

# Chapter 01

## Introduction



*One day if I go to heaven... I'll look around and say  
"It ain't bad, but it ain't San Francisco"*

*-Herb Caen*

Anyone who spends time in San Francisco quickly recognizes its incredible beauty. Dramatic landscapes and vistas, proximity to water, wonderful hills, mild weather, and rolling fog are all part of what make San Francisco such a great place to live. However, the same geologic and climate forces that create this setting also make us susceptible to natural disasters. Coping with, recovering from, and in many cases thriving after disasters are not new to San Franciscans.

The Great Earthquake of 1906, when a magnitude 7.9 earthquake and subsequent fires destroyed 80% of the city, as well as smaller earthquakes such as the Loma Prieta Earthquake of 1989 are present in peoples' minds. In recent years, new and unprecedented hazards have challenged San Francisco, from extreme heat in 2017 to unhealthy air quality in 2018 and 2019. Climate science tell us that these and other climate-related hazards, such as coastal flooding and drought, will be on the rise as greenhouse gas emissions drive higher temperatures, higher sea levels, and unpredictable precipitation patterns.

The Hazards and Climate Resilience Plan (HCR) captures our latest understanding of how hazards are intensifying along with the climate crisis and what we can expect in the years to come. It presents a strategy for how San Francisco will become a safer and more resilient place by mitigating the impacts of seismic, weather-related, combustion-related, and other hazards to our communities, buildings, and infrastructure, and adapting to what we cannot mitigate. This chapter describes the purpose, scope, and drivers of San Francisco's first Hazards and Climate Resilience Plan.

## 1.1 Purpose and Scope

### Purpose

The City and County of San Francisco's HCR is a combined hazard mitigation and climate adaptation plan. It serves as the City's action plan for reducing the impacts of hazards that have long been a part of life in San Francisco, such as earthquakes and landslides, and hazards that are becoming more frequent and severe due to climate change, including flooding, drought, and extreme heat.

The HCR uses a scientific approach to assess the current and increasing risks facing San Franciscans today and in the years and decades to come. It includes goals and

strategies to increase the resilience of San Francisco’s infrastructure, buildings, and communities. In so doing, it also serves as a guide for decision makers as they commit resources to reduce the impacts of hazards on people, infrastructure, and the environment.

The HCR also serves as a guide for the broader community as to how the City is working to mitigate and adapt to natural disasters. This is through specific projects and programs that increase the resilience capacity of departments, non-profits, community groups, individuals, and other partners. Finally, the HCR seeks to encourage deeper levels of participation and collaboration on hazards and climate resilience planning.

The key drivers of hazard mitigation, climate adaptation, and resilience planning are described below.

## ***Resilience Vision***

The overall vision of the HCR is to make San Francisco resilient to immediate and long-term threats of climate change and natural hazards through actions to mitigate risks, adapt built and natural assets, and build a more equitable and sustainable city. This includes ensuring systems are in place so that individuals, communities, institutions and businesses survive, adapt, and thrive no matter the kinds of chronic stresses and acute shocks they experience. The HCR also coordinates with and supports the City’s Climate Action Strategy, which outlines urgent strategies needed to reduce greenhouse gas emissions and minimize the severity of climate change and its associated impacts.

## ***Guiding Principles***

The following principles guided the development of the HCR, from scoping the assessment to evaluating and refining strategies.

- **Equity & Health:** Proactively work to eliminate racial or social disparities in the impacts of all hazards and/or the distribution of resilience benefits.
- **Community Cohesion:** Empower people and partnerships to reduce vulnerability and promote resilience at the building, block, and neighborhood level.
- **Affordability & Economic Viability:** Help residents and business stay and thrive in San Francisco.

