conditions

when combined with warmer temperatures, and such conditions have become more common in recent decades.

Most of California's precipitation occurs between November and April. This rainfall and snowpack replenish reservoirs and groundwater basins that supply homes, businesses, and farms, and sustain ecological systems. Reduced snowpack and altered spring runoff timing reduce the reliability of these water supplies.

Most rain and snow fall in California from November through April. This precipitation fills our reservoirs and aquifers that we use to supply homes, businesses and farms with water. It is also a vital resource for fish and wildlife that rely on our rivers and wetlands.

Approximately 90 percent of the City's potable water is provided by the East Bay Municipal Utility District (EBMUD) from the Mokelumne River watershed in the Sierra Nevada. The remaining 10 percent is derived from local East Bay watershed runoff. Water is conveyed across the Sacramento–San Joaquin River Delta through more than 15 miles of aqueducts and pipelines, which has become increasingly vulnerable to flooding, landslides, and earthquakes. This dependency increases vulnerability to reduced snowpack, altered runoff timing, and potential infrastructure disruptions. Both the quality and quantity of potable water can be impacted when the water supply distribution system is compromised. For example, in September 2017, an unprotected cross connection from an irrigation line impacted the quality of water supplied to hundreds of Alameda homes and businesses.

## Location and Extent

Drought affects the entire City of Alameda. Unlike localized hazards, drought is regional in scale and impacts the full planning area simultaneously.

# History

Statewide droughts impacting Alameda were declared in 1976-1977, 1987-1992, 2008, 2013-2016, and 2020-2023. The 2013–2016 drought resulted in the most severe moisture deficit in 1,200 years and resulted in significant reservoir depletion and water conservation mandates. The time series shown in **Figure 4-23** shows the percentage of land area in Alameda County within each drought category over time.

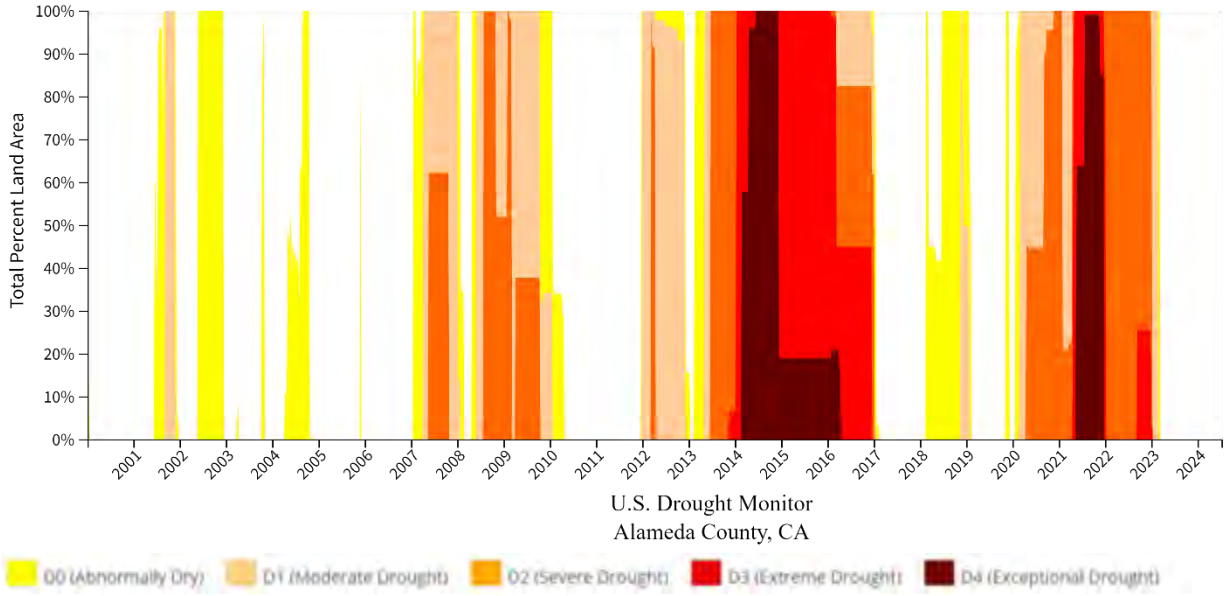



***Figure 4-23 Alameda County Percent Area in U.S. Drought Monitor Categories***

A statewide drought emergency was recently declared in October 2021 and the State Water Board issued an emergency regulation to prohibit wasteful water use and called for a voluntary 10 percent reduction in water use in 2022. [36] Record-low water levels at the state's reservoirs during this time forced curtailment of hydro power production from hydroelectric dams, an important source of power for Alameda Municipal Power. In April 2023, EBMUD indicated that it had moved out of drought and ended a recommendation for a 10 percent voluntary water use reduction while continuing to urge customers to use water efficiently. [37] However, EBMUD retained the State restrictions against water waste, including no irrigation within 48 hours of rainfall, no irrigation of ornamental turf on non-residential sites, no irrigation runoff, no spraying sidewalks and driveways, and only allowing hoses with shut-off nozzles when washing vehicles. As of June 5, 2024, the State Water Board's statewide water conservation emergency regulations expired, signaling the end of the drought emergency.

No state or federal disaster declarations for drought that affect the planning area have occurred since the last Local Hazard Mitigation Plan update.

## Probability of Future Droughts

Although droughts are a natural part of our climate cycle in California, studies have shown that warmer temperatures and lower precipitation associated with climate change increases the overall likelihood of extreme droughts in California. [38] Studies have also shown that precipitation deficits in California were

[36] State Water Resources Control Board. Drought Orders, Proclamations, Notices, and Letters. Retrieved December 4, 2024 from https://www.waterboards.ca.gov/drought/drought_orders_proclamations.html.
[37] EBMUD. EBMUD Moves Out of Drought. Retrieved December 4, 2024 from https://www.ebmud.com/water/drought.
[38] Williams AP, Seager R, Abatzoglou JT, Vook BI, Smerdon JE, Cook ER. (2015). Contribution of Anthropogenic Warming to California Drought During 2012-2014. Retrieved from: https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2015GL064924

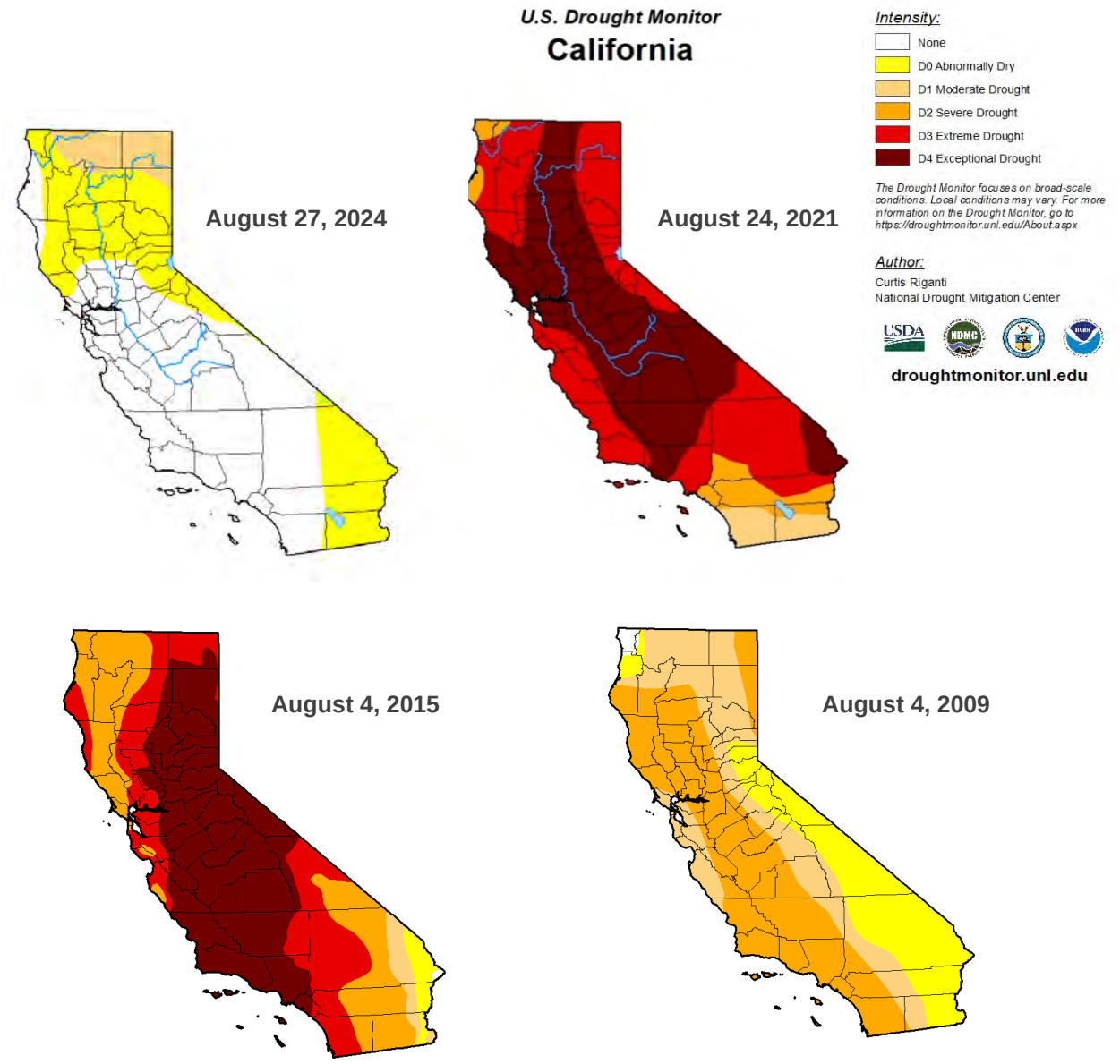
more than twice as likely to yield drought years if they occurred when conditions were warm and that such confluences have increased in recent decades. [39]

Drought is considered a highly likely and recurring hazard for Alameda. Based on historical patterns, significant drought conditions have occurred approximately once per decade over the past 50 years. Although precise probability cannot be calculated due to variability in precipitation, continued warming trends substantially increase the likelihood of future extreme drought events. As of February 2026,

Alameda is not experiencing drought conditions and NOAA's seasonal outlook does not predict drought in California through April 2026. [40] **Figure 4-24** shows the historical California Drought Monitor for August 2024, 2021, 2015 and 2009.

[39] Diffenbaugh NS, Swain DL, and Touma D. (2015) Anthropogenic warming has increased drought risk in California. Retrieved from: https://www.pnas.org/content/112/13/3931
[40] NOAA. U.S. Seasonal Drought Outlook. Retrieved December 4, 2024 from https://www.cpc.ncep.noaa.gov/index.php

*Figure 4-24 California Drought Monitor for August 2024, 2021, 2015, 2009*




# Drought Risk Assessment

## Vulnerability

All residents are vulnerable to drought impacts; however, low-income households (more than one-third of Alameda households) and renters are subject to rising utility costs and the elderly and medically vulnerable residents are sensitive to heat and water access disruptions.

Drought does not usually cause structural damage; however, it affects municipal landscaping and urban forests, soil moisture and vegetation health, water supply and hydroelectric generation capacity. Loss of tree health due to prolonged drought may increase the risk of downed trees during subsequent storms. Water supply is vulnerable due to reliance on Sierra Nevada snowpack.

According to EBMUD's (2014) Climate Change Monitoring and Response Plan, potential risks to water supply include:

- Increased demands for outdoor water use;
- Increased drought frequency, intensity, and duration;
- Decreased snowpack; and
- Changes in the timing of the Mokelumne River spring runoff.

### Impact

The primary impact of recent droughts on the City of Alameda has been loss of, or decreased health of, landscaping and trees in the City's parks and streets. This may contribute to more downed trees during future storms and depleted soil health. Long term concerns are a lack of adequate water for drinking and irrigation.

As Alameda's population increases and with the increase of planned development, demand for water supplies will also grow, and residents and structures will become more vulnerable to experiencing greater impacts in the event of drought. An increase in water costs in the event of a drought could especially impact lower income populations in Alameda making them more vulnerable to water insecurity. Droughts can also lead to water conservation mandates.

Alameda can reduce its per capita water use to increase resiliency to drought by limited showers to 5 minutes, turning off the faucet when brushing teeth, only washing full loads of laundry, and planting drought resistant plants. Outdoor landscaping is one of the most significant uses of water and the place where residents and businesses can have the most impact in conserving water. EBMUD's (2015) Urban Water Management Plan calls for a combination of rationing, conservation, and use of recycled water to satisfy demand through 2040. The City of Alameda has taken a number of measures to further reduce water usage, including, increasing composting, reducing irrigation of decorative lawns (resulting in 3.6 percent reduction), converting decorative lawns at city facilities and some parks to drought tolerant landscape, prioritizing fixing pipe leaks, converting irrigation clocks to rain sensitive clocks (resulting in 15 percent reduction).

# Wildfire-Related Hazards

## Hazard Description

Wildfires are a natural part of California's landscape and the state's forest has historically adapted to periodic fire. However, over the past 20 years, both the total area burned by wildfire and the number of large fires has increased markedly across the state. This increase is largely attributed to changes in land use patterns, fire management practices and the impacts of climate change. [41]

### Location

The City of Alameda is not located within a wildfire hazard zone and does not contain wildland vegetation or wildland-urban interface (WUI) areas where wildfires typically occur.

[41] California Office of Environmental Health Hazard Assessment. Wildfires. Retrieved December 4, 2024 from https://oehha.ca.gov/climate-change/epic-2022/impacts-vegetation-and-wildlife/wildfire.

However, Alameda may be affected by:

- **Smoke impacts** from large wildfires occurring in Northern or Central California.
- **Public Safety Power Shutoffs (PSPS)** initiated by regional utility providers during high fire-weather conditions.

## Extent

Over the last decade wildfires have become increasingly frequent and intense and have impacted all of California. While wildfires do not occur within the City of Alameda, wildfires occurring outside the region can impact public health in Alameda.

## History

Statewide wildfire activity has increased substantially in recent decades.

- In 2020, approximately **4.2 million acres** burned in California (**Figure 4-26)**, the highest annual total on record.[42]
- The number of large fires (greater than 10,000 acres) has also increased (**Figure 4-27)**, with a rising 10-year moving average since 1950.
- The Dixie Fire (2021) burned 963,309 acres, becoming the second-largest wildfire in California history behind the 2020 August Complex Fire (1.03 million acres).

[42] California Department of Forestry and Fire Protection

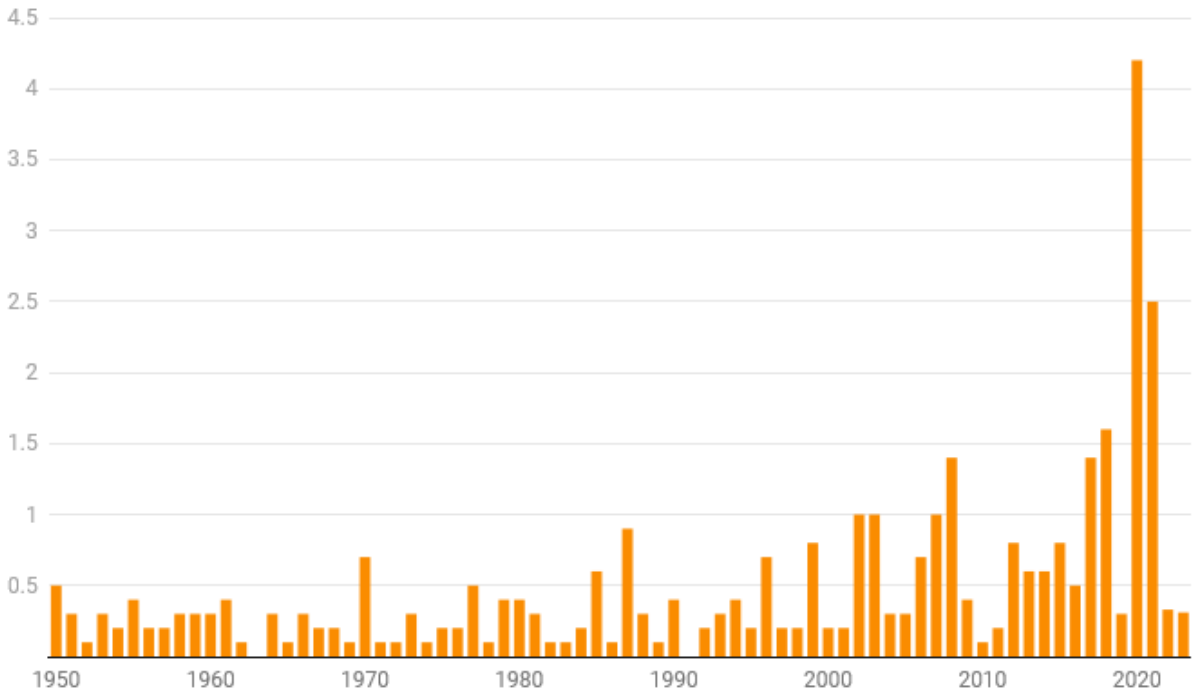



***Figure 4-25 Statewide annual acres burned, 1950-2023***

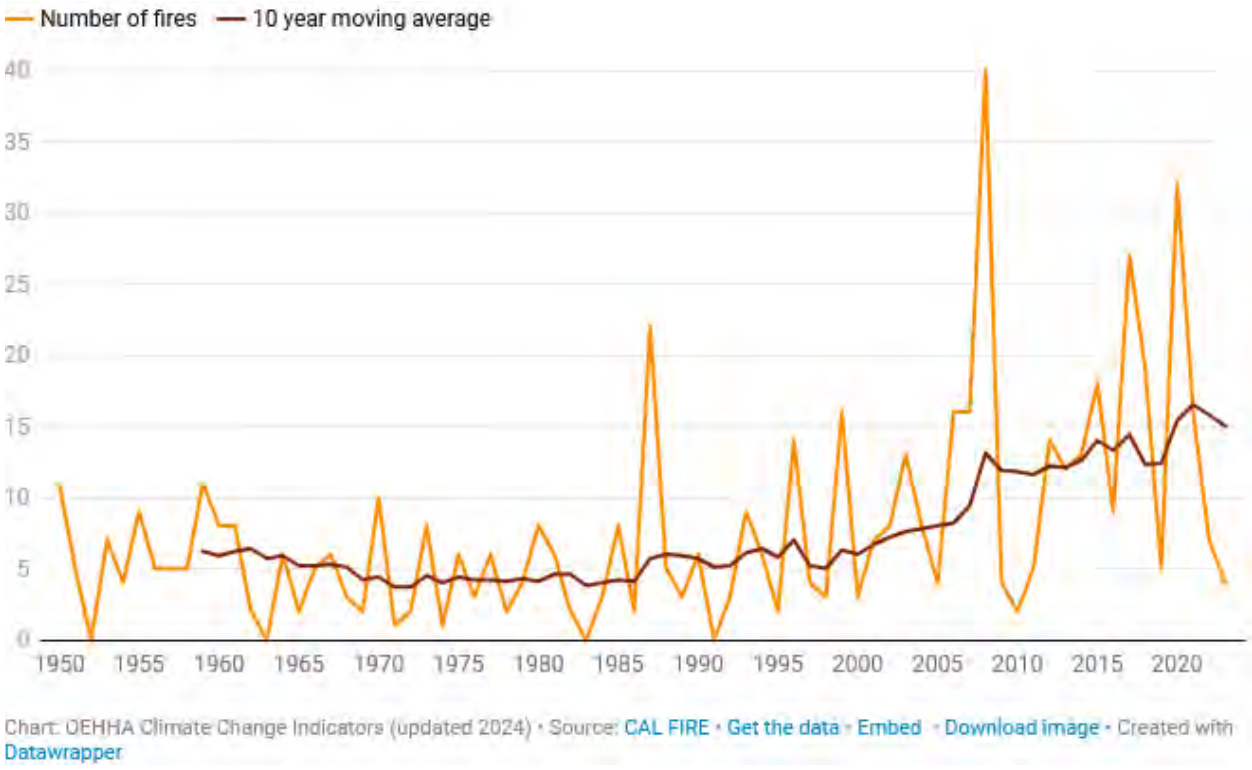



***Figure 4-26 Annual number of large wildfires, 1950-2023***

## Probability of Future Wildfire-Related Events

Wildfires are part of the natural ecosystem of California and are certain to occur in the future with increasing intensity and frequency. Some of those events will impact Alameda's air quality and electric power supply, depending on the proximity, regional wind patterns, and atmospheric conditions for a particular event.

## Wildfire Hazards Risk Assessment

### Smoky Air

#### Vulnerability

Breathing in smoky air can have serious consequences for human health. Exposure to smoke is known to impact lung health and has been associated with respiratory infections and increased risk of death. Those who are especially vulnerable in Alameda have existing cardiovascular and respiratory ailments such as asthma, diabetes, pregnancy, young children, older adults, and those who work outdoors. Most of Alameda is exposed to high levels of diesel particulate matter and most of Alameda experiences a higher than state average asthma rate With the average number of asthma emergency department visits per 10,000 people in Alameda being higher than 69.1% of the state.[43] Wildfire smoke can exacerbate health issues already present in this population of Alamedans. Exposure to wildfire smoke is also an equity issue as disadvantaged community members in Alameda are already more likely to live in areas with worse air quality, and lower-income residents may not be able to afford air conditioning or air purifiers.

The high unpredictability of wildfires and their impact on downwind areas heightens the vulnerability of Alamedans to wildfire-related risks. Furthermore, because wildfires spread so quickly and wind direction may suddenly change, there is little lead time to warn and prepare residents for wildfire smoke impacts. It is also difficult to predict the severity of wildfire smoke impacts or how long they are likely to last. Community members are generally taken by surprise and don't realize how hazardous air quality may be to their health.

#### Impact

Winds can carry smoke from active wildfires into the region and wildfire smoke can reach hazardous levels in Alameda as measured by the U.S. Environmental Protection Agency's (EPA's) Air Quality Index (AQI). Air quality impacts from wildfires recently raised public awareness and concern beginning during the Camp Fire that occurred in fall 2018. During that event, air quality, measured by $PM_{2.5}$ (particulate matter with a diameter of 2.5 micrometers or less), was rated "hazardous for all groups" for 12 consecutive days, with the peak occurring on November 16, 2018, when "very unhealthy" levels were recorded at a monitoring station near Alameda (Bay Area Air Quality Monitoring District).

**Table 4-9** below lists the number of Spare the Air Days that were called by the Bay Area Air Quality Management District because particulate matter (PM) was forecast to exceed national standards, as well as the number of days on which PM concentrations officially exceeded the state and federal health-based air quality standards. PM exceedance typically occurs because of wintertime wood burning, but since

[43] https://oehha.ca.gov/calenviroscreen/maps-data

2020 has more commonly occurred in the summer as a result of wildfires. The Spare the Air Days shown in **Table 4-9** were called for the entire 9-county Bay Area, including the City of Alameda.

***Table 4-10 Number of Spare the Air Days Issued for Excess PM Levels***

| Year | Spare the Air Alerts | National 24 Hour PM 10 Excess Days | CA 24 Hour PM Excess Days | National 24 Hour PM 2.5 Excess Days |
|---|---|---|---|---|
| 2024 | 2 | 0 | 0 | 0 |
| 2023 | 8 | 0 | 0 | 3 |
| 2022 | 8 | 0 | 0 | 3 |
| 2021 | 5 | 0 | 0 | 2 |
| 2020 | 46 | 0 | 0 | 25 |
| 2019 | 3 | 0 | 5 | 1 |
| 2018 | 18 | 1 | 6 | 18 |
| 2017 | 28 | 0 | 6 | 18 |
| 2016 | 5 | 0 | 0 | 0 |
| 2015 | 17 | 0 | 0 | 6 |
| 2014 | 13 | 0 | 2 | 3 |
| 2013 | 33 | 0 | 6 | 13 |
| 2012 | 5 | 0 | 1 | 3 |
| 2011 | 12 | 0 | 3 | 8 |
| 2010 | 6 | 0 | 2 | 6 |

Source: https://www.sparetheair.org/understanding-air-quality/data-and-records/pm-data. Accessed November 26, 2024

The City of Alameda took the following actions in response to smoky air days to protect employees and the public:

- September 11, 2020, the City of Alameda moved all city employees inside to work because of very unhealthy air quality
- September 27 through October 2, 2020, was a continuous spare the air period. The City allowed at-risk employees to work inside, and masks were available for the public and the employees.
- June 22, 2021, the Clean Air center was opened at the Main Library.
- August 30, 2021, the Clean Air center was opened at the Main Library

There are no established climate projections for increased risk of wildfire smoke; the existing projections focus on determining areas susceptible to wildfires themselves and not specifically the downwind impacts. Nonetheless, increases in air temperature and the frequency and severity of droughts are likely to result in an elevated risk of more intense, prolonged, and/or large-scale fires throughout California, which could create conditions like those experienced in November 2018.

During a poor air quality event, the Bay Area Air Quality Management District provides air monitoring data for several constituents, including ozone and $PM_{2.5}$, that track smoke impacts. **Figure 4-28** shows the level of health concern associated with each AQI category. **Figure 4-29** shows the U.S. Air Quality Index

Activity Guide provides ways to protect your health when particle pollution reaches unhealthy levels. Local air quality forecasts can be found at visit www.airnow.gov.

| Daily AQI Color | Levels of Concern | Values of Index | Description of Air Quality |
|---|---|---|---|
| Green | Good | 0 to 50 | Air quality is satisfactory, and air pollution poses little or no risk. |
| Yellow | Moderate | 51 to 100 | Air quality is acceptable. However, there may be a risk for some people, particularly those who are unusually sensitive to air pollution. |
| Orange | Unhealthy for Sensitive Groups | 101 to 150 | Members of sensitive groups may experience health effects. The general public is less likely to be affected. |
| Red | Unhealthy | 151 to 200 | Some members of the general public may experience health effects; members of sensitive groups may experience more serious health effects. |
| Purple | Very Unhealthy | 201 to 300 | Health alert: The risk of health effects is increased for everyone. |
| Maroon | Hazardous | 301 and higher | Health warning of emergency conditions: everyone is more likely to be affected. |

***Figure 4-27 AQI Basics for Ozone and Particle Pollution***

| Air Quality Index | Who Needs to be Concerned? | What Should I Do? |
|---|---|---|
| Good (0-50) | It's a great day to be active outside. | |
| Moderate (51-100) | Some people who may be unusually sensitive to particle pollution. | **Unusually sensitive people:** *Consider reducing* prolonged or heavy exertion. Watch for symptoms such as coughing or shortness of breath. These are signs to take it easier.<br>**Everyone else:** It's a good day to be active outside. |
| Unhealthy for Sensitive Groups (101-150) | Sensitive groups include **people with heart or lung disease, older adults, children and teenagers.** | **Sensitive groups:** *Reduce* prolonged or heavy exertion. It's OK to be active outside, but take more breaks and do less intense activities. Watch for symptoms such as coughing or shortness of breath.<br>**People with asthma** should follow their asthma action plans and keep quick relief medicine handy.<br>**If you have heart disease:** Symptoms such as palpitations, shortness of breath, or unusual fatigue may indicate a serious problem. If you have any of these, contact your heath care provider. |
| Unhealthy (151-200) | **Everyone** | **Sensitive groups:** *Avoid* prolonged or heavy exertion. Consider moving activities indoors or rescheduling.<br>**Everyone else:** *Reduce* prolonged or heavy exertion. Take more breaks during outdoor activities. |
| Very Unhealthy (201-300) | **Everyone** | **Sensitive groups:** *Avoid all* physical activity outdoors. Move activities indoors or reschedule to a time when air quality is better.<br>**Everyone else:** *Avoid* prolonged or heavy exertion. Consider moving activities indoors or rescheduling to a time when air quality is better. |
| Hazardous (301-500) | **Everyone** | **Everyone:** *Avoid all* physical activity outdoors.<br>**Sensitive groups:** Remain indoors and keep activity levels low. Follow tips for keeping particle levels low indoors. |

***Figure 4-28 Air Quality Guide for Particulate Pollution***

## Public Safety Power Shut-offs (PSPS)

### Vulnerability

In recent years, power lines have been responsible for some of the most destructive wildfires in California history. In response, PG&E has begun to proactively cut power to (de-energize) electrical lines that may fail in certain weather conditions to reduce the likelihood that their infrastructure could cause or contribute to a wildfire. These shut-offs are called Public Safety Power Shut-offs (PSPS). A PSPS can leave downstream communities that rely on the de-energized power lines to be without power, causing

hardships particularly for vulnerable and medically fragile populations. Because PSPS occur in response to high heat and wind conditions during wildfire season, they can leave residents without power at a time when air conditioning and clean air is needed the most. From 2013 to the end of 2019, California experienced over 57,000 wildfires (averaging 8,000 per year) and the three large energy companies conducted 33 PSPS de-energizations. Widespread and prolonged PSPS events in late fall 2019 led to customer confusion, anger and led to some customers, including medical baseline customers, not being notified of PSPS events. In response, the California Public Utility Commission assessed the performance of PG&E, Southern California Edison and San Diego Gas and Electric in these PSPS events and made significant updates to the guidance about when and how to conduct PSPS outages.

### Impact

Alameda has not been affected by PSPS outages to date but could be in the future. While Alameda Municipal Power procures and provides power to customers in Alameda, electricity travels from power generation sources across the state to Alameda on PG&E transmission lines. Alameda receives power from two redundant transmission lines that enter Alameda from the South and from the North. Each transmission line is fully capable of carrying Alameda's electric load. The likelihood of both transmission lines being de-energized for PSPS simultaneously is considered extremely low.

# Dam Breach Inundation

## Hazard Description

A dam failure would result in the sudden release of stored water, causing downstream flooding. Dam breach inundation may result in human fatalities and casualties, damage to structures and infrastructure, economic impacts, and environmental impacts. Overall, the consequences of dam breach could be severe, but the probability of occurrence is considered extremely low.

## Location

Two upstream dams have potential inundation areas that extend into portions of the City of Alameda: Chabot Dam and New Upper San Leandro (USL) Dam.

Chabot Reservoir is a 10,350-acre-foot raw water storage facility operated by EBMUD and located in San Leandro, Oakland, and Castro Valley.[44] The dam is a 135-foot-high earthen structure. The dam and outlet works structure underwent a seismic upgrade to improve the performance of the facility during a large earthquake. Construction was completed in 2017.

Upper San Leandro (USL) Reservoir is a 42,000-acre-foot reservoir located approximately 8 miles upstream of downtown Oakland. [45] It receives local runoff and imported Sierra Nevada water via the Mokelumne Aqueduct. The USL Reservoir receives local runoff as well as imported Sierra Nevada water via the Mokelumne Aqueduct. Seismic evaluations concluded that the USL Dam Outlet Tower located in the Reservoir which conveys raw water to the USL Water Treatment Plant for distribution to EBMUD customers would sustain damage in a seismic event. The Tower was retrofitted to ensure safe operation of the structure in 2018. The earthen USL Dam was not determined to need seismic upgrades.

[44] www.ebmud.com/about-us/construction-and-maintenance/construction-my-neighborhood/chabot-dam-upgrade
[45] www.ebmud.com/about-us/construction-and-maintenance/construction-my-neighborhood/upper-san-leandro-usl-dam-outlet-tower/

## Extent

In the event of dam breach inundation, the extent would depend on the volume of stored water, breach characteristics, and downstream topography. The inundation maps shown in **Figure 4-30** and **Figure 4-31** show the geographic extent of the flooding impacting Alameda that could result from a hypothetical dam breach inundation due to the failure of the Chabot and New Upper San Leandro Dams.[46] Both dams are owned and operated by EBMUD. Maps developed by EBMUD and published on DSOD's web publisher provides the maximum inundation depths associated with hypothetical failure of these dams, which are 1-5 feet that would take at least 4 hours to reach Alameda.

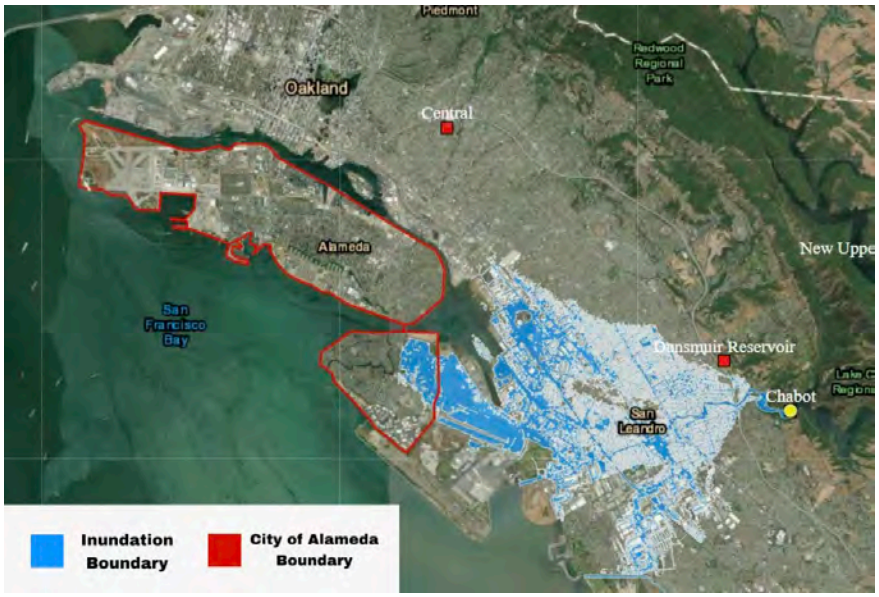



*Figure 4-29 Chabot Dam Inundation Map*




[46] California Division of Safety of Dams, Dam Breach Inundation Maps

*Figure 4-30 Figure New Upper San Leandro Dam Inundation Map*

# History

There have been no previous inundation events from either profiled dam. No state or federal disaster declarations for dam breach inundation that affect the planning area have occurred since the last Local Hazard Mitigation Plan update.

# Probability of Future Dam Breach Inundation

Dam failure is considered very unlikely. Although the State of California Division of Safety of Dams (DSOD) has rated the downstream hazard of a breach of both dams as “extremely high”, their structural conditions is rated “satisfactory”, the highest safety rating issued by DSOD.[47]

The State of California does not publish the likelihood of dam failure, however one study reports that earthfill and concrete dams in the U.S. such as Chabot and New Upper San Leandro have historically had failure rates of less than 0.0005 dam failures per dam-year, reflecting an extremely low probability of occurrence.[48]

# Dam Bream Inundation Risk Assessment

## Vulnerability

The dam inundation maps developed by EBMUD show that Alameda would have more than four hours of warning before possible inundation. In this scenario vulnerable populations, including those disabled and elderly who would have difficult evacuating on their own would be most vulnerable. No schools or hospitals are within the mapped inundation zone.

## Impact

In the unlikely event of complete failure of Chabot Dam, potential inundation areas within Alameda include Corica Park Golf Course, Godfrey Park, residential properties along Beach Road, Maitland Drive, and Garden Road on Bay Farm Island, and portions of the Eastshore Drive area on the Main Island (See **Figure 4-30**).

In the unlikely event of complete failure of the Chabot Dam, Corica Park Golf Course, Godfrey Park and some residential properties along Beach Road, Maitland Drive and Garden Road on Bay Farm Island and the Eastshore Drive area of the Main Island of Alameda could become inundated as shown on **Figure 4-30**.

[47] California Division of Safety of Dams, List of State Jurisdictional Dams Including Hazard Characterization (2022). https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/All-Programs/Division-of-Safety-of-Dams/Files/Publications/Dams-Within-Jurisdiction-of-the-State-of-California-Listed-Alphabetically-by-Name-September-2022.pdf

[48] Dupuis, M.R., de Melo, L., Rix, G. (2023, September 17-21). *Estimated rates of failure for dams in the United States* [Poster-Lightning Talk Presentation]. Association of State Dam Safety Officials, Palm Springs, CA. https://damsafety.org/reference/estimated-rates-failure-dams-united-states

Significant development has not taken place since adoption of the previous plan and is not anticipated in the future. Development changes are not expected to increase vulnerability to dam breach inundation.

## Other Hazards Not Considered in this Plan

This plan focused on geologic and weather-related hazards impacting Alameda that can be in part addressed through upgrades to the physical environment. Hazards that are either not significant or don't fit within the scope of the plan are not included in our analysis. Many of these hazards are still addressed within the context of the City's emergency response planning efforts.

Lesser natural hazards for the City of Alameda include extreme cold and wind. While these hazards are important to plan for, and have occurred in Alameda, they present a much lower risk to life and property and the primary method to address them is through response planning, rather than pre-disaster mitigation. The record low temperature for Alameda was 26°F, set in December of 1972, during an unusual week-long cold snap with below freezing temperatures.

Hazards caused by immediate human activity are not within the required scope of this Local Hazard Mitigation Plan. Such hazards include chemical spills, tanker spills, large urban fires, arson, pandemics, cyber-attacks, civil unrest, energy shortages, terrorism, and transportation incidents (airplane, truck, ship, ferry, pipeline and bus). However, the City learned through its citizen survey, conducted as a part of this update process, that the community is concerned about these potential issues, and many are included in Alameda Emergency Operations Plan. Also not included in this plan is accidental dredging damage to Alameda infrastructures in the Estuary and San Leandro Channel, including sewer, water, power, natural gas, communications, marinas, and transportation.



# Chapter 5 Climate Adaptation and Hazard Mitigation Strategy

# Climate Adaptation and Hazard Mitigation Strategy Development

Development of the mitigation and climate adaptation strategy included identifying and analyzing existing capabilities and available mitigation measures to achieve the vision and goals.

# Capabilities Assessment

The City of Alameda has a variety of capabilities for reducing our long-term vulnerability to hazards, including planning and regulatory, administrative and technical, financial, education and outreach. Our mitigation and adaptation strategy draws from and builds on these existing capabilities. The following capabilities are already in place and informed the City's climate adaptation and hazard mitigation planning process. A description of the City's ability to expand on each of these capabilities is described within each capability section.

## Planning and Regulatory

The following ordinances, policies, local laws, plans and programs guide and manage growth and development in Alameda.

**General Plan 2040 (2022).** The General Plan is a statement of goals, objectives, policies and actions that describe the community's priorities for the next 20 years. California State law requires that every city adopt and maintain an up to date, internally consistent general plan. The General Plan addresses climate change, affordable housing, equity and inclusiveness, safe streets, open space and park funding priorities, and disaster preparation.

**Zoning Ordinance.** The Zoning Ordinance (Alameda Municipal Code Chapter 30) is a set of regulations that promote and protect the public health, safety, and general welfare of Alameda by guiding, controlling, **and** regulating future growth and development that occurs in the city. Zoning regulations apply to all new construction, building alterations, property line changes and most site construction work including some tree cutting and landscaping.

**Alameda Building Code.** All construction in California is regulated by building codes set forth by the California Department of Housing and Community Development. In addition, construction in Alameda must also comply with the Alameda Building Code (Alameda Municipal Code Chapter 13). Local governments can adopt amendments to the building code that require higher levels of performance than state minimum requirements when required by local climatic, geological, and topographical conditions. Alameda has adopted local amendments to the Energy Code, Green Buildings Standards Code and Fire Code as necessitated by local climatic, geological, or topographical conditions.

**Capital Improvement Program.** Alameda's Capital Improvement Program (CIP) aims to maintain and improve the City's aged public infrastructure as best it can with the resources available. An updated capital improvement budget is adopted every two years with the City's biennial budget.

**Storm Drain Master Plan** (Conveyance and Pump Stations): The City's master plan recommends improvements to address lack of capacity during 10-year and 25-year storms. The City relies on multiple gravity outfalls that discharge stormwater directly to San Francisco and San Leandro Bays, and the

master plan includes sensitivity testing to evaluate the discharge capacity with future sea level rise (e.g., 18- and 55-inches of sea level rise). Many of the areas most prone to stormwater flooding are the same low-lying areas identified by FEMA as flood-prone during the 1% annual chance coastal flood event. As sea levels rise, the shallow groundwater table will also rise. Rising groundwater levels are intricately linked with the City's storm drain system and lagoon operations. Future updates to the Storm Drain Master Plan could consider the potential for a rising groundwater table, with increased investments to identify areas with groundwater infiltration.

**Sewer Master Plan**: This plan updates all pump stations to meet current capacity and prioritizes rehabilitation of aging sewer pipes with more flexible material known to withstand seismic and flooding hazards.

**Transportation Master Plans**: The Alameda City Council has adopted the following plans that together aim to eliminate traffic deaths and severe injuries; create safe, comfortable, and accessible ways for people of all ages and all abilities to get around Alameda by walking and biking, and to reduce solo driving and increase other modes while improving safety and equity and reducing greenhouse gas emissions.

- Transportation Choices Plan (2018)
- Vision Zero Action Plan (2021)
- Active Transportation Plan (2022)

**Master Infrastructure Plan for Alameda Point**: This document established the requirements and standards for the backbone infrastructure to support re-development and reuse of Alameda Point (the former US Naval Air Station). The infrastructure improvements will create a seismically stable site that provides long-range flood risk reduction for Alameda Point from rising sea levels. The plan includes flood risk reduction strategies and requirements for raising elevations within the Development Areas, providing a perimeter flood risk reduction berm surrounding the historic core of the Adaptive Reuse Areas and managed shoreline retreat within open spaces. The plan also addresses rising groundwater as a result of sea level rise and the potential for mobilization of contaminants.

**Shoreline Adaptation Plan (in development)**: The Alameda Shoreline Adaptation Plan will adapt Alameda's shoreline to rising sea levels and groundwater and reduce current flood risk. The plan will include strategies, adaptation pathways, and priority projects, a study of potential land use changes and policies as well as an implementation plan. The plan will be completed in coordination with the Oakland Alameda Adaptation Committee (OAAC). Some of the projects being advanced by OAAC were identified in the 2019 CARP and 2022 LHMP, and the development of the Shoreline Adaptation Plan helped inform new projects in this LHMP update.

**Emergency Operations Plan.** The City of Alameda Emergency Operations Plan (EOP) is the foundation for disaster response and recovery operations for the City of Alameda. The plan outlines how the City of Alameda government complies with and implements the requirements of the California Emergency Services Act to protect the lives and property of the community of the City of Alameda.

**Floodplain Management Ordinance:** The ordinance includes provisions for residential and commercial construction in flood prone areas. The flood prone areas are generally defined by the FEMA Flood Insurance Rate Maps and base flood elevations. These provisions could be extended to include areas projected to be exposed by sea level rise and/or emergent groundwater. Over 1,000 properties within the City of Alameda are located within an SFHA. Current FIS and FIRMs were revised December 21, 2018.

### *Opportunities to expand Planning and Regulatory Capabilities*

- The Emergency Operations Plan was updated in 2026 and the Functional Annexes to the plan are going through additional revisions and testing before they are finalized.
- The Shoreline Adaptation Plan will be completed in 2027 for BCDC review and Council adoption. The planning process will include robust community engagement and will inform the City's strategy for adaptation to sea level rise.

## Administrative and Technical

The city employs a professional staff of approximately 500 (not including Alameda Municipal Power staff) that includes engineers, planners, attorneys, building officials and inspectors, administrative analysts, first responders, enforcement officers, and technicians who can all help to advance Alameda's mitigation and adaptation strategy. Staff coordinate across departments and agencies to implement mitigation and adaptation planning efforts on behalf of the City.

In addition, several staff have within their job descriptions the specific responsibility for climate adaptation and hazard mitigation.

- In 2020, the City hired a full-time Sustainability and Resilience Manager to oversee implementation of the Climate Action and Resiliency Plan and Climate Adaptation and Hazard Mitigation Plan.
- In 2023, the City dedicated one project manager to oversee the sea level rise adaptation work part-time.
- The Fire Department employs a full-time Disaster Preparedness Coordinator/Emergency Manager to coordinate citywide disaster preparedness, response and recovery efforts.
- A staff engineer within Public Works is designated to act as the Flood Plain Manager.
- All inspectors, code enforcement officers, and planners have received Post Disaster Assessment Certification.

### *Opportunities to expand Administrative and Technical Capabilities*

- City Council approved making the project manager responsible for sea level rise adaptation a full-time position and that position will be hired in 2026.

## Fiscal

The City of Alameda has a variety of financial resources available to help fund mitigation activities. In addition, Alameda regularly pursues State, Federal and other grant opportunities to implement identified mitigation and adaptation projects. As a municipal agency, Alameda can also place revenue measures on the ballot to fund specific climate adaptation and hazard mitigation projects.

- **General Fund.** Sources of revenue for Alameda's General Funs include property taxes, property transfer taxes, sales taxes, transient occupancy taxes (hotel tax), utility users' tax, franchise fees, business license taxes, and departmental fees and charges for services. General funds are used

to fund the day-to-day operations of the city. The General Fund budget includes $152.2 million in expenditures for FY 2025-26 and $153.8 million in expenditures for FY 2026-27

- **Capital Improvement Program Budget.** The capital budget implements the Capital Improvement Program. The Capital Improvement Program Budget totals $43.8 million for FY 2025-26 and $42.4 million for FY 2026-27. The capital budget is funded almost exclusively from restricted funds. The Sewer Fund is restricted to maintenance and replacement of City sewers. Transportation funds include Measure B/BB, Gas Tax, Road Maintenance and Vehicle Registration Fee. Transportation projects also are supplemented by the Development Impact Fee funds, which are paid for by new residential and commercial development, and an assortment of grant funding. Urban Runoff and Water Quality and Flood Protection fees are for the maintenance and enhancement of the City's stormwater infrastructure and various efforts to make stormwater pollution-free before it enters the Bay. The General Fund contributes about 15% of the total two-year funding and is one of the only funding sources that is not restricted and can support any public infrastructure expense.

### *Opportunities to expand Administrative and Technical Capabilities*

- The City has identified about $800 million in unmet infrastructure needs in the City, including aging roads, bridges, storm drains, and public safety facilities tat are increasingly vulnerable to severe storms, sea-level rise, and major earthquakes. To address this issue, the City is considering placing a $300 million local bond measure on the November 2026 ballot. This would create a protected, dedicated funding source specifically for our infrastructure needs.

## Education and Outreach

Alameda educates and informs the public about hazards and climate impacts and actions that can be taken to reduce their impact in a variety of ways.

- Alameda community members can opt in to AC Alert to receive important or emergency notifications from the City and County of Alameda. A total of 20,544 in Alameda (about 26% of the population) have subscribed to AC Alert as of June 2026.
- Regardless of opt-in, the City also has access to all AT&T and Comcast landline phone numbers and can send automated voice messages to those numbers.
- The City can also send, via Alameda County, Wireless Emergency Alerts (WEA) or IPAWS - Emergency Alert System (EAS) message that pushes the notification to all cell phones in the range of a selected wireless tower.
- Residents can also download the MyShake app to receive earthquake early warnings.
- Residents can use Genasys Protect to find out what Zone they live in and determine if an evacuation order or warning has been issued.
- The City's Public Information Officer also maintains official social media accounts on Facebook, Nextdoor and Instagram to educate and inform residents.
- In an emergency, important information may also be broadcast via public access television, channel 15 and the low power city radio notification system, 1280 AM.

Alameda conducts a variety of education and outreach to community members on disaster preparedness, including:

- **Community Emergency Response Team (CERT).** The CERT program provides training to Alameda residents and employees of Alameda businesses to increase self-sufficiency in a disaster. Participants learn skills that will enable them to provide emergency assistance to their families, colleagues, and neighbors.
- **Be Alameda Ready webpage.** The Be Alameda Ready webpage on the City's website provides information to community members about hazards in Alameda, how to prepare for an emergency, and includes notification of active emergency alerts. The website also includes and 8-week preparedness program that was shared with the community through an 8-week social media campaign.

### *Opportunities to expand Education and Outreach Capabilities*

- The development of the Shoreline Adaptation Plan and associated sea level rise adaptation projects will include significant community and stakeholder outreach that will inform the community of the risks and vulnerabilities Alameda faces from flooding on the shoreline and options to address the risk. With recent grant funding for these efforts, the City will be able to expand its ability to reach more community members with paid community partner organizations.

## National Flood Insurance Program (NFIP) Participation

The City is a National Flood Insurance Program (NFIP) participant which offers flood insurance to all Alameda residents and businesses and provides for disaster relief in case of an emergency. The City Council adopted Ordinance 3370 in May 2024, a comprehensive update to the City's Municipal Code Chapter XX – Floodplain Management, using a model ordinance provided by the California Department of Water Resources. The updated ordinance is consistent with current NFIP requirements and includes an automatic adoption clause for "all subsequent amendments and/or revisions" to the Flood Insurance Study (FIS) for Alameda County, California, and Incorporated Area with accompanying flood insurance rate maps (FIRMs). Per the ordinance, the Public Works Director is designated the Floodplain Administrator responsible for implementing the commitments and requirements of the NFIP.

The City continues to educate residents about the FIRMs, flood insurance and flood preparedness. The City regulates new construction in Special Flood Hazard Areas, per Municipal Code Chapter XX – Floodplain Management, and administers any local requests for map updates, gives community assistance, and monitors activities. All residential buildings constructed, substantially improved, and/or reconstructed due to substantial damage within Alameda are required to be built in conformance with a 1-foot freeboard requirement above Base Flood Elevation, meaning to a minimum Elevation of 11 ft NAVD88 or higher. The City also continues to work with Homeowner Associations regarding shoreline dike improvements. The Current FIS and FIRMs were revised December 21, 2018.

## Community Rating System (CRS) Participation

In response to the 2018 FIRM release, the City joined FEMA's voluntary Community Rating System (CRS) in 2019, which encourages communities to go above and beyond minimum NFIP requirements. In

exchange for participation in the CRS, communities receive an automatic discount on flood insurance premiums. Alameda is currently designated as a Class 8 community within CRS and homeowners receive a 10% discount on flood insurance accordingly. The City has investigated the possibility of participating as a Class 7 community and found that the level of outreach, documentation, and points required for the upgrade exceeds available staff capacity at this time.

# Mitigation Strategies

## Completed and Ongoing Strategies

The City and community members have worked together for years to address certain aspects of risk such as strengthening structures and utilities, bolstering pre and post disaster communication systems and hiring City staff tasked specifically with increasing disaster readiness in Alameda. Accomplishments include:

The following strategies were completed during the 2023-2026 planning period:

- Held regular meetings of the Oakland Alameda Adaptation Committee (OAAC), formerly known at the San Leandro Bay/Oakland Alameda Estuary Adaptation Working Group, with neighboring jurisdictions, agencies and community-based organizations to coordinate San Leandro Bay/Oakland-Alameda Estuary flood and adaptation projects to protect and restore water quality, habitat, and community resilience. (Strategy C3)
- Completed 30% design drawings and community engagement for Bay Farm Island Adaptation Project with grant funding from Federal Emergency Management Agency (FEMA). (Strategy I6)
- Completed design concept for Estuary Adaptation Project with grant funding from California Department of Transportation (Caltrans). (Strategy I6)
- Began Geomorphology and Ecology Study to inform design concept for South Shore beach area. (Strategy I6)
- Received Environmental Infrastructure authorization in the 2024 Water Resources Development Act (WRDA) to implement storm drain and shoreline improvements along the northern shoreline of Alameda Point. (Strategy I6)
- Began development of a Shoreline Adaptation Plan that details preliminary strategies and pathways for shoreline communities to take as the climate and shorelines change over time, as required by state law with grant funding from San Francisco Estuary Partnership (SFEP) and National Fish and Wildlife Foundation (NFWF). (Strategy S1)
- Converted lawn to drought tolerant landscape at City Hall and City Hall West. (Strategy B2)
- Completed a cost-benefit analysis and scope of work to apply for a FEMA HMGP grant to provide financial assistance to retrofit soft-story apartment buildings and encouraging residents of single-family homes to take advantage of the California Earthquake Brace and Bolt Program retrofit grants. (Strategy B4)
- Received Community Rating System 8 classification. (Strategy B5)

- Adopted a new Floodplain Ordinance to enhance flood risk reduction for all buildings within the City's floodplain. (Strategy L2)
- Completed additional groundwater analysis building on the 2020 study with a review a subset of monitoring well data post 2020, with an emphasis on the well observations in the spring of 2023 that consider the groundwater surface in response to the winter 2022/2023 rainfall events. (Strategy S2)
- Adopted the 2025 California Building Standards Code and adopted local amendments to the 2025 California Fire Code, Energy and Green Buildings Standards Code. (Strategy B10)
- Signed an MOU with AUSD for Mass Care and Shelter in an emergency. (Strategy E4)

The status of each strategy included in the 2022 Hazard Mitigation Plan is shown in **Appendix G**.

## Priority Mitigation Strategies

Mitigation and adaptation strategies include those that were in the previous plan, suggestions from the State of California Hazard Mitigation Plan, the City's General Plan and Climate Action and Resiliency Plan and other City plans, public input, staff input, board and commission input, and other sources. Additional mitigation measures will continue to be considered as future mitigation opportunities are identified, as data and technology improve, as mitigation funding becomes available, and as the Plan is maintained over time. Each mitigation strategy listed in **Table 5-1** below with the priority actions for 2026-2031, hazards addressed, lead department, timeframe, and potential funding source. Each strategy is explained in greater detail in **Appendix H.**

Timeframes are defined as:

- Ongoing: The strategy is currently being implemented and will continue to be implemented in the future
- Short-term: The strategy is anticipated to be implemented within the 5-year period of the plan
- Long-term: The strategy is anticipated to take longer than 5-years to be implemented

*Table 5-1 Priority Mitigation Strategies*

| Strategy | 2026-2031 Priority Actions | Hazards Addressed | Lead Department | Timeframe | Potential Funding Source |
|---|---|---|---|---|---|
| **Buildings** | | | | | |
| **B1 Water Efficiency and Conservation.** Minimize water use in existing and new construction and landscaped areas to make Alameda more resilient to drought and generate less wastewater. | Promote the production and usage of recycled and reclaimed water (sometimes called "grey water") for potable and non-potable uses. | Drought | Planning, Building and Transportation<br>Public Works<br>Recreation and Parks | Ongoing | EBMUD, HMGP, General Fund |
| **B2 Rising Groundwater.** Prepare for the impacts of rising groundwater levels on private and public property. | Develop a policy that minimizes groundwater pump in the development or expansion of new below ground basements in areas with high groundwater. Basement flooding is a recurring issue experienced by individual homeowners or renters, using sump pump devices. | Groundwater Rise | Planning, Building and Transportation<br>Public Works | Short-term | General Fund |
| **B3 Seismic Retrofit for Private Buildings.** Require owners of vulnerable structures, to the extent feasible, to retrofit existing structures to withstand earthquake ground shaking, and require retrofitting when such structures are substantially rehabilitated or remodeled. | a. Seek funding to support seismic retrofit of vulnerable soft-story buildings.<br>b. Encourage residents through a variety of means to apply for CEA Earthquake Brace and Bolt (EBB) and Earthquake Soft-Story (ESS) retrofit programs. | Earthquake Ground Shaking<br>Earthquake Liquefaction | Planning, Building and Transportation | Short-term | HMGP, CEA Brace and Bolt Program, CDBG |

| Strategy | 2026-2031 Priority Actions | Hazards Addressed | Lead Department | Timeframe | Potential Funding Source |
|---|---|---|---|---|---|
| **B4 Flood Insurance.** Continue the City's participation in the National Flood Insurance Program and the Community Rating System as a Class 8 community. Maintain Alameda's Community Rating to reduce flood insurance costs. | a. Continue to recertify CRS status annually.<br>b. Maintain City participation in the National Flood Insurance Program, thereby allowing citizens benefits of reduced flood insurance rates.<br>c. Continue to educate residents about floods and how they can prepare.<br>d. Continue to enforce floodplain management requirements, including regulating new construction in Special Flood Hazard Areas, administer any local requests for map updates, give community assistance, and monitor activities. | Flooding<br>Sea Level Rise | Public Works | | Urban Runoff Fund |
| **B5 Design for Flooding.** Implement programs and amend regulations to require and incentivize flood-proofing retrofits to existing buildings in flood-prone areas and require all new development to raise finished floor elevations and design for sea level and associated groundwater rise based on the most current regional projections. | a. Develop policies for new developments to ensure they are designed to accommodate future sea and groundwater levels. | Flooding<br>Groundwater Rise<br>Sea Level Rise | Planning, Building and Transportation | Ongoing | Private developers, HMGP, BRIC |
| **B6 Building Codes.** Maintain up to date building codes and adopt new codes as needed to | Adopt latest version of the California Buildings Standards Code with local amendments as | Earthquake Caused Fires | Fire<br>Planning, Building and Transportation | Ongoing | Private developers, General Fund |

| Strategy | 2026-2031 Priority Actions | Hazards Addressed | Lead Department | Timeframe | Potential Funding Source |
|---|---|---|---|---|---|
| improve building safety and reoccupancy in an earthquake, fire, flood or other disaster. | needed to improve building safety and reoccupancy in an earthquake, flood or disaster. | Earthquake Ground Shaking | | | |
| **B7 Fire Prevention in Existing Properties.** Encourage existing properties to minimize the risks of fire and include adequate provisions for emergency access and appropriate firefighting equipment. | Consider local amendments to future editions of the California Energy and Fire Codes that require higher than state minimum standards for energy efficiency and fire sprinklers. | Earthquake Caused Fires | Fire<br>Planning, Building and Transportation | Long-term | General Fund, HMGP |
| **B8 Cool/Green Buildings.** Incentivize and consider requiring the installation of cool roofs, green roofs, and/or other energy-efficient cool building methods to mitigate heat impacts and reduce runoff. | Consider ways to support green roof installation on new and existing buildings | Heat | Planning, Building and Transportation | Long-term | General Fund |
| **B9 Sea Level Rise Protection.** Reduce the potential for property damage and loss, and loss of natural habitat resulting from sea level rise. | Seek additional grants to implement concept designs for shoreline adaptation projects and continue community engagement. | Flooding Sea Level Rise | Community and Economic Development<br>Planning, Building and Transportation<br>Public Works | Ongoing | General Fund, Prop 68, Prop 4, SB1 Track 2 grants |
| **Infrastructure** | | | | | |
| **I1 Critical Public Assets.** Ensure resilience and long-term functionality of critical public assets threatened by earthquakes, sea level rise or rising groundwater. | a. Upgrade storm drain pump stations and replace storm drain pipes and culverts, and drainage improvements to reduce surface flooding.<br>b. Replace sewer pipes to decrease groundwater and | Dam Failure Earthquake Ground Shaking Flooding Liquefaction | AMP<br>Planning, Building and Transportation<br>Public Works | Ongoing | Facility Maintenance Fund 706, HMGP, BRIC, AMP and City Capital |

| Strategy | 2026-2031 Priority Actions | Hazards Addressed | Lead Department | Timeframe | Potential Funding Source |
|---|---|---|---|---|---|
| | rainwater infiltration and improve performance in earthquakes. | Sea Level Rise | | | Improvement Programs |
| **I2 Stormwater Detention.** Design street rights-of-way, parks, other public spaces, street trees and landscaping to be resilient to temporary flooding and to serve as temporary water detention sites where feasible. | Continue to incorporate street trees and rain gardens as part of corridor and transportation projects | Flooding<br>Sea Level Rise | Planning, Building and Transportation<br>Public Works | Ongoing | Capital Budget |
| **I3 Urban Forest.** Maintain and expand the number of trees in Alameda on public and private property to improve public health, reduce pollution, and reduce heat island effects. | a. Adopt and implement the Urban Forest Plan.<br>b. Plant trees in parks and the public right of way. | Heat | Public Works<br>Recreation and Parks | Short-term | Urban Forest operating budget, General Fund |
| **I4 Lagoons.** Continue to preserve and maintain the lagoons as natural habitat as well as an integral component of the City's green infrastructure network and flood control system. | Implement lagoon dredging and lagoon system outfall maintenance projects to preserve and maintain lagoon system functionality. | Flooding | Public Works | Ongoing | Capital Budget |
| **I5 On-Island Generation.** Support development of on-island solar power generation and wind power. | a. Continue to support residents to install rooftop solar systems. | Earthquake<br>Ground Shaking<br>Wind/Storms | AMP | Ongoing | AMP funds |

| Strategy | 2026-2031 Priority Actions | Hazards Addressed | Lead Department | Timeframe | Potential Funding Source |
|---|---|---|---|---|---|
| **I6 Public Infrastructure Priorities.** Identify public transportation, streets, electric facilities, stormwater and wastewater facilities, open space, shoreline assets, and other public assets vulnerable to sea level and groundwater rise and flooding hazards and earthquakes and prioritize projects for adaptation funding, including strategies for Location-Based Priority Flooding (Appendix I). | a. Complete design and begin construction of the Bay Farm Island Adaptation Project.<br>b. Advance the design concept for the Estuary Adaptation Project.<br>c. Identify funding to develop a design concept for the South Shore Adaptation Project<br>d. Request appropriations from the Water Resources Development Act authorization to design and construct the Alameda Point Adaptation Project | Coastal Erosion<br>Earthquake Ground Shaking<br>Flooding<br>Groundwater Rise<br>Liquefaction<br>Sea Level Rise | Planning, Building and Transportation<br>Public Works | Ongoing | Proposition 68 Climate Adaptation Grant, Caltrans Sustainable Communities Grant, HMGP, BRIC, SB1 Track 2, Prop 4, Facility Maintenance Fund 706, AMP and City Capital Improvement Programs |
| **I7 Green Infrastructure.** Implement the 2019 City of Alameda Green Infrastructure Plan to increase and incorporate areas for green infrastructure in Alameda to help infiltrate stormwater and reduce street flooding. Green infrastructure can be implemented and designed in pre-existing infrastructure plans or new development plans. | a. Continue planning and permitting development project oversight to promote inclusion of Green Infrastructure project features in public and private projects.<br>b. Educate the public about small-scale green infrastructure design for residential and garden projects. | Flooding<br>Sea Level Rise | Planning, Building and Transportation<br>Public Works | Ongoing | Capital Budget, Private Developers |

| Strategy | 2026-2031 Priority Actions | Hazards Addressed | Lead Department | Timeframe | Potential Funding Source |
|---|---|---|---|---|---|
| **I8 Underground Utilities.** Continue to replace overhead electrical power lines with underground lines and require new development to underground power lines to improve the safety and reliability of the power grid and minimize disruption by fire or other natural disasters. | a. Complete undergrounding project for Otis/Broadway District<br>b. Recommend City Council approval for additional undergrounding projects for the following areas:<br>-Webster Street - all crossings - Central Avenue to Pacific Avenue including Eagle Avenue - West of Constitution Way; and along Central Avenue from Eighth Street to Webster Street.<br>- Broadway - Buena Vista Ave to Clement Ave<br>- Fernside Boulevard from Encinal Avenue to High Street, including lines on Lincoln Park access road<br>- Park Street - San Jose Avenue to Otis Drive | Earthquake Caused Fires | AMP | Ongoing | 2% of AMP's electric revenue are put into the Underground Utility District Fund (UUDF) |
| **I9 Lifeline Standard Estuary Crossing.** Work with Caltrans, Alameda County, and other regional agencies to retrofit and improve at least one estuary crossing to meet a lifeline standard to ensure access to the larger region for emergency access, equipment supplies, and disaster response and recovery shortly after a major seismic event. | a. Work with Alameda County to upgrade estuary crossing bridges and provide back up power supply to ensure they can be used for the movement of supplies, evacuations and emergency vehicles and to support recovery efforts in the event of a major earthquake.<br>b. Continue to work with the U.S. Army Corps of Engineers to complete the disposition study of the Fruitvale Rail Bridge. | Earthquake Ground Shaking Liquefaction | Public Works | Long-term | Alameda County, HMGP, BRIC |

| Strategy | 2026-2031 Priority Actions | Hazards Addressed | Lead Department | Timeframe | Potential Funding Source |
|---|---|---|---|---|---|
| **I10 Emergency Firefighting Water Supply.** Create an emergency water supply system to ensure sufficient firefighting capabilities after an earthquake or large emergency. | a. Secure funding to begin phased build out of emergency firefighting water supply system.<br>b. Consider purchase of 2 additional tenders for a total of 4. This would allow for each fire station to have one. | Earthquake Caused Fires | Fire | Short-term | HMGP |
| **Land Use** | | | | | |
| **L1 Land Development.** Require that new development include onsite stormwater detention, reduce the potential for property damage, and loss of natural habitat, which results from groundwater and sea level rise. | Future updates of the General Plan will explore and consider more fully this 50-year climate scenario and its implications for Alameda. | Coastal Erosion<br>Groundwater Rise<br>Sea Level Rise | Planning, Building and Transportation | Ongoing | Private developers |
| **Emergency Response** | | | | | |
| **E1 Heat and Wildfire Smoke Emergencies.** Create a network of clean air and cooling emergency shelters throughout Alameda. | Evaluate need for additional Clean Air and Cooling Centers | Heat<br>Wildfire Smoke | Library<br>Public Works<br>Recreation and Parks | Ongoing | General Fund |
| **E2 Emergency Preparedness.** Maintain emergency management and disaster preparedness as a top City priority. | Finalize Functional Annexes to the City's Emergency Operations Plan and conduct regular exercises of the plan. | All Hazards | Fire | Ongoing | General Fund |
| **E3 Tsunami Preparedness.** Prepare Alameda for tsunamis and prepare for a timely evacuation from the shoreline | a. Become a TsunamiReady city<br>b. Participate in Tsunami Preparedness week each year in March and encourage residents to | Tsunamis | Fire<br>Planning, Building and Transportation | Ongoing | USGS/CalOES and Public Works funds |

| Strategy | 2026-2031 Priority Actions | Hazards Addressed | Lead Department | Timeframe | Potential Funding Source |
|---|---|---|---|---|---|
| with a focus of access and functional needs populations. | sign up for AC Alert and know their zone in Genasys Protect | | | | |
| **E4 Emergency Coordination.** Coordinate local emergency preparedness efforts with local, state and federal partners in preparation for natural and man-made disasters and ensure that the City's disaster response communication technologies are compatible with other agency communication technologies. | | All Hazards | Fire | Ongoing | General Fund, Assistance provided or received during an emergency will be reimbursed with state or federal funding if it is a declared emergency. |
| **E5 Wildfire Smoke.** Prepare for future wildfire smoke events. | Continue to provide Clean Air and Cooling centers at the Library and other locations on smoky or hot days to provide relief for residents. | Wildfire Smoke | Fire | Ongoing | General Fund, Capital Improvement Program |
| **E6 Emergency Response and Disaster Preparedness.** Preserve access for emergency response vehicles to people and property and for evacuation. | Continue working with the United States Army Corps of Engineers (Army Corps) to address the public safety hazard posed by the adjacent abandoned Fruitvale rail bridge.<br><br>Continue coordination with WETA and AC Transit and participate in Bay Area emergency response training exercises. | Dam Failure<br>Earthquake Ground Shaking<br>Liquefaction<br>Tsunamis | Planning, Building and Transportation<br>Public Works | Long-term | HMGP, BRIC, General Fund |
| **Communication, Community and Coordination** | | | | | |

| Strategy | 2026-2031 Priority Actions | Hazards Addressed | Lead Department | Timeframe | Potential Funding Source |
|---|---|---|---|---|---|
| **C1 Public Communication.** Maintain and promote community programs to train volunteers, support vulnerable community members like seniors and individuals with disabilities, coordinate with food banks and other local aid organizations, and assist police, fire, and civil defense personnel during and after a major earthquake, fire, or flood. | Encourage the public to opt-in to AC Alert and follow the City on social media.<br>Continue to support CERT teams and train more volunteers | All Hazards | City Manager's Office<br>Fire<br>Police | Ongoing | General Fund |
| **C2 Air Quality Alerts.** Continue to partner with Bay Area Air District to enhance awareness of air quality index alerts and related outreach and education to protect the health of residents. | Continue to encourage residents to sign up for AC Alert to receive emergency notifications | Wildfire<br>Smoke | Fire | Ongoing | General Fund |
| **C3 Regional Partnerships.** Actively participate in regional discussions on groundwater and sea level rise mitigation, infrastructure improvements, and adaptation strategies. | Continue to facilitate and lead the Oakland Alameda Adaptation Committee (OAAC) to prepare for sea level rise and coastal flooding in the Oakland and Alameda subregion. | Groundwater Rise<br>Sea Level Rise | City Manager's Office<br>Planning, Building and Transportation<br>Public Works | Ongoing | Regional, state and federal grants, General Fund |
| **C4 Collaboration.** Work collaboratively with other jurisdictions and agencies to reduce fire hazards in Alameda, such as post-earthquake fire hazards, with an emphasis on mutual aid agreements | Continue to participate in Bay Area emergency response training exercises. | Earthquake Caused Fires | Fire | Ongoing | General Fund |

| Strategy | 2026-2031 Priority Actions | Hazards Addressed | Lead Department | Timeframe | Potential Funding Source |
|---|---|---|---|---|---|
| **C5 Neighborhood Resilience Coordination.** Consider piloting building electrification, water conservation and other climate initiatives at a block or neighborhood level to more cost effectively transition to climate friendly energy, water, and resource use. | Consider opportunities to pilot neighborhood electrification pilots based on SB 1221. | All Hazards | Planning, Building and Transportation | Ongoing | General Fund |
| **C6 Social Vulnerability.** Prioritize the needs of frontline communities when prioritizing public investments and improvements to address climate change. | - Update Social Vulnerability Assessment with 2020 Census<br>- Develop equity toolkit to prioritize equity in the development and implementation of policies | All Hazards | All | Ongoing | General Fund |
| **Studies and Plans** | | | | | |
| **S1 Shoreline Adaptation Plan.** Develop a shoreline adaptation plan that includes additional vulnerability studies as needed, economic analysis, groundwater rise studies and other data collection as needed to identify the range of flood risk reduction, groundwater management and adaptation strategies over time from short- to long-term as well as land use, building and infrastructure design standards needed to help Alameda adapt to rising sea and groundwater | Complete Shoreline Adaptation Plan for BCDC approval and Council adoption as required by SB272. | Sea Level Rise | Community and Economic Development<br>Planning, Building and Transportation<br>Public Works | Long-term | SB1 grant |

| Strategy | 2026-2031 Priority Actions | Hazards Addressed | Lead Department | Timeframe | Potential Funding Source |
|---|---|---|---|---|---|
| levels and comply with BCDC's Regional Shoreline Adaptation Plan Guidance. | | | | | |
| **S2 Rising Groundwater.** Collect new data, add groundwater monitoring wells, analyze additional contaminants and potential landfill risks, update liquefaction zones and continue to refine the quality of the groundwater model to better prepare for the impacts of rising groundwater levels on private and public property. | Identify funding to add new groundwater monitoring wells and update Alameda's groundwater map with new data. | Groundwater Rise | Planning, Building and Transportation<br>Public Works | Short-term | General Fund |
| **S3 Flood Hazard Maps.** Prioritize the review and publishing for public discussion the latest and most up to date flood hazard and sea level rise forecasts from all trusted sources. | Continue to maintain up to date website with flood and sea level rise maps and information. | Flooding | Planning, Building and Transportation | Ongoing | General Fund |

## Strategies for Location-Based Priority Flooding

Flooding is one of the greatest climate threats that Alameda faces. The City identified potential strategies to mitigate flood risks associated with overland coastal flooding due to high tides and/or storm surge, rising groundwater tables and emergent groundwater, and precipitation-based flooding. These strategies are presented in **Appendix I.**




***Figure 5-1 Strategies for Location-Based Priority Flooding***

## Strategies Provided by Key Partners

**Table 5-2** shows owners of key infrastructure and facilities in Alameda and includes known mitigation actions. The individual agencies should be contacted directly for a complete list of hazard mitigation efforts.

*Table 5-2 Key Partner Mitigation Strategies*

| Owner/Manager | Infrastructure Within City | Known Hazard Mitigation Efforts |
|---|---|---|
| East Bay Municipal Utility District (EBMUD) | ■ Potable (including fire suppression) and non-potable (irrigation), pipelines and fire suppression water supply system consisting of pipelines, pumping plants, flow/pressure control facilities, and storage tanks and reservoirs owned by EBMUD<br>■ Sanitary sewer transmission pipeline (wastewater interceptor) and pumping stations<br>■ Sewer and water connections under the Estuary and San Leandro Bay | ■ Three new pipeline crossings are proposed to replace the existing pipeline crossings and new large diameter in-street pipelines are to connect the new crossings to transmission mains to ensure long-term reliability of the water distribution system, meet existing and future water needs, and facilitate repair and replacement of aging infrastructure. The first crossing which crosses the Oakland Inner Habor from Oakland was installed in 2023 and the second crossing which will cross the San Leandro Channel from Bay Farm Island is being designed and is scheduled for construction by July 2028. The last crossing which will cross the tidal canal from Oakland is scheduled to be completed by July 2031.<br>■ The environmental review process for the project is underway. Through this process, EBMUD will assess the impacts of the project and identify ways to reduce or eliminate the impacts with input from stakeholders and the community.<br>■ One new sanitary sewer force main pipe crossing from Bay Farm Island to the main island of Alameda to provide redundancy to an existing aging force main pipe. The environmental review process for the project will start in 2025, with design following completion of the environmental document.<br>■ EBMUD has an ongoing program of rehabilitating wastewater interceptor and force main pipes, as well as pump stations.<br>■ EMBUD has an ongoing program to replace aging and brittle water lines with more modern materials.<br>■ EBMUD is collaborating with the City on the development of a Debris Management Plan and a Utility Staging Area.<br>■ EBMUD is bringing recycled water to the main island by 2032 – 2035, enhancing our resilience to drought. |

| Owner/Manager | Infrastructure Within City | Known Hazard Mitigation Efforts |
|---|---|---|
| | | ■ For more information about activities EBMUD is taking for earthquake readiness: https://www.ebmud.com/about-us/construction-and-maintenance/fire-safety-and-suppression/emergency-preparedness/ |
| Pacific Gas and Electric (PG&E) | ■ Natural gas distribution system, including main pipelines, lateral pipelines and meters. | ■ PG&E has an ongoing program to replace aging pipelines with more modern materials and to install new valves and pressure regulation facilities.<br>■ PG&E is considering replacement of the power feeds under the Estuary.<br>■ As a consequence of the San Bruno gas rupture, the National Transportation Safety Board (NTSB) has issued a number of recommendations to State and federal administrations and institutions to improve the safety of pipeline networks as well as to upgrade the integrity management program and emergency response system. As a result, PG&E proposed a $2.2 billion Pipeline Safety Enhancement Plan to modernize its gas transmissions operations over the next several years. As part of this plan, PG&E has installed approximately 13 SCADA units to remotely monitor and manage the pressure in gas transmission lines in the City of Alameda.<br>■ Additionally, PG&E has created a First Responders Safety website, which provides secure access to maps and information about natural gas transmission lines, natural gas storage facilities, and shut-off valves. |
| AT&T, Comcast, and other telecoms | Telecommunications aerial and underground conduits. Switching facilities. Cell towers. | ■ Improvements are ongoing. |
| Caltrans | Posey and Webster Tubes, Bay Farm Island (AKA San Leandro Channel) Bridge and Bike Bridge, Constitution Overpass, State Routes 61 and 260. | ■ Seismic evaluation and retrofit of bridges<br>Posey and Webster Tubes – The tubes were retrofit to “no collapse” standard in 2003. Caltrans has no plans for seismic upgrades or upgrading the facility other than current refurbishment of the ventilation system.<br>Bay Farm Island vehicular bridge (San Leandro Creek Bridge) – Built in 1953 and |

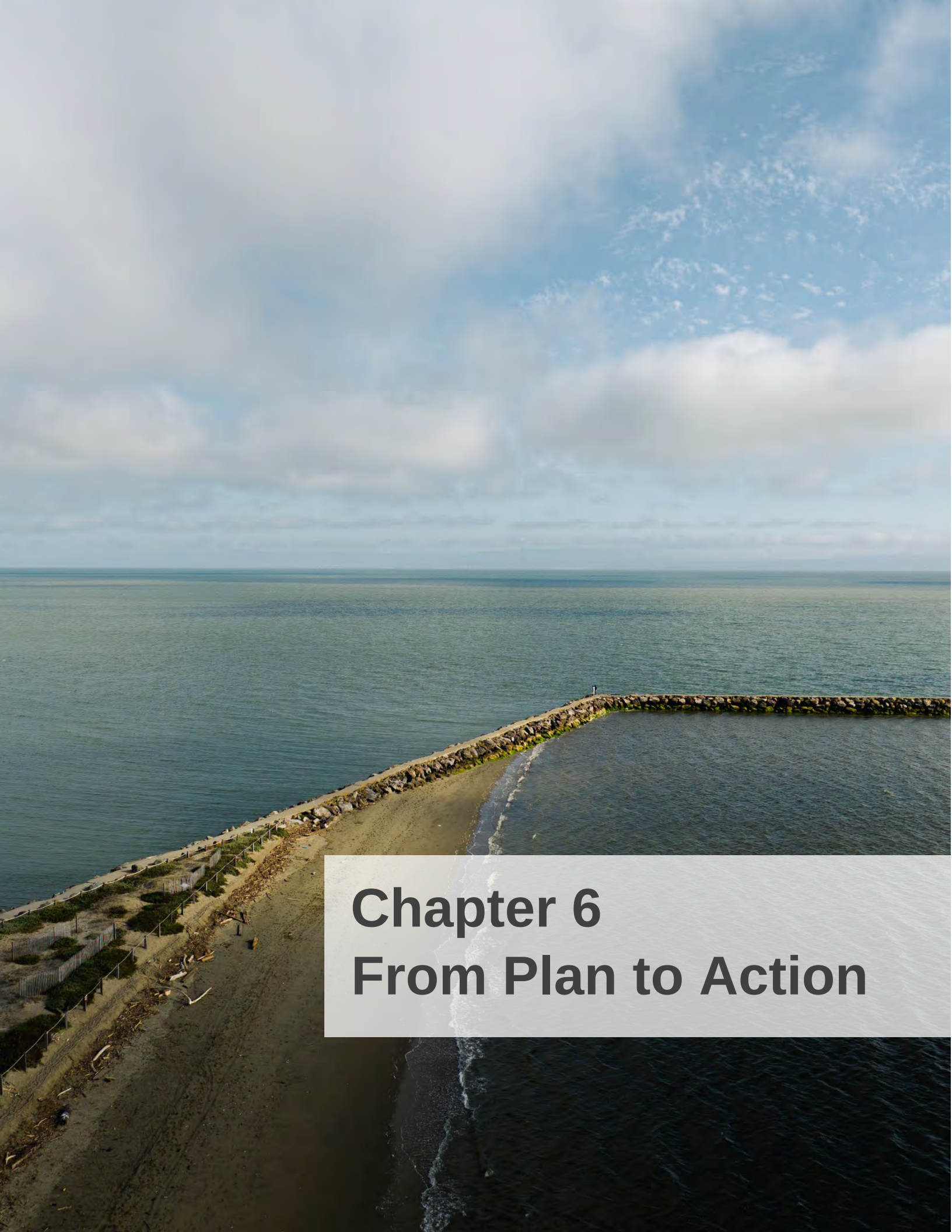
| Owner/Manager | Infrastructure Within City | Known Hazard Mitigation Efforts |
|---|---|---|
| | | seismically retrofitted in 1997 to "no collapse" standard. City sent a letter in 2007 requesting retrofit to "lifeline" standard.<br>Caltrans completed a Project Initiation Document (PID) (EA 4W410) in June 2023 to maintain the integrity of the bridge and extend its lifespan. The project is currently in the Environmental Review phase with construction completion expected in 2034.<br>— Bay Farm Island bike/pedestrian bridge – The bridge was built in 1996 and there are no plans for seismic retrofit work.<br>— Constitution Way overcrossing – this bridge was built in 1985 and there are no plans for seismic retrofit work.<br>■ Temporary detour plans<br>— Posey and Webster Tube: There is a current Traffic Management Plan in use during the construction/refurbishment of the ventilation system, and when closing the tunnel. The detour plan may be utilized, subject to Incident Commander discretion when an incident occurs. There is currently a traffic restriction prohibiting 3+ axle vehicles from using the tubes, requiring those vehicles to use detours. That restriction and detour plan will be in place through estimated completion of the ventilation project in 2028.<br>— Roadway – State Routes 61 and 260: Detour plans may be activated as necessitated by an emergency, subject to Incident Commander discretion. Caltrans District Traffic Manager may be able to assist during the time of the incident.<br>■ Post-earthquake inspection of Caltrans bridges, roadways and tunnels will be conducted by Caltrans staff as necessary depending on the earthquake intensity and extent of damage.<br>■ Caltrans is participating in OAAC to identify and implement shoreline adaptation measures. |

| Owner/Manager | Infrastructure Within City | Known Hazard Mitigation Efforts |
|---|---|---|
| County of Alameda | Miller-Sweeney (Fruitvale), Park Street, and High Street Bridges. | ■ The County retrofitted all three bridges to “no collapse” standard from 2008 to 2011, and continues to maintain, operate and monitor these bridges. |
| Federal Government – Army Corps of Engineers | Fruitvale Railroad Bridge | ■ City staff is working with the United States Army Corps of Engineers (Army Corps) to address the public safety hazard posed by the abandoned rail bridge that is likely to collapse in a seismic event.<br>■ In 2020, the Army Corps submitted a request for funding to prepare a "Disposition Study," which is a comprehensive analysis of the economic utility of the bridge, in light of federal purpose and benefit.<br>■ In 2024, the Army Corps kicked off the disposition study and are considering four alternatives:<br>— No Action- bridge remains an authorized project and they would make structural repairs and bring up to code.<br>— Disassemble and recycle<br>— Disassemble and relocate for another owner in another location<br>— Transfer ownership in its existing location (no one is interested yet).<br>■ The Army Corps has initiated environmental review under NEPA and the cultural resources and historic preservation review. They are expecting a draft report of potential solutions for public comment in early 2025. Construction of the determined alternative will not start for several years.<br>■ The City of Alameda would like to have the hazardous structure replaced with a new crossing for transit, bicycles and pedestrians. |
| Federal Government – Coast Guard and Navy | Portions of Alameda Point, all of Coast Guard Island including bridge, Coast Guard Housing, Ready Reserve, Navy Operations Reserve Center | ■ The United States Coast Guard has completed a sea level rise vulnerability assessment and adaptation plan for Coast Guard Island, which looked holistically at the shoreline. An adaptation design has been completed that segments the island into nine different adaptation areas with primarily natural measures on the east side and |

| Owner/Manager | Infrastructure Within City | Known Hazard Mitigation Efforts |
|---|---|---|
| | | riprap/sheet pile replacement on the west side. |
| East Bay Regional Park District (EBRPD) | EBRPD manages the Robert Crown Memorial Beach and the Northern Territories at Alameda Point on behalf of the City of Alameda and State of California. EBRPD is responsible for major maintenance and upgrades; the City is responsible for storm drain maintenance. | ■ EBRPD completed restoration of Crown Beach in 2014, which has the indirect effect of protecting Shoreline Drive from storm erosion.<br>■ EBRPD completed the Crown Memorial Beach Groin Extension and Elsie Romer Wetland Restoration projects in 2017 to extend the groin at Park Street to decrease beach erosion and continue to help preserve the Elsie Romer Wetland.<br>■ EBRPD and the City are collaborating on immediate efforts to reduce beach erosion and on grant funding for a near-term beach replenishment project with nature-based solutions.<br>■ EBRPD is participating in OAAC to identify and implement shoreline adaptation measures. |
| Housing Authority | The Housing Authority has 572 senior, disabled, and low income housing units. | ■ The Housing Authority has recently completed a comprehensive needs assessment of all properties.<br>■ A capital improvements plan has been prepared to reduce risks to vulnerable populations. The plan includes management training, waterproofing work, communications systems, backup generators and other features. |
| Alameda Unified School District (AUSD) | AUSD has 19 schools in Alameda, serving TK through 12 grades, plus a preschool and an adult school. | ■ AUSD has completed seismic retrofits of the Historic Alameda High School and Kofman Auditorium.<br>■ Lum Elementary school was closed in 2017 because of concerns about liquefaction risk on the campus.<br>■ The City of Alameda is in the process of entering into an MOU with AUSD to use any school site as a shelter. |
| American Red Cross (ARC) | Tasked with providing shelter operations and feeding during disasters. | ■ The ARC and the City are working on shelter agreements for sheltering locations within the City.<br>■ The ARC is also working on shelter agreements with other organizations, |

| Owner/Manager | Infrastructure Within City | Known Hazard Mitigation Efforts |
|---|---|---|
| | | including schools and churches, for additional sheltering locations.<br>■ The ARC is working with other organizations to prepare for mass feeding needs.<br>■ The ARC has moved out of its warehouse at Alameda Point. They now have a very small warehouse in San Leandro and moved the rest of the cache supplies (cots, food, etc.) for Bay Area sheltering needs to San Jose with a major part of the cache moving out to Stockton. |
| Medical Facilities | There are numerous medical facilities that provide services to vulnerable populations.<br>■ Alameda Hospital<br>■ Private Clinics<br>■ Alameda County Health<br>■ (Future) Veterans Administration Clinic<br>■ Pharmacies | ■ Alameda Hospital is completing a seismic retrofit of the west building, in compliance with SB1953. |
| Water Emergency Transportation Authority (WETA) | WETA operates ferries that travel to three terminals within the City of Alameda. The landside portion of the ferry terminals is operated and maintained by the City; the waterside portion is operated and maintained by WETA. | ■ Built a maintenance facility and new ferry terminal on Alameda Point.<br>■ Completed the Main Street Alameda Ferry Terminal Refurbishment Project to repair and replace existing infrastructure to bring the building into compliance with current seismic safety standards, including foundation work. Renovations also involved replacement of gangways and passenger floats -- which are waiting and boarding areas, as well as utility upgrades that will prepare the terminal for electrification<br>■ Awarded grant funding to support electrification of the Harbor Bay Terminal as part of a $21.5M program to construct an electrified universal charging float and battery, electrical infrastructure system for both ferry vessels and automobiles as well as provide for facility modernization of the Harbor Bay Ferry Terminal. |

| Owner/Manager | Infrastructure Within City | Known Hazard Mitigation Efforts |
|---|---|---|
| | | ■ WETA's electrification project is part of the ferry system's Rapid Electric Emission-Free Ferry Program, which outlines steps to take to create the first zero-emission ferry system in the nation, including installing charging and battery stations. |



# Chapter 6
# From Plan to Action

The Climate Adaptation and Hazard Mitigation Plan is a living document that must be regularly reviewed and updated. This chapter provides a roadmap for how the public will remain engaged in the plan, how the plan will be integrated into other planning processes and how it will be maintained and updated over time. The plan will undergo a comprehensive revision and update before the expiration of this 5-year plan.

# Continued Public Involvement

Public participation is an integral component of the mitigation planning process and will continue to be essential as this Plan evolves and is updated over time. The most appropriate and meaningful opportunity for the public to be involved in the maintenance and implementation of the Plan is during the five-year plan review process. However, the City also intends to do hazard mitigation outreach and education during the interim periods, which may promote a more engaged citizenry for the five-year update process. The public can review the plan and provide input and feedback during the five-year plan maintenance period at www.alamedaca.gov/hazardmitigationplan.

As demonstrated in **Appendix B**, the City was diligent and successful in providing public involvement opportunities during this five-year plan review process through multiple methods. However, despite our efforts, we know that we missed certain segments of the population, particularly minorities, youth, and the disabled. These are important voices to be part of the conversation and represent some of the populations most likely to significantly impacted by the hazards described in this plan. As we design outreach and education opportunities going forward, we must consider additional ways to reach these populations. Considerations may include partnering more closely with Mastick Senior Center, audio programs for the visually impaired, materials translated into multiple languages, flyering to tenants, and engagement with the schools.

# Integration into Other Planning Processes

Information from the 2016 plan was integrated into other planning processes, including the 2040 General Plan Safety and Climate Conservation Elements, 2019 Emergency Operations Plan, and the Capital Improvement Program. As City departments and regional agencies update various plans they will incorporate the data and strategies from this plan into their planning processes. The construction of new infrastructure or completion of mitigation programs will also be tracked for inclusion in the subsequent update of the plan. Information from the current plan may be integrated into the following plans as they are updated:

**Emergency Operations Plan.** The Local Hazard Mitigation Plan is a key component of the City's Emergency Operations Plan (EOP) of 2019. The EOP addresses the City's planned response to emergency situations. The objective of the EOP is to coordinate the personnel, facilities, and other resources of the City into an efficient organization capable of responding to any emergency, disaster, or planned event. The key mitigation effort of the EOP is to have planning, strategies, personnel assignments, and training in place before a disaster strikes, so that the response and recovery can be effective and professional. The City's EOP includes discussions of the National Incident Management System (NIMS) to establish the chain of command, the Standardized Emergency Management System (SEMS) to identify functions and responsibilities, Incident Command (IC), mutual aid, functioning of the Emergency Operations Center (EOC), and ongoing training.

**Capital Improvement Program (CIP).** The most recent CIP, for FY 19-21, aims to maintain and improve our City's aged public infrastructure as best it can with the resources available. The CIP has one budget

for each of the main infrastructures, such as sanitary sewer piping, city buildings, street resurfacing, etc. Concurrently, the Public Works Department is developing short- and long-term master plans for each infrastructure, to best spend the limited dollars to address both new needs and the drawdown of deferred maintenance. This more flexible budget also allows for reprioritization as serious maintenance needs become apparent.

**Master Plans.** Master plans have been developed or are in the final stages of development. All of these have been developed to best meet the needs of the users, within the projected CIP budget. Some address hazard mitigation, more specifically:

- **General Plan (2021):** The City completed a comprehensive update of the General Plan in 2021. The Health and Safety element has been updated coincident with the 2021 LHMP so that the information is consistent between the two documents.
- **Alameda Housing Element 2022:** The Housing Element provides policies and programs to shape and guide decision making on types of housing needed, locations for new housing in Alameda, and strategies to preserve housing and help people with special housing needs. The goals include improving resiliency and reducing the greenhouse gas emissions of Alameda's housing stock and minimizing displacement in the event of a natural disaster.
- **Climate Action and Resiliency Plan (2025):** The Climate Action and Resiliency Plan is a long-term plan to reduce Alameda's Greenhouse Gas emissions that cause climate change through equitable improvements to transportation, buildings, energy use, and waste management and adapt to the impacts of climate change, such as rising seas and increasing extreme heat and smoke days. The Local Hazard Mitigation Plan is included as a component of CARP.
- **City-Owned Buildings Facility Assessment:** The City completed a study on the highest maintenance needs for existing city buildings. This included the immediate needs of code deficits, ADA issues, damage repair, normal wear and tear (paint, carpet, etc.) and deferred maintenance. The study did not include a seismic review of each building. This will be done in future revisions of the Plan. Other than the golf course buildings, no city buildings have been identified within the 100-year flood plain.
- **Storm Drain Master Plan (Conveyance and Pump Stations):** The City's master plans specifically address lack of capacity during 10-year and 25-year storms. While the plans were completed before the new FEMA floodplain maps were issued, they do address 18-inch and 55-inch sea level rise adaptations, which impact the same areas identified by FEMA as flood-prone.
- **Sewer Master Plan:** This plan updates all pump stations to meet current capacity and prioritizes rehabilitation of aging sewer pipe with more flexible material known to withstand seismic and flooding hazards.
- **Transportation Master Plans** (transportation plans addressing transit, bicycle, pedestrian, signals, goods movement, air quality, and other transportation needs): City Council approved the Transportation Choices Plan in 2018, which has goals to reduce solo driving and increasing the share of other modes with the primary objectives of safety, equity, and reducing greenhouse gases, including improved evacuation. In December 2021, City staff will request City Council approval of the Vision Zero Action Plan that includes specific actions and policy changes to increase street safety in Alameda. In 2022, City staff will request City

Council approval of the Active Transportation Plan, which will update the existing Pedestrian Plan (2009) and Bicycle Master Plan (2010). All these plans encourage the flexibility of transportation by diversifying both routing and conveyance means. This will be useful during times when regular transportation is disrupted.

- **Master Infrastructure Plan for Alameda Point:** This document established the requirements and standards for the backbone infrastructure to support redevelopment and reuse of Alameda Point (the old Navy Base). The infrastructure improvements will create a seismically stable site that can adapt to the potential impacts of climate change.
- **Urban Forest Plan (in development):** The plan provides guidelines for increasing urban tree canopy in Alameda which can help mitigate against environmental challenges such unhealthy air quality, and urban heat islands. The plan also emphasizes equity when increasing canopy cover.

# Keeping the Plan Current

## Plan Monitoring and Evaluation

The Climate Adaptation and Hazard Mitigation Plan is a living document that must be regularly reviewed and updated. Public participation is an integral component of the mitigation planning process and will continue to be essential as this Plan evolves and is updated over time.

The Sustainability and Resilience Manager in the City Manager's Office will be charged with providing an annual report on an annual basis within the five-year cycle. The annual report will be provided to the public, relevant boards and commissions, and to the City Council at a public meeting in conjunction with the Climate Action and Resiliency Plan annual report.

The responsible agency assigned to each mitigation strategy will be responsible for tracking and reporting on each of their actions. The annual report will include a table that tracks progress of the mitigation strategies as well as an evaluation of the plan's effectiveness. This evaluation may include an assessment of whether there have been changes in the political climate, if there have been any hazard events that require revision to the risk assessment or mitigation strategies, or changes to the plan's goals or objectives. The evaluation will determine whether there have been any changes that necessitate a plan modification. Any modifications to the plan will be submitted to CalOES and FEMA.

## Plan Update Process

Per federal regulations, this plan must be updated every five years. The Sustainability and Resilience Manager will ensure that a complete review and update of the Plan, including the hazard analysis and mitigation strategy, is completed before the expiration of the current Plan. The plan update process will follow much the same process as followed in the 2024 update. The General Plan will also be amended as necessary to maintain consistency with the Climate Adaptation and Hazard Mitigation Plan.



# Appendix A
# Planning Process

# Alameda CARP Update

*February 6, 2024*

## Green Team Meeting #1

## Agenda

1. **3-3:10pm Introductions**

2. **3:10-3:30pm CARP Update Overview**
    a. Project Team
    b. Purpose of the CARP
    c. What the CARP Covers
    d. Key Steps in the CARP Update
    e. Build on Past and Ongoing Work
    f. Community Engagement
    g. Overall Project Schedule
    h. Questions on the CARP Update and Process?

3. **3:30-3:40pm Green Team Roles and Expectations** (Danielle leads)
    a. Purpose
    b. Roles and Responsibilities
    c. Ground Rules
    d. Logistics
    e. Anticipated Topics to be Covered at the Meetings

4. **3:40-3:55pm CARP and City Department Alignment Activity**

5. **3:55-4:55pm Group Discussion**

6. **4:55-5pm Next Steps**
    a. Data request
    b. Evaluation of past strategies
    c. Next meeting

# Alameda CARP Update

## Green Team Meeting #2: Agenda and Background Materials

April 18, 2024

1. **10:30am Welcome and Get Settled**

2. **10:35-11:00am Preliminary Draft 2022 Greenhouse Gas Inventory**
    a. Purpose of the GHG Inventory
    b. Inventory Review
    c. Discussion

3. **11:00-11:45am CARP Vision and Goals**
    a. Review Existing CARP Vision and Goals
    b. Group Activity to Revise Vision and Goals (see following page for more details)

4. **11:45-12:00pm Next Steps**
    a. Ongoing / Upcoming Community Engagement
    b. Green Team and Departmental Meetings

## CARP Vision

The 2019 CARP included the following vision statement as an umbrella for plan implementation.