- **Climate Mitigation:** Pursue hazard mitigation and climate adaptation strategies in ways that also help eliminate the greenhouse gas emissions, which drive climate change and worsen climate-related hazards.
- **Biodiversity & Connection to Nature:** Restore and leverage local ecosystems to help mitigate hazards and support climate adaptation, while ensuring all residents can access green spaces, parks, and natural habitats and experience nature every day.
- **Science-Grounded Innovation:** Closely monitor evolving climate and hazard-related science and modify approaches appropriately to maintain maximum effectiveness.
- **Good Governance:** Provide dependable and actionable information to foster transparency and openness

## *Hazard Mitigation Planning*

The HCR serves as San Francisco’s 2019 Hazard Mitigation Plan (HMP) update. It builds and expands the 2014 and 2008 HMPs and related efforts. Hazard mitigation is a process in which a jurisdiction identifies and profiles hazards that affect the area, analyzes the people and facilities at risk from those hazards, and develops mitigation actions to lessen or reduce the impact of profiled hazards. The jurisdiction’s implementation of mitigation actions, which include long-term strategies that may involve planning, policy changes, programs, projects, and other activities, is the primary objective of this process.

Local hazard mitigation planning is governed by the Stafford Act, as amended by Disaster Management Act of 2000 (DMA 2000), and by federal regulations implementing the Stafford Act. As revised by DMA 2000, the Stafford Act requires state, local, and tribal governments to develop and submit for approval a mitigation plan that outlines processes for identifying the natural hazards, risks, and vulnerabilities of the jurisdiction. Federal Emergency Management Agency (FEMA) approval of such plans is a prerequisite to receiving federal pre- and post-disaster hazard mitigation assistance funding.

## Climate Adaptation Planning

Climate adaptation planning strives to reduce the unavoidable impacts of climate change. Climate change is already affecting San Francisco and is projected to continue into the foreseeable future. Reducing global greenhouse gas (GHG) emissions may avoid some of more severe impacts, but given the amount of emissions already in the atmosphere and the current emissions trajectory, San Francisco will continue to see higher temperatures, sea level rise, and altered precipitation patterns. Chapter 03 provides more information on climate change projections and the implications for local hazards.

Local climate adaptation planning in California is governed by Senate Bill 379 (2016) which states that when a local jurisdiction updates its Hazard Mitigation Plan (HMP), it must also update the Safety Element of its General Plan to address climate adaptation and resilience strategies. The bill requires the update to include goals, policies, and objectives based on a climate change and vulnerability assessment. The State provides guidance and resources to undertake this type of planning through the online Cal-Adapt tool and the California Adaptation Planning Guide. The HCR builds on these tools and uses previous and ongoing climate adaptation planning in San Francisco, including the Sea Level Rise Action Plan and Sea Level Rise Vulnerability & Consequences Assessment. Linking the HMP to the Safety Element also makes the City and County eligible to be considered for part, or all, of its local-share costs on eligible Public Assistance funding to be provided by the State per Assembly Bill 2140.

Climate resilience planning in San Francisco is also driven by the City's commitment to develop a Climate Action Strategy aligned with the Paris Agreement, a global compact on climate change committing nations to ambitious efforts to keep global average temperature rise to well below two degrees Celsius relative to pre-industrial levels. The Agreement also commits to strengthening the ability of countries to deal with the unavoidable impacts of climate change through adaptation and increased resilience. That means that San Francisco is not only developing a strategy to reach net zero carbon emissions by 2050, but also developing a plan to increase resilience to the impacts of climate change through this HCR. All of this is set within the context of sustainable development and inclusivity for all communities.

## Resilience Planning

Resilience describes the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow, no matter what kinds of chronic stresses and acute shocks they experience. Approaching challenges with a resilience lens calls for considering problems systematically to better serve residents today while also planning for the longer term. Resilience aims to bridge the gaps between social justice, sustainability, disaster recovery, and other areas. In San Francisco, the term climate resilience is being used to coordinate synergistic efforts that benefit mitigation and adaptation.

The HCR builds on San Francisco's 2016 resilience strategy, *Resilient SF*, which was produced in partnership with 100 Resilient Cities initiative funded through the Rockefeller Foundation. As over 90% of the strategies from Resilient SF are complete or underway, the HCR provides new direction for the City's resilience efforts over the next five years. It also takes a more in-depth focus on the shocks of natural hazards and climate change impacts, while continuing to develop solutions that also address the chronic stresses San Franciscans face day to day, including but not limited to:

- Unaffordability
- Social Inequity
- Aging Infrastructure
- Population Growth

As over 90% of the strategies from Resilient SF are complete or underway, this Plan provides new direction for the City's resilience efforts for the next five years. The City of San Francisco continues to be a part of efforts to support and promote resilience in the region, the State, and across the globe. Our current Chief Resilience Officer is the longest standing member of the State Interagency Climate and Adaptation Resilience Program Technical Steering Committee. San Francisco is also leading the way as one of two representatives for North America that is forming the new Global Resilience Cities Network (GCRN) to foster resilience in cities across the world by sharing best practices, training resilience officers, and bringing cities that are on the front lines of addressing climate change and implementing disaster mitigations programs together.