> *Alameda will be an innovative leader in achieving net zero carbon emissions and community resilience as soon as possible, and serve as an example that inspires similarly impacted cities to do the same. Our community members will be a vital part of this ongoing process.*

Discussion Question: Do you feel like the statement continues to reflect the community's vision for climate action? If it has changed, how so?

## CARP Goals

The 2019 CARP included eight targeted goals to achieve the City's vision. This section lists those eight goals, organized by GHG reduction, climate adaptation, and implementation, followed by a series of discussion questions.

### Greenhouse Gas Reduction

> *1. GHG reduction: Reduce GHG emissions to 50 percent below 2005 levels by 2030 and achieve net zero GHG emissions as soon as possible. Alameda will achieve these targets by completing current actions and implementing new actions focused on transportation, building management, waste management, and carbon sequestration. Co-benefits of GHG reduction include the reduction of fossil fuel pollutants and a reduction in asthma, cardiovascular disease, and other health issues.*

**Discussion Questions:**

- Does this GHG reduction goal still resonate with you? Is it missing anything and/or how would you refine it?
- In the context of your work / partners, what actions do you feel should be prioritized to reduce emission?
- Although the City is actively addressing climate change by reducing emissions and addressing climate hazards, is the CARP missing anything? Is there more that the City could do?

### Climate Adaptation

> *2. Sea level rise and storm surges: Protect assets from sea level rise and storm surges, plan future land use to avoid impacts, and enhance natural shoreline habitat to mitigate impacts.*
>
> *3. Inland flooding: Increase the resiliency and capacity of the stormwater system to prevent flooding of assets during extreme precipitation events.*
>
> *4. Drought: Reduce water consumption and increase drought-resistant landscaping. EBMUD is bringing recycled water to the main island by 2023.*

*5. Extreme heat: Reduce the heat island effect and protect vulnerable populations from heat impacts during heat waves.*

*6. Wildfires: Protect public health from smoke impacts during wildfire events, especially among vulnerable populations.*

*7. Earthquakes/liquefaction: Ensure that building and infrastructure retrofits and new design standards in areas at high risk of liquefaction consider both seismic risk and sea level rise impacts.*

**Discussion Questions:**

- Do these adaptation goals still resonate with you? Is it missing anything and/or how would you refine the goals?
- Thinking of recent disasters, can you share any lessons learned from coping with or responding to these events?
- Thinking ahead 20 years, what do you think would make Alameda, your community, and/or the groups of people you work with better able to cope with climate change?

## Implementation

*8. Effective implementation and capacity building: Develop financial and human resources and increase transparency, community engagement, social resilience, and support for effective CARP implementation.*

**Discussion Questions:**

- What barriers or challenges exist to implementing CARP strategies?
- How do you/your organization engage with the City now? In what other ways could you engage with the City on climate-related topics?

# Alameda CARP Update

## Green Team Meeting #3: Agenda

May 16, 2024

1. **10:30am Welcome**

2. **10:30-10:45am Vision/Goals Stakeholder Engagement Feedback**
    a. Stakeholder Focus Group main take-aways
        i. CASA and CBOs
        ii. Youth
        iii. Chamber of Commerce
        iv. Housing
    b. Community Survey #1
        i. Open 4/18 to 5/10
        ii. 112 responses (will update at closing)
    c. Discussion

3. **10:45-11:45am Updated CARP Mitigation Strategies Framework**
    a. Review CARP Mitigation Strategies Framework
    b. Group Discussion
        i. *Purpose*: Engage Green Team in revision of the CARP mitigation strategies
        *ii.* *Questions*:
            1. Tell us what you think about the proposed CARP sectors and strategies. Does the new structure make sense to you?
            2. Are we missing any important strategies?
            3. What other key plans or programs should the strategy align with?
            4. Should a more detailed action plan be prepared for this strategy?

4. **11:45-12:00pm Next Steps**
    a. Green Team
        i. Departmental meetings – Mitigation action plans; confirm participation
        ii. Green Team Meeting #4 – Adaptation strategies
    b. Ongoing / Upcoming Community Engagement
        i. June community workshop

# Alameda CARP Update

## Green Team Meeting #3: Agenda and Background Materials

May 16, 2024

1. **10:30am Welcome and Get Settled**

2. **10:30-10:45am Vision/Goals Stakeholder Engagement Feedback**
    a. Stakeholder Focus Group main take-aways
    c. Community Survey #1
    b. Discussion

3. **10:45-11:45am Updated CARP Mitigation Strategies Framework**
    a. Review CARP Mitigation Strategies Framework
    b. Group Discussion
        i. Tell us what you think about the proposed CARP sectors and strategies. Does the new structure make sense to you?
        ii. Are we missing any important strategies?
        iii. What other key plans or programs should the strategy align with?
        iv. Should a more detailed action plan be prepared for this strategy?

4. **11:45-12:00pm Next Steps**
    a. Green Team and Departmental Meetings
    b. Ongoing / Upcoming Community Engagement

# Alameda CARP Update

## Green Team Meeting #4: Agenda

August 15, 2024

1. **10:30 Welcome and Get Settled**

2. **10:30-10:35 Review CARP Strategies Table**

3. **10:35-11:15 Review Proposed Targets and Metrics**
    a. Tell us what you think about the proposed targets and metrics.
    b. Are we missing any important targets?
    c. Do you have data or data sources that you are tracking that support monitoring / reporting efforts for these strategies?

4. **11:15-12:00 Review Draft GHG Action Plans for CARP Strategies**
    a. Tell us what you think about the proposed action plans.
    b. Are we missing any actions or initiatives that should be included?

5. **12:00 Next Steps**
    a. How to comment on the action plans

# Alameda CARP Update

## Green Team Meeting #5: Agenda

September 19, 2024

1. **10:30am Welcome**

2. **10:35-10:45am Overview of CARP and LHMP Update Process**
    a. Overview of process and hazards

3. **10:45-11:30am Flooding-Related Hazards**
    a. Overview of Flood Hazards
    b. Review of Previous Priority Areas / Strategies
    c. Review of Updated Priority Areas / Strategies
4. **11:30-11:45am Other Hazards**
    a. Overview of Other Hazards
    b. Review of Previous Priority Strategies
    c. LHMP Update
5. **11:45-12:00pm Next Steps**
    a. Green Team
        i. Review and comments on strategies via submission form
    b. Ongoing / Upcoming Community Engagement
        i. CARP City Council Update Oct 15, 2024
        ii. OAAC City Council Update Jan 2024
        iii. Release Draft CARP in Dec 2024 (for public comment)

# Alameda CARP Update

## Green Team Meeting #6: Agenda and Background Materials

November 14, 2024

1. **3:00pm Welcome and Get Settled**

2. **3:00pm-3:45pm Adaptation Measures**
    a. Review CARP/LHMP adaptation framework
    b. Discussion

3. **3:45-4:15pm GHG Action Plan Questions**

4. **11:45-12:00pm Next Steps**
    a. Ongoing / Upcoming Community Engagement
    b. Public draft release
    c. Upcoming annual report



# Appendix B
# Public Outreach

# May Sustainability Newsletter

City of Alameda sent this bulletin at 05/08/2024 02:35 PM PDT

Having trouble viewing this email? View it as a Web page.

# Sustainability and Resilience News


- Take our Climate Action and Resiliency Plan Update Community Survey!
- Sea Level Rise Survey and Workshop on May 20
- Introducing AMP's New Induction Cooktop Rebate!
- AMP Multifamily EV Charging Technical Assistance Program Webinar on May 14
- East Bay Green Home Tour on June 1


---

## Take our Climate Action and Resiliency Plan Update Community Survey!




The City of Alameda is updating the Climate Action and Resiliency Plan, and we'd like your input! In the update, the City is looking to reflect the community's visions, goals, and ideas to achieve our 2030 climate action goals in the areas of land use and housing, transportation, building energy use, waste management, and climate adaptation.

We want to hear from you! Please take the **CARP survey** to give your input on Alameda's climate action vision and goals.

---

## Sea Level Rise Survey and Workshop on May 20

Your input is vital in helping us navigate the challenges posed by rising sea levels. Please complete the **sea level rise adaptation survey** to share your goals for the shoreline. As a valued stakeholder, your perspective is crucial. We appreciate your input!

Please join us for a workshop on May 20th to understand what sea level rise means for Oakland and Alameda, what we're doing to prepare and the tools we have to make our communities safer.

The **Oakland Alameda Adaptation Committee** is a coalition of shoreline communities and stakeholders working to co-create a resilient shoreline. We are committed to getting your input to help make our shoreline resilient.

Please help us spread the word by sharing this event with your networks!

**Date: May 20th, 2024**

**Time: 6:00 PM**

**Location: Zoom [Register here]**




## Introducing AMP's New Induction Cooktop Rebate!



AMP is helping you revolutionize your kitchen space with a new sizzling hot induction cooktop rebate program! Receive up to $600 when you make the switch. Induction cooking is convenient, provides instant heat for faster boiling, and promotes a healthier home! Visit **AMP's rebate page** to learn more and apply today!

---

## AMP Multifamily EV Charging Technical Assistance Program Webinar on May 14



Alameda Municipal Power (AMP) has launched its Electric Vehicle (EV) Charging Technical Assistance Program to provide free technical assistance for planning and designing EV charging solutions at multifamily properties in Alameda. AMP and CLEAResult will host a **webinar** **on Tuesday, May 14th from 11am-12pm** for multifamily decisionmakers to learn more about AMP's programs to support EV charging at multifamily properties and receive rebates.

EV charging at multifamily properties has multiple benefits, including increased property value by attracting and retaining tenants as more people switch to EVs, as well as removing barriers to EV ownership with convenient charging for households who rent.

Learn more and register for the **webinar** today!

---

## East Bay Green Home Tour on June 1

See what your East Bay neighbors are doing with their homes to combat climate change, improve air quality, generate clean energy, conserve water, and move towards a safer, healthier, greener future.

This year's Green Home Tour will include a virtual tour of 3 homes in the morning and an in-person tour of 10+ homes in the afternoon. See green home features, systems, and appliances up close. So many good ideas to jump start your own home projects!

**Learn more and register here.**




---

**Contact us**
sustainability@alamedaca.gov

https://www.alamedaca.gov/climateaction

*You are receiving this because you are signed up for the Environment, Sustainability and Climate Action mailing list.*

Stay Connected with the City of Alameda:

SUBSCRIBER SERVICES:
Manage Subscriptions | Unsubscribe All | Help

## Subscribe to updates from City of Alameda

Email Address e.g. name@example.com
Subscribe

## Share Bulletin

Powered by GOVDELIVERY

Privacy Policy | Cookie Statement | Help

# June Sustainability Newsletter

City of Alameda sent this bulletin at 06/05/2024 05:07 PM PDT

Having trouble viewing this email? View it as a Web page.

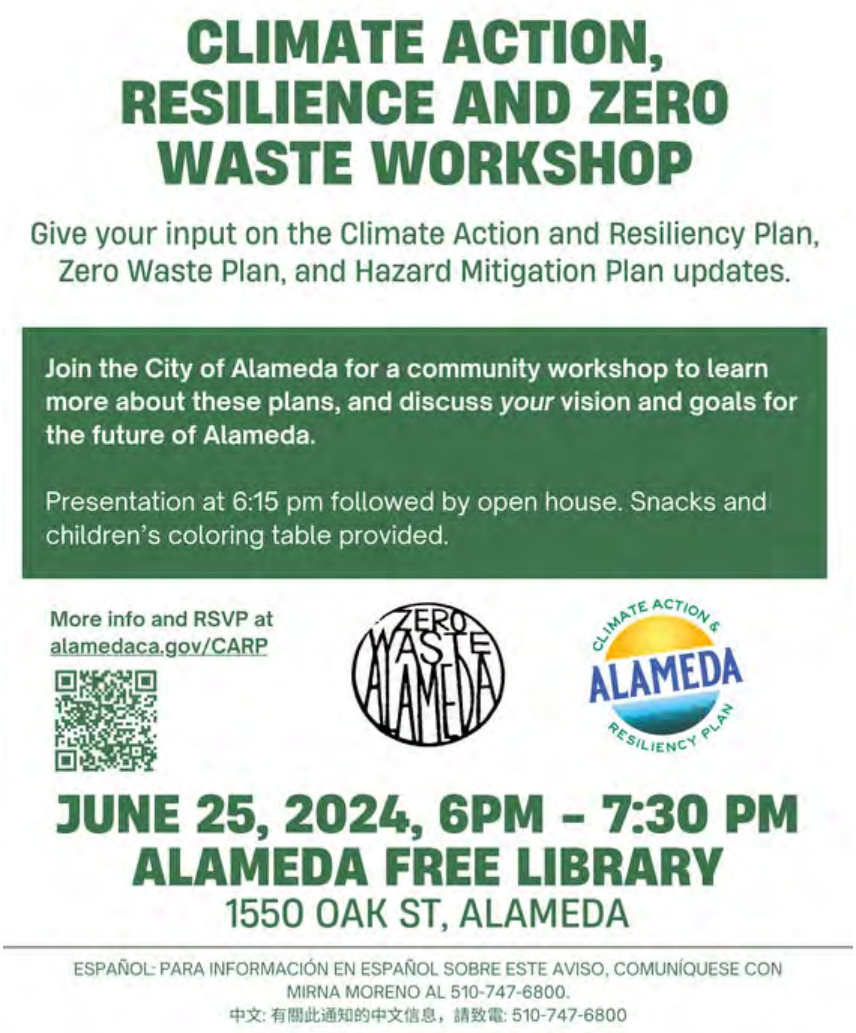
# Sustainability and Resilience News


- Climate Action, Resilience and Zero Waste Workshop June 25 at Alameda Free Library
- Alameda is Recruiting a CivicSpark Fellow - Apply Today!
- “Save the Planet in Your Spare Time” book launch event August 3 at Books Inc.


---

## Climate Action, Resilience and Zero Waste Workshop June 25 at Alameda Free Library

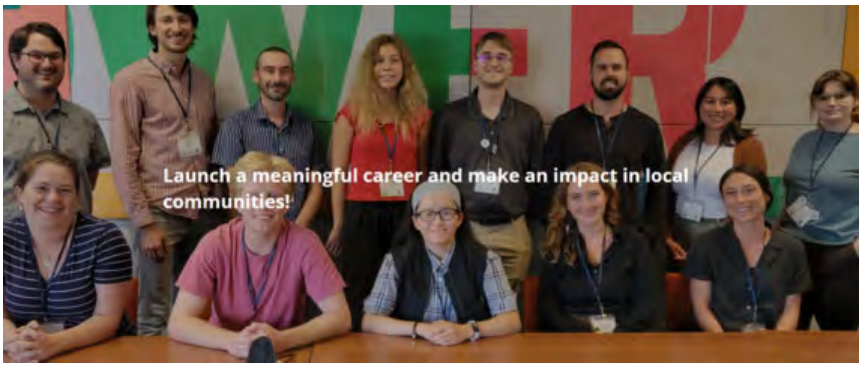
The City of Alameda invites you to a public workshop and open house to give your input on the Climate Action and Resilience Plan (CARP), Local Hazard Mitigation Plan (LHMP), and Zero Waste Implementation Plan (ZWIP) updates. Join to discuss your vision and goals for sustainability in Alameda! Learn more and register here.




---

## Alameda is Recruiting a CivicSpark Fellow - Apply Today!

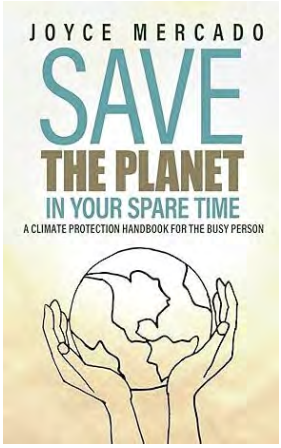
The City of Alameda is recruiting a CivicSpark Climate Action and Adaptation Fellow for the 2024-2025 service year. The Fellow will work in the Sustainability and Resilience Division on various projects including implementation of the updated Climate Action and Resiliency Plan, assisting in sea level rise adaptation project planning, expanding EV charging and building electrification. Visit the City of Alameda's project description, and visit the CivicSpark webpage to learn more and apply today!




---

## "Save the Planet in Your Spare Time" book

## launch event August 3 at Books Inc.




Join local author and passionate climate activist Joyce Mercado to launch her book “Save the Planet in Your Spare Time – A Climate Protection Handbook for the Busy Person” at **Books Inc., 1344 Park Street, Alameda** on **Saturday August 3 at 3:30 pm.** The event will include a book signing and interview by Community Action for a Sustainable Alameda's Ruth Abbe.

If you want to learn how to do more to protect the climate, this book is for you! It chronicles Joyce’s journey to becoming a climate protection leader in Alameda.

Leaders influencing others in their communities to protect the climate, community by community, is an essential element in fighting climate change and you can be an effective part of the solution to the climate crisis. Anyone can be such a leader, even if you have a busy life. We need thousands of leaders like you in communities across the country and the world to solve the climate crisis. Together we can make a difference!

Join the book launch and learn how to become a climate leader in your community! The book is available at Books Inc. in Alameda.

---

**Contact us**

sustainability@alamedaca.gov

https://www.alamedaca.gov/climateaction

*You are receiving this because you are signed up for the Environment, Sustainability and Climate Action mailing list.*

Stay Connected with the City of Alameda:

SUBSCRIBER SERVICES:
Manage Subscriptions | Unsubscribe All | Help

### Subscribe to updates from City of Alameda

Email Address e.g. name@example.com
Subscribe

### Share Bulletin

Powered by GOVDELIVERY

Privacy Policy | Cookie Statement | Help

# CLIMATE ACTION, RESILIENCE AND ZERO WASTE WORKSHOP

Give your input on the Climate Action and Resiliency Plan, Zero Waste Plan, and Hazard Mitigation Plan updates.

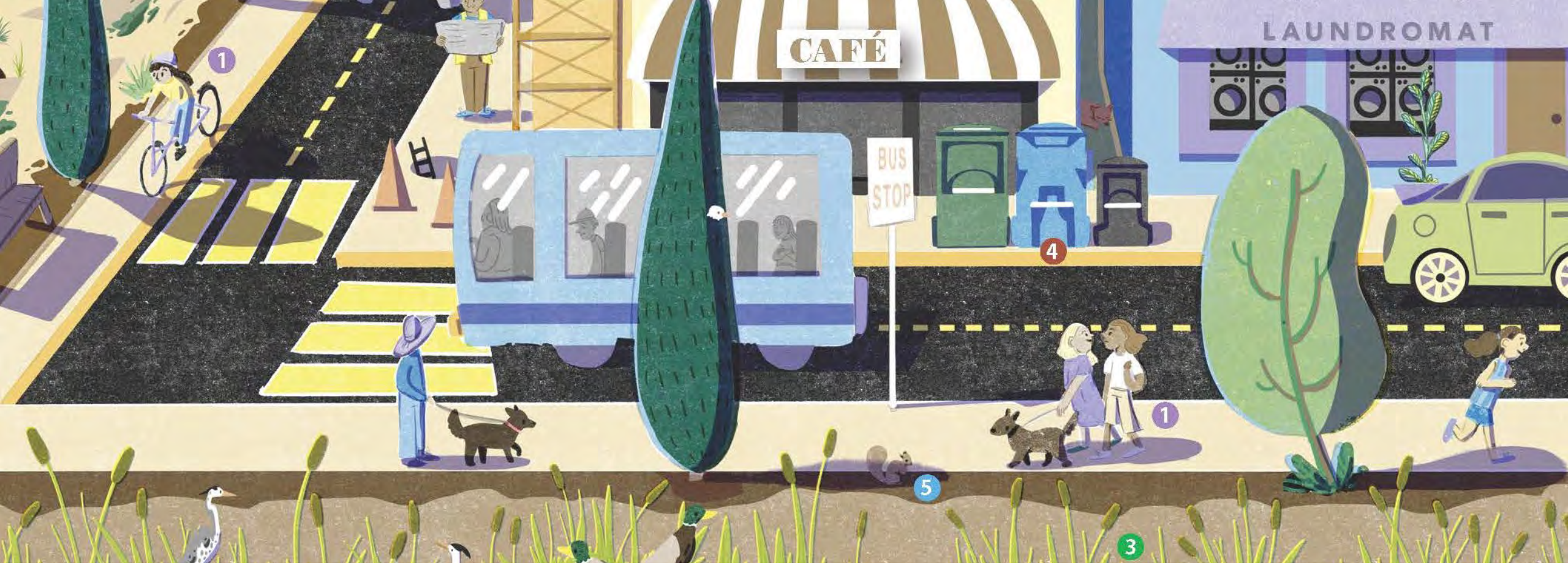
**Join the City of Alameda for a community workshop to learn more about these plans, and discuss *your* vision and goals for the future of Alameda.**

Presentation at 6:15 pm followed by open house. Snacks and children's coloring table provided.

**More info and RSVP at**
**alamedaca.gov/CARP**

## JUNE 25, 2024, 6PM – 7:30 PM
## ALAMEDA FREE LIBRARY
## 1550 OAK ST, ALAMEDA

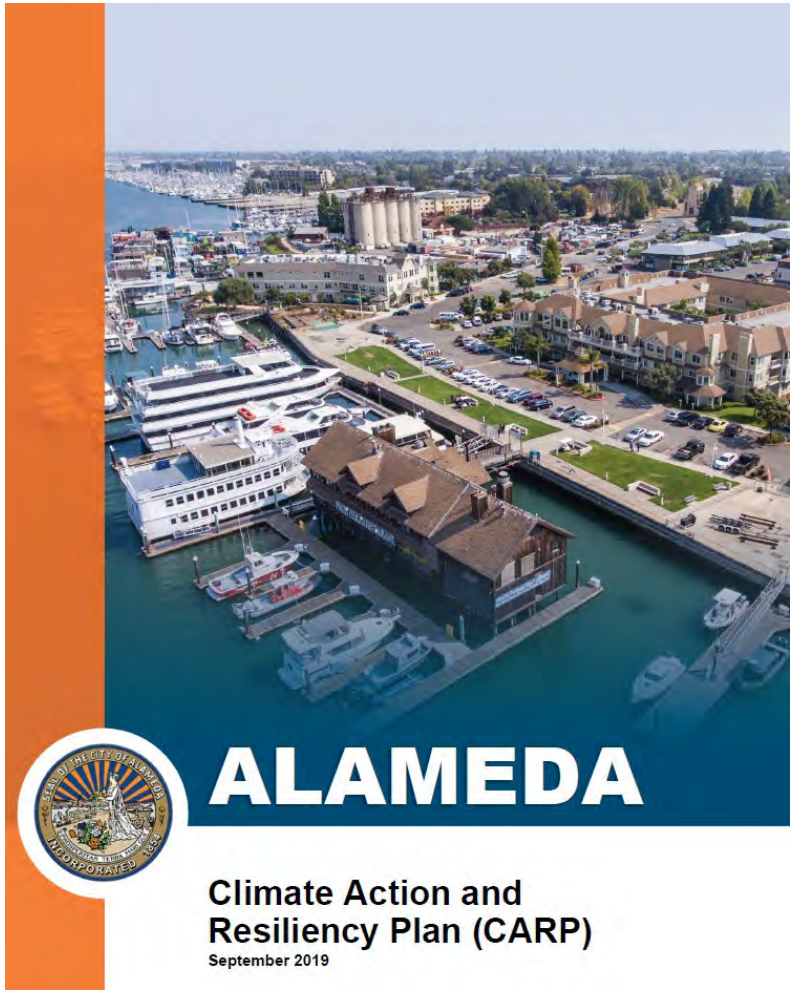
ESPAÑOL: PARA INFORMACIÓN EN ESPAÑOL SOBRE ESTE AVISO, COMUNÍQUESE CON MIRNA MORENO AL 510-747-6800.
中文: 有關此通知的中文信息，請致電: 510-747-6800




# Community Workshop

June 25, 2024

# Workshop Agenda




| | |
|---|---|
| **6:00-6:10pm** | Welcome and Workshop Overview |
| **6:10-6:40pm** | Plan Update Overview and Open House |

- Climate Action and Resiliency Plan (CARP)
- Local Hazard Mitigation Plan (LHMP)
- Zero Waste Implementation Plan (ZWIP)
- Open House Stations

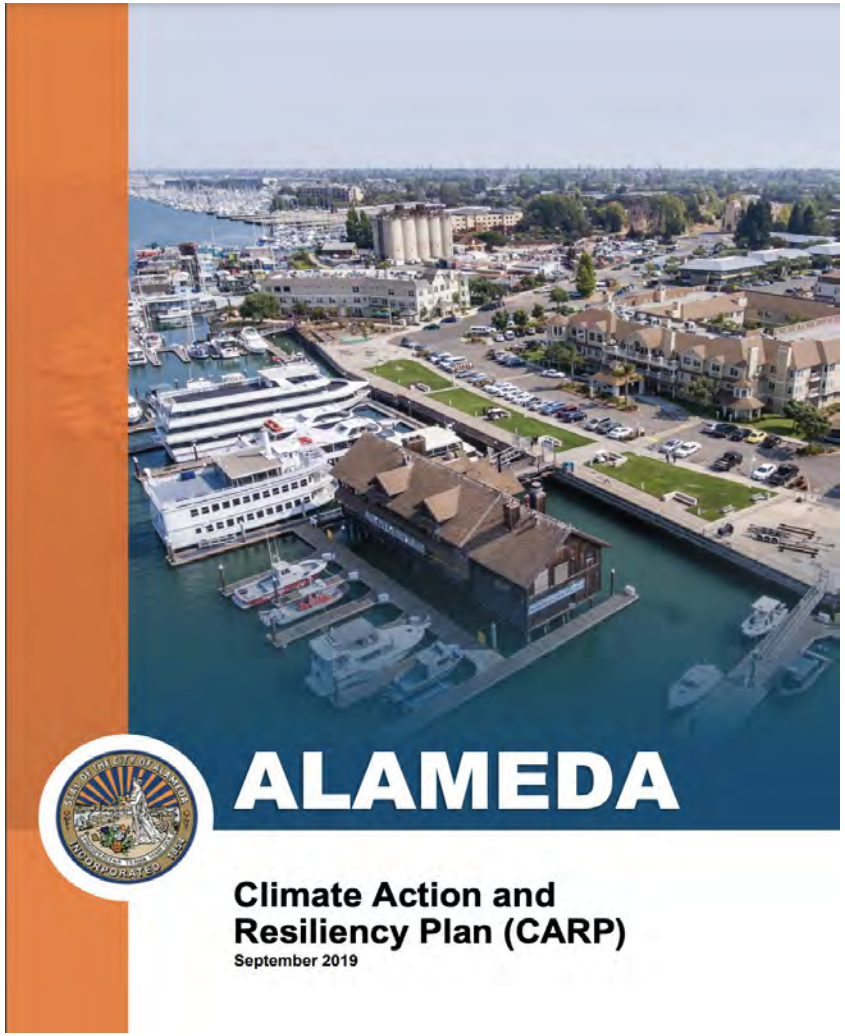
| | |
|---|---|
| **6:40-7:30pm** | Open House Stations |
| **7:30pm** | Raffle and Adjourn |

# Climate Action and Resiliency Plan Update

# Alameda Climate Action and Resiliency Plan

- Reduce emissions by 50% below 2005 levels by 2030
- 2019 Climate Emergency Declaration
  - Achieve net zero emissions as soon as possible
- Climate Adaptation
  - Flooding, sea level and groundwater rise, drought, extreme heat, hazardous air quality, and earthquakes/ liquefaction.

www.alamedaca.gov/CARP



# Climate Action and Resiliency Plan (CARP)

## Climate Adaptation & Hazard Mitigation

- Local Hazard Mitigation Plan
  - General Plan Safety Element
  - Oakland Alameda Adaptation Committee (OAAC) Projects

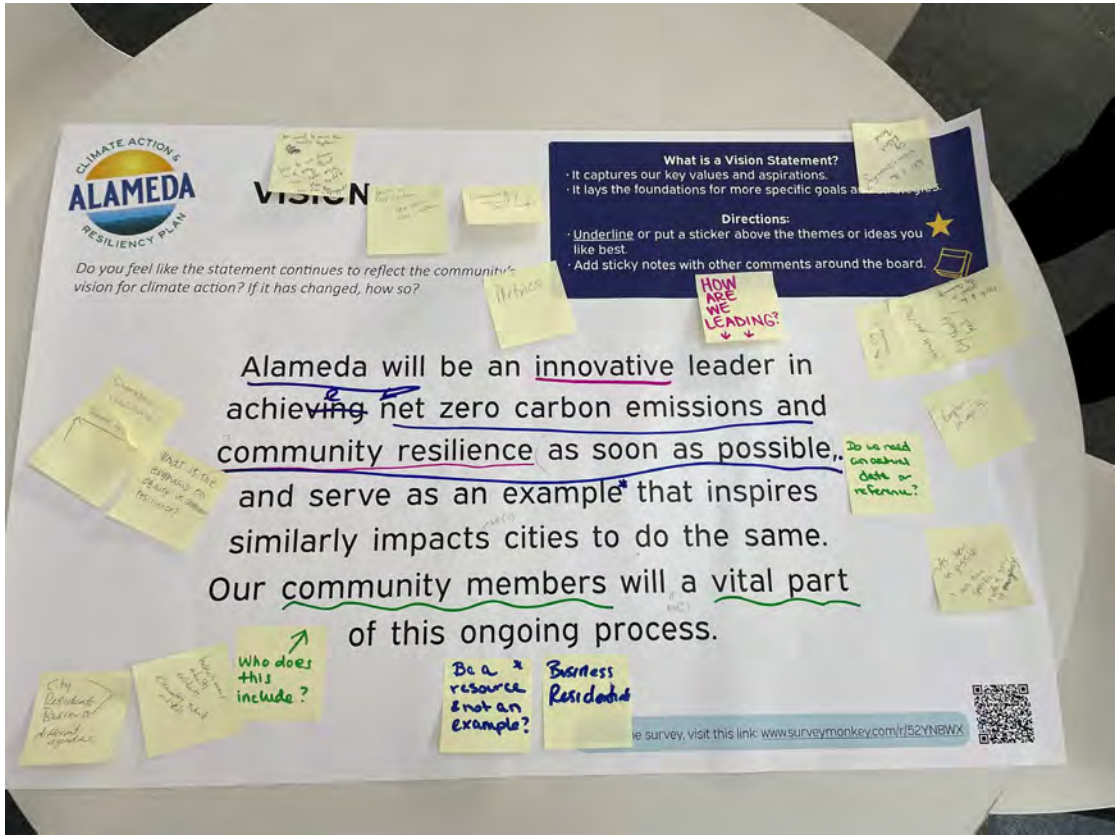
## Greenhouse Gas Reduction

- Equitable Building Decarbonization Plan
- General Plan
- Urban Forest Plan

### Guiding & Implementation Plans

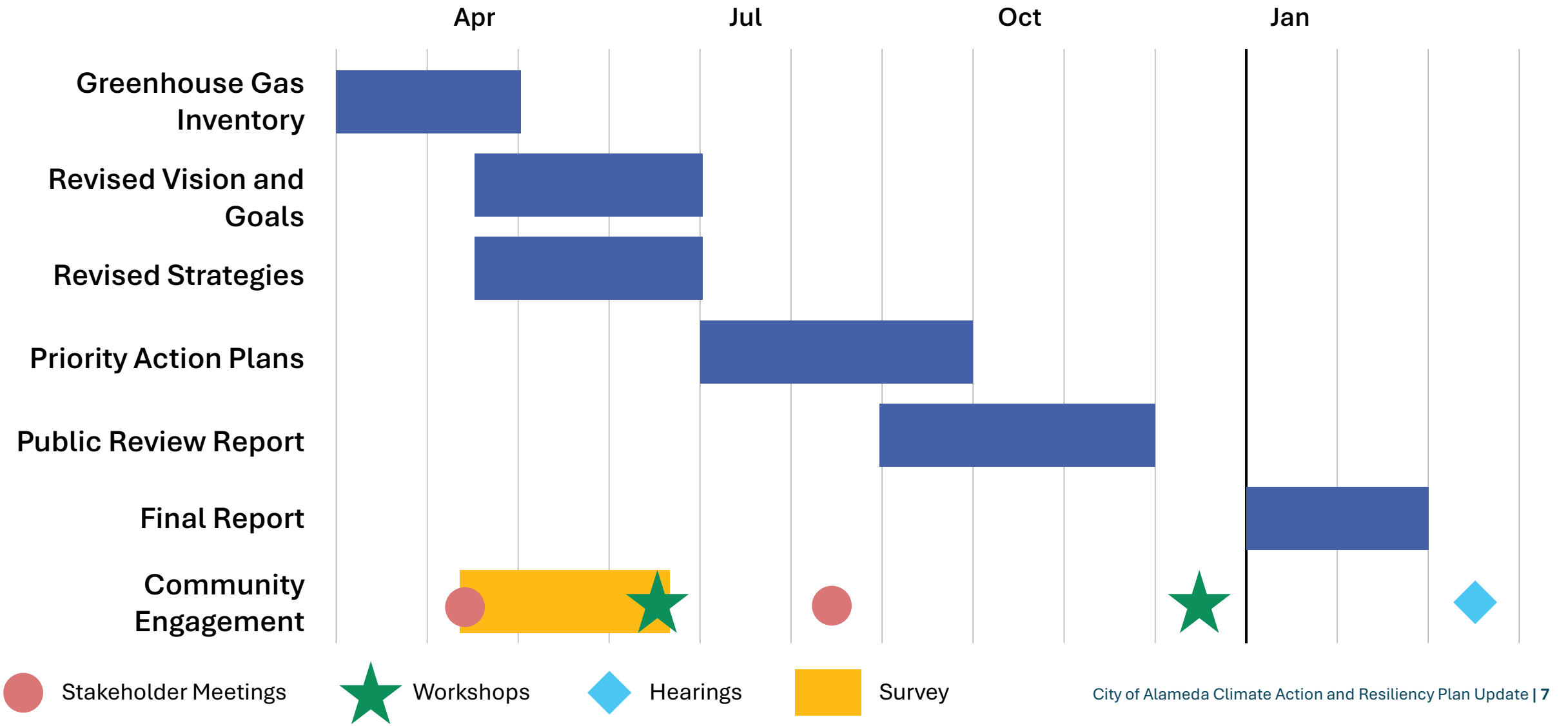
- Transportation Choices Plan
- Zero Waste Implementation Plan
- Active Transportation Plan

# Community Engagement Activities To Date



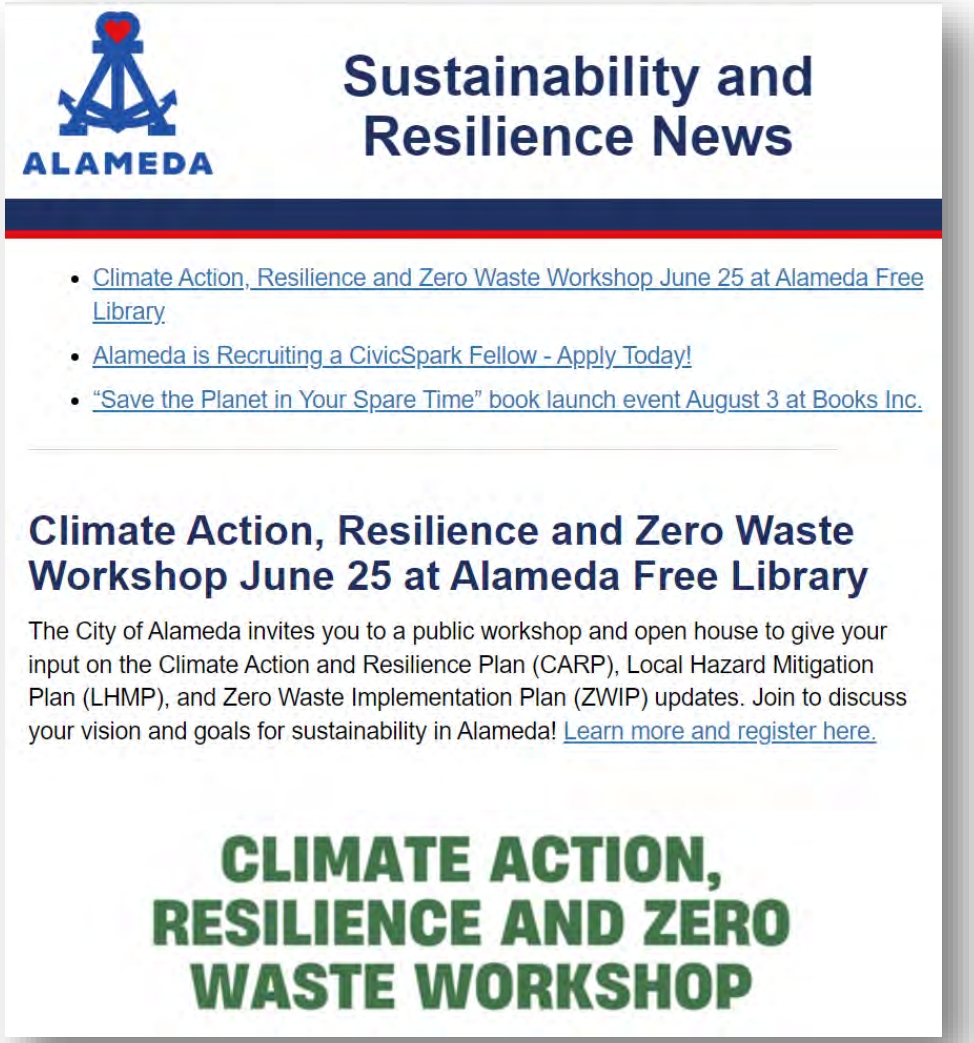

- **City Green Team Meetings** (3 meetings)
- **Stakeholder Meetings** (April / May, 4 meetings)
- **Community Survey** (April 15 – June 18, 156 respondents)
- **Community Popups** (Spring Shindig, Bike Fest)
- **Community Workshops** (Tonight!)

# Project Timeline



# How to Stay Involved

- Project information will be regularly updated on: www.alamedaca.gov/CARP
- To stay up to date on plan progress, please subscribe to the "Environment, Sustainability and Climate Action" mailing list



# CARP Update

# CARP Structure and Definitions




Captures key values and aspirations. Lays the foundation for goals, strategies, and actions

Broad, aspirational statements of what we want to achieve

Approaches that we take to achieve a goal

Specific policies, programs, or partnerships to achieve a strategy

## Existing Vision

Alameda will be an innovative leader in achieving net zero carbon emissions and community resilience as soon as possible, and serve as an example that inspires similarly impacted cities to do the same. Our community members will be a vital part of this ongoing process.

## Draft Revised Vision

Alameda is an innovative leader in achieving net zero carbon emissions by 2045 and building community resilience to climate change, in ways that reduce disparities and environmental injustices experienced by socially vulnerable communities. Our residents, businesses, community-based organizations, and regional partners are a vital part of this ongoing effort.

# Existing Goals

1. GHG Reduction
2. Sea Level Rise and Storm Surges
3. Inland Flooding
4. Drought
5. Extreme Heat
6. Wildfires
7. Earthquakes and Liquefaction
8. Effective Implementation and Capacity Building

# Draft Revised Goals

1. Carbon Neutrality
2. Community Resilience
3. Community Education and Activation
4. City Leadership

# Draft Revised GHG Reduction Strategies

- **Land Use and Development**
  - Land Use and Transportation Development
- **Clean Transportation**
  - Active Transportation and Complete Streets
  - Mobility Management
  - Parking Management
  - Public Transit Service
  - Zero Emission Vehicles and Infrastructure
  - Micromobility
- **Clean Energy**
  - Clean Energy Purchase
  - Clean Energy Generation
- **Clean Buildings**
  - Existing Buildings
  - New Construction
- **Zero Waste**
  - Zero Waste
  - Goods and Services
- **Urban Greening**
  - Urban Forestry
  - Parks, Open Space, and Natural Areas
- **Municipal Operations**
  - Organization, Training, Monitoring, and Reporting
  - Facilities and Buildings
  - Fleet Electrification
  - Mobility Management

Existing CARP Strategy

New CARP Strategy

# Scales of Inventories

## Consumption-Based Emissions

Activities within *and* outside city limits, including imported goods and services

**≈ 1,095,431 $MTCO_2e$**

(source: UC Berkeley Cool Climate)

**Communitywide Emissions (Sector-Based Emissions)**

**Municipal Emissions**

Activities within city limits, bound by geography

*Basis for City of Alameda inventory*

**≈ 267,894 $MTCO_2e$**

Activities within the City's control (facilities, operations, maintenance)

# Greenhouse Gas Emissions by Sector for 2022

**267,894**

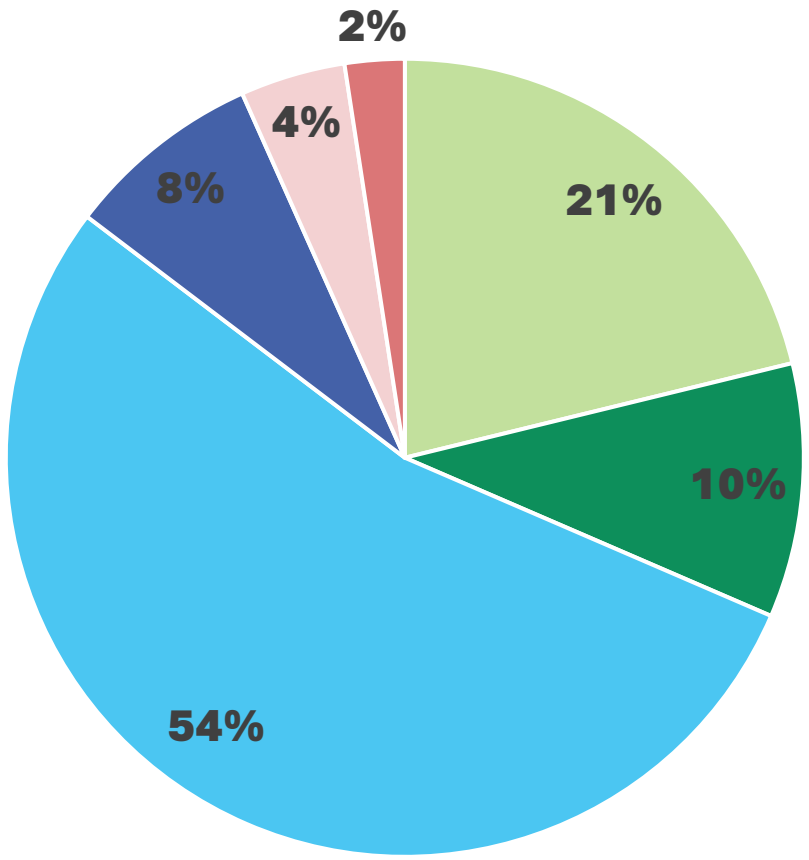
Total $MTCO_2e$ in 2022

**3.4**

$MTCO_2e$ per Capita

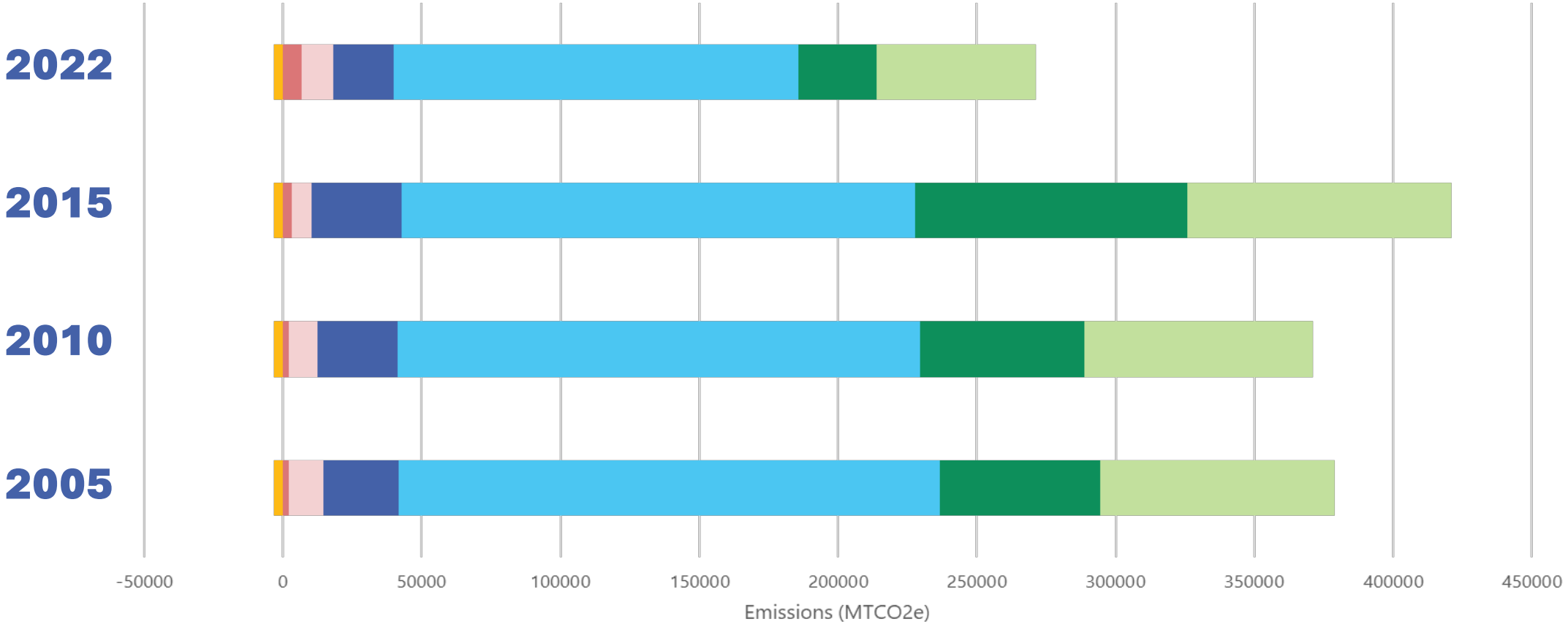
**2.4**

$MTCO_2e$ per Service Population



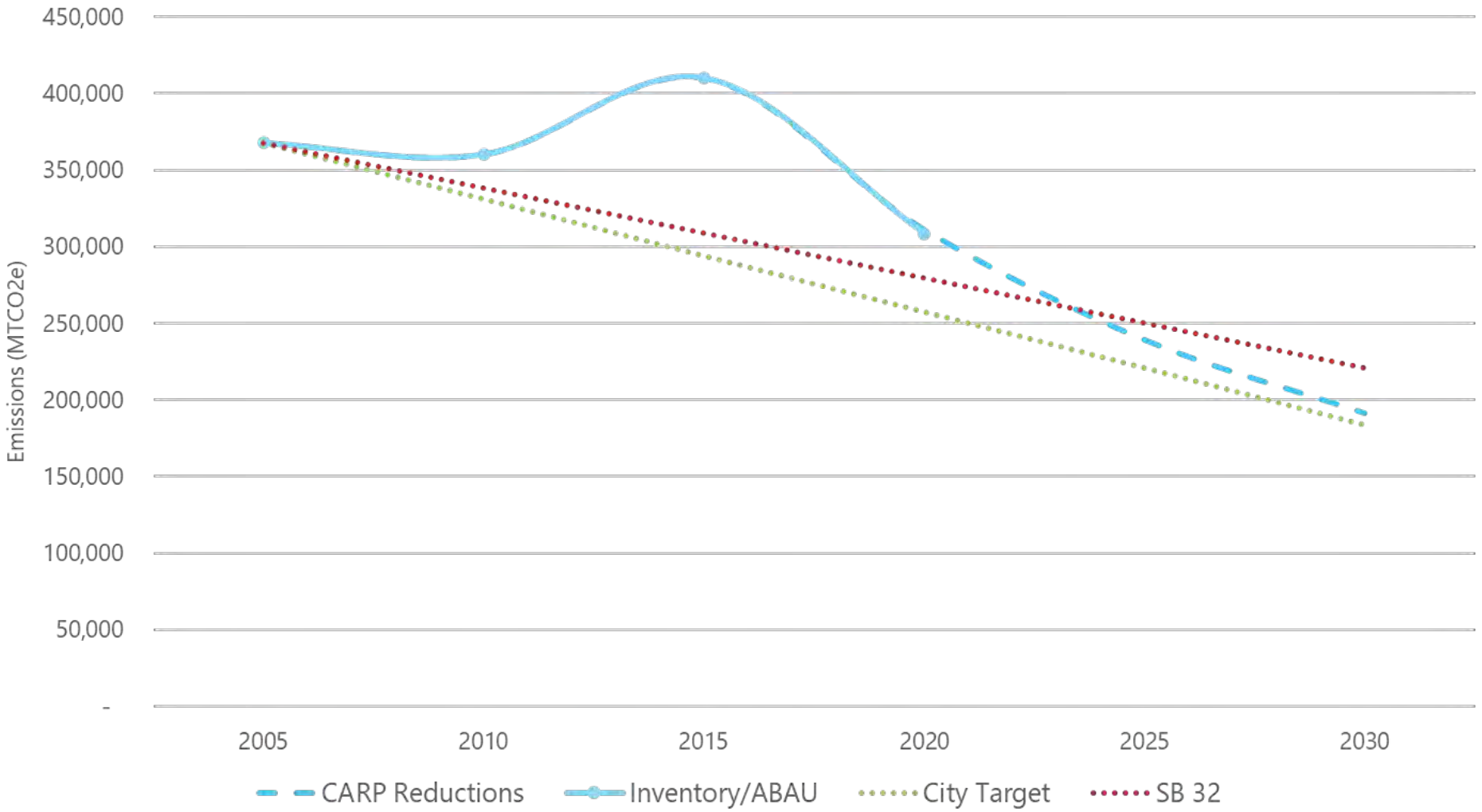

- Residential energy (natural gas only)
- Nonresidential energy (natural gas only)
- On-road transportation
- Small off-road engines
- Solid waste
- Water and wastewater
- Sequestration credit = 3,270 $MTCO_2e$

# Greenhouse Gas Emissions Over Time (Total)




Residential energy
On-road transportation
Solid waste
Sequestration
Nonresidential energy
Small off-road engines
Water and wastewater

# Greenhouse Gas Emissions Over Time (Total)




**-29%**

% reduction in $MTCO_2e$ between 2005-2022

**-50%**

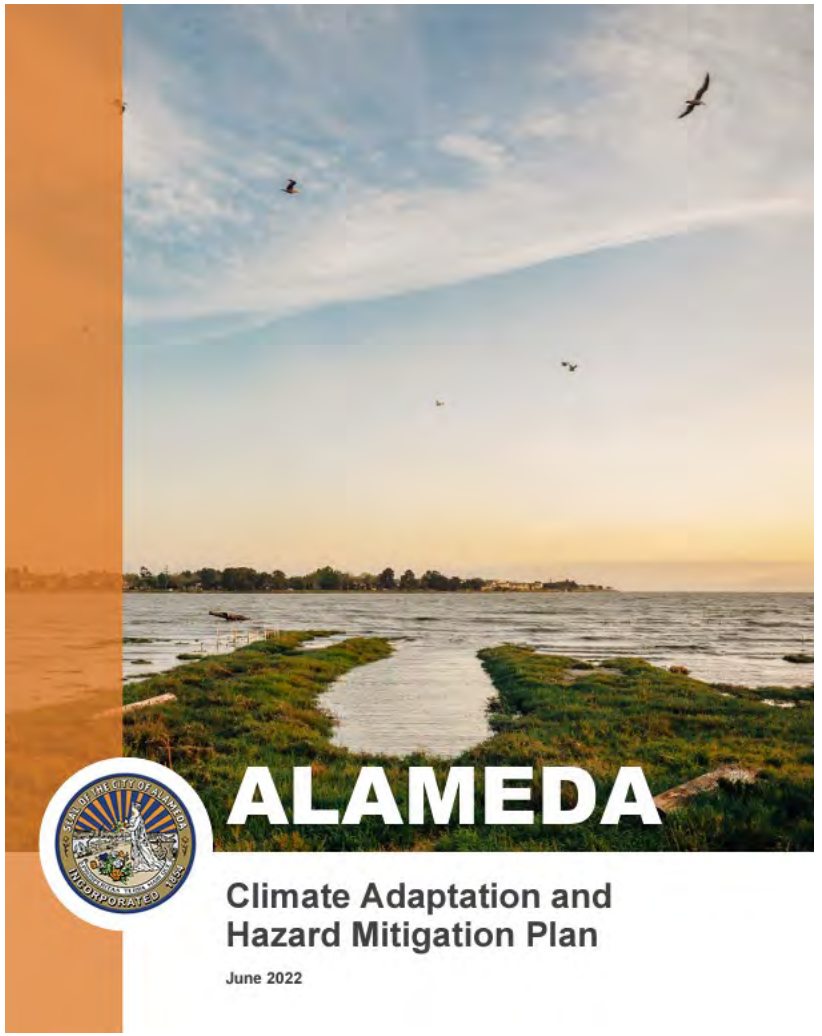
**City Goal:** % reduction by 2030 compared to 2005

# Climate Change Impacts

# Adaptation and Hazard Mitigation Plan

- City's Local Hazard Mitigation Plan and is the strategy for mitigating natural hazards and adapting to climate change
- Success of the plan closely tied with our ability to meet our goals to reduce greenhouse gas emissions
- Plan must be updated every five years

www.alamedaca.gov/hazardmitigationplan



# OAAC Adapt Engagement Timeline (Near Term Projects)




Two Projects Identified in the CARP

- Bay Farm Island / Veterans Court
- Oakland Alameda Estuary Projects

## Climate Science and Analysis

Spring 2024

- Develop vision, goals and planning principles
- Analyze existing conditions
- Explore compound flood hazards (coastal, stormwater, groundwater)

## Draft Alternatives

Summer 2024

- Gather input on preliminary alternatives exploring near–term ideas.

## Early Project Preferred Adaptation Concept

Fall 2024

- Oakland Alameda Estuary Project advanced from preliminary alternatives to a preferred scheme.

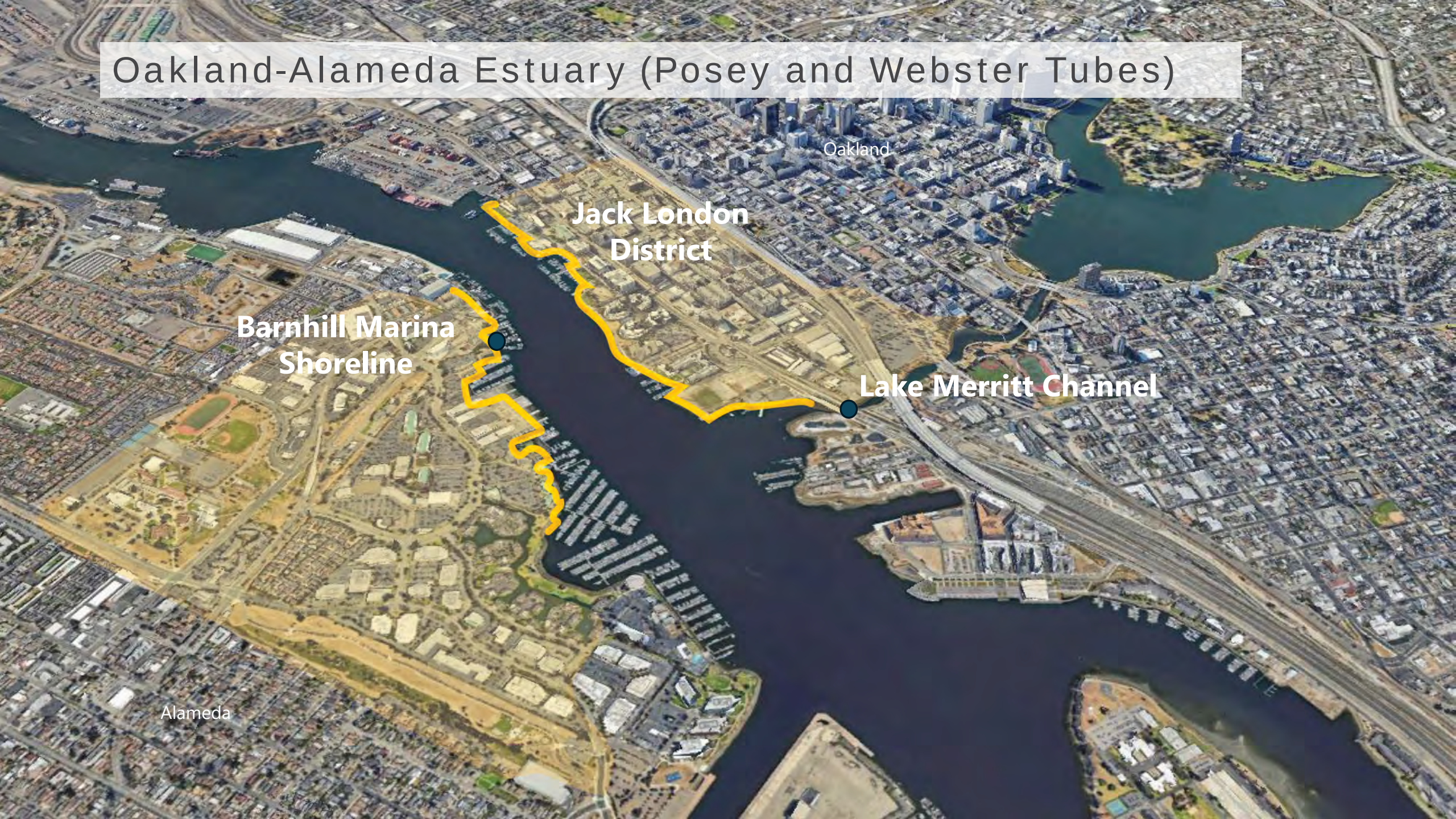
## Project Synthesis & Adaptation Pathways

Spring 2025

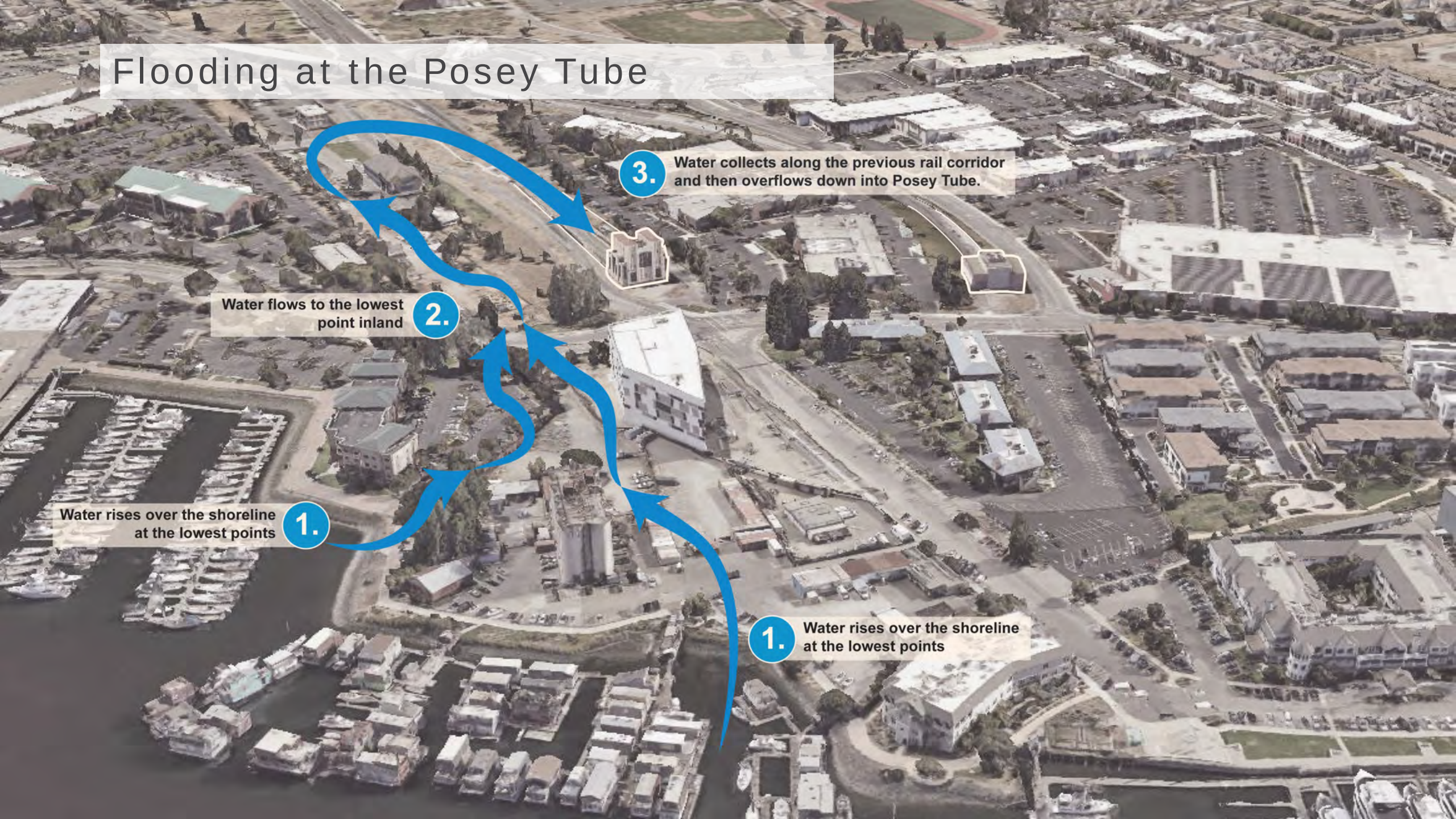
- Bay Farm Island advanced from preliminary alternatives to a preferred adaptation concept.
- Long-Term Adaptation Project will develop long term adaptation pathways.


Bay Farm Island
Oakland Airport
Doolittle Drive
San Leandro Bay
Veteran's Court
Lagoon Outfall
Shoreline Erosion

# Oakland-Alameda Estuary (Posey and Webster Tubes)



# Flooding at the Posey Tube



# OAAC Adapt Engagement Timeline (Long-Term Adaptation)




## Climate Science and Analysis

Fall 2023 - Spring 2024

- Develop vision, goals and planning principles
- Analyze existing conditions
- Explore compound flood hazards (coastal, stormwater, groundwater)

## Strategy Development

Summer and Fall 2024

- Co-creation with OAAC
- Review shoreline characteristics and inland development
- Draft strategy development with options

## Public Input and Strategy Refinement

Spring and Summer 2025

- Gather input on long-term adaptation options and adaptation pathways
- Identify next suite of projects to move forward (in CARP / LHMP)

## Plan Completion

Fall 2025

- Respond to feedback
- Finalize plan

# Zero Waste Implementation Plan (ZWIP)

# Achieving Zero Waste

The City's 2024 **Zero Waste Implementation Plan** (ZWIP)



# Zero Waste Plan




**A successful Zero Waste Plan is one that the City and its communities develop and implement together to achieve a shared vision of sustainability through waste diversion.**

# Plan Purpose

**Zero Waste Goal:**

Divert 89% of materials from landfill through reducing, reusing, recycling and composting

**Progress:**

- First ZWIP adopted in 2010
- Updated ZWIP in 2018
- 2022 diversion was 81%

**2024 Plan:**

- Recommend new and revised policies and actions to achieve zero waste
- Create a roadmap for the City to reach its zero waste goal



# 2024 Plan Focus Areas



Behavior Change



Waste Reduction Efforts



Reuse



Construction & Demolition

# Ways to Engage

**We want your input and ideas on how to improve zero waste efforts in Alameda. Let your voice be heard by:**

1. Participating in an upcoming community meeting.
   - Series of 4 meetings to be held in July
2. Attending a focus group discussion.
   - Two focus group discussions held in July
3. Taking our survey (released this July).
4. Contacting allewellyn@alamedaca.gov directly with questions or to learn more.

**Bookmark https://www.alamedaca.gov/zwip to find the latest news and updates related to the Zero Waste Plan.**



# Open House Stations

# Open House Stations

Greenhouse Gas Inventory

Revised Vision

Revised Goals

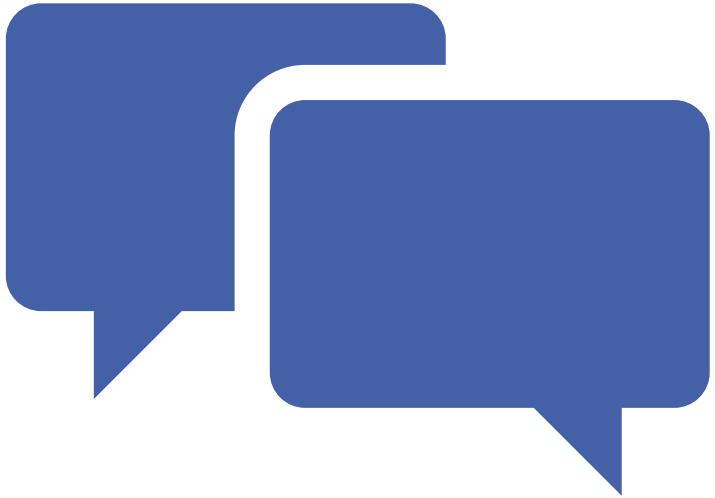
Revised GHG Reduction Strategies

Local Hazard Mitigation Plan

Zero Waste Implementation Plan

# Rules of Engagement

1. Be a good listener
2. Welcome all viewpoints and value diversity
3. Show common courtesy and respect
4. Share the air
5. Avoid editorials
6. Honor time



# July Sustainability Newsletter

City of Alameda sent this bulletin at 07/24/2024 10:44 AM PDT

Having trouble viewing this email? View it as a Web page.

# Sustainability and Resilience News


- Sea Level Rise Adaptation Community Workshops in August
- Rhythmix Rising Seas Dance Kick-off Event August 24
- Sucessful Climate Action, Resilience and Zero Waste Workshop in June!
- Alameda Municipal Power New E-Bike Rebate
- Announcing the “Save the Planet in Your Spare Time – A Climate Protection Handbook for the Busy Person” book launch!


---

## Sea Level Rise Adaptation Community Workshops in August

Join the Oakland Alameda Adaptation Committee's upcoming community workshops this August! These events are a great opportunity for you to learn about and contribute to our Oakland and Alameda shoreline resilience efforts as we plan for sea level rise. Your participation is crucial in shaping a resilient future for our beloved shoreline. Together, we can make a difference!

Come join us to learn about current adaptation plans, share your thoughts and feedback, and engage with agency leaders and experts. Each informational workshop will include an overview of all the current adaptation projects with a deep dive into a particular shoreline area.

Workshop dates:

- **August 3, 10:00 AM - 1:00 PM** - Estuary Project (Alameda focus) at the REAP Climate Center, 2133 Tynan Ave, Alameda.
- **August 12, 5:30 - 8:00 PM** - Bay Farm Island Project at Leydecker Recreation Center, 3221 Mecartney Road, Alameda (Bay Farm Island)
- **August 15, 5:30 - 8:00 PM** - Estuary Project (Oakland focus) at Port of Oakland Community Room, 530 Water St, Oakland.

Please learn more and RSVP for a meeting here. Registration is encouraged but not required unless you need childcare or translation services. Refreshments will be served.




---

## Rhythmix Rising Seas Dance Kick-off Event August 24

Rhythmix Cultural Works is launching the Rising Seas Project - a yearlong series of performances of live music, immersive dance, site-responsive theater and an art exhibit that will engage audiences by raising climate awareness and un-earthing solutions for sustainability and resiliency.

The Rising Seas Kick-off Performance will be held held on **August 24 from 2 - 5 PM**. It is free to attend. To learn more and RSVP, visit Rhythmix Rising Seas Premiere.



## Sucessful Climate Action, Resilience and Zero Waste Workshop in June!

The City hosted a successful public workshop on June 25 discussing the Climate Action and Resilience Plan, Zero Waste Plan, and Local Hazard Mitigation Plan updates. We were thrilled to welcome over 50 attendees, including many youth participants who provided valuable feedback. If you missed the meeting and want to catch up, the presentation can be found here.

The City of Alameda is holding a **virtual youth stakeholder meeting on August 20th from 4 - 5:30 PM** to discuss specific strategies in the Climate Action and Resiliency Plan (CARP) update to help us meet our climate action goals. All youth are welcome, no educational background is needed to attend. The general public will have additional opportunities to weigh in on the plan strategies in the coming months. Register here.



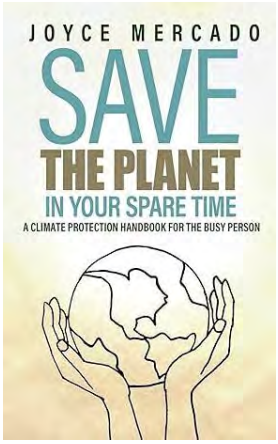
## Alameda Municipal Power New E-Bike Rebate



Are you looking for a fun, fast, and climate-friendly way to get around town? Why not try an e-bike? AMP is currently offering a standard rebate of $100 for new electric bicycles, and $300 rebate for income-qualified customers. Learn more about AMP rebates here.

Not confident in your biking skills? Bike East Bay offers bicycle classes and workshops for adults, youth, and families of all skill levels. There are class and webinar options in English, Spanish, and Chinese.

# Announcing the “Save the Planet in Your Spare Time – A Climate Protection Handbook for the Busy Person” book launch!




Join local author and passionate climate activist Joyce Mercado to launch her book “Save the Planet in Your Spare Time – A Climate Protection Handbook for the Busy Person” at **Books Inc., 1344 Park Street, Alameda** on **Saturday August 3 at 3:30 pm.** The event will include a book signing and interview by Community Action for a Sustainable Alameda's Ruth Abbe.

If you want to learn how to do more to protect the climate, this book is for you! It chronicles Joyce’s journey to becoming a climate protection leader in Alameda.

Leaders influencing others in their communities to protect the climate, community by community, is an essential element in fighting climate change and you can be an effective part of the solution to the climate crisis. Anyone can be such a leader, even if you have a busy life. We need thousands of leaders like you in communities across the country and the world to solve the climate crisis. Together we can make a difference!

Join the book launch and learn how to become a climate leader in your community! The book is available at Books Inc. in Alameda.

---

**Contact us**

sustainability@alamedaca.gov

https://www.alamedaca.gov/climateaction

*You are receiving this because you are signed up for the Environment, Sustainability and Climate Action mailing list.*

Stay Connected with the City of Alameda:

SUBSCRIBER SERVICES:
Manage Subscriptions | Unsubscribe All | Help

### Subscribe to updates from City of Alameda

Email Address e.g. name@example.com
Subscribe

### Share Bulletin

Powered by GOVDELIVERY

Privacy Policy | Cookie Statement | Help

CARP Update and Climate Adaptation and Hazard Mitigation Plan and Workshop- Sustainability and Resilience News

From: City of Alameda <alameda@public.govdelivery.com>

Subject: CARP Update and Climate Adaptation and Hazard Mitigation Plan and Workshop- Sustainability and Resilience News

Having trouble viewing this email? View it as a Web page.

# Sustainability and Resilience News

- Draft Climate Action and Resiliency Plan (CARP) and Climate Adaptation and Hazard Mitigation Plan available for public review until January 17th
- Climate Action, Resilience, and Local Hazard Mitigation Plan Workshop #2
- Take the Oakland Alameda Adaptation Committee Survey
- Capture the King Tides: Photography Workshop and King Tide Walk- Dec 14

## Draft Climate Action and Resiliency Plan (CARP) and Climate Adaptation and Hazard Mitigation Plan available for public review until January 17th




The Draft CARP Update and Climate Adaptation and Hazard Mitigation Plan are available for public comment until January 17, 2025. The update supersedes the 2019 CARP and includes the updated CARP vision and goals, updated GHG mitigation measures (which are reorganized into GHG action plans), and updated hazard mitigation and the CARP resilience measures, which are now housed in the Hazard Mitigation Plan.

**Read the draft documents and provide your input at www.alamedaca.gov/CARP.**

**Give Your Input on the Draft Documents:**

- Fill out the CARP/LHMP Input Form by January 17, 2025
- Attend the virtual Climate Action, Resilience, and Hazard Mitigation Workshop #2 on December 18th, from 5:30-7pm. Zoom registration.

## Climate Action, Resilience, and Local Hazard Mitigation Plan Workshop #2

Give your input on the Draft Climate Action and Resiliency Plan and the Local Hazard Mitigation Plan. Join the City of Alameda for a community workshop to learn more about these plans and discuss strategies and actions to achieve our vision. Register here!

CARP Update and Climate Adaptation and Hazard Mitigation Plan and Workshop- Sustainability and Resilience News ×

From: City of Alameda <alameda@public.govdelivery.com>

Subject: CARP Update and Climate Adaptation and Hazard Mitigation Plan and Workshop- Sustainability and Resilience News

This Wednesday: Workshop on Climate Action, Resilience, and Local Hazard Mitigation Plan

From: City of Alameda <alameda@public.govdelivery.com>

Subject: This Wednesday: Workshop on Climate Action, Resilience, and Local Hazard Mitigation Plan

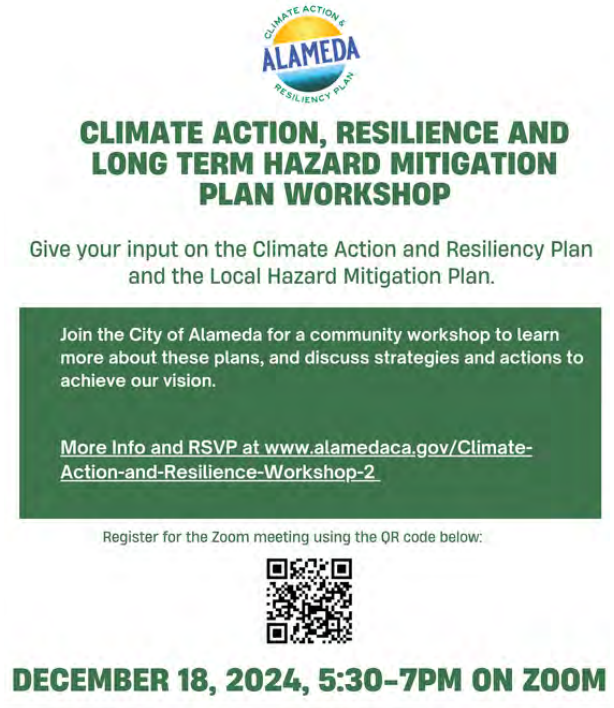
Having trouble viewing this email? View it as a Web page.

# Climate Action, Resilience, and Local Hazard Mitigation Plan Workshop


- This Wednesday: Workshop on Climate Action, Resilience, and Local Hazard Mitigation Plan
- Draft CARP and Local Hazard Mitigation Plan available for public review until January 17th


## This Wednesday: Workshop on Climate Action, Resilience, and Local Hazard Mitigation Plan

Give your input on the City's Draft Climate Action and Resiliency Plan (CARP) and Local Hazard Mitigation Plan (LHMP). Join the City of Alameda for a community workshop this Wednesday, December 18th to learn more about these plans and discuss strategies and actions to achieve our vision. Register here!




ESPAÑOL: PARA INFORMACIÓN EN ESPAÑOL SOBRE ESTE AVISO, COMUNÍQUESE CON MIRNA MORENO AL 510-747-6800.
中文: 有關此通知的中文信息，請致電: 510-747-6800

## Draft CARP and Local Hazard Mitigation Plan available for public review until January 17th



This Wednesday: Workshop on Climate Action, Resilience, and Local Hazard Mitigation Plan

From: City of Alameda <alameda@public.govdelivery.com>

Subject: This Wednesday: Workshop on Climate Action, Resilience, and Local Hazard Mitigation Plan

# CLIMATE ACTION, RESILIENCE AND LONG TERM HAZARD MITIGATION PLAN WORKSHOP

Give your input on the Climate Action and Resiliency Plan and the Local Hazard Mitigation Plan.

**Join the City of Alameda for a community workshop to learn more about these plans, and discuss strategies and actions to achieve our vision.**

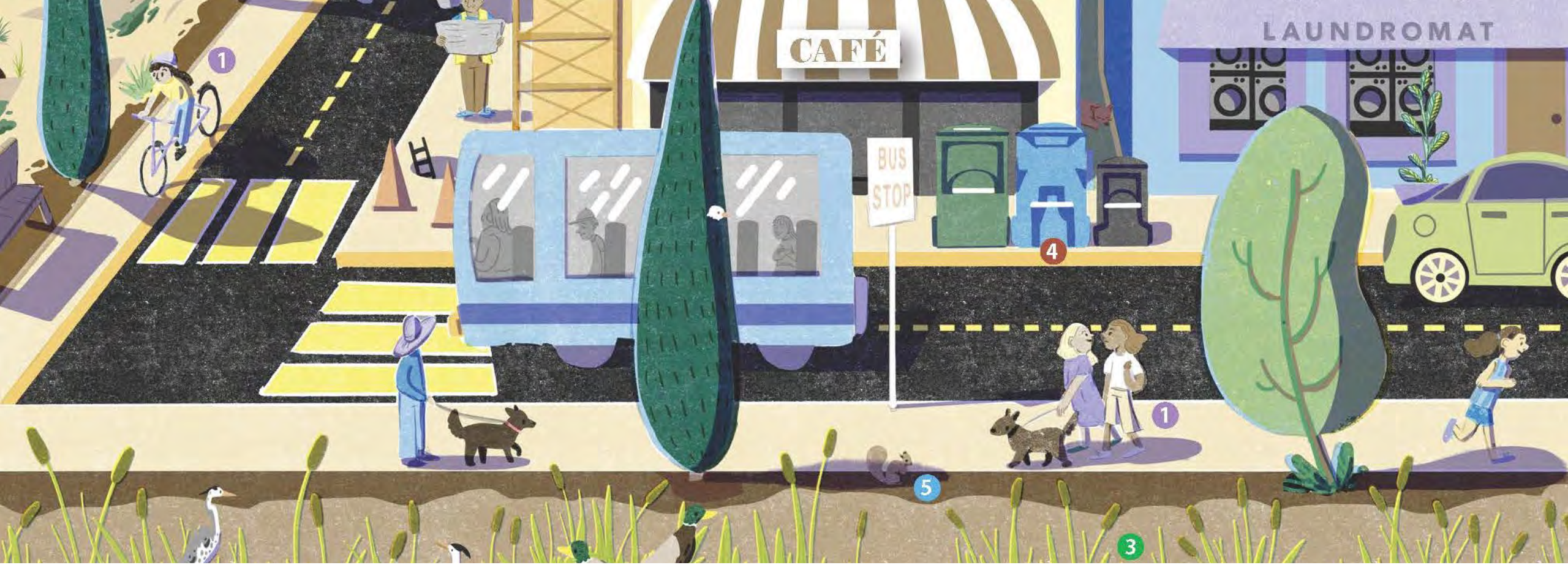
**More Info and RSVP at www.alamedaca.gov/Climate-Action-and-Resilience-Workshop-2**

Register for the Zoom meeting using the QR code below:

# DECEMBER 18, 2024, 5:30–7PM ON ZOOM

ESPAÑOL: PARA INFORMACIÓN EN ESPAÑOL SOBRE ESTE AVISO, COMUNÍQUESE CON MIRNA MORENO AL 510-747-6800.

中文: 有關此通知的中文信息，請致電: 510-747-6800



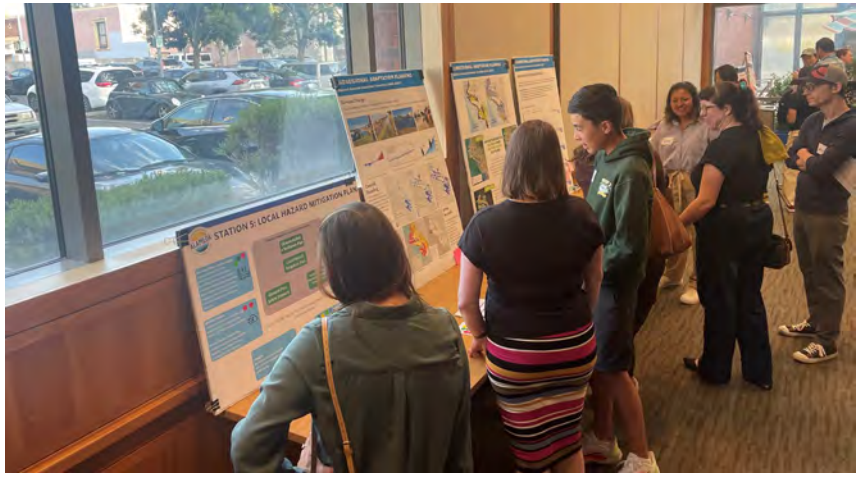

# Climate Action, Resilience, and Hazard Mitigation Plan

## Community Workshop 2

December 18, 2024

# Workshop Agenda

| | |
|---|---|
| **5:30-5:40pm** | Welcome and Workshop Overview |
| **5:40-6:20pm** | Plan Update Overview<br>• Climate Action and Resiliency Plan (CARP)<br>• Local Hazard Mitigation Plan (LHMP) |
| **6:20-7:00pm** | Question and Answer |



Community workshop 6/28/24



Stakeholder meeting 8/27/24

# CARP Update Team



**Danielle Mieler,** Sustainability and Resilience Manager, City of Alameda



**Eric Yurkovich,** Principal, Raimi + Associates

**Sami Taylor,** Senior Sustainability Planner, Raimi + Associates





**Kris May,** CEO and Founder, Pathways Climate Institute

**Daisy Ramirez Lopez,** Environmental Engineer, Pathways Climate Institute



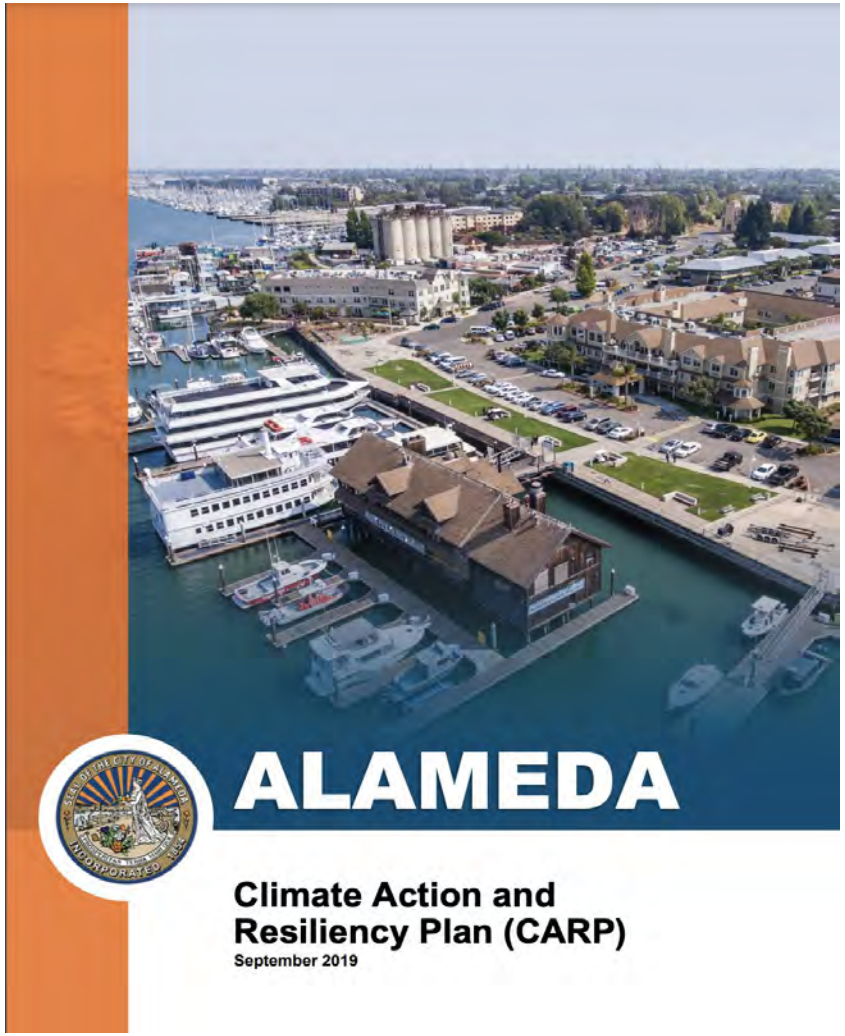
# How to Read and Comment on the Plans

- Visit www.alamedaca.gov/CARP to download the plans and provide your feedback or go directly to:
- https://www.surveymonkey.com/r/DKVLSY6

# Climate Action and Resiliency Plan Update

# Why Update Now?

- Mid-cycle
- Holistically **evaluate and celebrate** our successes and barriers to progress
- **Align with recent and ongoing** local initiatives and plans by City and regional agencies
- New **State laws and initiatives**, including 2022 Scoping Plan update




www.alamedaca.gov/CARP

www.alamedaca.gov/HazardMitigationPlan

CARP update + inventory: Strategic Plan Project CC1

# Climate Action and Resiliency Plan (CARP)

## Climate Adaptation & Hazard Mitigation

- Local Hazard Mitigation Plan
  - General Plan Safety Element
  - Oakland Alameda Adaptation Committee (OAAC) Projects

## Greenhouse Gas Reduction

- Equitable Building Decarbonization Plan
- General Plan
- Urban Forest Plan

### Guiding & Implementation Plans

- Transportation Choices Plan
- Zero Waste Implementation Plan
- Active Transportation Plan

# CARP Report Process

**Greenhouse Gas Inventory**
Spring 2024





**Listening, Visioning and Goal Setting**
Spring/Summer 2024

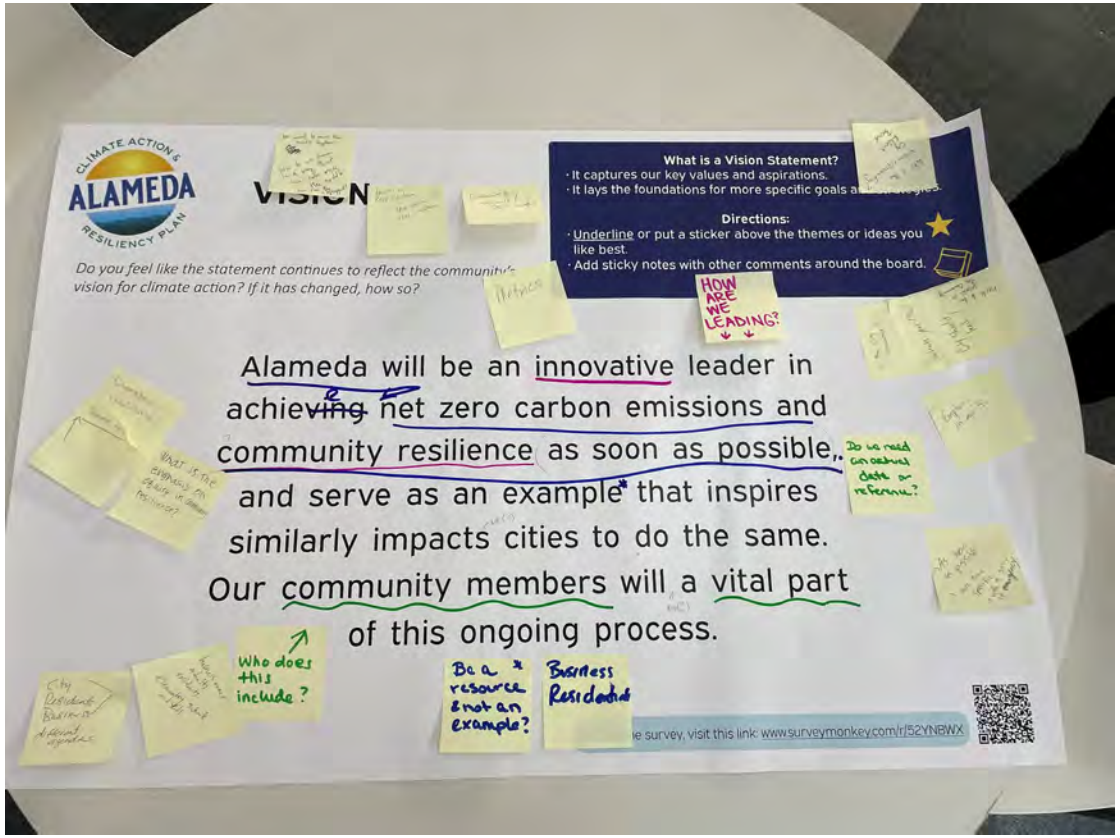
**Strategy Revision**
Summer 2024

**Action Plan Development**
Summer/Fall 2024

**Report Preparation and Adoption**
Fall 2024/Winter 2025



# Community Engagement Activities To Date




Stakeholder meeting 4/18/24

- **City Green Team Meetings** (5 meetings)
- **Key departments/organizations interviews**
- **Community Survey** (April 15 – June 18) - 144 responses
- **Stakeholder Meetings** (8 meetings) April & August ~50 participants each round
- **Community Popups** (Spring Shindig, Bike Fest)
- **Community Workshop #1** (June 25) – 44 participants
- **Sustainability Newsletter** ~1,400 recipients
- **City Council Workshop** (October 15)

# Oakland Alameda Adaptation Engagement



Stakeholder meeting 8/15/24

- **OAAC Adaptation Plan Workshop** (April 2024)
- **Rhythmix Rising Seas** (August 2024)
- **OAAC Sea Level Rise Projects Workshops** (August 2024)
- **Somewhere to Land: Dances for Sea and Low Sky** (September 2024)
- **OAAC Workshops** (December 2024)

# Our Vision

Alameda aims to be carbon neutral and to build community resilience in ways that enhance our quality of life and reduce environmental burden on vulnerable communities. The whole community is a vital part of this effort.

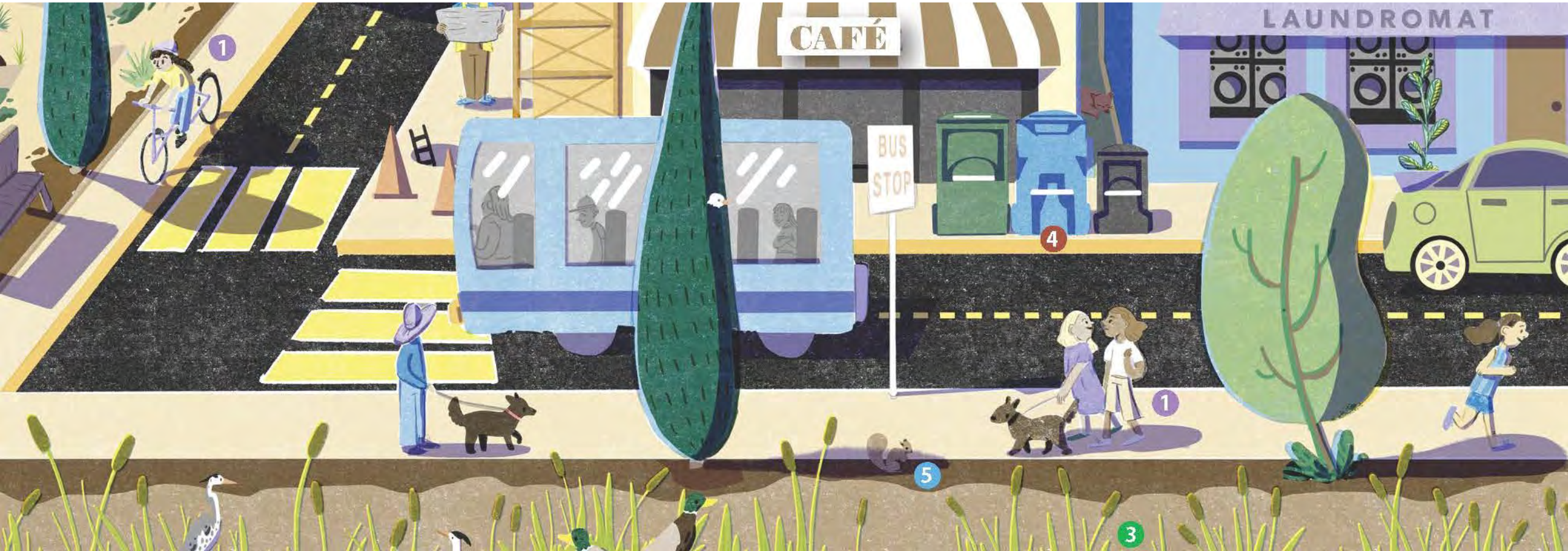






# Our Goals

1. Carbon Neutral
2. Community Resilience
3. Community Education and Activation
4. City Leadership



# Our Goals

**Goal 1: Carbon Neutral.** Alameda will fairly reduce emissions from transportation, buildings, solid waste, and water in line with local and State targets.

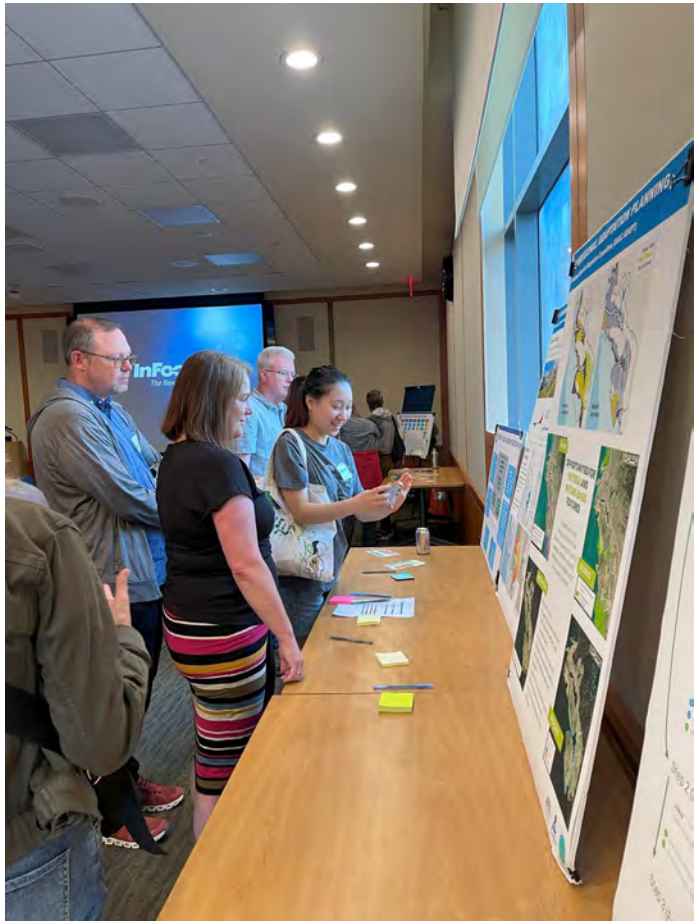
**Goal 2: Community Resilience.** Alameda will safeguard the community, especially vulnerable communities, from the impacts of climate change and natural hazards.



# Our Goals

**Goal 3: Community Education and Activation.** The Alameda community will be inspired to participate in climate action and resilience efforts. Alameda will cultivate climate leadership, innovation, and community building among all residents, businesses, community organizations, and service providers.

**Goal 4: City Leadership.** The City of Alameda will lead by example by aligning resources and working collaboratively to implement CARP.



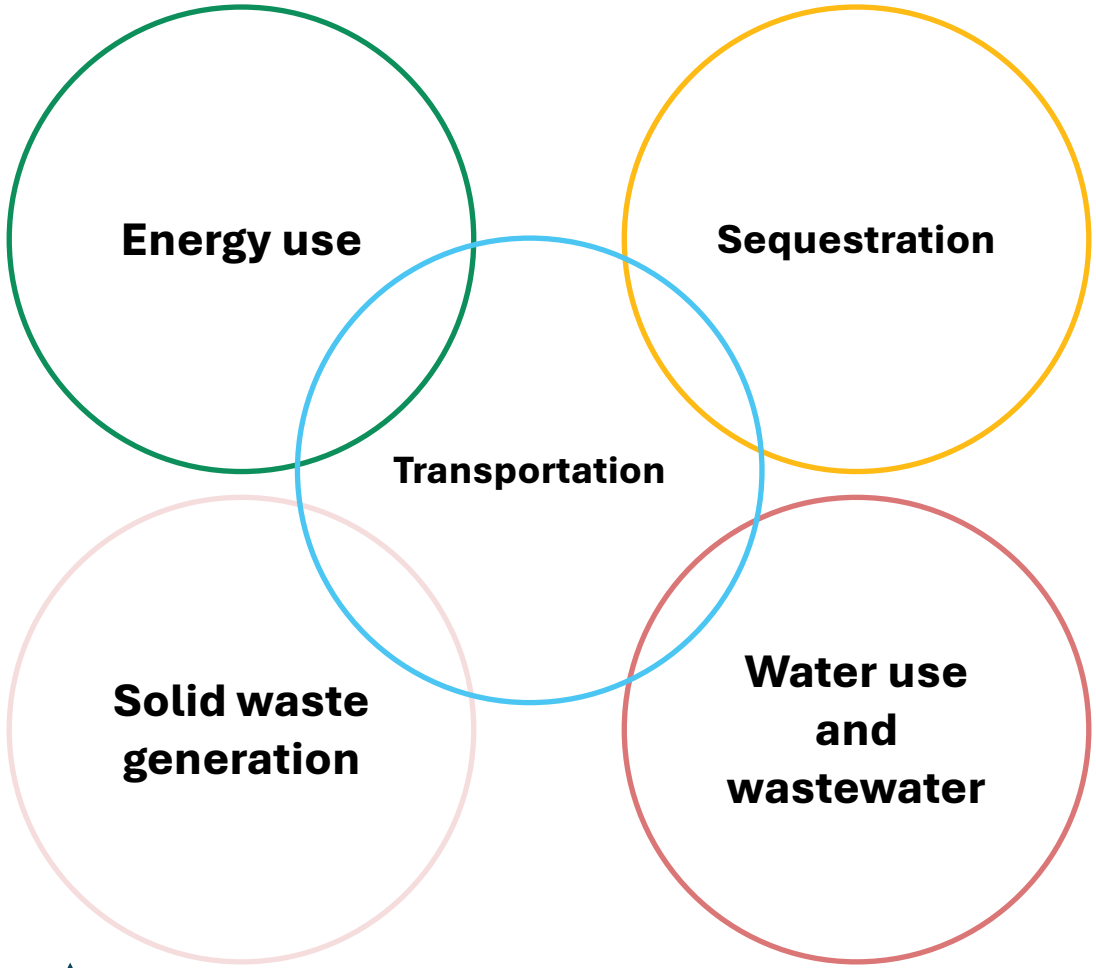




# Our Targets

Alameda set targets in line with the State and scientific community to:

- Reduce emissions 50% below 2005 levels by 2030
- Become carbon neutral by 2045



# Greenhouse Gas Emissions by Sector for 2022

**267,894**

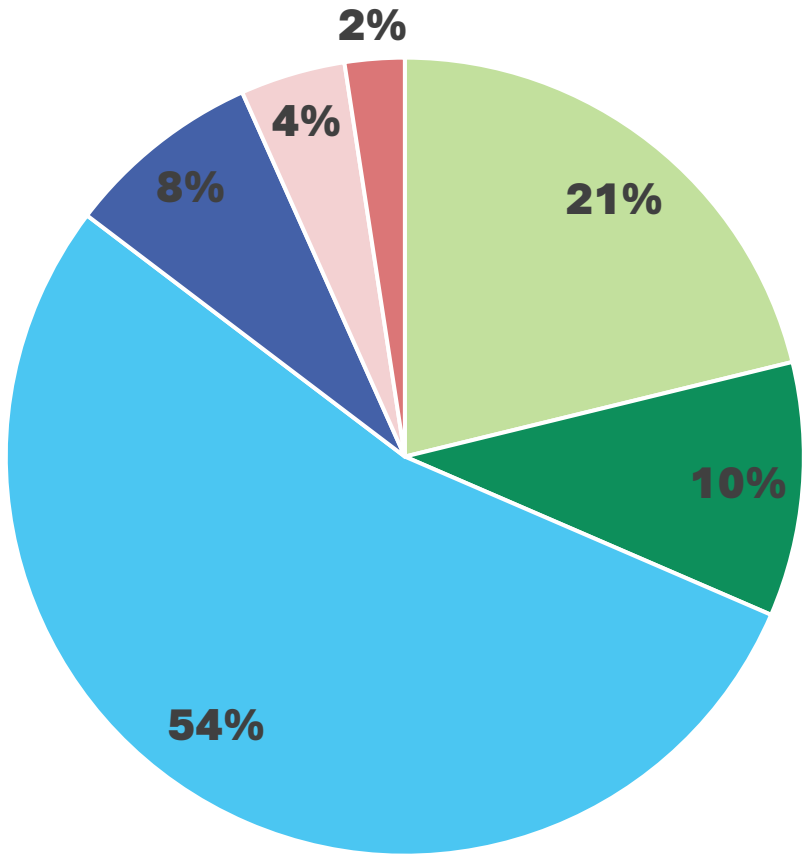
Total $MTCO_2e$ in 2022

**3.5**

$MTCO_2e$ per Capita

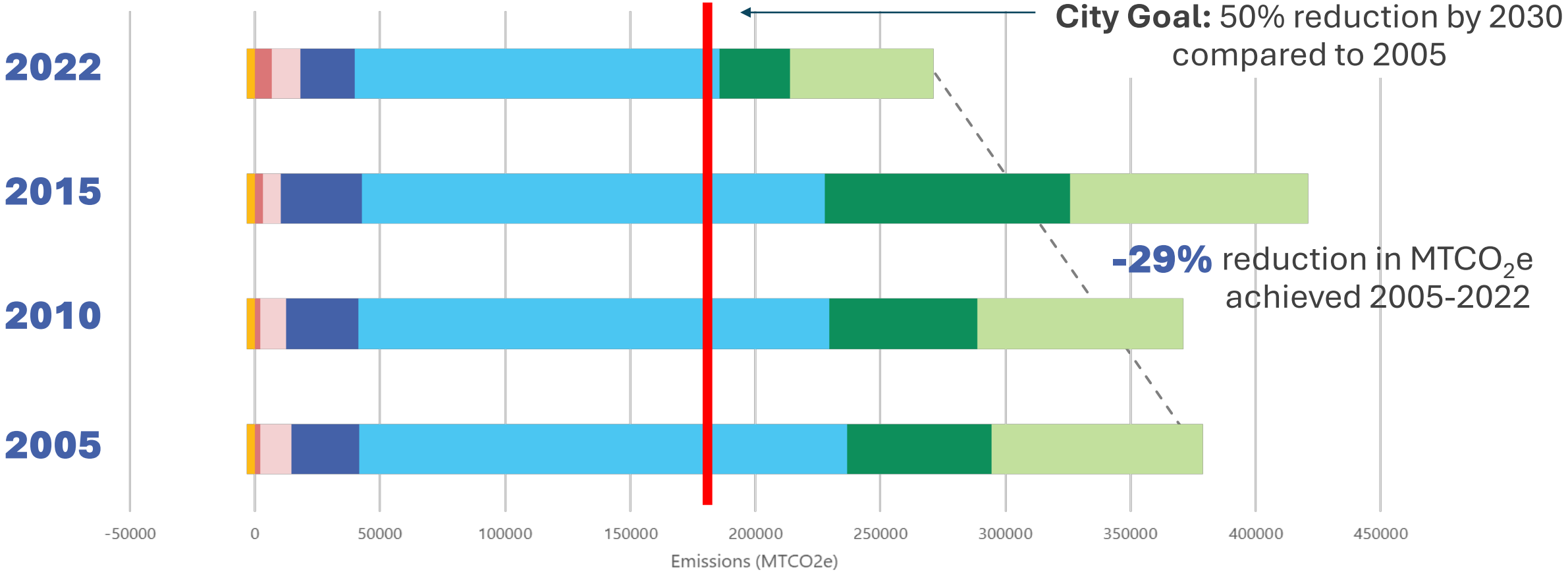
**2.4**

$MTCO_2e$ per Service Population




- Residential energy (natural gas only)
- Nonresidential energy (natural gas only)
- On-road transportation
- Small off-road engines
- Solid waste
- Water and wastewater

# Greenhouse Gas Emissions Over Time




**City Goal:** 50% reduction by 2030 compared to 2005

**-29%** reduction in $MTCO_2e$ achieved 2005-2022

- Residential energy
- Nonresidential energy
- On-road transportation
- Small off-road engines
- Solid waste
- Water and wastewater
- Sequestration credit = 1% (3,207 $MTCO_2e$)

# Key Findings 2005-2022

**Total Emissions: -29%**

Main driver: AMP providing 100% clean energy

**Per capita: -31%**
**Per service population: -40%**

Main driver: AMP providing 100% clean energy

**Electricity Emissions: -100%**

Main driver: AMP providing 100% clean energy

**Natural Gas Emissions: -6%**

Main driver: reduced residential NG usage

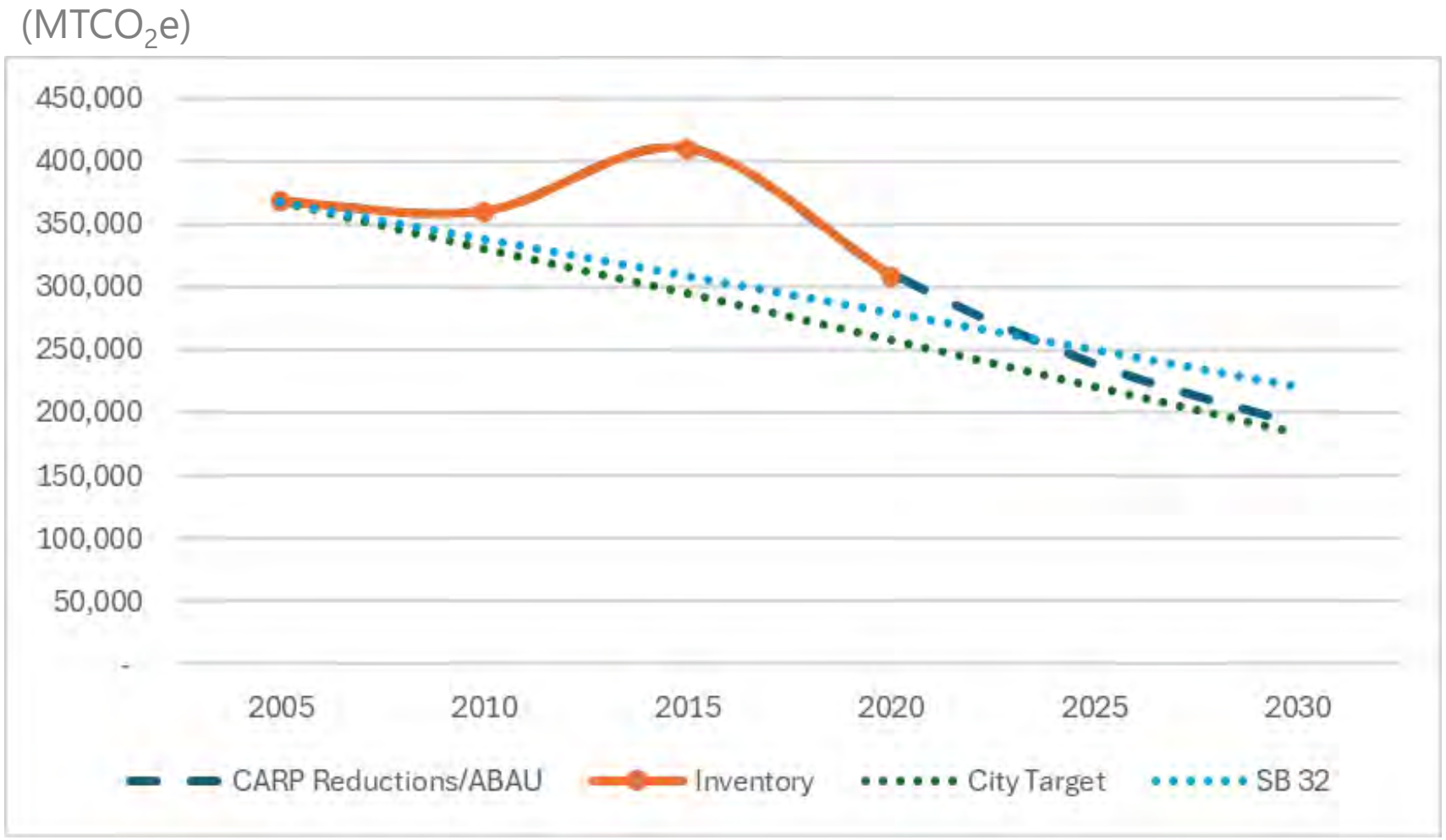
**Transportation Emissions: -25%**

Main driver: cleaner vehicles, more EVs on the road, reduced VMT, more efficient off-road equipment

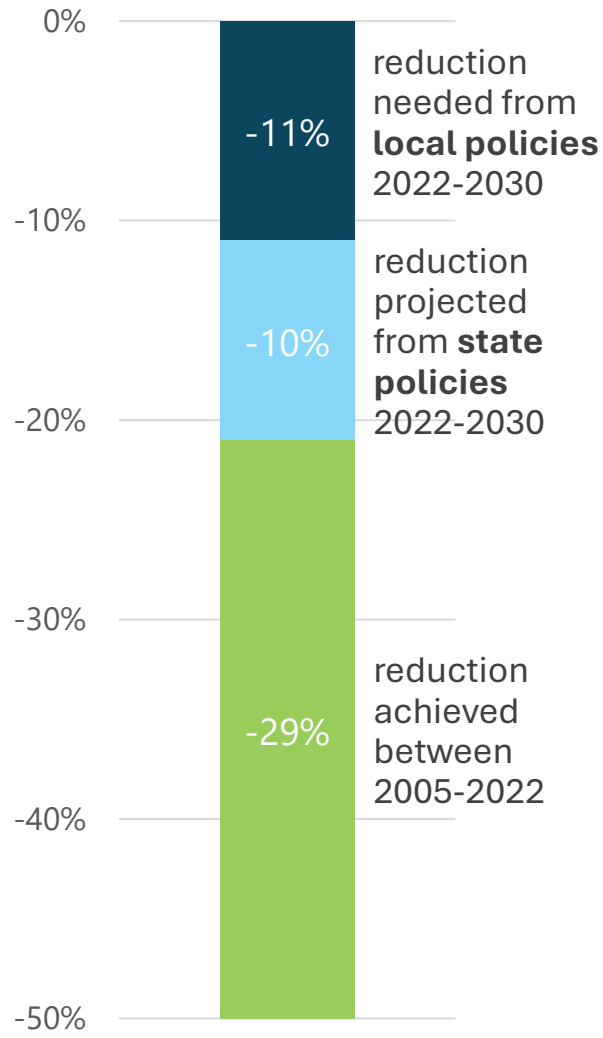
**Vehicle Miles Traveled: -6%**

Main driver: Pandemic driving patterns, city mode shift efforts

# Progress Toward GHG Reduction Goals




**City Goal: -50%** $MTCO_2e$ reduction by 2030 compared to 2005

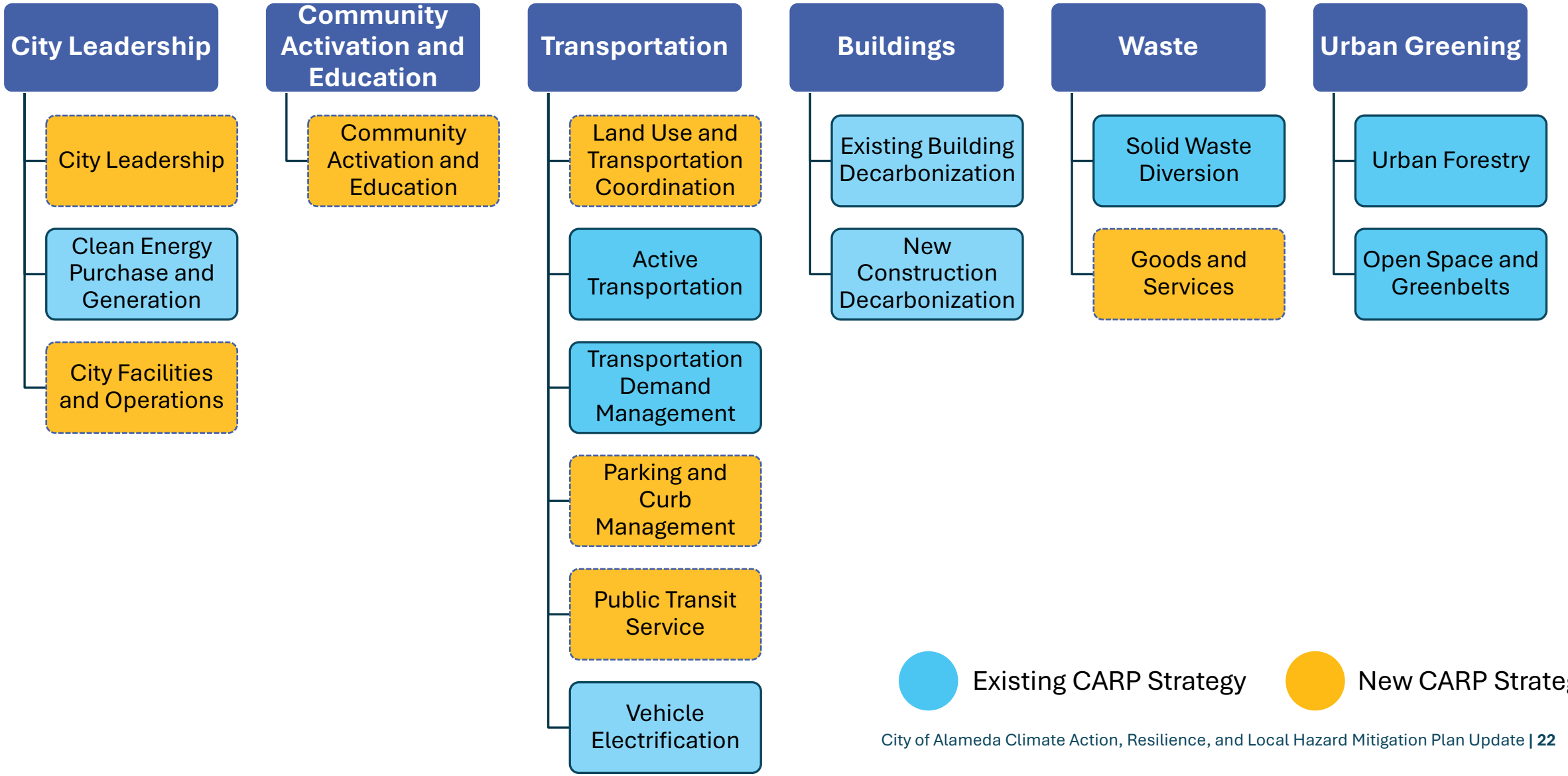


# Greenhouse Gas Reduction Strategies

# Greenhouse Gas Reduction Strategies

- **City Leadership**
  - City Leadership
  - Clean Energy Purchase and Generation
  - City Facilities and Operations
- **Community Activation and Education**
  - Community Activation and Education
- **Transportation**
  - Land Use and Transportation Coordination
  - Active Transportation
  - Transportation Demand Management
  - Parking and Curb Management
  - Public Transit Service
  - Vehicle Electrification
- **Buildings**
  - Existing Building Decarbonization
  - New Construction Decarbonization
- **Waste**
  - Solid Waste Diversion
  - Goods and Services
- **Urban Greening**
  - Urban Forestry
  - Open Space and Greenbelts

# Greenhouse Gas Reduction Strategies



# Greenhouse Gas Reduction Strategies

| CARP Focus Area | Strategy | Key Actions (2025 – 2030) | Targets | Metrics and Data Source | 2030 Annual Emissions Reductions (MTCO2e)* |
|---|---|---|---|---|---|
| **City Leadership** | **CL-3: City Facilities and Operations.** Implement policies and programs to reduce emissions associated with City facilities and operations. | • Continue to prioritize the purchase of zero emission fleet vehicles<br>• Minimize and eliminate where possible natural gas infrastructure for new and renovated City buildings<br>• Evaluate existing municipal buildings and take actions to switch to climate-friendly refrigerants, reduce water consumption, and electrify new and existing facilities<br>• Conduct regular City employee commute surveys and explore city employee commute programs<br>• Modify city procurement standards to reduce waste | • 208 light duty, non police patrol, and police patrol vehicles are EV by 2030 (2019 CARP)<br>• Assessment of buildings and facilities by 2035. | • # and % of EV fleet vehicles (City)<br>• # of new all electric buildings (City)<br>• % of City buildings all-electric (City)<br>• % City workers mode share to work (City)<br>• % of City workers who work from home (HR) | Not quantified |
| **Community Activation and Education** | **CAE-1: Community Activation and Education.** Educate the community about anticipated near- and long-term climate impacts, community vulnerabilities, opportunities for adaptation, and opportunities for GHG mitigation with the intent to activate residents, businesses, and community partners. | • Partner with community- and faith-based organizations and engage youth to raise community awareness and inspire climate action<br>• Encourage behavior change around purchasing to reduce waste | • No target established | • # of community engagement touchpoints<br>• # of community leader touchpoints<br>• Website and social media analytics<br>• Community surveys | Not quantified |

# Example Strategy Organization

## CAE-1: Community Activation and Education

### Description

The City will continue to collaborate with CASA, the Alameda Chamber of Commerce, and other partners to provide education around critical issues to allow the community to develop a better understanding of the benefits of certain greenhouse gas mitigation and resilience actions, making them more likely to participate. Similarly, education around how to participate is equally valuable to empower community members to take action and change behaviors.

Likewise, a public engagement and education campaign can enhance procedural equity by ensuring all community members, particularly socially vulnerable populations, have access to information about climate change hazards and the programs available to them. Providing a mix of in-person, online, and meeting people where they are engagement opportunities can help to ensure equitable participation and access to information.

### CAE-1 Summary Table

| | |
|---|---|
| **Strategy Type** | Greenhouse Gas Reduction and Climate Resiliency |
| **Responsible City Departments** | • Primary: Sustainability<br>• Secondary: AMP |
| **GHG Reduction Potential** | **Supporting**<br>Not quantified. Although not quantitatively evaluated, supporting measures may achieve emissions reductions, produce co-benefits, and/or enhance the ability of quantified measures to reach expected reductions. This strategy strengthens the implementation of other strategies in the CARP. |
| **Co-Benefits** | • Supports co-benefits from other strategies<br>• Improves equity outcomes |
| **Equity and Environmental Justice Considerations** | Engagement materials, outreach, and activities regarding the implementation of these strategies should be accessible to the diverse communities of the city. Actions such as ensuring the deliverables are translated into Spanish and other prominent languages spoken in Alameda would ensure equitable engagement practices are part of the CARP. Partnering with organizations in Alameda that already have established relationships with socially vulnerable communities is key to effective implementation. |
| **Performance Targets and Metrics** | Target<br>• No targets established<br><br>Metrics<br>• # of community engagement touchpoints<br>• # of community leader touchpoints<br>• Website and social media analytics<br>• Community surveys |

# Implementation Plans

## Key Implementation Actions

| Actions | Funding Available | Lead |
|---|---|---|
| **Climate awareness and action program.** Continue to collaborate with CASA, the Alameda Chamber of Commerce, AMP, and other community partners to implement a robust, ongoing climate awareness and action program, focused on reducing emissions, including consumption-based emissions, by residents, businesses, and contractors through educational events, media outreach, and other creative approaches.<br><br>Components include:<br>• Highlighting a sustainable local business in every City newsletter and other communications including social media.<br>• Providing information about sustainable local businesses and other consumption-related topics at relevant City counters and offices, such as the Permit Center and Mastick Senior Center.<br>• Creating a module on the City's website that highlights resources (i.e., local "buy nothing" groups, thrift stores, donation centers, etc.) and local businesses to help Alameda residents reuse. | Partially | Sustainability; PIO |
| **Youth engagement and partnership.** Continue partnership with Alameda Unified School District to empower students to be leaders in reducing greenhouse gas emissions, lowering energy consumption, and utilizing active transportation in their community through in-class education, guest presentations, internships, and other programs. Modify and/or expand green school activities through presentations and in-class education. | Partially | Sustainability |
| **Socially vulnerable community partnerships.** Continue to establish relationships and build partnerships with CBOs, faith-based organizations, and trusted partners within socially vulnerable communities. Develop mini-training on the CARP and resources available to residents and businesses. | Partially | Sustainability |

## Future Actions for Consideration

Future actions for consideration if funding and staff resources become available.

- **Green job partnerships.** Develop partnerships with local trade associations, vocational programs, and community colleges to support workforce development in green jobs, such as for installers and building owners/operators to discuss the benefits and technical requirements of electrification.

Key implementation actions for this strategy, funding availability, and lead department

Additional actions if staffing or funding become available

# Continuous Improvement

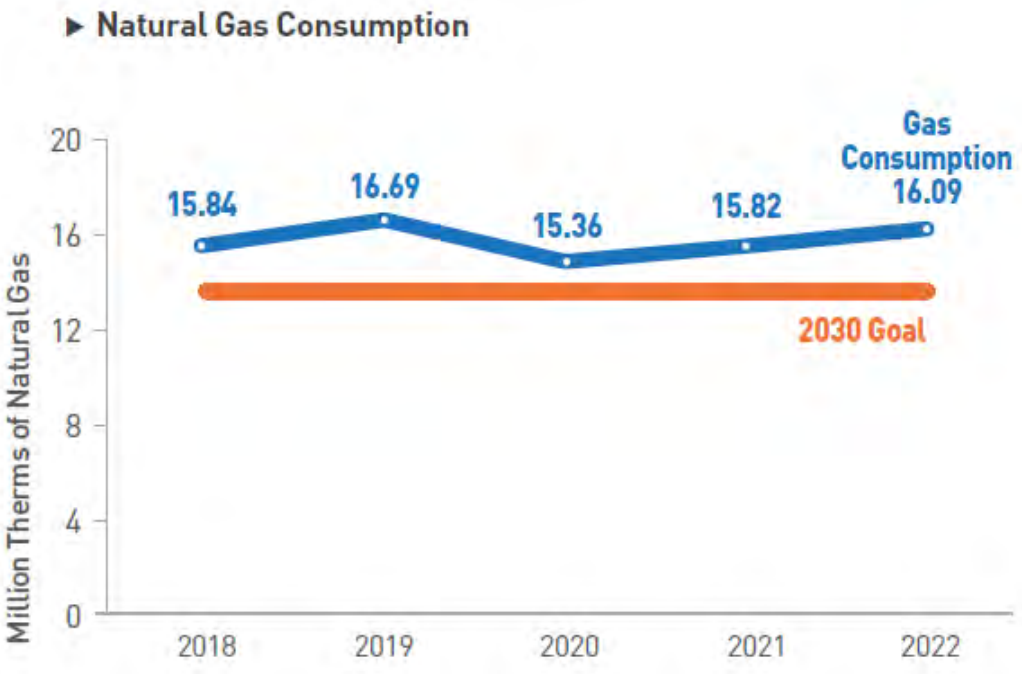
- Green Team
- Education and training for City staff
- Annual reporting



# Annual Reporting

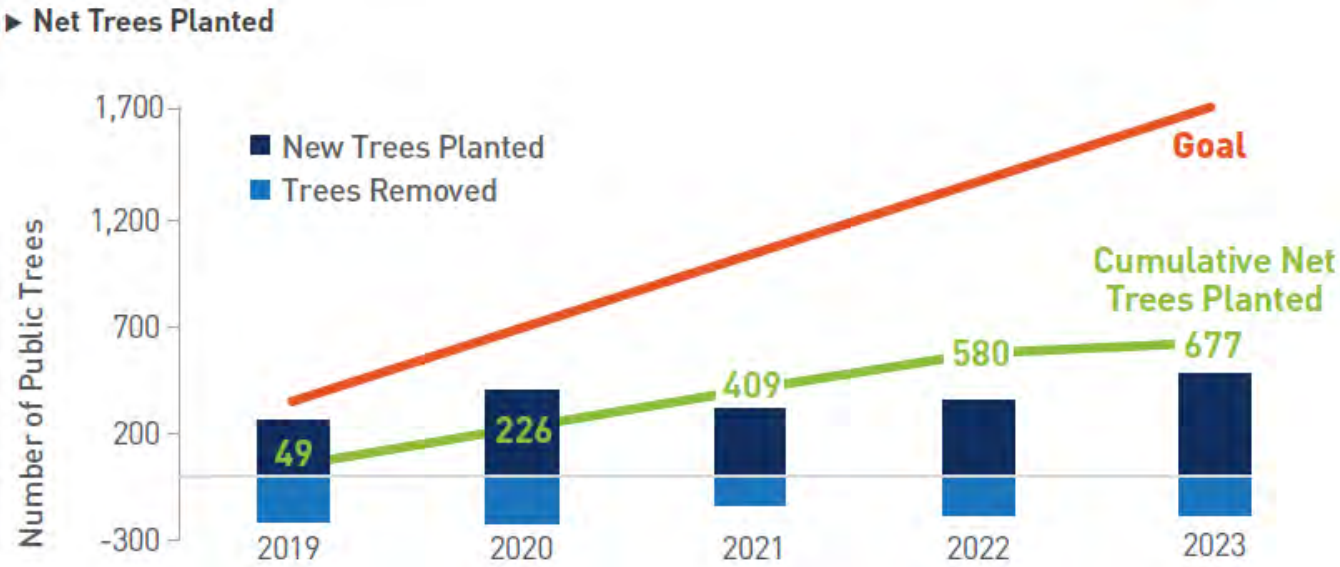
**Strategy**

## BE-1: Existing Building Decarbonization




**Strategy**

## UG-1: Urban Forestry



# Local Hazard Mitigation Plan (LHMP)

# Climate Action and Resiliency Plan (CARP)

## Climate Adaptation & Hazard Mitigation

- Local Hazard Mitigation Plan
  - General Plan Safety Element
  - Oakland Alameda Adaptation Committee (OAAC) Projects

## Greenhouse Gas Reduction

- Equitable Building Decarbonization Plan
- General Plan
- Urban Forest Plan

### Guiding & Implementation Plans

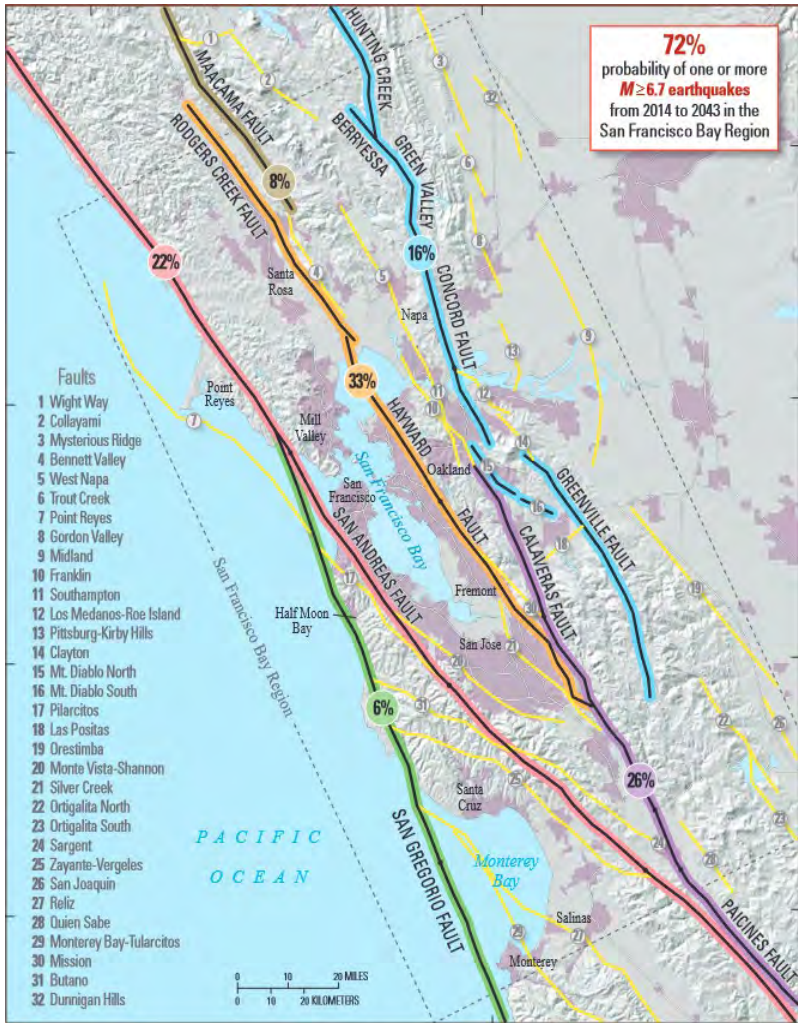
- Transportation Choices Plan
- Zero Waste Implementation Plan
- Active Transportation Plan

# LHMP Hazards (Geologic & Weather-Related)

- Earthquakes
- Shaking
- Liquefaction
- Fires
- Other Related Losses
- Flooding
- Tides
- Coastal Flooding
- Coastal Erosion
- Stormwater Flooding
- Groundwater
- Tsunamis
- Heat
- Drought
- Wildfire-Related
- Dam-Breach Inundation

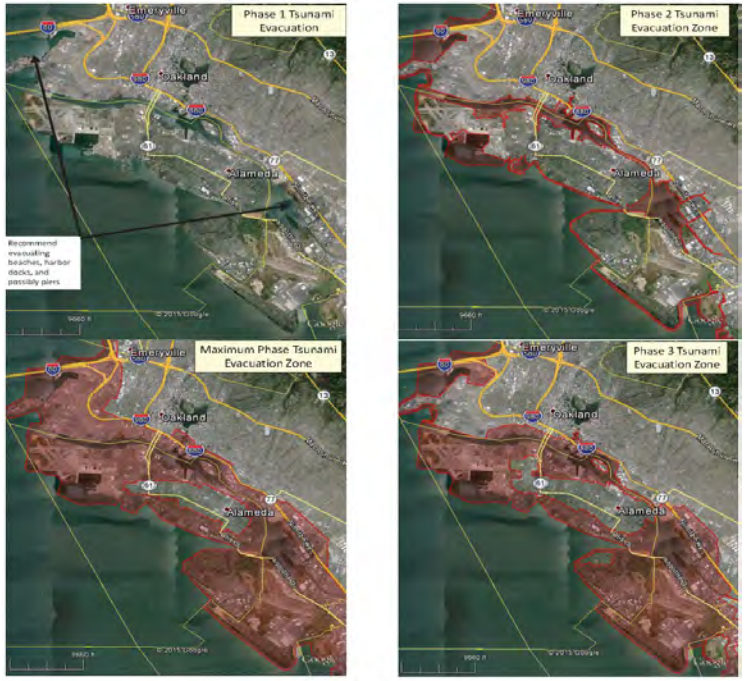
# Earthquakes & Tsunamis

- According to the USGS, the chance of an earthquake of M6.7 or greater somewhere in the Bay Area before 2043 is 72%
- Manmade portions of Alameda are susceptible to liquefaction
- Tsunamis impacting Alameda can result from offshore earthquakes within the Bay Area, or from distant offshore faults
- Alameda will have several hours warning time for tsunamis generated in distant locations





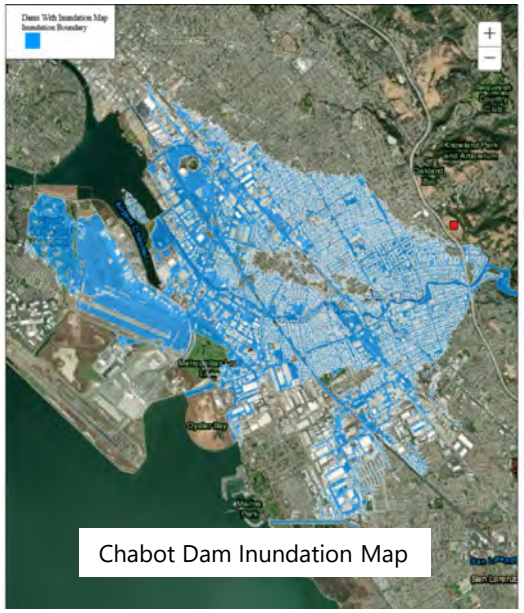





Tsunami Evacuation Phases

# Dam Failure, Drought, Heat & Wildfires

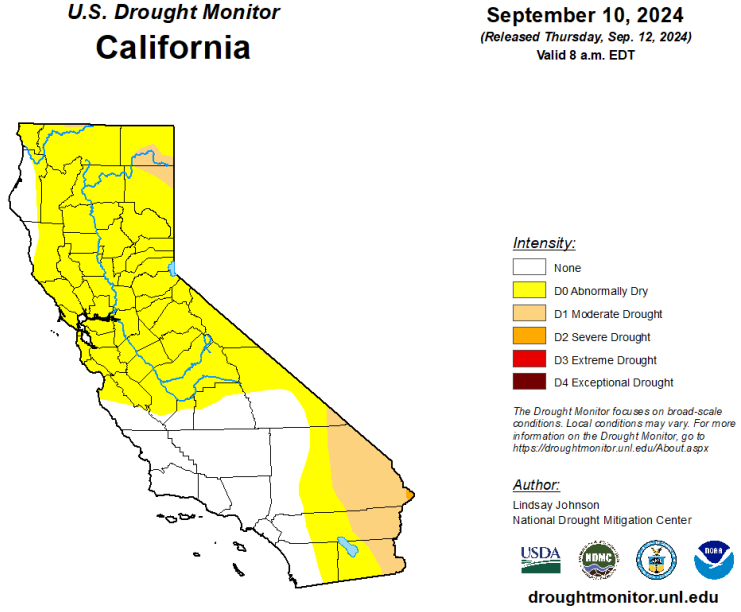
- More frequent and severe droughts anticipated
- Extreme heat events expected to increase in severity, frequency and duration due to climate change
- Wildfires becoming increasingly frequent and intense, with smoky air impacting public health in Alameda
- Inundation from dam failure highly unlikely, but would impact Alameda



Chabot Dam Inundation Map



Upper San Leandro Dam Inundation Map

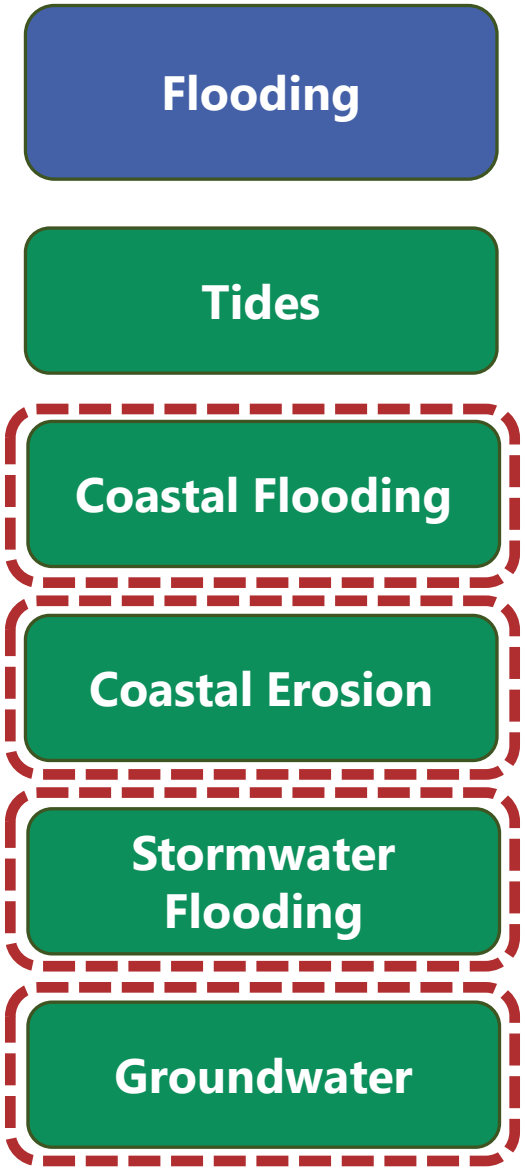





# LHMP Hazards Affected by Climate Change

- Earthquakes
- Shaking
- Liquefaction
- Fires
- Other Related Losses
- Flooding
- Tides
- Coastal Flooding
- Coastal Erosion
- Stormwater Flooding
- Groundwater
- Tsunamis
- Heat
- Drought
- Wildfire-Related
- Dam-Breach Inundation

# Flood Hazards – Existing and Future



# Wave Hazards

- 1% annual chance offshore wave heights
- Larger waves can contribute to higher wave runup elevations and increased coastal erosion
- Does not consider climate change



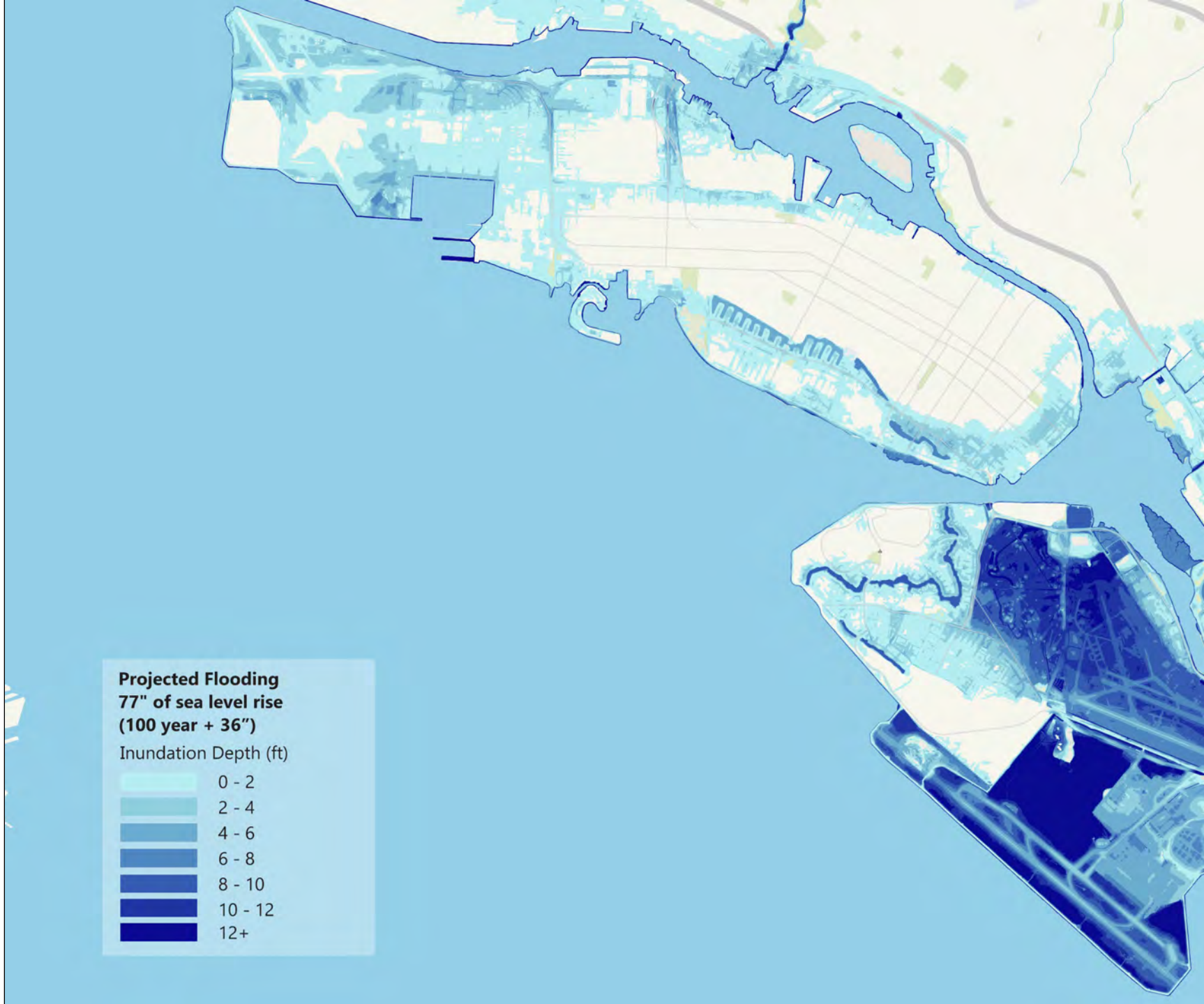
# FEMA Flood Hazards

- 1% annual chance coastal flood inundation and wave hazards
- 0.2% annual chance flood inundation
- Does not consider stormwater flooding or climate change



# 1% annual chance flooding with 36” of Sea Level Rise

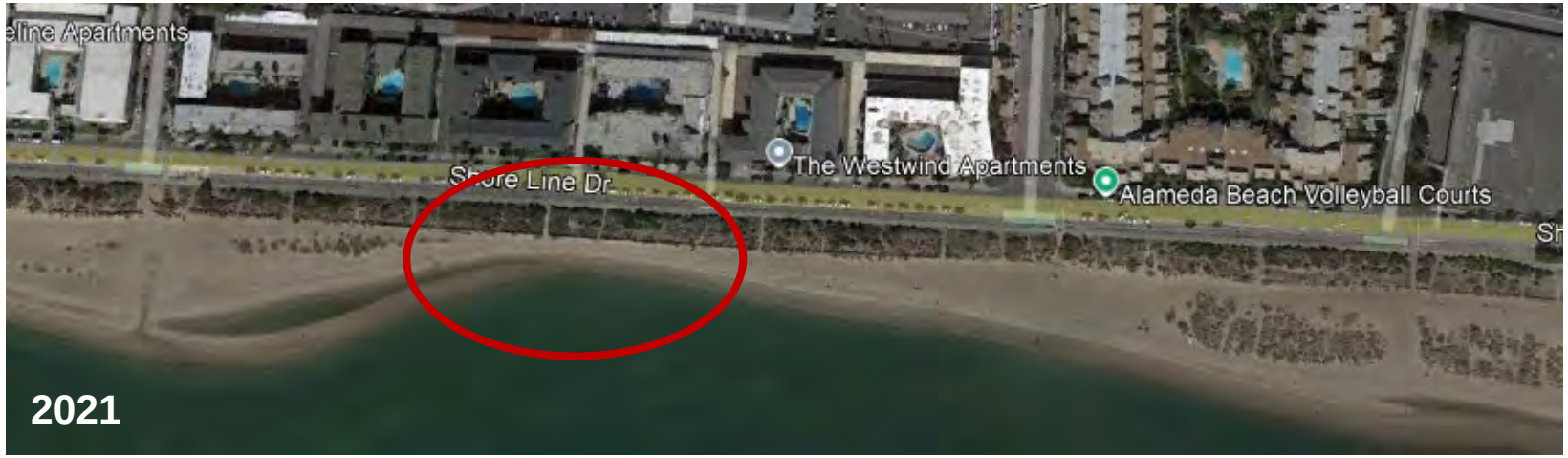
- 36 inches = 3 feet
- High-end estimate by 2070
- Likely estimate by 2100
- 2024 Ocean Protection Council Guidance recommends using 3.5 feet as a likely value for 2100
- LHMP does not need to address long-term 2100 hazards



# Coastal Erosion

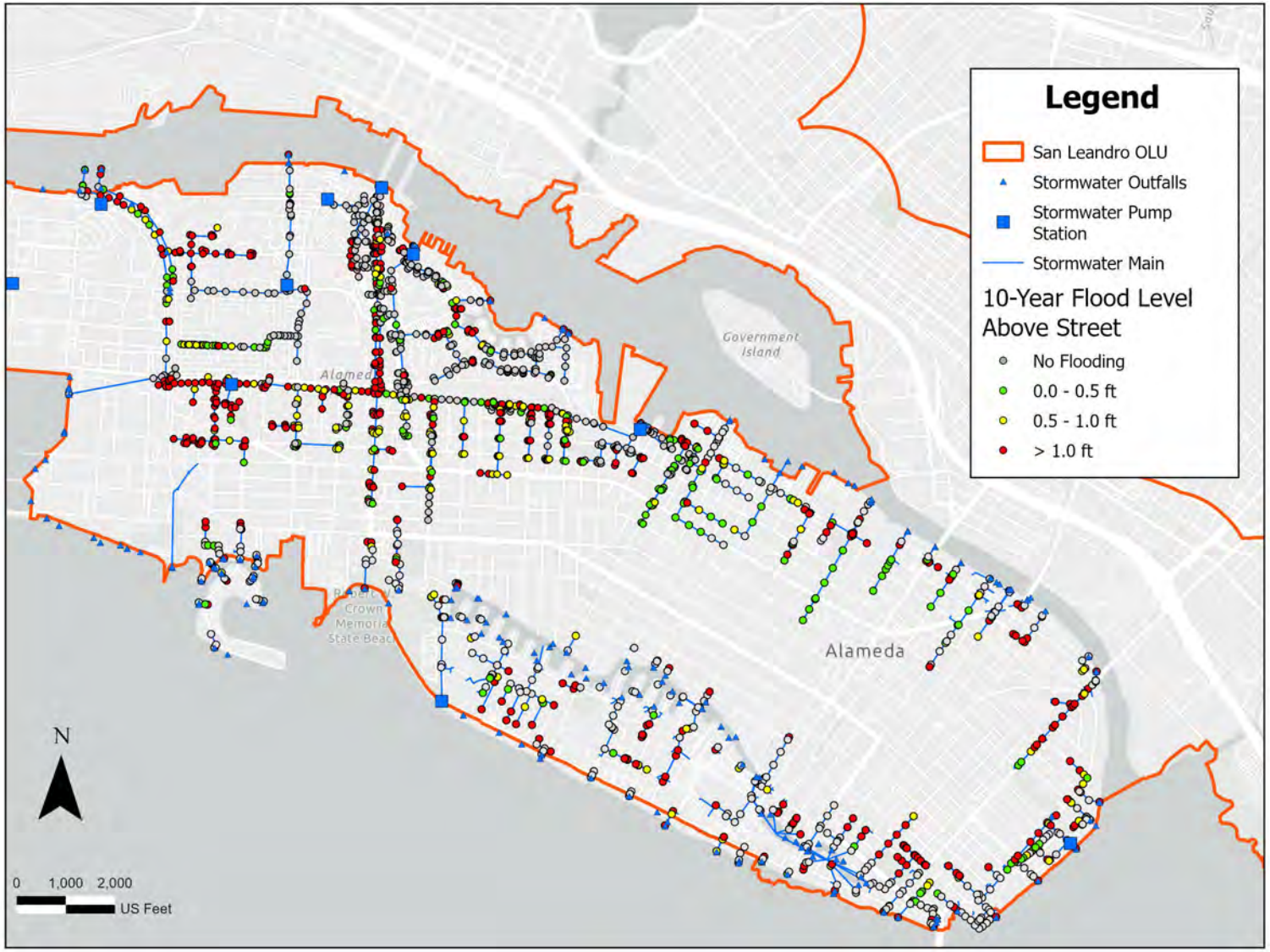
- Caused by elevated Bay water level, waves, or combination of the two
- Ongoing threat to areas such as Shoreline Drive and the northern shoreline of Bay Farm Island



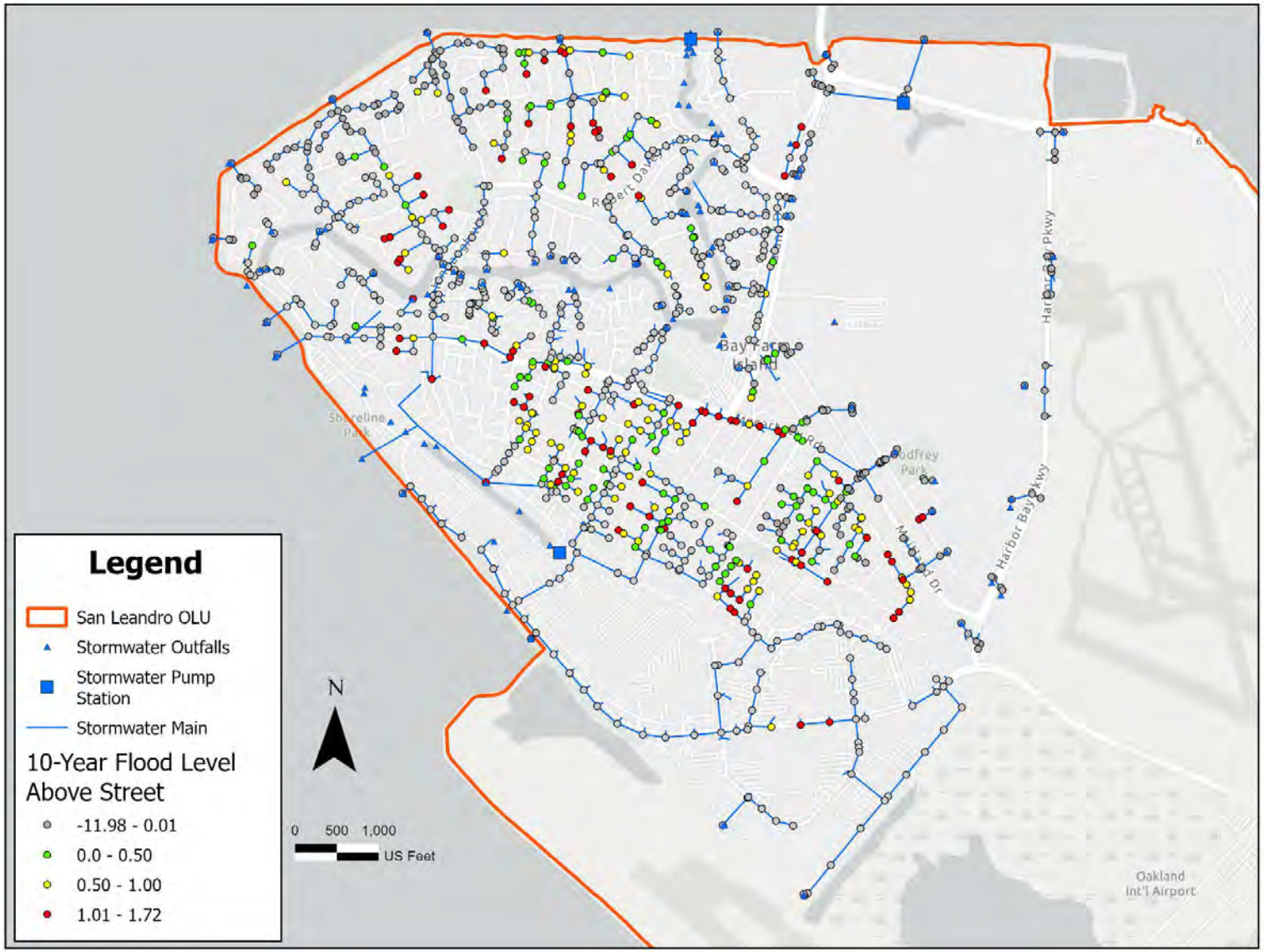
# Stormwater Flooding – Alameda

- 10-year rainfall event
- Storm Drain Master Plan (2008)
- Does not consider climate change



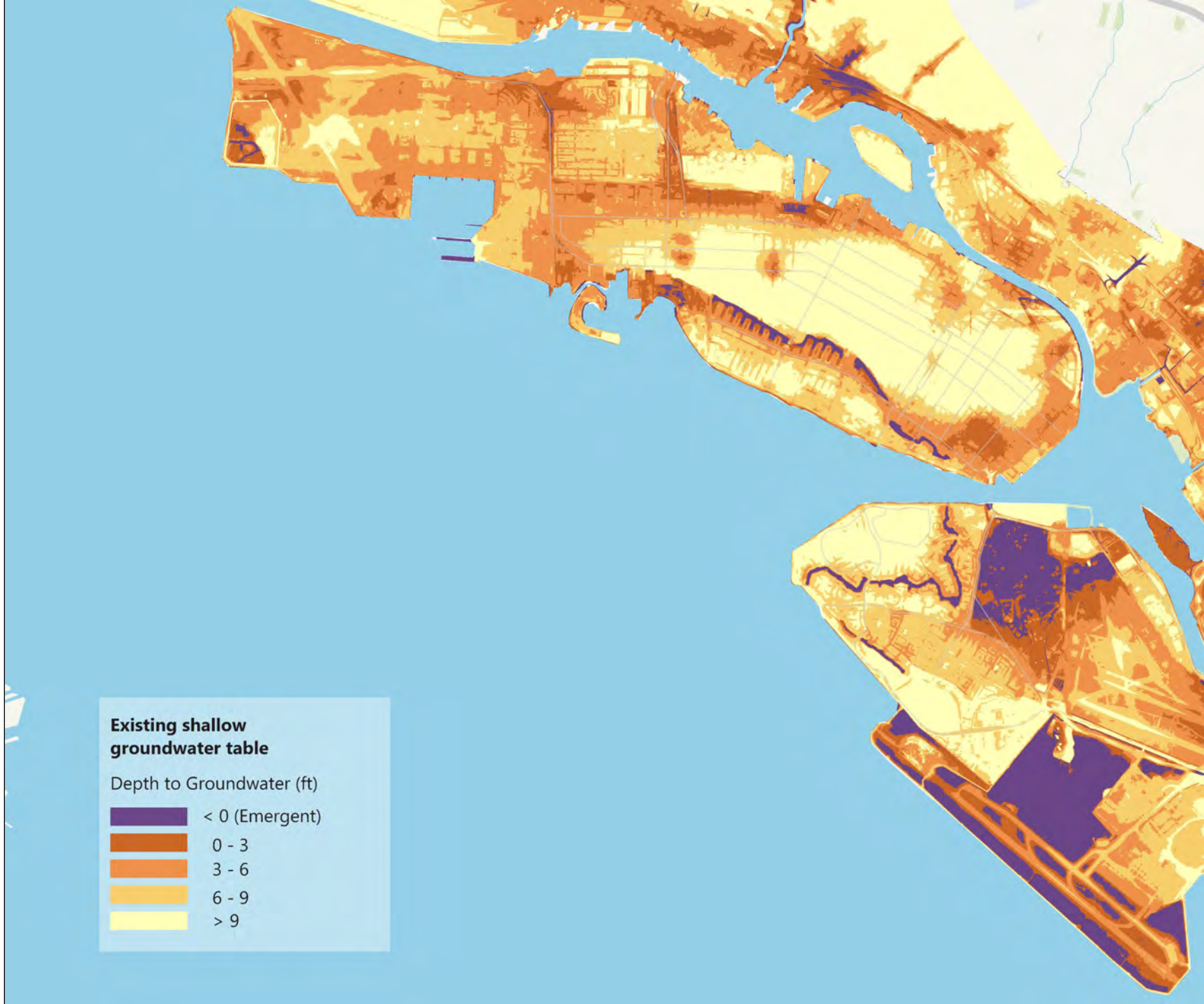
# Stormwater Flooding – Bay Farm Island

- 10-year rainfall event
- Storm Drain Master Plan (2008)
- Does not consider climate change



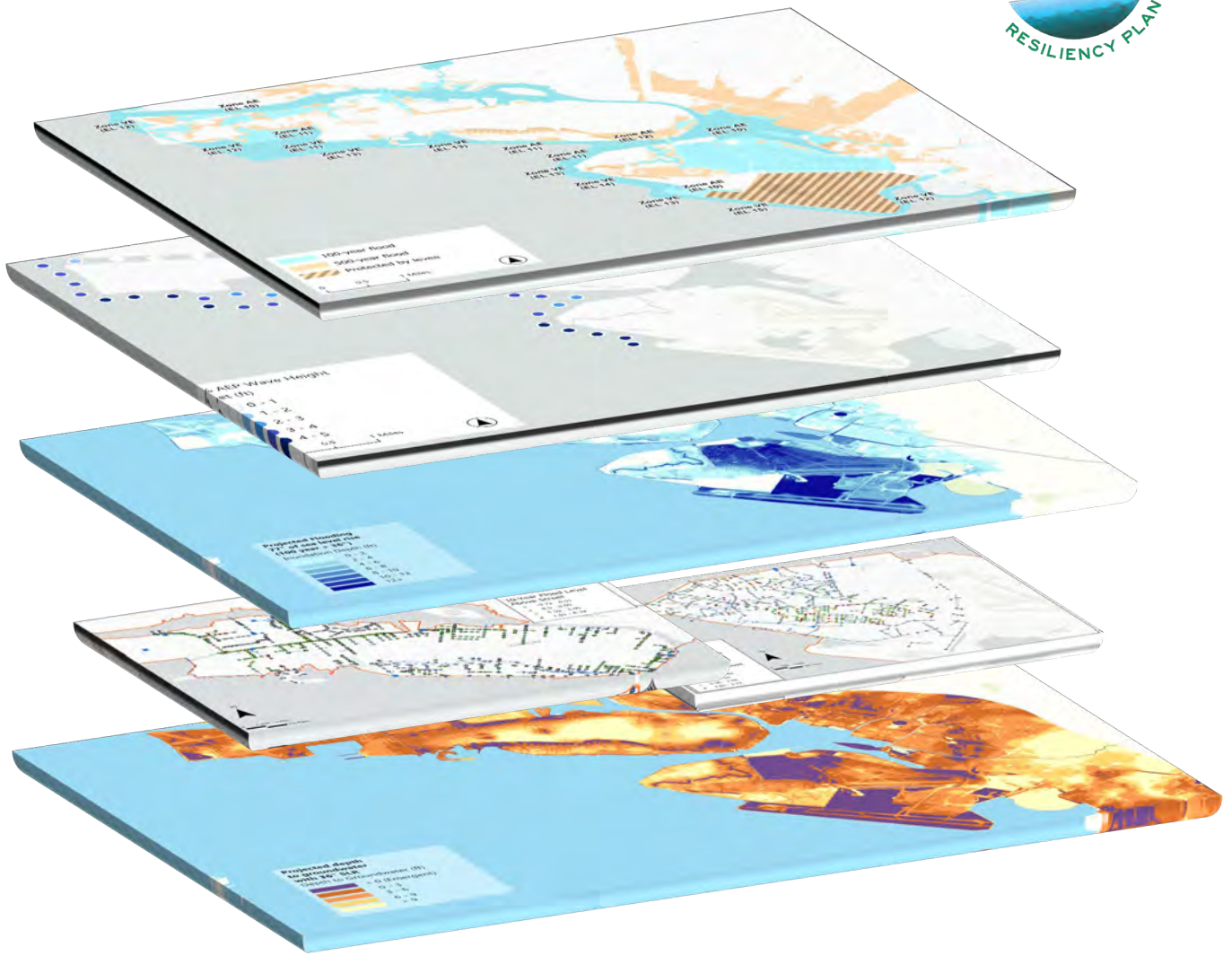
# Existing Depth-to-Water / Shallow Groundwater Table

- Highest annual shallow groundwater table
- Generally, occurs after wet winters (shallow groundwater table rises in response to rainfall)
- Based on wet winters from 2000 to 2018 (does not include the 2022-2023 extreme winter rainfall)



# Overlay Hazards and Identify Priority Areas

- LHMP identifies projects and strategies
- Projects in the LHMP that mitigate (reduce) hazards are eligible for FEMA funding
- Strategies can include:
  - capacity building
  - new or updated policies
  - project components
  - additional studies to address data gaps



# Previous Strategies for Location-Based Priority Flooding

- Identified priority assets based on the risk posed by both temporary and permanent flooding
  - Shallow groundwater was not considered (this represents a filled data gap)
- Based on analyses of previous City studies, activities implemented in other municipalities, and state and federal guidance
- 11 areas identified and organized by asset type with short-, mid-, and long-term considerations



# Updated Strategies for Location-Based Priority Flooding

- Consider all flood hazards, with some future condition data gaps (e.g., future stormwater with increased precipitation)
- Include updates based on recent progress and grant-funded projects (e.g., Oakland-Alameda Adaptation Plan [OAAC])
- 19 areas identified and organized based on:
  - Immediate need (0 – 3 years)
  - Near-term project (3 – 10 years)
  - Mid-term project (10 – 30 years)
- Longer term projects will be outlined in the Oakland-Alameda Subregional Adaptation Plan



# Strategies for Location-Based Priority Flooding

- 4 Immediate
- 11 Near-term
- 4 Mid-term
- More information available in **Chapter 5**



# Next Steps and Ways to Stay Engaged

# How to Read and Comment on the Plans

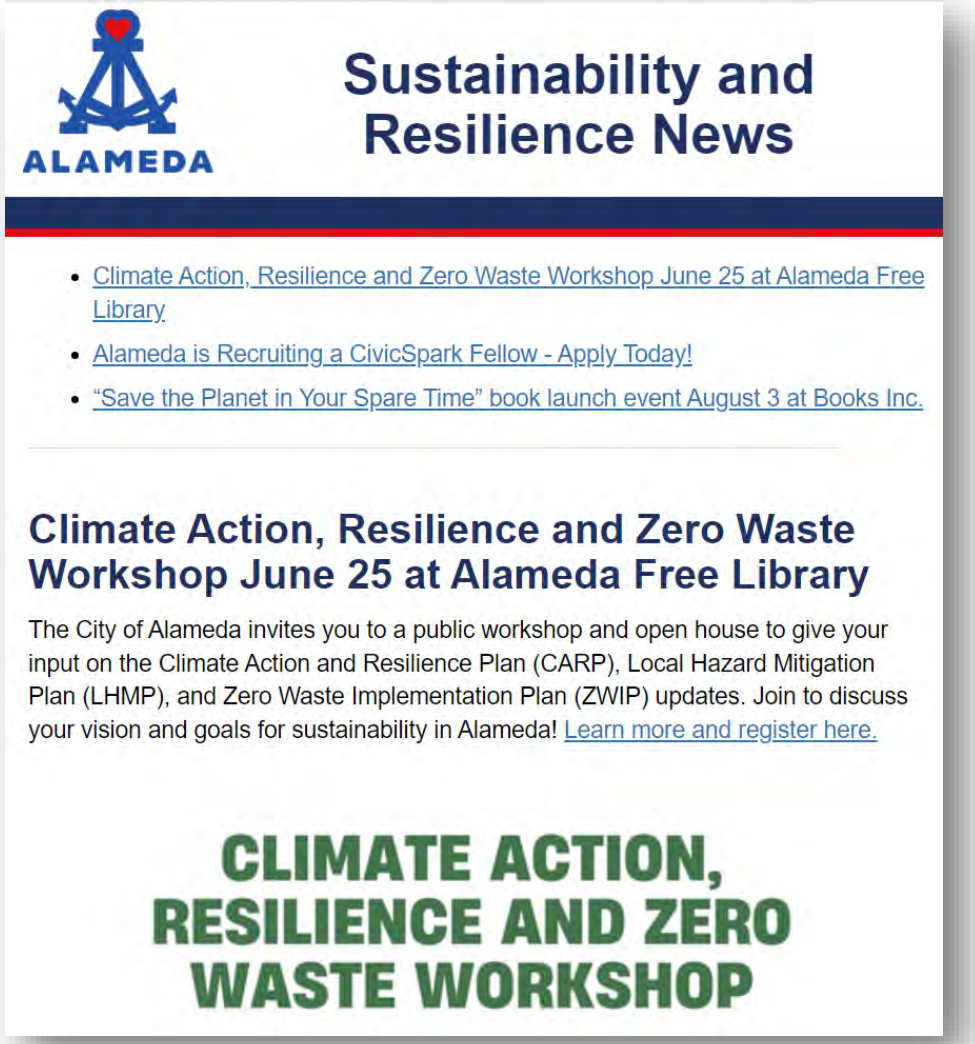
- Visit www.alamedaca.gov/CARP to download the plans and provide your feedback or go directly to:
- https://www.surveymonkey.com/r/DKVLSY6

# Next Steps

- Collect comments on the CARP and LHMP until January 17, 2025
- Summarize feedback and update CARP and LHMP
- Board and commission hearings (tentative schedule)
  - February 19 - Public Utilities Board
  - February 24 - Planning Board
  - February 26 - Transportation Commission
  - March 18 - City Council
- LHMP to be sent to CalOES and FEMA for review and back to City Council for adoption

# How to Stay Involved

- Project information will be regularly updated on: www.alamedaca.gov/CARP
- To stay up to date on plan progress, please subscribe to the "Environment, Sustainability and Climate Action" mailing list: www.alamedaca.gov/subscribe



# Thank you!



# Appendix C
# Community Survey

# Community Survey #1 Results

## CARP Vision and Goals + Climate Hazard Awareness

## Community Survey Background

This survey was designed to gather information about community members' opinions about the CARP vision and goals for climate action, resilience, zero waste, and to better understand climate hazard awareness to inform the Local Hazard Mitigation Plan update happening as part of the CARP update. Responses will also help to inform development of the City's Zero Waste Implementation Plan (ZWIP). The CARP update will reevaluate community greenhouse gas (GHG) emissions, revise the CARP vision, goals, and strategies, and develop detailed action plans for priority strategies. The Local Hazard Mitigation Plan aims to help Alameda adapt to climate change, reduce the impact of future disasters on the community and help to recover more quickly when disasters do occur.

The survey was open to community members online from April 18, 2024 – May 13, 2024. It was advertised at Alameda's Spring Shindig, Bike Festival, and stakeholder meetings, as well as promoted in the City's sustainability newsletter and using the City's social media channels. The survey received 147 responses.

## Survey Results

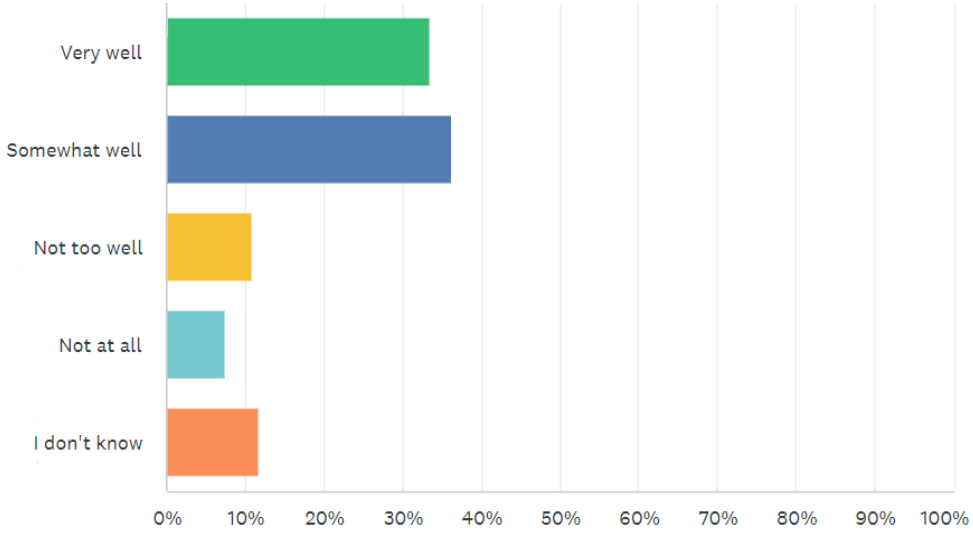
Participants were asked several demographic questions during the survey. These questions are intended to help City staff determine whether survey respondents generally matched the profile of Alameda and/or whether any groups were over- or underrepresented. Key takeaways are summarized below:

- Almost all respondents (94 percent) are residents of the City of Alameda.
- Out of the respondents that live in Alameda, 74% of respondents own their home and 26% rent. The survey results overrepresented homeowners (49 percent of the city population) compared to renters (51 percent of the city population).
- 70 percent of survey respondents identified as Non-Hispanic White or Caucasian (compared to the citywide average of 42 percent) followed by 12 percent identified as Asian or Asian American (compared to the citywide average of 32 percent). Thirteen percent of respondents preferred not to answer.
- People aged 55 and above comprised 42 percent of respondents, while youth aged under 18 and young adults 18-24 accounted for only 3 percent of respondents combined.

### Vision and Goals

Question 1 asked respondents to evaluate the CARP's existing vision statement and goals to see how well they reflected the community's opinion on climate action. Nearly 70 percent of respondents agreed that the vision statement very well or somewhat well continues to reflect the vision of the community.

**Figure 1: How well the CARP vision statement reflects the community's vision for climate action**




Question 2 asked respondents to explain how they think the vision has changed, if applicable. The main takeaways are summarized below:

- Need more specificity; add a date rather than "as soon as possible"
- Want to know how the City will achieve the vision
- Need to recognize marginalized populations and low-income community members
- Uncertainty about how Alameda is being a leader

Question 3 asked respondents to describe the physical, cultural, or community qualities of Alameda that need to be preserved as climate changes. The main takeaways are summarized below:

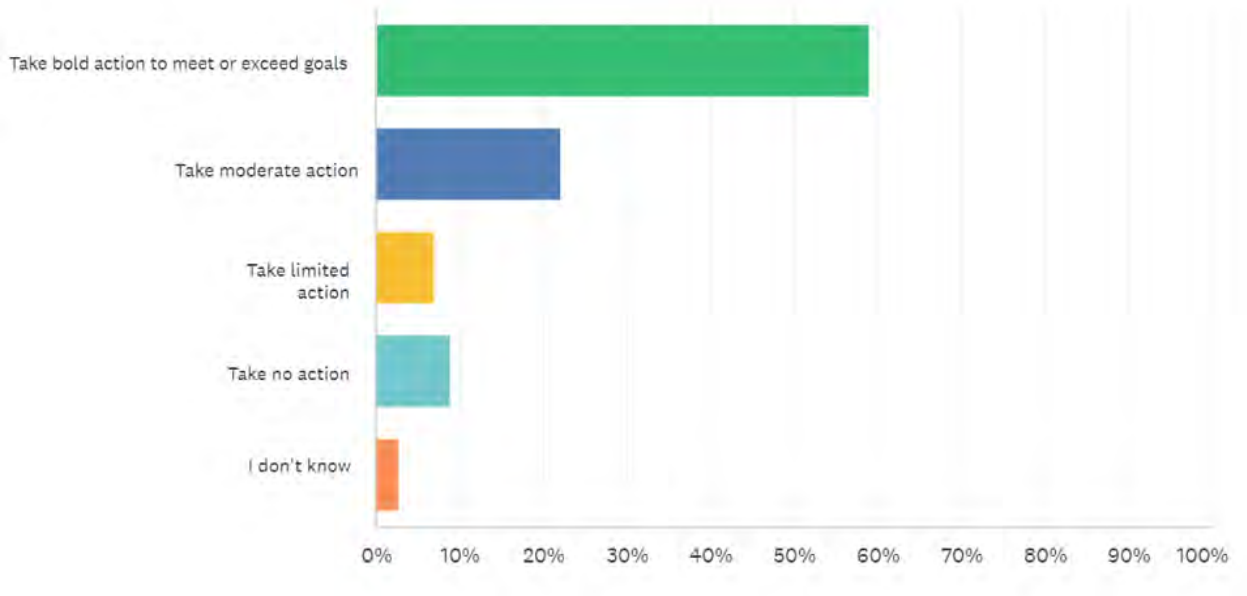
- Diversity and affordability
- The walkability and bikeability of the community
- The city's green spaces and trees and shoreline and beach access
- Alameda is a very cohesive community
- Historic buildings
- Small town feel
- Preparing for sea level rise

**Figure 2: Word cloud representing the most common qualities mentioned in responses.**



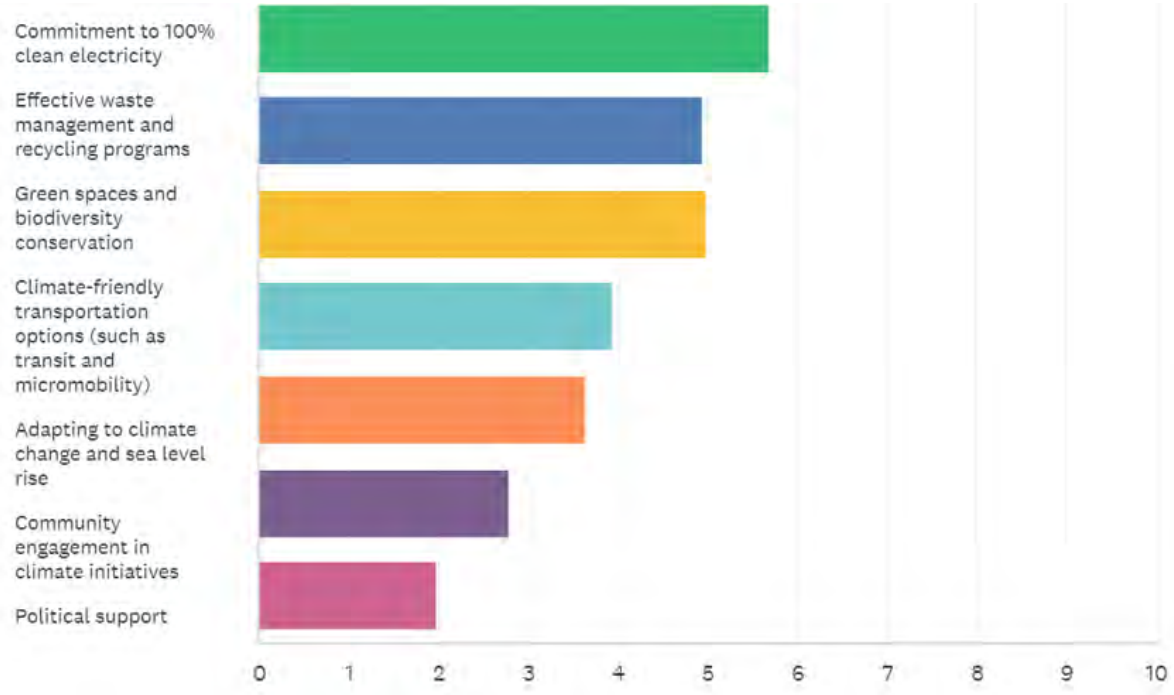

Question 4 asked the community how actively the City should work to achieve its greenhouse gas reduction goals. Eighty-one percent of respondents said the City should take bold or moderate action to meet or exceed goals. Nine percent responded that the City should take no action.

**Figure 3: The level of action the City should take to meet its GHG goals**



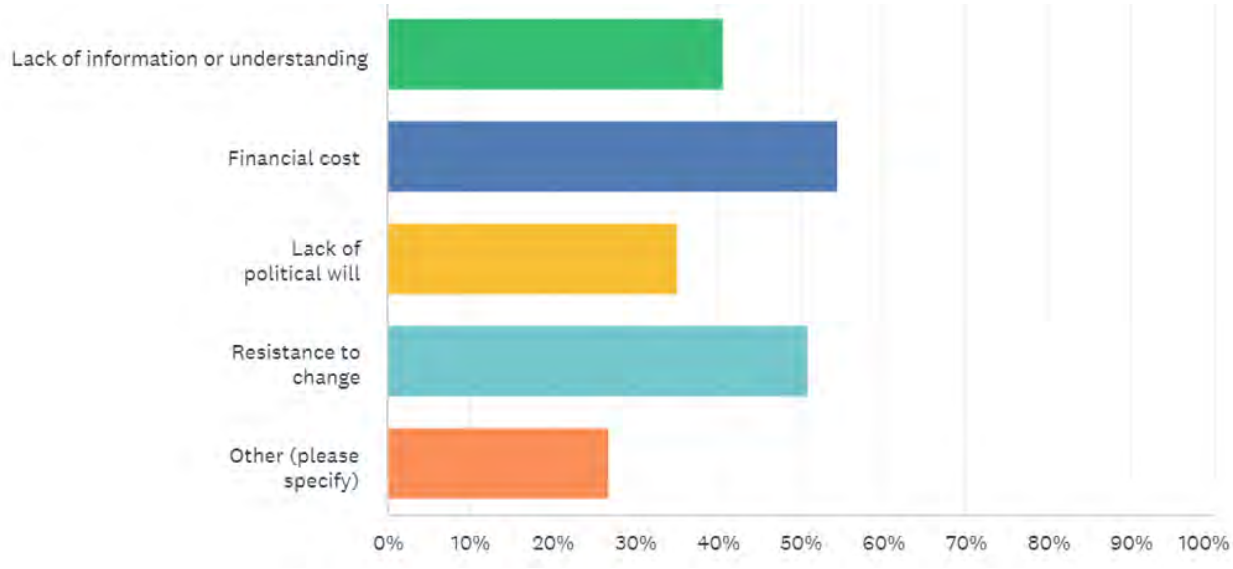

Question 5 asked respondents to rank what they think are Alameda's greatest strengths in terms of climate action. Commitment to 100 percent clean electricity ranked the highest and political support ranked the lowest.

## Figure 4: Alameda's strengths in terms of climate action




Question 6 asked the community to identify the biggest barriers to taking climate action in Alameda. Financial cost was the biggest barrier followed by resistance to change. Many "other" responses noted that they don't want to lose their personal freedoms to fight climate change.

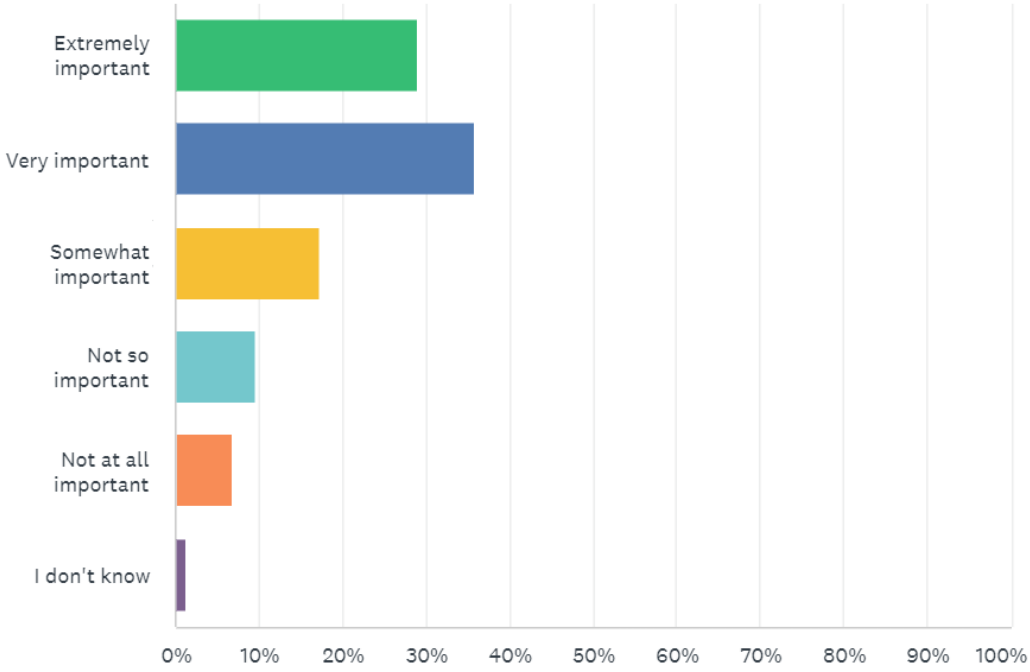
## Figure 5: Biggest barriers to taking climate action in Alameda



## Zero Waste

Question 7 asked the community how important it is for the City to achieve its zero waste goals. Zero waste is defined as diverting at least 90 percent of waste from landfill. Almost 65 percent of respondents believed it was extremely or very important to achieve zero waste goals.

### Figure 6: The importance of achieving zero waste in Alameda



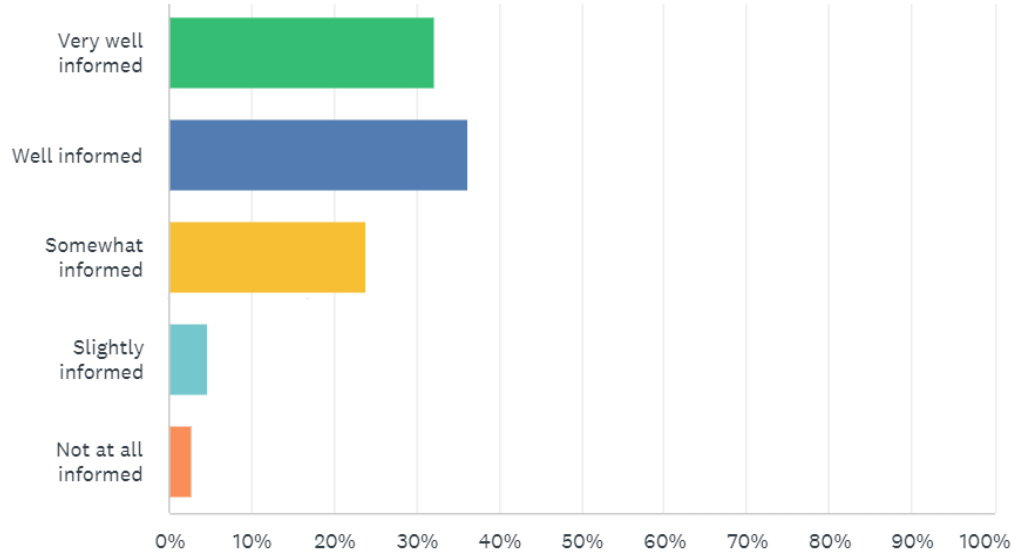

Question 8 asked the community what types of programs they believe are most effective to achieve zero waste. The top four most effective programs include incentives for reducing waste (e.g. discounts for bringing a reusable cup, green business recognition), promotion of citywide reuse programs, mandatory reuse/recycling/composting services and programs, and requiring producers who make packaging to pay for recycling or organics programs. A summary of "other" responses include:

- Normalizing the circular economy
- Banning single-use plastics
- Ensuring that sorted waste is actually recycled
- Zero waste is not needed and the City shouldn't focus resources on it.

## Climate Change Hazards and Preparedness

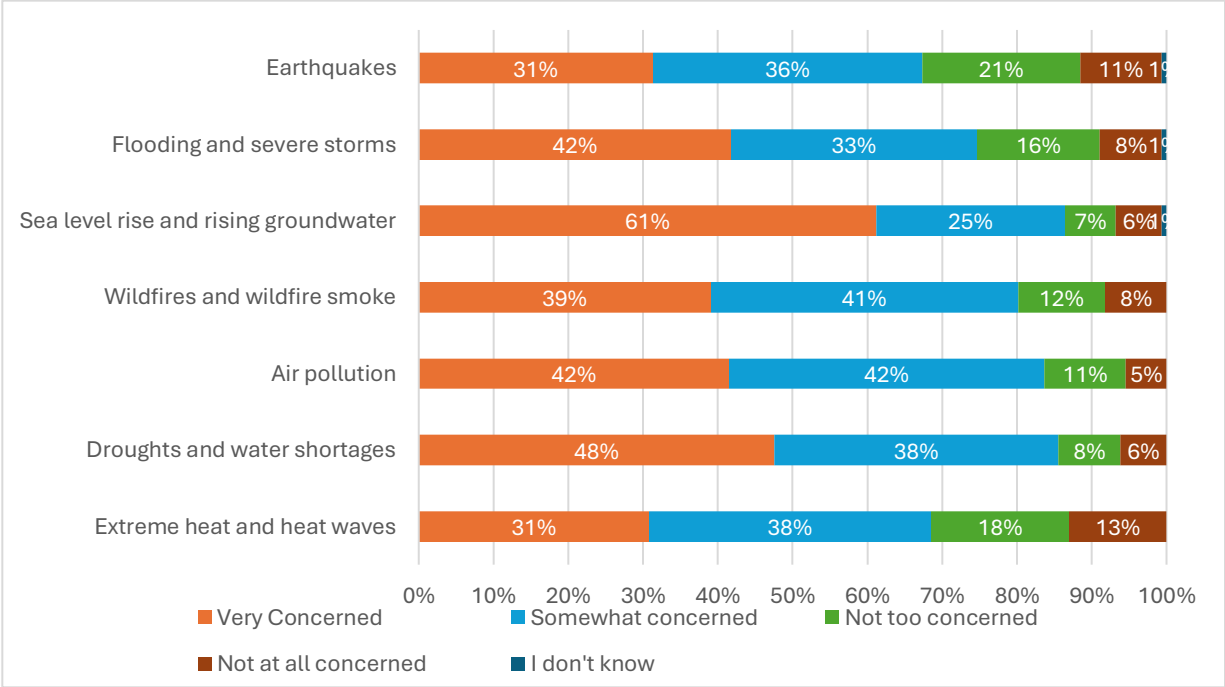
Question 9 asked the community about how informed they are about the effects of climate change in Alameda. The majority of respondents (69 percent) replied that they are very well or well informed about the effects of climate change.

## Figure 7: How informed the community is about the effects of climate change in Alameda



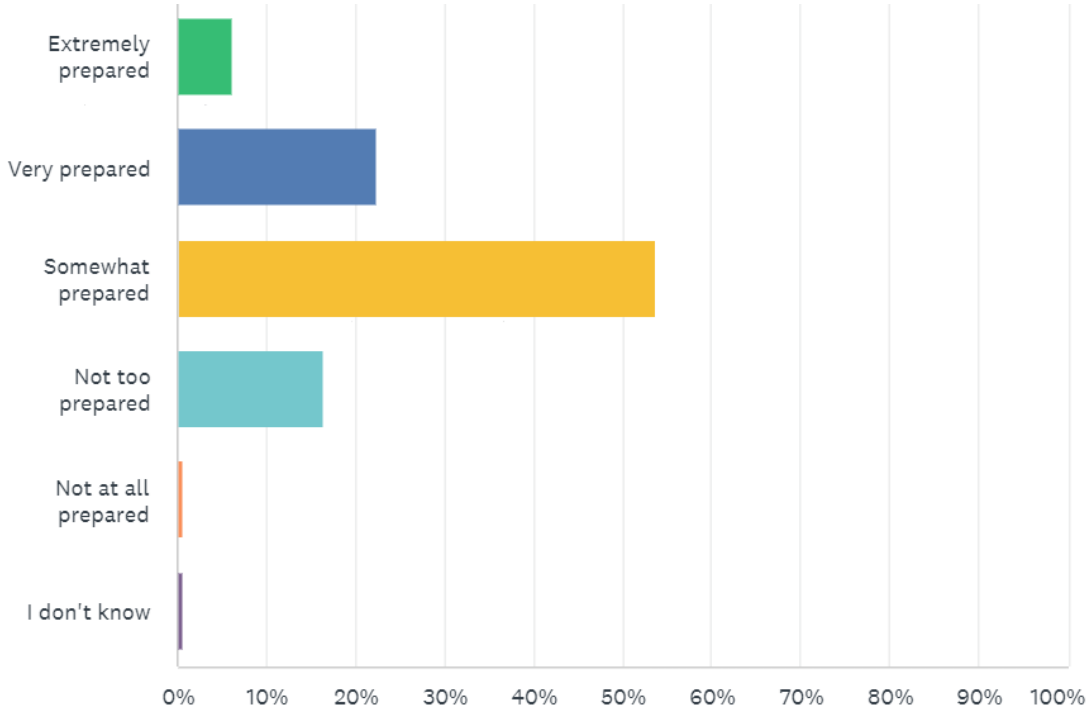

Question 10 asked the community how concerned they are about the following climate hazards: extreme heat and heatwaves, droughts and water shortages, air pollution, wildfires and wildfire smoke, sea level rise and rising groundwater, flooding and severe storms, and earthquakes. Sea level rise and rising groundwater are the most concerning hazard with 61 percent of respondents responding "very concerned."

## Figure 8: How concerned the community is about climate hazards in Alameda



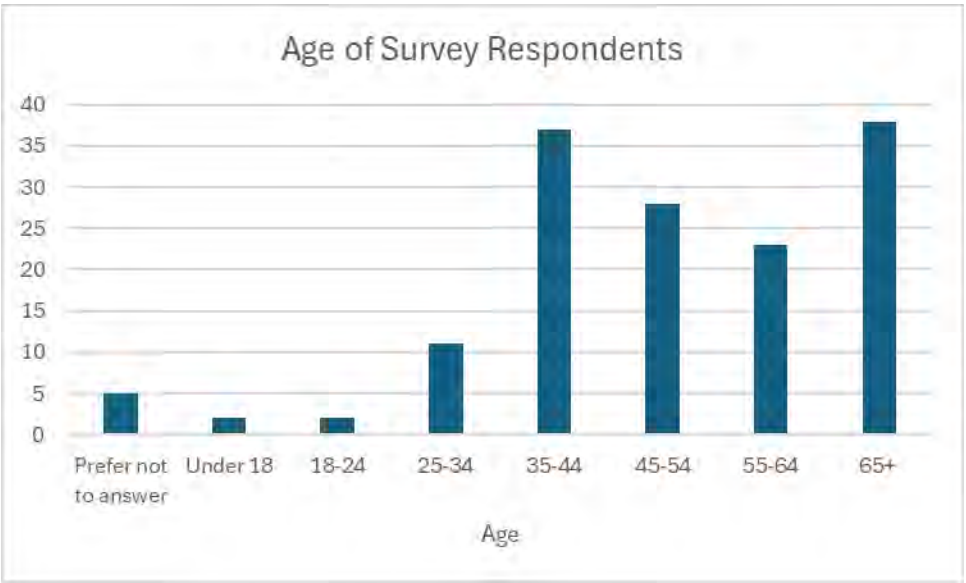
Questions 11 and 12 asked the community how well prepared they themselves are for disasters and how well the City is prepared to respond to disasters. Over half of the respondents (54 percent) replied that they are only somewhat prepared for disasters. Similarly, nearly half of respondents (48 percent) replied that they think the City is only somewhat prepared for disasters.

**Figure 9: How prepared the community is for disasters**

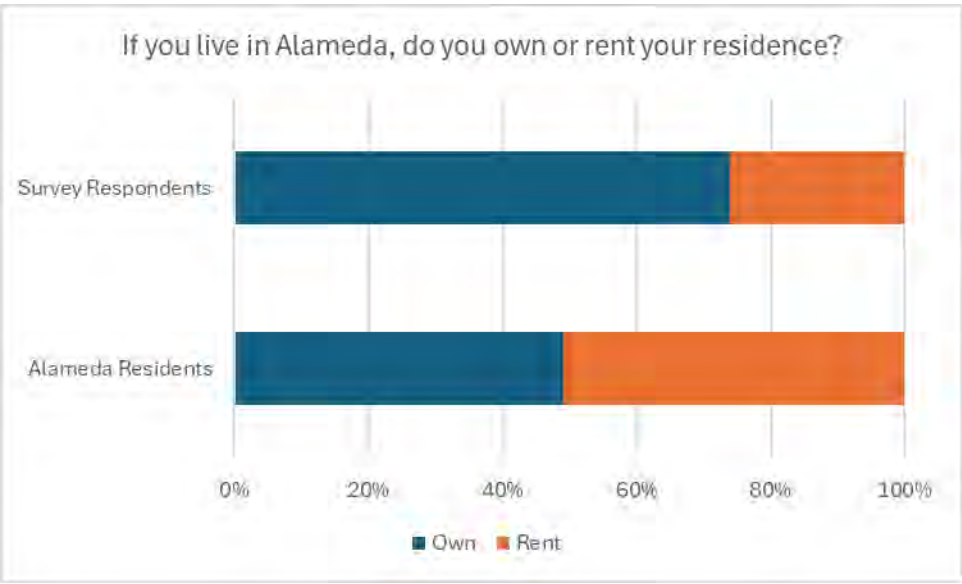



## Demographics

Question 13 asked the age of survey respondents. People aged 55 and above comprised 42 percent of respondents, while youth aged under 18 and young adults 19-24 accounted for only 3 percent of respondents combined.