## 1.2 Key Changes Since 2014 Hazard Mitigation Plan

While mitigating our seismic risks remains a major priority, additional hazards and resilience priorities have emerged since 2014. These updates are organized under climate change, seismic, housing and homelessness, and progress on local mitigation efforts.

### Climate Change

- Former Mayor Ed Lee convened the Mayor’s Coordinating Committee on Sea Level Rise (SLR), which oversaw the development of the Sea Level Rise Action Plan in 2016 and updates to the Sea Level Rise Guidance for Capital Planning in 2015 and 2019, and the SLR Vulnerability & Consequence Assessment.
- Of recent note, the City experienced unprecedented extreme heat (hottest day on record: September 2017) and dangerous air quality (two weeks in November 2018) events. In December 2018, Mayor Breed issued Executive Directive 18-04 requesting that the Department of Emergency Management, the Department of Public Health, and the City Administrator’s Office take action to strengthen the City’s preparedness and response to air quality and other weather-related emergencies.
- In 2018, San Francisco helped develop and then participated in the regional Resilient by Design competition, funded by the Rockefeller Foundation and participating cities. One of the nine selected projects focused on the Islais Creek area of San Francisco, an area which is vulnerable to sea level rise and flooding. Proposed adaptation and resilience strategies also sought to create co-benefits like public open space and ecosystem restoration.

### Seismic

- Studies have improved our understanding of the seismic vulnerabilities of the Embarcadero Seawall and voters overwhelmingly approved a \$425 million bond in 2018 to begin to shore up sections that are most vulnerable.
- New studies have improved our understanding of the vulnerabilities of tall buildings and the locations of vulnerable concrete and steel buildings. In January 2019, Mayor Breed issued Executive Directive 19-01 to strengthen high-rise buildings and create

a recovery framework and downtown recovery plan in preparation for the next major earthquake.

- Update of the building-by-building HAZUS Earthquake Loss Estimation Model in 2017 and new or updated Seismic Hazard Ratings for over 50 buildings
- Approval of the Earthquake Safety and Emergency Response program bonds in 2014 for \$400 million and Public Health and Safety Bonds in 2016 for \$350 million by San Francisco voters

## Housing and Homelessness

- Making San Francisco more affordable in a time of increased housing costs is a key priority, including adding more housing for low- and middle-income residents by streamlining bureaucracy and reducing permitting times while also investing in affordable housing.
- San Francisco faces a significant challenge with people experiencing homelessness. According to the 2019 Homeless Count and Survey, the homeless population has increased from 6,775 in 2015 to 8,011 in 2019. With limited resources and fewer connections to their communities, people experiencing homelessness are often the most vulnerable and at risk in a disaster or other emergency situations. Through improved coordination citywide and the development of Navigation Centers, existing Temporary Shelters and SAFE Navigation Centers, the City is having a significant impact in our ability to bring our unhoused neighbors indoors.
- The City launched the Healthy Streets Operations Center (HSOC) in January 2018 to coordinate responses to homeless encampments and quality of life issues.
- San Francisco voters passed affordable housing bonds in 2015 and 2019 for \$310 million and \$600 million, respectively.

## Progress in Local Mitigation Efforts

Chapter 06 provides an inventory of all the hazards and climate resilience actions in progress, including the status of 2014 HMP actions. Particularly notable progress since 2014 includes:

- Implementation and near completion of the Soft Story Retrofit Ordinance
- Completion of Private Schools Earthquake Evaluation Program



- Development of the Tall Buildings Safety Strategy
- Development of the Sea Level Rise Vulnerability and Consequences Assessment
- Initiation of the Seawall Safety Program and Flood Study through the receipt of an Army Corps of Engineers New Start funding in 2018
- Implementation of the Ocean Beach Master Plan is underway
- Implementation of the Sewer System Improvement Program is underway
- Completion of the Resilient by Design Competition Islais Creek project and progress next steps through the Southeast Mobility Adaptation Strategy
- Initiation of the Waterfront Resilience Program
- Implementation of Vision Zero SF efforts to reduce pedestrian and bike deaths to zero is ongoing
- The 2014 HMP was used to inform updates to the 10-Year Capital Plan and the 2016 update to the Tsunami Annex and Winter Storm and Flood Annex of the Emergency Response Plan.