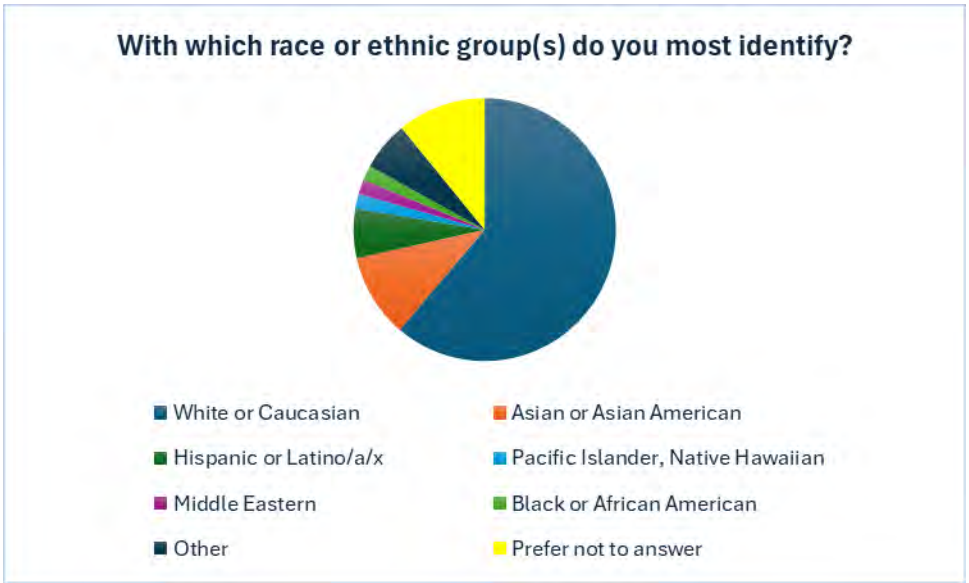



Questions 14 and 15 asked respondents if they lived in Alameda, and whether they owned or rented their residence. 95% of respondents lived in Alameda, and 5% live elsewhere but work or spend time in Alameda. Out of the respondents that live in Alameda, 74% of survey respondents own their home and 26% rent, compared to the City as a whole which is comprised of 51% renters and 49% homeowners.




Question 16 asked the race or ethnic group(s) respondents identified with. 70 percent of survey respondents identified as Non-Hispanic White or Caucasian (compared to the citywide average of

42 percent) followed by 12 percent identified as Asian or Asian American (compared to the citywide average of 32 percent). Thirteen percent of respondents preferred not to answer.






# Appendix D
# Detailed Asset Inventory

# Asset Inventory

The following table provides a list of buildings and open space owned by the City of Alameda, as well as other non-city owned buildings that serve critical community functions. The table describes the recovery priority for each building, based on its post-disaster importance for restoring community function. Information is also provided on the seismic retrofit status of each building, if known.

Recovery Priority:

- Critical = Life/Safety issues or needed for recovery within 1 week
- High = Needed for 90% recovery within one month, especially for vulnerable populations
- Moderate = Quick recovery would benefit City's overall recovery, especially for vulnerable populations, but alternatives available
- Low = Needed for property owner's recovery, but alternative available

# Soft-Story Buildings

The following table provides a list of buildings identified as soft-story and are vulnerable to damage Alameda's Soft-Story Hazard Reduction Program and have not been seismically retrofitted.

3250 BRIGGS AVE

1500 ALAMEDA AVE

2128 ALAMEDA AVE

1455 BAY ST

3215 BRIGGS AVE

3224 BRIGGS AVE

3228 BRIGGS AVE

470 BUENA VISTA AVE

520 BUENA VISTA AVE

434 CENTRAL AVE

600 CENTRAL AVE

724 CENTRAL AVE

831 CENTRAL AVE

1704 CENTRAL AVE

1715 CENTRAL AVE

1732 CENTRAL AVE

2026 CENTRAL AVE

2037 CENTRAL AVE

2043 CENTRAL AVE

2050 CENTRAL AVE

1515 CHESTNUT ST

1531 CHESTNUT ST

2045 CLINTON AVE

895 LAFAYETTE ST

753 LINCOLN AVE

2224 LINCOLN AVE

1417 NINTH ST

431 PACIFIC AVE

1583 PACIFIC AVE

1179 PARK AVE

1182 PARK AVE

1190 PARK AVE

400 PARK ST

1364 PARK ST

1825 POGGI ST

1152 REGENT ST

2153 SAN ANTONIO AVE

2236 SAN ANTONIO AVE

2209 SAN JOSE AVE

2210 SAN JOSE AVE

2215 SAN JOSE AVE

2236 SAN JOSE AVE

2246 SAN JOSE AVE

410 SANTA CLARA AVE

722 SANTA CLARA AVE

757 SANTA CLARA AVE

1815 SANTA CLARA AVE

2060 SANTA CLARA AVE

2241 SANTA CLARA AVE

2318 SANTA CLARA AVE

1557 SHERMAN

2019 SHORE LINE DR

2051 SHORE LINE DR

1538 ST CHARLES ST

1850 THAU WAY

1522 VERDI ST

1526 VERDI ST

1534 VERDI ST

1548 WEBSTER ST

424 WHITEHALL

1808-12 CENTRAL AVE

2149 OTIS DR

2225 OTIS DR

# Alameda Asset Inventory

| Type | Facility Name | Address | City Department or Owner | Function | Recovery Priority | Seismic Retrofit/Notes |
|---|---|---|---|---|---|---|
| City Bldg | Animal Shelter | 1590 Fortmann | Police/Friends of AAS | Animal Shelter | Critical | No data |
| City Bldg | Chochenyo Park Bandstand | 2430 Encinal Ave | Rec & Park | Bandstand, RR | Low | No data |
| City Bldg | Maintenance Service Center | 1616 Fortmann | Public Works | Corp Yard & Offices | Critical | Elec/Mech retrofit in 2012, no other data |
| City Bldg | Alameda Municipal Power Office Bldg & Warehouse | 2000 Grand St | Alameda Municipal Power | Corp Yard, Offices, MAN Core Site | Critical | Modern construction |
| City Bldg | Emergency Ops Ctr | 1809 Grand St | Fire | EOC | Critical | Modern construction |
| City Bldg | Fire Station 3 | 1625 Buena Vista Ave | Fire | Fire Sta & Residence | Critical | Modern construction |
| City Bldg | Fire Station 1 | 2401 Encinal Ave | Fire | Fire Sta & Residence | Critical | Reinforced masonry, no data |
| City Bldg | Fire Station 2 | 635 Pacific Ave | Fire | Fire Sta & Residence | Critical | Stucco, no data |
| City Bldg | Fire Station 4 | 2595 Mecartney Rd | Fire | Fire Sta & Residence | Critical | Modern construction |
| City Bldg | Fire Station 5, Building 6 | 950 W Ranger Ave | Fire | Fire Sta only | Critical | Day use only, 1940s concrete bldg, closed in 2009 |
| City Bldg | Building 522, Fire Dept Conf Rm | 431 Stardust Place | Fire | Gov't Office | Low | No data |
| City Bldg | City Hall West | 950 West Mall Sq | City Hall | Gov't Offices | Critical | Concrete bldg, elec/mech retrofit 2012, no other data |
| City Bldg | Recreation & Park Administration Building | 2226 Santa Clara Ave | Rec & Park | Gov't Offices | Critical | No data |
| City Bldg | Central Garage (at City Hall) | 2263 Santa Clara Ave | City Hall | Gov't Offices, garage | High | Inspected approx 2010, found to be OK |
| City Bldg | City Hall | 2263 Santa Clara Ave | City Hall | Gov't Offices, MAN Core Site | Critical | Repaired after tower lost in 1906. Electro/Mechanical retrofits 2012. |
| City Bldg | Grand Marina Harbormaster's Office | end of Grand St | Planning/Bldg/Dev | Harbormaster Bldg | High | No data |
| City Bldg | Bay Farm Library | 3221 Mecartney Rd | Library | Library | High | Assessed and found OK in 2007 |
| City Bldg | Main Library | 1550 Oak St | Library | Library | High | Modern construction |
| City Bldg | West End Library | 788 Santa Clara Ave | Library | Library | High | Retrofit in 2007 |
| City Bldg | Golf Misc Bldgs (6 or more) | 1 Clubhouse Memorial Dr | Golf | Maint Bldgs | Low | No data |
| City Bldg | Albert H. Dewit "O" Club | 641 West Redline | Rec & Park | Meeting Hall | High | 1940s building, no data |
| City Bldg | Grandview Pavilion | 300 Island Dr | Rec & Park | Meeting Hall | High | Modern construction |
| City Bldg | Veterans Memorial Building | 2203 Central Ave | Rec & Park | Meeting Hall | High | Concrete Bldg, no data |
| City Bldg | Parking Structure | 1401 Oak St (approx) | Public Works | Parking Structure | High | Modern construction |
| City Bldg | Police Station | 1555 Oak St | Police | Police & Jail | Critical | Modern construction, elec/mech upgrades 2012 |
| City Bldg | Jim's on the Course | 1 Clubhouse Memorial Dr | Golf | Pro Shop, Clubhouse, Restaurant | Low | No data |
| City Bldg | Bayport Park Rec Center | 301 Jack London | Rec & Park | Rec Center | High | Owned by AUSD, operated by City |
| City Bldg | Godfrey Rec Center | 281 Beach Rd | Rec & Park | Rec Ctr | High | Modern construction |
| City Bldg | Krusi Rec Center | 900 Mound St | Rec & Park | Rec Ctr | High | Modern construction. Built in 2020 |
| City Bldg | Leydecker Rec Ceter | 3225 Mecartney Rd | Rec & Park | Rec Ctr | High | Modern construction |
| City Bldg | Longfellow Rec Center | 520 Lincoln Ave | Rec & Park | Rec Ctr | High | No data |
| City Bldg | McKinley Rec Center | 2165 Buena Vista Ave | Rec & Park | Rec Ctr | High | No data |
| City Bldg | Tillman Rec Center | 220 Aughinbaugh Wy | Rec & Park | Rec Ctr | High | Modern Construction |
| City Bldg | Washington Rec Center | 740 Central Ave | Rec & Park | Rec Ctr | High | No data |
| City Bldg | Woodstock Rec Center | 351 Cypress Ave | Rec & Park | Rec Ctr | High | No data |
| City Bldg | Littlejohn Rec Center | 1401 Pacific Ave | Rec & Park | Rec Ctr , Day Care | High | No data |
| City Bldg | Franklin Rec Center and Pool | 1432 San Antonio Ave | Rec & Park | Rec Ctr, Outdoor Pool | High | No data |
| City Bldg | Harrison Ctr and Lincoln Park Pool | 1450 High St | Rec & Park | Rec Ctr, Pool bldg | High | No data |
| City Bldg | Alameda Point Gym | 1101 West Redline Ave | Rec & Park | Rec Ctr, unused pool | High | 1940s building, no data |
| City Bldg | Building 2 Storage | Bldg 2 Alameda Pt | City Hall | Record storage | Low | No data |
| City Bldg | Alameda Municipal Power Central Storage | 1828 Grand St | Alameda Municipal Power | Records Storage | Low | No data |
| City Bldg | MSC City Garage | 2000 Grand St | Public Works | Repair Garage | Critical | No data |
| City Bldg | Golf Driving Range Shop and assoc bldgs | 1 Clubhouse Memorial Dr | Golf | Retail | Low | No data |
| City Bldg | Golf Pro Shop | 1 Clubhouse Memorial Dr | Golf | Retail | Low | No data |
| City Bldg | Mastick Senior Center | 1155 Santa Clara Ave | Rec & Park | Senior Center | Critical | Former school, no other data. Designated Fresh Air and Cooling Center |
| City Bldg | Bldg behind Carnegie (old library annex) | 1429 Oak St | Planning/Bldg/Dev | Unoccupied bldg | Low | Need for retrofit identified in 1990s |
| City Bldg | Carnegie Library | 2264 Santa Clara | Planning/Bldg/Dev | Unoccupied bldg | Low | Seismically upgraded in 2001 |
| City Bldg | Other City Bldgs on Alameda Point | Various | Alameda Point | Various | Low | No data |
| City Open Space | Grand Street Boat Ramp | North End of Grand | Rec & Park | Boat Ramp | High | N/A |

| Type | Facility Name | Address | City Department or Owner | Function | Recovery Priority | Seismic Retrofit/Notes |
|---|---|---|---|---|---|---|
| City Open Space | Encinal Boat Launch Facility | S. end Central Ave | Rec & Park | Dock, RR | High | Fully rebuilt and reopened in 2020 |
| City Open Space | Main St Dog Park | Main St & Navy Way | Rec & Park | Dog Park | Low | N/A |
| City Open Space | Washington Dog Park AKA Alameda Dog Park | 1200 Eighth St (approx) | Rec & Park | Dog Park | Low | N/A |
| City Open Space | Chuck Corica Golf Courses | 1 Clubhouse Memorial Dr | Golf | Golf Course, RR | Low | N/A |
| City Open Space | Elsie Romer Bird Sanctuary | S. of Bayview | EBRPD/State | Open space | Low | N/A |
| City Open Space | Estuary Park | 230 Mosley Ave | Rec & Park | Open space | Low | N/A |
| City Open Space | Portola Triangle | S. of Portola | Rec & Park | Open space | Low | N/A |
| City Open Space | City-owned portions of Alameda Point | Various | Alameda Point | Open space | Low | N/A |
| City Open Space | Alameda Landing Waterfront Park (future) | 5th Street near Mitchelle | Rec & Park | Park | Low | n/a |
| City Open Space | Alameda Point Neighborhood Park (future) | Orion St. and Coronado Ave. | Rec & Park | Park | Low | n/a |
| City Open Space | Alameda Point Watefront Park (future) | Seaplane Lagoon | Rec & Park | Park | Low | n/a |
| City Open Space | Thompson Field | 2165 Buena Vista Ave | AUSD | Park | Low | N/A |
| City Open Space | Bill Osborne Model Airplane Field | Doolittle Dr | Rec & Park | Park | Low | N/A |
| City Open Space | Cityview Skatepark | 1177 West Redline Ave | Rec & Park | Park | Low | N/A |
| City Open Space | Franklin Park | 1432 San Antonio Ave | Rec & Park | Park | Low | N/A |
| City Open Space | Godfrey Park | 281 Beach Rd | Rec & Park | Park | Low | N/A |
| City Open Space | Chochenyo Parlk | 2430 Encinal Ave | Rec & Park | Park | Low | N/A |
| City Open Space | Jean Sweeny Park | S. of Atlantic | Rec & Park | Park | Low | N/A |
| City Open Space | Krusi Park | 900 Mound St | Rec & Park | Park | Low | N/A |
| City Open Space | Lexington Fields AKA Alameda Point Soccer Fields | Lexington | Rec & Park | Park | Low | N/A |
| City Open Space | Leydecker Park | 3225 Mecartney Rd | Rec & Park | Park | Low | N/A |
| City Open Space | Linear Park | ~2001 Main St | Rec & Park | Park | Low | N/A |
| City Open Space | Littlejohn Park | 1401 Pacific Ave | Rec & Park | Park | Low | N/A |
| City Open Space | Longfellow Park | 520 Lincoln Ave | Rec & Park | Park | Low | N/A |
| City Open Space | Main St Soccer Field | ~1900 Main St | Rec & Park | Park | Low | N/A |
| City Open Space | Marina Cove Waterfront Park | 1591 Clement Ave | Rec & Park | Park | Low | N/A |
| City Open Space | Marina Village Shoreline Park | N. of Independence | Rec & Park | Park | Low | N/A |
| City Open Space | McKinley Park | 2165 Buena Vista Ave | Rec & Park | Park | Low | N/A |
| City Open Space | Neptune Park | 2301 Webster St | Rec & Park | Park | Low | N/A |
| City Open Space | Rittler Park | 1400 Otis Dr | Rec & Park | Park | Low | N/A |
| City Open Space | Scout Park | Powell St | Rec & Park | Park | Low | N/A |
| City Open Space | Tillman Park | 220 Aughinbaugh Wy | Rec & Park | Park | Low | N/A |
| City Open Space | Towata Park | 3315 Bridgeway Isle | Rec & Park | Park | Low | N/A |
| City Open Space | Veterans Park | Veterans Ct | CHBIOA | Park | Low | N/A |
| City Open Space | Bayport Park | 301 Jack London | Rec & Park | Park, RR | Low | N/A |
| City Open Space | BFI Shoreline Park near Brunswick | 2801 Seaview Parkway | Rec & Park | Park, RR | Low | N/A |
| City Open Space | BFI Shoreline Park near Oldcastle | 2801 Seaview Parkway | Rec & Park | Park, RR | Low | N/A |
| City Open Space | BFI Shoreline Park on HBI | 2801 Seaview Parkway | Rec & Park | Park, RR | Low | N/A |
| City Open Space | Harrington Field | 3400 Oleander Ave | Rec & Park | Park, RR | Low | N/A |
| City Open Space | Lincoln Park | 1450 High St | Rec & Park | Park, RR | Low | N/A |
| City Open Space | Washington Park | 740 Central Ave | Rec & Park | Park, RR | Low | N/A |
| City Open Space | Woodstock Park | 351 Cypress Ave | Rec & Park | Park, RR | Low | N/A |
| City Open Space | Hornet Field | W. Hornet Ave | Rec & Park | Park, RR? | Low | N/A |
| City Open Space | Multi Purpose Fields | W. Red Line Ave | Rec & Park | Park, RR? | Low | N/A |
| City Open Space | City Parking Lots | Various | Public Works | Parking Lot | Moderate | N/A |
| City Transp | Grand Marina Boat Slips | end of Grand St | Planning/Bldg/Dev | Boat Slips | Low | No data |
| City Transp | Ballena Bridge | Ballena Blvd | Public Works | Bridge | Critical | Retrofit 2008 to "lifeline" standard |
| City Transp | Grand Bridge | Grand St | Public Works | Bridge | Critical | Unknown |
| City Transp | Harbor Bay Ferry Terminal - Land side | Mecartney Rd | Private/Public Works | Parking lot, RR | Critical | N/A |
| City Transp | Main Street Ferry Terminal - Land side | 2990 Main St | Public Works | Parking lot, RR | Critical | N/A |
| City Transp | Seaplane Lagoon Ferry Terminal - Land side | | Public Works | Parking lot, RR | Critical | Modern construction.Completed in 2021 |
| City Transp | Public Streets | Various | Public Works | Streets | High | N/A |

| Type | Facility Name | Address | City Department or Owner | Function | Recovery Priority | Seismic Retrofit/Notes |
|---|---|---|---|---|---|---|
| City Utility | Building 14 MPOE | 1801 Viking | Alameda Municipal Power | AMP & AT&T Telecom Demarc | Critical | No data |
| City Utility | Fiber core site | 1 Clubhouse Memorial Parkway | Alameda Municipal Power | Municipal Area Network (MAN) Core Site | Critical | No data |
| City Utility | Street Lights | Various | Public Works | Safety and Security | Moderate | NA |
| City Utility | City Hall West Building 2 Telecom MPOE | 1025 W Midway | Alameda Municipal Power & City | Telecom Demarc | Critical | No data |
| City Utility | Wireless Telecom (Cell, wifi) | various | IT? | Towers | Critical | No data |
| City Utility | Doolittle Landfill | N. of Doolittle Dr | Public Works | Utility - Landfill | Critical | No info (leakage and burning unit) |
| City Utility | Sanitary Sewer Pump Stations (37) | Various | Public Works | Utility Bldg | Critical | Currently retrofitting all (see Pump Station upgrade schedule) |
| City Utility | − Storm Drain Pump Stations (10) | Various | Public Works | Utility Bldg | Critical | No data |
| City Utility | Webster SDPS | 2400 Webster St | Public Works | Utility Bldg | Critical | |
| City Utility | Bayport SDPS | 455 Willie Stargell Ave | Public Works | Utility Bldg | Critical | Generator |
| City Utility | Southshore Lagoon SDPS | | Public Works | Utility Bldg | Critical | |
| City Utility | Arbor SDPS | 1535 Buena Vista Ave | Public Works | Utility Bldg | Critical | |
| City Utility | Golf Course SDPS | | Public Works | Utility Bldg | Critical | |
| City Utility | Eastshore SDPS | Eastshore Dr | Public Works | Utility Bldg | Critical | |
| City Utility | 3rd St SDPS | Ralph Appezzatto Memorial Dr | Public Works | Utility Bldg | Critical | |
| City Utility | Main St SDPS | Main St | Public Works | Utility Bldg | Critical | |
| City Utility | Northside/Marina Village SDPS | 1300 Marina Village Parkway | Public Works | Utility Bldg | Critical | Generator |
| City Utility | HBI Lagoon 1 Pump North | Ratto Rd | Public Works | Utility Bldg | Critical | |
| City Utility | Cartwright Substation | 90 Atlantic Ave | Alameda Municipal Power | Utility Bldg & Yard | Critical | No data |
| City Utility | Jenny Substation | 2179 Clement Av | Alameda Municipal Power | Utility Bldg & Yard | Critical | No data |
| City Utility | City Hall West Building 2 Telecom Switch Sta | 1025 W Midway | Alameda Municipal Power | Utility Bldg, MAN Core Site | Critical | No data |
| City Utility | Sanitary Sewer Pipes | Various | Public Works | Utility Lines | Critical | No data |
| City Utility | Storm Dain Pipes and Culverts | Various | Public Works | Utility Lines | Critical | No data |
| City Utility | Power Lines, Overhead and Underground | Various | Alameda Municipal Power | Utility Lines | Critical | No data |
| City Utility | Street Lights on Signal Poles | Various | Public Works | Utility Poles | Critical | NA |
| City Utility | Signals and Interconnects | Various | Public Works | Utility Poles and Lines | Critical | NA |
| City Utility | Alameda West Lagoon Bayview Weir Structure | Various | Public Works | Utility Structure | Critical | No data |
| City Utility | HBI Lagoon I & II Pumps, Gates & Weirs | Various | Public Works | Utility Structure | Critical | No data |
| City Utility | East Transfer Station | 2000 High St | Alameda Municipal Power | Utility Yard | Critical | No data |
| City Utility | West Transfer Station | Webster Tube at Estuary | Alameda Municipal Power | Utility Yard | Critical | No data |
| Non-City Bldg | Golden House Adult Dev. Center | *Address on File w City* | Private | Adult Day Care | High | No data |
| Non-City Bldg | Rythmix Culture Works | Blanding | Private | Art House | Moderate | No data |
| Non-City Bldg | Altarena Playhouse | High Street | Private | Art House | Moderate | No data |
| Non-City Bldg | Alameda Head Start - Sue Matheson Center | 670 West Midway | AHS | Child Day Care | High | No data |
| Non-City Bldg | AUSD Woodstock Child Development Center | 190 Singleton Ave | AUSD | Child Day Care | High | No data |
| Non-City Bldg | − Child Day Care and Family Day Care Centers ( | *Addresses on file w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | ABC Preschool | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Bayside Montessori Association | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Child Education Center-Kathleen Seabolt | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Child Unique Montessori School | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Fuzzy Caterpillar | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | ICRI of Alameda Child Care Center | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Jean Wonderful Child Care | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Kiddie KAlameda Municipal Powerus Cooperative Play School | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Kindercare Learning Center | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Little Seeds Childrens Center | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Luna's Montessori Bilingual School | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Lynn Chen | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Marriann Cassidy | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Park Avenue Child Care | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Peter Pan Learning Center | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Peter Pan Preschool/Infant Center | *Address on File w City* | Private | Child Day Care | Moderate | No data |

| Type | Facility Name | Address | City Department or Owner | Function | Recovery Priority | Seismic Retrofit/Notes |
|---|---|---|---|---|---|---|
| Non-City Bldg | Rising Star Montessori School | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Rising Star School | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Small Size big Mind Preschool & Infant Ctr | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Son Rise Preschool | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Son-Light Preschool | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Star Bright Child Care | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Sugar and Spice | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Sui Ying Feng | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Suzhen Zhen | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | The Child Unique Montessori School | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Tiny Treasures Preschool | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Veronica Carraza | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Wee Care Preschool and Child Care | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Xiulan Wu and Huilian Shangguan | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Yanhong Li | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Yanyi Ma | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Zazueiro Cucchiara | *Address on File w City* | Private | Child Day Care | Moderate | No data |
| Non-City Bldg | Althea Riley-Franklin | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Anita Stevens | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Catherine Cook | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Chang Zhu | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Chikako Narahara | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Colleen Bang | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Elizabeth Rollins-Rucker | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Elizabeth Rollins-Rucker | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Esguerra | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Fredeswinda Wilkins | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Iluminada Dela Cruz | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Ivette Fagel | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Janette Howard | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Jian Li | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Josephine Esguerra | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Josephine Quale | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Las Semillas Coop School | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Lourdes Curry | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Marva Lyons | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Norma Washington-Palmer | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Rachel Rodrigues | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Roberta Meno | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Rosemarie & Alan Sapalicio | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Sandra Reyes | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Shaosun Zhu | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Shu Fang Huang | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Sun-Mui Chow | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Tenisha Tatom | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Veronica Carraza | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | Wenyan Shi | *Address on File w City* | Private | Family Day Care | Moderate | No data |
| Non-City Bldg | College of Alameda | 555 Atlantic Ave | Peralta Colleges | College, Day Care | High | No data |
| Non-City Bldg | Golden Age of Channing II | *Address on File w City* | Housing Authority | Elder Care | High | No data |
| Non-City Bldg | Sunset Home for the Elderly | *Address on File w City* | Housing Authority | Elder Care | High | No data |
| Non-City Bldg | Waters Edge Lodge | *Address on File w City* | Housing Authority | Elder Care | High | No data |
| Non-City Bldg | Autumn Residential Care Home | *Address on File w City* | Private | Elder Care | High | No data |
| Non-City Bldg | Bay Harbour Residential Care Home | *Address on File w City* | Private | Elder Care | High | No data |

| Type | Facility Name | Address | City Department or Owner | Function | Recovery Priority | Seismic Retrofit/Notes |
|---|---|---|---|---|---|---|
| Non-City Bldg | Elders Inn on Webster | *Address on File w City* | Private | Elder Care | High | No data |
| Non-City Bldg | Golden Age Bayside II | *Address on File w City* | Private | Elder Care | High | No data |
| Non-City Bldg | Golden Age of Sweet Rd | *Address on File w City* | Private | Elder Care | High | No data |
| Non-City Bldg | Goldencare Assisted Living, Inc | *Address on File w City* | Private | Elder Care | High | No data |
| Non-City Bldg | Sandcreek Lodge | *Address on File w City* | Private | Elder Care | High | No data |
| Non-City Bldg | Sea Breeze Care Home, Inc | *Address on File w City* | Private | Elder Care | High | No data |
| Non-City Bldg | Alameda Food Bank | 650 W Ranger Ave | Alameda Food Bank | Food Bank | Critical | No data |
| Non-City Bldg | Waters Edge | *Address on File w City* | Private | Health Care Facility | High | No data |
| Non-City Bldg | Alameda Hospital | 2070 Clinton Ave | Alameda Hospital | Hospital | High | No data |
| Non-City Bldg | Jack Capon Villa | *Address on File w City* | Private | Housing for People with Dev. Disabilities | Moderate | No data |
| Non-City Bldg | Alameda Elder Services | *Address on File w City* | Housing Authority | Housing Offices | High | No data |
| Non-City Bldg | All buildings on Coast Guard Island | Coast Guard Island | US Coast Guard | Military Base | Critical (some) | No data |
| Non-City Bldg | All Coast Guard Housing | Singleton | US Coast Guard | Military Housing | Low | No data |
| Non-City Bldg | Alameda Museum | 2324 Alameda Ave | Private | Museum | Moderate | No data |
| Non-City Bldg | Alameda Naval Air Museum | 2151 Ferry Point | Private | Museum | Moderate | No data |
| Non-City Bldg | Hornet Museum | 707 W. Hornet Ave | Private | Museum | Moderate | No data |
| Non-City Bldg | Pinball Museum | 1510 Webster St | Private | Museum | Moderate | No data |
| Non-City Bldg | Meyer's House & Garden Museum | 2021 Alameda Av | Alameda Museum | Museum | Moderate | No data, built 1897 |
| Non-City Bldg | Alameda County Municipal Ct | Shoreline | Alameda County | Offices | Critical | No data |
| Non-City Bldg | US Post Office | Southshore | USPS | Post Office | Critical | No data |
| Non-City Bldg | American Red Cross Regional Warehouse | 650 W Ranger Ave | American Red Cross | Regional Warehouse | Critical | No data |
| Non-City Bldg | − 63 Soft Story Buildings | Various - See Map | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 3250 BRIGGS AVE | Privately Owned | Commercial | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 1500 ALAMEDA AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 2128 ALAMEDA AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 1455 BAY ST | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 3215 BRIGGS AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 3224 BRIGGS AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 3228 BRIGGS AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 470 BUENA VISTA AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 520 BUENA VISTA AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 434 CENTRAL AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 600 CENTRAL AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 724 CENTRAL AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 831 CENTRAL AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 1704 CENTRAL AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 1715 CENTRAL AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 1732 CENTRAL AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 2026 CENTRAL AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 2037 CENTRAL AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 2043 CENTRAL AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 2050 CENTRAL AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 1515 CHESTNUT ST | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 1531 CHESTNUT ST | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 2045 CLINTON AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 895 LAFAYETTE ST | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 753 LINCOLN AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 2222 LINCOLN AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 1417 NINTH ST | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 431 PACIFIC AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 1583 PACIFIC AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 1179 PARK AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |

| Type | Facility Name | Address | City Department or Owner | Function | Recovery Priority | Seismic Retrofit/Notes |
|---|---|---|---|---|---|---|
| Non-City Bldg | Soft Story Building | 1182 PARK AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 1190 PARK AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 400 PARK ST | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 1364 PARK ST | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 1825 POGGI ST | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 1152 REGENT ST | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 2153 SAN ANTONIO AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 2236 SAN ANTONIO AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 2209 SAN JOSE AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 2210 SAN JOSE AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 2215 SAN JOSE AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 2236 SAN JOSE AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 2246 SAN JOSE AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 410 SANTA CLARA AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 722 SANTA CLARA AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 757 SANTA CLARA AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 1815 SANTA CLARA AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 2060 SANTA CLARA AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 2241 SANTA CLARA AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 2318 SANTA CLARA AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 1557 SHERMAN | ST | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 2019 SHORE LINE DR | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 2051 SHORE LINE DR | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 1538 ST CHARLES ST | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 1850 THAU WAY | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 1522 VERDI ST | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 1526 VERDI ST | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 1534 VERDI ST | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 1548 WEBSTER ST | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 424 WHITEHALL | RD | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 1808-12 CENTRAL AVE | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 2149 OTIS DR | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | Soft Story Building | 2225 OTIS DR | Privately Owned | Residence | Moderate | Soft Story needs retrofit |
| Non-City Bldg | ALAMEDA ADULT SCHOOL | 401 Pacific Ave | AUSD | School | High | No data |
| Non-City Bldg | ALAMEDA HS, Emma Hood Swim Ctr | 2201 Encinal Ave | AUSD | School | High | No data |
| Non-City Bldg | BAY FARM ELEM & MS | 200 Auginbaugh | AUSD | School | High | No data |
| Non-City Bldg | EARHART ELEMENTARY | 400 Packet Landing Dr | AUSD | School | High | No data |
| Non-City Bldg | EDISON ELEMENTARY | 2700 Buena Vista | AUSD | School | High | No data |
| Non-City Bldg | FRANKLIN ELEMENTARY | 1433 San Antonio Ave | AUSD | School | High | No data |
| Non-City Bldg | HENRY HAIGHT ELEMENTARY | 2025 Santa Clara Ave | AUSD | school | High | No data |
| Non-City Bldg | LINCON MIDDLE SCHOOL | 1250 Fernside Blvd | AUSD | school | High | No data |
| Non-City Bldg | OTIS ELEMENTARY | 3010 Filmore St | AUSD | School | High | No data |
| Non-City Bldg | PADEN ELEMENTARY | 444 Central Ave | AUSD | School | High | No data |
| Non-City Bldg | RUBY BRIDGES ELEMENTARY | 351 Jack London | AUSD | School | High | No data |
| Non-City Bldg | ENCINAL HS & Pool, Jr. Jets MS, Ala. CLC, NEA CLC | 210 Central Ave | AUSD | School | High | No data |
| Non-City Bldg | St Joseph Notre Dame Schools | *Address on File w City* | Catholic Chuch | School | High | No data |
| Non-City Bldg | St. Barnabas School | *Address on File w City* | Catholic Chuch | School | High | No data |
| Non-City Bldg | St. Joseph Elementary School | *Address on File w City* | Catholic Chuch | School | High | No data |
| Non-City Bldg | Alameda Chinese Christian School | *Address on File w City* | Private | School | High | No data |
| Non-City Bldg | Saint Philip Neri Catholic Elementary | *Address on File w City* | Catholic Chuch | School | High | No data |
| Non-City Bldg | Island HS, Cal Safe Infant Care, Head Start | 1900 Third St | AUSD | School, Child Day Care | High | No data |
| Non-City Bldg | MAYA LIN ELEM | 825 Taylor | AUSD | School, Day Care | High | No data |
| Non-City Bldg | Woodstock Ctr, Various Schools & Child Care | 500 Pacific Ave | AUSD | School, Day Care | High | No data |

| Type | Facility Name | Address | City Department or Owner | Function | Recovery Priority | Seismic Retrofit/Notes |
|---|---|---|---|---|---|---|
| Non-City Bldg | LUM ELEMENTARY/WOOD MIDDLE | 420 Grand St | AUSD | School, Unoccupied | Low | No data |
| Non-City Bldg | China Clipper Plaza | *Address on File w City* | Housing Authority | Section 8 Housing | High | No data |
| Non-City Bldg | Eagle Village | *Address on File w City* | Housing Authority | Section 8 Housing | High | No data |
| Non-City Bldg | Esperanza | *Address on File w City* | Housing Authority | Section 8 Housing | High | No data |
| Non-City Bldg | Lincoln House | *Address on File w City* | Housing Authority | Section 8 Housing | High | No data |
| Non-City Bldg | Parrot Gardens | *Address on File w City* | Housing Authority | Section 8 Housing | High | No data |
| Non-City Bldg | Parrot Village | *Address on File w City* | Housing Authority | Section 8 Housing | High | No data |
| Non-City Bldg | Rosefield Village | *Address on File w City* | Housing Authority | Section 8 Housing | High | No data |
| Non-City Bldg | Sherman House | *Address on File w City* | Housing Authority | Section 8 Housing | High | No data |
| Non-City Bldg | Stanford house | *Address on File w City* | Housing Authority | Section 8 Housing | High | No data |
| Non-City Bldg | Shinsei Gardens | *Address on File w City* | Private | Section 8 Housing | Moderate | No data |
| Non-City Bldg | The Breakers at Bayport | *Address on File w City* | Private | Section 8 Housing | Moderate | No data |
| Non-City Bldg | The Park Alameda | *Address on File w City* | Private | Section 8 Housing | Moderate | No data |
| Non-City Bldg | Eagle Village | *Address on File w City* | Housing Authority | Section 8 Housing | High | Modern construction, all-electric |
| Non-City Bldg | Independence Plaza Senior Housing | *Address on File w City* | Housing Authority | Senior Housing | High | No data |
| Non-City Bldg | Anne B. Diament Senior Plaza | *Address on File w City* | Housing Authority | Senior Section 8 Housing | High | No data |
| Non-City Bldg | Lincoln Willow Apartments | *Address on File w City* | Housing Authority | Senior Section 8 Housing | High | No data |
| Non-City Bldg | Senior Codominiums (various) | *Address on File w City* | Housing Authority | Senior Section 8 Housing | High | No data |
| Non-City Bldg | Alameda Care Center | *Address on File w City* | Private | Skilled Nursing | High | No data |
| Non-City Bldg | Bay View Nursing & Rehab Center | *Address on File w City* | Private | Skilled Nursing | High | No data |
| Non-City Bldg | CROWN BAY NURSING&REBAB CENTER | *Address on File w City* | Private | Skilled Nursing | High | No data |
| Non-City Bldg | Marina Garden Nursing Center | *Address on File w City* | Private | Skilled Nursing | High | No data |
| Non-City Bldg | South Shore Convalescent Hospital | *Address on File w City* | Private | Skilled Nursing | High | No data |
| Non-City Bldg | The Waters Edge | *Address on File w City* | Private | Skilled Nursing | High | No data |
| Non-City Bldg | All non-City Alameda Point Buildings | Various | US Navy | Various | Low | No data |
| Non-City Bldg | Non-Ductile Concrete Buildings built before 1980 | *Draft List on File w City* | Public and Private | Various | Moderate | No data |
| Non-City Bldg | Crab Cove Visitors Center | McKay Ave | EBRPD/State | Visitors Center | Moderate | No data |
| Non-City Bldg | All other residences | | Public and Private | | Low | |
| Non-City Bldg | All other commercial/industrial/institutional | | Public and Private | | Moderate | |
| Non-City Open Space | Crown/Shoreline Beach | McKay Ave | EBRPD/State | Beach, RR | High | N/A |
| Non-City Open Space | Crown Beach Park | McKay Ave | EBRPD/State | Park, RR | High | N/A |
| Non-City Transp | Bay Farm Island Vehicle Bridge | Doolittle Dr/Otis Dr | Caltrans | Bridge | Critical | Built in 1953 and seismically retrofitted in 1997. City sent letter in 2007 requesting retrofit to “lifeline” standard; however, Caltrans has no future plans for retrofitting the bridge. |
| Non-City Transp | Bay Farm Island Bike/Ped Bridge | Doolittle Dr/Otis Dr | Caltrans | Bridge | Low | Built in 1996 and there are no future plans for seismic retrofit work. |
| Non-City Transp | Fruitvale RR Bridge | Tilden Way | Army Corps of Engineers | Bridge | Low | Needs to be retrofit to "no collapse" or removed. |
| Non-City Transp | Fruitvale Miller Sweeney Bridge | Tilden Way | Alameda County | Bridge | Critical | Retrofit in 2011 to "No collapse". |
| Non-City Transp | High St Bridge | High Street | Alameda County | Bridge | Critical | Retrofit in 2009 to "No collapse" |
| Non-City Transp | Park St Bridge | Park St | Alameda County | Bridge | Critical | Retrofit in 2008 to "No collapse" |
| Non-City Transp | Harbor Bay Ferry Terminal - Water side | Mecartney Rd | WETA | Dock, RR | Critical | No data |
| Non-City Transp | Main Street Ferry Terminal - Water side | 2990 Main St | WETA | Dock, RR | Critical | No data |
| Non-City Transp | Ballena Isle Marina | Ballena Blvd | City, Onshore private? | Docks, slips | Low | No data |
| Non-City Transp | Other Marinas? | Various | City, Onshore private? | Docks, slips | Low | No data |
| Non-City Transp | Fortman Marina | Grand St | City, Onshore private | Docks, slips, bldg | Low | No data |
| Non-City Transp | Posey/Webster Tubes, incl ventilation buildings | Webster, Constitution | Caltrans | Tubes | Critical | 2003 Retrofit to No Collapse: “Minimum Performance Level” to withstand a maximum credible earthquake of 7.25 Richter scale on the Hayward fault with no collapse of the tubes or portal buildings and no loss of life. However, significant damage is expected and it is likely that the tube would be closed to public traffic after the seismic event for evaluation, repair, and possibly permanent closure. (letter from Stanley Gee, Caltrans, “retrofitcaltransattached” March 25, 2002). Caltrans has no future plans for seismic upgrades or upgrading the facility other than current refurbishment of the ventilation system. |
| Non-City Transp | Constitution Way Overcrossing | Constitution Way | Caltrans | Bridge | Moderate | Bridge was built in 1985 and there are no future plans for seismic retrofit work. |
| Non-City Utility | Main Island Drain - BFI - sewer | Near BFI bridge | EBMUD | Estuary xing | Critical | No info, drains BFI to Main Island |

| Type | Facility Name | Address | City Department or Owner | Function | Recovery Priority | Seismic Retrofit/Notes |
|---|---|---|---|---|---|---|
| Non-City Utility | Main Island Drain - West - sewer | Near Marina Village | EBMUD | Estuary xing | Critical | No info |
| Non-City Utility | Main Island Feed - BFI- water | At BFI bridge | EBMUD | Estuary xing | Critical | In environmental phase to replace, as of Aug 2015 |
| Non-City Utility | Main Island Feed - East - water | Extension of Broadway | EBMUD | Estuary xing | Critical | In environmental phase to replace, as of Aug 2015 |
| Non-City Utility | Main Island Feed - West - recycled water | Near tubes | EBMUD | Estuary xing | Critical | Proposed for 2017 |
| Non-City Utility | Main Island Feed - West - water | Near Marina Village | EBMUD | Estuary xing | Critical | In environmental phase to replace, as of Aug 2015 |
| Non-City Utility | Main Island Feed - BFI - gas | Near Doolittle | PG&E | Estuary xing | Critical | Not sure if it exists, or its status |
| Non-City Utility | Main Island Feed - BFI - power | Near Doolittle | PG&E | Estuary xing | Critical | Not sure if it exists, or its status |
| Non-City Utility | Main Island Feed - East - power | Near Park St | PG&E | Estuary xing | Critical | On PG&Es radar |
| Non-City Utility | Main Island Feed - Oakland - gas | Near Park St ? | PG&E | Estuary xing | Critical | On PG&Es radar |
| Non-City Utility | Main Island Feed - West - power | Near tubes | PG&E | Estuary xing | Critical | On PG&Es radar |
| Non-City Utility | Main Island Feed - Telecom | various | various | Estuary xing | Critical | No info |
| Non-City Utility | Alameda West Lagoon Intake | Shoreline Dr | AWLHOA | Pump & Line | High | No data |
| Non-City Utility | Telecom Lines | Various | Various Telecoms | Utility Lines | Critical | No data |
| Non-City Utility | Gas Lines | Various | PG&E | Utility Lines | Critical | No data |
| Non-City Utility | Sewer Trunk Lines | Various | EBMUD | Utility Lines | Critical | No data |
| Non-City Utility | Water Lines | Various | EBMUD | Utility Lines | Critical | No data |
| Non-City Utility | Alameda West Lagoon Willow Weir Structure | Willow St | AWLHOA | Utility Structure | High | No data |



# Appendix E
# Detailed Earthquake Risk Assessment

This appendix provides detailed assessment of how existing and future people, economy, buildings and infrastructure may be impacted by an earthquake in Alameda. This appendix describes the vulnerability of the assets to damage in earthquakes and the consequences on the community of such damage.

The anticipated damages and disruptions are based on a magnitude 7.0 earthquake on the Hayward Fault, roughly similar to the scenario evaluated in the USGS HayWired scenario.[1] The earthquake has its epicenter in Oakland and strong shaking results in severe impacts throughout the greater Bay Area. Such an earthquake would result in strong shaking that will trigger surface fault rupture, liquefaction, landslides, fires, and severe impacts throughout the entire Bay Area. While landslides and fault rupture will not directly impact Alameda, all of these secondary hazards will cause significant disruption and damage to buildings, utilities, transportation and communication networks, and fuel supply. The HayWired scenario represents an earthquake with approximately a 150-year return period; one that has about a 20% chance of occurring in the next 30 years. While the impacts of this scenario are severe, it does not represent the worst-case earthquake by any means. By comparison, most newer buildings today are designed to protect the safety of occupants in earthquake shaking with approximately a 975-year return period, or a 2% change of occurring in any 50-year period.

This appendix details the impact of such an earthquake on these systems and the people and economy serving Alameda. The assets covered in this chapter are characterized in detail in **Chapter 3** and the earthquake hazard is characterized in **Chapter 4** of the Plan.

# The People of Alameda

Across the San Francisco Bay region, more than 750,000 people could be displaced from their homes in a major earthquake.[2] Many studies have shown that socially disadvantaged groups such as persons of color, low income residents and persons with disabilities are disproportionately impacted by natural disasters. These populations may have more difficulty evacuating from their homes in an earthquake and more difficulty recovering after an event. Persons with disabilities may be reliant on electricity for medical equipment and refrigeration of medication that can be lost during floods and winter storms. Disaster-related damages can also disrupt social and economic services for disadvantaged populations. Housing affordability is an existing challenge for many Alameda residents that can exacerbate poor outcomes for residents following an earthquake and hinder community recovery. A 2016 study found that disadvantaged populations are more likely to live in housing that may be damaged in an earthquake and less able to prepare, respond and recover from an earthquake.[3] Without proactive public policy and support, these residents are more likely to be permanently displaced from Alameda following an earthquake. This study found that the neighborhoods most likely to have communities at risk in fragile housing are Central Alameda, Southshore and along the Northern Shoreline.

# Alameda Economy

The major Hayward fault earthquake contemplated in the USGS HayWired scenario will result in an estimated $44.2 billion losses to the California Gross State Product (4.2% of California projected GSP) in

[1] Detweiler, S.T., and Wein, A.M., eds., 2017, The HayWired earthquake scenario: U.S. Geological Survey Scientific Investigations Report 2017–5013, https://doi.org/10.3133/sir20175013.
[2] Detweiler, S.T., and Wein, A.M., eds., 2018, The HayWired earthquake scenario—Engineering implications: U.S. Geological Survey Scientific Investigations Report 2017–5013–I–Q, 429 p., https://doi.org/10.3133/sir20175013v2.
[3] ABAG and BCDC, 2015, *Stronger Housing, Safer Communities*, www.adaptingtorisingtides.org/project/stronger-housing-safer-communities-strategies-for-seismic-and-flood-risks/.

the first six months following the earthquake.[4] Alameda County will be the hardest hit county with a 13.8% loss in county Gross Regional Product and an estimated 15 percent loss in jobs. The study estimates that GSP losses could be reduced by 42% with resilience measures such as deploying portable cellular sites, supply chain workarounds, more efficient use of resources like water and employee overtime, and pre-earthquake business continuity planning. Alameda County would experience a recession lasting 5 to 10 years due to significant employment and population losses. Small businesses and minority owned businesses will be particularly hard hit and a shortage of construction workers could lead to a deeper and longer recession as rebuilding is postponed.

# Buildings

Alameda has an extensive inventory of buildings that are vulnerable to damage in earthquakes. Many of these buildings are also vulnerable to flood and tsunami damage. Damage to homes, businesses, community facilities, and their associated infrastructure represents a serious socioeconomic threat to the city. Older buildings were not designed to withstand the earthquake shaking or liquefaction. Seismic retrofits are usually designed to prevent catastrophic collapse and harm to occupants, but typically does not ensure that a building will be repairable. Damage to community services like shelters, hospitals, and elderly care facilities can disproportionately impact vulnerable populations, including those who are ill, immobile, elderly, or economically disadvantaged.

All building contents are vulnerable to flooding and violent earth shaking. More importantly, many buildings lose function temporarily until they are deemed safe or are rebuilt. Depending upon the building, this loss of service may include emergency services, sheltering and gathering, commerce, education, medical care, daycare, elder care, government, and recreation. Short term and long-term recovery of the City depends upon quick restoration of these services.

## Earthquake Vulnerable Building Types

Certain types of buildings are more susceptible to the shaking and ground disturbances of earthquakes. Older buildings constructed before modern building codes are generally not designed to withstand earthquake shaking. These buildings can sustain significant damage and even collapse in earthquakes, killing and injuring occupants and displacing residents and businesses for a long time. The HayWired study estimates that most Alameda Census tracts, particularly those in the liquefaction zone will experience extensive or complete damage to 20 percent or more of their total building area, with several tracts at risk from such damage from post-earthquake fires.[5]

Buildings subject to violent shaking can also dislodge asbestos or encapsulated (abated) asbestos, lead paint, and other hazardous materials. Broken plumbing can discharge sewage. Broken gas lines and damaged electrical wiring can spark fires and present health and safety hazards. Older houses, especially Victorian-era houses, were built without fire blocking, which means that fire can easily spread up walls and through ceilings to other parts of the house and to neighboring properties. Other hazards in buildings from earthquake shaking include falling piping, shelving, and goods. Limited insurance coverage will be available to recover these losses and will prolong the recovery period.

The following sections describes the most common types of earthquake vulnerable buildings in Alameda: soft-story buildings, homes with cripple walls or house over garage, unreinforced masonry buildings, and

[4] Detweiler, S.T., and Wein, A.M., eds., 2018.
[5] Detweiler, S.T., and Wein, A.M., eds., 2018.

nonductile concrete buildings. Newer buildings are also designed to protect lives, but may not be re-occupiable following a major earthquake.

## Soft-story buildings

Buildings with soft-story, weak or open front walls are multi-story wood frame apartment buildings with an open or more flexible ground compared to the more rigid second floor.[6] These two stories flex differently during violent ground shaking, resulting in damage to the building and sometimes collapse. A common soft-story building type is the apartment or business building with ground level parking (just pillars and open spaces) and traditional structures above. Soft-stories are also commonly found with businesses that have large expanses of glass for a first-floor storefront and a more traditional structure on the second story.




***Figure E-1 Soft-Story Apartment Building in Alameda***

In 2009, the City of Alameda established a wood-frame soft-story program under Ordinance 2989, *Earthquake Hazard Reduction in Existing Wood Frame Residential Structures with Soft-Story, Weak, or Open Front Walls*.[7] Alameda's mandatory wood-frame soft-story program applies to existing buildings that have the following characteristics:

- Wood-frame construction
- Permitted for construction prior to December 17, 1985
- Five or more dwelling units

[6] https://homequakequiz.org/housing-types/multi-family-homes#17
[7] http://docs.ci.alameda.ca.us/WebLink/DocView.aspx?id=373444&dbid=0&repo=CityofAlameda&cr=1

- Ground floor containing parking or similar open floor or basement space causing soft, weak, or open lines where there exist one or more levels above.

Based on these criteria, the City established an inventory of potentially hazardous soft-story buildings under the ordinance and notified the owners and residents of such buildings.

Owners of buildings listed on the inventory were required to submit to the City a structural seismic adequacy analysis to determine potential hazards to the structure and describe what would be necessary to remedy any identified weaknesses. 209 buildings were determined to have seismic vulnerabilities based on an engineering analysis

Owners were not required to retrofit their buildings, however to date, 146 buildings have completed a seismic retrofit. Buildings retrofitted in accordance with the ordinance will have their seismic performance substantially improved, but will not necessarily prevent all earthquake damage. The retrofit strengthens the portion of the structure that is most vulnerable to earthquake damage but may not address other structural issues.

63 multi-family buildings containing approximately 1,000 units remain on the list of potentially hazardous soft-story buildings. Three buildings contain more than 50 units each. Some buildings contain retail spaces on the ground floor frequented by members of the public. The status of soft-story buildings and number of units is shown in **Table E-1**. The retrofitted soft-story buildings are shown in light blue and unretrofitted buildings are shown in dark blue in **Figure E-2** (there are no soft-story buildings west of Main St or on Bay Farm Island). The addresses are listed in **Appendix D** and on the City's website.[8]

***Table E-1 Alameda's Soft-Story Building Inventory***

| Description | Number of Buildings | Residential Units |
|---|---|---|
| **Designated Soft Story** | 209 | ~4,500 |
| **Retrofitted** | 146 | ~3,500 |
| **Not retrofitted** | 63 | ~1,000 |

[8] https://www.alamedaca.gov/Departments/Planning-Building-and-Transportation/Building/Seismic-Retrofit/Potential-Soft-Story-Buildings




***Figure E-2 Designated Soft-Story Buildings in Alameda***

The City of Alameda's Soft Story Structural Assessment Grant provides up to $5,000 for structural assessment of potential soft-story buildings with more than 51% of units occupied by low- and moderate-income households.[9] These property owners are also eligible for the Rental Rehabilitation Loan Program for the retrofit of buildings determined to be soft-story structures. The program provides loans at 2% interest to landlords who rehabilitate rental property in Alameda.

While Alameda's soft-story ordinance specifically addresses buildings with more than 5 residential units, soft-story conditions can exist in residential buildings with fewer than 5 units as well. If the definition of soft-story buildings were expanded to include 3-to-4-unit buildings built before 1985, approximately 850

[9] https://www.alamedaca.gov/Departments/Community-Development/Community-Housing-Resources

additional residential buildings with nearly 3,000 units could be added to the potentially soft-story list.[10] Single family homes with soft-story conditions are covered in the following section.

Damage to soft-story apartment buildings would have significant consequences to renters and vulnerable populations in Alameda. Occupants could be injured in an earthquake and loss of housing units would exacerbate Alameda's housing shortage and further limit the availability of these naturally occurring affordable housing units. Many vulnerable residents could be permanently displaced.

## Homes with Cripple Walls and House Over Garage

A "cripple wall" is a low height wall often found in the ground floor basement or crawlspace in Victorian-era and older homes in Alameda. These buildings can generally be identified by stairs leading to the front door. Cripple walls tend to be damaged during violent ground shaking because they do not have proper sheathing on the interior side of the walls and there are fewer interior walls than in the story above to



***Figure E-3 Single Family Home with Cripple Wall in Alameda***

resist lateral earthquake forces. The cripple walls are also not tied to the foundation or the first floor above and they can slide off their foundation as the ground shakes under them. Depending on the severity of the earthquake, damage to these kinds of buildings can range from minor facade and glass damage to total loss.

Alameda homes that have an attached garage with living space above that lacks interior walls may be unable to support the living space above in an earthquake.[11] In an earthquake, the garage walls may lean

[10] Alameda County Assessor's Parcel Data, 2018
[11] https://homequakequiz.org/housing-types/single-family-homes#21

or collapse, putting occupants in the living space above at risk from serious harm and the home can become uninhabitable.

Alameda has an estimated 10,600 pre-1980 single family homes that could be damaged in an earthquake.[12] In 2006, the City of Alameda adopted Ordinance 2950 to establish minimum standards for seismic retrofitting of cripple wall buildings.[13] The California Earthquake Authority's Brace and Bolt Program provides grants to retrofit cripple wall homes.[14] Approximately 600 homes are believed to have been retrofitted to appropriate standards.[15] In addition, many homeowners in Alameda excavate and dig out their basement as a way to add additional space to their homes. This work includes adding shear walls, bolts and tie downs to the portion of the basement walls above ground (the cripple wall). This work, while not formally a seismic retrofit, does have the effect of reducing the potential for earthquake losses of this type of building. There may be 50 to 300 permitted basement digouts in Alameda.

Alameda is a town of historic homes that contribute to the unique character of the neighborhoods and much of this character could be lost by damaged cripple wall buildings or post-earthquake fires. Many homes will need to be rebuilt or substantially repaired and few will have adequate insurance or the financial resources to cover losses. Home damage or destruction can result in significant social and financial costs, potentially displacing many people. The city will face a loss of property tax revenue. Displaced residents face significant challenges, especially among socially vulnerable populations and renters, who have limited capacity to address deficiencies in their buildings and rely on landlords to make changes. Retrofitted homes may still be damaged in earthquakes, but by keeping the building attached to the foundation and preventing collapse of the cripple wall, the damage should be repairable and the home may remain habitable.

## Unreinforced Masonry Buildings

Unreinforced masonry (URM) buildings are older buildings built entirely with brick or stone with wood frame floors and roofs that are vulnerable to catastrophic collapse in even minor earthquakes. In Alameda, many URMs are historic buildings located in the Park and Webster commercial corridors and can have retail with offices or residential units in upper stories. URM buildings also tend to be car repair garages and industrial buildings. URM buildings may have bricks that can be visible on both the outside and inside walls. If every 5th or 6th row of bricks has a different width (because it has been turned perpendicular), this indicates that the wall is likely a structural brick wall, not just a decorative siding.[16] URMs may also have thick window sills due to thicker walls (more common in stone buildings, but may also be seen in brick buildings).

[12] Alameda County Assessor's Parcel Data, 2018
[13] http://docs.ci.alameda.ca.us/WebLink/DocView.aspx?id=373396&dbid=0&repo=CityofAlameda&cr=1
[14] https://www.earthquakeauthority.com/Prepare-Your-House-Earthquake-Risk/Brace-and-Bolt-Grants/CEA-Policyholder-Brace-Bolt-Grants/About-CEA-BB
[15] Alameda permit database, 2021
[16] https://homequakequiz.org/housing-types/multi-family-homes#56



***Figure E-4 Retrofitted Unreinforced Masonry Building in Alameda***

In 1991, the City of Alameda passed Ordinance 2573 to reduce the risk of death or injury from the effects of earthquakes on URMs.[17] The ordinance required URM building owners to brace any parapet walls and anchor walls to the roofline that are parallel to and adjacent to a public sidewalk or to an adjacent lower building. In addition, the masonry and mortar joints were to be tested and replaced if they were found to lack adequate strength.

As a result of this requirement, all of the City's 74 identified URMs have been retrofitted or demolished. An estimated 10 additional buildings that did not fall within the scope of the ordinance have also been retrofitted or are being upgraded as part of redevelopment efforts, such as the Del Monte building.

The required retrofit standards were designed to "reduce the risk of loss of life or injury" from damage to these buildings. Despite these beneficial retrofits, many retrofitted URMs will still sustain damage in future earthquakes and falling bricks can be lethal to occupants and pedestrians on the sidewalk. Damaged buildings may be closed for a long time to complete repairs or not be economically feasible to repair. A map of retrofitted URMs is shown in **Figure E-5** (there are no URMs west of Webster St. or on Bay Farm Island).

Residential structures containing five or fewer dwelling units, buildings with low occupancy, and those used as warehouses were exempted from the requirements of the ordinance, and many of these buildings remain vulnerable to damage or collapse in earthquakes.

17 https://library.municode.com/ca/alameda/codes/code_of_ordinances?nodeId=CHXIIIBUHO_ARTXVIIIEAHAREEXUNMABEWABU




***Figure E-5 Map of Retrofitted URM Buildings in Alameda***

## Nonductile Concrete Buildings

Non-ductile concrete buildings are concrete structures, built before 1980, contain brittle concrete elements (columns, beams, walls and connections). Nonductile concrete buildings are vulnerable to significant damage or collapse in earthquakes resulting in fatalities. A survey was completed of these buildings by volunteers as part of a statewide study for the Concrete Coalition. The objective of the survey was to get a total number of these buildings, not a definitive inventory like the City has for soft-story or URM buildings. The survey was based on external observations made by volunteers and therefore is not definitive. However, it is estimated that the City has between 140 and 150 non-ductile concrete

buildings.[18] Many of the buildings identified were one story and contained many shear walls that would be less vulnerable to earthquake damage. Alameda does not currently require evaluation or retrofit of nonductile concrete buildings. These buildings are typically used for commercial office buildings and retail. Many nonductile concrete buildings are airplane hangars located at the former Naval Air Station and are undergoing renovations that include seismic retrofit or will be demolished as part of the Alameda Point redevelopment. Alameda does not currently require structural evaluation or retrofit of nonductile buildings.

### Chimneys

Masonry or stone chimneys in older homes are also a falling hazard in earthquakes. The chimney can break off at the roofline and fall inside or outside the house, potentially damaging the structure and injuring or killing occupants. The taller and more flexible the chimney, the more likely it is to fail. Chimneys exterior to the house and separate from the structure. Some owners will attempt to brace the chimney against the roof; however, this will not prevent the chimney from falling. Falling chimneys are one of the most common issues in an earthquake. The most effective solution is to entirely rebuild the chimney with a new code-compliant chimney.[19] Chimneys can also be removed above the firebox and capped at the roofline or replaced with a new code-complaint chimney above the firebox. Alameda does not currently inspect chimneys for potential earthquake damage or require chimney mitigation.

## Newly Constructed Buildings

Newer buildings built to modern building codes (after the early 1990s) are designed to protect lives and not collapse in a major earthquake, but they do not ensure buildings will be safe to re-occupy. Significant damage to newer housing stock would add to the disruptions and lengthy recovery expected from a major earthquake. An additional 1% in construction cost to build new buildings to a “functional recovery standard” could increase the availability of homes and businesses by 75 to 95% following a major earthquake.[20] Recommendations for implementation of this concept are laid out in a recent NIST-FEMA Special Publication for improving the post-earthquake reoccupancy and functional recovery of the nation’s building stock.[21]

## City-Owned Buildings

Some of the City’s most important buildings were vulnerable to earthquake shaking because they were constructed with the building standards that pre-dated current knowledge about earthquake dynamics. Most city buildings have been seismically retrofitted or have been constructed to more modern standards.

- City Hall was retrofitted in 1997. The original 120-foot clock tower was removed after it sustained damage in the 1906 earthquake.
- The Carnegie Library closed in 1998 and remains vacant, however seismic retrofitting was completed in 2001. A new library was constructed on Oak St in 2006.

[18] EERI Concrete Coalition, 2011. https://www.eeri.org/images/archived/wp-content/uploads/Concrete_Coalition_Final_0911.pdf
[19] https://sfgov.org/sfc/sites/default/files/ESIP/FileCenter/Documents/13436-ATC-119_TaskA.4.g_ChimneyMitigation.pdf
[20] Detweiler, S.T., and Wein, A.M., eds., 2018.
[21] https://www.fema.gov/sites/default/files/documents/fema_p-2090_nist_sp-1254_functional-recovery_01-01-2021.pdf

- Fire Station No. 3 was abandoned in 2001. A new fire station and Emergency Operations Center was constructed to replace Fire Station No. 3 at Grand and Buena Vista in 2017.
- The West End library was seismically retrofitted in 2007.

Other buildings were assessed and determined to be seismically safe. One concern are the 1940s era residences and hangars on Alameda Point, the former Alameda Naval Air Station, that would be subject to earthquake shaking, liquefaction, ground settlement, and flooding. The Alameda Point Master Infrastructure Plan addresses areas of redevelopment where buildings will be constructed to modern day seismic standards and reuse areas where retrofit work may be needed. This redevelopment is currently underway and many buildings have or will soon undergo rehabilitation.

# Critical Services

Alameda Unified School District (AUSD) has seismically evaluated and upgraded a number of its school facilities in accordance with AB 300 and the Field Act. AUSD has seismically retrofitted several buildings at the historic Alameda High School and permanently closed Lum Elementary in response to seismic safety concerns. Private schools are not subject to the seismic safety provisions of the Field Act, however

Newly constructed emergency response facilities such as police and fire stations are required to be designed to higher seismic design standards than most other buildings because of the importance that they be immediately usable following an earthquake. In 2017, the City of Alameda completed construction of a new Fire Station 3 to replace the one located at 1709 Grand Street, which was deemed seismically unsafe and obsolete in the year 2000. The new fire station was constructed on the same site, and in conjunction with, an Emergency Operations Center (EOC).

Alameda Hospital is currently undergoing a seismic retrofit project of the hospital's west wing. The retrofit is required by the Alfred E. Alquist Hospital Facilities Seismic Safety Act (SB 1953), a state law that requires that hospitals to complete any necessary seismic retrofits to guarantee they can remain open in a major earthquake by 2030.

Alameda is home to a number of other facilities that serve and/or house vulnerable populations, such as daycares, elder cares, medical offices and clinics, and others. These buildings are critical to a healthy and vibrant city. Damage to these critical care facilities can disproportionately impact vulnerable populations, including those who are ill, immobile, elderly or economically disadvantaged. The location of these facilities can change from year to year and there are no regulatory requirements that require these services to be located in seismically safe buildings, thereby making targeted building mitigation efforts challenging. The City does maintain a listing of current locations as this is critical information for effective disaster response.

# Land Use

A significant portion of Alameda is in a liquefaction zone and all land use types (commercial, transportation/utilities, residential, open space, shoreline, municipal, institutional) are subject to liquefaction and strong shaking. As groundwater rises, a growing proportion of city land may be at risk of liquefaction in an earthquake. Existing and future land uses planning needs to incorporate strategies to protect residents and businesses out of harm's way from both liquefaction and other hazards such as sea level rise, flooding and tsunamis. This involves important decisions about how to modify existing land use, where development opportunities still exist, and how to design new development and redevelopment that

can adapt to future conditions. Land use decisions must also consider the interests of vulnerable populations and engage with those groups to ensure land use policies are equitable. Land use policies are an important avenue to creating a resilient and equitable Alameda.

# Utilities

## Stormwater and Sewer Systems

In earthquakes, pump station components can be destroyed by strong shaking, often requiring more extensive and time intensive repairs to return service. Liquefaction is extremely damaging to pipe networks, especially older more brittle pipes.

## Drinking Water System

Liquefaction damage will be a serious concern for drinking water pipes as well. Estimates are that EBMUD will experience about 1,800 breaks and 3,900 leaks in the 4,162 miles of pipe network within its service area.[22] An average East Bay customer would lose water for an estimated six weeks and some will lose service for as long as six months. Water supply outages will impede fighting post-earthquake fires. These service disruptions will be reduced as EBMUD continues to implement its old, brittle pipe.

## Electric System

A strong earthquake will likely have a significant negative impact on AMP's distribution system and the regional grid, including widespread structure and equipment failures. Electrical substation components can be destroyed by strong shaking, often requiring more extensive and time intensive repairs to return service. The Cartwright substation located near Woodstock Park is particularly vulnerable to earthquake damage, including foundation damage, the bus structures and equipment. Hardening of system components and regular inspections and maintenance can reduce the impacts of earthquakes on the electric grid.

## Natural Gas System

The greatest risks to the energy system are liquefaction and other impacts to buried infrastructure, including corrosion of pipes. PG&E completed a vulnerability assessment that included the natural gas system but was not specific to Alameda. This assessment lays the foundation for PG&E to identify strategies to address key threats, but the City has limited control over the natural gas infrastructure within Alameda

Natural gas infrastructure is subject to damage and disruption in areas with liquefaction. Natural gas lines can also rupture in earthquakes when buildings are damaged or when natural gas appliances topple. The repair of damaged underground lines will take time. Following the Loma Prieta earthquake, it took about 30 days to repair damaged lines in the San Francisco Marina. In a future earthquake, restoration of the natural gas system can take up to six months because of the time it will take to integrity test the lines prior to repressurizing and the number of qualified personnel required to relight pilot lights.[23]

[22] Detweiler, S.T., and Wein, A.M., eds., 2018.
[23] City and County of San Francisco, 2020. San Francisco Lifelines Restoration Performance Project. https://onesanfrancisco.org/sites/default/files/inline-files/Lifelines%20Restoration%20Performance%20Report%20Final-03-02-21.pdf

Broken lines can create fires if ignited until the fuel supply is exhausted. An estimated 25 percent of post-earthquake fire ignitions may be natural gas related.[24] **Figure E-6** shows a map of estimated fire ignitions within fire station primary response areas following the hypothetical magnitude 7.0 mainshock of the USGS HayWired scenario.[25] Green indicates a small likelihood of ignition and dark red indicates five or more ignitions per area. The length of the Hayward Fault ruptured in the scenario is shown on the map. According to the scenario, Alameda could have more than 11 simultaneous fire ignitions in this scenario. Responding to these fires will be complicated by the fact that Alameda is extremely likely to be without water supply following an earthquake and fire departments in other cities will not be able to respond with mutual aid given that 352 ignitions are anticipated in Alameda County, with 198 becoming conflagrations (multi-block fires).

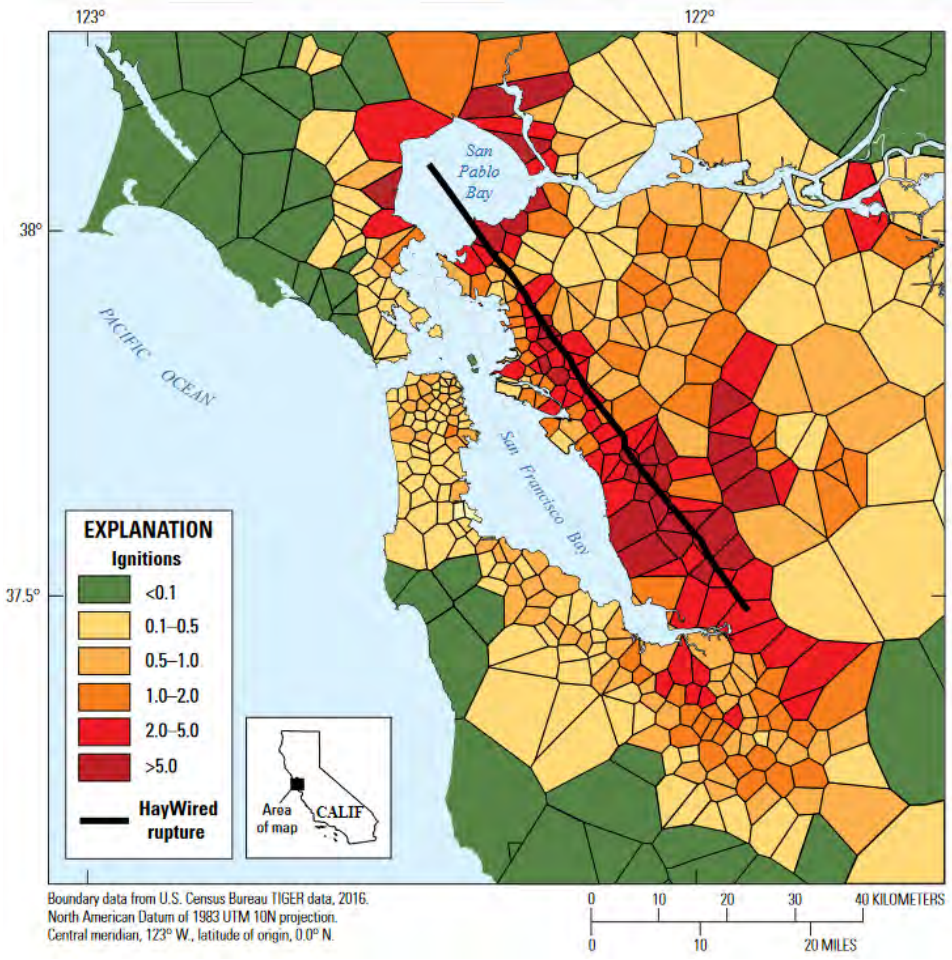



***Figure E-6 Estimated number of ignitions within fire station primary response areas in HayWired event***

Given the dense urban nature of Alameda's neighborhoods with wood frame construction and isolation as an island, preventing fires after earthquakes is extremely important. Owners of soft-story buildings were required to install an earthquake-actuated gas shut-off valve on the building to reduce the likelihood of natural gas fire ignitions in earthquakes.[26] Automatic gas shut-off valves are also required any time a

[24] Detweiler, S.T., and Wein, A.M., eds., 2018.
[25] Detweiler, S.T., and Wein, A.M., eds., 2018.
[26] http://docs.ci.alameda.ca.us/WebLink/DocView.aspx?id=373444&dbid=0&repo=CityofAlameda&cr=1

permit is issued for gas piping, whenever a property is sold or has a transfer of title.[27] A of 2021, approximately 2,794 permits have been issued for gas shut-off valves in the city.[28] **Figure E-7** shows the location of gas shut-off valves on buildings. Gas shut-off valves together with flexible gas lines to appliances inside the buildings, reduce the likelihood of fire ignitions when buildings shift and break gas pipes and appliances topple. However, seismically retrofitting buildings can prevent both the gas fires and damage to the building itself. Converting gas appliances to electric alternatives can also reduce the risk of post-earthquake fires.

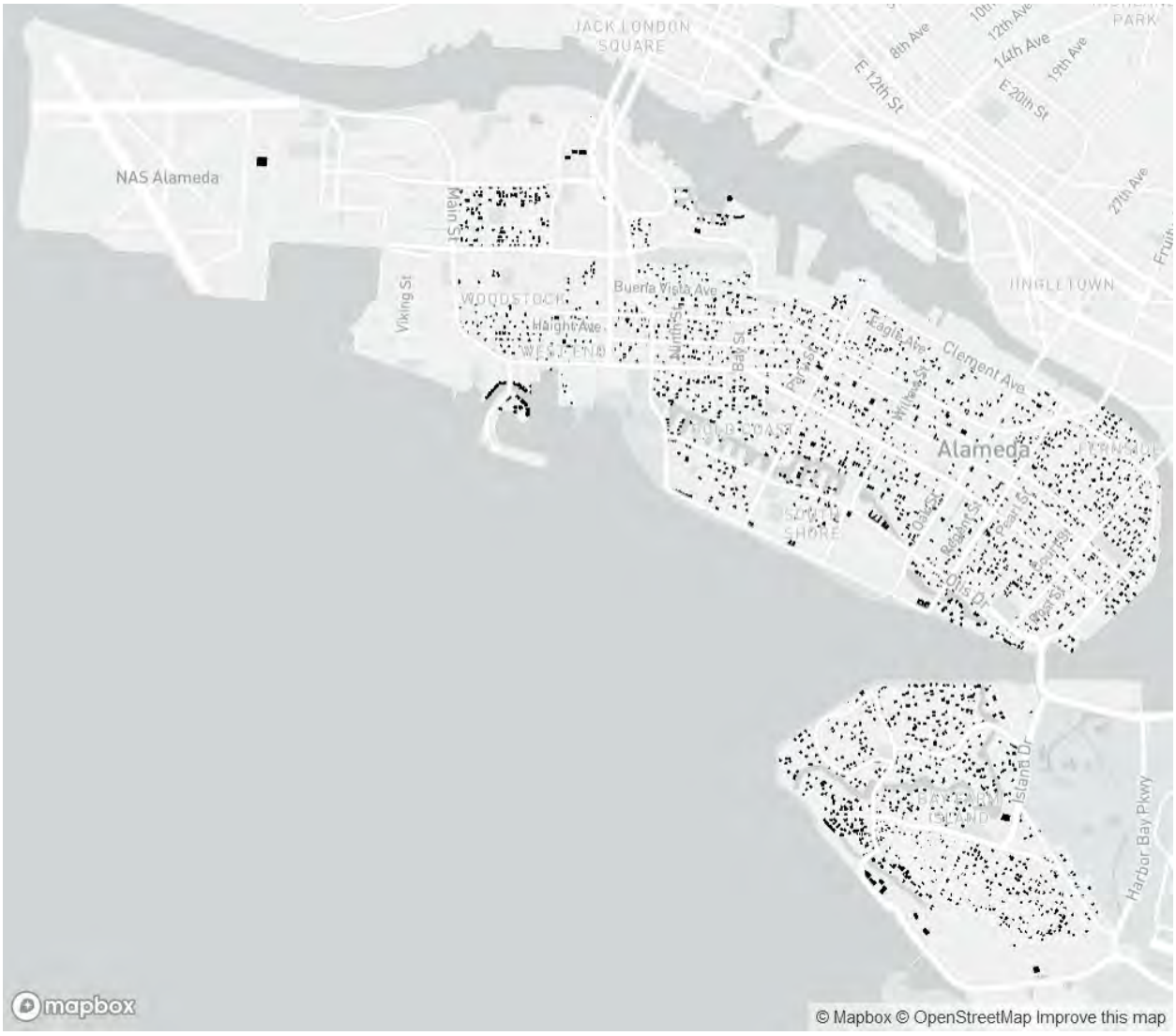



***Figure E-7 Gas Shut-off Valves installed on Alameda Buildings (August 2021)***

## Communications and Technology Systems

Reduced capacity and increased demand for cellular communication following an earthquake will result in degraded service. Loss of power will result in further outages once battery backup systems on cell towers

[27] https://www.alamedaca.gov/files/assets/public/departments/alameda/building-planning-transportation/ordinances/com_dev_-_bld_-_ord_-_gas_shut_off_valve.pdf
[28] Alameda permit database, 2021

run out in 4-12 hours.[29] Cellular communications systems face several vulnerabilities, including the number of cell sites that lack of permanent backup power (including an increasing number of small cell sites used to densify the network), damage to the fiber network from liquefaction and collocated infrastructure damage, and significant number of cell sites located on buildings vulnerable to damage in earthquakes. Deploying portable cell sites and timely delivery of fuel to back up generators can all aid in the recovery of the communications network.

# Transportation

In an earthquake, transportation assets will be significantly impacted by shaking and liquefaction. Surface streets and ferry terminals are particularly susceptible to liquefaction damage. Bus lines in Alameda may be disrupted, but alternate routes will likely be available. Alameda's biking and pedestrian network will provide resilience following an earthquake and allow continued local access even if certain streets are closed.

Bart's core service between downtown Oakland and downtown San Francisco will be restored within 24 hours; however, the Fremont line and Berkeley Hills Tunnel are expected to sustain significant damage and be inoperable for many months.[30]

Alameda's four main bridges and two tunnels will provide critical connection to the region following an earthquake. All the connections off the island have been evaluated or upgraded to ensure that they will protect life safety in the event of a major earthquake, however they may not be usable for some time. A "no collapse" standard means that while the bridge will survive without loss of life, significant repairs or replacement may be necessary. Bridges upgraded to "lifeline" standards are designed to be nearly immediately usable following an earthquake. **Table E-2** summarizes the seismic performance of bridges and tubes in Alameda

***Table E-2 Seismic Status of Bridges and Tubes in Alameda***

| Bridge/Tube | Owner | Year Built | Seismic Performance | Seismic Retrofit Notes |
|---|---|---|---|---|
| High Street bridge | Alameda County | 1939 | No collapse | Retrofitted to "no collapse" standard in 2009. |
| Park St bridge | Alameda County | 1935 | No collapse | Retrofitted to "no collapse" standard in 2008. |
| Miller-Sweeney bridge | Alameda County | 1973 | No collapse | Retrofitted to "no collapse" standard in 2011. City of Alameda has requested the bridge be upgraded to "lifeline" standard. |
| Fruitvale rail bridge | U.S. Army Corps of Engineers | 1951 | Collapse hazard | Rail bridge is a collapse hazard that poses a safety hazard to Miller-Sweeney Bridge. The City of Alameda is working with the Army Corps to fund the removal or rehabilitation of this public safety hazard. |

[29] City and County of San Francisco, 2020.
[30] City and County of San Francisco, 2020.

| Bridge/Tube | Owner | Year Built | Seismic Performance | Seismic Retrofit Notes |
|---|---|---|---|---|
| Bay Farm Island vehicular bridge | Caltrans | 1953 | No collapse | Seismically retrofitted in 1997 to "no collapse" standard. City sent letter in 2007 requesting retrofit to "lifeline" standard; however, Caltrans needs to better understand liquefiable soils in the area before considering the request. |
| Bay Farm Island bike/pedestrian bridge | Caltrans | 1996 | No collapse | Bridge is newer structures with modern seismic details. Does not meet criteria for further seismic evaluation by Caltrans. |
| Webster and Posey tubes | Caltrans | 1928 (Posey) 1963 (Webster) | No collapse | The tubes were seismically retrofitted to "no collapse" standard in 2001. Caltrans has no future plans for seismic upgrades or upgrading the facility other than current refurbishment of the ventilation system. |
| Constitution Way overcrossing | Caltrans | 1985 | No collapse | Bridge is newer structures with modern seismic details. Does not meet criteria for further seismic evaluation by Caltrans. |
| Grand St bridge | City of Alameda | 1958 | Unknown | No record of seismic evaluation or retrofit |
| Ballena bridge | City of Alameda | 1966 | Lifeline | Retrofit in 2008 to "lifeline" standard |

Fuel is a vital part of the transportation system. Fuel supply will be extremely limited following an earthquake due to likely damage of the oil refineries along the Carquinez Strait and in Richmond, the isolation of the Northern California fuel System and potential damage to the Kinder Morgan fuel pipeline in a Hayward fault earthquake.[31] Power and telecom are needed for full restoration of traffic signals and SMART technology functions.

# Shoreline, Natural, and Recreation Areas

Alameda has both engineered shorelines (primarily seawalls or levees and associated riprap and other armoring) and a variety of natural shoreline habitats. These natural shoreline protection systems are vulnerable to damage in earthquakes and are susceptible to liquefaction if they are not designed to resist liquefaction. Major economic impacts and property loss will result from damage to shoreline protection systems.

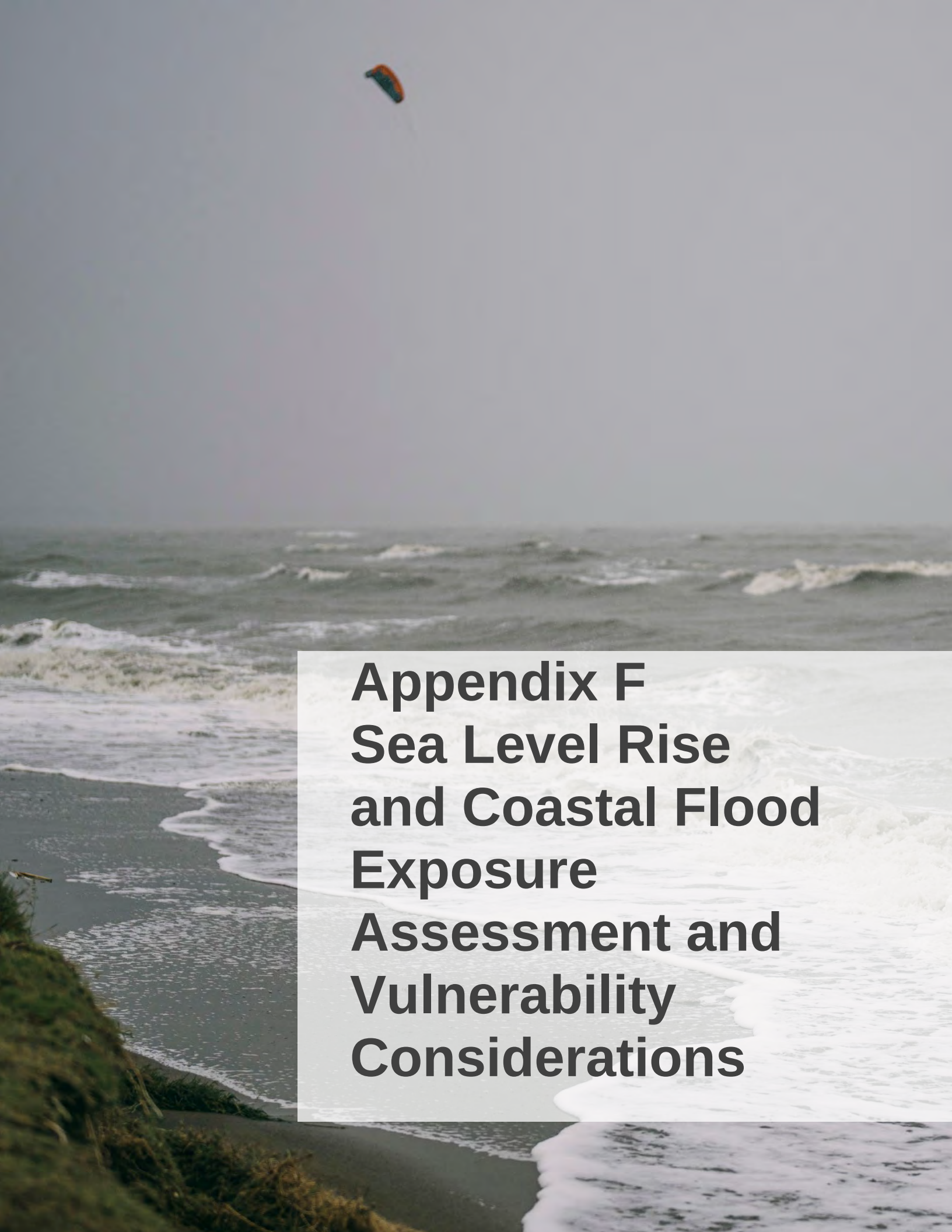
[31] City and County of San Francisco, 2020.

# Public Health and Welfare

Earthquakes can have significant impacts on public health, the extent of which varies depending on geography, damage to residences, socioeconomic status, and other factors. Socially vulnerable populations are particularly at risk. Earthquakes can not only physically harm residents, but cause stress and harm to residents' wellbeing. Depending on the extent of damage, recovery from a major earthquake could take many years and will impact many aspects of residents' lives, from access to utilities, school closures, damage to homes or displacement, loss of employment, and loss of community. Some residents will bear these impacts more than others and have less ability to respond and recover themselves. Combined across the community, these individual stressors can have major impacts on public health and wellbeing, especially for residents who lack the resources and financial capacity to respond.

In New Zealand, following the Christchurch earthquake sequence of 2010/11, the Canterbury Wellbeing Index was designed to monitor wellbeing and track the progress of social recovery from the earthquakes.[32] The Wellbeing Index draws from the data of many local and national agencies and incorporates information from the Canterbury Wellbeing Survey, which is conducted annually and provides an opportunity for residents to describe how they are feeling and their quality of life. The Survey also provides an opportunity for the local governments of the region to track recovery from the earthquakes in terms most important to residents and improve programs to better meet residents' needs. Following a major earthquake requiring a long recovery, tracking public health and welfare will be an important tool for protecting the wellbeing of Alamedans.

[32] https://www.cph.co.nz/your-health/canterbury-wellbeing-index/



# Appendix F
# Sea Level Rise and Coastal Flood Exposure Assessment and Vulnerability Considerations

# Subregional Flood Exposure and Vulnerability

## A Sea Level Rise and Coastal Flood Exposure Assessment and Vulnerability Considerations for the Oakland-Alameda Subregion

**PREPARED FOR:** Oakland-Alameda Adaptation Committee

**PREPARED BY:** Pathways Climate Institute, CMG Team

**DATE:** 12/5/2024

## 1 Purpose and Background

This exposure assessment supports adaptation planning for the Oakland-Alameda Adaptation Committee (OAAC) and the OAAC Adapt projects, specifically the Subregional Adaptation Plan. The analysis supports long-term adaptation strategy development, high-level evaluation, and prioritization within the Oakland-Alameda Subregion (Subregion). The Subregion is located along the eastern San Francisco Bay shoreline (Figure 1), with low-lying areas developed on Bay fill over former marsh and Baylands (OAAC 2024).[1]

The assessment includes exposure and vulnerability findings for a subset of asset types described in the OAAC Adapt Existing Conditions Report (OAAC 2024) including:

- Residential and commercial buildings
- Roads and bikeways
- Parks and trails
- Stormwater infrastructure
- Wastewater infrastructure

In addition to exposure, this memo summarizes asset sensitivity, adaptive capacity, and consequences related to flooding. Sensitivity is the degree to which the conditions, functions, and/or performance of an asset are adversely affected due to exposure (BCDC 2024). Adaptive capacity is the ability of an asset to adjust to exposure or effectively manage and cope with the consequences (BCDC 2024). Consequence is the harm or disruption that may result from exposure to the asset (BCDC 2024).

[1] The Subregion is approximately the same geography as the San Leandro Operational Land Unit in the Adaptation Atlas (SFEI and SPUR 2019).

This assessment does not meet the full breadth of the exposure and vulnerability assessment recommendations outlined in the San Francisco Bay Conservation and Development Commission (BCDC) Regional Shoreline Adaptation Plan (RSAP) Guidelines, adopted on December 5, 2024. However, the findings from this assessment are informing the near-term and long-term adaptation planning for OAAC.

Additional exposure and vulnerability efforts are underway in the Oakland-Alameda Subregion (Subregion). For example, the Port of Oakland (Port), in collaboration with the City of Oakland, is conducting an asset inventory and sea level rise vulnerability assessment focused on Port lands and adjacent neighborhoods within the City of Oakland. The Port oversees nearly 20 miles of San Francisco Bay shoreline, most of which is within the Subregion.

The OAAC is collaborating to secure additional funding to expand the exposure and vulnerability assessment outside of Port lands in response to the RSAP guidelines. This includes expanding the assessment to include more assets, and assessing vulnerabilities related to rising groundwater, wave hazards, and shoreline erosion. Section 9 of this memorandum summarizes how this and other future analysis can deepen our understanding of risk in the Subregion as additional funding becomes available.

The assessment uses regionally-best available sea level rise inundation data, including BCDC's Adapting to Rising Tides' ten water level scenarios (Table 1) to estimate exposure of people, places, and assets to sea level rise and coastal flooding throughout the Subregion (Vandever et al. 2017). The scenarios represent a water level above mean higher high water (MHHW), which can represent a suite of potential conditions, including sea level rise and extreme tide events.[2]

The assessment relies on asset data from the OAAC Adapt Existing Conditions Report (OAAC 2024) data collection effort (see local, regional, state, and federal data sources listed in table notes), and relevant, readily available vulnerability considerations for these assets (City of Alameda 2019; BCDC 2012; CCSF 2020).

Table 1. Adapting to Rising Tides Scenarios

| Mapping Scenario | Reference Water Level |
|---|---|
| Scenario 1 | MHHW + 12" |
| Scenario 2 | MHHW + 24" |
| Scenario 3 | MHHW + 36" |
| Scenario 4 | MHHW + 48" |
| Scenario 5 | MHHW + 52" |
| Scenario 6 | MHHW + 66" |
| Scenario 7 | MHHW + 77" |
| Scenario 8 | MHHW + 84" |
| Scenario 9 | MHHW + 96" |
| Scenario 10 | MHHW + 108" |

*MHHW = Mean Higher High Water*

[2] This is the "One Map, Many Futures" concept. For example, Scenario 10 can represent 9 feet (108 inches) of sea level rise on a "sunny" day (no extreme tide / storm event), 5.5 feet (66" inches) of sea level rise and a 1% annual exceedance probability event (a.k.a. 100-year coastal water level), and innumerable other combinations of conditions in between these two bookends (Vandever et al. 2017).

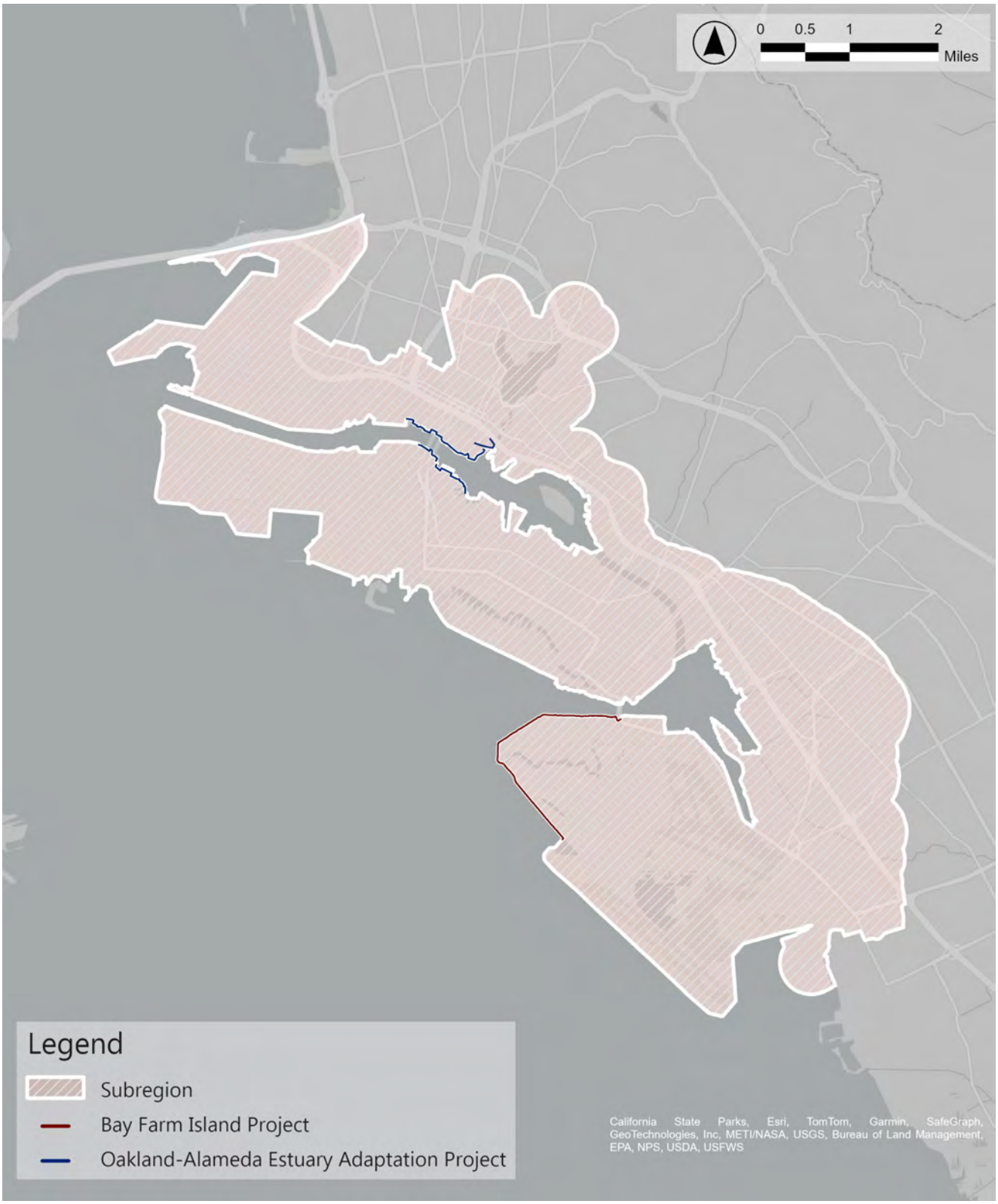



Figure 1. Subregional Adaptation Plan Study Area (Oakland-Alameda Subregion)

Data Source: (SFEI 2019)

# 2 Sea Level Rise and Coastal Flood Exposure Overview

Portions of the Subregion could be exposed during a 1% annual exceedance probability (AEP) event under current conditions (Figure 2). As sea levels rise, more people, infrastructure, and spaces will be exposed to coastal flooding if no action is taken to adapt. Sea levels are projected to rise 9 to 12 inches by 2050, and between 3 feet and 7 feet by 2100, depending on global actions to reduce greenhouse gas emissions and future rates of ice sheet melting. [3] If all global greenhouse gas emissions stopped today, we would still have at least 2 ft of sea level rise by the end of the century, and sea levels would continue to rise for hundreds of years in response to past greenhouse gas emissions (May et al. 2023; Sweet et al. 2022).

Three scenarios (3, 6, and 10) were selected to represent the range of uncertainty related to future sea level rise. Results for additional scenarios are included in Attachment A.

- **Scenario 3** represents a 2% AEP event under current conditions, and a future royal tide[4] with 2 feet of sea level rise.
- **Scenario 6** represents a 1% AEP event with 2 feet of sea level rise, and a future royal tide with 4.3 feet of sea level rise.
- **Scenario 10** represents a 1% AEP event with 5.5 feet of sea level rise, and a future royal tide with 8 feet of sea level rise.

Using the geographic information system (GIS) data collected for the Existing Conditions Report (OAAC 2024), Table 2 provides a snapshot of the area of Subregion exposed to current and future sea level rise for these scenarios, and the number of exposed residential buildings, commercial buildings, roads, and parks. Although Table 2 presents this information by the major geographic areas within the Subregion (e.g., Alameda Island, Bay Farm Island, City of Oakland, and the Port of Oakland's Seaport and Airport), the analysis was completed using subwatersheds to inform adaptation strategy development.

Subwatersheds were originally developed for the Existing Conditions Report (OAAC 2024). They were delineated using flow accumulation and pour point analysis to generate initial watersheds and then adjusted to reflect subsurface infrastructure. For this exposure analysis, some of the larger subwatersheds were further divided to allow for higher resolution exposure results. These divisions were made in approximate alignment with key infrastructure (e.g., along a road, at a coastal groin, adjacent to a pump station). The resulting refined subwatersheds (Figure 3) were developed specifically to support the long-term adaptation planning process, high-level evaluation of strategies, and

[3] All sea level rise scenarios are compared to baseline 2000. The 2100 projections here reflect the Intermediate (3.1 feet by 2100) and high (6.6 feet by 2100) scenarios for State of California, as recommended to inform planning and project-based decisions (OPC, OST, and California Sea Level Rise Task Force 2024).

[4] A "royal tide," called a "king tide" in the Adapting to Rising Tides (ART) documentation, is a popular non-scientific term used to describe exceptionally high tides. For the ART mapping effort, this term was used to represent a water level approximately 12 to 15 inches above MHHW. The ART documentation defines the king tide as unusually high but predictable astronomical tides that occur approximately two to four times per year, generally between December and February (Vandever et al. 2017).

prioritization across areas within the Subregion. They are not intended to be used to define specific project boundaries or as specific boundaries for land use purposes or policy guidance.[5]

Where sufficient asset data were readily available, this memo presents the exposure results for each subwatershed (Attachment A). Alameda Island corresponds to subwatersheds A-01 through A-11; Bay Farm Island corresponds to subwatersheds A-12 through A-17; City of Oakland (and Port of Oakland CRE[6]) corresponds to subwatersheds O-05 through O-17 and O-19, O-20, O-21, O- 22, O-23; Port of Oakland – Seaport (including adjacent areas) corresponds to subwatersheds O-01 through O-04; and Port of Oakland – Airport (including adjacent areas) corresponds to subwatersheds O-18 and O-24 through O-26.

[5] This exposure and vulnerability memorandum supports the development of the first iteration of the Subregional Adaptation Plan. While the Subregional Adaptation Plan is a collaborative effort among OAAC partners and may reference potential land use and policy changes, it does not change or override the land use authority of any participating or non-participating jurisdiction within the Subregion.

[6] CRE = Commercial Real Estate areas

Table 2. Subregion Exposure Overview

| | | TOTAL | Scenario 3 MHHW + 36” | Scenario 6 MHHW + 66” | Scenario 10 MHHW + 108” |
|---|---|---|---|---|---|
| **Alameda Island** | Area (acres) | 5,543 | 517 | 1,979 | 3,412 |
| | Residential Buildings (#) | 14,070 | 203 | 2,463 | 5,723 |
| | Commercial Buildings (#) | 1,427 | 25 | 219 | 553 |
| | Roads (miles) | 155 | 11 | 50 | 94 |
| | Parks (acres) | 232 | 23 | 105 | 189 |
| **Bay Farm Island** | Area (acres) | 1,648 | 525 | 934 | 1,407 |
| | Residential Buildings (#) | 5,061 | 534 | 2,788 | 4,555 |
| | Commercial Buildings (#) | 193 | 18 | 55 | 130 |
| | Roads (miles) | 49 | 11 | 32 | 45 |
| | Parks (acres) | 388 | 313 | 329 | 351 |
| **City of Oakland** (Incl. Port of Oakland CRE) | Area (acres) | 6,720 | 293 | 1,466 | 2,919 |
| | Residential Buildings (#) | 13,946 | 5 | 370 | 1,446 |
| | Commercial Buildings (#) | 3,448 | 6 | 282 | 814 |
| | Roads (miles) | 239 | 3 | 41 | 78 |
| | Parks (acres) | 701 | 130 | 220 | 521 |
| **Port of Oakland – Seaport** (Incl. Adjacent Areas) | Area (acres) | 2,787 | 54 | 695 | 1,821 |
| | Residential Buildings (#) | 892 | - | 92 | 244 |
| | Commercial Buildings (#) | 356 | - | 51 | 111 |
| | Roads (miles) | 65 | - | 20 | 38 |
| | Parks (acres) | 35 | 6 | 23 | 28 |
| **Port of Oakland – Airport** (Incl. Adjacent Areas) | Area (acres) | 2,703 | 2,240 | 2,501 | 2,571 |
| | Residential Buildings (#) | - | - | - | - |
| | Commercial Buildings (#) | 32 | 14 | 22 | 32 |
| | Roads (miles) | 18 | 12 | 17 | 17 |
| | Parks (acres) | 10 | <1 | 3 | 10 |

Runways and other airport infrastructure are not included in the roadway dataset (See Figure 8 for roadways included in the analysis). Values rounded to the nearest whole number. Alameda Island corresponds to subwatersheds A-01 through A-11; Bay Farm Island corresponds to subwatersheds A-12 through A-17; City of Oakland (including Port of Oakland CRE) corresponds to subwatersheds O-05 through O-17 and O-19, O-20, O-21, O- 22, O-23; Port of Oakland – Seaport (including adjacent areas) corresponds to subwatersheds O-01 through O-04; and Port of Oakland – Airport (including adjacent areas) corresponds to subwatersheds O-18 and O-24 through O-26.

CRE = Commercial Real Estate areas

MHHW = Mean Higher High Water

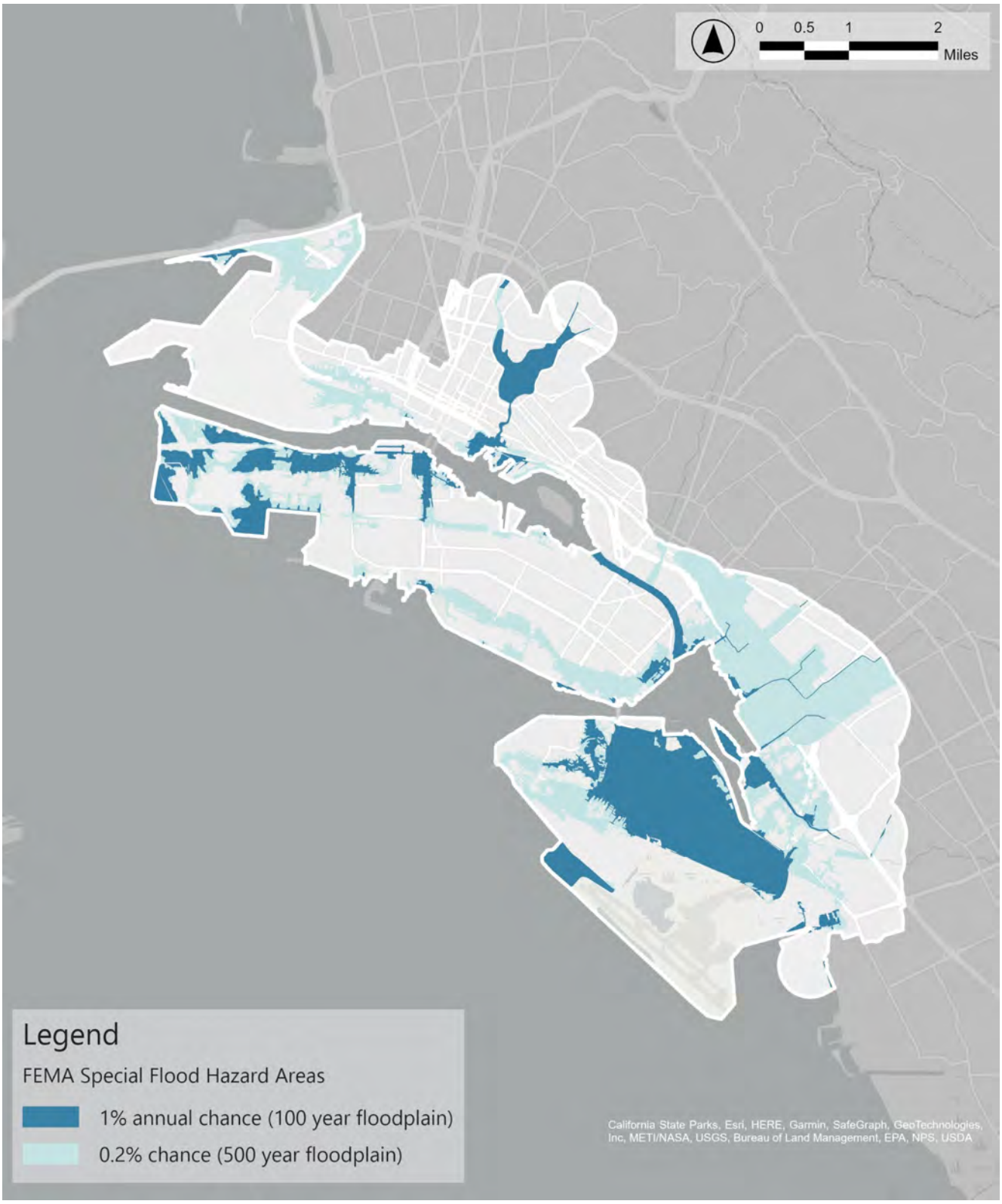



Figure 2. FEMA Special Flood Hazard Areas (Current Conditions)

Data Source: (FEMA 2018)

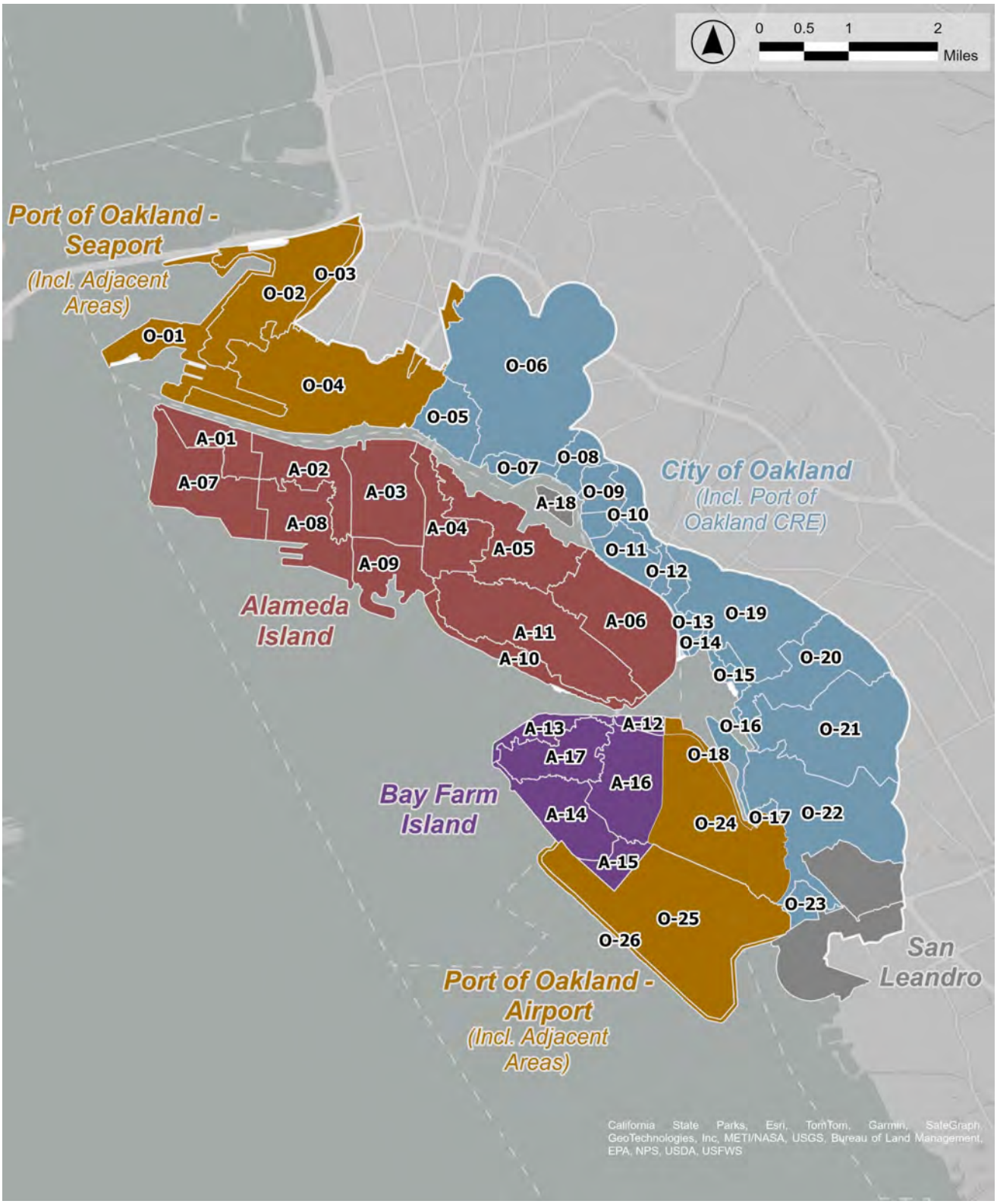



Figure 3. Subwatershed Unit Map

Data Source: Boundaries defined primarily based on elevation data (AECOM, MTC, and BCDC 2017) and jurisdiction boundaries (Alameda County 2022a; EBRPD 2023; Caltrans 2022; City of Oakland 2015)

# 3 Overview of Total Acreage Exposed

Limited areas of the Subregion are exposed to flooding under Scenarios 1 and 2 (12- and 24-inches above MHHW, respectively); therefore, the exposure analysis focuses on Scenario 3 through 10 (Figure 4, Figure 5, Figure 6, Table 3). Under Scenario 3 (MHHW + 36"), the most extensive exposure to flooding is on Bay Farm Island, primarily at the airport[7] and at the golf course[8]. Land along the creeks and sloughs connected to San Leandro Bay, along Lake Merritt Channel, Alameda Point, and near the entrances to the Webster and Posey tubes also experience some flooding under this scenario. Under Scenario 6 (MHHW + 66"), flood exposure is more pronounced in all the above areas in addition to East and West Oakland. Under Scenario 10 (MHHW + 108"), most of the Subregion's shorelines are overtopped, and substantial inland areas (total of 12,500 acres) are exposed to flooding. Detailed exposure tables for acreage exposed in each subwatershed can be found in Appendix A.

Table 3. Land Area Exposed within the Subregion

| Acres of Land Exposed within the Subregion | | | | |
|---|---|---|---|---|
| | | Water Level Scenarios | | |
| Area | Total Acres | 3 | 6 | 10 |
| | | MHHW + 36" | MHHW + 66" | MHHW + 108" |
| **Alameda Island** | 5,543 | 517 | 1,979 | 3,412 |
| **Bay Farm Island** | 1,648 | 525 | 934 | 1,407 |
| **City of Oakland** (Incl. Port of Oakland CRE) | 6,720 | 293 | 1,466 | 2,919 |
| **Port of Oakland – Seaport** (Incl. Adjacent Areas) | 2,787 | 54 | 695 | 1,822 |
| **Port of Oakland - Airport** (Incl. Adjacent Areas) | 2,703 | 2,240 | 2,501 | 2,571 |

Data Source: (Vandever et al. 2017)

Values rounded to nearest whole number. Alameda Island corresponds to subwatersheds A-01 through A-11; Bay Farm Island corresponds to subwatersheds A-12 through A-17; City of Oakland (including Port of Oakland CRE) corresponds to subwatersheds O-05 through O-17 and O-19, O-20, O-21, O- 22, O-23; Port of Oakland – Seaport (including adjacent areas) corresponds to subwatersheds O-01 through O-04; and Port of Oakland – Airport (including adjacent areas) corresponds to subwatersheds O-18 and O-24 through O-26.

CRE = Commercial Real Estate areas

MHHW = Mean Higher High Water

[7] Under temporary flood conditions during an extreme coastal flood event, the flooding shown in the airport is likely an over-estimate as the methods do not account for all physical hydrodynamic processes related to overland flooding (Port of Oakland 2023).

[8] Elevation data for recent grade changes (i.e., increased grades due to the import of fill material) at Corica Golf Course on Bay Farm Island are not available; therefore, the exposed area is likely an over-estimate.

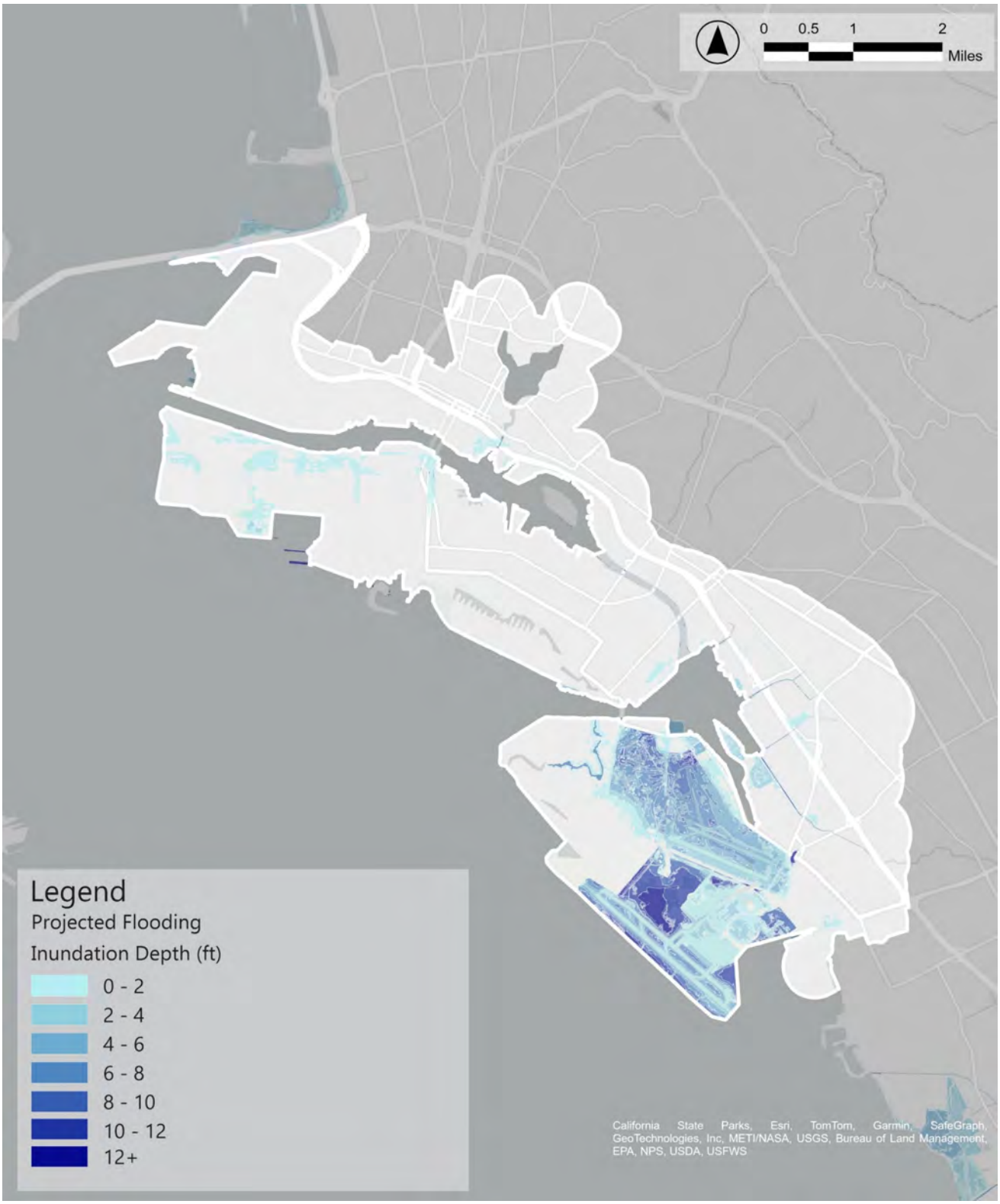



Figure 4. Scenario 3 Area Flooded (MHHW + 36")

Data Source: (Vandever et al. 2017)

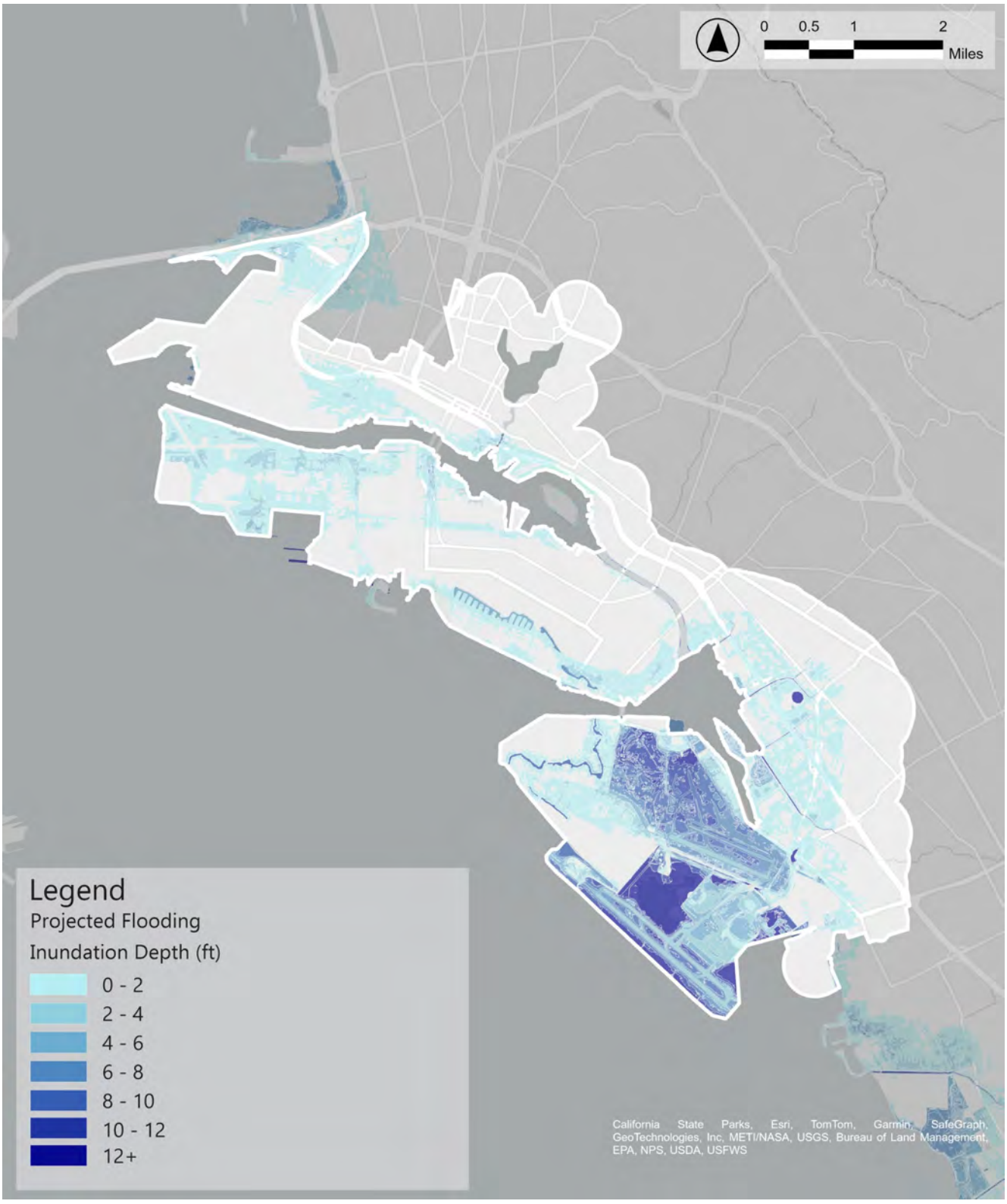



Figure 5. Scenario 6 Area Flooded (MHHW + 66")

Data Source: (Vandever et al. 2017)

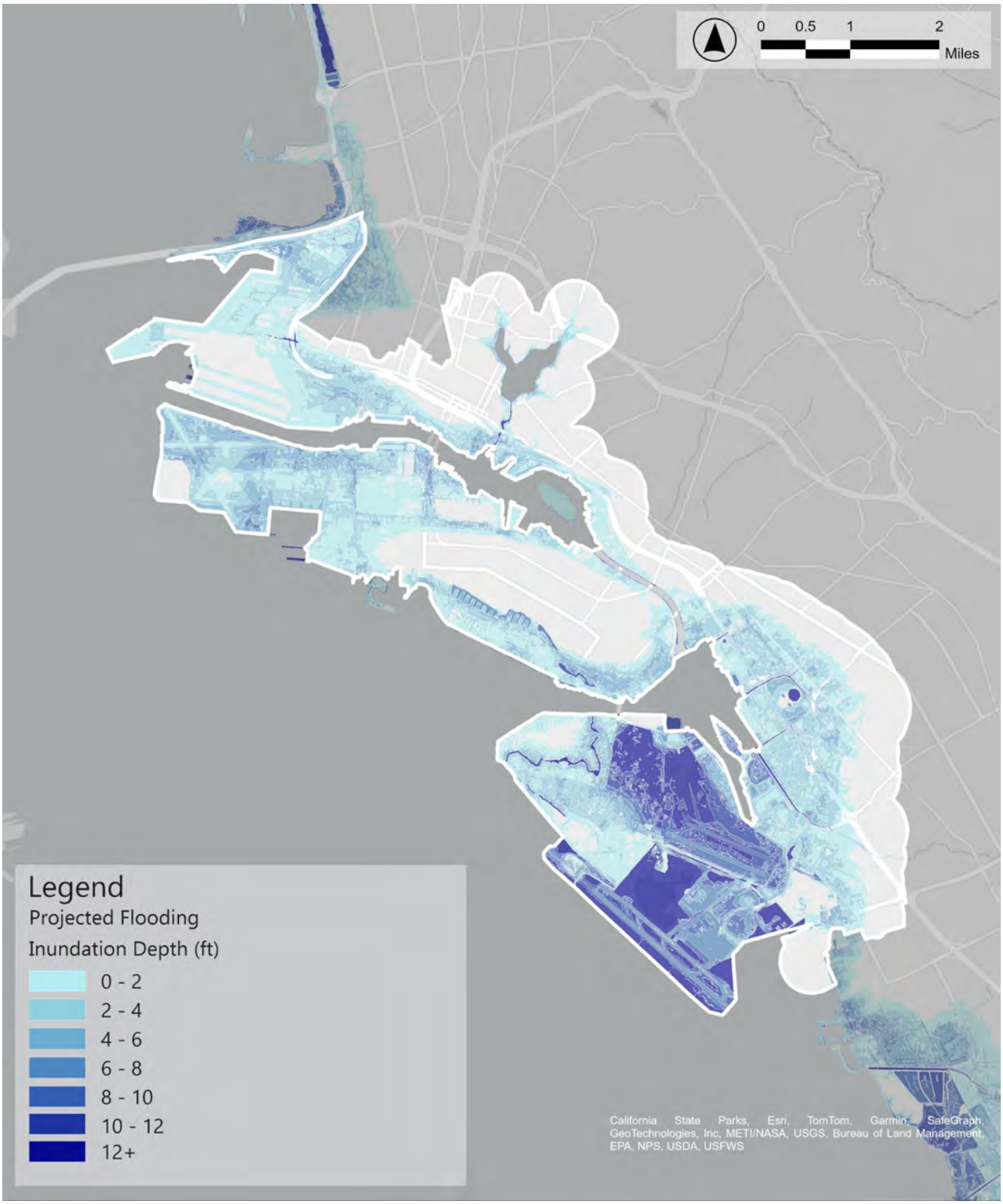



Figure 6. Scenario 10 Area Flooded (MHHW + 108")

Data Source: (Vandever et al. 2017)

# 4 Buildings

The Subregion includes over 30,000 residential and 5,500 commercial buildings (USACE 2022), supporting vibrant communities and economic activity.

## 4.1 Exposure

The number of buildings exposed to inundation and coastal flooding increases as sea levels rise (Figure 7, Table 4). Under Scenario 3 (MHHW + 36”), Alameda Island and Bay Farm Island have the most exposed buildings, including about 100 buildings near the low points at the Webster and Posey tubes, 100 buildings exposed via low points between Lincoln Park and Eastshore Drive, and 400 residential buildings exposed via flood pathways at Veterans Court and along Doolittle Drive (including both City of Alameda and Port of Oakland) and Maitland Drive. Under Scenario 6 (MHHW + 66”), building exposure increases in these areas, and additional buildings are exposed along the south shore of Alameda Island, interior Bay Farm Island, East Creek Point, along the creeks in East Oakland, in or adjacent to the seaport, and from Clinton Basin to East Oakland. Under Scenario 10 (MHHW + 108”), most of the Subregion’s shorelines are overtopped, and 743 (35%) residential buildings and 1,747 (30%) commercial buildings are exposed to inundation and/or coastal flooding Subregion-wide. Detailed exposure tables for residential and commercial buildings exposed in each subwatershed are presented in Appendix A.

Table 4. Commercial & Residential Structures Exposed within the Subregion

| Number of Commercial and Residential Buildings Exposed within the Subregion | | | | | |
|---|---|---|---|---|---|
| Area | Building Type | Total Buildings | Water Level Scenarios | | |
| | | | 3 MHHW + 36" | 6 MHHW + 66" | 10 MHHW + 108" |
| Alameda Island | Commercial | 1,427 | 25 | 219 | 553 |
| | Residential | 14,070 | 203 | 2,463 | 5,723 |
| Bay Farm Island | Commercial | 193 | 18 | 55 | 130 |
| | Residential | 5,061 | 534 | 2,788 | 4,555 |
| City of Oakland (Incl. Port of Oakland CRE) | Commercial | 3,448 | 6 | 282 | 814 |
| | Residential | 13,946 | 5 | 370 | 1,446 |
| Port of Oakland – Seaport (Incl. Adjacent Areas) | Commercial | 356 | - | 51 | 111 |
| | Residential | 892[9] | - | 92 | 244 |
| Port of Oakland – Airport (Incl. Adjacent Areas) | Commercial | 32 | 14 | 22 | 32 |
| | Residential | - | - | - | - |

Data Source: (USACE 2022)

Alameda Island corresponds to subwatersheds A-01 through A-11; Bay Farm Island corresponds to subwatersheds A-12 through A-17; City of Oakland (including Port of Oakland CRE) corresponds to subwatersheds O-05 through O-17 and O-19, O-20, O-21, O- 22, O-23; Port of Oakland – Seaport (including adjacent areas) corresponds to subwatersheds O-01 through O-04; and Port of Oakland – Airport (including adjacent areas) corresponds to subwatersheds O-18 and O-24 through O-26.

CRE = Commercial Real Estate areas

MHHW = Mean Higher High Water

[9] Residential buildings are not present within the Port of Oakland jurisdiction, as they are not allowed by the Tidelands Trust determination for seaport use. The residential buildings identified in the Port of Oakland – Seaport (including adjacent areas) are located in the areas adjacent to the Seaport.

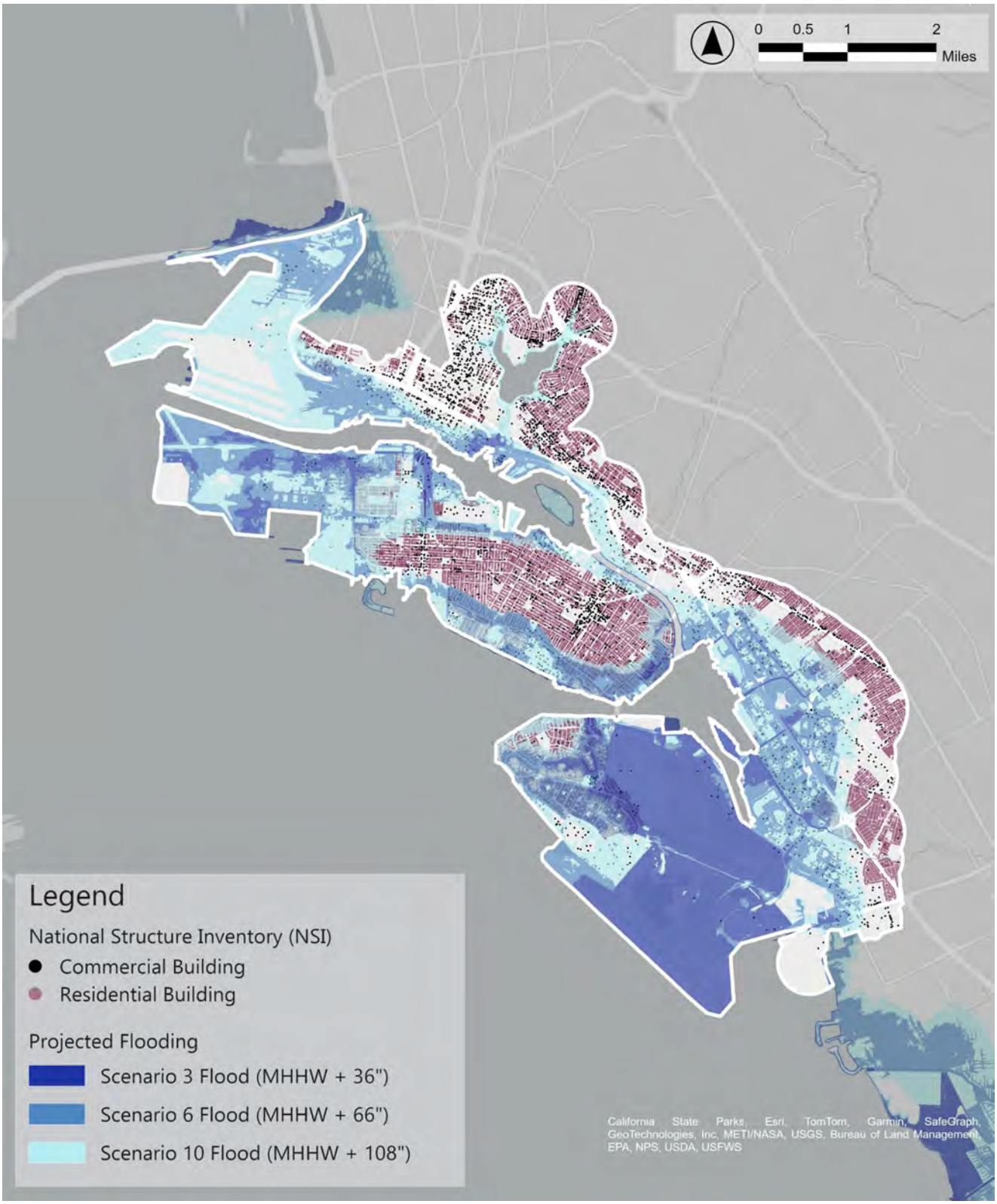



Figure 7. Commercial and Residential Buildings Exposed to Flooding within the Subregion

Data Source: (USACE 2022; Vandever et al. 2017)

## 4.2 Sensitivity, Adaptive Capacity, and Consequences

Commercial and residential buildings can be **sensitive** to sea level rise and storm flooding. Characteristics of the building (e.g., building materials, building uses, types of contents and where they are stored, occupants at the time of the event) can influence degree of sensitivity, and it may vary based on characteristics of the flood (e.g., salt vs freshwater, presence of contaminants, duration). Accurate and up-to-date information on the location and needs of socially vulnerable populations is important to evaluate the vulnerability of specific buildings or neighborhoods, but that information is difficult to collect and maintain (City of Alameda 2019). Most homes and businesses are not currently resilient to flooding or saltwater impacts like corrosion, and electrical and mechanical systems are often located in basements and are at risk of damage from even small amounts of flooding (City of Alameda 2019).

The **adaptive capacity** of commercial and residential buildings varies widely depending on factors like building age, use, design, and ownership, with new development or redevelopment having the greatest adaptive capacity because of updated building codes and other policies that can dictate adaptation measures (City of Alameda 2019). Retrofitting existing buildings with floodproofing measures can also enhance resilience, though it can involve significant costs (Aerts 2018). Communities with proactive planning and zoning regulations that incorporate climate adaptation strategies, such as restricting development in high-risk areas, are better positioned to adjust to these impacts (Wolff, Bonatz, and Vafeidis 2023).

The **consequences** of sea level rise and coastal flooding can include direct damage to buildings, disruption to the people who live or work in flooding areas, and indirect impacts beyond the flooded area. Economically, businesses may suffer from the cost to repair/replace buildings and equipment as well as the cost to the local economy (tax revenue, retail sales, etc.) (City of Alameda 2019). Homeowners may face costly repairs and potential displacement. Displaced residents face challenges, especially among socially vulnerable populations. There is an extra burden on renters, who have limited capacity to address deficiencies in their buildings and rely on landlords to make changes (City of Alameda 2019). Repeated flooding events can devalue properties, impact local tax revenues, and strain municipal resources dedicated to recovery and infrastructure maintenance (Union of Concerned Scientists 2018). Some consequences of flooding may not be easily monetized, including public health concerns (e.g., related to mold growth and waterborne diseases), mental stress and anxiety, trauma, loss of life, community health and safety, and damage to cultural heritage sites.

# 5 Roads and Bikeways

Roads and bikeways are vital components of urban infrastructure, facilitating transportation, commerce, tourism, and daily commutes for residents and workers. These networks ensure connectivity and accessibility within and across regions.

## 5.1 Exposure

The extensive network of roads and bikeways serving residents and workers throughout the Subregion will be increasingly exposed to coastal flooding as sea levels rise (Figure 8, Figure 9, Table 5, Table 6). Under Scenario 3 (MHHW + 36”), a portion of 880 is exposed near the Lake Merritt Channel. Major arterials are exposed in Oakland along Doolittle Drive, near the Coliseum and Edgewater, and at the

airport; and in Alameda near the low points (Webster/Posey Tubes and Eastshore Drive) and eastern portions of Bay Farm Island. Local roads and bikeways, including portions of the Bay Trail, are also exposed. Under Scenario 6 (MHHW + 66"), roads and bikeways along the Oakland shoreline experience significant inundation, and inundation in Alameda and Bay Farm Islands grows more extensive. Under Scenario 10 (MHHW + 108"), most of the Subregion's shorelines are overtopped, and a substantial percentage of roads and bikeways are exposed to flooding including 90% of roads and bikeways on Bay Farm Island, more than 50% of roads and bikeways on Alameda Island, 35% of roads and bikeways in the portion of Oakland within the Subregion, and 80% of roads and bikeways within the Port of Oakland Airport and Seaport (including adjacent areas). Detailed exposure tables for roads and bikeways exposed in each subwatershed are presented in Attachment A, Sections 0 and A.3.

Table 5. Roads Exposed within the Subregion

| Miles of Roadway Exposed within the Subregion | | | | | |
|---|---|---|---|---|---|
| Area | Roadway Type | Total Miles | Water Level Scenarios | | |
| | | | 3 | 6 | 10 |
| | | | MHHW + 36" | MHHW + 66" | MHHW + 108" |
| Alameda Island | Local | 124 | 8 | 42 | 81 |
| | Major Arterial | 31 | 3 | 9 | 13 |
| | Freeway | - | - | - | - |
| Bay Farm Island | Local | 37 | 8 | 26 | 35 |
| | Major Arterial | 11 | 3 | 6 | 10 |
| | Freeway | 1 | - | - | - |
| City of Oakland (Incl. Port of Oakland CRE) | Local | 163 | 2 | 29 | 52 |
| | Major Arterial | 56 | <1 | 5 | 16 |
| | Freeway | 20 | <1 | 7 | 10 |
| Port of Oakland – Seaport (Incl. Adjacent Areas) | Local | 36 | - | 13 | 24 |
| | Major Arterial | 16 | - | 1 | 6 |
| | Freeway | 14 | - | 6 | 8 |
| Port of Oakland – Airport (Incl. Adjacent Areas) | Local | 15 | 11 | 14 | 15 |
| | Major Arterial | 3 | 1 | 3 | 3 |
| | Freeway | - | - | - | - |

Data Source: (Alameda County 2022b)

Values rounded to nearest whole number. Alameda Island corresponds to subwatersheds A-01 through A-11; Bay Farm Island corresponds to subwatersheds A-12 through A-17; City of Oakland (including Port of Oakland CRE) corresponds to subwatersheds O-05 through O-17 and O-19, O-20, O-21, O- 22, O-23; Port of Oakland – Seaport (including adjacent areas) corresponds to subwatersheds O-01 through O-04; and Port of Oakland – Airport (including adjacent areas) corresponds to subwatersheds O-18 and O-24 through O-26.

CRE = Commercial Real Estate areas

MHHW = Mean Higher High Water

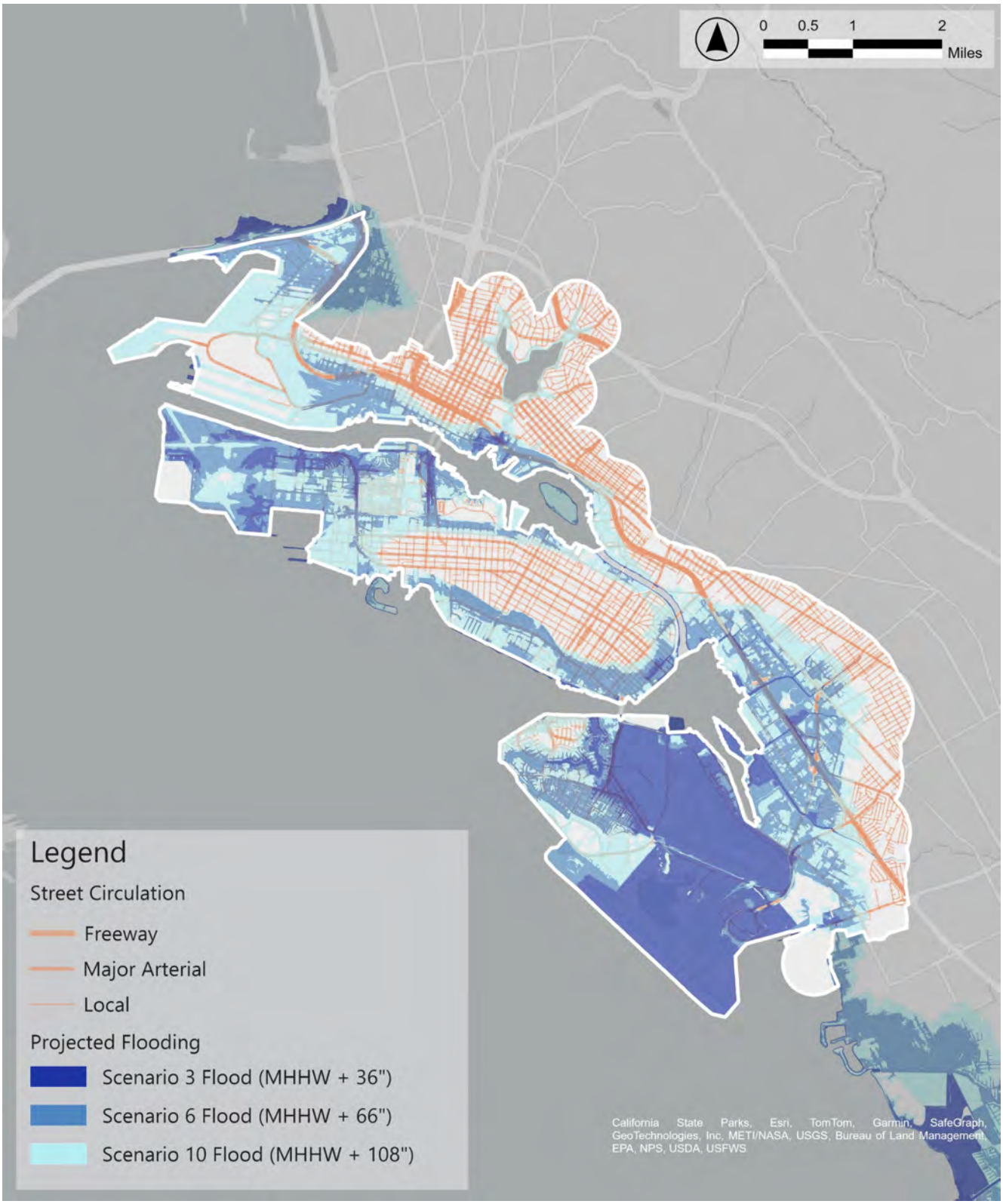



Figure 8. Roads Exposed to Flooding within the Subregion

Data Source: (Alameda County 2022b; Vandever et al. 2017)

Table 6. Bikeways Exposed within the Subregion

| Miles of Bikeway Exposed within the Subregion | | | | | |
|---|---|---|---|---|---|
| | | | Water Level Scenarios | | |
| Area | Bikeway Type | Total Miles | 3 MHHW + 36" | 6 MHHW + 66" | 10 MHHW + 108" |
| Alameda Island | Class I - Bike Path | 10 | 2 | 6 | 10 |
| | Class II - Bike Lanes | 14 | <1 | 4 | 6 |
| | Class III - Bike Route | 5 | <1 | <1 | 2 |
| Bay Farm Island | Class I - Bike Path | 13 | 5 | 8 | 12 |
| | Class II - Bike Lanes | 5 | <1 | 3 | 4 |
| | Class III - Bike Route | - | - | - | - |
| City of Oakland (Incl. Port of Oakland CRE) | Class I - Bike Path | 6 | <1 | 5 | 6 |
| | Class II - Bike Lanes | 7 | <1 | 1 | 2 |
| | Class III - Bike Route | 18 | <1 | 6 | 11 |
| Port of Oakland – Seaport[10] (Incl. Adjacent Areas) | Class I - Bike Path | - | - | - | - |
| | Class II - Bike Lanes | 2 | - | 1 | 1 |
| | Class III - Bike Route | 2 | - | - | <1 |
| Port of Oakland – Airport (Incl. Adjacent Areas) | Class I - Bike Path | 2 | <1 | <1 | 2 |
| | Class II - Bike Lanes | 4 | 3 | 4 | 4 |
| | Class III - Bike Route | - | - | - | - |

Data Source: (MTC 2010)

Values rounded to nearest whole number. Alameda Island corresponds to subwatersheds A-01 through A-11; Bay Farm Island corresponds to subwatersheds A-12 through A-17; City of Oakland (including Port of Oakland CRE) corresponds to subwatersheds O-05 through O-17 and O-19, O-20, O-21, O- 22, O-23; Port of Oakland – Seaport (including adjacent areas) corresponds to subwatersheds O-01 through O-04; and Port of Oakland – Airport (including adjacent areas) corresponds to subwatersheds O-18 and O-24 through O-26.

CRE = Commercial Real Estate areas; MHHW = Mean Higher High Water

[10] This table includes bikeways captured in GIS data from MTC. GIS data for other bikeways in the Subregion, such as the Maritime Street bike path located within the Port of Oakland – Seaport, was not available at the time of analysis. This and other assets may be considered for incorporation in a future update of the exposure analysis.

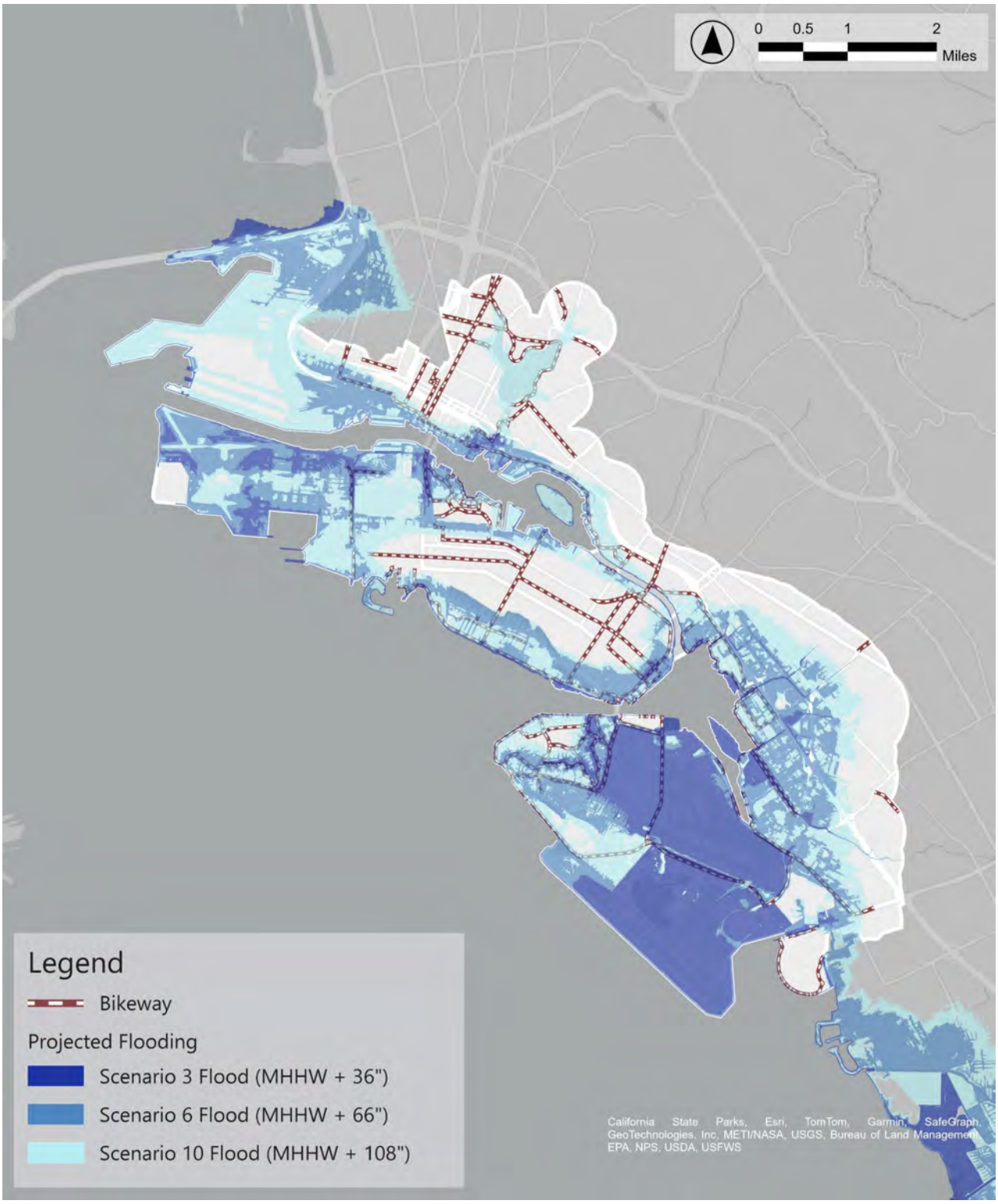



Figure 9. Bikeways Exposed to Flooding within the Subregion

Data Source: (MTC 2010; Vandever et al. 2017)

This map includes bikeways captured in GIS data from MTC. GIS data for other bikeways in the Subregion, such as the Maritime Street bike path located within the Port of Oakland – Seaport, was not available at the time of analysis. This and other assets may be considered for incorporation in a future update of the exposure analysis.

## 5.2 Sensitivity, Adaptive Capacity, and Consequences

Depending on the local road and bikeway network characteristics and other conditions, a relatively small amount of flooding can have significant consequences for the network and community. Both the Alameda Climate Action and Resiliency Plan (CARP) and the San Francisco's Sea Level Rise Vulnerability and Consequences Assessment provide insight into the vulnerability and consequences of transportation assets (City of Alameda 2019; CCSF 2020).

Some transportation system components are especially **sensitive** to flooding and inundation, including culverts that may not be large enough to accommodate projected future precipitation events or at elevations that would be flooded regularly at higher water levels (City of Alameda 2019). For example, electrical components (e.g., traffic signals, lighting, control systems) are particularly sensitive to inundation (CCSF 2020). Bridges in the Subregion are vulnerable to sea level rise and storm surge, particularly mechanical rooms that are closer to existing mean higher high water and those with more limited clearance for boats to pass underneath (City of Alameda 2019).

**Adaptive capacity** varies among transportation assets, for example, it can be easier to reroute cars, trucks, and buses than it is to reroute BART or other rail-based transportation. However, Alameda Island, Bay Farm Island, and some areas of the Oakland shoreline present limited options for rerouting because there are limited alternate routes available.

Flooded roads can have **consequences** on all transportation modes (e.g., cars, trucks, buses, bicycles, pedestrians). It can lead to traffic congestion and increased air pollution on alternative routes, increased likelihood of accidents, impediments to critical access and emergency response, limited access to healthcare services (which may disproportionately impact disadvantaged communities, the elderly, young children, and those with pre-existing conditions), and surface and subsurface infrastructure damage, particularly with repeated inundation by saltwater (CCSF 2020). With more frequent and more extensive flood events, roads are likely to erode and subside (CCSF 2020). Flooded roads can also provide a conduit for floodwaters to enter utility access holes, vents, and other low-lying or subsurface infrastructure (CCSF 2020).

# 6 Parks and Trails

Parks and trails provide essential recreational services and natural beauty, connecting communities, and enhancing the quality of life for residents. These green spaces and pathways are intricately designed, incorporating various construction materials and engineering features to ensure accessibility and enjoyment for all users. These facilities collectively contribute to public health, ecosystem health, and community well-being.

## 6.1 Exposure

There are many parks and trails under the jurisdiction of the East Bay Regional Park District, City of Alameda, and City of Oakland within the Subregion that could be exposed to flooding as sea levels rise (Figure 10, Figure 11, Table 7, Table 8). Under Scenario 3 (MHHW + 36"), shoreline parks and trails are exposed within the Subregion, and Bay Farm Island parks and trails are about 80% inundated. However, this includes the Corica Golf Course on Bay Farm Island which has raised grades and may not be entirely inundated under Scenario 3. Under Scenario 6 (MHHW + 66"), about 50% of parks and

trails on Alameda Island are exposed to sea level rise, as are 30% of the parks and trails within the Oakland portion of the Subregion.[11] Under Scenario 10 (MHHW + 108"), most of the Subregion's shorelines are overtopped, and about 90% of parks and trails on Bay Farm Island, 80% of parks and trails on Alameda Island are exposed to sea level rise. In addition, about 70% of the parks and trails along the Oakland shoreline and 95% of parks and trails within Oakland Airport and Seaport are inundated. Detailed exposure tables for parks and trails exposed in each subwatershed unit can be found in Attachment A, Sections A.5 and A.6.

Table 7. Parks Exposed within the Subregion

| Acres of Parks Exposed within the Subregion | | | | |
|---|---|---|---|---|
| Area | Total Acres | Water Level Scenarios | | |
| | | 3 | 6 | 10 |
| | | MHHW + 36" | MHHW + 66" | MHHW + 108" |
| **Alameda Island** | 232 | 23 | 105 | 189 |
| **Bay Farm Island** | 388 | 313 | 329 | 351 |
| **City of Oakland** (Incl. Port of Oakland CRE) | 701 | 130 | 220 | 521 |
| **Port of Oakland – Seaport**[12] (Incl. Adjacent Areas) | 35 | 6 | 23 | 28 |
| **Port of Oakland - Airport**[13] (Incl. Adjacent Areas) | 25 | 6 | 16 | 24 |

Data Source: (EBRPD 2023; City of Alameda 2023a; City of Oakland 2023a)

Values rounded to nearest whole number. Alameda Island corresponds to subwatersheds A-01 through A-11; Bay Farm Island corresponds to subwatersheds A-12 through A-17; City of Oakland (including Port of Oakland CRE) corresponds to subwatersheds O-05 through O-17 and O-19, O-20, O-21, O- 22, O-23; Port of Oakland – Seaport (including adjacent areas) corresponds to subwatersheds O-01 through O-04; and Port of Oakland – Airport (including adjacent areas) corresponds to subwatersheds O-18 and O-24 through O-26.

This data is specific to parks and trails. It does not include all publicly accessible open spaces within the Subregion (e.g., Jack London Square, Brooklyn Basin).

CRE = Commercial Real Estate areas

MHHW = Mean Higher High Water

[11] Oakland parks dataset includes marsh areas like Arrowhead Marsh and MLK Marsh.

[12] This table includes parks captured in GIS data from EBRPD, City of Alameda, and City of Oakland. GIS data for Port View Park (6 acres) and Middle Harbor Shoreline Park (46.4 acres) not included in this analysis; this is a data gap. Additional assets may be considered for incorporation in a future update of the exposure analysis.

[13] The Oakland International Airport does not include parks. The park areas identified in this table are located in adjacent areas such as part of the Martin Luther King Jr. Shoreline (managed by EBRPD) along Doolittle Drive.

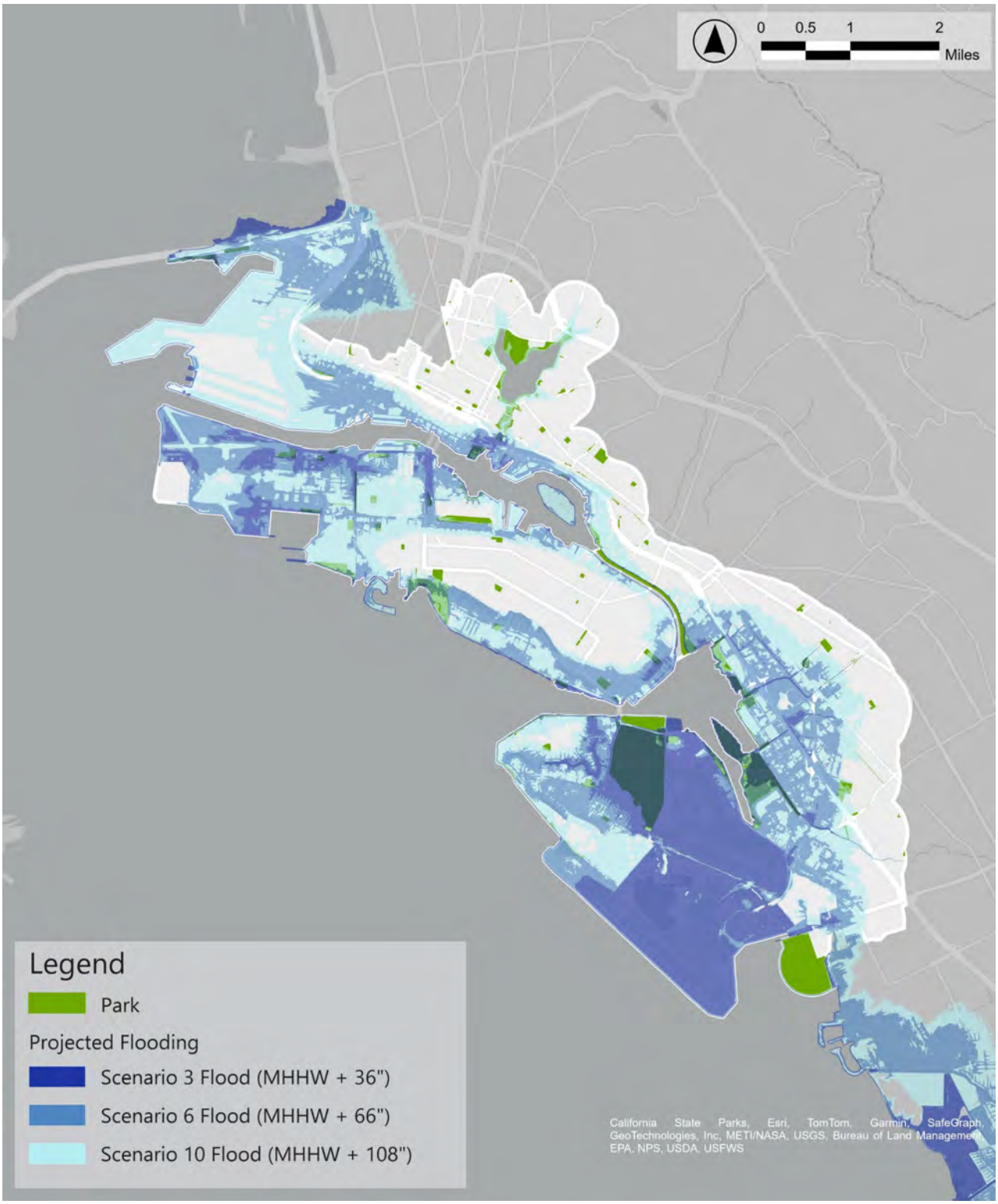



Figure 10. Parks Exposed to Flooding within the Subregion

Data Source: (EBRPD 2023; City of Alameda 2023a; City of Oakland 2023a; Vandever et al. 2017)

This map includes parks captured in GIS data from EBRPD, City of Alameda, and City of Oakland. GIS data for Port View Park (6 acres) and Middle Harbor Shoreline Park (46.4 acres) not included in this analysis; this is a data gap. Additional assets may be considered for incorporation in a future update of the exposure analysis.

Table 8. Trails Exposed within the Subregion

| Miles of Trail Exposed within the Subregion | | | | |
|---|---|---|---|---|
| Area | Total Miles | Water Level Scenarios | | |
| | | 3 | 6 | 10 |
| | | MHHW + 36" | MHHW + 66" | MHHW + 108" |
| **Alameda Island** | 17 | 2 | 9 | 14 |
| **Bay Farm Island** | 6 | 1 | 3 | 6 |
| **City of Oakland** (Incl. Port of Oakland CRE) | 18 | 2 | 11 | 18 |
| **Port of Oakland – Seaport** (Incl. Adjacent Areas) | 8 | - | 3 | 6 |
| **Port of Oakland – Airport** (Incl. Adjacent Areas) | 2 | <1 | 2 | 2 |

Data Source: (EBRPD 2023; City of Alameda 2023b)

Values rounded to nearest whole number. Alameda Island corresponds to subwatersheds A-01 through A-11; Bay Farm Island corresponds to subwatersheds A-12 through A-17; City of Oakland (including Port of Oakland CRE) corresponds to subwatersheds O-05 through O-17 and O-19, O-20, O-21, O- 22, O-23; Port of Oakland – Seaport (including adjacent areas) corresponds to subwatersheds O-01 through O-04; and Port of Oakland – Airport (including adjacent areas) corresponds to subwatersheds O-18 and O-24 through O-26.

CRE = Commercial Real Estate areas

MHHW = Mean Higher High Water

## 6.2 Sensitivity, Adaptive Capacity, and Consequences

Trail **sensitivity** to flooding varies with elevation, location, construction, and connectivity, causing closures, damage, pooling, and impassability, especially for users with limited mobility or in wheelchairs. (BCDC 2012). Most parks and trails can withstand infrequent, temporary flooding. However, frequent or permanent flooding poses a significant risk to parks and open spaces, potentially making them unavailable or lost due to their location in dense urban areas with no room for relocation (CCSF 2020).

Park and trail **adaptive capacity** within the Subregion varies depending on the characteristics of each site, recreational activities, and ecosystem functions. Natural shorelines with room to expand landward have the most adaptive capacity; however, land use policy updates may be needed to allow landward migration. Parks and trails along existing engineered shorelines can be elevated to adapt to sea level rise and, in some cases, integrated with living shoreline designs (City of Alameda 2019).

Over time, sea level rise impacts will lead to significant negative **consequences** for many of the recreational services provided by parks (including golf courses) in the Subregion. This loss disproportionately affects vulnerable communities by reducing access to recreational opportunities, exacerbating urban heat island effects, and endangering local wildlife habitats (BCDC 2012). The likelihood is very high that after storm events, managing agencies will regularly be faced with extensive damage to multiple parks that they operate. Agencies will have to prioritize recovery efforts, and this may strain relationships between agencies that co-own and/or manage a park if priorities for recovery

differ. (BCDC 2012). Major economic impacts are likely if engineered or natural shoreline features fail. Additionally, habitat loss is likely for many species, including some threatened or endangered species. Loss of natural areas are important to residents and provide substantial value for recreation and general well-being (City of Alameda 2019).

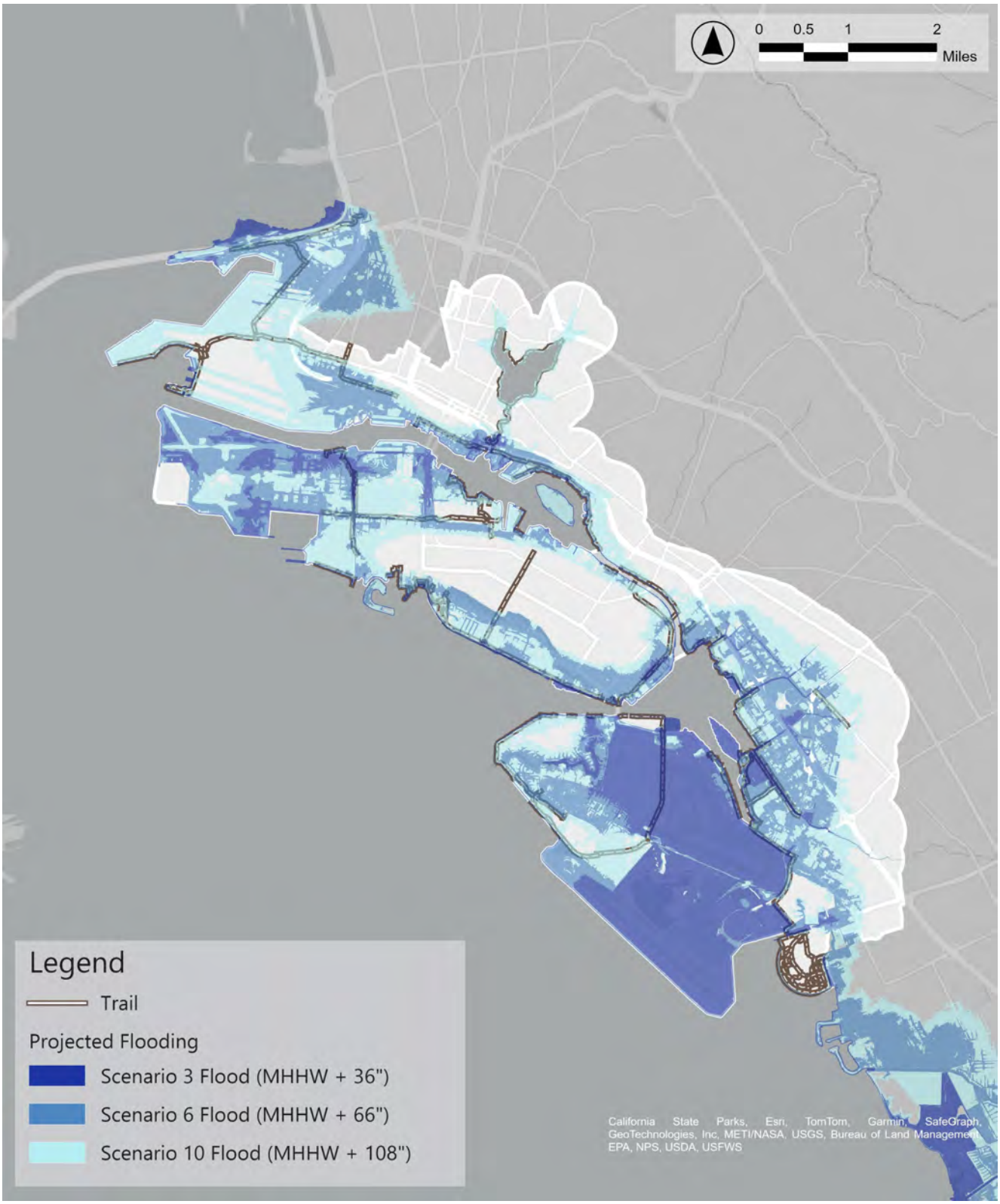



Figure 11. Trails Exposed to Flooding within the Subregion

Data Source: (EBRPD 2023; City of Alameda 2023b; Vandever et al. 2017)

# 7 Stormwater Infrastructure

Stormwater infrastructure in this Subregion includes pipes, channels, lagoons, lakes, ditches, and pump stations, which work together to direct the flow of stormwater to appropriate discharge points to the Oakland-Alameda Estuary or to the Bay.[14] The Cities of Alameda and Oakland, and the Port of Oakland, are also making investments in green infrastructure which act in combination with traditional stormwater infrastructure to reduce stormwater flooding and improve water quality. These systems collectively provide essential services to protect communities from flooding and minimize the environmental impact on local waterways.

This limited, high-level exposure assessment for stormwater assets only includes the pump stations and buried pipes. While these assets can be vulnerable to coastal flooding, (e.g., coastal floodwater can infiltrate pipes, damage sensitive pump station equipment, and reduce system capacity, see Section 7.2), they also serve as a proxy for other stormwater system assets in the absence of more data and detailed analysis throughout the Subregion.

## 7.1 Exposure

As described in this project's Existing Conditions Report (OAAC 2024), the pipe networks are typically designed to handle a 10-year storm (9.5% annual chance), while pump stations are typically designed to handle a 100-year storm (1% annual chance), where the term "storm" is related to the intensity of precipitation, or rainfall, falling within a specific duration of time (e.g., 24-hours). As the climate changes, the frequency and intensity of Bay Area rainfall will also change (Patricola et al. 2022), requiring interior drainage adaptation strategies such as green infrastructure, increased pump capacity, and expanded detention and conveyance structures.

However, this assessment is specific to exposure to coastal flooding and sea level rise. It does not include an assessment of the system's capacity to handle current or future precipitation, or the existing or future stormwater flooding that may result if the system exceeds its capacity. Rather, this assessment indicates the degree to which stormwater pipes and pump stations within the Subregion are exposed to coastal flooding as sea levels rise (Figure 12, Figure 13, Table 9).

The smaller diameter pipes are generally found in residential neighborhoods and near the fringes of the collection system. Smaller pipes connect to larger diameter pipes, which have more conveyance capacity. The largest pipes are often outfalls where the stormwater pipes discharge to the Bay. Under Scenario 3 (MHHW + 36"), about 36% of the stormwater pipes on Bay Farm Island, 10% on Alameda Island, and 5% along the Oakland shoreline are exposed to sea level rise. Under Scenario 6 (MHHW + 66"), more than 50% of stormwater pipes are exposed on Alameda and Bay Farm Islands, and 25% in Oakland. Under Scenario 10 (MHHW + 108"), most of the Subregion's shorelines are overtopped, and about 95% of the stormwater pipes on Bay Farm Island, 80% on Alameda Island, 46% in the portion of Oakland within the Subregion, 75% in the Seaport and nearly 100% in the Airport are exposed to sea

[14] Stormwater is the runoff generated from rain that flows over land surfaces and impervious areas, such as streets, parking lots, and rooftops. This water is collected, conveyed, and sometimes treated through a network of structures and facilities designed to manage its flow and reduce flooding.

level rise. Detailed exposure tables for stormwater pipes exposed in each subwatershed unit can be found in Attachment A, Section A.1.

Pump stations lift stormwater to move it through the system, especially in low-lying areas where gravity flow is insufficient. Under Scenario 3 (MHHW + 36"), stormwater pumps begin to be exposed, including (or primarily in) the Oakland Airport as well as Eastshore Drive, near the Webster Tube, and the Alameda Main Street Ferry Terminal. Under Scenario 6 (MHHW + 66"), over 50% of stormwater pumps on Alameda and Bay Farm Islands are exposed. Under Scenario 10 (MHHW + 108"), most of the Subregion's shorelines are overtopped, and all stormwater pumps on Alameda and Bay Farm Islands, 80% of pumps in the portion of Oakland within the Subregion, and 100% of Airport and Seaport pumps are exposed to sea level rise. Detailed exposure tables for stormwater pumps exposed in each subwatershed are presented in Attachment A, Section A.9.

Table 9. Stormwater Pipes and Pump Stations Exposed within the Subregion

| Stormwater Pipes and Pump Stations Exposed within the Subregion | | | | | |
|---|---|---|---|---|---|
| | | | Water Level Scenarios | | |
| Area | Asset | Total | 3 MHHW + 36" | 6 MHHW + 66" | 10 MHHW + 108" |
| Alameda Island | Pipes (miles) | 59 | 6 | 36 | 48 |
| | Pump Stations | 10 | 2 | 7 | 10 |
| Bay Farm Island | Pipes (miles) | 45 | 17 | 33 | 43 |
| | Pump Stations | 3 | 2 | 3 | 3 |
| City of Oakland (Incl. Port of Oakland CRE) | Pipes (miles) | 126 | 7 | 34 | 58 |
| | Pump Stations | 5 | 1 | 1 | 4 |
| Port of Oakland – Seaport (Incl. Adjacent Areas) | Pipes (miles) | 102 | <1 | 23 | 69 |
| | Pump Stations | 2 | - | - | 2 |
| Port of Oakland – Airport (Incl. Adjacent Areas) | Pipes (miles) | 51 | 47 | 50 | 51 |
| | Pump Stations | 4 | 4 | 4 | 4 |

Data Source: (City of Alameda 2023e; 2023f; City of Oakland 2023d; 2023e; Schaaf and Wheeler 2019). This analysis does not include data provided by Wood Rodgers received spring 2024; data received from the City of Oakland was nearly identical, therefore, the City of Oakland was preferred.

Values rounded to nearest whole number. Alameda Island corresponds to subwatersheds A-01 through A-11; Bay Farm Island corresponds to subwatersheds A-12 through A-17; City of Oakland (including Port of Oakland CRE) corresponds to subwatersheds O-05 through O-17 and O-19, O-20, O-21, O- 22, O-23; Port of Oakland – Seaport (including adjacent areas) corresponds to subwatersheds O-01 through O-04; and Port of Oakland – Airport (including adjacent areas) corresponds to subwatersheds O-18 and O-24 through O-26.

CRE = Commercial Real Estate areas

MHHW = Mean Higher High Water

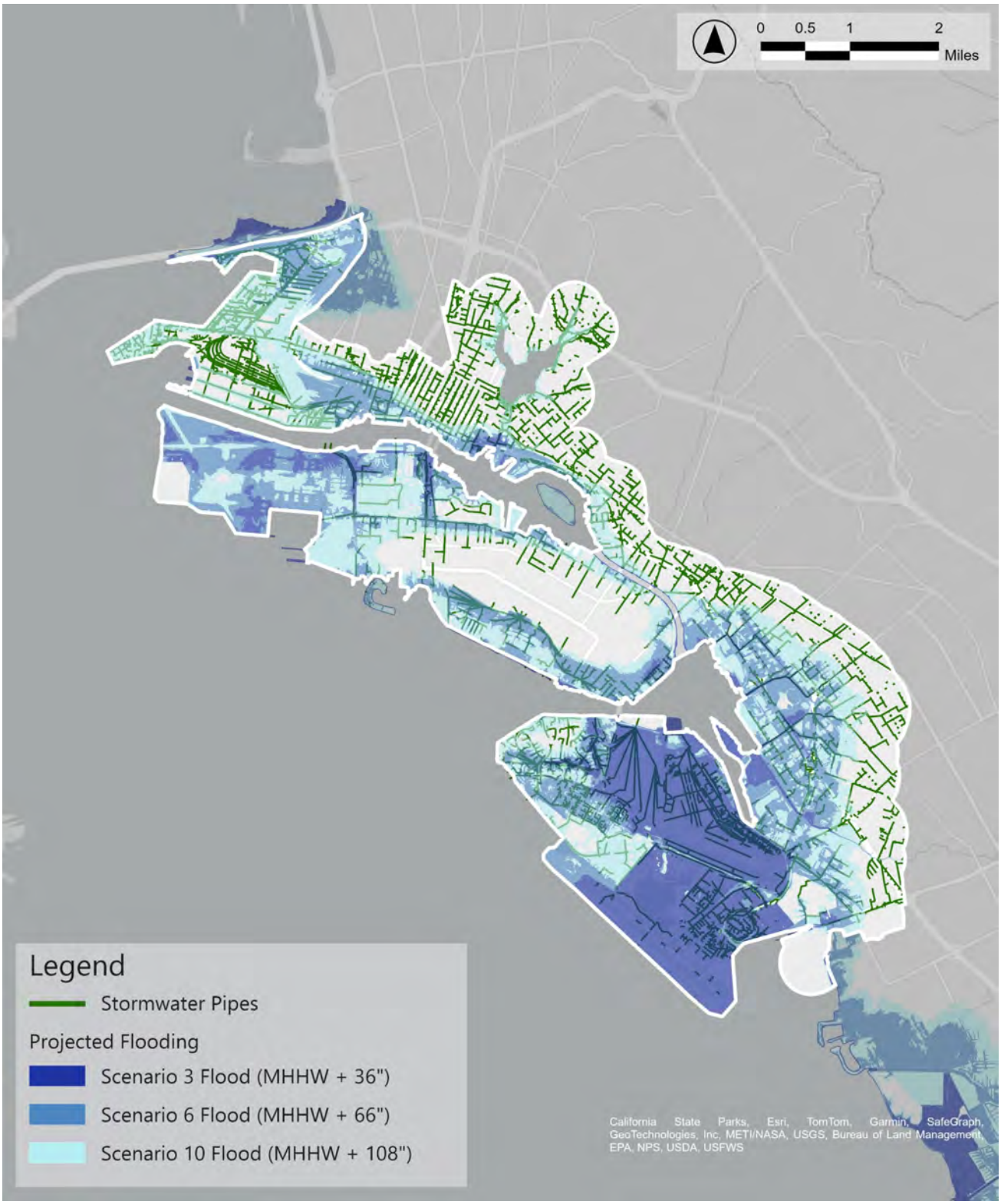



Figure 12. Stormwater Pipes Exposed to Flooding within the Subregion

Data Source: (City of Alameda 2023e; City of Oakland 2023d; Schaaf and Wheeler 2019; Vandever et al. 2017)

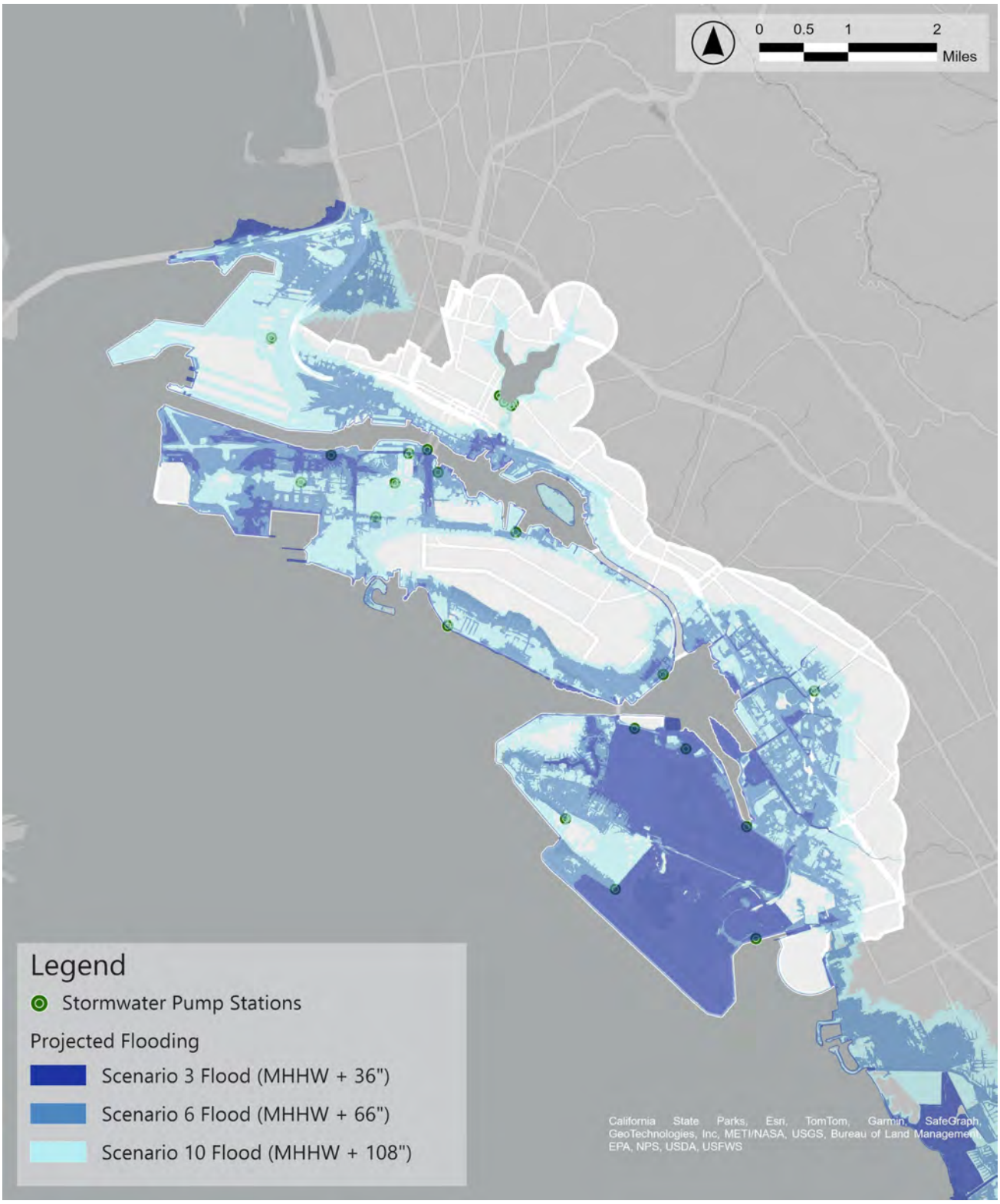



Figure 13. Stormwater Pump Stations Exposed to Flooding within the Subregion

Data Source: (City of Alameda 2023f; City of Oakland 2023e; Schaaf and Wheeler 2019; Vandever et al. 2017)

## 7.2 Sensitivity, Adaptive Capacity, and Consequences

Stormwater pipes relying on gravity for drainage are highly **sensitive** to sea level rise (BCDC 2012). Overland coastal flooding can infiltrate into stormwater pipes and flow into utility holes and catch basins, reducing the capacity of the system to convey stormwater. If the amount of water exceeds the capacity of the system – or if debris caused by coastal flooding clogs the stormwater system – floodwaters could linger on surface streets and other areas. In Alameda, there are known capacity issues within the overall stormwater system (upgrades are planned) that can result in overland flooding during heavy precipitation events (City of Alameda 2019).

Other examples of stormwater-system-related impacts from sea level rise and coastal flooding include: coastal water flowing into the system through outfalls ("backflow"), reduced ability of outfalls to drain to the Bay (due to a smaller difference between the drain inlet elevation and Bay water elevation), shoreline erosion exposing or damaging stormwater infrastructure, and increased runoff due to decreased soil absorption capacity as a result of rising groundwater (NOAA 2024). Even if pipes are equipped with a device to prevent backflow such as a flap gate, they may not be able to drain by gravity during high tide, which could cause stormwater to back up upstream of the outfall. As sea levels rise, the resulting stormwater flooding on streets will occur more frequently. Stormwater pumps are also sensitive to sea level rise, as they contain both electrical and mechanical equipment that floodwaters could damage (electric motors drive all pumps) and reduce the efficiency of the pump due to higher tailwater conditions. The primary risks are for shorted electrical systems or corroded mechanical equipment (City of Alameda 2019). Most pump stations are not designed with built-in excess capacity (backup pumps), and pump stations may also lack backup power systems in the event of a power failure (City of Alameda 2019).

Stormwater outfalls are often impacted by sedimentation which can reduce their discharge capacity and functionality, particularly after drought periods when stormwater outflows do not flush debris and accumulated material away from the discharge point.

**Adaptive capacity** refers to the system's ability to adjust and maintain function. City of Alameda ownership of most storm drain pump stations increases their adaptive capacity by removing barriers to action. The City can take (and is currently taking) some immediate steps to increase the resilience of the pump stations, including elevating electrical panels (City of Alameda 2019). The City of Oakland is in the process of updating its stormwater master plan, which will include an assessment of areas that do not meet the City's conveyance goals, along with potential improvements to reduce the potential for stormwater flooding.

Compromised stormwater system components can result in **consequences** throughout the Subregion. Increased strain on stormwater pumps (e.g., due to blocked outfalls), pump failure (e.g., due to electrical or mechanical issues, insufficient capacity), and overall reduced ability to drain to the Bay can cause damages, disruption, and adverse health effects associated with floodwater collecting in low-lying areas. Damages to stormwater pipes (e.g., related to shoreline erosion) and sedimentation build-up can also increase maintenance and rehabilitation costs.

# 8 Wastewater Infrastructure

Wastewater is collected, conveyed, treated, and discharged through an interconnected network of structures and facilities.[15] Wastewater assets can be owned and operated by separate providers, and they function together to provide critical services to the communities they serve while protecting Bay water quality and natural resources. The wastewater system in the Subregion is fully separate from the stormwater system.

This limited, high-level exposure assessment for wastewater assets only includes the pump/lift stations and buried pipes. While these assets can be vulnerable to coastal flooding, (e.g., coastal floodwater can infiltrate pipes, damage sensitive pump station equipment, and reduce system capacity, see Section 8.2), they also serve as a proxy for other wastewater system assets in the absence of more data and detailed analysis throughout the Subregion.

## 8.1 Exposure

The only wastewater assets included in this assessment are the pipes, pump stations, and lift stations located throughout the Subregion (Figure 14, Figure 15, Table 10). Wastewater flows are conveyed to the East Bay Municipal Utility District (EBMUD) Wastewater Treatment Plant for treatment, which is located near the entrance of the San Francisco-Oakland Bay Bridge. Pump stations and lift stations lift wastewater throughout the collection system as it travels to the treatment plant, and from the treatment plant to the ultimate discharge location (BCDC 2012).[16]

Under Scenario 3 (MHHW + 36”), about 30% of wastewater pipes are exposed on Bay Farm Island and 10% on Alameda Island. Under Scenario 6 (MHHW + 66”), 50% of wastewater pipes are exposed on Bay Farm Island, 25% on Alameda Island, 15% in the Oakland portion of the Subregion, and 50% within the Port’s jurisdiction. Under Scenario 10 (MHHW + 108”), most of the Subregion’s shorelines are overtopped, and about 95% of wastewater pipes are exposed on Bay Farm Island, over 50% on Alameda Island, 30% in the portion of Oakland within the Subregion, 75% in the Seaport and 100% of pipes in the Airport. Detailed exposure tables for wastewater pipes exposed in each subwatershed are presented in Attachment A, Section A.1.

Under Scenario 3 (MHHW + 36”), 20% of the wastewater pumps on Bay Farm Island and 10% of the pumps on Alameda Island are exposed to sea level rise. Under Scenario 6 (MHHW + 66”), 50% of wastewater pumps are exposed in the portion of Oakland within the Subregion and on Alameda and Bay Farm Islands. Under Scenario 10 (MHHW + 108”), most of the Subregion’s shorelines are overtopped, and about 90% on Alameda and Bay Farm Islands wastewater pump stations are exposed, 50% in the portion of Oakland within the Subregion, and 100% of pumps within the Seaport and Airport are exposed. Detailed exposure tables for wastewater pumps exposed in each subwatershed are presented in Attachment A, Section A.1.

---

[15] Wastewater is the resulting liquid and solid waste from washing, flushing, or industrial processes. The term is sometimes used interchangeably with “sewage,” though “sewage” refers specifically to wastewater that contains organic matter from sources such as toilets, sinks, and showers.

[16] Pump stations and lift stations differ in terms of the types of materials processed, security features, specialized equipment, and associated maintenance requirements.

Table 10. Wastewater Pipes, Pump Stations, and Lift Stations Exposed within the Subregion

| Wastewater Pipes, Pump Stations, and Lift Stations Exposed within the Subregion | | | | | |
|---|---|---|---|---|---|
| | | | Water Level Scenarios | | |
| Area | Asset | Total | 3 | 6 | 10 |
| | | | MHHW + 36" | MHHW + 66" | MHHW + 108" |
| Alameda Island | Pipes (miles) | 123 | 7 | 37 | 63 |
| | Pump/Lift Stations | 32 | 4 | 16 | 28 |
| Bay Farm Island | Pipes (miles) | 25 | 6 | 13 | 23 |
| | Pump/Lift Stations | 14 | 3 | 7 | 13 |
| City of Oakland (Incl. Port of Oakland CRE) | Pipes (miles) | 216 | 2 | 28 | 65 |
| | Pump/Lift Stations | 4 | - | 2 | 2 |
| Port of Oakland – Seaport[17] (Incl. Adjacent Areas) | Pipes (miles) | 42 | <1 | 13 | 24 |
| | Pump/Lift Stations | 4 | - | 2 | 4 |
| Port of Oakland – Airport[18] (Incl. Adjacent Areas) | Pipes (miles) | 1 | <1 | 1 | 1 |
| | Pump/Lift Stations | - | - | - | - |

Data Source: (City of Alameda 2023c; City of Alameda 2023d; City of Oakland 2023b; City of Oakland 2023c; EBMUD 2023)

Values rounded to nearest whole number. Alameda Island corresponds to subwatersheds A-01 through A-11; Bay Farm Island corresponds to subwatersheds A-12 through A-17; City of Oakland (including Port of Oakland CRE) corresponds to subwatersheds O-05 through O-17 and O-19, O-20, O-21, O- 22, O-23; Port of Oakland – Seaport (including adjacent areas) corresponds to subwatersheds O-01 through O-04; and Port of Oakland – Airport (including adjacent areas) corresponds to subwatersheds O-18 and O-24 through O-26.

CRE = Commercial Real Estate areas

MHHW = Mean Higher High Water

[17] No wastewater system GIS data was available directly from the Port of Oakland at the time of analysis. Additional assets may be considered for incorporation in a future update of the exposure analysis.

[18] No wastewater system GIS data was available directly from the Port of Oakland at the time of analysis.. Additional assets may be considered for incorporation in a future update of the exposure analysis.

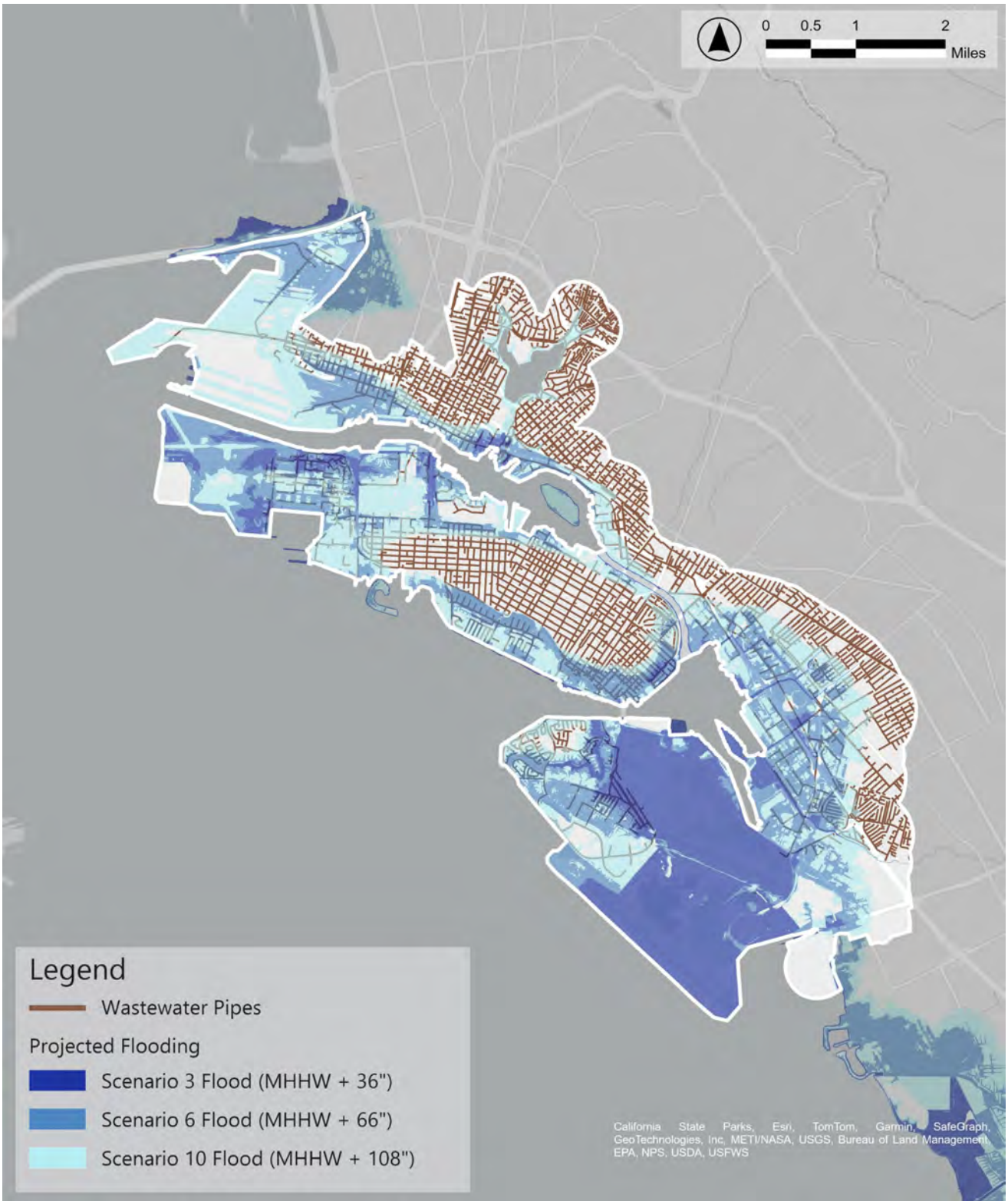



Figure 14. Wastewater Pipes Exposed to Flooding within the Subregion

Data Source: (City of Alameda 2023d; City of Oakland 2023b; Vandever et al. 2017)

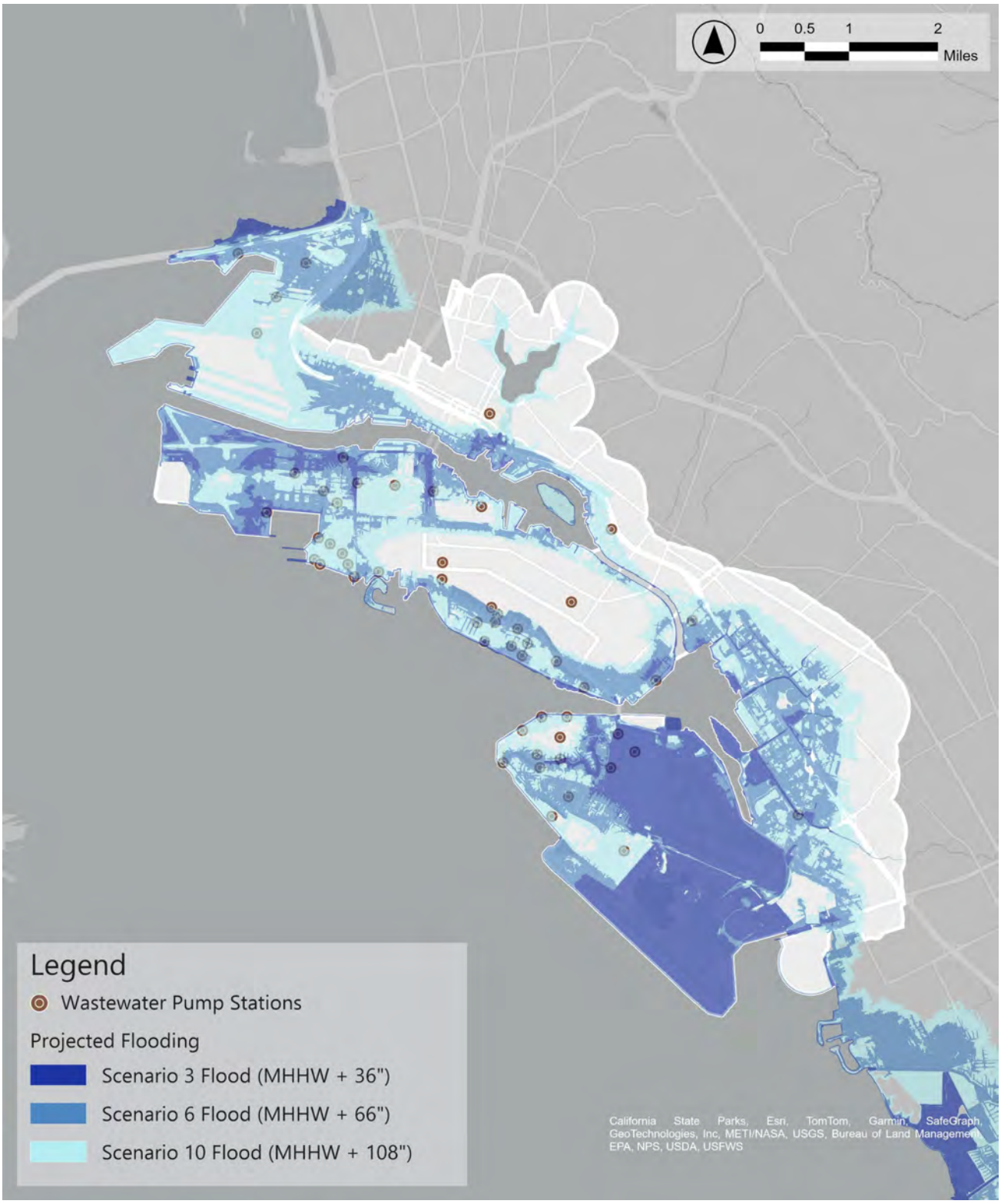



Figure 15. Wastewater Pump Stations and Lift Stations Exposed to Flooding within the Subregion

Data Source: (City of Alameda 2023c; City of Oakland 2023c; Vandever et al. 2017)

## 8.2 Sensitivity, Adaptive Capacity, and Consequences

Wastewater pipes, pumps, and treatment plants can be **sensitive** to frequent and prolonged flooding and tidal inundation. Floodwater can infiltrate wastewater pipes, increasing the total volume of wastewater in the system conveyed to the treatment plant (City of Alameda 2022). EBMUD's Wastewater Climate Change Plan suggests that temporary inundation of pumps may temporarily disrupt their function. Sea level rise will also reduce the overall system discharge capacity because the pumps would be operating against a higher pressure due to higher Bay water levels (EBMUD 2020). EBMUD pump stations are less sensitive to potential power outages (which could be a cascading effect of a major flood event). They are equipped to operate through local or widespread power outages, using equipment such as standby generators on-site, portable generators, and temporary pumps and hoses to divert sewage around disabled pumps (EBMUD 2020).