## Key Updates from the 2014 HMP

This update includes more information on climate science and integrated, relevant climate information. For instance, poor air quality is now included as a hazard. In addition to a hazard-based analysis in Hazard Profiles, this the HCR also includes a sector-based assessment with an emphasis on seismic and climate hazards. An overview of this assessment is in Chapter 05 and the full results are in Appendix A. This update also includes an effort to reach stakeholder organizations that serve vulnerable populations to help ensure the HCR reflects their feedback. Finally, the strategies in Chapter 07 build on progress achieving the 2014 strategies and a better understanding of San Francisco’s vulnerabilities and their consequences.

# 1.3 Scope

## Planning Area

The Planning Area covered by the HCR includes the City and County of San Francisco, as shown on Figure 1-1. San Francisco is the only consolidated city-county in California; the City of San Francisco is the sole municipality located within the county. San Francisco County encompasses approximately 232 square miles, though land makes up only 47 of those square miles. Included within county boundaries are Treasure Island and the Farallon Islands. Unlike Treasure Island, the Farallon Islands are uninhabited, with the exception of the Southeast Farallon Islands where research residents stay.

**FIGURE 1-1: HCR PLANNING AREA**



In addition, the HCR Planning Team determined that it is important to the safety and resilience of San Francisco to address essential City-owned assets located outside county boundaries in its mitigation planning. The HCR begins this integration process by identifying hazard impacts to out-of-county assets in the Hazard Profiles (especially wildfire and drought). In addition, San Francisco International Airport (SFO) is assessed at the same level of detail as other in-county assets (see Appendix A). All other essential out-of-county assets are included in Appendix B: Out-of-Jurisdiction Assets and Primary Assets, with related strategies to improve the resilience of out-of-county assets in Chapter 07. Future HCR updates will continue to seek ways to incorporate out-of-county assets into the vulnerability analysis and other sections of the Plan as well.

## All Hazards

This assessment takes an all-hazards approach with a greater focus on natural hazards and hazards influenced by climate change. Information on the hazards analysis is found in Chapter 04.

## 1.4 Key Concepts and Terms

- **Adaptability:** The ability, competency, or capacity of a system to adjust to climatic variables.
- **Asset:** a useful or valuable thing, person, or quality
- **Asset Class:** A categorization of multiple assets that are of similar type, or serve similar functional purposes
- **Baseline/Reference:** The baseline (or reference) is the state against which the change is being measured. It might be ‘current baseline’, in which case it represents observable, present day conditions. It might also be a ‘future baseline’, which is the projected future set of conditions excluding the driving factor of interest. Alternative interpretations of the reference conditions can give rise to multiple baselines.
- **Climate adaptation:** Measures taken to adjust human or natural system to reduce harm from the impacts of climate change; similar in use to hazard mitigation.
- **Climate projections:** The modelled change in climate variability.
- **Climate variability:** Variations in the mean state and other statistics (such as standard deviations, statistics of extremes, etc.) of the climate on all temporal and

spatial scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability) or to variations in natural or anthropogenic external forcing (external variability).