**Adaptive capacity** ranges from moderate to low depending on the size, location, and design of the wastewater asset. Smaller pump stations may have greater adaptive capacity than larger ones because there is some capacity to maintain their function using portable pumps. Some pump stations could be reengineered to improve their capacity to accommodate or adjust to storm events and tidal inundation. It is less likely that pump stations would be relocated; depending on the size of the facility, capital replacement costs can be fairly high and there may not be a feasible or appropriate alternative site (BCDC 2012).

Wastewater assets do not have the capacity to handle large, frequent, or severe storm events and tidal inundation, leading to potentially severe **consequences** including sewage overflows and backups into basements, streets, emergency overflow areas, and the Bay. Such disruptions could significantly impact the economy, society, environment, and governance. High costs for asset replacement, redesign, or relocation, and significant financial resources to restore full function, would affect residential, commercial, and industrial areas. Public health costs could rise due to exposure to pathogens from sewer overflows, affecting recreational resources and necessitating extensive cleanup. The Bay ecosystem could experience potential significant impacts from untreated wastewater discharges. Governance challenges would involve complex coordination among various owners, operators, and regulatory bodies, especially under changing climate conditions (BCDC 2012).

# 9 Next Steps

The assessment informs the first iteration of the Subregional Adaptation Plan (anticipated 2025). This effort was time- and budget-limited, and the OAAC members have identified data and analysis gaps. BCDC's RSAP guidelines, which were not adopted at the time of this analysis, also recommend an evaluation of additional assets and vulnerabilities. Expansion of the analysis to fill these and other data gaps may occur when additional funding becomes available. Examples include:

- **Conduct groundwater exposure assessment**. As sea levels rise, groundwater in low-lying coastal communities will also rise (Plane, Hill, and May 2019; Befus et al. 2020; May et al. 2023). A rising groundwater table can damage underground infrastructure (May 2020), mobilize soil contaminants (Hill et al. 2023), and increase liquefaction risks during earthquakes (Grant et al. 2021).
- **Expand exposure assessment to additional asset categories, demographic information, and environmental and health considerations**. Examples may include:
    - Vulnerable populations and environmental justice communities
    - Health care facilities and other community services
    - Existing Baylands habitats, such as eelgrass habitat, beaches, rocky intertidal areas, and estuarine-terrestrial transition zones
    - Current and future land uses, including affordable housing sites and housing element opportunity sites, job spaces, and open space
    - Emergency facilities and access routes (e.g., fire and police stations, critical facilities identified in the Metropolitan Transportation Commission's 2021 Multi-Jurisdictional Hazard Mitigation Plan) and single points of entry
    - Additional transportation assets, (e.g., rail, bus, and ferry)
    - Contaminated sites
- **Address data gaps for assets included in this assessment**. This includes the Maritime Street bike path; Middle Harbor Shoreline Park; Port View Park; additional stormwater assets, including catch basins; and updated GIS data for stormwater and wastewater assets within the City of Oakland and the Port of Oakland's jurisdiction.

The Port will address some of the data gaps in the sea level rise vulnerability assessment of Port lands and adjacent communities. The Port's assessment will also include a detailed assessment of rising groundwater and groundwater intrusion. The City of Oakland's Storm Drainage Master Plan Project was still underway at the time of this assessment, and this project will fill asset-based data gaps for the Oakland stormwater system. Both projects are led by OAAC partners, and the findings will inform future iterations of the Subregional Adaptation Plan.

OAAC partners are also working to identify other potential funding sources to fill the remaining data gaps, and to support further strategy refinement and evaluation, expand community engagement, conduct additional technical analysis, and advance project governance and funding approaches.

# 10 References


AECOM, MTC, and BCDC. 2017. “Alameda County Digital Elevation Model (1-Meter).” Geodatabase.

Aerts, Jeroen C. J. H. 2018. “A Review of Cost Estimates for Flood Adaptation.” *Water* 10 (11): 1646. https://doi.org/10.3390/w10111646.

Alameda County. 2022a. “Cities.” Shapefile. https://data.acgov.org/datasets/f42e1e37bd20495d94100d6153c929a9_0/explore?location=37.776459%2C-122.139444%2C12.00.

———. 2022b. “Street Centerlines.” Shapefile. https://data.acgov.org/datasets/da0be53b6d0d44eda6c1d88a799b5fb0/explore.

BCDC. 2012. “Adapting to Rising Tides Existing Conditions and Stressors Report.” Prepared by the San Francisco Bay Conservation and Development Commission. https://www.adaptingtorisingtides.org/wp-content/uploads/2015/04/ART_ExistingCondtionsReport_final_sm.pdf.

———. 2024. “RSAP (DRAFT).”

Befus, K. M., P. L. Barnard, D. J. Hoover, J. A. Finzi Hart, and C. I. Voss. 2020. “Increasing Threat of Coastal Groundwater Hazards from Sea-Level Rise in California.” *Nature Climate Change* 10 (10): 946–52. https://doi.org/10.1038/s41558-020-0874-1.

Caltrans. 2022. “State Highway Network.”

CCSF. 2020. “Sea Level Rise Vulnerability and Consequence Assessment.” San Francisco, CA: City and County of San Francisco, San Francisco Planning. https://sfplanning.org/sea-level-rise-action-plan.

City of Alameda. 2019. “Climate Action and Resiliency Plan.” City of Alameda. https://www.alamedaca.gov/Departments/Planning-Building-and-Transportation/Sustainability-and-Resilience/Climate-Action-and-Resiliency-Plan-CARP.

———. 2022. “Climate Adaptation and Hazard Mitigation Plan Appendix F: Detailed Flood and Sea Level Rise Risk Assessment.”

———. 2023a. “City Parks.” Geodatabase.

———. 2023b. “Pedestrian Trails.” Geodatabase.

———. 2023c. “Sanitary Sewer Lift Stations.” Geodatabase.

———. 2023d. “Sanitary Sewer Main.” Geodatabase.

———. 2023e. “Stormwater Pipes.” Geodatabase.

———. 2023f. “Stormwater Pump Stations.” Geodatabase.

City of Oakland. 2015. “Oakland General Plan.”

———. 2023a. “Oakland Parks.” Geodatabase.

———. 2023b. “Sanitary Sewer Collection System.” Geodatabase.

———. 2023c. “Sanitary Sewer Pump Stations.” Geodatabase.

———. 2023d. “Storm Drain Pipes.” Geodatabase.

———. 2023e. “Storm Drain Pumps.” Geodatabase.

EBMUD. 2020. “Wastewater Climate Change Plan.” https://www.ebmud.com/application/files/3916/0078/8240/EBMUD_Climate_Change_Plan_June_2020_wGuidelines.pdf.

———. 2023. “Wastewater Interceptors.” Geodatabase.

EBRPD. 2023. “EBRPD Parks & Trails.”

FEMA. 2018. “FEMA Flood Insurance Study - Alameda County, CA and Incorporated Areas.”

Grant, Alex R. R., Anne M. Wein, Kevin Befus, Juliette Finzi Hart, Mike T. Frame, Rachel Volentine, Patrick Barnard, and Keith Knudsen. 2021. “Changes in Liquefaction Severity in the San Francisco Bay Area with Sea-Level Rise.” *Geo-Extreme 2021 : Climatic Extremes and Earthquake Modeling*. https://doi.org/10.1061/9780784483695.030.

Hill, K., D. Hirschfeld, C. Lindquist, F. Cook, and S. Warner. 2023. “Rising Coastal Groundwater as a Result of Sea-Level Rise Will Influence Contaminated Coastal Sites and Underground Infrastructure.” *Earth’s Future* 11 (9): e2023EF003825. https://doi.org/10.1029/2023EF003825.

May, C.L. 2020. “Rising Groundwater and Sea-Level Rise.” *Nature Climate Change* 10:889–90. https://doi.org/10.1038/s41558-020-0886-x.

May, C.L., M.S. Osler, H.F. Stockdon, P.L. Barnard, J.A. Callahan, R.C. Collini, C.M. Ferreira, et al. 2023. “Chapter 9 : Coastal Effects. Fifth National Climate Assessment.” In *Fifth National Climate Assessment*, edited by A.R. Crimmins, C.W. Avery, D.R. Easterling, K.E. Kunkel, B.C. Stewart, and T.K. Maycock. Washington, DC, USA: U.S. Global Change Research Program. https://doi.org/10.7930/NCA5.2023.CH9.

MTC. 2010. “Alameda County Bikeways.” http://purl.stanford.edu/ht211xd7810.

NOAA. 2024. “Understanding Stormwater Inundation.” 2024. https://coast.noaa.gov/stormwater-floods/understand/.

OAAC. 2024. “OAAC ADAPT: Oakland-Alameda Adaptation Projects, Existing Conditions Report.” Prepared for the Oakland Alameda Adaptation Committee by CMG Landscape Architecture, Pathways Climate Institute, Moffat & Nichol, Schaaf & Wheeler, ESA, and Earth Mechanics, Inc.

OPC, OST, and California Sea Level Rise Task Force. 2024. “California Sea Level Rise Guidance: 2024 Science and Policy Update.” https://opc.ca.gov/wp-content/uploads/2024/05/Item-4-Exhibit-A-Final-Draft-Sea-Level-Rise-Guidance-Update-2024-508.pdf?utm_medium=email&utm_source=govdelivery.

Patricola, Christina M., Michael F. Wehner, Emily Bercos-Hickey, Flor Vanessa Maciel, Christine May, Michael Mak, Olivia Yip, Anna Roche, and Susan Leal. 2022. “Future Changes in Extreme Precipitation over the San Francisco Bay Area: Dependence on Atmospheric River and Extratropical Cyclone Events.” *Weather and Climate Extremes* 36. https://doi.org/10.1016/j.wace.2022.100440.

Plane, E., K. Hill, and C. L. May. 2019. “A Rapid Assessment Method to Identify Potential Groundwater Flooding Hotspots as Driven by Sea Levels Rise in Coastal Cities.” *Water* 2228 (11): 8–10. https://doi.org/10.3390/w11112228.

Port of Oakland. 2023. “Stormwater Management and Tidal Flooding Vulnerability Assessment at North Field Oakland International Airport: Tidal Flooding Vulnerability Assessment.” Prepared by Wood Rogers for the Port of Oakland.

Schaaf and Wheeler. 2019. “Storm Drain Network.” Geodatabase.

SFEI. 2019. “San Francisco Bay Shoreline Adaptation Atlas GIS Data.” Geodatabase. https://www.sfei.org/data/adaptation-atlas-data#sthash.YmDm4rD4.dpbs.

SFEI, and SPUR. 2019. “San Francisco Bay Shoreline Adaptation Atlas: Working with Nature to Plan for Sea Level Rise - Using Operational Landscape Units.”

Sweet, W.V., B.D. Hamlington, R.E. Kopp, C.P. Weaver, P.L. Barnard, D. Bekaert, W. Brooks, et al. 2022. “Global and Regional Sea Level Rise Scenarios for the United States: Updated Mean Projections and Extreme Water Level Probabilities Along U.S. Coastlines.” Silver Spring, Maryland: NOAA Technical Report NOS 01.

Union of Concerned Scientists. 2018. “Underwater: Rising Seas, Chronic Floods, and the Implications for US Coastal Real Estate.”

USACE. 2022. “National Structure Inventory.” https://nsi.sec.usace.army.mil/downloads/.

Vandever, Justin, Mark Lightner, Sarah Kassem, Julie Guyenet, Michael Mak, and Claire Bonham-Carter. 2017. “Adapting to Rising Tides Bay Area Sea Level Rise Analysis and Mapping Project.” San Francisco, CA: Prepared by AECOM for the San Francisco Bay Conservation and Development Commission, the Metropolitan Transportation Commission, and the Bay Area Toll Authority.

Wolff, Claudia, Hedda Bonatz, and Athanasios T. Vafeidis. 2023. “Setback Zones Can Effectively Reduce Exposure to Sea-Level Rise in Europe.” *Scientific Reports* 13 (1): 5515. https://doi.org/10.1038/s41598-023-32059-9.

# Attachment A: Detailed Exposure Tables

Caution: Values in the tables below have been rounded to one tenth of a unit, while recognizing this suggests a higher level of precision at the subwatershed scale than is warranted by this analysis. This is intended to support the aggregation of subwatershed results to support high-level planning.

## A.1. Land Area

| Acres of Land Exposed within the Subregion | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Water Level Scenarios | | | | | | | |
| Area | Total Acres | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| O-01 | 545.2 | 38.6 | 44.7 | 46.8 | 55.8 | 93.5 | 118.9 | 218.4 | 295.4 |
| O-02 | 780.9 | 1.4 | 16.5 | 153.2 | 274.8 | 423.4 | 516.4 | 621.2 | 673.7 |
| O-03 | 137.5 | - | - | 45.5 | 56.2 | 60.7 | 62.8 | 65.5 | 68.5 |
| O-04 | 1323.8 | 13.5 | 15.9 | 136.5 | 308.0 | 430.9 | 519.0 | 647.4 | 784.1 |
| O-05 | 277.2 | 13.9 | 23.3 | 28.5 | 63.5 | 89.4 | 97.3 | 105.1 | 113.3 |
| O-06 | 1772.0 | 24.6 | 37.9 | 44.7 | 68.5 | 326.0 | 346.1 | 380.6 | 408.9 |
| O-07 | 117.2 | 13.4 | 43.2 | 51.6 | 71.4 | 82.1 | 85.8 | 93.7 | 94.1 |
| O-08 | 139.4 | 2.7 | 3.6 | 4.3 | 12.6 | 18.3 | 20.2 | 22.1 | 22.5 |
| O-09 | 143.7 | 1.9 | 2.5 | 2.8 | 10.1 | 21.6 | 28.0 | 41.9 | 51.1 |
| O-10 | 198.6 | 2.3 | 3.2 | 3.4 | 5.2 | 7.9 | 16.6 | 31.2 | 39.3 |
| O-11 | 199.9 | 4.8 | 5.1 | 5.2 | 7.0 | 17.4 | 30.3 | 48.5 | 67.9 |
| O-12 | 58.4 | 1.1 | 1.1 | 1.1 | 1.2 | 1.2 | 1.2 | 1.3 | 3.2 |
| O-13 | 114.8 | 4.9 | 20.6 | 24.8 | 38.6 | 48.1 | 52.5 | 57.9 | 67.3 |
| O-14 | 24.7 | 7.3 | 14.5 | 16.9 | 21.2 | 22.1 | 22.2 | 22.2 | 22.3 |
| O-15 | 57.6 | 11.5 | 15.5 | 17.6 | 24.0 | 32.2 | 37.7 | 42.2 | 46.1 |
| O-16 | 19.8 | 3.1 | 3.5 | 3.6 | 4.3 | 5.0 | 6.2 | 8.3 | 9.6 |
| O-17 | 135.7 | 51.5 | 62.1 | 67.2 | 81.4 | 88.5 | 91.4 | 94.2 | 95.4 |
| O-18 | 77.5 | 34.5 | 41.7 | 42.7 | 44.6 | 45.5 | 45.8 | 46.2 | 46.5 |
| O-19 | 810.3 | 16.3 | 60.2 | 80.9 | 167.5 | 256.5 | 290.9 | 330.1 | 359.8 |
| O-20 | 603.3 | 20.0 | 72.4 | 83.6 | 172.2 | 255.9 | 288.4 | 324.0 | 344.3 |
| O-21 | 941.4 | 30.1 | 88.4 | 124.9 | 272.0 | 359.5 | 413.0 | 472.8 | 515.1 |
| O-22 | 1005.1 | 83.5 | 164.2 | 219.6 | 443.9 | 539.5 | 572.4 | 612.4 | 647.2 |
| O-23 | 101.4 | 0.5 | 1.1 | 1.3 | 8.2 | 10.2 | 11.6 | 16.2 | 20.1 |
| O-24 | 970.3 | 840.5 | 884.3 | 895.7 | 930.2 | 951.4 | 960.3 | 967.6 | 969.0 |
| O-25 | 1537.9 | 1344.0 | 1468.2 | 1478.1 | 1501.3 | 1512.5 | 1516.1 | 1521.2 | 1524.3 |
| O-26 | 117.2 | 20.5 | 21.7 | 22.3 | 25.1 | 27.3 | 28.5 | 30.3 | 31.4 |
| A-01 | 260.1 | 59.7 | 132.1 | 149.3 | 201.7 | 222.8 | 233.0 | 240.7 | 242.0 |
| A-02 | 371.6 | 103.1 | 163.9 | 183.8 | 249.4 | 310.5 | 340.8 | 353.7 | 354.5 |

| Acres of Land Exposed within the Subregion | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Water Level Scenarios | | | | | | | |
| Area | Total Acres | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| A-03 | 574.5 | 45.9 | 80.3 | 94.6 | 172.9 | 244.1 | 294.9 | 411.1 | 487.3 |
| A-04 | 386.3 | 36.5 | 78.5 | 93.4 | 123.3 | 141.4 | 150.8 | 167.4 | 178.5 |
| A-05 | 610.7 | 23.2 | 44.4 | 50.9 | 100.8 | 133.8 | 159.7 | 200.0 | 228.2 |
| A-06 | 745.8 | 35.2 | 66.9 | 75.2 | 117.2 | 147.3 | 165.7 | 202.0 | 253.9 |
| A-07 | 610.6 | 123.4 | 226.4 | 256.9 | 345.2 | 401.7 | 426.9 | 451.9 | 466.0 |
| A-08 | 479.9 | 33.4 | 63.3 | 79.1 | 161.4 | 244.9 | 294.1 | 330.4 | 336.2 |
| A-09 | 335.1 | 20.6 | 40.5 | 44.7 | 79.2 | 121.9 | 141.3 | 166.5 | 185.7 |
| A-10 | 215.9 | 35.5 | 57.3 | 65.3 | 94.6 | 117.5 | 132.6 | 152.0 | 163.4 |
| A-11 | 952.6 | - | 204.6 | 235.5 | 333.8 | 406.5 | 445.1 | 488.3 | 516.3 |
| A-12 | 58.2 | 8.1 | 10.2 | 10.8 | 12.7 | 14.0 | 14.4 | 15.0 | 15.9 |
| A-13 | 143.4 | 8.6 | 12.0 | 13.4 | 19.9 | 30.4 | 43.4 | 64.9 | 87.5 |
| A-14 | 408.9 | 6.0 | 15.1 | 98.2 | 178.0 | 212.8 | 256.7 | 296.2 | 328.6 |
| A-15 | 129.6 | 0.1 | 2.6 | 3.5 | 9.5 | 15.6 | 56.0 | 91.2 | 117.6 |
| A-16 | 535.2 | 432.9 | 467.0 | 477.4 | 508.8 | 522.0 | 525.8 | 530.0 | 532.7 |
| A-17 | 372.5 | 69.6 | 128.2 | 147.3 | 204.9 | 247.9 | 271.7 | 301.0 | 325.0 |
| A-18 | 65.6 | 1.4 | 2.2 | 2.7 | 8.4 | 21.4 | 34.5 | 56.9 | 64.5 |

Data Source: (Vandever et al. 2017)

## A.2. Buildings

| Number of Commercial and Residential Buildings Exposed within the Subregion | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Area | Building Type | Total Buildings | Water Level Scenarios | | | | | | | |
| | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| O-01 | Commercial | 4 | - | - | - | - | - | - | 2 | 3 |
| | Residential | - | - | - | - | - | - | - | - | - |
| O-02 | Commercial | 24 | - | - | 4 | 12 | 14 | 17 | 21 | 22 |
| | Residential | - | - | - | - | - | - | - | - | - |
| O-03 | Commercial | 54 | - | - | 1 | 2 | 2 | 2 | 2 | 2 |
| | Residential | 124 | - | - | - | - | - | 44 | 44 | 44 |
| O-04 | Commercial | 274 | - | - | 12 | 37 | 52 | 59 | 62 | 84 |
| | Residential | 768 | - | - | 33 | 92 | 125 | 139 | 171 | 200 |
| O-05 | Commercial | 470 | 1 | 6 | 8 | 42 | 65 | 83 | 96 | 107 |
| | Residential | 604 | 1 | 5 | 5 | 7 | 111 | 116 | 118 | 124 |
| O-06 | Commercial | 1,641 | 1 | 1 | 1 | 2 | 45 | 77 | 126 | 162 |
| | Residential | 5,311 | - | - | - | 2 | 57 | 61 | 109 | 131 |
| O-07 | Commercial | 15 | 4 | 9 | 10 | 13 | 14 | 14 | 14 | 14 |
| | Residential | 7 | 2 | 2 | 2 | 4 | 4 | 4 | 5 | 5 |
| O-08 | Commercial | 85 | - | - | - | - | - | - | - | - |
| | Residential | 371 | - | - | - | - | 1 | 1 | 1 | 1 |
| O-09 | Commercial | 109 | - | - | - | - | 5 | 8 | 15 | 21 |
| | Residential | 281 | - | - | - | - | 1 | 1 | 2 | 2 |
| O-10 | Commercial | 99 | - | - | - | - | - | 2 | 8 | 10 |
| | Residential | 398 | - | - | - | - | - | - | 3 | 3 |
| O-11 | Commercial | 68 | - | - | - | - | 2 | 6 | 14 | 25 |
| | Residential | 372 | - | - | - | - | 1 | 47 | 69 | 79 |
| O-12 | Commercial | 10 | - | - | - | - | - | - | - | - |
| | Residential | 58 | - | - | - | - | - | - | - | - |
| O-13 | Commercial | 22 | - | 6 | 6 | 6 | 10 | 10 | 10 | 15 |
| | Residential | 17 | - | - | - | - | - | - | 1 | 1 |
| O-14 | Commercial | 4 | - | 2 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Residential | - | - | - | - | - | - | - | - | - |
| O-15 | Commercial | - | - | - | - | - | - | - | - | - |
| | Residential | - | - | - | - | - | - | - | - | - |
| O-16 | Commercial | - | - | - | - | - | - | - | - | - |
| | Residential | - | - | - | - | - | - | - | - | - |
| O-17 | Commercial | 1 | - | - | - | - | 1 | 1 | 1 | 1 |
| | Residential | - | - | - | - | - | - | - | - | - |

| Number of Commercial and Residential Buildings Exposed within the Subregion | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Area | Building Type | Total Buildings | Water Level Scenarios | | | | | | | |
| | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| O-18 | Commercial | 1 | - | - | 1 | 1 | 1 | 1 | 1 | 1 |
| | Residential | - | - | - | - | - | - | - | - | - |
| O-19 | Commercial | 347 | - | 14 | 21 | 46 | 74 | 83 | 93 | 98 |
| | Residential | 1,612 | - | 9 | 13 | 28 | 105 | 145 | 203 | 254 |
| O-20 | Commercial | 111 | - | - | - | 6 | 17 | 20 | 21 | 21 |
| | Residential | 1,599 | 1 | 1 | 1 | 68 | 145 | 165 | 231 | 298 |
| O-21 | Commercial | 243 | - | 7 | 9 | 69 | 104 | 122 | 147 | 155 |
| | Residential | 1,368 | - | 1 | 1 | 17 | 40 | 55 | 84 | 97 |
| O-22 | Commercial | 223 | - | 3 | 11 | 94 | 151 | 164 | 177 | 181 |
| | Residential | 1,948 | 1 | 73 | 120 | 244 | 328 | 342 | 380 | 451 |
| O-23 | Commercial | - | - | - | - | - | - | - | - | - |
| | Residential | - | - | - | - | - | - | - | - | - |
| O-24 | Commercial | 26 | 9 | 10 | 10 | 16 | 20 | 23 | 26 | 26 |
| | Residential | - | - | - | - | - | - | - | - | - |
| O-25 | Commercial | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| | Residential | - | - | - | - | - | - | - | - | - |
| O-26 | Commercial | - | - | - | - | - | - | - | - | - |
| | Residential | - | - | - | - | - | - | - | - | - |
| A-01 | Commercial | - | - | - | - | - | - | - | - | - |
| | Residential | - | - | - | - | - | - | - | - | - |
| A-02 | Commercial | 20 | 3 | 8 | 9 | 9 | 16 | 19 | 20 | 20 |
| | Residential | 82 | 11 | 25 | 33 | 52 | 76 | 82 | 82 | 82 |
| A-03 | Commercial | 94 | 5 | 10 | 11 | 23 | 33 | 42 | 54 | 69 |
| | Residential | 1,237 | 21 | 50 | 54 | 154 | 264 | 362 | 669 | 1,008 |
| A-04 | Commercial | 175 | 15 | 31 | 32 | 49 | 53 | 59 | 68 | 74 |
| | Residential | 1,506 | 70 | 148 | 185 | 254 | 302 | 320 | 379 | 401 |
| A-05 | Commercial | 227 | 0 | 15 | 20 | 46 | 63 | 73 | 105 | 110 |
| | Residential | 1,994 | 0 | 1 | 5 | 48 | 101 | 120 | 211 | 274 |
| A-06 | Commercial | 452 | 1 | 3 | 5 | 16 | 34 | 43 | 55 | 96 |
| | Residential | 3,249 | 101 | 288 | 344 | 535 | 652 | 728 | 871 | 1,047 |
| A-07 | Commercial | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Residential | - | - | - | - | - | - | - | - | - |
| A-08 | Commercial | 16 | 0 | 0 | 1 | 9 | 13 | 13 | 16 | 16 |
| | Residential | 14 | 0 | 0 | 0 | 1 | 11 | 14 | 14 | 14 |
| A-09 | Commercial | 96 | 0 | 0 | 0 | 0 | 6 | 8 | 12 | 16 |
| | Residential | 1,151 | 0 | 0 | 0 | 36 | 113 | 203 | 345 | 461 |
| A-10 | Commercial | 47 | 1 | 3 | 6 | 13 | 23 | 26 | 35 | 47 |

| Number of Commercial and Residential Buildings Exposed within the Subregion | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Area | Building Type | Total Buildings | Water Level Scenarios | | | | | | | |
| | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| | Residential | 296 | 0 | 16 | 32 | 153 | 178 | 208 | 280 | 293 |
| A-11 | Commercial | 299 | 0 | 20 | 25 | 53 | 67 | 76 | 87 | 104 |
| | Residential | 4,541 | 0 | 635 | 784 | 1,230 | 1,585 | 1,834 | 2,056 | 2,143 |
| A-12 | Commercial | - | - | - | - | - | - | - | - | - |
| | Residential | - | - | - | - | - | - | - | - | - |
| A-13 | Commercial | 14 | 0 | 0 | 0 | 1 | 1 | 4 | 6 | 9 |
| | Residential | 509 | 0 | 0 | 0 | 1 | 16 | 48 | 148 | 320 |
| A-14 | Commercial | 70 | 0 | 0 | 3 | 9 | 20 | 21 | 27 | 41 |
| | Residential | 1,622 | 2 | 5 | 294 | 1,156 | 1,387 | 1,468 | 1,542 | 1,605 |
| A-15 | Commercial | 40 | 0 | 0 | 0 | 0 | 0 | 3 | 5 | 21 |
| | Residential | - | - | - | - | - | - | - | - | - |
| A-16 | Commercial | 35 | 15 | 22 | 27 | 32 | 34 | 34 | 35 | 35 |
| | Residential | 1,045 | 401 | 616 | 658 | 882 | 998 | 1,022 | 1,045 | 1,045 |
| A-17 | Commercial | 34 | 3 | 8 | 10 | 13 | 17 | 20 | 22 | 24 |
| | Residential | 1,885 | 131 | 332 | 428 | 749 | 1,035 | 1,235 | 1,443 | 1,585 |
| A-18 | Commercial | - | - | - | - | - | - | - | - | - |
| | Residential | - | - | - | - | - | - | - | - | - |

## A.3. Roadways

| Miles of Roadway Exposed within the Subregion | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Water Level Scenarios | | | | | | | |
| Area | Roadway Type | Total Miles | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| O-01 | Local | - | - | - | - | - | - | - | - | - |
| | Major Arterial | 2.0 | - | - | - | - | 0.4 | 0.5 | 0.9 | 1.1 |
| | Freeway | - | - | - | - | - | - | - | - | - |
| O-02 | Local | 12.3 | - | - | 3.3 | 6.4 | 10.2 | 11.5 | 12.0 | 12.2 |
| | Major Arterial | 1.6 | - | - | - | - | 0.6 | 0.7 | 0.8 | 0.9 |
| | Freeway | 3.1 | - | - | 1.1 | 1.6 | 2.0 | 2.2 | 2.5 | 2.8 |
| O-03 | Local | 5.3 | - | - | 1.4 | 1.7 | 2.0 | 2.1 | 2.2 | 2.3 |
| | Major Arterial | 1.6 | - | - | - | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| | Freeway | 5.8 | - | - | 2.8 | 3.5 | 3.7 | 3.8 | 4.0 | 4.2 |
| O-04 | Local | 17.7 | - | 0.1 | 2.4 | 4.4 | 6.3 | 7.2 | 8.2 | 9.2 |
| | Major Arterial | 10.7 | - | - | 0.7 | 1.2 | 2.2 | 2.3 | 2.6 | 3.8 |
| | Freeway | 5.1 | - | - | 0.4 | 0.7 | 0.8 | 0.9 | 1.0 | 1.4 |
| O-05 | Local | 9.0 | 0.3 | 0.4 | 0.5 | 1.7 | 2.3 | 2.5 | 2.8 | 3.1 |
| | Major Arterial | 6.2 | - | - | - | 0.4 | 0.7 | 0.8 | 1.0 | 1.1 |
| | Freeway | 2.0 | - | - | - | - | - | - | - | 0.1 |
| O-06 | Local | 44.2 | 0.3 | 0.6 | 0.7 | 1.1 | 2.3 | 2.6 | 3.2 | 3.9 |
| | Major Arterial | 20.7 | - | - | - | - | 3.7 | 4.0 | 4.6 | 5.2 |
| | Freeway | 3.5 | 0.2 | 0.4 | 0.5 | 0.7 | 0.9 | 1.0 | 1.1 | 1.2 |
| O-07 | Local | 2.4 | 0.1 | 1.2 | 1.6 | 2.1 | 2.2 | 2.3 | 2.3 | 2.3 |
| | Major Arterial | 0.1 | - | - | - | - | - | - | - | - |
| | Freeway | 1.4 | - | 0.5 | 0.6 | 1.1 | 1.2 | 1.3 | 1.4 | 1.4 |
| O-08 | Local | 5.0 | - | - | - | 0.5 | 0.6 | 0.6 | 0.6 | 0.7 |
| | Major Arterial | 2.8 | - | - | - | - | - | - | - | - |
| | Freeway | 0.9 | - | - | - | 0.1 | 0.3 | 0.5 | 0.8 | 0.9 |
| O-09 | Local | 5.3 | - | - | - | 0.4 | 0.6 | 0.6 | 0.9 | 1.0 |
| | Major Arterial | 2.3 | - | - | - | - | 0.3 | 0.3 | 0.4 | 0.5 |
| | Freeway | 1.0 | - | - | - | - | - | 0.2 | 0.5 | 0.7 |
| O-10 | Local | 6.3 | - | 0.1 | 0.1 | 0.2 | 0.4 | 0.6 | 0.9 | 1.2 |
| | Major Arterial | 2.3 | - | - | - | - | - | - | - | - |
| | Freeway | 0.6 | - | - | - | - | - | - | - | - |
| O-11 | Local | 7.4 | - | - | - | 0.1 | 0.4 | 0.8 | 1.5 | 1.9 |
| | Major Arterial | 0.9 | - | - | - | - | 0.1 | 0.1 | 0.2 | 0.3 |
| | Freeway | 1.6 | - | - | - | - | - | - | - | - |
| O-12 | Local | 1.5 | - | - | - | - | - | - | - | 0.1 |
| | Major Arterial | 0.7 | - | - | - | - | - | - | - | - |
| | Freeway | 0.5 | - | - | - | - | - | - | - | - |

| Miles of Roadway Exposed within the Subregion | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Water Level Scenarios | | | | | | | |
| Area | Roadway Type | Total Miles | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| O-13 | Local | 1.9 | - | 0.2 | 0.2 | 0.4 | 0.5 | 0.5 | 0.6 | 0.9 |
| | Major Arterial | 0.1 | - | - | - | - | - | - | - | - |
| | Freeway | 0.6 | - | - | - | - | - | - | - | - |
| O-14 | Local | 0.2 | - | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| | Major Arterial | - | - | - | - | - | - | - | - | - |
| | Freeway | - | - | - | - | - | - | - | - | - |
| O-15 | Local | 0.7 | - | - | - | 0.4 | 0.6 | 0.6 | 0.7 | 0.7 |
| | Major Arterial | - | - | - | - | - | - | - | - | - |
| | Freeway | - | - | - | - | - | - | - | - | - |
| O-16 | Local | - | - | - | - | - | - | - | - | - |
| | Major Arterial | - | - | - | - | - | - | - | - | - |
| | Freeway | - | - | - | - | - | - | - | - | - |
| O-17 | Local | 0.5 | - | 0.1 | 0.2 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| | Major Arterial | - | - | - | - | - | - | - | - | - |
| | Freeway | - | - | - | - | - | - | - | - | - |
| O-18 | Local | 0.2 | - | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| | Major Arterial | 1.0 | 0.5 | 0.9 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| | Freeway | - | - | - | - | - | - | - | - | - |
| O-19 | Local | 19.6 | 0.1 | 1.0 | 1.4 | 3.1 | 4.8 | 5.3 | 6.1 | 7.2 |
| | Major Arterial | 6.2 | - | - | 0.1 | 0.2 | 0.8 | 1.1 | 1.4 | 1.5 |
| | Freeway | 2.5 | - | - | 0.1 | 0.8 | 1.0 | 1.2 | 1.5 | 1.6 |
| O-20 | Local | 16.7 | 0.2 | 0.9 | 1.2 | 4.9 | 6.5 | 7.1 | 7.7 | 8.3 |
| | Major Arterial | 3.8 | 0.1 | 0.1 | 0.1 | 0.2 | 0.6 | 0.9 | 1.1 | 1.3 |
| | Freeway | 1.2 | - | 0.1 | 0.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| O-21 | Local | 19.1 | 0.2 | 1.8 | 2.6 | 5.8 | 6.3 | 6.8 | 7.2 | 8.1 |
| | Major Arterial | 5.3 | 0.1 | 0.5 | 1.0 | 2.5 | 2.8 | 3.0 | 3.3 | 3.6 |
| | Freeway | 2.2 | - | 0.9 | 1.9 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 |
| O-22 | Local | 23.2 | 1.1 | 2.6 | 3.7 | 8.0 | 8.9 | 9.5 | 10.2 | 11.4 |
| | Major Arterial | 4.2 | 0.2 | 0.3 | 0.4 | 1.4 | 2.0 | 2.2 | 2.3 | 2.4 |
| | Freeway | 2.5 | - | - | 0.3 | 0.4 | 0.6 | 0.6 | 0.9 | 1.1 |
| O-23 | Local | - | - | - | - | - | - | - | - | - |
| | Major Arterial | - | - | - | - | - | - | - | - | - |
| | Freeway | - | - | - | - | - | - | - | - | - |
| O-24 | Local | 7.6 | 6.3 | 6.4 | 7.1 | 7.2 | 7.3 | 7.4 | 7.4 | 7.0 |
| | Major Arterial | 1.7 | 0.5 | 1.3 | 1.5 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 |
| | Freeway | - | - | - | - | - | - | - | - | - |
| O-25 | Local | 7.5 | 6.4 | 6.5 | 6.7 | 6.8 | 6.8 | 6.9 | 7.0 | 7.0 |
| | Major Arterial | - | - | - | - | - | - | - | - | - |

| Miles of Roadway Exposed within the Subregion | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Water Level Scenarios | | | | | | | |
| Area | Roadway Type | Total Miles | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| | Freeway | - | - | - | - | - | - | - | - | - |
| | Local | - | - | - | - | - | - | - | - | - |
| O-26 | Major Arterial | - | - | - | - | - | - | - | - | - |
| | Freeway | - | - | - | - | - | - | - | - | - |
| | Local | 1.4 | 0.3 | 0.9 | 1.0 | 1.3 | 1.4 | 1.4 | 1.4 | 1.4 |
| A-01 | Major Arterial | - | - | - | - | - | - | - | - | - |
| | Freeway | - | - | - | - | - | - | - | - | - |
| | Local | 10.1 | 3.5 | 4.7 | 5.3 | 7.3 | 9.6 | 10.0 | 10.1 | 10.1 |
| A-02 | Major Arterial | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| | Freeway | - | - | - | - | - | - | - | - | - |
| | Local | 20.8 | 0.8 | 2.4 | 2.8 | 5.7 | 8.8 | 11.5 | 17.4 | 19.7 |
| A-03 | Major Arterial | 3.2 | 1.0 | 1.2 | 1.3 | 1.8 | 2.0 | 2.1 | 2.5 | 2.6 |
| | Freeway | - | - | - | - | - | - | - | - | - |
| | Local | 10.4 | 0.9 | 2.1 | 2.4 | 3.3 | 3.7 | 3.9 | 4.6 | 5.2 |
| A-04 | Major Arterial | 4.1 | 1.0 | 1.3 | 1.4 | 1.7 | 1.8 | 1.8 | 1.9 | 2.0 |
| | Freeway | - | - | - | - | - | - | - | - | - |
| | Local | 15.1 | 0.0 | 0.4 | 0.5 | 1.9 | 2.9 | 3.5 | 4.8 | 5.8 |
| A-05 | Major Arterial | 4.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 |
| | Freeway | - | - | - | - | - | - | - | - | - |
| | Local | 19.4 | 1.0 | 1.8 | 2.1 | 3.4 | 4.6 | 5.1 | 6.5 | 7.9 |
| A-06 | Major Arterial | 7.4 | 0.2 | 0.4 | 0.4 | 0.8 | 0.9 | 1.0 | 1.2 | 1.4 |
| | Freeway | - | - | - | - | - | - | - | - | - |
| | Local | 2.7 | 1.1 | 2.0 | 2.3 | 2.7 | 2.7 | 2.7 | 2.7 | 2.7 |
| A-07 | Major Arterial | - | - | - | - | - | - | - | - | - |
| | Freeway | - | - | - | - | - | - | - | - | - |
| | Local | 7.0 | 0.1 | 0.5 | 0.7 | 3.1 | 5.0 | 6.3 | 6.9 | 7.0 |
| A-08 | Major Arterial | - | - | - | - | - | - | - | - | - |
| | Freeway | - | - | - | - | - | - | - | - | - |
| | Local | 6.2 | 0.0 | 0.1 | 0.1 | 1.0 | 1.8 | 2.2 | 3.0 | 3.4 |
| A-09 | Major Arterial | 2.4 | 0.0 | 0.0 | 0.0 | 0.1 | 0.6 | 0.8 | 1.1 | 1.3 |
| | Freeway | - | - | - | - | - | - | - | - | - |
| | Local | 4.6 | 0.2 | 0.8 | 1.0 | 2.2 | 3.2 | 3.7 | 4.2 | 4.5 |
| A-10 | Major Arterial | 0.5 | 0.0 | 0.1 | 0.2 | 0.2 | 0.3 | 0.3 | 0.4 | 0.5 |
| | Freeway | - | - | - | - | - | - | - | - | - |
| | Local | 26.6 | 0.0 | 5.2 | 6.1 | 9.6 | 11.2 | 11.7 | 12.7 | 13.4 |
| A-11 | Major Arterial | 8.6 | 0.0 | 2.3 | 2.8 | 3.3 | 3.5 | 3.7 | 3.9 | 4.0 |
| | Freeway | - | - | - | - | - | - | - | - | - |
| A-12 | Local | 0.7 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 |

| Miles of Roadway Exposed within the Subregion | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Water Level Scenarios | | | | | | | |
| Area | Roadway Type | Total Miles | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| | Major Arterial | 0.3 | 0.1 | 0.1 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 |
| | Freeway | - | - | - | - | - | - | - | - | - |
| | Local | 2.8 | 0.0 | 0.0 | 0.0 | 0.1 | 0.5 | 1.0 | 1.7 | 2.4 |
| A-13 | Major Arterial | 1.6 | 0.0 | 0.0 | 0.0 | 0.2 | 0.4 | 0.7 | 1.1 | 1.3 |
| | Freeway | - | - | - | - | - | - | - | - | - |
| | Local | 11.9 | 0.0 | 1.5 | 8.0 | 10.1 | 10.7 | 11.6 | 11.9 | 11.9 |
| A-14 | Major Arterial | 2.5 | 0.0 | 0.1 | 0.5 | 1.1 | 1.3 | 2.0 | 2.5 | 2.5 |
| | Freeway | - | - | - | - | - | - | - | - | - |
| | Local | 0.9 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.6 | 0.9 | 0.9 |
| A-15 | Major Arterial | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 0.5 | 0.5 |
| | Freeway | - | - | - | - | - | - | - | - | - |
| | Local | 7.9 | 4.9 | 6.3 | 6.5 | 7.6 | 7.8 | 7.9 | 7.9 | 7.9 |
| A-16 | Major Arterial | 3.7 | 3.0 | 3.1 | 3.2 | 3.5 | 3.6 | 3.6 | 3.7 | 3.7 |
| | Freeway | - | - | - | - | - | - | - | - | - |
| | Local | 12.7 | 2.4 | 5.0 | 6.1 | 8.2 | 9.2 | 10.0 | 10.9 | 11.8 |
| A-17 | Major Arterial | 2.0 | 0.0 | 0.2 | 0.4 | 0.8 | 1.1 | 1.3 | 1.6 | 1.8 |
| | Freeway | - | - | - | - | - | - | - | - | - |
| | Local | - | - | - | - | - | - | - | - | - |
| A-18 | Major Arterial | - | - | - | - | - | - | - | - | - |
| | Freeway | - | - | - | - | - | - | - | - | - |

Data Source: (Alameda County 2022b)

## A.4. Bikeways

| Miles of Bikeway Exposed within the Subregion | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Water Level Scenarios | | | | | | | |
| Area | Bikeway Type | Total Miles | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| O-01 | Class I - Bike Path | - | - | - | - | - | - | - | - | - |
| | Class II - Bike Lanes | - | - | - | - | - | - | - | - | - |
| | Class III - Bike Route | - | - | - | - | - | - | - | - | - |
| O-02 | Class I - Bike Path | - | - | - | - | - | - | - | - | - |
| | Class II - Bike Lanes | - | - | - | - | - | - | - | - | - |
| | Class III - Bike Route | - | - | - | - | - | - | - | - | - |
| O-03 | Class I - Bike Path | - | - | - | - | - | - | - | - | - |
| | Class II - Bike Lanes | 0.7 | - | - | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| | Class III - Bike Route | - | - | - | - | - | - | - | - | - |
| O-04 | Class I - Bike Path | - | - | - | - | - | - | - | - | - |
| | Class II - Bike Lanes | 1.6 | - | - | 0.5 | 0.7 | 0.8 | 0.8 | 0.8 | 0.9 |
| | Class III - Bike Route | 1.5 | - | - | - | - | 0.4 | 0.4 | 0.5 | 0.5 |
| O-05 | Class I - Bike Path | - | - | - | - | - | - | - | - | - |
| | Class II - Bike Lanes | - | - | - | - | - | - | - | - | - |
| | Class III - Bike Route | 3.0 | 0.1 | 0.2 | 0.2 | 1.2 | 1.5 | 1.6 | 1.7 | 1.8 |
| O-06 | Class I - Bike Path | 0.5 | 0.1 | 0.1 | 0.1 | 0.2 | 0.4 | 0.4 | 0.5 | 0.5 |
| | Class II - Bike Lanes | 4.1 | - | - | - | - | 0.2 | 0.4 | 0.7 | 0.8 |
| | Class III - Bike Route | 6.5 | 0.1 | 0.2 | 0.2 | 0.4 | 2.0 | 2.2 | 2.4 | 2.6 |

| Miles of Bikeway Exposed within the Subregion | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Water Level Scenarios | | | | | | | |
| Area | Bikeway Type | Total Miles | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| O-07 | Class I - Bike Path | - | - | - | - | - | - | - | - | - |
| | Class II - Bike Lanes | - | - | - | - | - | - | - | - | - |
| | Class III - Bike Route | 0.7 | - | 0.3 | 0.5 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| O-08 | Class I - Bike Path | - | - | - | - | - | - | - | - | - |
| | Class II - Bike Lanes | - | - | - | - | - | - | - | - | - |
| | Class III - Bike Route | 0.7 | - | - | - | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| O-09 | Class I - Bike Path | - | - | - | - | - | - | - | - | - |
| | Class II - Bike Lanes | - | - | - | - | - | - | - | - | - |
| | Class III - Bike Route | 0.4 | - | - | - | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 |
| O-10 | Class I - Bike Path | - | - | - | - | - | - | - | - | - |
| | Class II - Bike Lanes | - | - | - | - | - | - | - | - | - |
| | Class III - Bike Route | 0.4 | - | - | - | 0.1 | 0.2 | 0.4 | 0.4 | 0.4 |
| O-11 | Class I - Bike Path | 0.2 | - | - | - | - | - | 0.1 | 0.1 | 0.1 |
| | Class II - Bike Lanes | 0.2 | - | - | - | - | - | - | - | - |
| | Class III - Bike Route | 1.2 | - | - | - | - | 0.2 | 0.4 | 0.6 | 0.7 |
| O-12 | Class I - Bike Path | - | - | - | - | - | - | - | - | - |
| | Class II - Bike Lanes | 0.8 | - | - | - | - | - | - | - | - |
| | Class III - Bike Route | 0.6 | - | - | - | - | - | - | - | 0.1 |
| O-13 | Class I - Bike Path | 0.5 | - | 0.3 | 0.3 | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 |
| | Class II - Bike Lanes | - | - | - | - | - | - | - | - | - |

| Miles of Bikeway Exposed within the Subregion | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Water Level Scenarios | | | | | | | |
| Area | Bikeway Type | Total Miles | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| | Class III - Bike Route | 0.3 | - | - | - | - | - | - | - | 0.3 |
| O-14 | Class I - Bike Path | 0.3 | 0.1 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| | Class II - Bike Lanes | - | - | - | - | - | - | - | - | - |
| | Class III - Bike Route | - | - | - | - | - | - | - | - | - |
| O-15 | Class I - Bike Path | 0.7 | 0.2 | 0.4 | 0.5 | 0.6 | 0.7 | 0.7 | 0.7 | 0.7 |
| | Class II - Bike Lanes | - | - | - | - | - | - | - | - | - |
| | Class III - Bike Route | 0.3 | - | - | - | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 |
| O-16 | Class I - Bike Path | 0.5 | - | - | - | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 |
| | Class II - Bike Lanes | - | - | - | - | - | - | - | - | - |
| | Class III - Bike Route | - | - | - | - | - | - | - | - | - |
| O-17 | Class I - Bike Path | 0.5 | 0.0 | 0.2 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.5 |
| | Class II - Bike Lanes | - | - | - | - | - | - | - | - | - |
| | Class III - Bike Route | - | - | - | - | - | - | - | - | - |
| O-18 | Class I - Bike Path | 0.6 | 0.2 | 0.5 | 0.5 | 0.5 | 0.6 | 0.6 | 0.6 | 0.6 |
| | Class II - Bike Lanes | - | - | - | - | - | - | - | - | - |
| | Class III - Bike Route | - | - | - | - | - | - | - | - | - |
| O-19 | Class I - Bike Path | 0.3 | - | - | 0.1 | 0.1 | 0.2 | 0.2 | 0.3 | 0.3 |
| | Class II - Bike Lanes | 0.1 | - | - | - | - | - | - | - | - |
| | Class III - Bike Route | 0.9 | - | - | 0.1 | 0.2 | 0.6 | 0.6 | 0.6 | 0.8 |
| O-20 | Class I - Bike Path | 0.6 | 0.1 | 0.1 | 0.1 | 0.2 | 0.4 | 0.5 | 0.5 | 0.5 |

| Miles of Bikeway Exposed within the Subregion | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Water Level Scenarios | | | | | | | |
| Area | Bikeway Type | Total Miles | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| | Class II - Bike Lanes | 0.3 | - | - | - | - | - | - | - | - |
| | Class III - Bike Route | 1.5 | - | - | 0.1 | 1.2 | 1.5 | 1.5 | 1.5 | 1.5 |
| O-21 | Class I - Bike Path | 0.3 | - | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 |
| | Class II - Bike Lanes | - | - | - | - | - | - | - | - | - |
| | Class III - Bike Route | 0.9 | - | - | 0.1 | 0.8 | 0.9 | 0.9 | 0.9 | 0.9 |
| O-22 | Class I - Bike Path | 2.0 | 0.3 | 1.7 | 1.7 | 1.9 | 2.0 | 2.0 | 2.0 | 2.0 |
| | Class II - Bike Lanes | 1.5 | 0.1 | 0.1 | 0.3 | 1.4 | 1.5 | 1.5 | 1.5 | 1.5 |
| | Class III - Bike Route | 0.4 | - | - | - | - | - | - | - | - |
| O-23 | Class I - Bike Path | - | - | - | - | - | - | - | - | - |
| | Class II - Bike Lanes | - | - | - | - | - | - | - | - | - |
| | Class III - Bike Route | - | - | - | - | - | - | - | - | - |
| O-24 | Class I - Bike Path | 0.7 | 0.0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.6 |
| | Class II - Bike Lanes | 1.2 | 0.4 | 1.1 | 1.1 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| | Class III - Bike Route | - | - | - | - | - | - | - | - | - |
| O-25 | Class I - Bike Path | 0.5 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.4 | 0.4 |
| | Class II - Bike Lanes | 2.6 | 2.2 | 2.3 | 2.4 | 2.5 | 2.5 | 2.6 | 2.6 | 2.6 |
| | Class III - Bike Route | - | - | - | - | - | - | - | - | - |
| O-26 | Class I - Bike Path | - | - | - | - | - | - | - | - | - |
| | Class II - Bike Lanes | - | - | - | - | - | - | - | - | - |

| Miles of Bikeway Exposed within the Subregion | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Water Level Scenarios | | | | | | | |
| Area | Bikeway Type | Total Miles | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| | Class III - Bike Route | - | - | - | - | - | - | - | - | - |
| A-01 | Class I - Bike Path | - | - | - | - | - | - | - | - | - |
| | Class II - Bike Lanes | - | - | - | - | - | - | - | - | - |
| | Class III - Bike Route | - | - | - | - | - | - | - | - | - |
| A-02 | Class I - Bike Path | 0.9 | 0.4 | 0.4 | 0.4 | 0.7 | 0.9 | 0.9 | 0.9 | 0.9 |
| | Class II - Bike Lanes | - | - | - | - | - | - | - | - | - |
| | Class III - Bike Route | - | - | - | - | - | - | - | - | - |
| A-03 | Class I - Bike Path | 0.4 | 0.2 | 0.2 | 0.2 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 |
| | Class II - Bike Lanes | 0.4 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| | Class III - Bike Route | - | - | - | - | - | - | - | - | - |
| A-04 | Class I - Bike Path | 0.6 | 0.5 | 0.5 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| | Class II - Bike Lanes | 2.4 | 0.1 | 0.6 | 0.6 | 1.1 | 1.3 | 1.3 | 1.4 | 1.4 |
| | Class III - Bike Route | 1.1 | - | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.3 | 0.4 |
| A-05 | Class I - Bike Path | 1.2 | - | 0.2 | 0.2 | 0.5 | 0.6 | 0.7 | 1.0 | 1.1 |
| | Class II - Bike Lanes | 3.6 | - | 0.3 | 0.4 | 0.7 | 0.7 | 0.8 | 0.8 | 0.8 |
| | Class III - Bike Route | 1.2 | - | - | - | - | 0.1 | 0.1 | 0.2 | 0.5 |
| A-06 | Class I - Bike Path | 1.1 | 0.2 | 0.3 | 0.3 | 0.4 | 0.4 | 0.5 | 0.5 | 0.7 |
| | Class II - Bike Lanes | 5.3 | 0.5 | 0.6 | 0.6 | 1.0 | 1.2 | 1.4 | 1.6 | 2.1 |
| | Class III - Bike Route | 1.3 | 0.1 | 0.3 | 0.3 | 0.3 | 0.4 | 0.4 | 0.5 | 0.6 |

| Miles of Bikeway Exposed within the Subregion | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Water Level Scenarios | | | | | | | |
| Area | Bikeway Type | Total Miles | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| A-07 | Class I - Bike Path | - | - | - | - | - | - | - | - | - |
| | Class II - Bike Lanes | - | - | - | - | - | - | - | - | - |
| | Class III - Bike Route | - | - | - | - | - | - | - | - | - |
| A-08 | Class I - Bike Path | 0.1 | - | - | - | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| | Class II - Bike Lanes | - | - | - | - | - | - | - | - | - |
| | Class III - Bike Route | - | - | - | - | - | - | - | - | - |
| A-09 | Class I - Bike Path | 1.2 | 0.1 | 0.3 | 0.4 | 0.6 | 0.8 | 0.9 | 1.1 | 1.1 |
| | Class II - Bike Lanes | 0.1 | - | - | - | - | - | - | - | - |
| | Class III - Bike Route | 0.8 | - | - | - | 0.1 | 0.2 | 0.2 | 0.2 | 0.3 |
| A-10 | Class I - Bike Path | 2.8 | 0.2 | 0.6 | 0.7 | 1.6 | 2.1 | 2.3 | 2.5 | 2.6 |
| | Class II - Bike Lanes | 0.1 | - | - | - | - | 0.1 | 0.1 | 0.1 | 0.1 |
| | Class III - Bike Route | - | - | - | - | - | - | - | - | - |
| A-11 | Class I - Bike Path | 2.3 | - | 0.3 | 0.4 | 1.2 | 1.6 | 1.8 | 2.1 | 2.2 |
| | Class II - Bike Lanes | 2.5 | - | 0.3 | 0.3 | 0.4 | 0.6 | 0.7 | 0.8 | 0.9 |
| | Class III - Bike Route | - | - | - | - | - | - | - | - | - |
| A-12 | Class I - Bike Path | 0.5 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| | Class II - Bike Lanes | 0.6 | - | 0.2 | 0.2 | 0.4 | 0.5 | 0.6 | 0.6 | 0.6 |
| | Class III - Bike Route | - | - | - | - | - | - | - | - | - |
| A-13 | Class I - Bike Path | 2.0 | 0.1 | 0.3 | 0.4 | 0.7 | 1.0 | 1.1 | 1.3 | 1.4 |

| Miles of Bikeway Exposed within the Subregion | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Water Level Scenarios | | | | | | | |
| Area | Bikeway Type | Total Miles | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| | Class II - Bike Lanes | 0.3 | - | - | - | - | 0.1 | 0.1 | 0.2 | 0.3 |
| | Class III - Bike Route | - | - | - | - | - | - | - | - | - |
| A-14 | Class I - Bike Path | 3.0 | 0.2 | 0.2 | 1.0 | 1.3 | 1.8 | 2.5 | 2.9 | 3.0 |
| | Class II - Bike Lanes | 0.2 | - | - | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| | Class III - Bike Route | - | - | - | - | - | - | - | - | - |
| A-15 | Class I - Bike Path | 0.8 | - | - | - | - | - | 0.5 | 0.7 | 0.8 |
| | Class II - Bike Lanes | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 |
| | Class III - Bike Route | - | - | - | - | - | - | - | - | - |
| A-16 | Class I - Bike Path | 3.7 | 3.2 | 3.4 | 3.4 | 3.5 | 3.5 | 3.5 | 3.6 | 3.6 |
| | Class II - Bike Lanes | 0.7 | 0.2 | 0.4 | 0.5 | 0.6 | 0.7 | 0.7 | 0.7 | 0.7 |
| | Class III - Bike Route | - | - | - | - | - | - | - | - | - |
| A-17 | Class I - Bike Path | 3.5 | 1.4 | 2.3 | 2.4 | 2.6 | 2.7 | 2.9 | 3.1 | 3.1 |
| | Class II - Bike Lanes | 2.4 | 0.5 | 0.9 | 1.1 | 1.5 | 1.7 | 1.7 | 1.9 | 2.2 |
| | Class III - Bike Route | - | - | - | - | - | - | - | - | - |
| A-18 | Class I - Bike Path | - | - | - | - | - | - | - | - | - |
| | Class II - Bike Lanes | - | - | - | - | - | - | - | - | - |
| | Class III - Bike Route | - | - | - | - | - | - | - | - | - |

## A.5. Parks

| Acres of Parks Exposed within the Subregion | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Water Level Scenarios | | | | | | | |
| Area | Total Acres | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| O-01 | 11.0 | 5.1 | 8.4 | 9.5 | 10.8 | 11.0 | 11.0 | 11.0 | 11.0 |
| O-02 | 9.8 | 0.8 | 6.2 | 7.8 | 9.1 | 9.6 | 9.7 | 9.8 | 9.8 |
| O-03 | 3.2 | - | - | 0.3 | 0.9 | 1.5 | 1.8 | 2.1 | 2.4 |
| O-04 | 11.4 | - | - | 1.3 | 2.2 | 2.7 | 3.1 | 3.4 | 4.3 |
| O-05 | 8.5 | 3.2 | 4.0 | 4.2 | 4.4 | 4.4 | 4.4 | 4.4 | 4.4 |
| O-06 | 362.8 | 4.2 | 7.4 | 7.8 | 8.6 | 235.2 | 239.3 | 248.5 | 255.0 |
| O-07 | - | - | - | - | - | - | - | - | - |
| O-08 | 13.2 | - | 0.2 | 0.5 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| O-09 | 2.1 | - | - | - | 0.1 | 0.3 | 0.4 | 0.5 | 0.6 |
| O-10 | 7.2 | - | - | - | 0.1 | 0.3 | 1.4 | 3.2 | 3.6 |
| O-11 | 18.7 | 2.9 | 2.9 | 3.0 | 3.7 | 4.6 | 5.5 | 6.1 | 6.3 |
| O-12 | 3.8 | 1.2 | 1.3 | 1.3 | 1.3 | 1.3 | 1.4 | 1.4 | 1.5 |
| O-13 | 23.6 | 4.4 | 8.9 | 10.5 | 12.3 | 12.8 | 13.1 | 13.3 | 13.3 |
| O-14 | 3.7 | 1.1 | 3.3 | 3.4 | 3.6 | 3.7 | 3.7 | 3.7 | 3.7 |
| O-15 | 23.3 | 7.0 | 10.3 | 11.1 | 12.4 | 14.2 | 15.7 | 18.3 | 21.6 |
| O-16 | 4.4 | 0.0 | 0.1 | 0.1 | 0.6 | 1.3 | 1.8 | 2.8 | 3.7 |
| O-17 | 55.2 | 39.2 | 44.3 | 45.7 | 51.2 | 53.3 | 53.9 | 54.4 | 54.7 |
| O-18 | 15.6 | 5.5 | 10.6 | 11.4 | 13.2 | 14.1 | 14.3 | 14.7 | 15.0 |
| O-19 | 7.8 | 1.6 | 2.4 | 2.6 | 3.3 | 4.6 | 5.1 | 5.3 | 5.4 |
| O-20 | 36.0 | 3.1 | 5.2 | 5.8 | 16.6 | 21.2 | 23.4 | 26.0 | 27.3 |
| O-21 | 10.3 | 2.0 | 2.7 | 3.0 | 3.8 | 4.1 | 4.4 | 5.2 | 5.8 |
| O-22 | 120.3 | 60.6 | 85.0 | 88.8 | 96.6 | 100.5 | 103.4 | 109.0 | 113.3 |
| O-23 | - | - | - | - | - | - | - | - | - |
| O-24 | 8.5 | 0.8 | 1.4 | 1.5 | 2.5 | 4.1 | 5.4 | 7.7 | 8.4 |
| O-25 | 1.0 | - | 0.3 | 0.3 | 0.3 | 0.4 | 0.6 | 1.0 | 1.0 |
| O-26 | - | - | - | - | - | - | - | - | - |
| A-01 | - | - | - | - | - | - | - | - | - |
| A-02 | 20.1 | 4.4 | 11.1 | 12.5 | 13.6 | 17.1 | 19.6 | 20.0 | 20.1 |
| A-03 | 24.5 | 4.7 | 5.7 | 6.1 | 11.8 | 17.1 | 19.6 | 22.8 | 24.3 |
| A-04 | 31.8 | 2.7 | 4.4 | 5.0 | 6.4 | 7.5 | 8.1 | 9.8 | 12.8 |
| A-05 | 14.4 | 0.1 | 0.9 | 1.4 | 3.9 | 5.2 | 6.1 | 6.8 | 7.1 |
| A-06 | 11.2 | 2.0 | 3.4 | 3.7 | 4.3 | 4.8 | 5.3 | 6.0 | 6.7 |
| A-07 | - | - | - | - | - | - | - | - | - |
| A-08 | 27.5 | 2.6 | 5.1 | 5.5 | 12.6 | 21.1 | 24.6 | 27.3 | 27.5 |

| Acres of Parks Exposed within the Subregion | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Water Level Scenarios | | | | | | | |
| Area | Total Acres | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| A-09 | 25.9 | 2.5 | 11.9 | 13.4 | 19.5 | 22.6 | 23.4 | 23.9 | 24.1 |
| A-10 | 31.4 | 3.8 | 6.3 | 7.2 | 14.8 | 20.1 | 23.4 | 27.8 | 30.1 |
| A-11 | 45.0 | - | 9.0 | 10.6 | 17.5 | 23.7 | 26.9 | 33.9 | 36.5 |
| A-12 | 41.2 | 3.5 | 4.7 | 5.0 | 5.9 | 6.3 | 6.5 | 6.9 | 7.3 |
| A-13 | 8.9 | 0.3 | 1.5 | 1.9 | 4.2 | 6.3 | 7.3 | 8.3 | 8.6 |
| A-14 | 14.5 | - | 0.2 | 0.9 | 3.2 | 7.0 | 9.8 | 13.2 | 14.3 |
| A-15 | 0.5 | - | - | - | 0.2 | 0.3 | 0.4 | 0.5 | 0.5 |
| A-16 | 316.2 | 309.1 | 311.7 | 312.7 | 314.3 | 315.3 | 315.6 | 316.1 | 316.2 |
| A-17 | 7.0 | 0.4 | 0.7 | 0.8 | 1.1 | 1.5 | 1.9 | 3.3 | 4.4 |
| A-18 | - | - | - | - | - | - | - | - | - |

Data Source: (EBRPD 2023; City of Alameda 2023a; City of Oakland 2023a)

## A.7. Trails

| Miles of Trail Exposed within the Subregion | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Water Level Scenarios | | | | | | | |
| Area | Total Miles | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| O-01 | 2.2 | - | - | - | 0.1 | 0.5 | 0.9 | 1.3 | 1.4 |
| O-02 | 3.7 | - | - | 0.6 | 1.6 | 2.3 | 2.5 | 2.6 | 2.9 |
| O-03 | 0.3 | - | - | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 |
| O-04 | 2.1 | - | - | 0.4 | 0.7 | 1.3 | 1.3 | 1.6 | 1.9 |
| O-05 | 0.8 | 0.1 | 0.1 | 0.1 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| O-06 | 4.2 | 0.3 | 0.4 | 0.4 | 0.5 | 3.7 | 3.7 | 3.8 | 3.9 |
| O-07 | 1.4 | - | 0.8 | 1.1 | 1.3 | 1.3 | 1.4 | 1.4 | 1.4 |
| O-08 | 0.4 | - | 0.1 | 0.2 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| O-09 | 0.4 | - | 0.1 | 0.1 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| O-10 | 0.4 | - | - | - | 0.1 | 0.2 | 0.4 | 0.4 | 0.4 |
| O-11 | 0.6 | - | - | - | 0.2 | 0.3 | 0.5 | 0.5 | 0.5 |
| O-12 | 0.2 | - | - | - | - | - | - | - | - |
| O-13 | 1.0 | 0.1 | 0.4 | 0.5 | 0.6 | 0.6 | 0.6 | 0.7 | 0.8 |
| O-14 | 0.4 | 0.1 | 0.3 | 0.3 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 |
| O-15 | 0.8 | 0.1 | 0.6 | 0.7 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| O-16 | 0.7 | - | 0.1 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 |
| O-17 | 1.0 | 0.1 | 0.6 | 0.8 | 0.9 | 0.9 | 1.0 | 1.0 | 1.0 |
| O-18 | 1.0 | 0.3 | 0.9 | 0.9 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| O-19 | 0.5 | - | 0.1 | 0.2 | 0.3 | 0.4 | 0.4 | 0.5 | 0.5 |
| O-20 | 0.8 | 0.1 | 0.1 | 0.1 | 0.4 | 0.6 | 0.7 | 0.8 | 0.8 |
| O-21 | 0.9 | - | 0.2 | 0.2 | 0.3 | 0.4 | 0.5 | 0.7 | 0.9 |
| O-22 | 4.0 | 0.9 | 2.8 | 2.9 | 3.3 | 3.8 | 3.9 | 4.0 | 4.0 |
| O-23 | 0.2 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| O-24 | 0.7 | - | 0.5 | 0.5 | 0.6 | 0.6 | 0.6 | 0.7 | 0.7 |
| O-25 | 0.6 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.5 | 0.5 |
| O-26 | - | - | - | - | - | - | - | - | - |
| A-01 | - | - | - | - | - | - | - | - | - |
| A-02 | 1.2 | 0.3 | 0.5 | 0.6 | 0.9 | 1.2 | 1.2 | 1.2 | 1.2 |
| A-03 | 2.3 | 0.8 | 1.4 | 1.5 | 1.8 | 2.2 | 2.2 | 2.3 | 2.3 |
| A-04 | 1.0 | 0.0 | 0.1 | 0.1 | 0.2 | 0.3 | 0.3 | 0.4 | 0.4 |
| A-05 | 2.4 | 0.0 | 0.3 | 0.4 | 0.9 | 1.0 | 1.0 | 1.1 | 1.1 |
| A-06 | 1.7 | 0.4 | 0.5 | 0.6 | 0.9 | 1.0 | 1.2 | 1.3 | 1.6 |
| A-07 | - | - | - | - | - | - | - | - | - |
| A-08 | 0.8 | - | 0.1 | 0.1 | 0.6 | 0.8 | 0.8 | 0.8 | 0.8 |

| Miles of Trail Exposed within the Subregion | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Water Level Scenarios | | | | | | | |
| Area | Total Miles | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| A-09 | 1.6 | 0.2 | 0.9 | 1.0 | 1.3 | 1.5 | 1.5 | 1.6 | 1.6 |
| A-10 | 3.2 | 0.5 | 1.0 | 1.2 | 2.0 | 2.4 | 2.7 | 3.0 | 3.1 |
| A-11 | 2.9 | - | 0.2 | 0.3 | 0.6 | 1.1 | 1.4 | 2.1 | 2.3 |
| A-12 | 0.5 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 |
| A-13 | 0.9 | - | 0.2 | 0.2 | 0.5 | 0.8 | 0.8 | 0.9 | 0.9 |
| A-14 | 2.4 | - | - | 0.7 | 0.9 | 1.2 | 2.1 | 2.4 | 2.4 |
| A-15 | 0.6 | - | - | - | - | - | 0.4 | 0.5 | 0.5 |
| A-16 | 1.3 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| A-17 | 0.3 | - | 0.1 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 |
| A-18 | - | - | - | - | - | - | - | - | - |

Data Source: (EBRPD 2023; City of Alameda 2023b)

## A.8. Stormwater Pipes

| Miles of Stormwater Pipes Exposed within the Subregion | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Area | Diameter (in) | Total Miles | Water Level Scenarios | | | | | | | |
| | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| O-01 | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | 15 - 29 | 0.7 | - | - | - | - | 0.2 | 0.3 | 0.6 | 0.6 |
| | 30 - 44 | 0.1 | - | - | - | - | - | - | 0.1 | 0.1 |
| | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | 90+ | - | - | - | - | - | - | - | - | - |
| | Unknown | 17.6 | - | 0.1 | 0.1 | 0.2 | 2.2 | 3.4 | 8.8 | 12.0 |
| O-02 | 0 - 14 | 0.7 | - | 0.0 | 0.3 | 0.5 | 0.7 | 0.7 | 0.7 | 0.7 |
| | 15 - 29 | 3.0 | - | 0.4 | 0.8 | 1.7 | 2.7 | 2.8 | 3.0 | 3.0 |
| | 30 - 44 | 1.4 | - | - | 0.1 | 0.2 | 0.6 | 0.9 | 1.3 | 1.3 |
| | 45 - 59 | 1.9 | - | - | 0.9 | 1.6 | 1.7 | 1.8 | 1.8 | 1.9 |
| | 60 - 74 | 1.1 | - | - | 0.2 | 0.6 | 1.0 | 1.0 | 1.0 | 1.1 |
| | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | 90+ | - | - | - | - | - | - | - | - | - |
| | Unknown | 29.4 | - | 0.4 | 5.0 | 9.5 | 15.4 | 18.4 | 22.4 | 23.7 |
| O-03 | 0 - 14 | 1.1 | - | - | - | - | - | - | - | - |
| | 15 - 29 | 1.4 | - | - | - | - | - | - | - | 0.1 |
| | 30 - 44 | 0.7 | - | - | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 |
| | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | 90+ | - | - | - | - | - | - | - | - | - |
| | Unknown | 0.1 | - | - | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| O-04 | 0 - 14 | 6.4 | - | - | 1.1 | 2.0 | 2.5 | 2.7 | 2.9 | 3.2 |
| | 15 - 29 | 6.7 | - | - | 0.3 | 0.8 | 1.2 | 1.3 | 1.7 | 2.4 |
| | 30 - 44 | 3.4 | - | - | 0.8 | 1.1 | 1.8 | 1.9 | 2.2 | 2.6 |
| | 45 - 59 | 0.6 | - | - | - | 0.1 | 0.2 | 0.4 | 0.5 | 0.5 |
| | 60 - 74 | 0.2 | - | - | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | 90+ | 0.2 | - | - | - | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| | Unknown | 25.3 | - | - | 1.1 | 4.5 | 6.0 | 8.4 | 12.4 | 15.0 |
| O-05 | 0 - 14 | 3.8 | 0.3 | 0.4 | 0.4 | 1.2 | 1.6 | 1.7 | 1.8 | 1.8 |
| | 15 - 29 | 3.6 | 0.1 | 0.1 | 0.1 | 0.2 | 0.4 | 0.4 | 0.5 | 0.6 |
| | 30 - 44 | 1.3 | - | - | 0.1 | 0.3 | 0.5 | 0.6 | 0.7 | 0.9 |

| Miles of Stormwater Pipes Exposed within the Subregion | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Area | Diameter (in) | Total Miles | Water Level Scenarios | | | | | | | |
| | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | 60 - 74 | 0.1 | - | - | - | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | 90+ | - | - | - | - | - | - | - | - | - |
| | Unknown | 0.3 | - | 0.1 | 0.1 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| O-06 | 0 - 14 | 14.8 | 0.5 | 0.7 | 0.8 | 0.8 | 3.3 | 3.7 | 4.2 | 4.7 |
| | 15 - 29 | 12.5 | 0.1 | 0.1 | 0.2 | 0.3 | 1.6 | 1.9 | 2.1 | 2.3 |
| | 30 - 44 | 5.6 | - | - | - | - | 0.7 | 0.8 | 1.2 | 1.4 |
| | 45 - 59 | 1.1 | - | - | - | - | - | - | 0.1 | 0.1 |
| | 60 - 74 | 1.5 | - | - | - | - | 0.6 | 0.7 | 0.8 | 0.9 |
| | 75 - 89 | 1.9 | - | - | - | - | 0.5 | 0.6 | 0.8 | 1.0 |
| | 90+ | 0.1 | - | - | - | - | 0.1 | 0.1 | 0.1 | 0.1 |
| | Unknown | - | - | - | - | - | - | - | - | - |
| O-07 | 0 - 14 | 0.9 | 0.0 | 0.5 | 0.7 | 0.8 | 0.8 | 0.8 | 0.9 | 0.9 |
| | 15 - 29 | 0.3 | 0.0 | 0.1 | 0.1 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| | 30 - 44 | - | - | - | - | - | - | - | - | - |
| | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | 90+ | - | - | - | - | - | - | - | - | - |
| | Unknown | - | - | - | - | - | - | - | - | - |
| O-08 | 0 - 14 | 1.4 | - | - | - | 0.4 | 0.4 | 0.4 | 0.5 | 0.5 |
| | 15 - 29 | 1.3 | - | - | - | 0.2 | 0.3 | 0.3 | 0.4 | 0.4 |
| | 30 - 44 | 0.1 | - | - | - | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | 60 - 74 | 0.2 | - | - | - | - | - | - | - | - |
| | 75 - 89 | 0.3 | - | - | - | - | - | - | - | - |
| | 90+ | - | - | - | - | - | - | - | - | - |
| | Unknown | - | - | - | - | - | - | - | - | - |
| O-09 | 0 - 14 | 1.2 | - | - | - | 0.3 | 0.5 | 0.6 | 0.6 | 0.6 |
| | 15 - 29 | 1.8 | - | - | - | 0.1 | 0.2 | 0.4 | 0.6 | 0.6 |
| | 30 - 44 | 0.5 | - | - | - | 0.1 | 0.1 | 0.1 | 0.2 | 0.3 |
| | 45 - 59 | 0.2 | - | - | - | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 |
| | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | 90+ | - | - | - | - | - | - | - | - | - |
| | Unknown | - | - | - | - | - | - | - | - | - |

| Miles of Stormwater Pipes Exposed within the Subregion | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Area | Diameter (in) | Total Miles | Water Level Scenarios | | | | | | | |
| | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| O-10 | 0 - 14 | 1.8 | - | - | 0.1 | 0.3 | 0.4 | 0.4 | 0.6 | 0.7 |
| | 15 - 29 | 1.6 | - | - | - | - | - | - | 0.1 | 0.2 |
| | 30 - 44 | 0.7 | - | - | - | - | 0.1 | 0.1 | 0.2 | 0.2 |
| | 45 - 59 | 0.2 | - | - | - | - | - | - | - | - |
| | 60 - 74 | 0.1 | - | - | - | - | - | - | - | - |
| | 75 - 89 | 0.4 | - | - | - | - | - | - | - | - |
| | 90+ | - | - | - | - | - | - | - | - | - |
| | Unknown | - | - | - | - | - | - | - | - | - |
| O-11 | 0 - 14 | 1.7 | - | - | - | - | 0.3 | 0.6 | 0.8 | 0.9 |
| | 15 - 29 | 1.9 | - | - | - | - | 0.2 | 0.2 | 0.3 | 0.4 |
| | 30 - 44 | 0.3 | - | - | - | - | 0.1 | 0.1 | 0.1 | 0.1 |
| | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | 75 - 89 | 0.1 | - | - | - | - | - | 0.1 | 0.1 | 0.1 |
| | 90+ | - | - | - | - | - | - | - | - | - |
| | Unknown | - | - | - | - | - | - | - | - | - |
| O-12 | 0 - 14 | 0.6 | - | - | - | - | - | - | - | - |
| | 15 - 29 | 0.3 | - | - | - | - | - | - | - | - |
| | 30 - 44 | 0.5 | - | - | - | - | - | - | - | 0.1 |
| | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | 90+ | - | - | - | - | - | - | - | - | - |
| | Unknown | - | - | - | - | - | - | - | - | - |
| O-13 | 0 - 14 | 0.4 | - | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.3 |
| | 15 - 29 | 0.4 | - | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 |
| | 30 - 44 | 0.6 | - | - | - | - | - | - | - | 0.2 |
| | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | 90+ | - | - | - | - | - | - | - | - | - |
| | Unknown | - | - | - | - | - | - | - | - | - |
| O-14 | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | 15 - 29 | 0.1 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| | 30 - 44 | - | - | - | - | - | - | - | - | - |
| | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | 60 - 74 | - | - | - | - | - | - | - | - | - |

| Miles of Stormwater Pipes Exposed within the Subregion | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Area | Diameter (in) | Total Miles | Water Level Scenarios | | | | | | | |
| | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | 90+ | - | - | - | - | - | - | - | - | - |
| | Unknown | - | - | - | - | - | - | - | - | - |
| O-15 | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | 15 - 29 | - | - | - | - | - | - | - | - | - |
| | 30 - 44 | - | - | - | - | - | - | - | - | - |
| | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | 90+ | - | - | - | - | - | - | - | - | - |
| | Unknown | - | - | - | - | - | - | - | - | - |
| O-16 | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | 15 - 29 | - | - | - | - | - | - | - | - | - |
| | 30 - 44 | - | - | - | - | - | - | - | - | - |
| | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | 90+ | - | - | - | - | - | - | - | - | - |
| | Unknown | - | - | - | - | - | - | - | - | - |
| O-17 | 0 - 14 | 0.1 | - | - | - | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| | 15 - 29 | 0.2 | - | - | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| | 30 - 44 | - | - | - | - | - | - | - | - | - |
| | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | 90+ | - | - | - | - | - | - | - | - | - |
| | Unknown | 0.3 | - | 0.1 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| O-18 | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | 15 - 29 | - | - | - | - | - | - | - | - | - |
| | 30 - 44 | - | - | - | - | - | - | - | - | - |
| | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | 90+ | - | - | - | - | - | - | - | - | - |
| | Unknown | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| O-19 | 0 - 14 | 3.6 | 1.2 | 1.3 | 1.4 | 1.7 | 1.8 | 1.9 | 1.9 | 1.9 |
| | 15 - 29 | 6.3 | 0.2 | 0.6 | 0.7 | 1.1 | 1.7 | 1.9 | 2.1 | 2.5 |

| Miles of Stormwater Pipes Exposed within the Subregion | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Area | Diameter (in) | Total Miles | Water Level Scenarios | | | | | | | |
| | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| | 30 - 44 | 4.3 | 0.2 | 0.4 | 0.6 | 0.9 | 1.3 | 1.5 | 1.8 | 1.9 |
| | 45 - 59 | 0.5 | - | - | - | - | 0.1 | 0.1 | 0.1 | 0.2 |
| | 60 - 74 | 0.7 | - | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | 90+ | 0.5 | - | - | - | - | - | - | 0.1 | 0.2 |
| | Unknown | - | - | - | - | - | - | - | - | - |
| O-20 | 0 - 14 | 3.1 | 1.3 | 1.4 | 1.5 | 1.8 | 2.0 | 2.0 | 2.1 | 2.2 |
| | 15 - 29 | 3.2 | 0.4 | 0.8 | 0.8 | 1.8 | 2.2 | 2.3 | 2.4 | 2.5 |
| | 30 - 44 | 2.3 | 0.3 | 0.5 | 0.5 | 0.8 | 1.0 | 1.0 | 1.0 | 1.0 |
| | 45 - 59 | 0.1 | - | - | - | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | 90+ | - | - | - | - | - | - | - | - | - |
| | Unknown | 0.2 | - | - | - | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| O-21 | 0 - 14 | 3.9 | 1.1 | 1.8 | 1.9 | 2.5 | 2.6 | 2.7 | 2.8 | 3.0 |
| | 15 - 29 | 5.9 | 0.2 | 0.9 | 1.4 | 2.9 | 3.2 | 3.5 | 3.7 | 3.9 |
| | 30 - 44 | 3.3 | 0.1 | 0.3 | 0.3 | 0.7 | 0.9 | 1.0 | 1.1 | 1.4 |
| | 45 - 59 | 1.1 | - | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.9 |
| | 60 - 74 | 0.8 | - | 0.1 | 0.2 | 0.5 | 0.5 | 0.6 | 0.6 | 0.6 |
| | 75 - 89 | 0.2 | - | - | - | - | - | - | 0.1 | 0.2 |
| | 90+ | - | - | - | - | - | - | - | - | - |
| | Unknown | 1.6 | - | 0.4 | 0.6 | 1.5 | 1.6 | 1.6 | 1.6 | 1.6 |
| O-22 | 0 - 14 | 3.1 | - | 0.1 | 0.4 | 0.9 | 1.0 | 1.1 | 1.2 | 1.3 |
| | 15 - 29 | 5.4 | 0.1 | 0.4 | 1.0 | 2.8 | 3.0 | 3.1 | 3.2 | 3.3 |
| | 30 - 44 | 1.5 | - | 0.1 | 0.2 | 0.9 | 1.0 | 1.0 | 1.0 | 1.1 |
| | 45 - 59 | 1.1 | - | - | - | 0.2 | 0.3 | 0.3 | 0.4 | 0.6 |
| | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | 90+ | - | - | - | - | - | - | - | - | - |
| | Unknown | 4.2 | 0.2 | 1.1 | 1.8 | 3.8 | 4.0 | 4.0 | 4.1 | 4.1 |
| O-23 | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | 15 - 29 | - | - | - | - | - | - | - | - | - |
| | 30 - 44 | - | - | - | - | - | - | - | - | - |
| | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | 75 - 89 | - | - | - | - | - | - | - | - | - |

| Miles of Stormwater Pipes Exposed within the Subregion | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Area | Diameter (in) | Total Miles | Water Level Scenarios | | | | | | | |
| | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| | 90+ | - | - | - | - | - | - | - | - | - |
| | Unknown | 0.3 | - | - | - | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| O-24 | 0 - 14 | 0.3 | - | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 |
| | 15 - 29 | 0.6 | - | 0.2 | 0.3 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| | 30 - 44 | - | - | - | - | - | - | - | - | - |
| | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | 90+ | - | - | - | - | - | - | - | - | - |
| | Unknown | 27.5 | 25.7 | 26.7 | 26.9 | 27.3 | 27.3 | 27.3 | 27.4 | 27.4 |
| O-25 | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | 15 - 29 | - | - | - | - | - | - | - | - | - |
| | 30 - 44 | - | - | - | - | - | - | - | - | - |
| | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | 90+ | - | - | - | - | - | - | - | - | - |
| | Unknown | 21.9 | 20.7 | 21.1 | 21.2 | 21.5 | 21.5 | 21.6 | 21.7 | 21.8 |
| O-26 | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | 15 - 29 | - | - | - | - | - | - | - | - | - |
| | 30 - 44 | - | - | - | - | - | - | - | - | - |
| | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | 90+ | - | - | - | - | - | - | - | - | - |
| | Unknown | - | - | - | - | - | - | - | - | - |
| A-01 | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | 15 - 29 | - | - | - | - | - | - | - | - | - |
| A-02 | 0 - 14 | 1.2 | 0.5 | 0.6 | 0.8 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| | 15 - 29 | 0.2 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| A-03 | 0 - 14 | 8.6 | 2.1 | 2.9 | 3.2 | 4.9 | 5.9 | 6.7 | 7.9 | 8.1 |
| | 15 - 29 | 0.4 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| A-04 | 0 - 14 | 10.9 | 1.8 | 4.9 | 5.6 | 6.9 | 7.3 | 7.5 | 7.9 | 8.3 |
| | 15 - 29 | - | - | - | - | - | - | - | - | - |
| A-05 | 0 - 14 | 8.9 | - | 0.5 | 0.5 | 2.4 | 3.2 | 3.7 | 4.2 | 4.8 |
| | 15 - 29 | - | - | - | - | - | - | - | - | - |
| A-06 | 0 - 14 | 8.0 | 1.2 | 1.8 | 2.0 | 3.2 | 3.8 | 4.0 | 4.8 | 5.4 |

| Miles of Stormwater Pipes Exposed within the Subregion | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Area | Diameter (in) | Total Miles | Water Level Scenarios | | | | | | | |
| | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| | 15 - 29 | - | - | - | - | - | - | - | - | - |
| A-07 | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | 15 - 29 | - | - | - | - | - | - | - | - | - |
| A-08 | 0 - 14 | 0.2 | - | - | - | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 |
| | 15 - 29 | - | - | - | - | - | - | - | - | - |
| A-09 | 0 - 14 | 2.3 | 0.1 | 0.3 | 0.3 | 1.0 | 1.4 | 1.7 | 1.9 | 2.0 |
| | 15 - 29 | - | - | - | - | - | - | - | - | - |
| A-10 | 0 - 14 | 1.8 | 0.2 | 0.6 | 0.7 | 1.2 | 1.4 | 1.5 | 1.7 | 1.8 |
| | 15 - 29 | - | - | - | - | - | - | - | - | - |
| A-11 | 0 - 14 | 16.7 | - | 10.7 | 11.9 | 14.5 | 15.5 | 15.7 | 16.0 | 16.2 |
| | 15 - 29 | - | - | - | - | - | - | - | - | - |
| A-12 | 0 - 14 | 0.2 | - | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| | 15 - 29 | - | - | - | - | - | - | - | - | - |
| A-13 | 0 - 14 | 3.3 | 0.1 | 0.1 | 0.1 | 0.4 | 0.8 | 1.5 | 2.1 | 2.6 |
| | 15 - 29 | - | - | - | - | - | - | - | - | - |
| A-14 | 0 - 14 | 10.1 | - | 1.3 | 5.1 | 6.6 | 7.5 | 9.1 | 9.7 | 9.9 |
| | 15 - 29 | - | - | - | - | - | - | - | - | - |
| A-15 | 0 - 14 | 1.7 | - | 0.1 | 0.1 | 0.1 | 0.2 | 1.2 | 1.5 | 1.7 |
| | 15 - 29 | - | - | - | - | - | - | - | - | - |
| A-16 | 0 - 14 | 13.0 | 11.5 | 12.4 | 12.5 | 12.8 | 12.8 | 12.9 | 13.0 | 13.0 |
| | 15 - 29 | - | - | - | - | - | - | - | - | - |
| A-17 | 0 - 14 | 16.7 | 5.5 | 9.5 | 10.7 | 12.7 | 13.9 | 14.5 | 15.2 | 15.8 |
| | 15 - 29 | - | - | - | - | - | - | - | - | - |
| A-18 | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | 15 - 29 | - | - | - | - | - | - | - | - | - |

Data Source: (City of Alameda 2023e; City of Oakland 2023d; Schaaf and Wheeler 2019). Oakland data includes both the City of Oakland and the Port of Oakland, as shown on Figure 12. This analysis does not include data provided by Wood Rodgers received spring 2024 due to overlap with existing data received from the city of Oakland.

## A.10. Stormwater Pumps

| Number of Stormwater Pump Stations Exposed within the Subregion | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Water Level Scenarios | | | | | | | |
| Area | Total Pumps | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| O-01 | - | - | - | - | - | - | - | - | - |
| O-02 | - | - | - | - | - | - | - | - | - |
| O-03 | - | - | - | - | - | - | - | - | - |
| O-04 | 2 | - | - | - | - | 1 | 1 | 1 | 2 |
| O-05 | - | - | - | - | - | - | - | - | - |
| O-06 | 4 | - | - | - | - | 3 | 3 | 3 | 3 |
| O-07 | - | - | - | - | - | - | - | - | - |
| O-08 | - | - | - | - | - | - | - | - | - |
| O-09 | - | - | - | - | - | - | - | - | - |
| O-10 | - | - | - | - | - | - | - | - | - |
| O-11 | - | - | - | - | - | - | - | - | - |
| O-12 | - | - | - | - | - | - | - | - | - |
| O-13 | - | - | - | - | - | - | - | - | - |
| O-14 | - | - | - | - | - | - | - | - | - |
| O-15 | - | - | - | - | - | - | - | - | - |
| O-16 | - | - | - | - | - | - | - | - | - |
| O-17 | - | - | - | - | - | - | - | - | - |
| O-18 | - | - | - | - | - | - | - | - | - |
| O-19 | - | - | - | - | - | - | - | - | - |
| O-20 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| O-21 | - | - | - | - | - | - | - | - | - |
| O-22 | - | - | - | - | - | - | - | - | - |
| O-23 | - | - | - | - | - | - | - | - | - |
| O-24 | 2 | - | - | - | - | - | - | - | - |
| O-25 | 2 | - | - | - | - | - | - | - | - |
| O-26 | - | - | - | - | - | - | - | - | - |
| A-01 | - | - | - | - | - | - | - | - | - |
| A-02 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| A-03 | 3 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| A-04 | 2 | - | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| A-05 | 1 | - | - | - | 1 | 1 | 1 | 1 | 1 |
| A-06 | 1 | - | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| A-07 | - | - | - | - | - | - | - | - | - |
| A-08 | - | - | - | - | - | - | - | - | - |

| Number of Stormwater Pump Stations Exposed within the Subregion | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Water Level Scenarios | | | | | | | |
| Area | Total Pumps | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| A-09 | - | - | - | - | - | - | - | - | - |
| A-10 | 1 | - | - | - | - | - | 1 | 1 | 1 |
| A-11 | - | - | - | - | - | - | - | - | - |
| A-12 | - | - | - | - | - | - | - | - | - |
| A-13 | - | - | - | - | - | - | - | - | - |
| A-14 | 1 | - | - | 1 | 1 | 1 | 1 | 1 | 1 |
| A-15 | - | - | - | - | - | - | - | - | - |
| A-16 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| A-17 | - | - | - | - | - | - | - | - | - |
| A-18 | - | - | - | - | - | - | - | - | - |

Data Source: (City of Alameda 2023f; City of Oakland 2023e; Schaaf and Wheeler 2019)

## A.11. Wastewater Pipes

| Miles of Wastewater Pipes Exposed within the Subregion | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Water Level Scenarios | | | | | | | |
| Area | Sewer Type | Diameter (in) | Total Miles | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| O-01 | * | 0 - 14 | 1.3 | 0.1 | 0.3 | 0.4 | 0.6 | 0.8 | 1.0 | 1.1 | 1.2 |
| | | 15 - 29 | 0.1 | - | - | - | - | - | - | 0.1 | 0.1 |
| | | 30 - 44 | - | - | - | - | - | - | - | - | - |
| | | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | | 90+ | - | - | - | - | - | - | - | - | - |
| O-02 | * | 0 - 14 | 5.7 | - | 0.4 | 2.1 | 4.1 | 5.1 | 5.5 | 5.6 | 5.7 |
| | | 15 - 29 | 1.2 | - | - | - | - | 0.7 | 0.8 | 1.2 | 1.2 |
| | | 30 - 44 | - | - | - | - | - | - | - | - | - |
| | | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | | 75 - 89 | 0.1 | - | - | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| | | 90+ | 0.1 | - | - | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| O-03 | * | 0 - 14 | 4.5 | - | - | 0.7 | 0.8 | 0.9 | 0.9 | 1.0 | 1.0 |
| | | 15 - 29 | 0.2 | - | - | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| | | 30 - 44 | 0.3 | - | - | - | - | - | - | - | - |
| | | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | | 60 - 74 | 0.1 | - | - | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| | | 75 - 89 | 0.2 | - | - | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| | | 90+ | 0.2 | - | - | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| O-04 | * | 0 - 14 | 26.3 | - | - | 3.7 | 6.3 | 8.9 | 9.6 | 11.3 | 13.2 |
| | | 15 - 29 | 2.6 | - | - | 0.8 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 |
| | | 30 - 44 | 0.9 | - | - | - | - | 0.3 | 0.4 | 0.6 | 0.8 |
| | | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | | 90+ | 2.5 | - | - | 0.8 | 1.4 | 2.1 | 2.1 | 2.3 | 2.4 |
| O-05 | * | 0 - 14 | 11.7 | 0.2 | 0.4 | 0.5 | 2.1 | 3.1 | 3.4 | 3.7 | 4.0 |
| | | 15 - 29 | 0.5 | - | - | - | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 |
| | | 30 - 44 | - | - | - | - | - | - | - | - | - |
| | | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | | 75 - 89 | 0.1 | - | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| | | 90+ | 1.0 | - | - | - | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |

| Miles of Wastewater Pipes Exposed within the Subregion | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Area | Sewer Type | Diameter (in) | Total Miles | Water Level Scenarios | | | | | | | |
| | | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| O-06 | * | 0 - 14 | 61.1 | 0.4 | 0.7 | 0.9 | 1.2 | 2.8 | 3.5 | 4.6 | 5.4 |
| | | 15 - 29 | 8.6 | - | - | - | 0.1 | 1.9 | 2.2 | 2.6 | 2.8 |
| | | 30 - 44 | 3.3 | - | 0.1 | 0.1 | 0.1 | 1.7 | 1.8 | 2.1 | 2.2 |
| | | 45 - 59 | 1.8 | - | 0.1 | 0.1 | 0.1 | 1.3 | 1.4 | 1.4 | 1.4 |
| | | 60 - 74 | 0.8 | 0.1 | 0.1 | 0.2 | 0.2 | 0.4 | 0.4 | 0.4 | 0.5 |
| | | 75 - 89 | 0.5 | 0.1 | 0.2 | 0.2 | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 |
| | | 90+ | - | - | - | - | - | - | - | - | - |
| O-07 | * | 0 - 14 | 1.4 | 0.1 | 0.6 | 0.9 | 1.0 | 1.2 | 1.3 | 1.3 | 1.3 |
| | | 15 - 29 | - | - | - | - | - | - | - | - | - |
| | | 30 - 44 | 0.2 | - | - | - | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 |
| | | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | | 75 - 89 | 1.5 | - | 0.5 | 1.0 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |
| | | 90+ | - | - | - | - | - | - | - | - | - |
| O-08 | * | 0 - 14 | 5.0 | - | - | - | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 |
| | | 15 - 29 | 0.1 | - | - | - | - | - | - | 0.1 | 0.1 |
| | | 30 - 44 | 0.3 | - | - | - | - | 0.1 | 0.1 | 0.1 | 0.1 |
| | | 45 - 59 | 0.3 | - | - | - | - | - | 0.1 | 0.1 | 0.1 |
| | | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | | 75 - 89 | 0.7 | - | - | - | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| | | 90+ | - | - | - | - | - | - | - | - | - |
| O-09 | * | 0 - 14 | 5.5 | - | - | - | 0.5 | 0.8 | 0.8 | 1.2 | 1.3 |
| | | 15 - 29 | 0.3 | - | - | - | - | 0.2 | 0.3 | 0.3 | 0.3 |
| | | 30 - 44 | 0.2 | - | - | - | - | - | - | - | 0.1 |
| | | 45 - 59 | 0.1 | - | - | - | - | - | - | - | - |
| | | 60 - 74 | 0.0 | - | - | - | - | - | - | - | - |
| | | 75 - 89 | 0.5 | - | - | - | 0.2 | 0.3 | 0.3 | 0.5 | 0.5 |
| | | 90+ | 0.0 | - | - | - | - | - | - | - | - |
| O-10 | * | 0 - 14 | 7.5 | - | - | - | 0.1 | 0.2 | 0.4 | 0.5 | 0.7 |
| | | 15 - 29 | 0.9 | - | - | - | - | - | 0.1 | 0.2 | 0.3 |
| | | 30 - 44 | 0.2 | - | - | - | - | - | - | - | - |
| | | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | | 60 - 74 | 0.2 | - | - | - | - | - | - | - | - |
| | | 75 - 89 | 0.2 | - | - | - | - | - | - | 0.1 | 0.1 |
| | | 90+ | - | - | - | - | - | - | - | - | - |
| O-11 | * | 0 - 14 | 6.5 | - | - | - | - | 0.4 | 0.9 | 1.5 | 2.1 |
| | | 15 - 29 | 0.7 | - | - | - | - | - | 0.1 | 0.2 | 0.3 |

| Miles of Wastewater Pipes Exposed within the Subregion | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Area | Sewer Type | Diameter (in) | Total Miles | Water Level Scenarios | | | | | | | |
| | | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| | | 30 - 44 | - | - | - | - | - | - | - | - | - |
| | | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | | 60 - 74 | 0.8 | - | - | - | - | - | 0.1 | 0.1 | 0.2 |
| | | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | | 90+ | - | - | - | - | - | - | - | - | - |
| O-12 | * | 0 - 14 | 1.8 | - | - | - | - | - | - | - | 0.2 |
| | | 15 - 29 | 0.5 | - | - | - | - | - | - | - | - |
| | | 30 - 44 | 0.5 | - | - | - | - | - | - | - | - |
| | | 45 - 59 | 0.2 | - | - | - | - | - | - | - | - |
| | | 60 - 74 | 0.1 | - | - | - | - | - | - | - | - |
| | | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | | 90+ | - | - | - | - | - | - | - | - | - |
| O-13 | * | 0 - 14 | 2.7 | - | 0.2 | 0.3 | 0.4 | 0.8 | 0.8 | 0.9 | 1.3 |
| | | 15 - 29 | 0.3 | - | - | - | - | - | - | - | - |
| | | 30 - 44 | - | - | - | - | - | - | - | - | - |
| | | 45 - 59 | 0.3 | - | - | - | - | - | - | - | - |
| | | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | | 90+ | - | - | - | - | - | - | - | - | - |
| O-14 | * | 0 - 14 | 0.1 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| | | 15 - 29 | - | - | - | - | - | - | - | - | - |
| | | 30 - 44 | - | - | - | - | - | - | - | - | - |
| | | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | | 90+ | - | - | - | - | - | - | - | - | - |
| O-15 | * | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | | 15 - 29 | - | - | - | - | - | - | - | - | - |
| | | 30 - 44 | - | - | - | - | - | - | - | - | - |
| | | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | | 90+ | - | - | - | - | - | - | - | - | - |
| O-16 | * | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | | 15 - 29 | - | - | - | - | - | - | - | - | - |
| | | 30 - 44 | - | - | - | - | - | - | - | - | - |
| | | 45 - 59 | - | - | - | - | - | - | - | - | - |

| Miles of Wastewater Pipes Exposed within the Subregion | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Area | Sewer Type | Diameter (in) | Total Miles | Water Level Scenarios | | | | | | | |
| | | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| | | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | | 90+ | - | - | - | - | - | - | - | - | - |
| O-17 | * | 0 - 14 | 0.3 | 0.0 | 0.0 | 0.1 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| | | 15 - 29 | - | - | - | - | - | - | - | - | - |
| | | 30 - 44 | - | - | - | - | - | - | - | - | - |
| | | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | | 90+ | - | - | - | - | - | - | - | - | - |
| O-18 | * | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | | 15 - 29 | - | - | - | - | - | - | - | - | - |
| | | 30 - 44 | - | - | - | - | - | - | - | - | - |
| | | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | | 90+ | - | - | - | - | - | - | - | - | - |
| O-19 | * | 0 - 14 | 22.1 | 0.1 | 0.8 | 1.1 | 2.6 | 5.3 | 6.2 | 7.1 | 7.8 |
| | | 15 - 29 | 5.1 | - | 0.2 | 0.4 | 0.8 | 1.5 | 1.7 | 1.9 | 2.0 |
| | | 30 - 44 | 0.6 | 0.1 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.4 | 0.4 |
| | | 45 - 59 | 0.3 | - | - | - | - | - | - | - | - |
| | | 60 - 74 | 3.1 | 0.1 | 0.3 | 0.5 | 1.4 | 2.0 | 2.1 | 2.2 | 2.3 |
| | | 75 - 89 | 0.0 | - | - | - | - | - | - | - | - |
| | | 90+ | 0.1 | - | - | - | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| O-20 | * | 0 - 14 | 14.2 | - | 0.1 | 0.1 | 1.5 | 2.8 | 3.2 | 3.6 | 4.0 |
| | | 15 - 29 | 2.5 | - | - | - | 0.6 | 1.1 | 1.2 | 1.3 | 1.3 |
| | | 30 - 44 | 0.6 | - | 0.1 | 0.1 | 0.2 | 0.3 | 0.4 | 0.4 | 0.4 |
| | | 45 - 59 | 0.6 | - | - | - | - | - | - | - | - |
| | | 60 - 74 | 1.1 | - | 0.2 | 0.3 | 0.4 | 0.6 | 0.6 | 0.6 | 0.6 |
| | | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | | 90+ | - | - | - | - | - | - | - | - | - |
| O-21 | * | 0 - 14 | 16.0 | 0.1 | 1.1 | 1.9 | 4.7 | 5.6 | 6.1 | 6.6 | 7.1 |
| | | 15 - 29 | 2.7 | - | - | - | 0.2 | 0.3 | 0.4 | 0.5 | 0.7 |
| | | 30 - 44 | 2.6 | 0.3 | 0.5 | 0.5 | 0.8 | 0.9 | 1.1 | 1.3 | 1.7 |
| | | 45 - 59 | 0.7 | - | 0.2 | 0.2 | 0.4 | 0.5 | 0.5 | 0.6 | 0.7 |
| | | 60 - 74 | 0.6 | 0.2 | 0.2 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| | | 75 - 89 | - | - | - | - | - | - | - | - | - |

| Miles of Wastewater Pipes Exposed within the Subregion | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Area | Sewer Type | Diameter (in) | Total Miles | Water Level Scenarios | | | | | | | |
| | | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| | | 90+ | - | - | - | - | - | - | - | - | - |
| O-22 | * | 0 - 14 | 20.8 | 0.4 | 1.4 | 2.5 | 6.4 | 7.9 | 8.5 | 8.9 | 9.9 |
| | | 15 - 29 | 2.3 | - | 0.1 | 0.2 | 0.7 | 0.9 | 0.9 | 1.0 | 1.1 |
| | | 30 - 44 | 0.6 | - | - | - | 0.3 | 0.5 | 0.5 | 0.5 | 0.5 |
| | | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | | 90+ | - | - | - | - | - | - | - | - | - |
| O-23 | * | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | | 15 - 29 | - | - | - | - | - | - | - | - | - |
| | | 30 - 44 | - | - | - | - | - | - | - | - | - |
| | | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | | 90+ | - | - | - | - | - | - | - | - | - |
| O-24 | * | 0 - 14 | 1.0 | 0.1 | 0.4 | 0.5 | 0.8 | 1.0 | 1.0 | 1.0 | 1.0 |
| | | 15 - 29 | 0.3 | 0.1 | 0.1 | 0.1 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 |
| | | 30 - 44 | - | - | - | - | - | - | - | - | - |
| | | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | | 90+ | - | - | - | - | - | - | - | - | - |
| O-25 | * | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | | 15 - 29 | - | - | - | - | - | - | - | - | - |
| | | 30 - 44 | - | - | - | - | - | - | - | - | - |
| | | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | | 90+ | - | - | - | - | - | - | - | - | - |
| O-26 | * | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | | 15 - 29 | - | - | - | - | - | - | - | - | - |
| | | 30 - 44 | - | - | - | - | - | - | - | - | - |
| | | 45 - 59 | - | - | - | - | - | - | - | - | - |
| | | 60 - 74 | - | - | - | - | - | - | - | - | - |
| | | 75 - 89 | - | - | - | - | - | - | - | - | - |
| | | 90+ | - | - | - | - | - | - | - | - | - |
| A-01 | Force | 0 - 14 | - | - | - | - | - | - | - | - | - |

| Miles of Wastewater Pipes Exposed within the Subregion | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Area | Sewer Type | Diameter (in) | Total Miles | Water Level Scenarios | | | | | | | |
| | | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| | | 15 - 29 | - | - | - | - | - | - | - | - | - |
| | Gravity | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | | 15 - 29 | - | - | - | - | - | - | - | - | - |
| A-02 | Force | 0 - 14 | 0.7 | 0.4 | 0.5 | 0.5 | 0.5 | 0.7 | 0.7 | 0.7 | 0.7 |
| | | 15 - 29 | 7.0 | 1.9 | 3.0 | 3.4 | 4.5 | 6.3 | 6.8 | 7.0 | 7.0 |
| | Gravity | 0 - 14 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| | | 15 - 29 | 1.2 | 0.2 | 0.3 | 0.4 | 0.7 | 1.0 | 1.2 | 1.2 | 1.2 |
| A-03 | Force | 0 - 14 | 0.4 | - | - | - | - | 0.1 | 0.2 | 0.4 | 0.4 |
| | | 15 - 29 | 4.0 | 0.3 | 0.6 | 0.7 | 1.5 | 2.0 | 2.5 | 3.0 | 3.3 |
| | Gravity | 0 - 14 | 0.9 | 0.7 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 |
| | | 15 - 29 | 2.0 | 0.2 | 0.3 | 0.3 | 1.1 | 1.4 | 1.5 | 1.8 | 2.0 |
| A-04 | Force | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | | 15 - 29 | 9.9 | 0.3 | 1.3 | 1.5 | 2.2 | 2.5 | 2.6 | 3.1 | 3.6 |
| | Gravity | 0 - 14 | 0.3 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| | | 15 - 29 | 1.6 | 0.3 | 0.6 | 0.7 | 0.9 | 0.9 | 0.9 | 0.9 | 1.0 |
| A-05 | Force | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | | 15 - 29 | 15.1 | - | 0.2 | 0.3 | 1.1 | 1.6 | 2.2 | 2.8 | 3.4 |
| | Gravity | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | | 15 - 29 | 0.8 | - | - | - | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 |
| A-06 | Force | 0 - 14 | 0.6 | - | - | - | - | 0.1 | 0.2 | 0.3 | 0.4 |
| | | 15 - 29 | 25.1 | 1.3 | 2.2 | 2.6 | 4.3 | 5.6 | 6.4 | 7.7 | 9.3 |
| | Gravity | 0 - 14 | 0.6 | - | - | - | - | - | - | - | - |
| | | 15 - 29 | 2.1 | - | - | - | 0.1 | 0.3 | 0.4 | 0.5 | 0.6 |
| A-07 | Force | 0 - 14 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| | | 15 - 29 | 0.3 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| | Gravity | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | | 15 - 29 | - | - | - | - | - | - | - | - | - |
| A-08 | Force | 0 - 14 | 1.3 | 0.1 | 0.3 | 0.4 | 0.7 | 1.0 | 1.1 | 1.3 | 1.3 |
| | | 15 - 29 | 4.3 | - | 0.3 | 0.4 | 1.8 | 3.1 | 3.7 | 4.1 | 4.3 |
| | Gravity | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | | 15 - 29 | 0.5 | - | - | - | 0.3 | 0.4 | 0.4 | 0.5 | 0.5 |
| A-09 | Force | 0 - 14 | 0.5 | - | - | - | - | 0.1 | 0.2 | 0.4 | 0.5 |
| | | 15 - 29 | 5.7 | - | - | - | 0.4 | 0.8 | 1.1 | 1.8 | 2.3 |
| | Gravity | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | | 15 - 29 | 0.4 | - | - | - | - | - | - | - | - |
| A-10 | Force | 0 - 14 | 0.2 | - | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| | | 15 - 29 | 1.2 | - | 0.3 | 0.4 | 0.6 | 0.8 | 1.0 | 1.0 | 1.1 |

| Miles of Wastewater Pipes Exposed within the Subregion | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Area | Sewer Type | Diameter (in) | Total Miles | Water Level Scenarios | | | | | | | |
| | | | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| | Gravity | 0 - 14 | 0.2 | - | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| | | 15 - 29 | 0.1 | - | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| A-11 | Force | 0 - 14 | 0.7 | - | 0.3 | 0.3 | 0.4 | 0.4 | 0.5 | 0.5 | 0.5 |
| | | 15 - 29 | 29.3 | - | 5.7 | 6.8 | 10.3 | 11.8 | 12.5 | 13.1 | 13.6 |
| | Gravity | 0 - 14 | 2.1 | - | 0.9 | 1.0 | 1.1 | 1.1 | 1.1 | 1.1 | 1.2 |
| | | 15 - 29 | 2.6 | - | 0.9 | 1.2 | 1.5 | 1.6 | 1.6 | 1.6 | 1.7 |
| A-12 | Force | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | | 15 - 29 | - | - | - | - | - | - | - | - | - |
| | Gravity | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | | 15 - 29 | - | - | - | - | - | - | - | - | - |
| A-13 | Force | 0 - 14 | 0.3 | - | - | - | - | 0.1 | 0.2 | 0.2 | 0.3 |
| | | 15 - 29 | 3.6 | - | - | - | 0.2 | 0.5 | 1.5 | 2.3 | 3.0 |
| | Gravity | 0 - 14 | 0.2 | - | - | - | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 |
| | | 15 - 29 | - | - | - | - | - | - | - | - | - |
| A-14 | Force | 0 - 14 | 0.3 | - | - | - | - | 0.2 | 0.3 | 0.3 | 0.3 |
| | | 15 - 29 | 4.2 | 0.1 | 0.4 | 1.0 | 1.8 | 2.5 | 4.0 | 4.2 | 4.2 |
| | Gravity | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | | 15 - 29 | 0.2 | - | - | 0.1 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| A-15 | Force | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | | 15 - 29 | 1.2 | - | - | - | - | 0.1 | 0.9 | 1.1 | 1.2 |
| | Gravity | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | | 15 - 29 | - | - | - | - | - | - | - | - | - |
| A-16 | Force | 0 - 14 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| | | 15 - 29 | 5.2 | 4.0 | 4.4 | 4.5 | 4.9 | 5.0 | 5.1 | 5.1 | 5.1 |
| | Gravity | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | | 15 - 29 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| A-17 | Force | 0 - 14 | 0.5 | 0.1 | 0.2 | 0.2 | 0.3 | 0.4 | 0.5 | 0.5 | 0.5 |
| | | 15 - 29 | 6.2 | 0.6 | 2.0 | 2.7 | 3.7 | 4.2 | 4.6 | 5.0 | 5.6 |
| | Gravity | 0 - 14 | 0.3 | 0.1 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 |
| | | 15 - 29 | 1.1 | 0.1 | 0.3 | 0.4 | 0.6 | 0.7 | 0.8 | 0.8 | 1.0 |
| A-18 | Force | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | | 15 - 29 | - | - | - | - | - | - | - | - | - |
| | Gravity | 0 - 14 | - | - | - | - | - | - | - | - | - |
| | | 15 - 29 | - | - | - | - | - | - | - | - | - |

*Oakland GIS data does not distinguish between force and gravity sewers.

Data Source: (City of Alameda 2023d; City of Oakland 2023b; EBMUD 2023)

## A.12. Wastewater Pumps

| Number of Stormwater Pump Stations Exposed within the Subregion | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Water Level Scenarios | | | | | | | |
| Area | Total Pumps | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| O-01 | - | - | - | - | - | - | - | - | - |
| O-02 | 4 | - | 1 | 1 | 2 | 3 | 3 | 4 | 4 |
| O-03 | - | - | - | - | - | - | - | - | - |
| O-04 | - | - | - | - | - | - | - | - | - |
| O-05 | - | - | - | - | - | - | - | - | - |
| O-06 | 1 | - | - | - | - | - | - | - | - |
| O-07 | - | - | - | - | - | - | - | - | - |
| O-08 | - | - | - | - | - | - | - | - | - |
| O-09 | - | - | - | - | - | - | - | - | - |
| O-10 | 1 | - | - | - | - | - | - | - | - |
| O-11 | - | - | - | - | - | - | - | - | - |
| O-12 | - | - | - | - | - | - | - | - | - |
| O-13 | 1 | - | - | 1 | 1 | 1 | 1 | 1 | 1 |
| O-14 | - | - | - | - | - | - | - | - | - |
| O-15 | - | - | - | - | - | - | - | - | - |
| O-16 | - | - | - | - | - | - | - | - | - |
| O-17 | - | - | - | - | - | - | - | - | - |
| O-18 | - | - | - | - | - | - | - | - | - |
| O-19 | - | - | - | - | - | - | - | - | - |
| O-20 | - | - | - | - | - | - | - | - | - |
| O-21 | - | - | - | - | - | - | - | - | - |
| O-22 | 1 | - | - | - | 1 | 1 | 1 | 1 | 1 |
| O-23 | - | - | - | - | - | - | - | - | - |
| O-24 | - | - | - | - | - | - | - | - | - |
| O-25 | - | - | - | - | - | - | - | - | - |
| O-26 | - | - | - | - | - | - | - | - | - |
| A-01 | - | - | - | - | - | - | - | - | - |
| A-02 | 3 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 3 |
| A-03 | 2 | - | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| A-04 | 2 | - | - | 1 | 1 | 1 | 1 | 1 | 1 |
| A-05 | 1 | - | - | - | - | - | - | - | - |
| A-06 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| A-07 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| A-08 | 8 | - | - | 1 | 2 | 5 | 7 | 8 | 8 |

| Number of Stormwater Pump Stations Exposed within the Subregion | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Water Level Scenarios | | | | | | | |
| Area | Total Pumps | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | 36" | 48" | 52" | 66" | 77" | 84" | 96" | 108" |
| A-09 | 1 | - | - | - | - | 1 | 1 | 1 | 1 |
| A-10 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| A-11 | 9 | - | 3 | 4 | 5 | 7 | 7 | 7 | 8 |
| A-12 | - | - | - | - | - | - | - | - | - |
| A-13 | 3 | - | - | - | 1 | 1 | 2 | 2 | 3 |
| A-14 | 2 | - | - | - | 1 | 1 | 1 | 2 | 2 |
| A-15 | 1 | - | - | - | - | - | 1 | 1 | 1 |
| A-16 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| A-17 | 5 | - | 1 | 1 | 2 | 4 | 4 | 4 | 4 |
| A-18 | - | - | - | - | - | - | - | - | - |

Data Source: (City of Alameda 2023c; City of Oakland 2023c)




# Appendix G
# Status of Previous Mitigation Strategies

Table shows the status of each strategy included in the 2022 Hazard Mitigation Plan.

| Strategy | Status |
|---|---|
| **Buildings** | |
| **B1 Solar Panels.** Encourage installation of solar panels and energy storage equipment in existing and new development and on public property such as the former Doolittle Landfill. | Deleted |
| **B2 Water Efficiency and Conservation.** Minimize water use in existing and new construction and landscaped areas to make Alameda more resilient to drought and generate less wastewater. | Carried Over to New Plan |
| **B3 Rising Groundwater.** Prepare for the impacts of rising groundwater levels on private and public property. | Carried Over to New Plan |
| **B4 Seismic Retrofit for Private Buildings.** Require owners of vulnerable structures, to the extent feasible, to retrofit existing structures to withstand earthquake ground shaking, and require retrofitting when such structures are substantially rehabilitated or remodeled | Carried Over to New Plan |
| **B5 Flood Insurance.** Continue the City's participation in the National Flood Insurance Program and the Community Rating System as a Class 8 community. Identify ways to increase Alameda's Community Rating to reduce flood insurance costs. | Carried Over to New Plan |
| **B6 Flood Proofing for Existing Buildings.** Implement programs to encourage flood-proofing retrofits to existing buildings and redevelopment in flood-prone areas. | Deleted |
| **B7 Design for Flooding.** Implement programs and amend regulations to require and incentivize flood-proofing retrofits to existing buildings in flood-prone areas and require all new development to design for sea level and associated groundwater rise based on the most current regional projections. (See also Polices LU-30 and CC-20). | Carried Over to New Plan |
| **B8 Building Codes for New Development.** Require new development to comply with the City's current Electrification, Fire, Seismic, and Sprinkler Codes. | Carried Over to New Plan |
| **B9 Fire Prevention in Existing Properties.** Encourage existing properties to minimize the risks of fire and include adequate provisions for emergency access and appropriate firefighting equipment. | Carried Over to New Plan |
| **B10 Building and Infrastructure Standards.** Maintain up-to-date building codes and encourage or require new and existing buildings and infrastructure to be designed or retrofitted for timely restoration of service (functional recovery) following an earthquake, with particular attention on the effects of liquefaction on buildings and infrastructure. | Deleted |
| **B11 Cool/Green Buildings.** Incentivize and consider requiring the installation of cool roofs, green roofs, and/or other energy-efficient cool building methods to mitigate heat impacts and reduce runoff. | Carried Over to New Plan |
| **B12 Sea Level Rise Protection.** Reduce the potential for property damage and loss, and loss of natural habitat resulting from sea level rise. | Carried Over to New Plan |

| | |
|---|---|
| Infrastructure | |
| **I1 Critical Public Assets.** Ensure resilience and long-term functionality of critical public assets threatened by earthquakes, sea level rise or rising groundwater. | Carried Over to New Plan |
| **I2 Water Retention.** Develop and maintain large and small areas to retain water within the city that may serve as areas of "retreat" during large storm events. | Carried Over to New Plan |
| **I3 Urban Forest.** Take actions to maintain and expand the number of trees in Alameda on public and private property to improve public health, reduce pollution, and reduce heat island effects. | Carried Over to New Plan |
| **I4 Lagoons.** Continue to preserve and maintain all lagoons as natural habitat as well as an integral component of the City's green infrastructure network and flood control system. | Carried Over to New Plan |
| **I5 On-Island Generation.** Support development of on-island solar power generation and on-island wind power with appropriately sized generation, storage, and microgrid distribution infrastructure to be able to provide power for a range of uses, including essential functions. Permit renewable energy generation facilities by right in zones with compatible uses and remove financial disincentives associated with the installation of clean energy generation and storage equipment | Carried Over to New Plan |
| **I6 Public Infrastructure Priorities.** Identify public transportation, streets, electric facilities, stormwater and wastewater facilities, open space, shoreline assets, and other public assets vulnerable to sea level and groundwater rise and flooding hazards and prioritize projects for adaptation funding. | Carried Over to New Plan |
| **I7 Green Infrastructure.** Require the use of "green infrastructure", landscaping, pervious surfaces, green roofs, and on-site stormwater retention facilities to reduce surface runoff and storm drain flooding during storm events. | Carried Over to New Plan |
| **I8 Underground Utilities.** Require new development to underground utilities to minimize disruption by fire or other natural disasters. | Carried Over to New Plan |
| **I9 Lifeline Standard Estuary Crossing.** Work with Caltrans, Alameda County, and other regional agencies to retrofit and improve at least one estuary crossing to meet a lifeline standard to ensure access to the larger region for emergency access, equipment supplies, and disaster response and recovery shortly after a major seismic event. | Carried Over to New Plan |
| **I10 Collaboration.** Work collaboratively with other jurisdictions and agencies to reduce fire hazards in Alameda, such as post-earthquake fire hazards, with an emphasis on mutual aid agreements. | |
| **Land Use** | |
| **L1 Groundwater Rise.** Review remediation timelines for contaminated sites based on a groundwater model with projected sea level rise impacts. Work with applicable agencies to adjust remediation, as applicable. | Deleted |
| **L2 Land Development.** Require that new development reduce the potential for property damage, and loss of natural habitat, which results from groundwater and sea level rise. | Carried Over to New Plan |
| **L3 Resilient Rights-of-Way and Open Spaces.** Design street rights-of-way, parks, other public spaces, street trees and landscaping to be resilient to temporary flooding. | Deleted |

| | |
|---|---|
| **L4 Easements.** Require the creation and maintenance of easements along drainage ways necessary for adequate drainage of normal or increased surface runoff due to storms. | Deleted |
| **Emergency Response** | |
| **E1 Heat and Wildfire Smoke.** Emergencies. Create a network of clean air and cooling emergency shelters throughout Alameda. | Carried Over to New Plan |
| **E2 Emergency Preparedness.** Maintain emergency management and disaster preparedness as a top City priority. | Carried Over to New Plan |
| **E3 Tsunami Preparedness.** Prepare Alameda for tsunamis and prepare for a timely evacuation with a focus of access and functional needs populations. | Carried Over to New Plan |
| **E4 Emergency Coordination.** Coordinate local emergency preparedness efforts with the Federal Emergency Management Agency, California Office of Emergency Services, Coast Guard, United States Maritime Administration Ready Reserve Fleet, the San Francisco Bay Area Water Emergency Transportation Authority, Alameda County, East Bay Municipal Utility District, the Port of Oakland, adjacent jurisdictions, CalWARN, the Alameda Unified School District, the various private schools in Alameda, local hospitals, housing facilities for seniors or individuals with disabilities, and other local and regional police, fire and public health agencies in preparation for natural and man-made disasters, and ensure that the City's disaster response communication technologies are compatible with other agency communication technologies. | Carried Over to New Plan |
| **E5 Wildfire Smoke.** Prepare for future wildfire smoke events. | Carried Over to New Plan |
| **E6 Emergency Response and Disaster Preparedness.** Preserve access for emergency response vehicles to people and property and for evacuation. | Carried Over to New Plan |
| **Communication, Community and Coordination** | |
| **C1 Public Communication.** Maintain and promote community programs to train volunteers, support vulnerable community members like seniors and individuals with disabilities, coordinate with food banks and other local aid organizations, and assist police, fire, and civil defense personnel during and after a major earthquake, fire, or flood. | Carried Over to New Plan |
| **C2 Air Quality Alerts.** Continue to partner with BAAQMD to enhance awareness of air quality index alerts and related outreach and education to protect the health of residents. | Carried Over to New Plan |
| **C3 Regional Partnerships.** Actively participate in regional discussions on groundwater and sea level rise mitigation, infrastructure improvements, and adaptation strategies. | Carried Over to New Plan |
| **C4 Collaboration.** Work collaboratively with other jurisdictions and agencies to reduce fire hazards in Alameda, such as post-earthquake fire hazards, with an emphasis on mutual aid agreements | Carried Over to New Plan |
| **C5 Neighborhood Resilience Coordination.** Consider piloting building electrification, water conservation and other climate initiatives at a block or neighborhood level to more cost effectively transition to climate friendly energy, water, and resource use | Carried Over to New Plan |

| | |
|---|---|
| **C6 Social Vulnerability.** Prioritize the needs of frontline communities when prioritizing public investments and improvements to address climate change. | Carried Over to New Plan |
| **Studies and Plans** | |
| **S1 Adaptation Pathway Master Plan.** Develop an adaptation pathway master plan. The plan will include additional vulnerability studies as needed, economic analysis, groundwater rise studies and other data collection as needed to identify the range of shoreline protection, groundwater management and adaptation strategies over time from short- to long-term as well as land use, building and infrastructure design standards needed to help Alameda adapt to rising sea and groundwater levels. | Carried Over to New Plan |
| **S2 Rising Groundwater.** Prepare for the impacts of rising groundwater levels on private and public property. | Carried Over to New Plan |
| **S3 Flood Hazard Maps.** Prioritize the review and publishing for public discussion the latest and most up to date flood hazard and sea level rise forecasts from all trusted sources. | Carried Over to New Plan |




# Appendix H
# Priority Mitigation Strategies

# Prioritization of Strategies

The third and final step selected and prioritized the specific mitigation actions. The mitigation actions represent an unambiguous and functional plan for action and are the most essential outcome of the mitigation planning process.

In general, all mitigation strategies considered by the Planning Team can be classified under one of the following seven broad categories

- Long Range Planning (for example: master plans, climate action plans)
- Land Use Planning (ex: general plan, specific plan)
- Capital Planning (ex: capital improvement plan)
- Operations (ex: annual budgeting)
- Emergency and Hazard Planning (ex: emergency operations)
- Project Planning and Design (ex: private and public development projects)
- New Initiatives (ex: legislation, ballot measure)

The City incorporated six key factors in the prioritization of mitigation actions. These criteria are described below:

- **Support of goals and objectives.** Actions that support multiple goals and objectives are prioritized.
- **Funding availability.** Actions with secured funding are prioritized.
- **Hazards addressed.** Actions addressing the Plan's hazards of greatest concern (earthquake and flooding) are prioritized.
- **Public and political support.** Actions with public and political support are prioritized.
- **Adverse environmental impact**. Actions with low environmental impact are prioritized.
- **Environmental benefit.** Actions that provide an environmental benefit are prioritized.
- **Timeframe**. Actions that are ongoing, or that can be completed in the short-term, are prioritized.
    - Ongoing: Currently being funded and implemented under existing programs
    - Short-term: To be completed in 1-2 years
    - Long-term: To be completed in more than 2 years
- **Equity.** Strategies that address equity issues or promote equitable outcomes are prioritized.

# Assignment of Strategies

Each mitigation strategy has a mitigation action plan presented in table format. Every proposed action is assigned to a specific local department or agency to assign responsibility and accountability and increase the likelihood of subsequent implementation. In addition to the assignment of a local lead department or

agency, an implementation time period or a specific implementation date or window has been assigned to each mitigation action to help assess whether actions are being implemented in a timely fashion. Resource availability will strongly influence the pace of achievements for those actions noted as currently unfunded.

## Equity Review of Strategies

An equity review was conducted for each of the mitigation and adaptation strategies. The equity review provides initial assessment of opportunities to enhance equity in the implementation of the strategies to ensure that every action put forward in this plan has a positive equity benefit and actively seeks to dismantle past harms. At later stages of planning, as strategies become specific projects with plans and budgets of their own, an equity framework will be used to guide the development of project specific implementation plans.

## Detailed Mitigation Strategies

Detailed information for each of the climate adaptation and hazard mitigation strategies is presented below in greater detail, including:

- Description
- Hazard(s) addressed
- Responsible city department or agency
- Related plan or policy
- Partners
- Priority
- Actions and activities completed
- Future actions and activities
- Potential Funding source
- Timeframe
- Equity considerations for implementation

# 2026 Mitigation Plan Strategies

Row 1

| | |
|---|---|
| **ID** | B1 |
| **Strategy Name** | Water Efficiency and Conservation |
| **Strategy Description** | Minimize water use in existing and new construction and landscaped areas to make Alameda more resilient to drought and generate less wastewater. |
| **Hazards Addressed** | Drought |
| **Strategy Type** | Plans/Policy |
| **Actions** | a. Water Efficient Landscape Requirements. Maintain up-to-date water-efficient landscaping regulations and ordinances to reduce water use in both private and public landscapes that include healthy, drought tolerant soils, diverse native plant species, non-invasive drought tolerant/low water use plants, and high-efficiency irrigation systems. b. Water-Efficient Buildings. Require low-flow fixtures, such as low-flow toilets and faucets in new construction. c. Recycled and Reclaimed Water. Promote the production and usage of recycled and reclaimed water (sometimes called “grey water”) for potable and non-potable uses. d. Pesticides, Herbicides, and Fertilizers. Limit the use of pesticides, herbicides, and fertilizers throughout the city by fostering healthy soil practices, which include organic carbon amendments (e.g. compost and mulch) on all non-turf planting areas. e. Soil Health. Encourage soil health by promoting and educating the public about the benefits of organic carbon soil amendments that improve water retention in local landscapes. f. EBMUD. Work with EBMUD to improve effectiveness of water conservation programs and increase drought awareness. g. City Buildings. Implement water-saving technologies at all City-owned buildings and post visible signage to educate visitors to those buildings. |
| **Lead Department** | Planning, Building and Transportation<br>Public Works<br>Recreation and Parks |
| **Related Plan/ Policy** | General Plan Policy CC-16 |
| **Key Partners** | EBMUD |
| **2024 Status - Completed Actions** | Increased composting, reduced irrigation of decorative lawns (resulting in 3.6% reduction), turned off fish cleaning spigots at Encinal Beach (alternative fish cleaning methods being explored), converted City Hall lawn to drought tolerant landscape in 2022, converted City Hall West lawn to drought tolerant landscape in 2023, prioritized fixing pipe leaks, converted irrigation clocks to rain sensitive clocks (resulting in 15% reduction). |

| Future Actions | |
|---|---|
| **Potential Funding Source** | EBMUD, HMGP, General Fund |
| **Timeframe** | Ongoing |
| **Equity Considerations for Implementation** | Provide benefits for drought-resistant landscapes that support lower income communities. |

# 2026 Mitigation Plan Strategies

Row 2

| | |
|---|---|
| **ID** | B2 |
| **Strategy Name** | Rising Groundwater |
| **Strategy Description** | Prepare for the impacts of rising groundwater levels on private and public property. |
| **Hazards Addressed** | Groundwater Rise |
| **Strategy Type** | Plans/Policy |
| **Actions** | a. Infrastructure and Access. Develop plans and strategies to protect and/or relocate critical infrastructure to maintain access to impacted property. b. Building Codes. Prepare and adopt revised zoning and building codes to increase resilience of new buildings against the impacts of rising groundwater. c. Policies. Develop a policy that impedes the development or expansion of new below ground basements in areas with high groundwater. Basement flooding is a recurring issue experienced by individual homeowners or renters, using sump pump devices. c. Annual Review. Annually monitor groundwater levels and progress on specific strategies to mitigate impacts d. Data. Collect new data, add groundwater monitoring wells, analyze additional contaminants and potential landfill risks, update liquefaction zones and continue to refine the quality of the groundwater model. |
| **Lead Department** | Planning, Building and Transportation<br>Public Works |
| **Related Plan/ Policy** | General Plan Policy CC-23, HS-35 |
| **Key Partners** | |
| **2024 Status - Completed Actions** | - Completed and published a report, titled “The Response of the Shallow Groundwater Layer and Contaminants to Sea Level Rise”<br>- Incorporated groundwater rise in the 2022 Climate Adaptation and Hazard Mitigation Plan.<br>- Staff is evaluating needed building code updates and policies needed to respond to rising groundwater and incorporating groundwater considerations into shoreline adaptation projects.<br>- Staff is evaluating the need to update ts groundwater data and modeling. |
| **Future Actions** | Collect new data, add groundwater monitoring wells, analyze additional contaminants and potential landfill risks, update liquefaction zones and continue to refine the quality of the groundwater model. |

| | |
|---|---|
| **Potential Funding Source** | General Fund |
| **Timeframe** | Short-term |
| **Equity Considerations for Implementation** | |

# 2026 Mitigation Plan Strategies

Row 3

| | |
|---|---|
| **ID** | B3 |
| **Strategy Name** | Seismic Retrofit for Private Buildings |
| **Strategy Description** | Require owners of vulnerable structures, to the extent feasible, to retrofit existing structures to withstand earthquake ground shaking, and require retrofitting when such structures are substantially rehabilitated or remodeled. |
| **Hazards Addressed** | Earthquake Ground Shaking<br>Earthquake Liquefaction |
| **Strategy Type** | Plans/Policy |
| **Actions** | a. Soft Story Program. Continue to implement and expand the City's Soft Story Program including mandatory requirements for substantially improving the seismic performance of multi-family wood frame residential buildings with open ground floor parking or commercial spaces known as soft stories. b. Wood Framed Building Program. Continue to implement and expand the City's Wood Framed Building Program, including requirements for substantially improving the seismic performance of one- and two story wood frame residential buildings with vulnerable "cripple walls". c. Non-ductile Concrete Buildings. Identify, evaluate and retrofit non-ductile concrete residential and nonresidential buildings that are vulnerable to collapse in earthquakes. d. Chimneys. Encourage owners to remove or rebuild masonry or stone chimneys vulnerable to collapse in earthquakes. e. Incentives. Develop incentives and assistance to help property owners make their homes and businesses more earthquake-safe. Pursue a variety of funding sources, such as grants, low-interest loans, tax credits and zoning waivers and density bonuses, to assist residents and businesses with seismic upgrades. Provide exemptions from City zoning requirements, such as off-street parking and/or common open space to facilitate the retrofitting of vulnerable privately-owned buildings. f. Shoreline Property Management. Require owners of shoreline properties, to the extent feasible, to inspect, maintain, and repair the perimeter slopes to withstand earthquake ground shaking, consolidation of underlying bay mud, and wave erosion. |
| **Lead Department** | Planning, Building and Transportation |
| **Related Plan/ Policy** | General Plan Policy HS-13, Municipal Code Section 13-80.1 to 13-80.16 and 13-70.1 to 13-70.6 |
| **Key Partners** | Community and Economic Development |
| **2024 Status - Completed Actions** | - Staff completed a cost-benefit analysis of a typical soft-story seismic retrofit and scope of work and applied for a FEMA hazard mitigation grant (HMGP) in 2023 to provide financial support to soft-story building owners to complete a retrofit of their building. In 2024, |

| | |
|---|---|
| | the grant program was moved forward for funding consideration by CalOES.<br>- Staff have been conducting outreach to the public to encourage participation in the California Brace and Bolt programs that provide grants to seismically retrofit single family homes. |
| **Future Actions** | Seek funding to support retrofit of vulnerable soft-story buildings. Encourage residents through a variety of means to apply for CEA Brace and Bolt Program. |
| **Potential Funding Source** | HMGP, CEA Brace and Bolt Program, CDBG |
| **Timeframe** | Short-term |
| **Equity Considerations for Implementation** | Prioritize buildings that are most at risk for earthquake damage/pose a safety threat. Reach out to tenants and building owners through multiple channels and provide translated materials. |

# 2026 Mitigation Plan Strategies

Row 4

| | |
|---|---|
| **ID** | B4 |
| **Strategy Name** | Flood Insurance |
| **Strategy Description** | Continue the City’s participation in the National Flood Insurance Program and the Community Rating System as a Class 8 community. Maintain Alameda’s Community Rating to reduce flood insurance costs. |
| **Hazards Addressed** | Flooding<br>Sea Level Rise |
| **Strategy Type** | Financial |
| **Actions** | |
| **Lead Department** | Public Works |
| **Related Plan/ Policy** | General Plan Policy HS-14, Municipal Code Section XX - Floodplain Management |
| **Key Partners** | City Council Community and Economic Development FEMA Planning, Building, and Transportation |
| **2024 Status - Completed Actions** | - City Council adopted the 2018 revised FEMA Flood Insurance Rate Maps following the appeal period. City widened enforcement of floodplain management requirements regulating new construction in Special Flood Hazard Areas to include the additional properties added to the flood zone as a result of the FIRM map revision.<br><br>- The Community Rating System (CRS) is a voluntary program implemented by FEMA that encourages cities to take certain steps to reduce flood exposure through public information, mapping, regulations, flood damage reduction, warning, and response. As an incentive, insurance rates for individual policy holders are decreased by a percentage for creditable activities. The City joined CRS in October 2019 as a Class 8 community.<br><br>- The City adopted new Floodplain Management Regulations in May 2024 an updated Chapter XX - Floodplain Management in the Alameda Municipal Code. Key changes to the ordinance include: requiring finish floor elevations to one foot above the Base Flood Elevation, consistent with the California Building Code, track substantial addition valuations over a rolling five year period, and requiring a non-conversion agreement for all storage areas below the Base Flood Elevation. |
| **Future Actions** | The City must recertify its CRS status every year and provide supportive documentation. Maintain City participation in the National Flood Insurance Program, thereby allowing citizens benefits of |

| | |
|---|---|
| | reduced flood insurance rates. Work with HOAs concerning possible dike improvements. Continue to educate residents about floods and preparedness. Continue to enforce floodplain management requirements, including regulating new construction in Special Flood Hazard Areas, administer any local requests for map updates, give community assistance, and monitor activities. |
| **Potential Funding Source** | Urban Runoff Fund |
| **Timeframe** | City Council adopted new Floodplain Management Regulations in May 2024. City Council adopted the 2018 revised FEMA Flood Insurance Rate Maps following the appeal period. Ongoing implementation continues for building and construction standards for properties designated in flood zone. |
| **Equity Considerations for Implementation** | |

# 2026 Mitigation Plan Strategies

Row 5

| | |
|---|---|
| **ID** | B5 |
| **Strategy Name** | Design for Flooding |
| **Strategy Description** | Implement programs and amend regulations to require and incentivize flood-proofing retrofits to existing buildings in flood-prone areas and require all new development to raise finished floor elevations and design for sea level and associated groundwater rise based on the most current regional projections. |
| **Hazards Addressed** | Flooding<br>Groundwater Rise<br>Sea Level Rise |
| **Strategy Type** | Plans/Policy |
| **Actions** | a. Waterfront Setbacks. Require new development to provide adequate setbacks along waterfront areas for the future expansion of seawalls and levees to adapt to sea level rise. b. Data. Update maps and publish open data that display these risks clearly as soon as new data or guidelines are created, such as a digital elevation model, sea level and groundwater risks, or the latest risk tolerance guidance provided by the State of California. c. Building Codes. Amend local codes to require flood-proofing techniques in defined flood hazard zones and adjacent areas to protect them from future sea level rise. Consider incorporating sea level rise into the flood management section of the Building Code to encourage, incentivize, or require compliance with base floor elevation and flood-proofing requirements to mid-century sea levels. d. Risk Prioritization. Inventory and prioritize highest at-risk buildings, including those serving vulnerable populations, for resiliency upgrades. e. Assistance. Adopt fee waiver or small grant programs to help low-income households and other vulnerable residents pay for flood retrofits. |
| **Lead Department** | Planning, Building and Transportation |
| **Related Plan/ Policy** | General Plan Policies HS-19, HS-22, LU-20, CC-20 |
| **Key Partners** | |
| **2024 Status - Completed Actions** | - Completed Alameda Master Infrastructure Plan which requires the Adaptive Reuse Area to be designed to address 36-inches of sea level rise (plus required freeboard) and additional sea level rise in future years beyond 36 inches through adaptive management strategies.<br>- Updated Chapter XX, Floodplain Management of the Alameda Municipal Code to require elevating or floodproofing of all new or substantially approved structures to a minimum 1 foot above the Base Flood Elevation. Additionally incorporate the California Building |

| | |
|---|---|
| | Code by direct reference which includes risk prioritization where critical facilities are required to provide greater levels of protection against flooding. |
| **Future Actions** | |
| **Potential Funding Source** | Private developers, HMGP, BRIC |
| **Timeframe** | Ongoing |
| **Equity Considerations for Implementation** | Consider the impact of floodproofing requirements on undeserved populations and identify options to help low-income households and other vulnerable residents pay for flood retrofits. |

# 2026 Mitigation Plan Strategies

Row 6

| | |
|---|---|
| **ID** | B6 |
| **Strategy Name** | Building Codes |
| **Strategy Description** | Maintain up to date building codes and adopt new codes as needed to improve building safety and reoccupancy in an earthquake, fire, flood or other disaster. |
| **Hazards Addressed** | Earthquake Caused Fires<br>Earthquake Ground Shaking |
| **Strategy Type** | Plans/Policy |
| **Actions** | a. Adopt the latest California Building Standards Code with local amendments as needed to improve building safety and reoccupancy in an earthquake, fire, flood or other disaster. b. Amend the Alameda Municipal Code to adopt the latest International Property Maintenance Code with local amendments to preserve the integrity of all structural, plumbing, mechanical, electrical, egress, energy, light, ventilation and other elements of residential and commercial structures. c. Functional Recovery Standard. Amend the Alameda Municipal Code to ensure that all new buildings in Alameda are designed to a functional recovery standard so that they can continue to be used after an earthquake. d. No Collapse Standard. Ensure that all existing buildings meet a minimum no collapse standard. |
| **Lead Department** | Fire<br>Planning, Building and Transportation |
| **Related Plan/ Policy** | General Plan Policy HS-10, HS-28 |
| **Key Partners** | |
| **2024 Status - Completed Actions** | - The City adopted the 2022 California Building Standards Code with local amendment to the Fire Code requiring fire sprinklers for major remodels and additions for existing buildings.<br>- The City continues to enforce the building code<br>- Included discussion of functional recovery in hazard mitigation plan update |
| **Future Actions** | - Adopt future versions of the California Buildings Standards Code with local amendments as needed to improve building safety and reoccupancy in an earthquake, flood or disaster. - Consider model codes and guidance on how to effectively implement functional recovery standards. |
| **Potential Funding Source** | Private developers, General Fund |

| | |
|---|---|
| **Timeframe** | Ongoing |
| **Equity Considerations for Implementation** | Low income homeowners and tenants will have a harder time relocating following a disaster if their home is damaged and may be at a higher risk for displacement. |

# 2026 Mitigation Plan Strategies

Row 7

| | |
|---|---|
| **ID** | B7 |
| **Strategy Name** | Fire Prevention in Existing Properties |
| **Strategy Description** | Encourage existing properties to minimize the risks of fire and include adequate provisions for emergency access and appropriate firefighting equipment. |
| **Hazards Addressed** | Earthquake Caused Fires |
| **Strategy Type** | Plans/Policy |
| **Actions** | a. Fire sprinklers. Require certain properties to provide fire sprinklers during major renovations or remodels. b. Electrification. Encourage existing properties to convert natural gas fueled space heating, water heating, clothes drying and cooking appliances to electric to minimize the risk of post-earthquake fires and improve indoor air quality. c. Gas shut-off valves. Encourage and require properties to install automatic gas shut-off valves. |
| **Lead Department** | Fire<br>Planning, Building and Transportation |
| **Related Plan/ Policy** | General Plan Policy HS-29 |
| **Key Partners** | AMP |
| **2024 Status - Completed Actions** | - Alameda Municipal Power provides rebates and incentives for building electrification and will be rolling out new ones in the coming years.<br>- City adopted local amendments to the 2022 California Fire Code requiring fire sprinklers for major remodels and additions of existing buildings.<br>- Owners of identified soft-story buildings were required to install an earthquake-actuated gas shut-off valve on the building to reduce the likelihood of natural gas fire ignitions in earthquakes.<br>- To date, approximately 2,794 permits have been issued for gas shut-off valves in the city |
| **Future Actions** | - Consider local amendments to future editions of the California Energy and Fire Codes that require higher than state minimum standards for energy efficiency and fire sprinklers. - Adopt a City Ordinance mandating the permitting and installation of a listed and approved seismic gas shut-off valve for all properties being sold within 90 days after transferring title and undergoing a major remodeling job as deemed by the Building Official. |

| | |
|---|---|
| **Potential Funding Source** | General Fund, HMGP |
| **Timeframe** | Long-term |
| **Equity Considerations for Implementation** | Ensure that the transition to all-electric buildings includes residents in multi-unit housing, renters and low income tenants. |

# 2026 Mitigation Plan Strategies

Row 8

| | |
|---|---|
| **ID** | B8 |
| **Strategy Name** | Cool/Green Buildings |
| **Strategy Description** | Incentivize and consider requiring the installation of cool roofs, green roofs, and/or other energy-efficient cool building methods to mitigate heat impacts and reduce runoff. |
| **Hazards Addressed** | Heat |
| **Strategy Type** | Plans/Policy |
| **Actions** | |
| **Lead Department** | Planning, Building and Transportation |
| **Related Plan/ Policy** | General Plan Policy CC-34 |
| **Key Partners** | |
| **2024 Status - Completed Actions** | - The Alameda Point Stormwater Management Plan requires installation of green roofs at Alameda Point.<br>- City Council approved revisions to the Design Review ordinance in 2019 exempting green roof, cool roofs, and similar roof treatments from design review, provided the installation does not require modifying the existing roof form or pitch. |
| **Future Actions** | Consider ways to support green roof installation on existing buildings |
| **Potential Funding Source** | General Fund |
| **Timeframe** | Long-term |
| **Equity Considerations for Implementation** | Consider prioritizing and incentivizing cool/green roofs in heat island areas. |

# 2026 Mitigation Plan Strategies

Row 9

| | |
|---|---|
| **ID** | B9 |
| **Strategy Name** | Sea Level Rise Protection |
| **Strategy Description** | Reduce the potential for property damage and loss, and loss of natural habitat resulting from sea level rise. |
| **Hazards Addressed** | Flooding<br>Sea Level Rise |
| **Strategy Type** | Admin/Tech |
| **Actions** | a. Flood Protection Maps. Work with regional agencies to regularly update the Climate Action and Resiliency Plan with projected inundation zones for years 2070 and 2100 consistent with the most up to date guidance from the Ocean Protection Council (OPC) for sea level rise in California. b. Contaminated Lands. Identify and map contaminated lands at risk of inundation from rising groundwater and flood inundation and identify actions to mitigate the risk of mobilizing contaminants. c. Land Planning. Prioritize areas of little or no flood risk for new flood-incompatible development (i.e. housing and commercial development) in new plans or zoning decisions. d. Shoreline Habitat and Buffer Lands. Identify, preserve, and restore existing undeveloped areas susceptible to sea level rise to reduce flood risk, enhance biodiversity, and improve water quality. Maintain and restore existing natural features (i.e. marsh, vegetation, sills, etc.) between new development and the shore to allow for marsh or beach migration. e. Conservation Easements. Consider use of conservation easements to maintain private lands for shoreline and beach migration. f. Nature Based Flood Control Systems. When designing new flood control systems where none currently exist, prioritize use of nature based flood control systems, such as horizontal levees, marsh lands, or beach restoration. |
| **Lead Department** | Community and Economic Development<br>Planning, Building and Transportation<br>Public Works |
| **Related Plan/ Policy** | General Plan Policy CC-19 |
| **Key Partners** | Veterans' Administration (for Alameda Nature Reserve) |
| **2024 Status - Completed Actions** | - Launched Bay Farm Island and Estuary Adaptation Projects in 2023. Received funding, consultants have completed existing conditions analysis and developed draft alternatives for public consideration.<br>- Staff applied for the FEMA Building Resilient Infrastructure and Communities (BRIC) grant program in 2024 to advance the Bay Farm Island Adaptation Project in partnership with the City of Oakland, Port of Oakland, EBRPD and Caltrans to address flooding on Doolittle Drive and within FEMA Community Disaster Resilience |

| | |
|---|---|
| | Zones. The proposal was recommended by FEMA for further review. |
| **Future Actions** | Seek additional grants to implement concept designs and continue community engagement. |
| **Potential Funding Source** | General Fund |
| **Timeframe** | Ongoing |
| **Equity Considerations for Implementation** | Continue to fund community partners to conduct grassroots outreach to impacted communities and build capacity. |

# 2026 Mitigation Plan Strategies

Row 10

| | |
|---|---|
| **ID** | I1 |
| **Strategy Name** | Critical Public Assets |
| **Strategy Description** | Ensure resilience and long-term functionality of critical public assets threatened by earthquakes, sea level rise or rising groundwater. |
| **Hazards Addressed** | Dam Failure<br>Earthquake Ground Shaking<br>Flooding<br>Liquefaction<br>Sea Level Rise |
| **Strategy Type** | Admin/Tech |
| **Actions** | a. Stormwater System. Model potential impacts to utility infrastructure under future sea level rise scenarios, including an assessment of potential increases in inflow and infiltration rates from rising groundwater, and the impact of reduced outflow capacities at the City's 278 outfall locations. Conduct regular inspection and maintenance of stormwater infrastructure to identify infiltration points and maintain the conveyence capacity of the system. Identify funding sources to improve the public stormwater infrastructure and ensure it meets current needs and is prepared for the effects of sea level rise and climate change. b. Sewer System. Protect vulnerable wastewater systems and facilities to minimize disruption to the systems following ground shaking and extreme weather events. c. Electric System. Consider the impact of flooding on electrical infrastructure (AMP), including utility poles and pull boxes. Develop and implement an asset management plan that prioritizes repairing or replacing infrastructure that flooding is likely to impact. d. Transportation. Work with Caltrans and the Alameda County Transportation Commission to identify funding to adapt the regional and local roadways in Alameda. |
| **Lead Department** | AMP<br>Planning, Building and Transportation<br>Public Works |
| **Related Plan/ Policy** | General Plan Policy CC-22 and HS-12 |
| **Key Partners** | Northern California Power Agency PG&E EBMUD |
| **2024 Status - Completed Actions** | - Initiated sea level rise adaptation projects (see I6)<br>- An updated comprehensive cleaning and condition assessment for the entire stormwater system has been completed for three watersheds totaling $650K. An additional watershed is planned for 2024-25 totaling $250K. Annual funding availability will determine when remaining watersheds can be completed. |

| | |
|---|---|
| **Future Actions** | - Model potential impacts to utility infrastructure under future sea level rise scenarios. Implement wastewater resilience best practices for the City-owned sewer system by incorporating sea level rise projections into the City's next Sewer Management Plan. - Conduct comprehensive visual and functional test monitoring and asset condition assessment. Model potential impacts to utility infrastructure under future sea level and groundwater rise scenarios. - Raise and strengthen the foundation of Cartwright substation, install new seismically approved bus structures and seismically retrofit bus structures of the existing substation, and replace major equipment to withstand earthquakes. Continue evaluating local energy storage and other resiliency improvements to the electric system. - Seek funding to complete concepts for these three high-priority locations. - Conduct thorough review of all City buildings to determine any needed structural, mechanical or electrical seismic weaknesses. - Identify deficits and protection needed for City buildings subject to coastal flood hazards and local storm hazards. - For all critical City Buildings, consider responses needed to the secondary hazards of fire, temporary utility loss, and temporary access loss. - Address appropriate seismic, fire, and flood safety analysis based on current and future use for all City-owned facilities and structures. - Strengthen or replace City buildings in the identified prioritized order as funding is available. - Evaluate Alameda Point buildings as they are turned over to the City from the Navy. Have a plan to demolish them or make them habitable. |
| **Potential Funding Source** | Facility Maintenance Fund 706, HMGP, BRIC, AMP and City Capital Improvement Programs |
| **Timeframe** | Ongoing |
| **Equity Considerations for Implementation** | Possibly focus on buildings that incur a lot of public use so that improvements can be enjoyed by the maximum number of residents. |

# 2026 Mitigation Plan Strategies

Row 11

| | |
|---|---|
| **ID** | I2 |
| **Strategy Name** | Stormwater Detention |
| **Strategy Description** | Design street rights-of-way, parks, other public spaces, street trees and landscaping to be resilient to temporary flooding and to serve as temporary water detention sites where feasible. |
| **Hazards Addressed** | Flooding<br>Sea Level Rise |
| **Strategy Type** | Plans/Policy |
| **Actions** | a. Alameda Nature Reserve. Support use and development of the 550 acre former US Navy airfields and runways as a Nature Reserve and area of wetlands that may serve as flood water retention area during major storm events. b. Stormwater Detention Basins. Identify areas of open space that can be converted to temporary stormwater detention basins during large storms to improve the capacity of the stormwater system. c. Public Participation. Encourage the public's use of small-scale green infrastructure design standards, guidance, and typical details, as presented in the City's Green Infrastructure Plan, for residential and garden projects. |
| **Lead Department** | Planning, Building and Transportation<br>Public Works |
| **Related Plan/ Policy** | General Plan Policy HS-19, HS-22, CC-24 |
| **Key Partners** | |
| **2024 Status - Completed Actions** | - The Estuary Adaptation Project includes concepts for inland detention areas to reduce flooding during large storm events.<br>- General Plan 2040 supports the development of the Nature Reserve and Government sub-district for wildlife habitat to preserve and protect the natural habitat in this area and protect endangered species and other wildlife and plant life that inhabit, make use of, or are permanently established within this area. |
| **Future Actions** | |
| **Potential Funding Source** | Capital Budget, Grants |
| **Timeframe** | Ongoing |

| | |
|---|---|
| **Equity Considerations for Implementation** | Consider targeting neighborhoods with high exposure to heat island effect and high percentage of impervious pavement |

# 2026 Mitigation Plan Strategies

Row 12

| | |
|---|---|
| **ID** | I3 |
| **Strategy Name** | Urban Forest |
| **Strategy Description** | Maintain and expand the number of trees in Alameda on public and private property to improve public health, reduce pollution, and reduce heat island effects. |
| **Hazards Addressed** | Heat |
| **Strategy Type** | Admin/Tech |
| **Actions** | a. Tree Preservation. Continue to require and incent the preservation of large healthy non-invasive trees and vegetation. b. New Development and Parking Lots. Require ample tree plantings in new development and related parking lots. c. Strengthen Tree Replacement Requirement. Strengthen the tree replacement requirement for any protected trees removed due to new development or redevelopment. d. Prioritize Tree Planting. Invest in tree planting and maintenance, especially in low canopy areas and neighborhoods with under-served or under-represented communities. Resilient Urban Forest. Support the increase of the tree canopy in Alameda with drought tolerant, shade- producing, fire resistant tree species. f. Public Parks and Lands. Utilize public parks and public lands, such as Alameda Point, to significantly increase the urban forest. g. Maintain and Update the City's Master Tree Plan. Ensure an up-to-date, climate friendly Master Tree Plan that selects drought tolerant, shade-producing, fire resistant tree species adapted to Alameda's changing climate. |
| **Lead Department** | Public Works<br>Recreation and Parks |
| **Related Plan/ Policy** | General Plan Policy CC-26 |
| **Key Partners** | AMP |
| **2024 Status - Completed Actions** | Secured funding from Council to update and expand the Master Tree Plan as and Urban Forest Plan. |
| **Future Actions** | Provide draft plan for public review and seek Council adoption. Implement the plan. |
| **Potential Funding Source** | Urban Forest operating budget, General Fund |

| | |
|---|---|
| **Timeframe** | Short-term |
| **Equity Considerations for Implementation** | Utilize Priority Planting Score in Urban Forest Plan to expand the urban forest in underserved neighborhoods and those with high social vulnerability. |

# 2026 Mitigation Plan Strategies

Row 13

| | |
|---|---|
| **ID** | I4 |
| **Strategy Name** | Lagoons |
| **Strategy Description** | Continue to preserve and maintain the lagoons as natural habitat as well as an integral component of the City's green infrastructure network and flood control system. |
| **Hazards Addressed** | Flooding |
| **Strategy Type** | Admin/Tech |
| **Actions** | |
| **Lead Department** | Public Works |
| **Related Plan/ Policy** | General Plan Policy CC-32 |
| **Key Partners** | EBMUD, BCDC, Army Corp, State Water Board |
| **2024 Status - Completed Actions** | The FY-19-21 Capital Improvement Program includes an item for lagoon maintenance and dredging of the lagoons. Maintenance dredging of Lagoon 3 and a portion of Lagoon 5. |
| **Future Actions** | Bay Farm Island Adaptation Project includes concept to preserve and maintain the Bay Farm Island lagoons from sea level rise. |
| **Potential Funding Source** | Capital Budget, HMGP, BRIC |
| **Timeframe** | Ongoing |
| **Equity Considerations for Implementation** | |

# 2026 Mitigation Plan Strategies

Row 14

| | |
|---|---|
| **ID** | I5 |
| **Strategy Name** | On-Island Generation |
| **Strategy Description** | Support development of on-island solar power generation and wind power. |
| **Hazards Addressed** | Earthquake Ground Shaking<br>Wind/Storms |
| **Strategy Type** | Admin/Tech |
| **Actions** | a. Encourage installation of solar panels and energy storage equipment in existing and new development and on public property such as the former Doolittle Landfill. b. Permit renewable energy generation facilities by right in zones with compatible uses and remove financial disincentives associated with the installation of clean energy generation and storage equipment. c. Ensure appropriately sized generation, storage, and microgrid distribution infrastructure to be able to provide power for a range of uses, including essential functions. |
| **Lead Department** | AMP |
| **Related Plan/ Policy** | General Plan Policy CC-4, CC-14 |
| **Key Partners** | Planning, Building, and Transportation |
| **2024 Status - Completed Actions** | - Starting November 1, 2022, AMP began waiving the $300 interconnection fee for residential customers installing new PV systems or new PV systems with battery storage in buildings built before January 1, 2020. This fee waiver does not apply to commercial solar projects or installations greater than 50 kilowatts.<br>- AMP now offers a $500 rebate for income-qualified customers who are installing solar.<br>- AMP offers and Eligible Renewable Generation (ERG) plan, a special rate plan for new renewable generation customers that went into effect on December 31, 2016.<br>- In 2023, 240 AMP customers completed rooftop solar installations, a 33% increase from 2022. The cumulative capacity of al solar generation systems in Alameda is 3,029.7 kW.<br>- Distributed Energy Resources (DER) Plan:<br>• AMP has the ability and technology to safely integrate distributed energy resources into its distribution grid. Engineering staff has been evaluating various tools that lay the foundation to integrate software that will allow AMP to comprehensively determine the maximum amount of DER’s on AMP’s grid. This continuous process of development and implementation will last well into 2022.<br>• Engineering and Operations (E&O) continuously approves, inspects, and interconnects new solar photovoltaic systems often |

| | |
|---|---|
| | coupled with battery storage. |
| **Future Actions** | AMP is working on installing a 2 MW solar facility at Doolittle Landfill interconnected into AMP’s grid. Cost $9.15M over 20 years. |
| **Potential Funding Source** | AMP funds |
| **Timeframe** | Ongoing |
| **Equity Considerations for Implementation** | The elderly and disabled may rely on continuous power for medical devices and other uses and this project will help improve the reliability of the grid to protect those vulnerable populations. |

# 2026 Mitigation Plan Strategies

Row 15

| | |
|---|---|
| **ID** | I6 |
| **Strategy Name** | Public Infrastructure Priorities |
| **Strategy Description** | Identify public transportation, streets, electric facilities, stormwater and wastewater facilities, open space, shoreline assets, and other public assets vulnerable to sea level and groundwater rise and flooding hazards and earthquakes and prioritize projects for adaptation funding, including strategies for Location-Based Priority Flooding (Tables 5-1 to 5-19). |
| **Hazards Addressed** | Coastal Erosion<br>Earthquake Ground Shaking<br>Flooding<br>Groundwater Rise<br>Liquefaction<br>Sea Level Rise |
| **Strategy Type** | Admin/Tech |
| **Actions** | a. Shoreline Facilities Program. Implement a program for Resilient Shoreline Facilities, including performing appropriate seismic, storm, flooding and other safety analyses based on current and future use for all City-owned shoreline facilities, including dikes, shore protection (rip rap), lagoon sea walls, storm water outfalls, marinas and protective marshlands. b. Location-Based Priority Flooding. Design and permit shovel-ready adaptation projects at areas of location-based priority flooding. Include considerations of rising groundwater surface and the potential for contaminant mobilization into analysis of priority flooding locations. |
| **Lead Department** | Planning, Building and Transportation<br>Public Works |
| **Related Plan/ Policy** | General Plan Policy HS-17 |
| **Key Partners** | Caltrans FEMA |
| **2024 Status - Completed Actions** | Estuary Adaptation Project: This project consists of developing a design concept, which is equivalent to 10 percent design, to protect both Downtown Oakland/Jack London Square and the City's northern shoreline near the Posey/Webster Tubes from sea level rise and flooding. Budget: $500,000 ($425,000 from the California Department of Transportation (Caltrans) and $75,000 from the City). Began September 2023; Alternatives analysis in spring 2024; Draft concept design in fall 2024; Ongoing outreach led by paid Community Partners; and Concept design request for City Council approval (this agenda item). Current grant funding expires February 28, 2025. Webpage: www.alamedaca.gov/AdaptationEstuary<br><br>Bay Farm Island (BFI) Adaptation Project: This project consists of |

| | |
|---|---|
| | developing a long-term adaptation plan for the entire BFI as well as developing up to 30 percent designs in the northern shoreline area of BFI for a near-term project. Budget: $2 million ($1.5 million FEMA and $530,000 City of Alameda). Key Milestones: Began September 2023; Alternatives analysis in spring 2024; Draft concept design in fall 2024; Ongoing outreach led by paid Community Partners; Concept design request for City Council approval (this agenda item); and Up to 30 percent design on the northern shoreline of BFI by fall 2025. Grant funding expires September 29, 2025. Webpage: www.alamedaca.gov/AdaptationBayFarmIsland |
| **Future Actions** | Estuary Adaptation Project: OAAC and the City are taking initial steps to explore the potential for federal funding opportunities to continue this project beyond 2025, including requests for inclusion in the 2024 Water Resources Development Act (WRDA) legislation totaling up to $30 million depending on the WRDA authorization. More funding will be needed to complete environmental clearance, permitting, design and construction. Bay Farm Island Adaptation Project: OAAC and the City are working to secure $55 million in grant funding from FEMA BRIC to complete the environmental clearance, permitting, design and construction. |
| **Potential Funding Source** | Proposition 68 Climate Adaptation Grant, Caltrans Sustainable Communities Grant, HMGP, BRIC, Facility Maintenance Fund 706, AMP and City Capital Improvement Programs |
| **Timeframe** | Ongoing |
| **Equity Considerations for Implementation** | Working with the City and Port of Oakland and all key stakeholders in the Oakland Alameda subregion to ensure an equitable project solution in that what happens in one part of the shoreline impacts other parts. |

# 2026 Mitigation Plan Strategies

Row 16

| | |
|---|---|
| **ID** | I7 |
| **Strategy Name** | Green Infrastructure |
| **Strategy Description** | Implement the 2019 City of Alameda Green Infrastructure Plan to increase and incorporate areas for green infrastructure in Alameda to help infiltrate stormwater and reduce street flooding. Green infrastructure can be implemented and designed in pre-existing infrastructure plans or new development plans. |
| **Hazards Addressed** | Flooding<br>Sea Level Rise |
| **Strategy Type** | Plans/Policy |
| **Actions** | a. Encourage and require the use of “green infrastructure”, landscaping, pervious surfaces, green roofs, and on-site stormwater retention facilities to reduce surface runoff and storm drain flooding during storm events. b. Update the City's Green Infrastructure Plan as needed |
| **Lead Department** | Planning, Building and Transportation<br>Public Works |
| **Related Plan/ Policy** | General Plan Policy HS-23 |
| **Key Partners** | Planning, Building and Transportation |
| **2024 Status - Completed Actions** | GI Plan submitted to Water Board in September 2019. Performed active municipal oversight of development project planning approvals and permitting review to ensure Green Infrastructure features in necessary public and private projects.<br><br>Met or exceeded GI Plan's 2020 Benchmark values for numbers of completed GI Projects and total redeveloped acres subject to GI features benefits.<br><br>Promoted GI Plan as a community resource for small-scale project planning.<br><br>Provided feedback to draft General Plan Update to strengthen Green Infrastructure-related Policies/Objectives. |
| **Future Actions** | Await Water Board's feedback and/or regulatory direction on modifications to City's GI Plan. Continue planning and permitting development project oversight to promote inclusion of Green Infrastructure project features in public and private projects. Educate the public about small-scale green infrastructure design for residential and garden projects. |

| | |
|---|---|
| **Potential Funding Source** | Capital Budget, Private Developers |
| **Timeframe** | Ongoing |
| **Equity Considerations for Implementation** | Ensure communities support new upgrades and that green infrastructure benefits all communities in Alameda. |

# 2026 Mitigation Plan Strategies

Row 17

| | |
|---|---|
| **ID** | I8 |
| **Strategy Name** | Underground Utilities |
| **Strategy Description** | Continue to replace overhead electrical power lines with underground lines and require new development to underground power lines to improve the safety and reliability of the power grid and minimize disruption by fire or other natural disasters. |
| **Hazards Addressed** | Earthquake Caused Fires |
| **Strategy Type** | Plans/Policy |
| **Actions** | |
| **Lead Department** | AMP |
| **Related Plan/ Policy** | General Plan Policy HS-30, Underground Utility District Policy |
| **Key Partners** | Planning, Building and Transportation |
| **2024 Status - Completed Actions** | - AMP established the Underground Utility Districts (UUDs) through a City<br>Ordinance. Any overhead utility facilities within the UUD must be converted to<br>underground facilities.<br>- The City Council approved the Otis/Broadway Underground Utility District (UUD #38) at its February 19, 2019, meeting. The district boundaries are along Otis Drive from High Street to Broadway Street including streets south of Otis Drive (i.e. Pearl Street, Versailles Avenue, Mound Street, and Court Street) and along Broadway Street from La Jolla to Encinal Avenue. Consturction began June 2024. Website: https://www.alamedamp.com/262/Undergrounding |
| **Future Actions** | AMP plans to recommend that the City Council approve additional undergrounding projects from the list of recommendations received from the district nominating board (DNB). This list includes the following areas: -Webster Street - all crossings - Central Avenue to Pacific Avenue including Eagle Avenue - West of Constitution Way; and along Central Avenue from Eighth Street to Webster Street. - Broadway - Buena Vista Ave to Clement Ave - Fernside Boulevard from Encinal Avenue to High Street, including lines on Lincoln Park access road - Park Street - San Jose Avenue to Otis Drive |
| **Potential Funding Source** | 2% of AMP’s electric revenue are put into the Underground Utility District Fund (UUDF) |

| | |
|---|---|
| **Timeframe** | Ongoing |
| **Equity Considerations for Implementation** | |

# 2026 Mitigation Plan Strategies

Row 18

| | |
|---|---|
| **ID** | I9 |
| **Strategy Name** | Lifeline Standard Estuary Crossing |
| **Strategy Description** | Work with Caltrans, Alameda County, and other regional agencies to retrofit and improve at least one estuary crossing to meet a lifeline standard to ensure access to the larger region for emergency access, equipment supplies, and disaster response and recovery shortly after a major seismic event. |
| **Hazards Addressed** | Earthquake Ground Shaking<br>Liquefaction |
| **Strategy Type** | Admin/Tech |
| **Actions** | |
| **Lead Department** | Public Works |
| **Related Plan/ Policy** | General Plan Policy HS-11 |
| **Key Partners** | Alameda County; U.S. Army Corps of Engineers; Caltrans |
| **2024 Status - Completed Actions** | - The U.S. Army Corps of Engineers as the owner of the Fruitvale Rail Bridge is conducting a disposition study to make recommendations regarding whether to cease operation and maintenance of the bridge and potential courses of action for what to do with the bridge.. - - The City of Alameda has requested that Alameda County upgrade the Miller-Sweeney bridge and Bay Farm Island bridges be upgraded to a “lifeline” standard, which would allow them to be nearly immediately usable following an earthquake. |
| **Future Actions** | - Work with Alameda County to upgrade the Miller-Sweeney Bridge to meet lifeline standards to ensure that the bridge can be used for the movement of supplies, evacuations and emergency vehicles and to support recovery efforts in the event of a major earthquake. - Continue to work with the U.S. Army Corps of Engineers to complete the disposition study of the Fruitvale Rail Bridge and |
| **Potential Funding Source** | Alameda County, HMGP, BRIC |
| **Timeframe** | Long-term |
| **Equity Considerations for** | |

## Implementation

# 2026 Mitigation Plan Strategies

Row 19

| | |
|---|---|
| **ID** | I10 |
| **Strategy Name** | Emergency Firefighting Water Supply |
| **Strategy Description** | Create an emergency water supply system to ensure sufficient firefighting capabilities after an earthquake or large emergency. |
| **Hazards Addressed** | Earthquake Caused Fires |
| **Strategy Type** | Admin/Tech |
| **Actions** | a. Construct above ground water cistern sites in each fire district throughout the city, similar to San Francisco's system of below ground cisterns developed after the 1906 earthquake. The sites would also house emergency response supplies and all necessary equipment to get the water to a fire engine at the curb. b. Procure portable water tanks that can be filled by water tenders and deployed to strategic locations to provide backup firefighting water in case of loss of water supply. c. Purchase water tenders to use Bay water to fill the portable water tanks. |
| **Lead Department** | Fire |
| **Related Plan/ Policy** | Emergency Operations Plan |
| **Key Partners** | |
| **2024 Status - Completed Actions** | - Contacted vendors and designed a firefighting water system to meet the community's needs.<br>- Purchased two water tenders to use Bay water for firefighting. |
| **Future Actions** | - Secure funding to begin phased build out of emergency firefighting water supply system. - Consider purchase of 2 additional tenders for a total of 4. This would allow for each fire station to have one. |
| **Potential Funding Source** | HMGP |
| **Timeframe** | Short-term |
| **Equity Considerations for Implementation** | Ensure that all neighborhoods of Alameda have adequate firefighting water supply in the event of an earthquake or large emergency. |

# 2026 Mitigation Plan Strategies

Row 20

| | |
|---|---|
| **ID** | L1 |
| **Strategy Name** | Land Development |
| **Strategy Description** | Require that new development include onsite stormwater detention, reduce the potential for property damage, and loss of natural habitat, which results from groundwater and sea level rise. |
| **Hazards Addressed** | Coastal Erosion<br>Groundwater Rise<br>Sea Level Rise |
| **Strategy Type** | Plans/Policy |
| **Actions** | a. Assessment. Require new development proposed in areas of flood risk to assess flood risk and incorporate specific groundwater and sea level rise mitigation strategies. b. Mitigation. Require new development to incorporate design features to mitigate 50 years of the Ocean Protection Council's Medium-High Risk Aversion, high emissions scenario of sea level rise in addition to a 100 year storm in the initial design and funding mechanisms to pay for later adaptation improvements to address future sea level and groundwater increases above that level. Projects that include new seawalls where none currently exist shall evaluate the off-site impact of the new walls on adjacent and nearby communities. c. Nature Based Design. Require new development to incorporate low impact development design strategies and stormwater management systems, such as engineered landscapes, vegetated areas, or cisterns that mimic nature by soaking up and storing water, to manage and protect the quantity and quality of stormwater runoff. |
| **Lead Department** | Planning, Building and Transportation |
| **Related Plan/ Policy** | General Plan Policy CC-20 |
| **Key Partners** | |
| **2024 Status - Completed Actions** | - Floodplain ordinance requires special design requirements for new construction in the floodplain and in coastal high hazard areas.<br>- 2040 General Plan recommends following California's Ocean Protection Council 2018 Sea-Level Rise Guidance.<br>- Green Infrastructure Plan includes requirements for low impact development |
| **Future Actions** | Future updates of the General Plan will explore and consider more fully this 50-year climate scenario and its implications for Alameda. |

| | |
|---|---|
| **Potential Funding Source** | Private developers |
| **Timeframe** | Ongoing |
| **Equity Considerations for Implementation** | |

# 2026 Mitigation Plan Strategies

Row 21

| | |
|---|---|
| **ID** | E1 |
| **Strategy Name** | Heat and Wildfire Smoke Emergencies |
| **Strategy Description** | Create a network of clean air and cooling emergency shelters throughout Alameda. |
| **Hazards Addressed** | Heat<br>Wildfire Smoke |
| **Strategy Type** | Admin/Tech |
| **Actions** | a. Partnerships. Identify and partner with large HVAC equipped building owners to establish a network of facilities that are able to open to the public during heat waves and smoke events during the day. b. Incentives. Incentivize building owners to upgrade or install HVAC systems to provide more safe places during heat waves and times with dangerous air quality levels. c. City Facilities. Evaluate options to upgrade or otherwise retrofit HVAC systems and buildings to be able to maintain temperatures below 78 degrees Fahrenheit and adequately filter air pollutants when at capacity. |
| **Lead Department** | Library<br>Public Works<br>Recreation and Parks |
| **Related Plan/ Policy** | General Plan Policy CC-25, Emergency Operations Plan |
| **Key Partners** | |
| **2024 Status - Completed Actions** | West End Library was upgraded in 2021 with new A/C and air filtration to serve as a Cooling and Clean Air Center in addition to the Main Library and Mastick Senior Center. No further centers have been determined to be needed at this time. |
| **Future Actions** | Evaluate need for additional Clean Air and Cooling Centers |
| **Potential Funding Source** | General Fund |
| **Timeframe** | Ongoing |
| **Equity Considerations for Implementation** | Ensure equitable access from all neighborhoods and populations, especially the homeless, elderly, disabled. |

# 2026 Mitigation Plan Strategies

Row 22

| | |
|---|---|
| **ID** | E2 |
| **Strategy Name** | Emergency Preparedness |
| **Strategy Description** | Maintain emergency management and disaster preparedness as a top City priority. |
| **Hazards Addressed** | All Hazards |
| **Strategy Type** | Admin/Tech |
| **Actions** | a. Update Emergency Operations Plan. Maintain and update the recommendations and standards established in the City of Alameda's Emergency Operations Plan as the guide for disaster planning in Alameda. b. Training. Maintain training programs to ensure that City personnel are sufficiently prepared to respond to an emergency and staff the Emergency Operations Center. c. Facilities. Identify and publicize essential emergency facilities in the City, including shelters, evacuation routes, and emergency operation staging areas, and take the necessary actions to ensure that they will remain operational following a disaster. d. Exercises. Conduct periodic emergency response exercises to test the effectiveness of local preparedness response, recovery, and mitigation procedures. |
| **Lead Department** | Fire |
| **Related Plan/ Policy** | General Plan Policy HS-1 |
| **Key Partners** | |
| **2024 Status - Completed Actions** | - Completed Environmental Emergency Plan Annex draft. Draft plan added as an Annex to the Basic Emergency Operation Plan (EOP).<br>- EOC training exercises on a City, County, Regional and State level. Training for emergency repair, traffic control, evacuations, shelter in place, crowd control, emergency medical aid, grant reimbursement, etc.<br>- Education of City Employees about personal emergency preparedness and mitigation. |
| **Future Actions** | |
| **Potential Funding Source** | General Fund |
| **Timeframe** | Ongoing |

## Equity Considerations for Implementation

# 2026 Mitigation Plan Strategies

Row 23

| | |
|---|---|
| **ID** | E3 |
| **Strategy Name** | Tsunami Preparedness |
| **Strategy Description** | Prepare Alameda for tsunamis and prepare for a timely evacuation from the shoreline with a focus of access and functional needs populations. |
| **Hazards Addressed** | Tsunamis |
| **Strategy Type** | Admin/Tech |
| **Actions** | a. Awareness. Develop a public information campaign to educate the public about tsunami risks and evacuation procedures, with special emphasis on access and functional needs populations and maritime communities. b. Evacuation Emergency Annex. Include and maintain an Evacuation Emergency Annex in the Emergency Operations Plan that includes a strategy for tsunami evacuation. c. Signs. Place tsunami inundation zone and evacuation route signs. d. Vertical Evacuation. Assess vertical evacuation options. e. Drills. Conduct tsunami evacuation training and drills with schools. f. Partner. Partner with Caltrans, Alameda County, AC Transit, the City of Oakland and Port of Oakland to plan for tsunami evacuation. g. Tsunami Ready. Become recognized as a Tsunami Ready community by the National Weather Service. |
| **Lead Department** | Fire<br>Planning, Building and Transportation |
| **Related Plan/ Policy** | General Plan Policy HS-20 |
| **Key Partners** | Caltrans Alameda County City of Oakland Port of Oakland AC Transit CGS CalOES NOAA National Tsunami Hazard Mitigation Program USGS |
| **2024 Status - Completed Actions** | Hired a consultant to help with tsunami evacuation planning. The work scope includes creating evacuation scenarios and meeting with stakeholder partners to improve coordination. Staff will continue with tsunami awareness. The next step is for the City to become a designated Tsunami Ready Community, which will be possible with the City’s planned on-going mitigation, preparedness, and response steps.<br>www.AlamedaCA.gov/DisasterPreparedness |
| **Future Actions** | In 2022-23, staff is planning to: - Complete a tsunami emergency annex - Become a TsunamiReady city - Participate in Tsunami Preparedness week in March and encourage residents to sign up fro AC Alert - Create a special emergency contact list of marinas in Alameda |

| | |
|---|---|
| **Potential Funding Source** | USGS/CalOES and Public Works funds |
| **Timeframe** | Ongoing |
| **Equity Considerations for Implementation** | Provide education programs and signs in various languages depending on community need.<br>Ensure education program outlines evacuation plan for those who do not have access to personal transportation. |

# 2026 Mitigation Plan Strategies

Row 24

| | |
|---|---|
| **ID** | E4 |
| **Strategy Name** | Emergency Coordination |
| **Strategy Description** | Coordinate local emergency preparedness efforts with local, state and federal partners in preparation for natural and man-made disasters and ensure that the City's disaster response communication technologies are compatible with other agency communication technologies. |
| **Hazards Addressed** | All Hazards |
| **Strategy Type** | Admin/Tech |
| **Actions** | |
| **Lead Department** | Fire |
| **Related Plan/ Policy** | General Plan Policy HS-3 |
| **Key Partners** | Federal Emergency Management Agency, California Office of Emergency Services, Coast Guard, United States Maritime Administration Ready Reserve Fleet, the San Francisco Bay Area Water Emergency Transportation Authority, Alameda County, East Bay Municipal Utility District, the Port of Oakland, adjacent jurisdictions, CalWARN, the Alameda Unified School District, the various private schools in Alameda, local hospitals, housing facilities for seniors or individuals with disabilities, and other local and regional police, fire and public health agencies |
| **2024 Status - Completed Actions** | - Alameda Municipal Power is a signatory on two mutual aid agreements: California Utility Emergency Association (CUEA) and Northern California Power Agency (NCPA)<br>- Maintain agreements with adjoining jurisdictions for cooperative response to fires, floods, earthquakes, and other disasters.<br>- Working Relationships and Lifeline Committee Meetings with Caltrans, County, Coast Guard, Ready Reserve, Port of Oakland, San Leandro, Utilities, FEMA, and Other Agencies.<br>- Membership in CalWARN Mutual Aid for City-run and independent utilities that provide water and wastewater. |
| **Future Actions** | - Finalize a MOU with AUSD for Mass Care and Shelter. |
| **Potential Funding Source** | General Fund, Assistance provided or received during an emergency will be reimbursed with state or federal funding if it is a declared emergency. |

| | |
|---|---|
| **Timeframe** | Ongoing |
| **Equity Considerations for Implementation** | |

# 2026 Mitigation Plan Strategies

Row 25

| | |
|---|---|
| **ID** | E5 |
| **Strategy Name** | Wildfire Smoke |
| **Strategy Description** | Prepare for future wildfire smoke events. |
| **Hazards Addressed** | Wildfire Smoke |
| **Strategy Type** | Admin/Tech |
| **Actions** | a. Shelters. Work with local organizations and institutions to provide for public, clean air, temporary shelters, such as the Alameda Free Library, at locations throughout the City. b. Vulnerable Communities. Strengthen protocols and procedures for identifying and notifying the most vulnerable residents to wildfire smoke of shelter locations and other potential support. c. Indoor Air Quality. Facilitate and expedite efforts by local property owners and businesses to improve indoor air quality and filtration systems. d. Outdoor Air Quality. Continue to work with regional and local organizations and businesses to reduce local sources of air pollutants. |
| **Lead Department** | Fire |
| **Related Plan/ Policy** | General Plan Policy HS-61 |
| **Key Partners** | |
| **2024 Status - Completed Actions** | - Adopted and implement new air quality / smoke response protocols for City staff and employees.<br>- West End Library was upgraded in 2021 with new A/C and air filtration to serve as a Cooling and Clean Air Center in addition to the Main Library and Mastick Senior Center.<br>- Utilize AC Alert to notify residents about unsafe air quality. |
| **Future Actions** | |
| **Potential Funding Source** | General Fund, Capital Improvement Program |
| **Timeframe** | Ongoing |
| **Equity Considerations for Implementation** | Ensure equitable access from all neighborhoods and populations, especially the homeless, elderly, disabled. |

# 2026 Mitigation Plan Strategies

Row 26

| | |
|---|---|
| **ID** | E6 |
| **Strategy Name** | Emergency Response and Disaster Preparedness |
| **Strategy Description** | Preserve access for emergency response vehicles to people and property and for evacuation. |
| **Hazards Addressed** | Dam Failure<br>Earthquake Ground Shaking<br>Liquefaction<br>Tsunamis |
| **Strategy Type** | Admin/Tech |
| **Actions** | a. Emergency Response Planning. Include emergency response needs in all transportation planning, the design of new facilities, and modifications to existing facilities. Establish and sign designated evacuation routes, and provide ongoing education and outreach to ensure that Alameda is evacuation ready. Continue to work with AC Transit and WETA to ensure coordinated services in the event of the need for evacuation. b. Outreach. Educate the community on disaster preparedness using an all-hazard approach to emergency response. c. Miller-Sweeney Bridge. Upgrade the Miller-Sweeney Bridge to meet lifeline standards to ensure that the bridge can be used for the movement of supplies, evacuations and emergency vehicles and to support recovery efforts in the event of a major earthquake. d. Fruitvale Rail Bridge Hazard. Remove or seismically upgrade the abandoned Fruitvale Rail Bridge which poses a seismic hazard to the city's Miller-Sweeney Bridge. Consider replacing the hazardous structure with crossing for transit, bicycles and pedestrians. |
| **Lead Department** | Planning, Building and Transportation<br>Public Works |
| **Related Plan/ Policy** | General Plan Policy ME-9 |
| **Key Partners** | Alameda County Public Works Agency |
| **2024 Status - Completed Actions** | Coordinated with AC Transit on the locations of vulnerable populations in the City of Alameda including skilled nursing facilities, adult day care and child care facilities.<br><br>Participated in Bay Area Urban Areas Security Initiative trainings. |
| **Future Actions** | Continue working with the United States Army Corps of Engineers (Army Corps) to address the public safety hazard posed by the adjacent abandoned Fruitvale rail bridge. Draft letter to Alameda County requesting upgrade to Miller-Sweeney Bridge. Continue coordination with WETA and AC Transit, and will participate in Bay |

| | |
|---|---|
| | Area emergency response training exercises. |
| **Potential Funding Source** | HMGP, BRIC, General Fund |
| **Timeframe** | Long-term |
| **Equity Considerations for Implementation** | Ensure continuity of service for transit- dependent populations. |

# 2026 Mitigation Plan Strategies

Row 27

| | |
|---|---|
| **ID** | C1 |
| **Strategy Name** | Public Communication |
| **Strategy Description** | Maintain and promote community programs to train volunteers, support vulnerable community members like seniors and individuals with disabilities, coordinate with food banks and other local aid organizations, and assist police, fire, and civil defense personnel during and after a major earthquake, fire, or flood. |
| **Hazards Addressed** | All Hazards |
| **Strategy Type** | Outreach/Education |
| **Actions** | a. Volunteers. Maintain community based emergency preparedness training programs targeted to neighborhoods and business groups, such as Community Emergency Response Teams and outreach and coordination with Voluntary Organizations Active in Disasters (VOAD) and other community based programs. b. Education. Prepare and/or make available public education and awareness materials in multiple languages on all aspects of emergency preparedness, including the type and extent of hazards in the community, measures to reduce the likelihood of damage and injury, provisions for emergency supplies, steps to take immediately after a disaster, and the location of shelters and medical facilities. c. Targeted Communication. Engage Alamedans using a wide range of tools, languages and strategies to communicate about all types of health threats and planning, with a special emphasis on the most vulnerable people who are least likely to know about or be able to adapt to various threats. d. Resilience Hubs. Promote resilience hubs, community-serving facilities augmented to support residents, coordinate resource distribution and services before, during, or after a natural hazard event, and reduce carbon pollution while enhancing quality of life. |
| **Lead Department** | City Manager's Office<br>Fire<br>Police |
| **Related Plan/ Policy** | General Plan Policy HS-4, Emergency Operations Plan |
| **Key Partners** | Alameda County |
| **2024 Status - Completed Actions** | The City of Alameda in partnership with Alameda County Office of Emergency Services (OES) uses AC Alert as the County-wide mass notification system to alert community members of weather related issues, as well as posting to social media, and the city website. The City encourages the public to opt-in to AC Alert and follow the City on social media. |

| | |
|---|---|
| **Future Actions** | Encourage the public to opt-in to AC Alert and follow the City on social media. Learn lessons from resilience hub pilot program and identify opportunities for new resilience hub locations. Consider connecting resilience hubs with CERT teams. Promote Cool Block program to neighborhood leaders. |
| **Potential Funding Source** | General Fund, Cool City Challenge |
| **Timeframe** | Ongoing |
| **Equity Considerations for Implementation** | Ensure that all community members, including those who are non-English speaking and those without cell phones, receive key communications from city/local officials before, during, and after a disaster event.<br><br>Investigate options for disseminating emergency alerts through key community leaders to increase their reach in disadvantaged communities.<br><br>Ensure participation by all neighborhoods in Alameda and that resilience hubs are rooted in the neighborhoods they serve. |

# 2026 Mitigation Plan Strategies

Row 28

| | |
|---|---|
| **ID** | C2 |
| **Strategy Name** | Air Quality Alerts |
| **Strategy Description** | Continue to partner with Bay Area Air District to enhance awareness of air quality index alerts and related outreach and education to protect the health of residents. |
| **Hazards Addressed** | Wildfire Smoke |
| **Strategy Type** | Outreach/Education |
| **Actions** | |
| **Lead Department** | Fire |
| **Related Plan/ Policy** | General Plan Policy HS-65 |
| **Key Partners** | |
| **2024 Status - Completed Actions** | The City encourages residents to sign up for AC Alert to receive emergency notifications. |
| **Future Actions** | Continue to encourage residents to sign up for AC Alert to receive emergency notifications |
| **Potential Funding Source** | General Fund |
| **Timeframe** | Ongoing |
| **Equity Considerations for Implementation** | |

# 2026 Mitigation Plan Strategies

Row 29

| | |
|---|---|
| **ID** | C3 |
| **Strategy Name** | Regional Partnerships |
| **Strategy Description** | Actively participate in regional discussions on groundwater and sea level rise mitigation, infrastructure improvements, and adaptation strategies. |
| **Hazards Addressed** | Groundwater Rise<br>Sea Level Rise |
| **Strategy Type** | Admin/Tech |
| **Actions** | a. Funding and Partnerships. Develop partnerships with local, regional, and state agencies to expedite adaptation projects and ensure a healthy watershed that protects and restores water quality, habitat and community vitality along San Leandro Bay and the Oakland-Alameda Estuary. |
| **Lead Department** | City Manager's Office<br>Planning, Building and Transportation<br>Public Works |
| **Related Plan/ Policy** | General Plan Policy HS-16 |
| **Key Partners** | |
| **2024 Status - Completed Actions** | Continued the Oakland Alameda Adaptation Committee (OAAC) with neighboring jurisdictions, agencies, and community-based organizations to coordinate flood and adaptation projects in the Oakland Alameda subregion to protect and restore water quality, habitat, and community resilience. Sub-groups are focusing on adaptation of Doolittle Drive and Northern Shoreline near Posey/ Webster Tubes. Applied for BRIC and WRDA funding to support these sea level rise adaptation projects. Continuing seeking funding for development of a coordinated and inclusive future-looking sub-regional organizational structure and action plan with shared vision and needs assessment to accelerate sea level rise adaptation and exploring future governance options. |
| **Future Actions** | Launch development of a coordinated and inclusive future-looking subregional organizational structure and action plan with shared vision and needs assessment to accelerate sea level rise adaptation in alignment with the BayAdapt Joint Platform. |
| **Potential Funding Source** | Regional, state and federal grants, General Fund |

| | |
|---|---|
| **Timeframe** | Ongoing |
| **Equity Considerations for Implementation** | |

# 2026 Mitigation Plan Strategies

Row 30

| | |
|---|---|
| **ID** | C4 |
| **Strategy Name** | Collaboration |
| **Strategy Description** | Work collaboratively with other jurisdictions and agencies to reduce fire hazards in Alameda, such as post-earthquake fire hazards, with an emphasis on mutual aid agreements |
| **Hazards Addressed** | Earthquake Caused Fires |
| **Strategy Type** | Admin/Tech |
| **Actions** | |
| **Lead Department** | Fire |
| **Related Plan/ Policy** | General Plan Policy HS-27 |
| **Key Partners** | |
| **2024 Status - Completed Actions** | Maintain agreements with adjoining jurisdictions for cooperative response to fires, floods, earthquakes, and other disasters. |
| **Future Actions** | |
| **Potential Funding Source** | General Fund |
| **Timeframe** | Ongoing |
| **Equity Considerations for Implementation** | |

# 2026 Mitigation Plan Strategies

Row 31

| | |
|---|---|
| **ID** | C5 |
| **Strategy Name** | Neighborhood Resilience Coordination |
| **Strategy Description** | Consider piloting building electrification, water conservation and other climate initiatives at a block or neighborhood level to more cost effectively transition to climate friendly energy, water, and resource use |
| **Hazards Addressed** | All Hazards |
| **Strategy Type** | Outreach/Education |
| **Actions** | a. Electrification. Offer blocks or neighborhoods assistance in electrifying their homes through incentives that reflect the savings to taxpayers and ratepayers from being able to remove or shut off the natural gas infrastructure on their block. b. Flooding. Include tailored planning and support for communities testing various flooding adaptation strategies. c. Priorities. Prioritize block and neighborhood-driven priorities while selecting a broad range of interventions to test to maximize the City's ability to learn from each pilot project. |
| **Lead Department** | Planning, Building and Transportation |
| **Related Plan/ Policy** | General Plan Policy CC-15 |
| **Key Partners** | PG&E, AMP |
| **2024 Status - Completed Actions** | - In partnership with CASA and the Alameda Marketplace, staff piloted the Cool Blocks Program with a group of about 10 cool block leaders.<br>- SB 1221 passed in 2024 requires gas corporations to develop maps containing the location of all potential gas distribution line replacement projects and to designate priority neighborhood decarbonization zones considering the concentration of gas distribution line replacement projects identified in the maps. The bill requires establishing a voluntary program to facilitate the cost-effective decarbonization of priority neighborhood decarbonization zones |
| **Future Actions** | - Consider opportunities to pilot neighborhood electrification pilots based on SB 1221. |
| **Potential Funding Source** | General Fund, Cool City Challenge |

| | |
|---|---|
| **Timeframe** | Ongoing |
| **Equity Considerations for Implementation** | Ensure that resilience hubs exist in all neighborhoods in Alameda and they are rooted in the neighborhoods they serve. |

# 2026 Mitigation Plan Strategies

Row 32

| | |
|---|---|
| **ID** | C6 |
| **Strategy Name** | Social Vulnerability |
| **Strategy Description** | Prioritize the needs of frontline communities when prioritizing public investments and improvements to address climate change. |
| **Hazards Addressed** | All Hazards |
| **Strategy Type** | Outreach/Education |
| **Actions** | a. Equity. Ensure opportunities for leadership and actions to benefit Alameda’s low-income individuals, seniors, youth, people of color, people experiencing homelessness, individuals with disabilities, and socio-economically disadvantaged communities from environmental and climate change impacts. b. Environmental Justice. Ensure the equitable treatment and full involvement of all people when considering actions to reduce the adverse impacts of climate change on residents regardless of age, culture, ethnicity, gender, sexual orientation, race, socioeconomic status, or geographic location. Prioritize actions that will reverse historic policies of racial discrimination and exclusion. c. Assessments. Utilize BCDC's Community Vulnerability Tool to identify neighborhoods and specific groups with high levels of social vulnerability in order to prioritize locations for action and improvements. |
| **Lead Department** | All |
| **Related Plan/ Policy** | General Plan Policy CC-2 |
| **Key Partners** | |
| **2024 Status - Completed Actions** | City uses BCDC Community Vulnerability Analysis to prioritize funding for transportation projects and equity is centered in shoreline adaptation planning through the Estuary Working Group. The Urban Forest Plan also prioritizes equity when approaching increasing city-wide tree canopy cover. |
| **Future Actions** | - Update Social Vulnerability Assessment with 2020 Census - Develop equity toolkit to prioritize equity in the development and implementation of policies |
| **Potential Funding Source** | General Fund |
| **Timeframe** | Ongoing |

| | |
|---|---|
| **Equity Considerations for Implementation** | Review equity considerations in the development of project and policy proposals. |

# 2026 Mitigation Plan Strategies

Row 35

| | |
|---|---|
| **ID** | S1 |
| **Strategy Name** | Shoreline Adaptation Plan |
| **Strategy Description** | Develop a shoreline adaptation plan that includes additional vulnerability studies as needed, economic analysis, groundwater rise studies and other data collection as needed to identify the range of flood risk reduction, groundwater management and adaptation strategies over time from short- to long-term as well as land use, building and infrastructure design standards needed to help Alameda adapt to rising sea and groundwater levels and comply with BCDC's Regional Shoreline Adaptation Plan Guidance. |
| **Hazards Addressed** | Sea Level Rise |
| **Strategy Type** | Plans/Policy |
| **Actions** | Develop sea level and groundwater rise adaptive strategies for different areas of the City for public discussion and evaluation, including but not limited to: avoidance/planned retreat, enhanced levees, setback levees to accommodate habitat transition zones, buffer zones, beaches, expanded tidal prisms for enhanced natural scouring of channel sediments, raising and flood-proofing structures, and/or provisions for additional flood water pumping stations, and inland detention basins to reduce peak discharges. |
| **Lead Department** | Community and Economic Development<br>Planning, Building and Transportation<br>Public Works |
| **Related Plan/ Policy** | General Plan Policy CC-21 |
| **Key Partners** | OAAC Partners |
| **2024 Status - Completed Actions** | OAAC has been working to develop the Oakland-Alameda Subregional Adaptation Plan (Subregional Plan). This project consists of developing a plan to protect the Oakland-Alameda subregion from near- and long-term sea level rise and associated shoreline hazards. Budget: $840,000 ($300,000 from San Francisco Estuary Partnership (SFEP) and $540,000 from National Fish and Wildlife Foundation (NFWF). Began in September 2023; Feasibility assessment in spring 2024, Governance White Paper in fall 2024; Ongoing outreach led by paid Community Partners; and Request for City Council approval is anticipated in fall 2025. Grant funding expires October 31, 2025. Webpage: www.alamedaca.gov/AdaptationLongTermPlan |
| **Future Actions** | Seek planning grants. Initiate and complete planning effort with City Council approval. Implement plan with future funding needed. |

| | |
|---|---|
| **Potential Funding Source** | General Fund, grants |
| **Timeframe** | Adaptation strategies that reduce the burden of sea level rise from impacted community members. Ensure sea level rise preventative measures do not disturb shoreline ecosystems Focus new housing developments away from shorelines Prioritize communities most at risk for effects of sea level rise |
| **Equity Considerations for Implementation** | Incorporate social vulnerability assessment into adaptation pathway considerations |

# 2026 Mitigation Plan Strategies

Row 33

| | |
|---|---|
| **ID** | S2 |
| **Strategy Name** | Rising Groundwater |
| **Strategy Description** | Collect new data, add groundwater monitoring wells, analyze additional contaminants and potential landfill risks, update liquefaction zones and continue to refine the quality of the groundwater model to better prepare for the impacts of rising groundwater levels on private and public property. |
| **Hazards Addressed** | Groundwater Rise |
| **Strategy Type** | Admin/Tech |
| **Actions** | a. Infrastructure and Access. Develop plans and strategies to protect and/or relocate critical infrastructure and maintain access to impacted property. b. Building Codes. Prepare and adopt revised zoning and building codes to increase resilience of new buildings against the impacts of rising groundwater. c. Annual Review. Annually monitor groundwater levels and progress on specific strategies to mitigate impacts. d. Data. Collect new data, add groundwater monitoring wells, analyze additional contaminants and potential landfill risks, update liquefaction zones and continue to refine the quality of the groundwater model. |
| **Lead Department** | Planning, Building and Transportation<br>Public Works |
| **Related Plan/ Policy** | General Plan Policy CC-23, HS-24, Groundwater Study |
| **Key Partners** | |
| **2024 Status - Completed Actions** | The City is evaluating recommended policies and building code amendments to address groundwater rise and seeking funding for green infrastructure projects that can mitigate groundwater rise. Sites will consider current and future groundwater levels in the design. |
| **Future Actions** | |
| **Potential Funding Source** | General Fund |
| **Timeframe** | Short-term |
| **Equity Considerations for** | |

## Implementation

# 2026 Mitigation Plan Strategies

Row 34

| | |
|---|---|
| **ID** | S3 |
| **Strategy Name** | Flood Hazard Maps |
| **Strategy Description** | Prioritize the review and publishing for public discussion the latest and most up to date flood hazard and sea level rise forecasts from all trusted sources. |
| **Hazards Addressed** | Flooding |
| **Strategy Type** | Admin/Tech |
| **Actions** | a. Process. Create a regular process by which information is updated and released, identifying staff time and budget to ensure that this information is timely, accurate and accessible for all public and private decision-makers. |
| **Lead Department** | Planning, Building and Transportation |
| **Related Plan/ Policy** | General Plan Policy HS-15 |
| **Key Partners** | FEMA |
| **2024 Status - Completed Actions** | The most up to date FEMA flood hazard maps are published and the General Plan includes guidance on planning for sea level rise, following the Ocean Protection Council’s guidance. |
| **Future Actions** | |
| **Potential Funding Source** | General Fund |
| **Timeframe** | Ongoing |
| **Equity Considerations for Implementation** | |



# Appendix H Strategies for Location Based Priority Flooding

Flooding is one of the greatest climate threats that Alameda faces. The City identified potential strategies to mitigate flood risks associated with overland coastal flooding due to high tides and/or storm surge, rising groundwater tables and emergent groundwater, and precipitation-based flooding. These strategies are presented in **Tables 1 to 16** and organized in the following categories: Flood Risk Reduction Measures (< three years), near-term strategies (three to 10 years), and mid-term strategies (10 to 30 years).