- **Co-benefits:** Refers to environmental, social, or economic benefits that may be achieved as a result of initiating and implementing a hazard mitigation or adaptation strategy. Co-benefits are typically above and beyond the direct intention of the proposed strategy to address vulnerability, but often cost neutral.
- **Consequence:** The impacts to people, ecology, and economy if vulnerable assets are exposed to a hazard.
- **Emissions scenario:** A plausible representation of future greenhouse gas (GHG) emissions, based on a coherent and internally consistent set of assumptions about driving forces (demographic, socio-economic development, technological change, etc.) and their key relationships.
- **Exposure:** The extent to which an asset is situated in a place or setting that could be adversely affected by hazards.
- **Geographic Information Systems (GIS):** A technological system designed to capture, store, manipulate, analyze, manage, and present spatial or geographic data. In the HCR, GIS is used to analyze the exposure of assets using layers of hazard data.
- **Hazard:** A source of potential danger or an adverse condition that could harm people, socioeconomic systems, or built and natural environments.
- **Hazard Mitigation:** Sustained actions taken to reduce or eliminate short- and long-term risks to life and property from hazards; also similar to adaptation.
- **Natural hazard:** A hazard that results from conditions in the natural environment, such as flooding. Humans may contribute to or exacerbate the hazard but cannot directly cause it.
- **Preparedness:** Actions that strengthen the City's capability to respond to disasters.
- **Resilience:** The capability of preparing for, responding to, and recovering from difficult conditions; the ability to bounce back after change or adversity. The HCR uses the term resilience actions, which encompass both hazard mitigation and climate adaptation.

- **Risk:** The chance that a given hazard could occur multiplied by the understood consequences of an impact on people, socioeconomic systems, or the built and natural environment.
- **Risk Management:** Regulatory controls, plans, policies, programs, projects, initiatives, and anything else employed to cost-effectively eliminate, avoid, or minimize risks.
- **Sea Level Rise Vulnerability Zone:** The coastal areas within the City and County of San Francisco understood to potentially face future flooding and inundation by a 100-year coastal flood event given 66 inches of sea level rise, a high-end scenario projected by the end of the century. Consistent effort has been made to integrate these projections into the City’s planning process.
- **Vulnerability:** The extent to which people, socioeconomic systems, and the built and natural environments are exposed to a hazard and are unable to cope with the impacts.
- **Vulnerable populations:** Vulnerable communities experience heightened risk and increased sensitivity to climate change and have less capacity and fewer resources to cope with, adapt to, or recover from climate impacts. These disproportionate effects are caused by physical (built and environmental), social, political, and/ or economic factor(s), which are exacerbated by climate impacts. These factors include, but are not limited to, race, class, sexual orientation and identification, national origin, and income inequality.

## 1.5 Document Overview

As a city and county with complex systems and multiple policy bodies and boards, the Hazards and Climate Resilience Plan covers a lot of ground. It is organized into the following chapters and appendices. A brief description of what each chapter contains includes:

**Chapter 02: Planning Process** provides an overview of the methodology, approach, and steps used to develop this plan

**Chapter 03: San Francisco Risk Landscape** provides the context for the vulnerability assessment and strategies that follow, describing key demographic, geographic, and economic trends and a summary of the eight city sectors used in the Vulnerability & Consequences Assessment.

**Chapter 04: Hazard Analysis** provides a hazards-based assessment, which includes information on the history, impacts, location, and probability of future events for the hazards identified. This chapter also includes an overview of the implications of climate change on the hazards we experience in San Francisco.

**Chapter 05: Vulnerability and Consequence Analysis** includes an overview of the exposure assessment completed for all hazards and provides the results of the Vulnerability & Consequence profiles completed for 28 asset classes within eight sectors.

**Chapter 06: Capabilities and Existing Action** documents the abilities within the City and County of San Francisco to undertake future hazard mitigation and climate adaptation actions, existing actions underway, and the status of 2014 HMP actions.

**Chapter 07: Strategy** includes San Francisco's HCR goals and the complete set of strategies proposed to increase the resilience of buildings, infrastructure, and communities.

**Chapter 08: Plan Maintenance** describes how the City will maintain the HCR over the next five years.

**Appendix A** contains Vulnerability & Consequence Profiles for each asset class.

**Appendix B** lists out-of-county assets and primary out-of-county hazards.

**Appendix C** contains an overview and results from the stakeholder engagement process.

**Appendix D** covers the HCR maintenance documents, including the Planning Team Annual Review Questionnaire and the City and County of San Francisco Hazard Mitigation Action Progress Report

**Appendix E** details the local adoption process with relevant documentation.

**Appendix F** identifies detailed information on capabilities, revenue sources, and grant programs associated with mitigation plan requirement

**Appendix H** includes information on potential funding sources and estimated timelines for completion for strategies.

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