Flood Risk Reduction Measures include Capital Improvement Projects, such as operations and maintenance improvements, by the Department of Public Works, address where existing coastal erosion is already threatening infrastructure, pilot projects and studies needed to reduce uncertainties to support near-term projects, and community awareness campaigns to reduce residential flood risks. Near-term and mid-term projects address both existing and future flood risks, with near-term projects mitigating earlier flood risks. The City is also developing a long-term (> 30 years) adaptation plan for Alameda in collaboration with OAAC, referred to as the Long-term Subregional Adaptation Plan (Subregional Plan). The Subregional Plan will inform future updates to the LHMP. Physical strategies intended to address future sea level rise will use the following sea level rise criteria:

- **Flood Risk Reduction Measures** are interim responses to address existing urgent risks and should be implemented within the next three years. When feasible and cost effective, these strategies may consider up to two feet of sea level rise (which could occur between 2060 – 2080 based on best available science). However, Flood Risk Reduction Measures are intended to address existing risks that place homes, businesses, and/or infrastructure at risk today. To streamline planning, design, permitting, and implementation, these strategies may be temporary in nature and only address existing flood risks while more robust near-term and mid-term strategies are developed to address future flood risks.
- **Near-term strategies** will address two feet of sea level rise (which could occur between 2060 – 2080), with implementation occurring within three to 10 years, providing more time for planning, design, permitting, and implementation. Where feasible and cost effective, these strategies will be adaptable to higher rates of sea level rise, providing the foundation for future mid-term or long-term strategies.
- **Mid-term strategies** will address 3.5 feet of sea level rise, with adaptability to 7 feet of sea level rise. This range of sea level rise represents the current range of uncertainty in 2100 sea level rise projections based on best available science. If the more likely amount of sea level rise occurs by 2100 (3.5 feet), these strategies would provide adaptive capacity to address the continual rise in sea levels after 2100.
- **Long-term strategies** would potentially address 7 feet of sea level rise, which could occur between 2100 – 2150+, and would be implemented thirty or more years in the future. These strategies are outside the scope of the LHMP and will be informed by OAAC the Subregional Plan.

**Figure 1** shows the locations of the location-based priority flooding strategies. The strategy descriptions (**Tables 5-1** to **5-16)** identify the timeframe (e.g., Flood Risk Reduction Measure, near, or mid-term), hazard the strategy addresses, lead agency and potential partners, brief strategy description, and the strategy status (e.g., proposed, in progress). For new or proposed strategies, funds may not be committed and are subject to approval through the City's capital planning and budgeting process. For ongoing strategies, planning, engineering, and/or design efforts are underway, but they may not be fully

funded for implementation. Some strategies could be implemented in tandem if sufficient resources are available.



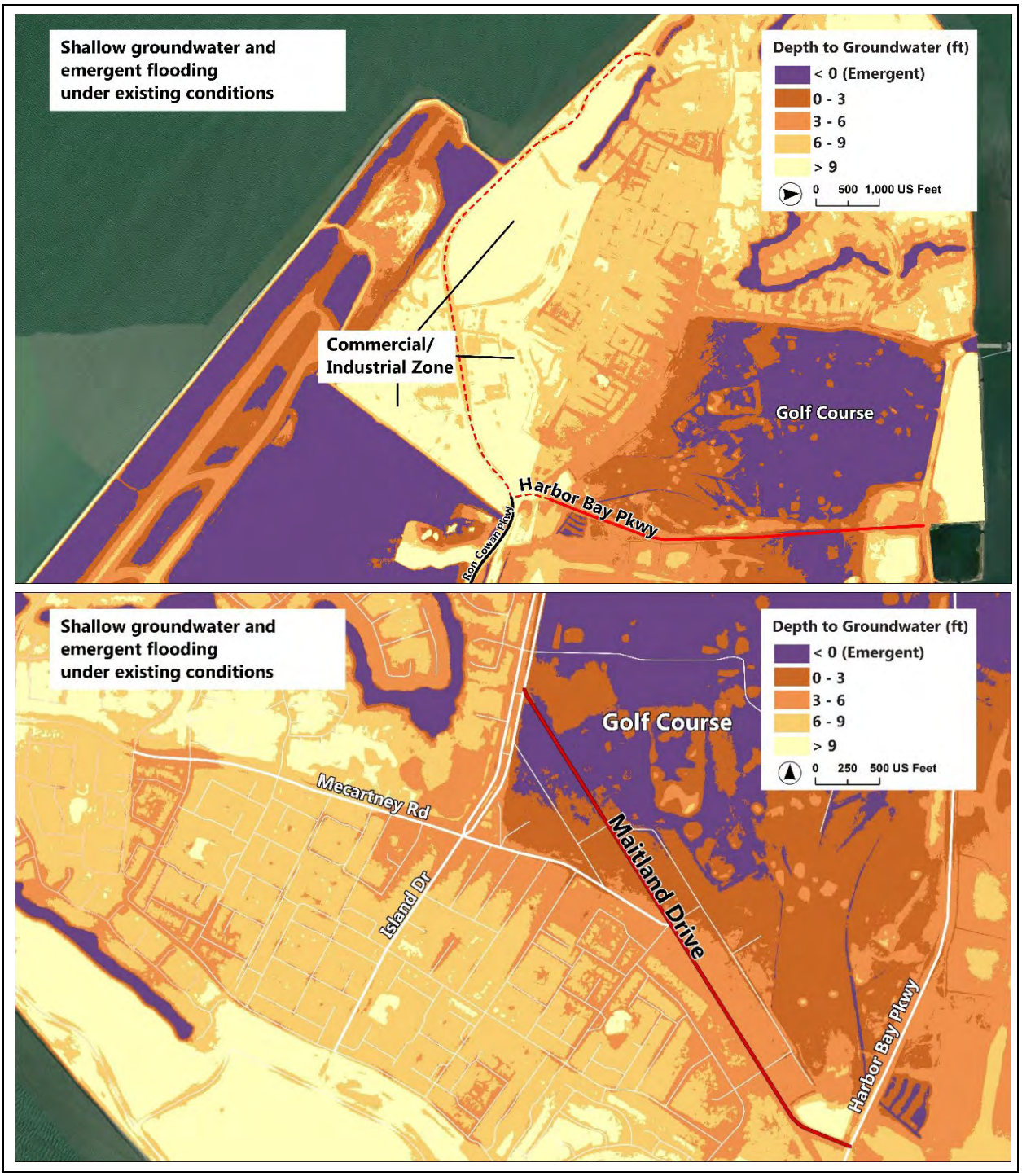

***Figure 1 Strategies for Location-Based Priority Flooding***

### *Strategy 1: Citywide Basement Flooding Campaign*

<table>
<tr><th>Strategy 1</th><th colspan="3">Citywide Basement Flooding Campaign</th></tr>
<tr><td>KEY PLANNING ISSUES:<br>Capacity Building</td><td colspan="3">VULNERABILITY ADDRESSED:<br>Numerous residential homes have partial or full basements at risk of flooding due to precipitation-based flooding and rising groundwater tables.</td></tr>
<tr><td>LEAD:<br>Planning<br>PARTNERS:<br>Public Works</td><td colspan="3">STRATEGY SUMMARY:<br>This basement flooding campaign will raise community awareness of the increasing threat that rising groundwater tables and more intense rainstorms will have on underground infrastructure, with a focus on residential basements. The campaign will provide practical advice and new policies to encourage or require these practices:<br>Educating on best practices for sump pump installation, including providing backup power, how and where to route pumped water (i.e., avoid pumping into the street and City storm drain system, and avoid causing excess stagnant water in roadway gutters)<br>Creating new guidance or policies regarding renovations, including no new basement dig outs, no conversions of existing below ground basements to livable space in areas with high groundwater table, and filling in below ground portions of basements.<br>At present, the City does not have a comprehensive database on the number of residences with full or partial basements, or the number of sump pumps currently installed and actively in service. A portion of the campaign may encourage residents to self-report these features to help increase the City's ability to understand and potentially manage rising groundwater tables and subsidence.</td></tr>
<tr><td>TIMEFRAME:<br>Flood Risk Reduction Measure (0-3 years)</td><td>STATUS:<br>Proposed</td><td>HAZARD(s):<br>Stormwater flooding, Rising groundwater</td><td>COORDINATED STRATEGY:<br>-</td></tr>
</table>

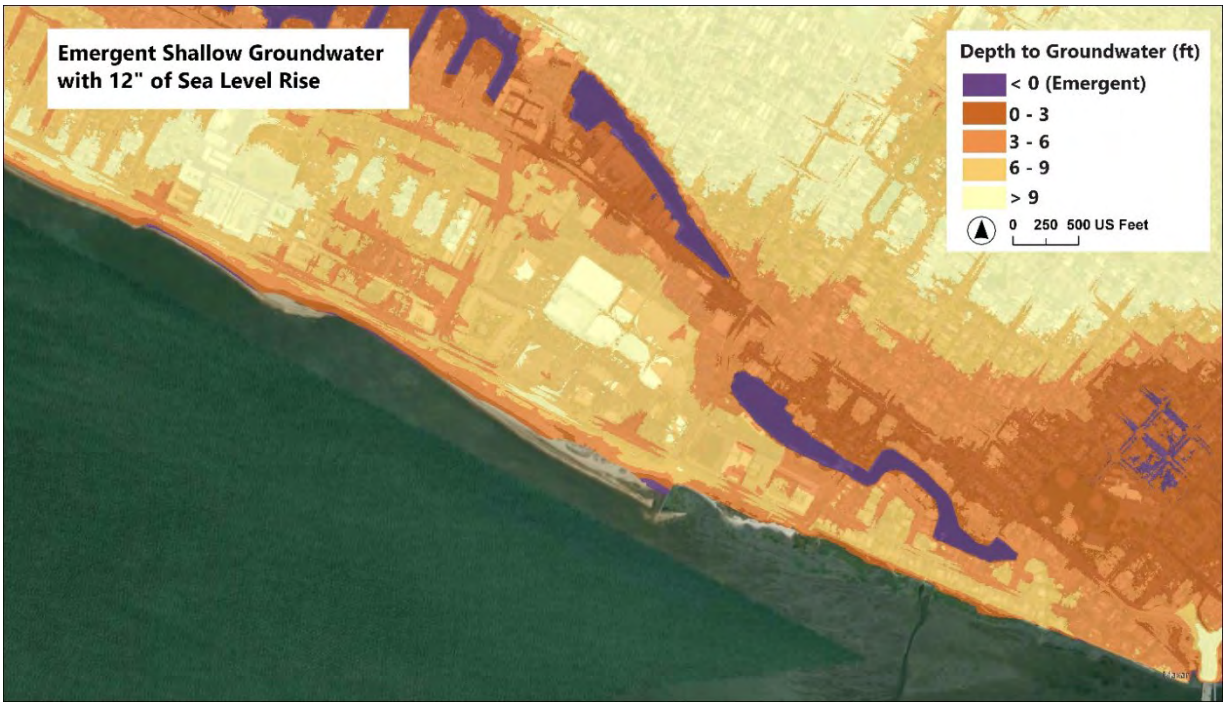
### *Strategy 2: Golf Course and Eastshore / Central Pump Station Drainage Study*

<table>
<tr><th>Strategy 2</th><th colspan="3">Golf Course and Eastshore / Central Pump Station Drainage Study</th></tr>
<tr><td>KEY PLANNING ISSUES:<br>Utilities, Existing Structures, Transportation</td><td colspan="3">VULNERABILITY ADDRESSED:<br>Maitland Drive is an extremely low-lying area on Bay Farm Island that experiences stormwater flooding during heavy rainstorms, with a high groundwater table at risk of becoming emergent with sea level rise. Severe flooding closes Harbor Bay Parkway between Doolittle Drive and Maitland Drive during heavy precipitation events. Excessive stormwater impedes storm water pump stations from operating at their maximum efficiency and causes flooding. With a rising groundwater table and increasing storm intensities, these inefficiencies will increase.</td></tr>
<tr><td>LEAD:<br>Public Works<br><br>PARTNERS:<br>Planning, Corica Golf Course, EBRPD</td><td colspan="3">STRATEGY SUMMARY:<br>Reducing the flood risk in the low-lying residential areas around Maitland Drive between Island Drive and Harbor Bay Parkway requires a detailed modeling study to assess both precipitation-based flooding and fluctuations in the groundwater table driven by precipitation and sea level rise. Flood risk in this area will not be addressed by the sea level rise adaptation strategies proposed in Strategies 7 and 12.<br><br>The drainage study will assess the Eastshore / Central pump station, golf course surface drainage and pump station with a 10% design and will pursue grant funding opportunities.<br><br>Solutions could require converting a portion of the adjacent golf course to a stormwater detention basin along with additional pump stations or pumping capacity. The need for an assessment was identified after the severe flooding events in 2023 and through OAAC, and residents of the area expressed concern during public outreach events about recent increases in stormwater flooding.<br><br>Historically, the golf course was the lowest-lying portion of Bay Farm Island, and stormwater from the neighborhood flowed into the golf course. However, significant amounts of reclaimed construction-site fill material have raised grades across the golf course. This may be contributing to increased stormwater flooding adjacent to the course.<br><br>Upgrades to the existing storm drain pump stations in accordance with the Storm Drain Master Plan and the Storm Drain Pump Station Assessment of 2011 includes replacing or upsizing storm drainpipes as needed. This could include removing nine existing outfalls along Shoreline Drive, which includes multiple pipes that run under the beach and discharge stormwater runoff to the Bay. One outfall is located at an erosion hotspot noted in Strategy 4 and may be exacerbating the erosion.<br><br>Between 2021 and 2023, the City of Alameda completed designs for improvements at Main Street, Webster Street, Third Street and the golf course pump station.</td></tr>
<tr><td>TIMEFRAME:<br>Flood Risk Reduction Measure (0-3 years)</td><td>STATUS:<br>Proposed</td><td>HAZARD(s):<br>Stormwater flooding, Rising groundwater</td><td>COORDINATED STRATEGY:<br>Strategy 4, Strategy 11, City of Alameda CIP No. C32000</td></tr>
</table>


Shallow groundwater and emergent flooding under existing conditions
Depth to Groundwater (ft)
< 0 (Emergent)
0 - 3
3 - 6
6 - 9
> 9
0 500 1,000 US Feet
Commercial/ Industrial Zone
Golf Course
Harbor Bay Pkwy
Ron Cowan Pkwy
Shallow groundwater and emergent flooding under existing conditions
Depth to Groundwater (ft)
< 0 (Emergent)
0 - 3
3 - 6
6 - 9
> 9
0 250 500 US Feet
Golf Course
Mecartney Rd
Island Dr
Maitland Drive
Harbor Bay Pkwy


City of Alameda Stormwater System
Pump Stations
Outfalls
Storm Lines
0 250 500 US Feet

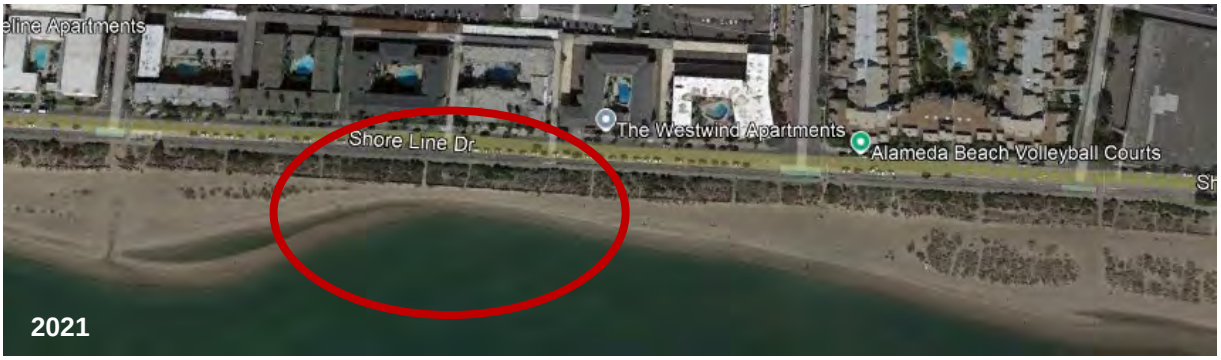
### *Strategy 3: Lagoon Maintenance*

<table>
<tr><th>Strategy 3</th><th colspan="3">Lagoon Maintenance</th></tr>
<tr><td>KEY PLANNING ISSUES:<br>Utilities, Existing Structures, Transportation</td><td colspan="3">VULNERABILITY ADDRESSED:<br>The storm drain outfalls along Shoreline Drive have become less efficient in discharging stormwater runoff to San Francisco Bay. With rising seas, a rising groundwater table and increasing storm intensities, the drainage capacity of the storm drain outfalls will continue to decrease.</td></tr>
<tr><td>LEAD:<br>Public Works<br><br>PARTNERS:<br>Planning, EBRPD</td><td colspan="3">STRATEGY SUMMARY:<br>The Alameda West Lagoon system (consisting of five lagoons) receives stormwater from a watershed about two square miles in size. Regular maintenance is required due to aging weirs, walls, drainage infrastructure, and sediment accumulation.<br>Between 2021-2023, design and construction of structural repairs to the Bayview Weir were completed. Currently, overflow bubblers or outlets are being placed on outfall pipes to allow streets to drain, as successfully completed at Park Street and Kitty Hawk Road.</td></tr>
<tr><td>TIMEFRAME:<br>Flood Risk Reduction Measure (0-3 years)</td><td>STATUS:<br>Ongoing</td><td>HAZARD(s):<br>Stormwater flooding, Rising groundwater</td><td>COORDINATE WITH:<br>Strategy 4, Strategy 11, City of Alameda CIP No. C34000</td></tr>
<tr><td colspan="4">
</td></tr>
</table>

### *Strategy 4: Shoreline Maintenance*

| Strategy 4 | Shoreline Maintenance | | |
|---|---|---|---|
| KEY PLANNING ISSUES:<br>Emergency Repair, Transportation | VULNERABILITY ADDRESSED:<br>Ongoing coastal erosion is threatening areas such as Shoreline Drive, the Bay Farm Island northern shoreline, the San Francisco Bay Trail, and the Ballena Bay Shoreline. Additional areas could experience coastal erosion during high wind and wave events. | | |
| LEAD:<br>Public Works<br>PARTNERS:<br>Planning, EBRPD | STRATEGY SUMMARY:<br>Alameda and Bay Farm Island have both natural or "soft" shorelines and armored shorelines protected by seawalls, engineered revetments, and riprap. The areas at greatest risk of coastal erosion based on historical conditions are typically armored. However, rising seas and changing storm conditions are increasing the erosion risk of soft shorelines.<br>The shoreline is eroding in numerous places, exposing irrigation infrastructure and reducing habitat space and open space. Materials used to stabilize the shoreline include biodegradable organic, riprap and vegetation; all of which require periodic replacements and upgrades, especially after winter storms and extreme high tides.<br>Interim remedies are needed at select locations to prevent further erosion.<br>Between 2021 and 2023, design and permitting was initiated to repair two eroded locations along the Bay Farm Island Northern Shoreline and at South Shore Beach in 2024 by EBRPD. | | |
| TIMEFRAME:<br>Flood Risk Reduction Measure (0-3 years) | STATUS:<br>Proposed | HAZARD(s):<br>Coastal erosion | COORDINATED STRATEGY:<br>Strategy 3, Strategy 5, Strategy 6, Strategy 11, City of Alameda CIP No. C35000 |

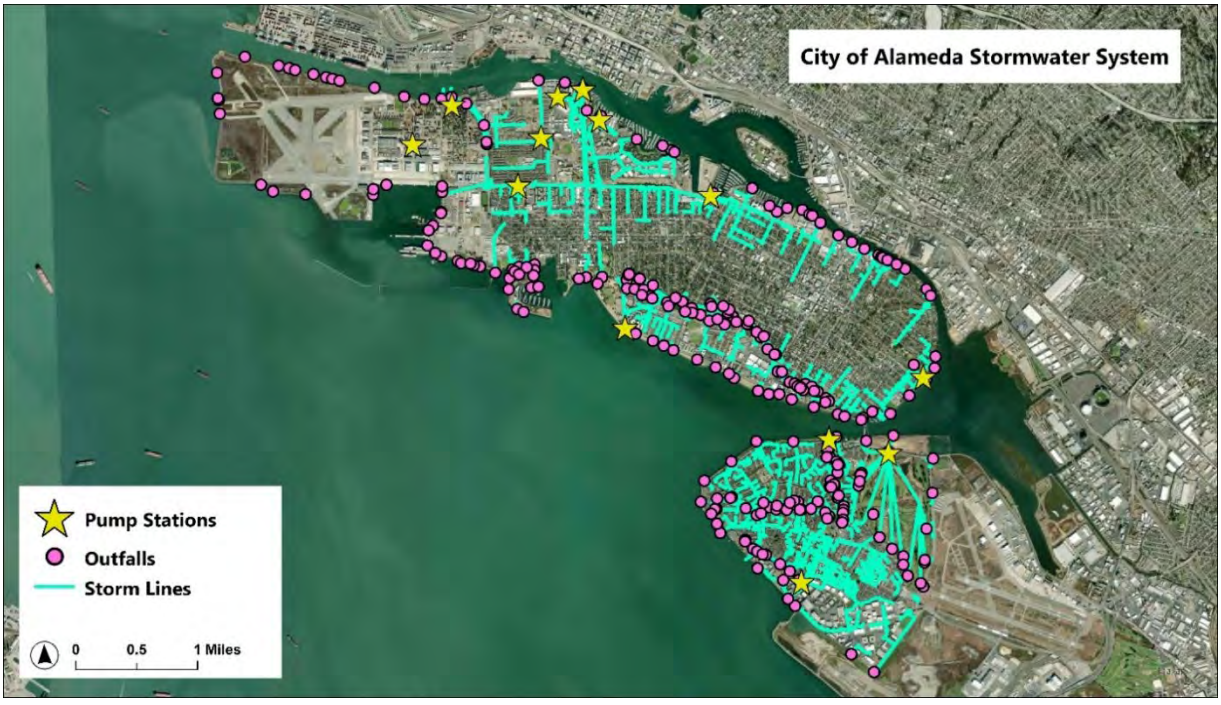





### *Strategy 5: South Shore Geomorphology / Ecological Study*

| **Strategy 5** | **South Shore Geomorphology / Ecological Study** | | |
|---|---|---|---|
| KEY PLANNING ISSUES:<br>Data Gap / Uncertainty, Habitat | VULNERABILITY ADDRESSED:<br>Sand movement along Crown Beach, South Shore Beach, Elsie Romer Bird Sanctuary, and within the San Leandro Bay Estuary is a key uncertainty for the implementation of nature-based strategies. | | |
| LEAD:<br>Planning<br>PARTNERS:<br>Public Works, California State Parks, EBRPD | STRATEGY SUMMARY:<br>South Shore and Crown beaches are manmade features requiring ongoing annual sand management. Understanding the natural movement of sand between the Bay and the beaches, and along the beach towards the San Leandro Bay Estuary will help inform potential natural-based pilot studies that may improve sand management and help address future sea level rise and coastal erosion. The study should leverage existing resources, including EBRPD sand management records, and include new modeling and research to better understand how geomorphic and ecological features, such as mudflat augmentation or eelgrass restoration, may reduce sediment loss and enhance sand management activities. | | |
| TIMEFRAME:<br>Flood Risk Reduction Measure (0-3 years) | STATUS:<br>Proposed | HAZARD(s):<br>Coastal erosion, Coastal overland flooding | COORDINATED STRATEGY:<br>Strategy 4, Strategy 11 |

### *Strategy 6: Stormwater Management*

<table>
<tr><th>Strategy 6</th><th colspan="3">Stormwater Management</th></tr>
<tr><td>KEY PLANNING ISSUES:<br>Existing Structures, Infrastructure</td><td colspan="3">VULNERABILITY ADDRESSED:<br>More intense precipitation events and a rising groundwater table are increasing the prevalence of stormwater flooding across Alameda. As sea level rise reduces the capacity of the gravity outfalls to discharge to the Bay, stormwater flooding may substantially increase.</td></tr>
<tr><td>LEAD:<br>Public Works<br><br>PARTNERS:<br>Planning</td><td colspan="3">STRATEGY SUMMARY:<br>The City of Alameda has identified several projects that would improve the conveyance capacity and efficiency of the City’s storm drain system and are documented in the City’s Capital Improvement Program (CIP).<br>In the absence of additional improvements, stormwater runoff will increasingly threaten property and safety. Identified stormwater capital improvements in the CIP, such as the Central / Eastshore Pump Station and Upstream Watershed project, will help address these risks.<br>Sensitivity analyses that include consideration of climate change (increasing precipitation, rising groundwater tables, and sea level rise) may provide insight into additional improvements that could reduce flood risks without significantly increasing the cost of baseline projects.<br>Between 2021 to 2023, structural repairs to the Bayview Weir were performed and stormwater infrastructure to reduce flooding along Shoreline Drive and automation controls to control Bay Farm Island Lagoons were installed.</td></tr>
<tr><td>TIMEFRAME:<br>Flood Risk Reduction Measure (0-3 years)</td><td>STATUS:<br>Ongoing (CIP)</td><td>HAZARD(s):<br>Stormwater flooding, Rising groundwater</td><td>COORDINATE WITH:<br>Strategy 2, Strategy 3, Strategy 6, City of Alameda CIP No. C31000</td></tr>
<tr><td colspan="4">
</td></tr>
</table>

### *Strategy 7: Bay Farm Island Adaptation Study*

| Strategy 7 | Bay Farm Island Adaptation Study |
|---|---|
| KEY PLANNING ISSUES:<br>Existing Structures, Infrastructure, Transportation, Airport, Recreation, Habitat | VULNERABILITY ADDRESSED:<br>Coastal floodwaters can overtop the shoreline at Veterans Court and at the northern end of the Bay Farm Lagoon System 1 during a 1% annual chance coastal flood, leading to flooding of nearby neighborhoods. Sea level rise and larger winter storms threaten the Bay Trail and residential homes along Bay Farm Island's northern shoreline. |
| LEAD:<br>Public Works<br><br>PARTNERS:<br>Planning, Harbor Bay Homeowners' Associations, EBRPD | STRATEGY SUMMARY:<br>The Bay Farm Island Adaptation Study includes three elements: Veteran's Court, Lagoon System 1, and the northern shoreline.<br>The existing shoreline along Veteran's Court includes a concrete floodwall that does not meet FEMA accreditation requirements. Improvements would include constructing a new seawall or flood risk reduction structure that reduces the risk of coastal flooding.<br>The shoreline berm and gate outlet structure at the northern end of Lagoon System 1 would be re-constructed and raised to function as a levee. The outlet gate is used to drain the lagoon system during low tide, allowing the lagoon to function as a stormwater detention basin during heavy rainfall events. To support future FEMA accreditation, the project would include a larger pump station and backup power, to allow water to be pumped out of the lagoon as needed to prevent neighborhood flooding during extreme rainstorms. The lagoon water level can also be managed to maintain a stable groundwater table elevation.<br>As noted in Strategy 4, severe winter storms with large waves have caused significant coastal erosion along Bay Farm Island's northern shoreline. Although immediate actions can temporarily reduce erosion, a more permanent solution is needed. Solutions could include building an earthen berm along the shoreline to reduce the likelihood of coastal flooding, coupled with vegetation enhancement and cobble beaches that can mitigate wave energy.<br>This strategy is currently under conceptual design through OAAC and addresses 24 inches of sea level rise, opportunities for nature-based solutions, improvements to the Bay Trail and includes community engagement with residents and Bay Trail users.<br>Removing Bay Farm Island and the Oakland International Airport from the FEMA Special Flood Hazard Area requires Strategy 7 and Strategy 12, as the coastal floodwaters are hydraulically connected across the low-lying areas of the island.<br>The project began in 2023 and City Council approved the initial design concept which is equivalent to 10 percent design in January 2024 and paid Community Partners conducted three rounds of community outreach on the initial concept with existing funding provided by a FEMA grant that terminates in October 2025. The City submitted a $55.5 million FEMA BRIC grant on behalf of OAAC to complete the environmental clearance, permitting, design and construction, which is being reviewed by FEMA. |
| LIMITATIONS AND BARRIERS:<br>The proximity of private property to Veteran's Court limits but does not prohibit conversion of impervious surface in this area into more nature-based features. Adaptation plans should include | |

replacing the existing bicycle and pedestrian path to allow continued access to the bicycle bridge from Island Drive. The proximity of homes to the existing levee limits the scale of shoreline modifications in this area and prevents the shoreline area from migrating inland without property buyouts. However, the presence of a park along the length of this shoreline makes mixed gray/green infrastructure and flood-tolerant landscaping design feasible. Encroachment into the Bay may be feasible but would require substantial coordination with permitting agencies and other stakeholders.

The City must consider the structural stability of the bridge when investigating major modifications to the Veteran's Court area to ensure waves and storm surge are not unintentionally redirected toward bridge support structures.

COSTS AND BENEFITS:

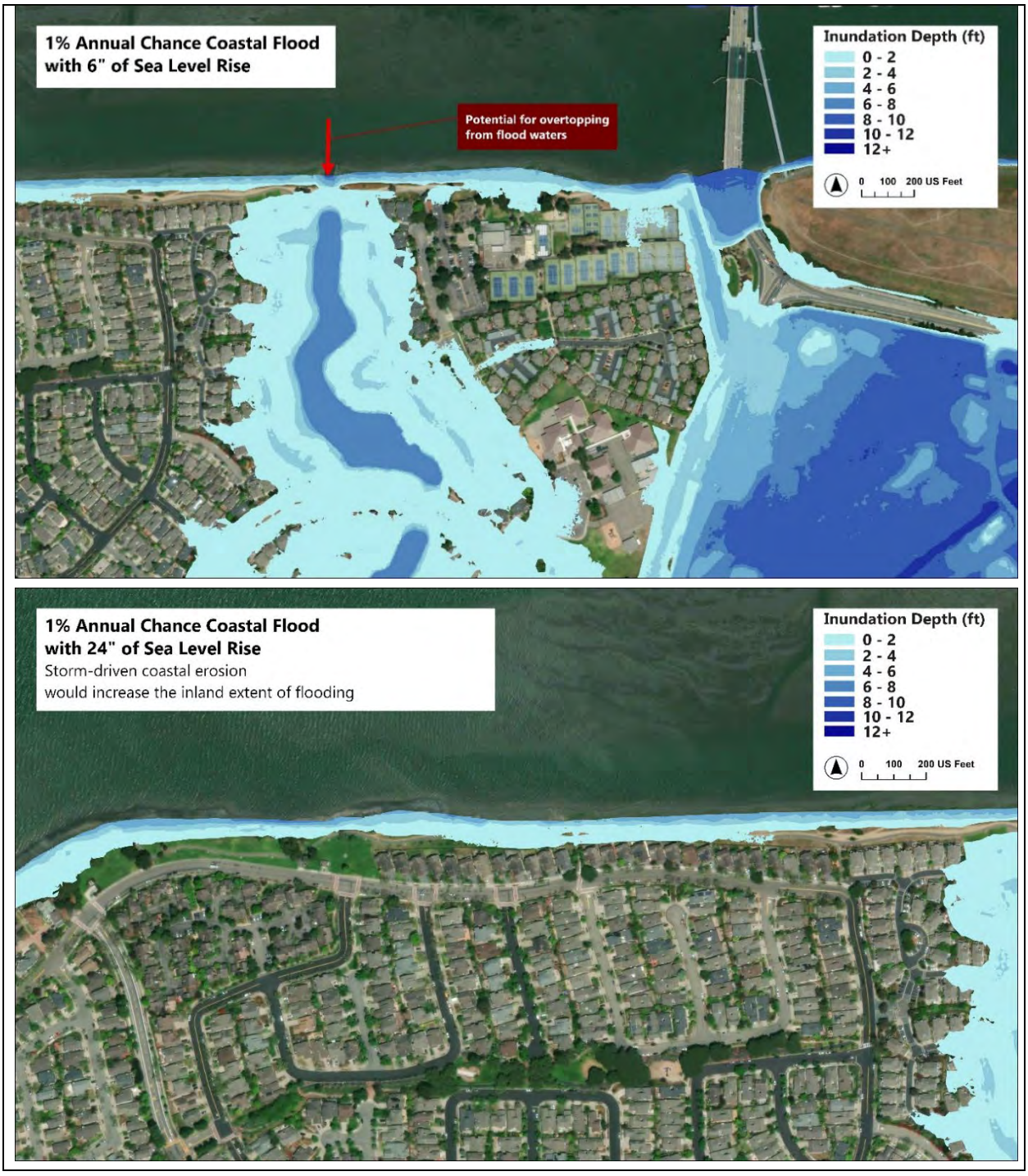
Flood risk reduction will support the removal of nearby residential homes from the FEMA 1% annual chance floodplain (if Strategy 12 is also implemented).

In addition, flood risk reduction will maintain access along State Route 61 across the Bay Farm Island Bridge, one of two access points on and off Bay Farm Island. State Route 61 provides an alternative route to the Oakland International Airport for Alameda residents.

Improved flood risk reduction strategies in this area will reduce flood risk to the Harbor Bay Island community, surrounding residential areas, and Earhart Elementary School.

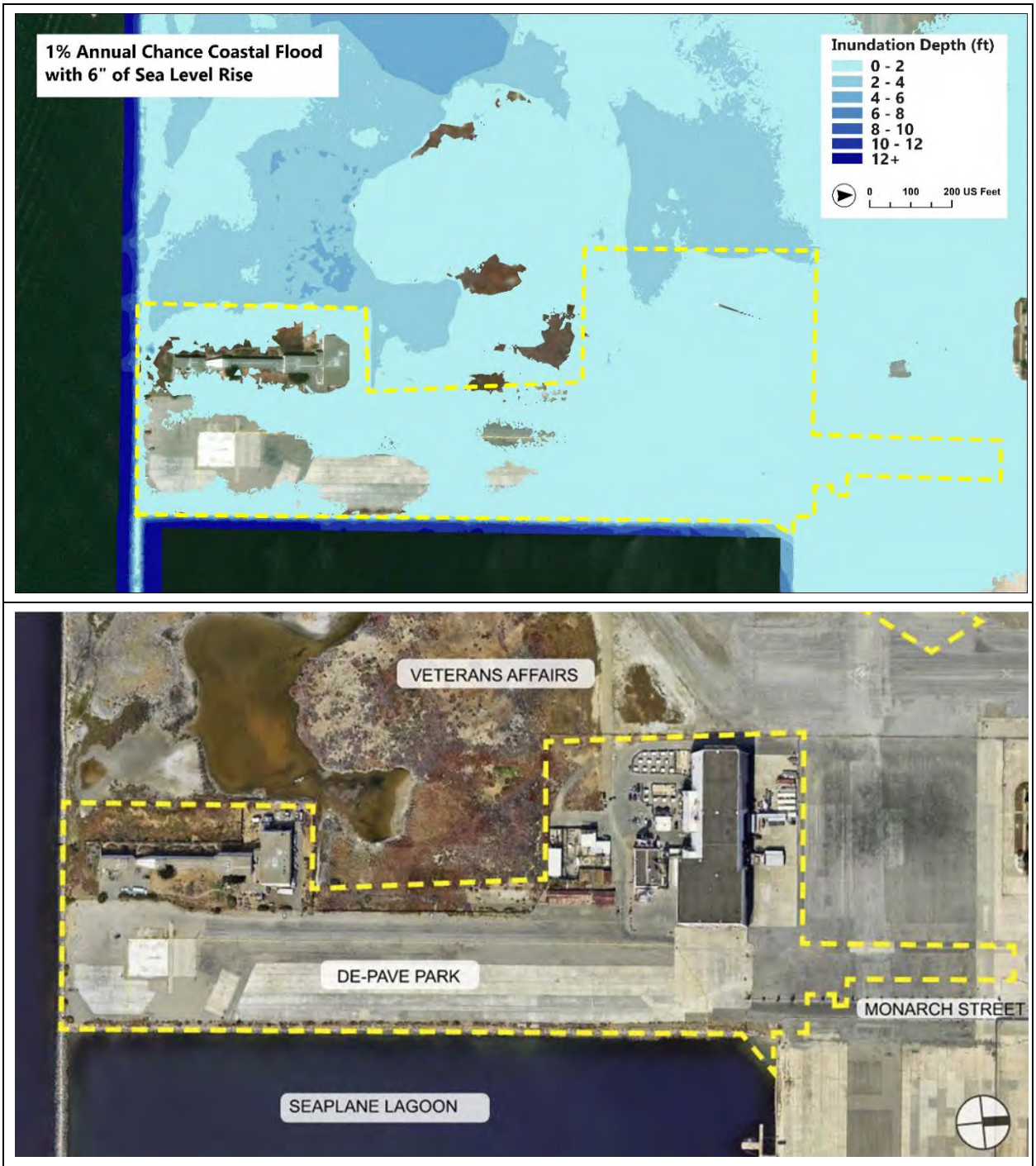
| TIMEFRAME: | STATUS: | HAZARD(s): | COORDINATED STRATEGY: |
|---|---|---|---|
| Near-term (3-10 years) | Ongoing (OAAC) | Coastal overland flooding, Coastal erosion, Stormwater flooding, Rising groundwater | Strategy 4, Strategy 7, Strategy 12, City of Alameda CIP No.C71100 |




1% Annual Chance Coastal Flood
with 6" of Sea Level Rise
Potential for overtopping
from flood waters
Inundation Depth (ft)
0 - 2
2 - 4
4 - 6
6 - 8
8 - 10
10 - 12
12+
0 100 200 US Feet
1% Annual Chance Coastal Flood
with 24" of Sea Level Rise
Storm-driven coastal erosion
would increase the inland extent of flooding
Inundation Depth (ft)
0 - 2
2 - 4
4 - 6
6 - 8
8 - 10
10 - 12
12+
0 100 200 US Feet

### *Strategy 8: De-Pave Park Flood Risk Reduction and Adaptation*

<table>
<tr><th>Strategy 8</th><th colspan="3">De-Pave Park Flood Risk Reduction and Adaptation</th></tr>
<tr><td>KEY PLANNING ISSUES:<br>Existing Structures, Infrastructure, Recreation, Habitat</td><td colspan="3">VULNERABILITY ADDRESSED:<br>Coastal floodwaters can overtop the shoreline along a hardened shoreline on the former US Naval Air Station on the western end of Alameda's Main Island (also known as Alameda Point).</td></tr>
<tr><td>LEAD:<br>ARPD<br><br>PARTNERS:<br>San Francisco Bay Restoration Authority, EBRPD, Public Works, Base Reuse and Economic Development (BRED)</td><td colspan="3">STRATEGY SUMMARY:<br>The De-Pave Park Master Plan provides a conceptual design for the transformation a paved tarmac into an ecological park that mitigates existing coastal flood risks and can adapt to future sea level rise and coastal overland flood risks. This strategy includes the final design and implementation of this managed retreat project.<br>The park offers a new model for resilient landscapes, offsetting its carbon footprint in four years to become Climate Positive and mitigating the carbon footprint of its original construction in less than 25 years through re-purposing materials. 100% of the existing site materials would be recycled. The park would become an ecologically productive landscape for native wildlife and a recreational and educational resource for the community.<br>Successful implementation of this managed retreat strategy could help increase public support for additional managed retreat areas on the former Naval Air Station.<br>Additional flood risk reduction will be required outside of the De-Pave Park boundaries to fully mitigate future flood risks, as noted in Strategy 13.</td></tr>
<tr><td>TIMEFRAME:<br>Near-term (3-10 years)</td><td>STATUS:<br>Ongoing (De-Pave Master Plan)</td><td>HAZARD(s):<br>Coastal overland flooding</td><td>COORDINATE WITH:<br>Strategy 13, City of Alameda CIP No.C55200</td></tr>
</table>




**Existing Conditions**



**Conceptual illustration of De-Pave Park design**

### *Strategy 9: Estuary Adaptation Project*

| Strategy 9 | Estuary Adaptation Project |
|---|---|
| KEY PLANNING ISSUES:<br>Existing Structures, Transportation | VULNERABILITY ADDRESSED:<br>The Posey and Webster Tubes, key transportation corridors between Oakland and Alameda, are at risk of flooding today during a 1% annual chance coastal flood event. |
| LEAD:<br>Public Works<br><br>PARTNERS:<br>City of Oakland,<br>Caltrans | STRATEGY SUMMARY:<br>The character of the Northern Shoreline in general limits the options for nature-based shoreline infrastructure. All the existing shoreline is hardened, and there is limited space to encroach into the estuary or migrate the shoreline inland. Shoreline modifications, such as levees and seawalls, can prevent coastal floodwater from overtopping the shoreline and entering the Posey and Webster Tubes.<br><br>This project focuses on prevention of Bay water from entering the Posey and Webster Tubes, properties in the affected area, and roadways providing egress in and out of the area. The project will address increased coastal, stormwater, and groundwater flooding. The project will include strategies to elevate and adapt low-lying areas of the shoreline combined with green infrastructure such as rain gardens and storm drainage improvements along Alameda's northern shoreline by Marina Village, including Caltrans' Posey and Webster Tubes State Route 260, and the San Francisco Bay Trail. The project is being designed in concert with improvements to Oakland's Jack London District and Lake Merritt Channel. This strategy is currently under conceptual design through OAAC and addresses 24 inches of sea level rise.<br><br>The project began in 2023 and City Council approved the initial design concept which is equivalent to 10% design in January 2024 and paid Community Partners conducted three rounds of community outreach on the initial concept with existing funding provided by a FEMA grant that terminates in October 2025. Grant expires February 28, 2025. |

LIMITATIONS AND BARRIERS:

Due to extensive private ownership of the shoreline along the Northern Shoreline, and the proximity of buildings and impervious surfaces to the existing shoreline, any flood risk reduction actions in this area require coordination with private landowners. The City must maintain multiple points of access to docks along this section of shoreline if levees and seawalls are elevated, including docks for semi-permanent houseboats. The City of Oakland must also implement adaptation strategies to protect the eastern tube entrances.

Several buildings in this immediate shoreline area are very close to the existing shoreline. As a result, options for inland parks and green infrastructure are limited. The City could consider establishing zoning overlays that identify high-risk zones and require floodproofing and other retrofits, while limiting expansion of buildings and impervious surfaces within a specified distance from the shoreline.

Caltrans must use transportation funds to plan, build, design, and construct transportation improvement projects, for transportation assets such as the Posey and Webster Tubes State Route 260. While these projects can include design elements to improve a transportation asset's resiliency to sea level rise, adaptation actions that Caltrans funds and implements must be components of broader transportation improvement projects or safety-based repairs.

There is known contaminated sediment and/or waste located near the existing tubes / State Route 260. Projects in this area should take care to prevent contamination from affecting nearby communities.

COSTS AND BENEFITS:

Benefits of flood risk reduction in this area will be felt citywide, as overtopping of the shoreline here could lead to flooding of the tubes, which provide residents, commuters, goods movement, and emergency access to Alameda Island.

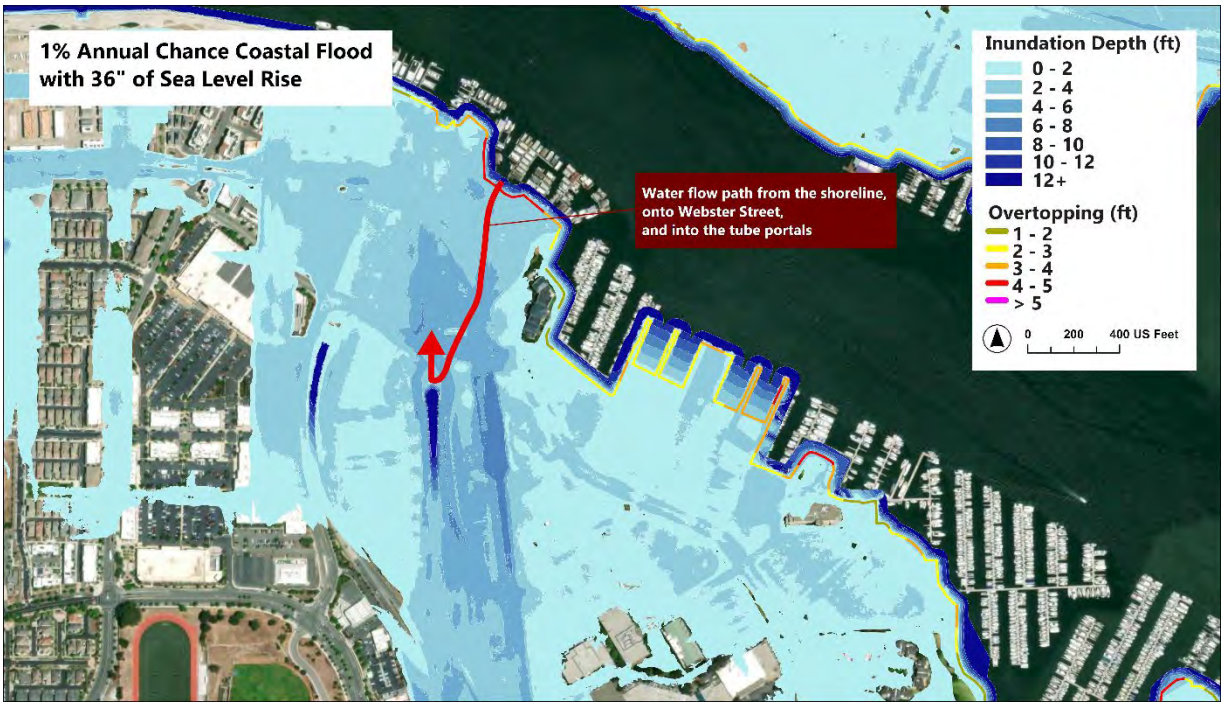
Disadvantaged communities may benefit from shoreline adaptation. The Alameda Landing and College of Alameda block groups have residents with socioeconomic characteristics that may make it harder for them to respond to and recover from flood events. For example, the Oakmont of Mariner Point (a retirement community) is located right on the shoreline.

State Route 260 and the tubes are AC Transit routes, providing access on and off the island and to the greater East Bay region for transit-dependent residents across Alameda.

CASE STUDIES AND EXAMPLES:

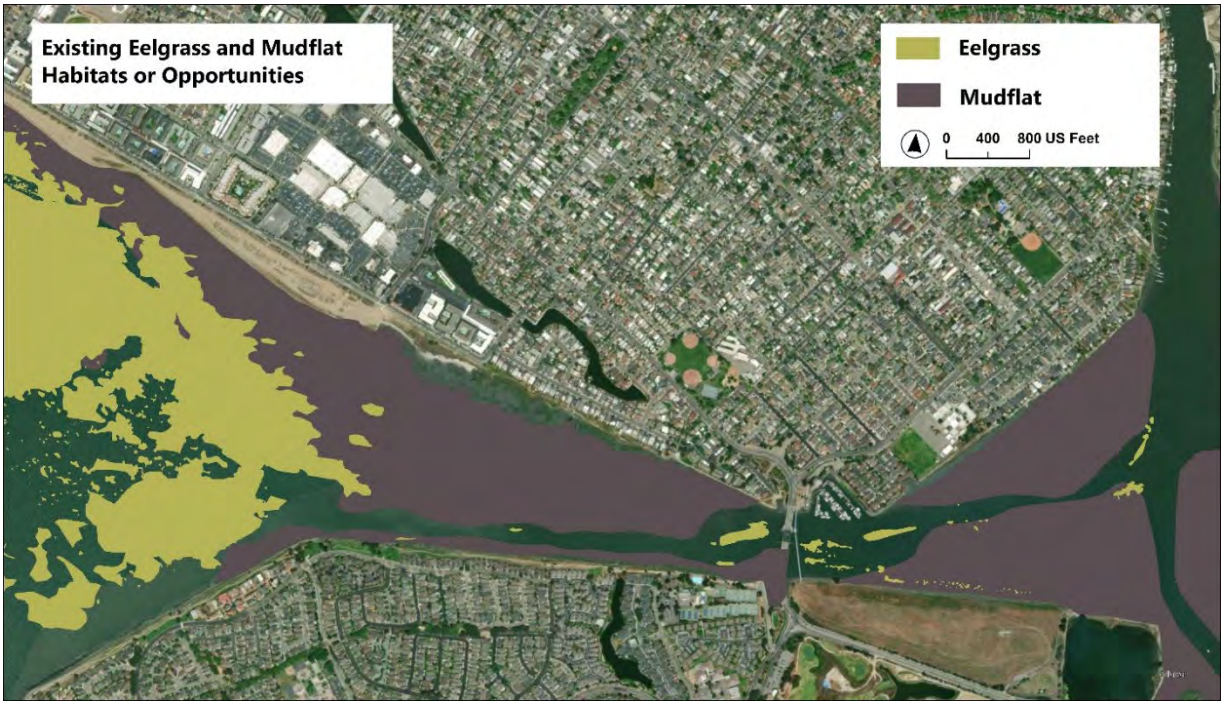
Elevating levees and seawalls to provide flood risk reduction is a common practice. Inland, flood-resistant shoreline design options that accommodate flooding and inundation, such as those outlined in the Alameda Point Master Infrastructure Plan (MIP) and other Northern Shoreline development plans, may apply in this area. The City of Seattle provides an example of hard flood risk reduction strategy integrating ecologically friendly features.

| TIMEFRAME: | STATUS: | HAZARD(s): | COORDINATED STRATEGY: |
|---|---|---|---|
| Near-term (3-10 years) | Ongoing (OAAC) | Coastal overland flooding | City of Alameda CIP No. C71300 |



### *Strategy 10: Mudflat and Eelgrass Restoration Pilot Project*

| Strategy 10 | Mudflat and Eelgrass Restoration Pilot Project | | |
|---|---|---|---|
| KEY PLANNING ISSUES:<br>Habitat | VULNERABILITY ADDRESSED:<br>The Elsie Romer Bird Sanctuary is at risk of coastal erosion, resulting in wetland and habitat loss. | | |
| LEAD:<br>Planning<br><br>PARTNERS:<br>Public Works, EBRPD, California State Coastal Conservancy | STRATEGY SUMMARY:<br>The findings from Strategy 5 may inform a pilot project to enhance sediment management, mitigate habitat loss, and dissipate wave energy. The project could include incrementally placing dredged sediment (of suitable quality) on the mudflats to help maintain the necessary elevation and structure of the mudflats as sea levels rise. The maintained mudflats could support submerged aquatic vegetation (e.g., eelgrass) and wetland habitat, promoting resilience of the bird sanctuary. | | |
| TIMEFRAME:<br>Near-term (3-10 years) | STATUS:<br>Proposed | HAZARD(s):<br>Coastal erosion | COORDINATE WITH:<br>Strategy 5, Strategy 11 |



### *Strategy 11: Shoreline Drive / Crown Beach Adaptation*

| Strategy 11 | Shoreline Drive / Crown Beach Adaptation |
|---|---|
| KEY PLANNING ISSUES:<br>Existing Structures, Transportation, Recreation, Habitat | VULNERABILITY ADDRESSED:<br>The vegetated sand dunes along Shoreline Drive provide coastal flood risk reduction to inland residences and businesses; however, with 12 inches of sea level rise, coastal floodwaters could overtop the shoreline and flood inland areas. Rising sea level may compromise the viability of the Elsie Roemer Bird Sanctuary's tidal wetland ecosystem, impacting Bay-wide diversity. |
| LEAD:<br>Planning<br><br>PARTNERS:<br>Public Works, EBRPD, California State Parks | STRATEGY SUMMARY:<br>As noted in Strategy 4, coastal erosion of the sand dunes is already threatening a portion of the Bay Trail and Shoreline Drive. As sea levels rise and storms increase in intensity, coastal erosion could become more widespread, increasing the extent of inland flooding. A more permanent solution is needed to mitigate coastal erosion and inland flooding, while also maintaining the beaches and tidal wetlands. Alameda's beaches are the most visited beaches in the Bay Area, providing recreation and economic benefits to the City. The Elsie Roemer Bird Sanctuary is one of the few remaining tidal wetlands on the Alameda shoreline, providing food and refuge for migrating and local bird populations.<br><br>The project would replace the interim Strategy 4 and be informed by the findings of the Strategy 5 pilot study. A potential solution could include burying armor stone below the sand dunes (mitigating coastal erosion) and raising the heights of the sand dunes (mitigating inland coastal flooding). Beach access and a sand management plan should be included.<br><br>This strategy could be planned, designed, and implemented in tandem with Strategy 3, 4, 6, and 10. |
| LIMITATIONS AND BARRIERS:<br>In the near term, with continuation of dune management and annual sand redistributions, the beach may continue to provide a range of services to the community. Over the next decade these benefits may degrade without a clear vision established among EBRPD, the City, and the community for the future of the beach. Key questions include:<br>How much of Crown Beach must be maintained as a beach to continue providing recreational benefits?<br>Can the ecosystem services that the beach, dunes, and marsh provide be quantified and can a system be established to pay for their maintenance?<br>How will tidal wetlands habitat be incorporated into the adaptation plans for the shoreline?<br><br>Adaptation strategies that include expanding the beach into the Bay with fill may encounter permitting challenges related to the Bay Conservation and Development Commission (BCDC) policies, which limit fill in the Bay. However, BCDC may approve adaptation strategies with Bay fill that restore or enhance tidal wetlands. The City of Alameda should continue engaging in regional conversations encouraging BCDC to re-evaluate these policies as the Bay adapts to sea level rise. | |
| COSTS AND BENEFITS:<br>Adapting the Crown Beach shoreline will benefit the nearby residential areas and businesses that receive direct flood risk reduction from the dunes. Maintaining the beaches and beach access will provide economic benefits to Alameda businesses and the City. Strategies that emphasize nature-based solutions, such wetland, dune, and eelgrass conservation and enhancement would support biodiversity into the future. Losing these ecosystems would impact local and Bay-wide biodiversity. | |

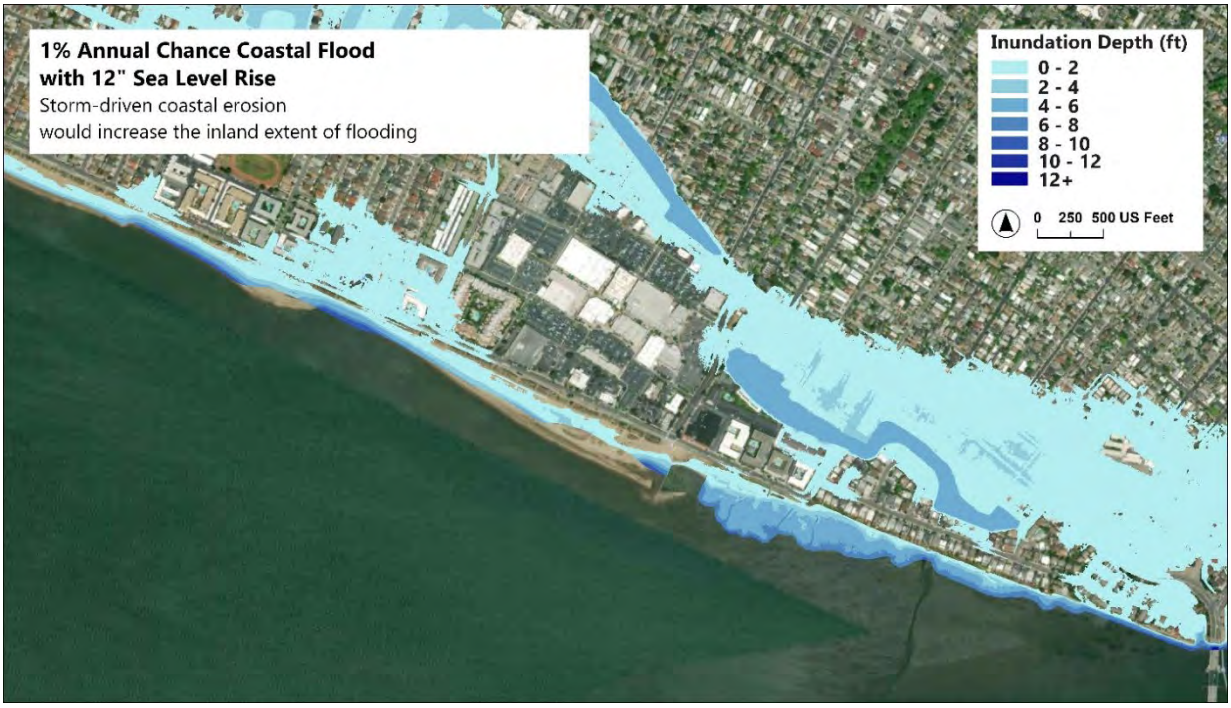
There will be trade-offs between maintaining the beaches and maintaining the transportation corridor along Shoreline Drive.

CASE STUDIES AND EXAMPLES:

As EBRPD and the City of Alameda clarify the vision for the future of Crown Beach (through the Crown Beach Master Planning process) and learn more about the geomorphology of the site with additional studies, it will be useful to examine other beach adaptation projects for guidance, such as the Cardiff Living Shoreline Project. This project, conducted by the San Elijo Lagoon Conservancy, California State Coastal Conservancy, and California State Parks in Encinitas, is building a 0.5-mile dune system on Cardiff State Beach to protect Highway 101 from sea level rise.

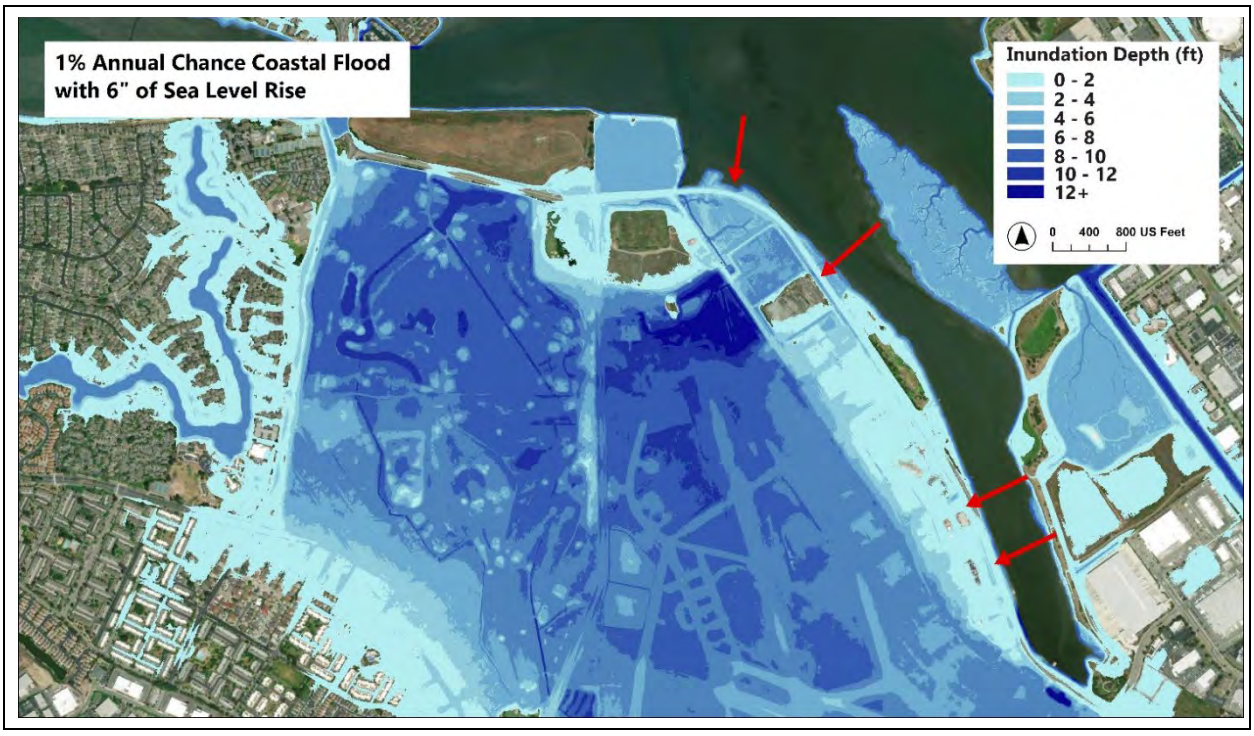
The San Francisco Bay Living Shorelines Project provides a local example of lessons learned on integrating eelgrass restoration and oyster reefs offshore.

| TIMEFRAME: | STATUS: | HAZARD(s): | COORDINATED STRATEGY: |
|---|---|---|---|
| Near-term (3-10 years) | Proposed | Coastal erosion, Coastal overland flooding | Strategy 3, Strategy 4, Strategy 6, Strategy 10, |



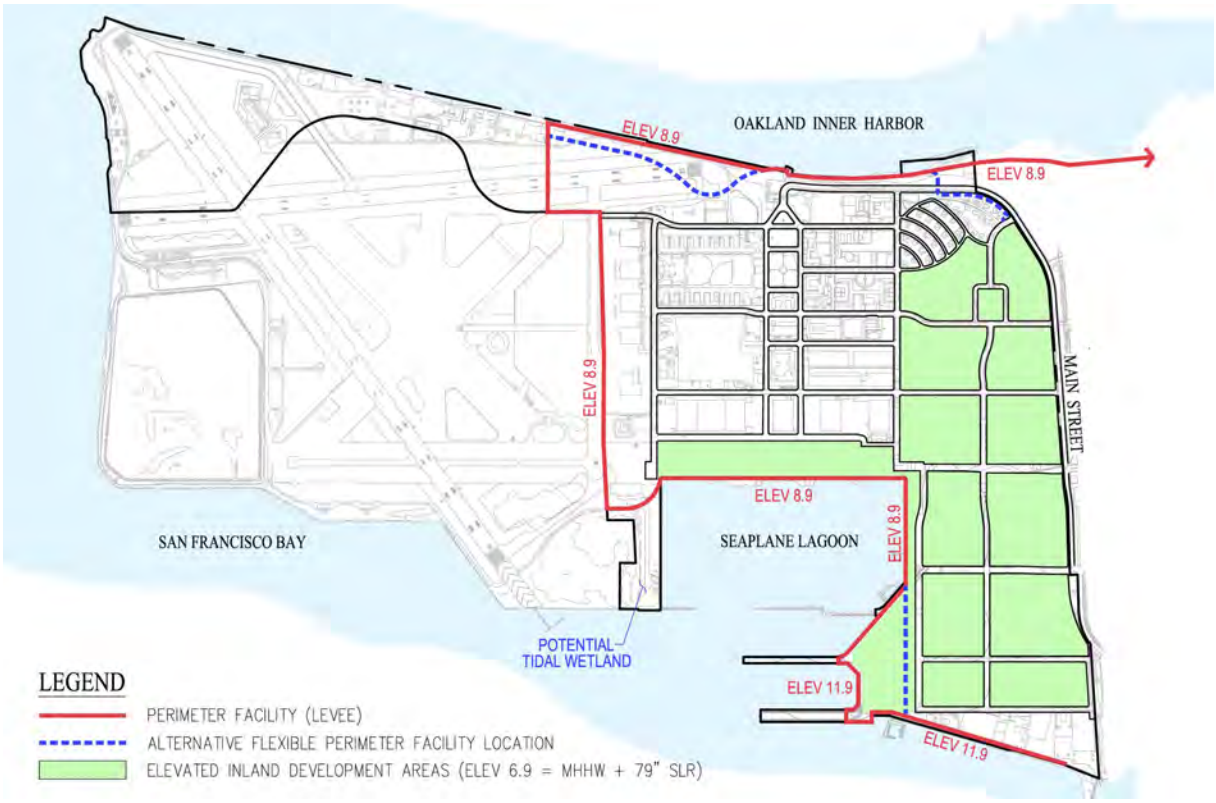
### *Strategy 12: State Route 61 / Doolittle Drive Adaptation*

<table>
<tr><th>Strategy 12</th><th colspan="3">State Route 61 / Doolittle Drive Adaptation</th></tr>
<tr><td>KEY PLANNING ISSUES:<br>Existing Structures, Infrastructure, Transportation, Airport</td><td colspan="3">VULNERABILITY ADDRESSED:<br>Coastal floodwaters can overtop the shoreline at multiple locations along Doolittle Drive during a 1% annual chance coastal flood, leading to flooding of the Oakland International Airport North Field and Bay Farm Island neighborhoods.</td></tr>
<tr><td>LEAD:<br>Port of Oakland<br><br>PARTNERS:<br>City of Alameda, City of Oakland, Caltrans, EBRPD</td><td colspan="3">STRATEGY SUMMARY:<br>State Route 61 (a.k.a., Doolittle Drive) connects the main Alameda Island to Bay Farm Island and serves as the primary evacuation route for Bay Farm Island residents during a tsunami or significant earthquake. Doolittle Drive is also an important transportation corridor for the Oakland International Airport and many of its supporting business/industries. However, about 1.5 miles of Doolittle Drive is low-lying and directly adjacent to San Leandro Bay, with multiple locations where the 1% annual flood change coastal flood could overtop today.<br><br>The construction of a short floodwall on the Bay side of Doolittle Drive would reduce this coastal flood risk. The Port of Oakland (which owns and manages the Oakland International Airport) has completed conceptual designs for this project.<br><br>This strategy is currently part of the long-term plan under development through OAAC and addresses 24 inches of sea level rise, offers opportunities for nature-based solutions, and includes trail improvements that would close the gap in the Bay Trail.</td></tr>
<tr><td colspan="4">LIMITATIONS AND BARRIERS:<br>Implementing a strategy along Doolittle Drive is outside of the City's control, and must be coordinated with the Port of Oakland, City of Oakland, Caltrans, and EBRPD. This coordination is ongoing through OAAC. Although this strategy is outside of the City of Alameda’s jurisdiction, it is included in the LHMP because removing the Oakland International Airport and Bay Farm Island from the FEMA Special Flood Hazard Area requires this strategy and Strategy 7, as the coastal floodwaters are hydraulically connected across the low-lying areas of the island. These strategies are part of a Building Resilient Infrastructure and Communities grant application that was selected for further review by FEMA in 2024.</td></tr>
<tr><td colspan="4">COSTS AND BENEFITS:<br>Collaborative action and successful completion of this strategy and Strategy 7 will provide benefits for Bay Farm Island residents and businesses. Regional economic benefits will accrue for the flood risk reduction for the Oakland International Airport and the array of airport support services located along Doolittle Drive.</td></tr>
<tr><td colspan="4">CASE STUDIES AND EXAMPLES:<br>In considering the expansion of Arrowhead Marsh, the City can look to Giant Marsh, Sonoma Baylands, and many other wetlands projects around the Bay as examples. In considering management of the golf course for flood risk reduction, the Palo Alto Flood Basin and Hamilton Wetlands Restoration Project can serve as examples.</td></tr>
<tr><td>TIMEFRAME:<br>Near-term (3-10 years)</td><td>STATUS:<br>Ongoing (OAAC)</td><td>HAZARD(s):<br>Coastal overland flooding</td><td>COORDINATED STRATEGY:<br>Strategy 7, City of Alameda CIP No.C71100</td></tr>
</table>


1% Annual Chance Coastal Flood
with 6" of Sea Level Rise
Inundation Depth (ft)
0 - 2
2 - 4
4 - 6
6 - 8
8 - 10
10 - 12
12+
0 400 800 US Feet

### *Strategy 13: Alameda Point Adaptation*

<table>
<tr><th>Strategy 13</th><th colspan="3">Alameda Point Adaptation</th></tr>
<tr><td>KEY PLANNING ISSUES:<br>Existing Structures, Contamination, Infrastructure, Habitat</td><td colspan="3">VULNERABILITY ADDRESSED:<br>Coastal floodwaters can overtop the shorelines of the former US Naval Air Station on the western end of Alameda's Main Island (also known as Alameda Point), and a rising groundwater table driven by sea level rise could impact contaminated sites.</td></tr>
<tr><td>LEAD:<br>Public Works<br><br>PARTNERS:<br>Planning, Parks and Recreation, EBRPD, Base Reuse and Economic Development (BRED), U.S. Veterans Administration</td><td colspan="3">STRATEGY SUMMARY:<br>The Alameda Point Master Infrastructure Plan (MIP) provides a long-range re-development and flood risk reduction plan for the western end of Alameda that addresses existing coastal flood risks and future risks driven by sea level rise and a rising groundwater table. Proposed flood risk reduction strategies include raising elevations within proposed development areas, providing a perimeter flood levee surrounding the historic core areas, managed retreat to create floodable parks and ecological habitat areas (such as De-Pave Park, Strategy 8), stormwater improvements, and other infrastructure improvements and monitoring to address the rising groundwater table.<br><br>The design of the proposed flood risk reduction measures must include future adaptability to higher rates of sea level rise. The City created a Community Facilities District for Alameda Point, which provides a funding mechanism for the implementation of future adaptive measures.</td></tr>
<tr><td>TIMEFRAME:<br>Mid-term (10-30 years)</td><td>STATUS:<br>Ongoing (Alameda Point Master Infrastructure Plan)</td><td>HAZARD(s):<br>Coastal overland flooding, Rising groundwater, Stormwater flooding</td><td>COORDINATE WITH:<br>Strategy 8</td></tr>
<tr><td colspan="4">
</td></tr>
</table>




**Alameda Point Master Infrastructure Plan**

Note: the elevations noted above are relative to an Alameda specific datum and are not presented relative to NAVD88. NAVD88 (feet) ≈ 6.083 feet (73 inches) + Alameda specific datum. Therefore 8.9 feet (Alameda) = 15 feet (NAVD88).

### *Strategy 14: Bridgeview Isle and Towata Park*

<table>
<tr><th>Strategy 14</th><th colspan="3">Bridgeview Isle and Towata Park</th></tr>
<tr><td>KEY PLANNING ISSUES:<br>Existing Structures, Infrastructure, Open Space</td><td colspan="3">VULNERABILITY ADDRESSED:<br>Coastal floodwaters can overtop the shoreline in Towata Park, flooding residential areas adjacent to the Bay Farm Island touchdown.</td></tr>
<tr><td>LEAD:<br>Public Works<br><br>PARTNERS:<br>Planning, Parks and Recreation, EBRPD, EBMUD, CDFW</td><td colspan="3">STRATEGY SUMMARY:<br>The existing shoreline at Towata Park is hardened with riprap with small areas of fringe wetlands. Although Towata Park provides adaptation space that could allow for nature-based solutions and Bay Trail improvements, the parcels to the west of the overtopping location park are outside the park boundary. One parcel adjacent to the existing homes is a privately owned undeveloped residential lot, and the other parcels are owned by the City.<br><br>Land acquisition could improve opportunities for flood risk reduction, including park and shoreline enhancements, closing a gap in the Bay Trail, nature-based solutions, and green infrastructure solutions. Solutions focused on natural features preserve open spaces while providing community benefits.</td></tr>
<tr><td colspan="4">LIMITATIONS AND BARRIERS:<br>An East Bay Municipal Utility District (EBMUD) pipeline connects the Main Island with Bay Farm Island at this location, and a second pipeline is proposed to provide increased capacity and redundancy.<br><br>This location is also included in California’s Department of Fish and Wildlife (CDFW) Office of Spill Prevention and Response Plan as a preferred site for deploying a shoreside skimming system or self-propelled skimmer, to prevent oil from harming sensitive habitats within San Leandro Bay. The oil response plan also includes the former boat launch site at this location; however, this location is not dredged and is too shallow for this use. The boat launch in Martin Luther King, Jr. Park along Doolittle Drive on Bay Farm Island was recently rehabilitated and could be recommended to CDFW as a preferred location.<br><br>This area is identified for a possible extension of the San Francisco Bay Trail extension. Coordination with EBRPD and Parks and Recreation is recommended.Collaboration with adjacent homeowners, such as the Ravens Cove Homeowners' Association, is recommended.</td></tr>
<tr><td colspan="4">COSTS AND BENEFITS:<br>This project will maintain access along State Route 61 to and from Bay Farm Island, providing transportation and emergency evacuation benefits for Alameda residents.<br><br>Enhancing Towata Park and implementing Bay Trail improvements will provide recreation and public access benefits, and the use of nature-based solutions could improve habitat connectivity and provide other ecological benefits.</td></tr>
<tr><td>TIMEFRAME:<br>Mid-term (10-25 years)</td><td>STATUS:<br>Proposed</td><td>HAZARD(s):<br>Coastal overland flooding</td><td>COORDINATE WITH:<br>-</td></tr>
</table>


1% Annual Chance Coastal Flood
with 6" of Sea Level Rise
Inundation Depth (ft)
0 - 2
2 - 4
4 - 6
6 - 8
8 - 10
10 - 12
12+
0
100
200 US Feet

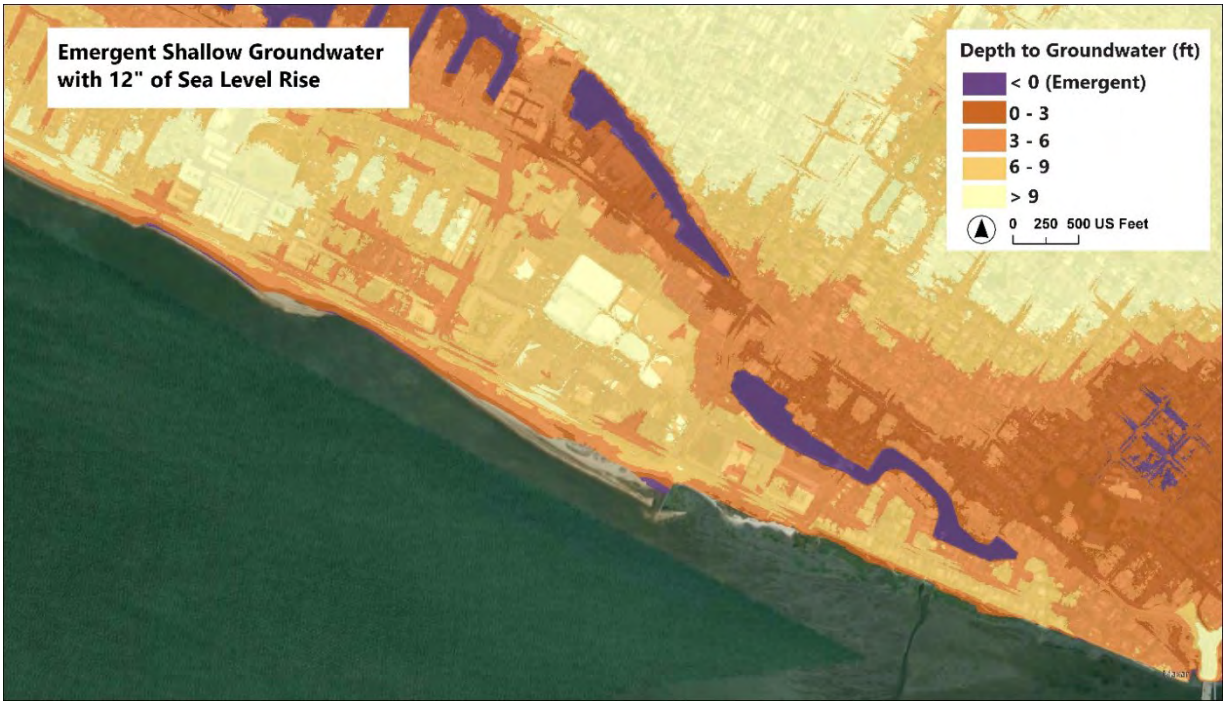
### *Strategy 15: Eastshore Drive Flood Risk Reduction*

<table>
<tr><th>Strategy 15</th><th colspan="3">Eastshore Drive Flood Risk Reduction</th></tr>
<tr><td>KEY PLANNING ISSUES:<br>Existing Structures, Infrastructure</td><td colspan="3">VULNERABILITY ADDRESSED:<br>Coastal flooding threatens residential homes along Eastshore Drive between Garfield Avenue and Encinal Avenues.</td></tr>
<tr><td>LEAD:<br>Public Works<br><br>PARTNERS:<br>Planning, EBRPD</td><td colspan="3">STRATEGY SUMMARY:<br>Low points along Eastshore Drive provide pathways for coastal flooding to overtop the shoreline, with floodwaters extending inland past Fernside Boulevard with 6 inches of sea level rise.<br><br>The residential homes are located directly adjacent to the shoreline, with public access to the Bay provided at only two locations, both of which are low points along the shoreline. The shoreline, intertidal, and subtidal areas in front of the homes between Thompson Ave and Lincoln Middle School are owned by the City of Alameda. Homeowners have constructed their own seawalls, or installed riprap armoring, to protect their individual properties. Many of these structures are on parcels owned by the City or parcels held in the public trust. Some homeowners have also constructed small docks for kayaks and other small watercrafts on these parcels.<br><br>This strategy will raise the shoreline along Eastshore Drive, and where feasible, construct public pathway improvements to improve shoreline access and improve the reliability and capacity of the Eastshore storm drain pump station. This strategy could require significant coordination with the shoreline homeowners. Locating the flood risk reduction structures between the shoreline homes and the Bay could require some land acquisition, whereas locating the structures inland of the shoreline homes could require floodproofing or raising of the shoreline homes to mitigate their flood risk. Additionally, the City may work with affected properties for a neighborhood solution.</td></tr>
<tr><td colspan="4">LIMITATIONS AND BARRIERS:<br>Private homes are built directly along the shoreline, with limited space for adaptation.</td></tr>
<tr><td colspan="4">COSTS AND BENEFITS:<br>Flood risk reduction along this stretch of shoreline will protect primarily residential areas, Lincoln Park, and local roads and infrastructure. Strategies that build on benefits provided by mudflats have potential to support the biodiversity of San Leandro Bay.<br><br>There may be tradeoffs between constructing a flood risk reduction structure along the shoreline and providing broader public access to the shoreline or requiring individual homeowners to floodproof or raise their own homes while the City constructs a flood risk reduction barrier farther inland.<br><br>If public access along the shoreline is not provided, the benefits may accrue primarily in the immediate neighborhoods.</td></tr>
<tr><td colspan="4">CASE STUDIES AND EXAMPLES:<br>The Seal Beach Salt Marsh Sediment Augmentation Project in Orange County—an 8-acre U.S. Fish and Wildlife Service project—is a good resource on implementing a mudflat augmentation project.</td></tr>
<tr><td>TIMEFRAME:<br>Mid-term (10-25 years)</td><td>STATUS:<br>Proposed</td><td>HAZARD(s):<br>Coastal overland flooding</td><td>COORDINATE WITH:<br>-</td></tr>
</table>


1% Annual Chance Coastal Flood with 6" of Sea Level Rise
Inundation Depth (ft)
0 - 2
2 - 4
4 - 6
6 - 8
8 - 10
10 - 12
12+
0
200
400 Feet
Eastshore Dr

### *Strategy 16: Shoreline Drive Stormwater Improvements*

| Strategy 16 | Shoreline Drive Stormwater Improvements | | |
|---|---|---|---|
| KEY PLANNING ISSUES:<br>Utilities, Existing Structures, Transportation | VULNERABILITY ADDRESSED:<br>With one to two feet of sea level rise, the storm drain outfalls that discharge to the Bay along Shoreline Drive will no longer function during high and extreme tide levels. The rising groundwater table and increasing storm intensities will also reduce the stormwater detention capacity of the Main Lagoon. | | |
| LEAD:<br>Public Works<br><br>PARTNERS:<br>Planning, EBRPD | STRATEGY SUMMARY:<br>This strategy includes removing nine existing outfalls along Shoreline Drive, which include multiple pipes that run under the beach and discharge stormwater runoff to the Bay. The Storm Drain Master Plan Update (2017) proposes new 24- and 48-inch pipelines under Shoreline Drive and directing the flows to the Main Lagoon. This strategy should also include a new pump station to manage seasonal water levels in the lagoon, including drawing down the lagoon water level in advance of extreme precipitation events. The pump station would also help manage the groundwater table elevation around the lagoon.<br>Strategy 6 may provide climate change design recommendations that can guide the timing and future design elements of this strategy. | | |
| TIMEFRAME:<br>Mid-term (10-25 years) | STATUS:<br>Ongoing (Stormwater CIP) | HAZARD(s):<br>Stormwater flooding, Rising groundwater | COORDINATE WITH:<br>Strategy 6 |





# Appendix J
# Approval Documentation

**U.S. Department of Homeland Security**
FEMA Region 9
1111 Broadway, Suite 1200
Oakland, CA 94607

FEMA

September 17, 2026

Danielle Mieler
Sustainability and Resilience Manager
City of Alameda
2263 Santa Clara Avenue, Room 190
Alameda, CA 94501

Reference: Hazard Mitigation Plan Approval
City of Alameda, CA

Dear Danielle Mieler:

The 2026 City of Alameda Hazard Mitigation Plan was officially adopted by the City of Alameda and submitted for final review and approval to the Federal Emergency Management Agency (FEMA). FEMA confirms this plan meets the requirements of Title 44, Code of Federal Regulations, Part 201, Section 6 for local hazard mitigation plans.

FEMA approves this plan for five years with an effective date of September 16, 2026, which is the completion date of our final review. To maintain grant eligibility, the City of Alameda must review, update, and resubmit the plan to FEMA before **September 15, 2031**.

While local mitigation plans may include additional content to meet Element H: Additional State Requirements or other local objectives, FEMA's approval only applies to elements required by its *Local Mitigation Planning Policy Guide* (FP-206-21-0002).

This plan approval ensures eligibility for project grants under FEMA's Hazard Mitigation Assistance programs, including the Hazard Mitigation Grant Program (HMGP), Building Resilient Infrastructure and Communities (BRIC) program, HMGP Post-Fire, Flood Mitigation Assistance (FMA), and Safeguarding Tomorrow Revolving Loan Fund (STORM RLF). Funding requests are reviewed individually for eligibility and other program requirements.

Thank you for your continued commitment to reducing risk and enhancing community safety. If you have any questions about the planning or review process, please contact the FEMA Region 9 Hazard Mitigation Planning Team at fema-r9-mitigation-planning@fema.dhs.gov.

Sincerely,

Kathryn Lipiecki
Director, Mitigation Division
FEMA Region 9

Enclosure (1)
City of Alameda Plan Review Tool, dated September 16, 2026

cc: Alison Kearns, Planning and Implementation Branch Chief, FEMA Region 9
Robyn Fennig, State Hazard Mitigation Officer, California Governor's Office of Emergency Services
Victoria LaMar-Haas, Hazard Mitigation Planning Chief, California Governor's Office of Emergency Services

Docusign Envelope ID: 94B5F03C-C6A2-80E6-82BA-67CAC0C1FEF0

# CITY OF ALAMEDA RESOLUTION NO. 16449

ADOPTING THE 2026 CITY OF ALAMEDA CLIMATE ADAPTATION AND HAZARD MITIGATION PLAN AS THE CITY'S LOCAL HAZARD MITIGATION PLAN, AS REQUIRED BY THE FEDERAL DISASTER MITIGATION ACT OF 2000, AND INCORPORATING BY REFERENCE THE 2026 CLIMATE ADAPTATION AND HAZARD MITIGATION PLAN INTO THE ALAMEDA GENERAL PLAN SAFETY ELEMENT, AS REQUIRED BY AB 2140 (2006)

WHEREAS, due to the City of Alameda's (City) proximity to major earthquake faults, our geography as a low-lying island community with older building stock, Alameda faces risks from several climate and natural hazards that have the potential to significantly disrupt daily life and cause damage to people and property; and

WHEREAS, earthquakes, floods and sea level and groundwater rise pose the greatest risk to people and property in Alameda; and

WHEREAS, the City also faces risks from tsunamis, heat, drought, wildfire-related hazards of smoky air and power outages, and dam breach inundation; and

WHEREAS, climate change is exacerbating the frequency, duration, extent, and consequences of many of the hazards Alameda faces; and

WHEREAS, some members of the community will be more significantly impacted by natural disasters and may have a more difficult time recovering than others due to a lack of stable housing, financial resources, and zoning laws that have historically disproportionately placed people of color into areas of the city more vulnerable to natural hazards; and

WHEREAS, the success of the Climate Adaptation and Hazard Mitigation rests not only on our ability to implement the strategies laid out in this plan, but also on our ability to implement the City's Climate Action and Resiliency Plan (CARP) and reduce our greenhouse gas emissions (GHG) by 50% below 2005 levels by 2030 and become carbon neutral as soon as possible. By taking strong actions to reduce our GHG emissions, the City will do its part to achieve a climate-safe path and avoid some of the most extreme climate effects we could face; and

WHEREAS, the City seeks to be prepared for future hazards and climate impacts by reducing the potential loss of life, property damage, and environmental degradation from natural disasters, while accelerating equitable economic recovery from those disasters; and

WHEREAS, given the interconnectedness of our ecosystems and the shared watershed of San Leandro Bay and the Oakland-Alameda Estuary, the City must work collaboratively with key stakeholders across the region to help ensure uniform protections

Docusign Envelope ID: 94B5F03C-C6A2-80E6-82BA-67CAC0C1FEF0

for all communities, especially for under-resourced communities, and speak with a unified voice to expedite collective hazard mitigation and climate adaptation goals; and

WHEREAS, the Federal Disaster Mitigation Act of 2000 (DMA 2000) requires all cities, counties, and special districts to have adopted a Local Hazard Mitigation Plan (LHMP) to receive disaster mitigation funding from the Federal Emergency Management Agency (FEMA); and

WHEREAS, the LHMP for the City of Alameda planning area was developed in accordance with DMA 2000 and followed FEMA's 2025 Local Hazard Mitigation Plan guidance; and

WHEREAS, the LHMP incorporates a process where hazards are identified and profiled, the people and facilities at risk are analyzed, and mitigation actions are developed to reduce or eliminate hazard risk; and

WHEREAS, the implementation of these mitigation actions, which include both short and long-term strategies, involve planning, policy changes, programs, projects, and other activities; and

WHEREAS, the FEMA approved the City's Local Hazard Mitigation Plan, 2026, pending City Council adoption of the plan on July 31, 2026; and

WHEREAS, Government Code section 65300.5 requires the City to maintain a General Plan that is an "integrated, internally consistent and compatible statement of policies for the adopting agency"; and

WHEREAS, the General Plan establishes the local development and conservation policies necessary to guide the long-term plan for the physical development of the City and protect the general health, safety, and welfare of the community and the environment; and

WHEREAS, on November 30, 2021, the City Council adopted the General Plan 2040, and on June 7, 2022, amended the Safety Element to align with the LHMP.

NOW, THEREFORE, BE IT RESOLVED that the City of Alameda adopts the Climate Adaptation and Hazard Mitigation Plan, 2026, as Alameda's Local Hazard Mitigation Plan; and

NOW, THEREFORE, BE IT FURTHER RESOLVED that the Climate Adaptation and Hazard Mitigation Plan is incorporated into the City of Alameda General Plan Safety Element by reference; and

NOW, THEREFORE, BE IT FURTHER RESOLVED, that the City Council finds that on November 30, 2021, by Resolution No. 15841, the City Council certified a Final Environmental Impact Report (State Clearinghouse No. 2021030563) in compliance with

Docusign Envelope ID: 94B5F03C-C6A2-80E6-82BA-67CAC0C1FEF0

the California Environmental Quality Act, and adopted written findings, a Statement of Overriding Considerations, and a Mitigation Monitoring and Reporting Program for the General Plan Amendment to update the Alameda General Plan. Pursuant to CEQA Guidelines sections 15162 and 15163, none of the circumstances necessitating further CEQA review are present. Further, this project is categorically exempt from further environmental review pursuant to the California Environmental Quality Act (CEQA) Guidelines Section 15262 (Feasibility and Planning Studies) and Section 15308 (Actions by Regulatory Agencies for Protection of the Environment).

* * * * *

I, the undersigned, hereby certify that the foregoing Resolution was duly and regularly adopted and passed by the Council of the City of Alameda in a regular meeting assembled on the 15th day of September 2026, by the following vote, to wit:

| | |
|---|---|
| AYES: | Councilmembers Boller, Daysog, Jensen, Pryor and Mayor Ezzy Ashcraft – 5. |
| NOES: | None. |
| ABSENT: | None. |
| ABSTENTIONS: | None. |

IN WITNESS, WHEREOF, I have hereunto set my hand and affixed the official seal of said City this 16th day of September 2026.

DocuSigned by:
Lara Weisiger
759F6A0E8CC74DC...
Lara Weisiger, City Clerk
City of Alameda

Signed by:
5603710AC04544F...
Len Aslanian, Acting City Attorney
City of Alameda

**CITY OF ALAMEDA**
2263 SANTA CLARA AVENUE, ROOM 190
ALAMEDA, CA 94501

(510) 747-6800

# Accommodations Request

If you need accessibility accommodations in an alternative or translated format, please fill out our ADA request form or contact ada@alamedaca.gov.